SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CA

APPENDIX E – ECONOMIC AND SOCIAL CONSIDERATIONS [DRAFT]

JANUARY 2024

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

Executive Summary

San Francisco is a major metropolitan area with 808,437 in total population (2022), an estimated 26.5 million visitors in 2019, and $399.5 billion annual Gross Domestic Product (2021). This appendix presents the economics methodology, assumptions, and resulting analysis for determining Federal interest in managing coastal storm risk on the San Francisco waterfront over a 100-year period of analysis from 2040 to 2139.

Analysis includes a feasibility-level assessment of 7.5 miles of the San Francisco waterfront from Aquatic Park to Heron Head's Park. This stretch of the San Francisco coastline includes over 5,000 assets, including single-family residential, multifamily apartments, commercial structures, industrial facilities, high-value high-rises, traditional infrastructure (bridges, piers, utilities, roadways), critical infrastructure (wastewater treatment plants, recycling plants, fire stations), nationally historic structures such as the Ferry Building, and specialized assets such as the Chase Center arena.

The study area also includes considerable assets for the Bay Area Rapid Transit (BART) and San Francisco Municipal Transportation Agency (SFMTA) including Embarcadero Station, the Central Subway underground system, and light rail transit surface track. In additional to the billions in asset value, these services provide transportation for hundreds of thousands of riders per day. In total, the asset inventory (structure and content) for physical assets is valued at over $60 billion.

By the base year of 2040, many assets in the study area are at risk of significant flooding from the 1% Annual Exceedance Probability storm and other low-frequency storm events, especially under the High sea level change (SLC) curve. SLC over the 100-year period of analysis will further increase vulnerability of the densely populated urban environment as the frequency and magnitude of damaging events increases. Rising sea levels will exacerbate existing asset exposure while introducing risk from moderate- and even high-frequency storm events, especially for low-lying assets such as the Embarcadero roadway and structures directly adjacent to the waterfront. Interruptions to transportation and critical services could also lead to the deterioration of public health and safety conditions. Retreat from the waterfront will become necessary.

Economic results are presented using the Fiscal Year (FY) 2023 Price Level and FY2023 Project Evaluation and Formulation Rate (Discount Rate) of 2.5% in accordance with EGM 23-01 *Federal Interest Rates for Corps of Engineers Projects for Fiscal Year 2023* (USACE 2020) (though the results in the Executive Summary are updated to FY2024 dollars). All results presented are in accordance with U.S. Army Corps of Engineers (USACE) policy and guidance with specific emphasis on EM 1110-2-1619 *Risk-Based Analysis for Flood Damage Reduction Studies,* ER 1105-2-100 *Planning Guidance Notebook*, ER 1100-2-8162 *Incorporating Sea Level Change in Civil Works Programs*, and ER 1105-2-101 *Risk Assessment for Flood Risk Management Studies*, (USACE 1996, 2000, 2013, 2019).

The Future Without Project (FWOP) and Future With Project (FWP) conditions are evaluated across four accounts: National Economic Development (NED), Regional Economic Development (RED), Other Social Effects (OSE), and Environmental Quality (EQ). The RED account register considers the distribution of regional economic activity and, in the context of this study, encompasses a wide variety of potential damages including direct, indirect, and induced revenue losses, revenue losses to the BART and SFMTA systems, and changes to regional employment opportunities. The OSE account registers effects to social aspects such as health and safety, displacement, and community impacts.

Figure ES-1 displays the average NED Present Value (PV) damages over time for the study area across all three of the USACE SLC curves. The results show a clear sensitivity to SLC when forecasting possible future conditions. Under the High relative sea level change (RSLC) curve, damages increase as more assets are at risk, then decrease due to discounting and the removal of at-risk assets as retreat from the waterfront begins.

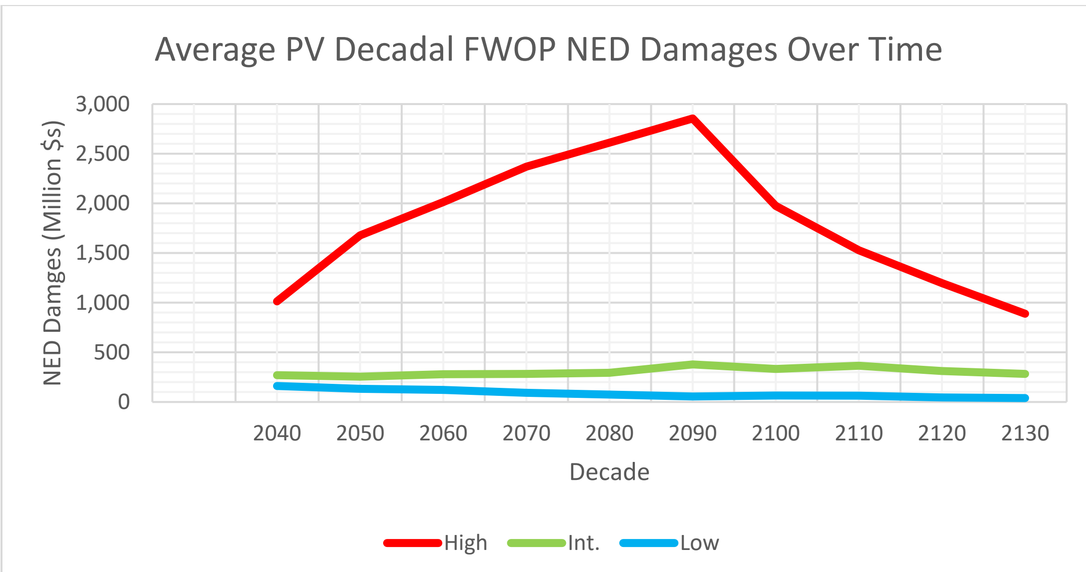

Figure ES-1: Average PV Decadal FWOP NED Damages Over Time

Table ES-1 displays the average PV damages for each model area across all three of the USACE SLC curves as well as the calculated Average Annual Damages (AAD). NED damages stem from physical losses to assets from flood and tidal events (structure and content damage), the cost of retreat (reactive floodproofing, condemnation of assets, and loss of land value), and costs from retrofitting existing systems in the face of increased risk (risk to the existing coastal defense system, costs to the wastewater system, and costs to the transportation network). Results are preliminary and are subject to change.

Table ES-1: FWOP Damages by Reach (FY2024 Dollars)

Reach	High SLC ($)	Intermediate SLC ($)	Low SLC ($)
1	1,629,952,000	441,412,000	385,624,000
2	8,053,816,000	1,617,316,000	748,180,000
3	9,764,884,000	2,168,303,000	922,335,000
4	3,728,486,000	1,882,566,000	1,648,553,000
TOTAL PV	**23,177,138,000**	**6,109,597,000**	**3,704,692,000**
1	44,517,000	12,055,000	10,532,000
2	219,965,000	44,172,000	20,434,000
3	266,697,000	59,221,000	25,190,000
4	101,832,000	51,417,000	45,025,000
TOTAL AAD	**633,011,000**	**166,865,000**	**101,181,000**

The damages are substantially higher under the High RSLC curve than the Intermediate and Low curves, suggesting the need for an adaptable plan that performs well under all three rates of RSLC. The initial array of alternatives formulated plans to address different rates of rise, and later hybridized plans were derived to offer a clear set of potential future actions that could respond to the full suite of potential future conditions.

The Project Delivery Team (PDT) identified the three NED plans (one for each RSLC curve), then used lessons learned to select one plan that performed well (i.e., achieved the goals of the study while balancing cost and risk) under each curve. From there, the PDT used information gathered on metrics in the RED, OSE, and EQ accounts to determine a Maximum Total Net Benefits Plan (MTNBP). Concerns about disruptions in vulnerable communities stemming from flooding moved the PDT away from nonstructural solutions in the Southern Waterfront, while concerns over disruption in the Embarcadero, seismic life safety issues, and desire to protect berthing suggested a larger initial plan in Reach 2.

The hybridized plan and the MTNBP, which doubles as the Tentatively Selected Plan (TSP), are shown in Table ES-2 and Table ES-3, respectively. Each has a preliminary action, assumed to be in 2040, and a range of secondary actions, assumed to be in 2090. Future analysis will relax the 2090 assumption and instead make the second action dependent on a “trigger,” or SLC threshold.

Table ES-2: First and Potential Second Actions, Hybridized Plan

Reach	First Action	Second Action Low	Second Action Intermediate	Second Action High
1	Alternative B	N/A	Alternative B (Additional nonstructural)	Alternative G (19 feet)
2	Alternative D (13.5 feet)	N/A	Alternative D (15.5 feet)	Alternative G (19 feet)
3	Alternative D (13.5 feet)	N/A	Alternative D (15.5 feet)	Alternative G (19 feet)
4	Alternative B	N/A	Alternative B (Additional nonstructural)	Alternative G (19 feet)

Table ES-3: Maximum Total Net Benefits Plan First and Potential Second Actions

Reach	First Action	Second Action Low	Second Action Intermediate	Second Action High
1	Alternative B	N/A	Alternative B (Additional nonstructural)	Alternative G 19 feet
2	Alternative G 15.5 feet	N/A	N/A	Alternative G 19 feet
3	Alternative D 13.5 feet	N/A	Alternative D 15.5 feet	Alternative E 19 feet
4	Alternative D 13.5 feet	N/A	Alternative D 15.5 feet	Alternative E 19 feet

Costs and benefits for the first action and the second action under the Intermediate and High RSLC curve are shown in Table ES-4 for both the NED plan and the MTNBP. Note that the costs used for the cost-benefit analysis do not include additional design and construction costs resulting from addressing seismic concerns, as specified in the Water Resources Development Act of 2020, Sec. 152(a). The costs also differ between the Intermediate and High RSLC curves because the second action depends on what rate of change is realized by 2090.

Table ES-4: TSP/MTNBP and NED Plan, FY2024 ($000s)

TSP/MTNBP (FY2024, Intermediate RSLC)	
FWOP AAD	180,583
FWP AAD	68,351
Total Reduced AAD	**112,232**
Total Initial Construction (2040 and 2090, Discounted)	4,587,487
Interest During Construction (IDC)	783,836
Operation, maintenance, repair, replacement, and rehabilitation (OMRR&R)	22,624
Average Annual Cost (AAC)	**180,832**
Average Annual Net Benefits	-68,600
Benefit-Cost Ratio	0.62
Residual Damages	37.85%

NED Plan (FY2024, Intermediate RSLC)	
FWOP AAD	**180,583**
FWP AAD	**86,512**
Total Reduced AAD	94,072
Total Initial Construction (2040 and 2090, Discounted)	**469,804**
Interest During Construction (IDC)	**29,749**
Operation, maintenance, repair, replacement, and rehabilitation (OMRR&R)	**1,926**
Average Annual Cost (AAC)	**16**,640
Average Annual Net Benefits	**77,431**
Benefit-Cost Ratio	**5.65**
Residual Damages	**47.91%**

TSP/MTNBP (FY2024, High SLC)	
FWOP AAD	685,054
FWP AAD	51,651
Total Reduced AAD	**633,402**
Total Initial Construction (2040 and 2090, Discounted)	7,010,544
IDC	1,337,598
OMRR&R	34,744
AAC	**280,632**
Average Annual Net Benefits	352,771
Benefit-Cost Ratio	2.26
Residual Damages	7.54%

NED Plan (FY2024, High SLC)	
FWOP AAD	**685,054**
FWP AAD	**249,350**
Total Reduced AAD	435,704
Total Initial Construction (2040 and 2090, Discounted)	**3,730,395**
IDC	**607,694**
OMRR&R	**14,490**
AAC	32,049
Average Annual Net Benefits	**403,655**
Benefit-Cost Ratio	**13.59**
Residual Damages	**36.40%**

Though Average Annual Net Benefits are lower in the TSP than in the NED plan, the PDT asserts that the difference is more than made up for when considering the four accounts and the resiliency goals of the study. Additionally, the first action of the NED plans under each RSLC curve are scoped for that curve's rate of rise, but because the decision about the first action must be done without knowing the rate of rise, it is unlikely any plan will be scoped perfectly for unknown future conditions. Instead, it is preferable to select a plan that performs well in all future conditions to avoid a high risk of over- or under-investment.

While this appendix is intended to provide a full breakdown of the data collection, methodology, assumptions, applications, modeling, and results of the economics analysis in the FWOP and FWP conditions, there is a sizeable volume of background and complimentary reports that can enhance the full representation of the ongoing economics analysis. A list of those supplemental reports is provided below:

Sub-Appendices:

- E.1: RED Report
- E.2: OSE Report

NED Supplemental Materials:

- Federal Emergency Management Agency Baseline Standard Economic Value Methodology Report
- BART and SFMTA Underground Flood Risk
- SFMTA Central Subway Underground Flood Risk
- SFMTA Light Rail Transit Surface Track Damage Estimates
- Regional Transit Assumptions Report
- Utility and Mobility Report
- SFMTA Waterfront Resiliency Transportation Assessment Adaptations Menu

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Acronyms and Abbreviations

Acronym	Definition
AAC	Average Annual Cost
AEP	Annual Exceedance Probability
BART	Bay Area Rapid Transit
BCR	Benefit-to-Cost
BRC	Building Replacement Cost
CCSF	City and County of San Francisco
CSRM	Coastal Storm Risk Management
CSVR	Contents to Structure Value Ratio
DEM	Digital Elevation Model
EQ	Environmental Quality
FEMA	Federal Emergency Management Agency
FFE	first floor elevation
FSR	Facility Systems of Record
FWOP	Future Without Project
FWP	Future With Project
FY	Fiscal Year
G2CRM	Generation 2 Coastal Risk Model
GDP	Gross Domestic Product
HTRW	Hazardous, Toxic, and Radioactive Waste
IDC	Interest During Construction
IWR	Institute for Water Resources
kV	Kilovolt(s)

LiDAR	Light Detection and Ranging
LRT	Light Rail Transit
LRV	Light Rail Vehicle
M&S	Marshall and Swift
MCDA	Multiple-Criteria Decision Analysis
MHRA	Multi-Hazard Risk Assessment
MTNBP	Maximum Total Net Benefits Plan
Muni	San Francisco Municipal Railway
NACCS	North Atlantic Coast Comprehensive Study
NAVD88	North American Vertical Datum of 1988
NED	National Economic Development
NFS	Non-Federal Sponsor
OMRR&R	operation, maintenance, repair, replacement, and rehabilitation
OSE	Other Social Effects
P&G	1983 Economic and Environmental Principles and Guidelines for Water and Related Land Implementation Studies
PDT	Project Design Team
PLU	Planning Land Use
POSF	Port of San Francisco
PSE	Protective System Element
PV	Present Value
RED	Regional Economic Development
RSLC	Relative Sea Level Change
SFBR	San Francisco Bay Railroad

SFMTA	San Francisco Municipal Transportation Agency
SFPUC	San Francisco Public Utilities Commission
SLC	Sea Level Change
TSP	Tentatively Selected Plan
UDV	Unit Day Value
WETA	Water Emergency Transportation Authority
WRDA	Water Resources Development Act
USACE	U.S. Army Corps of Engineers

1. Introduction

This appendix presents the economics methodology, assumptions, and resulting analysis for determining Federal interest in managing coastal storm risk on the San Francisco waterfront. This report will detail each step of the analytical process and describe relevant inputs and results for each subsection of the study area. Detailed discussion includes asset inventory creation, implementation of the Generation 2 Coastal Risk Model (G2CRM), modeling actuation, and results analysis. The assessment is conducted at a feasibility level and covers 7.5 miles of the San Francisco waterfront.

The authorized study area covers the waterfront between Aquatic Park (to the north) and Heron's Head Park (to the south). The study area, shown on Figure E-1, contains seven Model Areas as based on identifiable geographic references, specific wave action within each model area, major differences in physical structure inventory, and whether the area is in front of or behind the existing seawall. The delineation of these Model Areas can be seen on Figure E-2. Four Model Areas are landward of an existing shoreline seawall and three Model Areas are seaward of the seawall. These Model Areas were segregated based on their different responses to coastal forces and their likely different proposed future alternatives. The majority of structure assets are found in the four landward Model Areas.

The existing Embarcadero seawall is an existing coastal structure built over 100 years ago. The seawall varies in height along the study area and provides varying levels of coastal storm risk management. The existing seawall is discussed briefly in Section 4.2 and in greater detail in *Appendix B: Engineering*.

Model Area 1 begins at Aquatic Park and ends at Pier 33, Model Area 2 begins at Pier 33 and ends at the Bay Bridge, Model Area 3 extends from the Bay Bridge to Pier 70, and Model Area 4 spans from Pier 70 to Heron's Head Park. Model Areas 5, 6, and 7 are seaward of Model Areas 1 through 3, respectively. Within this appendix, a pair of Model Areas that represent a hydraulically independent unit that is both landward and seaward of the existing seawall (for instance, Model Areas 1 and 5) are called "reaches."

Though all four reaches are mixed-use communities, each with large amounts of residential, commercial, and industrial property, some generalities can be made about the composition of the reaches.

Reach 1 is home to many businesses developed before 1980 as single-use establishments. It is also home proportionally to the most single-family households.

Reach 2 includes the Embarcadero and, as such, has numerous high-value commercial structures and office high-rises, as well as Embarcadero Station (Bay Area Rapid Transit [BART] and San Francisco Municipal Railway [Muni] Subway). Reach 3 includes Mission Bay, which is low-lying and includes many high-value residential structures, as well as the Chase Center arena, home of the Golden State Warriors and utilized for other major multipurpose events (e.g., music concerts).

Reaches 3 and 4 include waterfront areas used for the Port of San Francisco's (POSF) cargo and ship repair operations, along with several habitat and public recreation areas. Reach 4 also contains predominately industrial assets including a wastewater treatment plant and a solid-waste recycling plant.

The waterfront area contains piers, structures, seawall, and open land. Most of the piers' bulkhead buildings, seawall, and waterfront structures along the Embarcadero were built before World War II and many have historical significance. Two districts in the study area are listed in the National Register. One is the Embarcadero Historic District, which includes the Ferry Building, the Agriculture Building, and finger piers from Pier 45 in Fisherman's Wharf to Pier 48 in Mission Bay. The other is the Union Iron Works Historic District in Pier 70. San Francisco Maritime National Historic Park, including the Aquatic Park, is also within the study's bounds.

Sections 2 and 3 detail the G2CRM inventory creation process and are displayed in the Fiscal Year (FY) 2018 Price Level. However, all economic analysis results (Section 4 onward) have been updated to FY2023 price level. Future versions of this appendix will update results to the FY2024 Price Level.

Figure E-1: Location of the Study Area

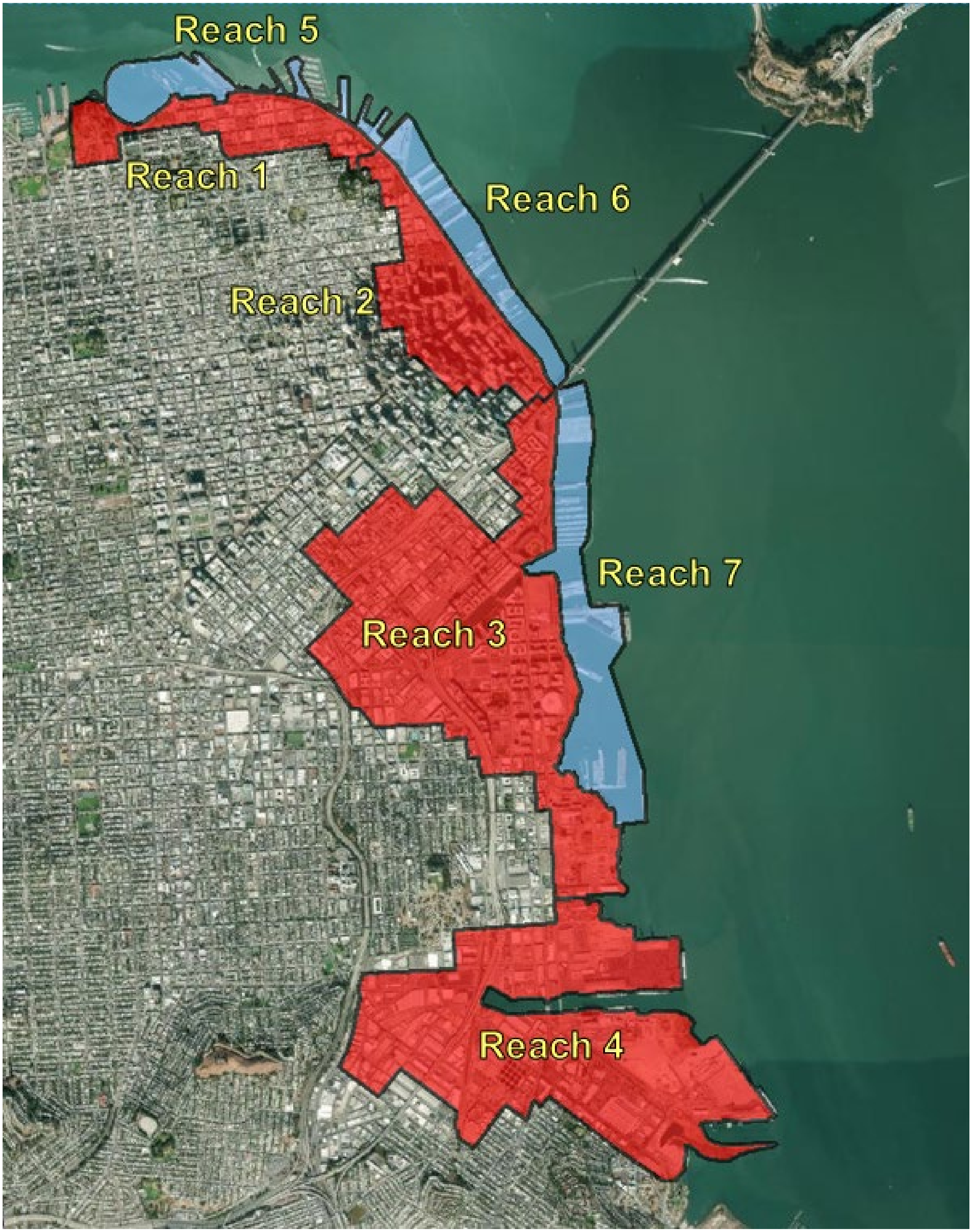


Figure E-2: San Francisco Waterfront Coastal Flood Study Area Extent

2. G2CRM and the Asset Inventory

2.1 G2CRM

G2CRM implements an object-oriented probabilistic life-cycle analysis model using Monte Carlo simulation. Monte Carlo simulation is a numerical-analysis procedure that computes the expected value of damage while explicitly accounting for uncertainty in the basic parameters used to determine flood inundation damage. The output is a probability distribution of outcomes that represents the range of potential damages and the probabilities of these possible outcomes.

G2CRM provides integrated hydrologic engineering and economic risk analysis during the formulation and evaluation of flood damage reduction plans in compliance with policy regulations ER 1105-2-100 *Planning Guidance Notebook* and ER 1105-2-101 *Risk Analysis for Flood Damage Reduction Studies* (USACE 2000, 2019). Uncertainty in storm inputs, economic variables, and depth-percent damage functions are quantified and incorporated into evaluation of the Future Without Project (FWOP) condition and the performance of any proposed alternatives.

Coastal storm modeling inputs, depth-percent damage functions, structures, and critical infrastructure within the study area are used as inputs for the G2CRM software. In conjunction with hydrologic modeling, G2CRM also incorporates Historic (Low), Intermediate, and High relative sea level change (RSLC) analysis in compliance with EM 1110-2-1619 *Risk-Based Analysis for Flood Damage Reduction Studies* and ER 1100-2-8162 *Incorporating Sea Level Change in Civil Works Programs* (USACE 1996, 2013).

G2CRM is a powerful tool for calculating economic damages whenever damages can be tied to water levels. Within G2CRM, this is done through the creation or application of a depth-percent damage curve: when the water reaches a certain height, relative to an asset’s FFE, a certain amount of damage occurs, relative to the structure’s assigned value. This framework is appropriate when evaluating damages to structures or to their contents, but it can also be appropriate when addressing critical infrastructure.

For critical infrastructure, empirical stage-damage curves were created that tie downstream damages, such as a loss of access to the BART, to water levels. These downstream effects are inserted into G2CRM as separate assets that can take an amount of damage that is not based on the asset’s value itself. This methodology is discussed extensively in Section 3.

FWOP conditions are used as the base condition over the 100-year period of analysis. The model uses the FY2023 Project Evaluation and Formulation Rate (Discount Rate) of 2.5% in accordance with EGM 23-01 *Federal Interest Rates for Corps of Engineers Projects for Fiscal Year 2023* (USACE 2023). In future iterations of the modeling and in updates to this draft report, the price level and discount rate will be updated.

2.2 Building Inventory

The geographic extent of the G2CRM building inventory is contained to seven model areas set by U.S. Army Corps of Engineers (USACE), as shown on Figure E-3. Building footprints and key attribute data were collected for all buildings within the model areas to create the G2CRM inventory, including but not limited to:

- Building location
- Building footprint/configuration
- Building footprint square footage
- Total building functional square footage
- Building and contents replacement costs
- First floor elevation
- Number of stories
- Number of residents
- Building use
- Construction type (Hazus Model Building Type)
- Age and/or condition (poor, average, or good)
- Historic significance

In all, the inventory contains 424 POSF-owned assets and 5,338 non-POSF assets. This section documents the data sources used and processing completed to populate the G2CRM building inventory template.

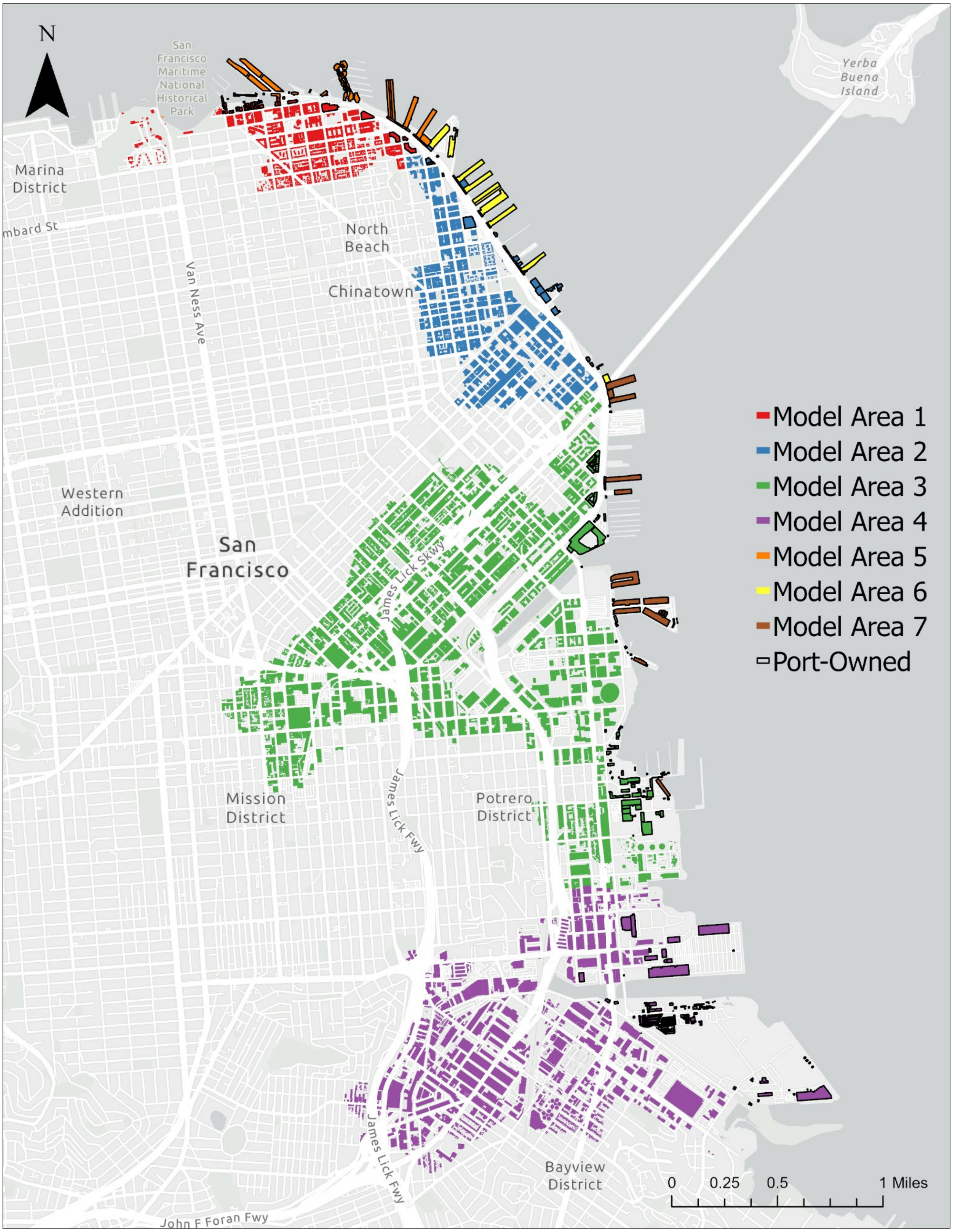


Figure E-3: Building Inventory and G2CRM Model Areas

2.3 Data Sources

Data sources for the G2CRM building inventory data were compiled by consolidating attributes from multiple sources. Table E-1 lists these sources in the order which they are considered to be complete and up to date.

Table E-1: Building Inventory Data Sources

Source Name	Purpose	Source
Building Footprints	Spatial basis for inventory. Building height and land use data were used when absent in other data sources.	Hilt 2017
POSF Leased Parcels (POSF Lease)	Pertinent information for POSF buildings only. Potentially multiple structures per parcel. Support identification of structure use, building area, and number of floors.	Hilt 2017
Facility Systems of Record (FSR)	Pertinent information for municipal buildings and public infrastructure only. Potentially multiple structures per parcel. Support identification of structure use, building area, and number of floors.	Hilt 2017
Tall Buildings Dataset (Tall Buildings)	Data for privately owned high-rise buildings. Potentially multiple structures per parcel. Support identification of structure use, building area, and number of floors.	DataSF 2018
Assessor's Database (Assessor)	Data for nearly all privately owned buildings. Potentially multiple structures per parcel. Support identification of structure use, building area, and number of floors.	Hilt 2017
Planning Land Use Database (PLU)	Data for nearly all privately owned buildings. Potentially multiple structures per parcel. Support identification of structure use, building area, and number of floors.	Hilt 2017
Census Block	Supports residential population counts. Multiple structures per census block.	Hilt 2017
Union Iron Works National Register Nomination	Used to identify historic buildings. Not available for most structures.	NPS 2014
Embarcadero Historic Structures	Used to flag historic structures on POSF property in the Northern Waterfront.	Hilt 2017
American Community Survey	Used to determine residential population	U.S. Census Bureau 2016
Digital Elevation Model	Used to estimate ground elevations within a building footprint.	CH2M/Arcadis Team 2020a

Source Name	Purpose	Source
San Francisco Property Information Map (Architecture Section)	Used to determine year-built information for some buildings.	SF Planning

The geometry of the building inventory is based on the City and County of San Francisco (CCSF) building footprint data (Hilt 2017). This serves as the foundation upon which all other data are joined. The original building footprint file was produced through a San Francisco Enterprise Geographic Information Systems Program effort to (1) split "building masses" into individual buildings, and (2) provide zonal statistics on the building height according to three sets of Light Detection and Ranging (LiDAR) data. The LiDAR-derived Digital Elevation Model (DEM) can be seen on Figure E-4. Building footprints were adjusted as needed based on review using aerial imagery and Google Street View. This review is discussed in more detail in Section 2.4.3.

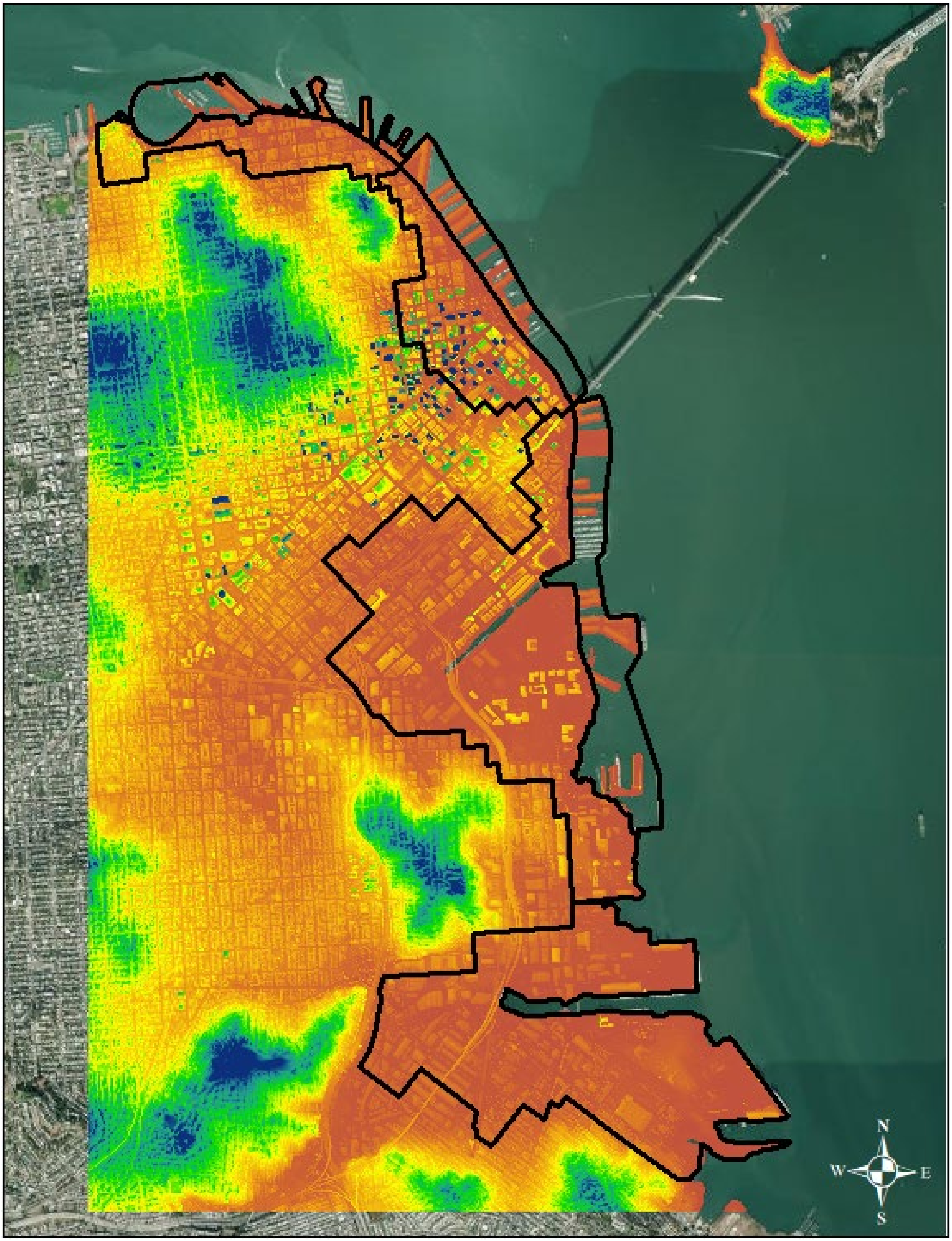


Figure E-4: LiDAR-Derived Digital Elevation Map of Study Area

2.4 Data Processing

Data were compiled from each resource in Table E-1 that would be necessary to either (1) populate the G2CRM inventory template directly, or (2) make an assumption to populate the G2CRM inventory. For example, building replacement cost estimates are the result of building use, the damageable building area, and building condition. Table E-2 summarizes the fields and data extracted from the resources in Table E-1. All dimensions are in feet or square feet. All elevations are in feet North American Vertical Datum of 1988 (NAVD88).

Table E-2: Data Processing Fields

Field Name	Data Source	Description
Inventory ID	Developed by Planning, Engineering, and Environmental Consultant (PEC)	Unique for each building. Used for facilitating data updates and consistent reference for each individual structure as it pertains to these analyses
Latitude		Latitude of the centroid of the structure footprint
Longitude		Longitude of the centroid of the structure footprint
Address	Tall Buildings, FSR, PLU	Street name (address if available) Street address from Tall Buildings Study, FSR, or Street Name from Census Tiger Lines/Google Street View
Descriptive Name	POSF Facilities, Tall Buildings, FSR	Common name of the building, from POSF Facilities, FSR, or PEC experience. For buildings on POSF property with no descriptive name, name was assigned based on the POSF facility name plus a letter to distinguish from other buildings (primarily on seawall lots, Pier 39, and in the Fisherman's Wharf reach)
Building Location	POSF Facilities	Building location according to Adapting to Rising Tides flood hazard data and POSF boundaries; classified as Non-POSF Buildings and POSF Buildings
Condition	Assumptions and Google Street View	• Marshall and Swift costing model building condition classification used in replacement cost calculations and asset depreciation estimates: – "Excellent" if "Office – High Class" or "Office – Trophy Class" in Assessor Property Class Description – "Excellent" if built within the last 20 years – "Average" if "Office Middle Class C" or "Office- Low Class" in Assessor Property Class Description – Otherwise "Good"

Field Name	Data Source	Description
		• QA/QC team made revisions as appropriate based on Google Street View • Light review by the POSF Real Estate team for buildings in Reaches 1 and 2 within the flood hazard area that should be in Excellent condition (e.g., Exploratorium and Lumina), and marked Average for all buildings included in POSF Request for Information 2018 • For POSF Buildings only, the condition level from the methodology above was reviewed and any suggestions (based on walk-by knowledge as of February 2019, no formal conditions assessment) were used to update this field in Reaches 1 and 2
Construction Type	Assessor	Marshall and Swift construction classes Only included if data were present in the Assessor's database
Model Building Type	Review of available Rapid Structural Assessment reports (from the POSF), then visual confirmation (walk-bys), and limited drawing review	Available for all POSF buildings within the Embarcadero seawall Program boundary. Other buildings are listed as "U" for unknown.
Number of Floors	Maximum of Tall Buildings, POSF Lease, Assessor, and building height-based assumptions	If no data was available, estimated using Building Footprint's Structure Height with the assumption of 10 feet per floor (rounded to the nearest integer with a minimum of 1) QA/QC team confirmed and revised in POSF and Hazard areas based on Google Street View
Basement Presence	Tall Buildings and Assessor with assumptions	• Absent if indicated in Tall Buildings and Assessor • Present if indicated in Tall Buildings or Assessor • Presence or absence was reviewed through Google Streetview.
Average Ground Elevation	DEM and Building Footprints	Reflects the average ground elevation within a building footprint. Obtained by overlaying LiDAR with building footprints and using zonal statistics.
Approximate Height Above Grade	Google Street View	Google Street View was used to review buildings and note potential flood entry points, including doors, windows, and vent shafts.
First Floor Elevation		Average Ground Elevation plus Approximate Height Above Grade
Building Area	FSR, Tall Buildings, Assessor, assumptions	Square footage of the entire building. If no data were available, this was taken as the building footprint area

Field Name	Data Source	Description
		multiplied by the number of floors (with a maximum of 10). Used in replacement cost calculations.
Year Built	Maximum of Tall Buildings, Assessor, and PLU	Missing year-built information is entered as 1900 for all buildings.
Number of Units	Maximum of Assessor and PLU	Used to support determination of structure use classification in residential buildings.
Historic Flag	Embarcadero Historic Structures Union Iron Works National Register Nomination	Used in replacement cost calculations (Section 2.4.2).
Structure Use	POSF Lease, Tall Buildings, Assessor, PLU	See Section 2.4.1
Structure Use Code	POSF Lease, Tall Buildings, Assessor, PLU	See Section 2.4.1

Data gathered from the resources outlined in Table E-2 were used to develop two critical attribute types in the G2CRM inventory that warrant further explanation: structure use codes and replacement costs.

2.4.1 Structure Use Code Crosswalks

Structure use is imperative to accurately estimate expected direct physical damages. The structure use helps identify accurate replacement costs, depth-damage functions, and even the type of impact expected as a result of flooding. All structures were assigned a structure use code based on Assessor Data Property Classes (Section 2.4.1.2). Structures without assigned Assessor Data Property Classes were reviewed and assigned to an existing structure use code type, or a new category was created. New structure use codes begin with X, Y, or Z. Multifamily and mixed residential classes were reclassified to match the number of units defined in Hazus Classes (structure use codes beginning with X3). Furthermore, structure use codes provided in the POSF Lease, Tall Buildings, and PLU Database were considered more accurate than Assessor data. POSF Lease data had the highest priority to identify structure use, followed by Tall Buildings, Assessor, and PLU. Structures with unknown or vacant uses were manually assigned codes based on Google Street View imagery.

2.4.1.1 Hazus and Occupancy Classes

Structures may be classified many ways to determine further information about the structure, such as replacement costs, restoration time estimates, and one-time disruption costs. Structure uses must be detailed enough to support crosswalks to different resources from the Federal Emergency Management Agency (FEMA) and USACE to estimate the attributes that are dependent on structure use. Four crosswalks were created for this purpose:

- Hazus Occupancy Class Crosswalk: The FEMA Hazus program has 34 occupancy classes with standard values for replacement costs and restoration time estimates. The occupancy classes and corresponding data used for the G2CRM inventory are provided in Table E-3. Restoration time estimates are based on the minimum, average, and maximum flood depths within a building present for the 22.7-foot stillwater elevation flood event.
- Marshall and Swift (M&S) Building Replacement Cost (BRC) Classifications: M&S provides unit replacement costs per square foot for different types of buildings. Four M&S classifications and 2015 unit costs proposed in a CAP 103 study were used to provide replacement cost estimates as required by G2CRM methodology. These unit costs were adjusted to account for local construction costs and higher building value associated with historic structures. More detail on these adjustments is provided in Section 2.4.2; unit costs are inflated to FY2023 values using the Bureau of Labor Statistics Consumer Price Index inflation calculator. Table E-4 includes information on M&S building replacement costs. Building costs were also calculated using RSMeans; these replacement values are shown in Table E-3.
- USACE Contents to Structure Value Ratio (CSVR) Classifications: CSVRs from the Donaldsonville to the Gulf, Louisiana, Feasibility Study were used to estimate the value of contents within a building for a variety of occupancy classes. Table E-5 contains information on these CSVRs.
- USACE Depreciation Categories: Categories from Institute for Water Resources (IWR) 95-R-9 Pr*ocedural Guidelines for Estimating Residential and Business Structure Value for Use in Flood Damage Estimation*s (IWR 1995) were used to apply depreciation factors to replacement costs based on structure condition and assumed maximum life span. Table E-6 includes information on these depreciation categories. These depreciation categories are used to calculate structure value, but over the course of the study depreciation is assumed not to occur (i.e., that structures will be maintained at the level they were at the beginning of the study).

Table E-3: Hazus Occupancy Classes, Restoration Times, and Unit Costs

Hazus Occupancy Class	Hazus Definition	Restoration Time			One-Time Disruption Cost (per square foot)	RSMeans Building Replacement Cost (per square foot)
		Minimum (0 foot Flooding)	Mode (4 feet Flooding)	Maximum (10 feet Flooding)		
RES1	Single Family Dwelling	0	360	495	$1.17	$248.05
RES2	Manufactured Housing	0	468	540	$1.17	$55.21
RES3A	Duplex	0	360	495	$1.17	$181.12
RES3B	Triplex/Quads	0	360	495	$1.17	$159.85
RES3C	5-9 units	0	420	540	$1.17	$293.48
RES3D	10-19 units	0	420	540	$1.17	$273.68
RES3E	20-49 units	0	420	540	$1.17	$274.75
RES3F	50+ units	0	420	540	$1.17	$254.41
RES4	Hotel	0	420	540	$1.17	$265.71
RES5	Institutional Dormitory	0	480	690	$1.17	$291.00
RES6	Nursing Home	0	480	690	$1.17	$314.73
COM1	Retail Trade	0	570	840	$1.55	$166.86
COM2	Wholesale Trade	0	570	840	$1.35	$174.92
COM3	Personal and Repair Services	0	360	495	$1.35	$203.90
COM4	Professional/ Technical/ Business Service	0	480	690	$1.35	$256.98
COM5	Banks	0	480	690	$1.35	$380.94
COM6	Hospital	540	720	900	$1.94	$440.74
COM7	Medical Office/Clinic	0	480	690	$1.94	$330.23
COM8	Entertainment and Recreation, Restaurants	0	570	840	$0.00	$331.67
COM9	Theaters	0	570	840	$0.00	$278.35
COM10	Parking	0	30	30	$0.00	$117.48
IND1	Heavy	0	210	210	$0.00	$193.92
IND2	Light	0	150	150	$1.35	$174.92

Hazus Occupancy Class	Hazus Definition	Restoration Time			One-Time Disruption Cost (per square foot)	RSMeans Building Replacement Cost (per square foot)
		Minimum (0 foot Flooding)	Mode (4 feet Flooding)	Maximum (10 feet Flooding)		
IND3	Food/Drugs/Chemicals	0	510	720	$1.35	$263.07
IND4	Metals/Minerals Processing	0	540	750	$1.35	$263.07
IND5	High Technology	0	630	900	$1.35	$263.07
IND6	Construction	0	150	150	$1.35	$174.92
AGR1	Agriculture	0	210	210	$0.97	$174.92
REL1	Church	0	570	840	$1.35	$277.74
GOV1	General Services	0	480	690	$1.35	$218.41
GOV2	Emergency Response	0	480	690	$1.35	$370.59
EDU1	Schools/Libraries	0	480	690	$1.35	$293.92
EDU2	Colleges/Universities	0	480	690	$1.35	$249.34
VACNT	Vacant Warehouse	0	0	0	$0.00	$174.92

Table E-4: Marshall and Swift Building Replacement Costs per Square Foot[a]

Classification	Condition		
	Average	Good	Excellent
Residential	$182.31	$230.23	$326.05
Mixed - Commercial	$136.95	$166.72	$226.27
Mixed - Residential	$133.81	$167.93	$236.17
Commercial	$239.61	$279.99	$363.77
[a]Costs are shown in FY2023 U.S. dollars.			

Table E-5: Contents to Structure Value Ratio Classifications

CSVR Classification	CSVR
Garage	0
Single Family Residential	0.5
Multifamily Residential	0.5
Eating and Recreation	0.4
Groceries and Gas Stations	1.4
Professional Businesses	0.2
Public	0.4
Retail and Personal Services	1.2
Industrial	0.4
Vacant	0.4

Table E-6: Maximum Building Life Spans for Depreciation Categories

Classification	Maximum Life Span
Commercial/Retail	50
Multifamily Residential	60
Office	55
Restaurant	40
Single Family Residential	55
Warehouse/Industrial	50

2.4.1.2 Mapping Structure Use Codes

San Francisco is an urban environment with many mixed-use buildings, but many FEMA and USACE standard values or classifications do not cover mixed-use building types. To account for this challenge, two schemes were developed for each crosswalk: structure use matches considering the dominant use of the building and structure use matches considering the first-floor use of the building.[1] These crosswalks schemes are consolidated in Table E-7 and Table E-8. Table E-9 provides information on structure use codes for POSF Lease, Tall Buildings, and PLU data.

Table E-7: Occupancy Class Assignment – Single Use[a]

Structure Use Code	Structure Use	Hazus Classes (First-Floor and Dominant Use)	M&S BRC Classification	USACE CSVR Classification (First-Floor and Dominant Use)	USACE Depreciation Category
B	Bank	COM5	Commercial	Professional Businesses	Office
C	Commercial Stores	COM1	Commercial	Retail and Personal Services	Commercial/Retail
C1	Shopping Center	COM1	Commercial	Retail and Personal Services	Commercial/Retail
CP	CCSF Property	GOV1	Commercial	Public	Office
D	Single Family Dwelling	RES1	Residential	Single Family Residential	Single Family Residential
DBM	Single Family Dwelling Below Market Value	RES1	Residential	Single Family Residential	Single Family Residential
E	Schools	EDU1	Commercial	Public	Office
EC	Entertainment Complex	COM8	Commercial	Eating and Recreation	Restaurant
G	Garages/Parking	COM10	Commercial	Garage	Commercial/Retail

1 First-floor and dominant use replacement cost classes were determined based on the Structure Use Code and number of units. For Structure Uses that indicate a single use type, the first-floor and dominant use codes are the same. Structure Uses that indicate multiple use types were assigned different codes for first-floor and dominant uses. It was assumed the first floor of a mixed-use building is commercial use, while upper floors are residential. If both uses were commercial, it was assumed that the first floor was not office.

Structure Use Code	Structure Use	Hazus Classes (First-Floor and Dominant Use)	M&S BRC Classification	USACE CSVR Classification (First-Floor and Dominant Use)	USACE Depreciation Category
H	Hotel	RES4	Residential	Multifamily Residential	Multifamily Residential
H1	Hotel	RES4	Residential	Multifamily Residential	Multifamily Residential
H2	Hotel	RES4	Residential	Multifamily Residential	Multifamily Residential
I	Industrial	IND2	Commercial	Industrial	Warehouse/Industrial
IDC	Data Center	IND5	Commercial	Professional Businesses	Warehouse/Industrial
IW	Warehouse	IND2	Commercial	Industrial	Warehouse/Industrial
M	Motels	RES4	Residential	Multifamily Residential	Multifamily Residential
MU	Museum	COM8	Commercial	Public	Commercial/Retail
N1	Hospitals	COM6	Commercial	Professional Businesses	Office
N2	Convalescent or Nursing Homes	RES6	Residential	Multifamily Residential	Multifamily Residential
NC-1	Commercial Stores	COM1	Commercial	Retail and Personal Services	Commercial/Retail
NC-3	Commercial Stores	COM1	Commercial	Retail and Personal Services	Commercial/Retail
NC-S	Commercial Stores	COM1	Commercial	Retail and Personal Services	Commercial/Retail
NCT	Commercial Stores	COM1	Commercial	Retail and Personal Services	Commercial/Retail
O	Office	COM4	Commercial	Professional Businesses	Office
OCH	Office	COM4	Commercial	Professional Businesses	Office

Structure Use Code	Structure Use	Hazus Classes (First-Floor and Dominant Use)	M&S BRC Classification	USACE CSVR Classification (First-Floor and Dominant Use)	USACE Depreciation Category
OCL	Office	COM4	Commercial	Professional Businesses	Office
OMD	Medical Office/Clinic	COM7	Commercial	Professional Businesses	Office
P	Public Buildings	GOV1	Commercial	Public	Office
PDR-1-G	Warehouse	IND2	Commercial	Industrial	Warehouse/Industrial
PDR-2	Warehouse	IND2	Commercial	Industrial	Warehouse/Industrial
PL	Garages/Parking	COM10	Commercial	Garage	Commercial/Retail
RH-1	Single Family Dwelling	RES1	Mixed – Residential	Single Family Residential	Single Family Residential
RH-2	Residential 1 to 2 units	RES3A	Mixed – Residential	Multifamily Residential	Multifamily Residential
RH-3	Residential 3 to 4 units	RES3B	Mixed – Residential	Multifamily Residential	Multifamily Residential
S	Gas Station	COM3	Commercial	Groceries and Gas Stations	Commercial/Retail
T	Theaters	COM9	Commercial	Eating and Recreation	Commercial/Retail
TH	Single Family Dwelling	RES1	Residential	Single Family Residential	Single Family Residential
U	Clubs Lodges Fraternal Organizations	COM8	Commercial	Public	Restaurant
UCP	Universities	EDU2	Commercial	Public	Commercial/Retail
W	Churches Convents Rectories	REL1	Commercial	Public	Office
X	RECLASSIFY	VACNT	Commercial	Vacant	Warehouse/Industrial
X3A	Residential 1 to 2 units	RES3A	Residential	Multifamily Residential	Multifamily Residential
X3B	Residential 3 to 4 units	RES3B	Residential	Multifamily Residential	Multifamily Residential

Structure Use Code	Structure Use	Hazus Classes (First-Floor and Dominant Use)	M&S BRC Classification	USACE CSVR Classification (First-Floor and Dominant Use)	USACE Depreciation Category
X3C	Residential 5 to 9 units	RES3C	Residential	Multifamily Residential	Multifamily Residential
X3D	Residential 10 to 19 units	RES3D	Residential	Multifamily Residential	Multifamily Residential
X3E	Residential 20 to 49 units	RES3E	Residential	Multifamily Residential	Multifamily Residential
X3F	Residential 50 or more units	RES3F	Residential	Multifamily Residential	Multifamily Residential
XFS	Fire Station	GOV2	Commercial	Public	Office
XHS	Housing Service	COM3	Commercial	Retail and Personal Services	Commercial/Retail
XMA	Machine	VACNT	Commercial	Vacant	Warehouse/Industrial
XNSPS	North Shore Pump Station	IND3	Commercial	Public	Warehouse/Industrial
XPD	Police Department	GOV2	Commercial	Public	Office
XPS	Pump Stations	IND3	Commercial	Public	Warehouse/Industrial
XT	Transportation	IND2	Commercial	Public	Warehouse/Industrial
XTA	Tank	IND3	Commercial	Industrial	Warehouse/Industrial
XTVS	TV Station	IND2	Commercial	Public	Warehouse/Industrial
XUT	Utilities	IND3	Commercial	Public	Warehouse/Industrial
xV	Vacant	VACNT	Commercial	Vacant	Warehouse/Industrial
YFP	Fish Processing	IND3	Commercial	Industrial	Warehouse/Industrial
YMT	Marine Terminal	IND2	Commercial	Industrial	Warehouse/Industrial
YRE	Restaurant	COM8	Commercial	Eating and Recreation	Restaurant
ZMC	Commercial Stores	COM1	Commercial	Retail and Personal Services	Commercial/Retail
ZMI	Industrial	IND2	Commercial	Industrial	Warehouse/Industrial
ZMIW	Warehouse	IND2	Commercial	Industrial	Warehouse/Industrial

Structure Use Code	Structure Use	Hazus Classes (First-Floor and Dominant Use)	M&S BRC Classification	USACE CSVR Classification (First-Floor and Dominant Use)	USACE Depreciation Category
ZMO	Office	COM4	Commercial	Professional Businesses	Office
ZMS	Gas Station	COM3	Commercial	Groceries and Gas Stations	Commercial/Retail
ZMU	Clubs Lodges Fraternal Organizations	COM8	Commercial	Public	Restaurant
ZMXPS	Pump Stations	IND3	Commercial	Public	Warehouse/Industrial
ZMXT	Transportation	IND2	Commercial	Public	Warehouse/Industrial
ZMXUT	Utilities	IND3	Commercial	Public	Warehouse/Industrial

[a]Multi-family and mixed residential classes were consolidated and reclassified to match the number of units defined in Hazus Classes (structure use codes beginning with X3). POSF Lease, Tall Buildings, and PLU uses were assigned structure use codes based on . POSF Lease data had the highest priority, followed by Tall Buildings, Assessor, and PLU. Structures with unknown or vacant uses were manually assigned codes based on Google Street View imagery.

Table E-8: Occupancy Class Assignment – Multiple Uses

Structure Use Code	Structure Use	Hazus Class – First Floor	Hazus Class – Dominant Use	M&S BRC Classification	USACE CSVR Classification – First Floor	USACE CSVR Classification – Dominant Use	USACE Depreciation Category – First Floor	USACE Depreciation Category – Dominant Use
CM	Mixed Use - Commercial Stores and Office	COM1	COM4	Mixed - Commercial	Retail and Personal Services	Professional Businesses	Commercial/Retail	Office
HC	Commercial Stores and Hotel	COM1	RES4	Mixed - Residential	Retail and Personal Services	Multifamily Residential	Commercial/Retail	Multifamily Residential
MUR	Mixed Use - Residential 3 to 4 units Office	COM4	RES3B	Mixed - Residential	Professional Businesses	Multifamily Residential	Office	Multifamily Residential
OC	Mixed Use - Commercial Stores and Office	COM1	COM4	Mixed - Commercial	Retail and Personal Services	Professional Businesses	Commercial/Retail	Office
RH1	Commercial Stores and Hotel	COM1	RES4	Mixed - Residential	Retail and Personal Services	Multifamily Residential	Commercial/Retail	Multifamily Residential
RM-1	Mixed Use - Residential 3 to 4 units Office	COM4	RES3B	Mixed - Residential	Professional Businesses	Multifamily Residential	Office	Multifamily Residential
RM-2	Mixed Use - Residential	COM4	RES3D	Mixed - Residential	Professional Businesses	Multifamily Residential	Office	Multifamily Residential

Structure Use Code	Structure Use	Hazus Class – First Floor	Hazus Class – Dominant Use	M&S BRC Classification	USACE CSVR Classification – First Floor	USACE CSVR Classification – Dominant Use	USACE Depreciation Category – First Floor	USACE Depreciation Category – Dominant Use
	10 to 19 units Office							
UMU	Mixed Use - Commercial Stores and Office	COM1	COM4	Mixed - Commercial	Retail and Personal Services	Professional Businesses	Commercial/Retail	Office
WMUG	Mixed Use - Commercial Stores and Office	COM1	COM4	Mixed - Commercial	Retail and Personal Services	Professional Businesses	Commercial/Retail	Office
X3AC1	Mixed Use - Residential 1 to 2 units Commercial Store	COM1	RES3A	Mixed - Residential	Retail and Personal Services	Multifamily Residential	Commercial/Retail	Multifamily Residential
X3AC4	Mixed Use - Residential 1 to 2 units Office	COM4	RES3A	Mixed - Residential	Professional Businesses	Multifamily Residential	Office	Multifamily Residential
X3AI	Mixed Use - Residential and Industrial	IND2	RES3C	Mixed - Residential	Industrial	Multifamily Residential	Warehouse/Industrial	Multifamily Residential
X3BC1	Mixed Use - Residential 3 to 4 units	COM1	RES3B	Mixed - Residential	Retail and Personal Services	Multifamily Residential	Commercial/Retail	Multifamily Residential

Structure Use Code	Structure Use	Hazus Class – First Floor	Hazus Class – Dominant Use	M&S BRC Classification	USACE CSVR Classification – First Floor	USACE CSVR Classification – Dominant Use	USACE Depreciation Category – First Floor	USACE Depreciation Category – Dominant Use
	Commercial Store							
X3BC4	Mixed Use - Residential 3 to 4 units Office	COM4	RES3B	Mixed - Residential	Professional Businesses	Multifamily Residential	Office	Multifamily Residential
X3CC1	Mixed Use - Residential 5 to 9 units Commercial Store	COM1	RES3C	Mixed - Residential	Retail and Personal Services	Multifamily Residential	Commercial/Retail	Multifamily Residential
X3CC10	Mixed Use - Residential 5 to 9 units Parking	COM10	RES3C	Mixed - Residential	Garage	Multifamily Residential	Commercial/Retail	Multifamily Residential
X3CC4	Mixed Use - Residential 5 to 9 units Office	COM4	RES3C	Mixed - Residential	Professional Businesses	Multifamily Residential	Office	Multifamily Residential
X3DC1	Mixed Use - Residential 10 to 19 units Commercial Store	COM1	RES3D	Mixed - Residential	Retail and Personal Services	Multifamily Residential	Commercial/Retail	Multifamily Residential

Structure Use Code	Structure Use	Hazus Class – First Floor	Hazus Class – Dominant Use	M&S BRC Classification	USACE CSVR Classification – First Floor	USACE CSVR Classification – Dominant Use	USACE Depreciation Category – First Floor	USACE Depreciation Category – Dominant Use
X3DC4	Mixed Use - Residential 10 to 19 units Office	COM4	RES3D	Mixed - Residential	Professional Businesses	Multifamily Residential	Office	Multifamily Residential
X3EC1	Mixed Use - Residential 20 to 49 units Commercial Store	COM1	RES3E	Mixed - Residential	Retail and Personal Services	Multifamily Residential	Commercial/Retail	Multifamily Residential
X3EC4	Mixed Use - Residential 20 to 49 units Office	COM4	RES3E	Mixed - Residential	Professional Businesses	Multifamily Residential	Office	Multifamily Residential
X3EI	Mixed Use - Residential 20 to 49 Units, Industrial	IND2	RES3E	Mixed - Residential	Industrial	Multifamily Residential	Warehouse/Industrial	Multifamily Residential
X3FC1	Mixed Use - Residential 50 or more units Commercial Store	COM1	RES3F	Mixed - Residential	Retail and Personal Services	Multifamily Residential	Commercial/Retail	Multifamily Residential

Structure Use Code	Structure Use	Hazus Class – First Floor	Hazus Class – Dominant Use	M&S BRC Classification	USACE CSVR Classification – First Floor	USACE CSVR Classification – Dominant Use	USACE Depreciation Category – First Floor	USACE Depreciation Category – Dominant Use
X3FC4	Mixed Use - Residential 50 or more units Office	COM4	RES3F	Mixed - Residential	Professional Businesses	Multifamily Residential	Office	Multifamily Residential
XBO	Mixed Use - Bank and Office	COM5	COM4	Mixed - Commercial	Professional Businesses	Professional Businesses	Office	Office
XCI	Mixed Use - Industrial and Commercial	IND2	COM4	Mixed - Commercial	Industrial	Professional Businesses	Warehouse/Industrial	Office
XCR	Mixed Use - Restaurant and Commercial Stores	COM8	COM1	Mixed - Commercial	Retail and Personal Services	Retail and Personal Services	Commercial/Retail	Commercial/Retail
XOC	Mixed Use - Commercial Stores and Office	COM1	COM4	Commercial	Retail and Personal Services	Professional Businesses	Commercial/Retail	Office
XRO	Mixed Use - Restaurant and Office	COM8	COM4	Mixed - Commercial	Eating and Recreation	Professional Businesses	Restaurant	Office
ZMXOC	Mixed Use - Commercial	COM1	COM4	Commercial	Retail and Personal Services	Professional Businesses	Commercial/Retail	Office

Structure Use Code	Structure Use	Hazus Class – First Floor	Hazus Class – Dominant Use	M&S BRC Classification	USACE CSVR Classification – First Floor	USACE CSVR Classification – Dominant Use	USACE Depreciation Category – First Floor	USACE Depreciation Category – Dominant Use
	Stores and Office							

Table E-9: Structure Use Code Assignment for POSF Lease, Tall Buildings, and PLU Data

Source	Source Use Code	Reclassified Structure Use Code	Structure Use
POSF Lease	Land Transportation/Tours	XT	Transportation
POSF Lease	Marine Support	YMT	Marine Terminal
POSF Lease	Marine Terminal	YMT	Marine Terminal
POSF Lease	Office	OMD	Medical Office/Clinic
POSF Lease	Public Use	P	Public Buildings
POSF Lease	Recreation/Visitor Attraction	C	Commercial Stores
POSF Lease	Restaurant	YRE	Restaurant
POSF Lease	Storage	IW	Warehouse
POSF Lease	Warehouse	IW	Warehouse
Tall Buildings	Hotel	H	Hotel
Tall Buildings	Office	O	Office
Tall Buildings	Residential	X3[a]	Residential, reclassified based on number of units
PLU	MIPS	O	Office
PLU	PDR	I	Industrial
PLU	Resident	X3 [a]	Residential, reclassified based on number of units
PLU	Retail/ENT	C	Commercial Stores

[a] Code begins with "X3." See Table E-7 and Table E-8 for a list of all RES3 Structure Use Codes

2.4.2 Replacement Costs

Replacement costs were calculated for buildings and contents using both RSMeans unit costs (Table E-3) and M&S unit costs (Table E-4), along with assigned CSVRs (Table E-5) to generate content values. The different sources are intended to account for the triangular distribution of replacement cost required as input by G2CRM.

Adjustments to the replacement costs were necessary as the M&S unit values represented a national average of standard replacement cost and did not account for the increased cost of construction in San Francisco. Furthermore, neither replacement cost model (RSMeans or M&S) considers the increased cost of structure repair for historic structures. The following adjustments were made to address these concerns:

- Applied the Department of Defense 2018 Area Cost Factor for the Alameda Coast Guard Station to M&S unit replacement costs (2017 PAX Newsletter, USACE). These factors are often used to cost estimate construction activities. Using the cost factor for Alameda, the closest military base, resulted in a 1.33 modifier applied to all M&S replacement cost estimates.
- Applied the FEMA benefit-cost analysis standard modifier of 1.3 to historic buildings for both replacement cost unit models. This increased replacement cost accounts for more expensive repair for materials and techniques that must conform to the historic nature of the building.

The building replacement costs developed for the G2CRM inventory represent the damageable value of a structure using depth-damage function prototypes from the North Atlantic Coast Comprehensive Study (NACCS), and FEMA (see Section 4.3). Damage function prototypes provide guidance to limit the number of floors that are analyzed for flood damage so as not to over-estimate expected building damages. As such, the building replacement costs are calculated by applying the modified unit price per square foot to the square footage of the damageable portion of the building. For example, the NACCS urban high-rise prototype assumes the damageable value of a building is limited to 10 floors. Therefore, the replacement costs for high-rise buildings in the San Francisco Waterfront Coastal Flood Study project area are based on the first 10 floors of a building, rather than the entire structure square footage.

Contents replacement costs are estimated by applying USACE CSVRs to both the M&S and RSMeans unit costs. Contents replacement costs are based on the first-floor use and square footage only.

Depreciated costs were calculated as a function of replacement costs, building condition, and standardized depreciation factors. Conditions were mapped to percentages of remaining building life (Table E-10) and multiplied by maximum life spans (Table E-6) to obtain a Life Remaining value. Depreciation factors (Table E-11) were then assigned to each building based on the Depreciation Category and calculated Life Remaining value. Each of the twelve calculated replacement costs (flood and seismic assumptions for building, contents, and business inventory for RSMeans and M&S unit costs) were then multiplied by these factors to obtain a full set of depreciated replacement costs.

Table E-10: Building Life Remaining by Condition

Condition	Building Life Remaining
New	100%
Excellent	90%
Good	75%
Average	60%
Fair	40%
Poor	20%
Dilapidated	0%

Table E-11: Depreciation Factors by Structure Type

Life Remaining (Years)	Single Family Residential	Multifamily Residential	Commercial/ Retail	Restaurant	Office	Warehouse/ Industrial	Factory
60	1.00	1.00	1.00	1.00	1.00	1.00	1.00
55	1.00	0.96	1.00	1.00	1.00	1.00	1.00
50	0.96	0.92	1.00	1.00	0.98	1.00	1.00
45	0.91	0.88	0.97	1.00	0.96	0.97	0.97
40	0.85	0.82	0.94	1.00	0.92	0.94	0.94
35	0.79	0.76	0.89	0.95	0.87	0.89	0.89
30	0.72	0.69	0.83	0.89	0.81	0.83	0.83
25	0.64	0.61	0.75	0.80	0.74	0.75	0.75
20	0.55	0.53	0.66	0.70	0.64	0.66	0.66

Life Remaining (Years)	Single Family Residential	Multifamily Residential	Commercial/ Retail	Restaurant	Office	Warehouse/ Industrial	Factory
15	0.45	0.45	0.54	0.57	0.54	0.54	0.54
10	0.37	0.36	0.41	0.43	0.42	0.41	0.41
5	0.29	0.30	0.28	0.30	0.32	0.28	0.28
0	0.20	0.20	0.20	0.20	0.20	0.20	0.20

2.4.3 Quality Assurance/Quality Control

Each building within the model area was reviewed by a specialized team using a combination of satellite and Google Street View imagery to increase the level of confidence in the accuracy of the building inventory attributes. The review team assessed if the data processing reflected accurate conditions on the ground, including if the building footprints represented accurate structure configurations and appropriate assigned structure condition, number of floors, basement presence, approximate height above grade, and structure use. If the processed data were not accurate, the review team adjusted the information in the database and marked the change to keep a log of revised attributes. The Non-Federal Sponsor (NFS), POSF, also reviewed the location, structure use classification, and square footage of buildings on their property located in the study areas and necessary adjustments were made.

In several cases, specialized assets are captured in the building inventory. The additional data gathered and the process for incorporating it in the building inventory are discussed in Section 3.2.

2.5 Occupancy Type

The Occupancy Type field in the G2CRM inventory is a code that links each building to a depth-damage function dependent on the building's specific attributes. Here, the Occupancy Type consists of a six-part code that reflects the building location, dominant use Hazus occupancy class, first floor use Hazus occupancy classes, the presence of a subterranean asset such as a garage or basement, a building height classification, and model building type. The six parts are strung together into a single occupancy type code (e.g., P-COM5-COM4-1-MS-U). Table E-12 summarizes the approach to constructing Occupancy Type Codes. Descriptive statistics for the asset inventory are shown in Section 4.3.

Table E-12: G2CRM Occupancy Type Code Approach

Occupancy Code Part	Value	Building Inventory Field
1	"P" for POSF-owned buildings; "F" for other buildings in the floodplain	Building Location
2	Class	Dominant Use Hazus Class
3	Class	First Floor Use Hazus Class
4	"SV" if parking or a basement is present "NSV" if absent	Basement Presence Structure Use (parking)
5	"SS" if the number of floors is 1 "LR" if number of floors range from 2-4 "MR" if number of floors is 5-9 "HR" if number of floors is 10 or more	Number of Floors
6	Model Building Type Hazus Code "U" if unknown	Model Building Type

2.6 G2CRM Building Inventory Attributes

The G2CRM building inventory template was populated using the data and assumptions described in the preceding sections. Specific fields and methodology are summarized in Table E-13 and are intended to serve as metadata for the G2CRM building inventory.

Table E-13: G2CRM Building Inventory Attributes

G2CRM Field	G2CRM Manual Description	Building Inventory Fields or "Value"	Comment
AssetExternalReference	Unique asset text identifier	*Inventory ID*	
AssetType	Type of asset (from the model's AssetType table)	"Structure"	All inputs are currently structures.
AssetActive	Boolean indicating if the asset is active (1 = true, 0 = false)	"1"	All inputs are currently active.

G2CRM Field	G2CRM Manual Description	Building Inventory Fields or "Value"	Comment
DateOnline	Date the asset is online in YYYY-MM-DD format	"1/1/2000"	All structures online during the study period
DateOffline	Date the asset is offline in YYYY-MM-DD format	"1/1/2150"	No structures taken offline during the study period
Description	Description of the asset (e.g., an address)	*Descriptive Name* or *Address*	*Descriptive Name* if available. Otherwise *Address.*
FoundationType	Type of foundation for the asset (from the FoundationType sheet in the non-spatial asset import)	*Basement Presence*	0 = "Slab" 1 = "Basement" Buildings over water are coded as having slab foundations.
ConstructionType	Type of construction for the asset (from the ConstructionType sheet in the non-spatial asset import)	*Construction Type*	Sourced from the CCSF's Assessor data where available.
OccupancyType	Type of occupancy for the asset (from the OccupancyType sheet in the non-spatial asset import)	See Section 2.5	The Occupancy Type Code is used to assign depth-damage functions to specific buildings based on its attributes.
StructureValueP1	Minimum value (in USD) to be used in the triangular distribution that calculates the structure value	*Depreciated Building Replacement Cost*	Estimated minimum replacement cost was identified using the approach described in Section 2.3.2.
StructureValueP2	Mode value (in USD) to be used in the triangular distribution that calculates the structure value	*Depreciated Building Replacement Cost*	Estimated median value replacement cost was identified using the approach described in Section 2.3.2.
StructureValueP3	Maximum value (in USD) to be used in the triangular distribution that calculates the structure value	*Depreciated Building Replacement Cost*	Estimated maximum value replacement cost was identified using the approach described in Section 2.3.2.
ContentsValueP1	Minimum value (in USD) to be used in the triangular distribution	*Depreciated Content*	Estimated minimum replacement cost was

G2CRM Field	G2CRM Manual Description	Building Inventory Fields or "Value"	Comment
	that calculates the contents value	*Replacement Cost*	identified using the approach described in Section 2.3.2.
ContentsValueP2	Mode value (in USD) to be used in the triangular distribution that calculates the contents value	*Depreciated Content Replacement Cost*	Estimated median value replacement cost was identified using the approach described in Section 2.3.2.
ContentsValueP3	Maximum value (in USD) to be used in the triangular distribution that calculates the contents value	*Depreciated Content Replacement Cost*	Estimated maximum value replacement cost was identified using the approach described in Section 2.3.2.
DepreciationFactor	Not used	"0.001"	Not yet a functional attribute in G2CRM.
Width	Width of structure (not used)	"0"	Not yet a functional attribute in G2CRM.
Length	Length of structure (not used)	"0"	Not yet a functional attribute in G2CRM.
FoundationHeight	Height of the foundation in feet	*Approximate Height Above Grade*	Sourced from desktop review of building entrances and height above grade.
GroundElevation	Ground elevation with respect to NAVD88 (not used)	*Average Ground Elevation*	Average ground elevation within the building footprint, from the DEM.
FirstFloorElevationP1	Minimum value to be used in the triangular distribution that calculates the FFE as defined by the lowest horizontal member of the lowest walking floor in feet with respect to NAVD88	*Average Ground Elevation*	*Average Ground Elevation* minus the margin of error associated with the DEM (0.6 foot)
FirstFloorElevationP2	Mode value to be used in the triangular distribution that calculates the FFE as defined by the lowest horizontal member of the lowest walking floor	*First Floor Elevation*	The average ground elevation plus the approximate height above grade.

G2CRM Field	G2CRM Manual Description	Building Inventory Fields or "Value"	Comment
	in feet with respect to NAVD88		
FirstFloorElevationP3	Maximum value to be used in the triangular distribution that calculates the FFE as defined by the lowest horizontal member of the lowest walking floor in feet with respect to NAVD88	*First Floor Elevation*	*First Floor Elevation P2* plus the margin of error associated with the DEM (0.6 foot) plus an additional 0.6 foot to account for risers.
NumberOfFloors	Number of floors in the structure	*Number of Floors*	Sourced from CCSF Assessor data and reviewed through Google Streetview screening.
TimeToRebuildP1	Minimum value in days to be used in the triangular distribution that calculates the time to rebuild value	*Dominant Use Hazus Class*	Restoration time estimates from the Hazus Flood Technical Manual were applied to the building inventory using the Hazus occupancy type crosswalk. See Minimum Restoration Time in Table E-3 for further detail.
TimeToRebuildP2	Mode value in days to be used in the triangular distribution that calculates the time to rebuild value	*Dominant Use Hazus Class*	Restoration time estimates from the Hazus Flood Technical Manual were applied to the building inventory using the Hazus occupancy type crosswalk. See Mode Restoration Time in Table E-3 for further detail.
TimeToRebuildP3	Maximum value in days to be used in the triangular distribution that calculates the time to rebuild value	*Dominant Use Hazus Class*	Restoration time estimates from the Hazus Flood Technical Manual were applied to the building inventory using the Hazus occupancy type crosswalk. See Maximum Restoration Time in Table E-3 for further detail.

G2CRM Field	G2CRM Manual Description	Building Inventory Fields or "Value"	Comment
NumberOfTimesRebuildingAllowed	Number of times this structure can be rebuilt (where rebuilds are calculated using the significant rebuild damage threshold)	*Number of Rebuilds*	See discussion in Section 4.4.
PopulationNightUnder65	Nighttime population aged under 65	*Population*	Estimated using Hazus methodology, not used in analysis.
PopulationDayUnder65	Daytime population aged under 65	*Population*	Estimated using Hazus methodology, not used in analysis.
PopulationNight65AndOver	Nighttime population aged 65 or older	*Population*	Estimated using Hazus methodology, not used in analysis.
PopulationDay65AndOver	Daytime population aged 65 or older	*Population*	Estimated using Hazus methodology, not used in analysis.
WaveDamageActive	Not used	"0"	Not used by G2CRM.
IsInBenefitsBase	Benefits base status of the structure per Water Resources Development Act (WRDA) 1990 (1 = in benefits base, 0 = outside benefits base if not raised)	"1"	All buildings are assumed to be in the benefits base.
TargetFirstFloorElevation	Elevation in feet of first floor as defined by the lowest horizontal member of the lowest walking floor with respect to NAVD88 that the structure should be raised to on repetitive damages	First Floor Elevation P2 + 3	Structures in inventory are not elevated. See dynamic inventory and floodproofing discussion in Section 4.4.
RaisingCostPerFoot	Raising cost (in USD) incurred per foot of difference between the initial FFE and the	*Floodproofing Cost*	See dynamic inventory and floodproofing discussion in Section 4.4.

G2CRM Field	G2CRM Manual Description	Building Inventory Fields or "Value"	Comment
	target first-floor elevation		
CumulativeDamageThreshold	A decimal number (e.g., 1.8 means 180% of the initial value, to be used in removing structures from inventory when the cumulative damage threshold is exceeded)	"2"	See dynamic inventory and floodproofing discussion in Section 4.4.
PostRaisingStructureValueP1	Minimum value (in USD) to be used in the triangular distribution that calculates the post-raising structure value	*Non-Depreciated Building Replacement Cost*	Set as estimated minimum replacement cost described in Section 2.3.2, but not used within the model. See Section 4.4.
PostRaisingStructureValueP2	Mode value (in USD) to be used in the triangular distribution that calculates the post-raising structure value	*Non-Depreciated Building Replacement Cost*	Set as estimated median replacement cost described in Section 2.3.2, but not used within the model. See Section 4.4.
PostRaisingStructureValueP3	Maximum value (in USD) to be used in the triangular distribution that calculates the post-raising structure value	*Non-Depreciated Building Replacement Cost*	Set as estimated maximum replacement cost described in Section 2.3.2, but not used within the model. See Section 4.4.
PostRaisingContentsValueP1	Minimum value (in USD) to be used in the triangular distribution that calculates the post-raising contents value	*Non-Depreciated Content Replacement Cost*	Set as estimated minimum replacement cost described in Section 2.3.2, but not used within the model. See Section 4.4.
PostRaisingContentsValueP2	Mode value (in USD) to be used in the triangular distribution that calculates the post-raising contents value	*Non-Depreciated Content Replacement Cost*	Set as estimated median replacement cost described in Section 2.3.2, but not used within the model. See Section 4.4.
PostRaisingContentsValueP3	Maximum value (in USD) to be used in the triangular distribution that calculates the post-raising contents value	*Non-Depreciated Content Replacement Cost*	Set as estimated maximum replacement cost described in Section 2.3.2, but not used within the model. See Section 4.4.

G2CRM Field	G2CRM Manual Description	Building Inventory Fields or “Value”	Comment
PostRaisingTimeToRebuildP1	Minimum value (in days) to be used in the triangular distribution that calculates the post-raising time to rebuild value	*Dominant Use Hazus Class*	Equals TimeToRebuildP1. Not used within the model. See Section 4.4.
PostRaisingTimeToRebuildP2	Mode value (in days) to be used in the triangular distribution that calculates the post-raising time to rebuild value	*Dominant Use Hazus Class*	Equals TimeToRebuildP2. Not used within the model. See Section 4.4.
PostRaisingTimeToRebuildP3	Maximum value (in days) to be used in the triangular distribution that calculates the post-raising time to rebuild value	*Dominant Use Hazus Class*	Equals TimeToRebuildP3. Not used within the model. See Section 4.4.

3. Specialized Assets

A limited selection of structures, facilities, or infrastructure of potential interest are described as “specialized assets” for the purposes of this study. These assets were selected for additional research for the following reasons:

- Based on the readily available data, it seemed likely that these assets could have a high potential for costly damages, economic disruption, or service impacts.
- Owning and/or operating agencies or partners were already engaged in the NFS’s Embarcadero Seawall Program multi-hazard risk assessment (MHRA).
- Methodologies and guidance to quantify and monetize impacts had been developed by other federal agencies for benefit-cost analysis, including FEMA.

Specialized assets and additional work to quantify their value include:

- San Francisco Municipal Transportation Agency (SFMTA) and BART Assets:
    - **The BART and SFMTA Embarcadero Station Underground Transit System** is vulnerable to flooding through vents on Market Street. As these two underground systems are hydrologically connected, they were analyzed together. Once water enters the system flood damage can be extensive, impacting the Embarcadero Station, Montgomery Station, Transbay Tube, Muni Metro Turnaround, and tunnels and platforms from Embarcadero Station through Civic Center. A unique methodology executed by USACE, the NFS, and transit agencies determined direct physical damages expected based on the extent of the system impacted, and agency revenue loss due to lost trips (though this is counted in the Regional Economic Development [RED] category). The methodology developed custom depth-damage and restoration time curves for each agency to represent vulnerability to coastal flood hazards.
    - The new **SFMTA Central Subway underground system** is vulnerable to flooding at 4th Street and Bryant Street. Floodwaters could enter the Central Subway portal entrance on 4th Street near Bryant Street and impact two stations in addition to the tunnels and platforms. A methodology similar to the Market Street Subway was also executed for damage expected to the Central Subway tunnels and stations, as well as lost revenue from the additional riders that this new line will serve. This portion of SFMTA’s system was treated as hydrologically disconnected from the Market Street lines that see flooding through the Embarcadero Station, and so the analysis was executed separately.
    - **SFMTA Light Rail Transit Surface Track** direct physical damage. Tracks are sensitive to saltwater inundation which would increase corrosion. Electrical systems for the light rail system are also highly sensitive to any

form of inundation. It is assumed that any interaction with saltwater will require eventual track replacement. The agency estimated the total cost of their assets at various depths (and extent of track flooded). This was based on actual bid prices, length of regular trackwork flooded, and location of special trackwork. It considers surface track that serves SFMTA's T-Third line as well as historic streetcars.

- **Fire Stations 1, 4, 8, and 9** are within the model areas for the San Francisco Waterfront Coastal Flood Study. The San Francisco Fire Department identified replacement costs to accurately estimate direct physical damages. This memo also introduces a new methodology to capture the value of firefighting services by estimating the potential additional damages caused by fires while service is disrupted.
- **Bridge Damage.** There are four bridges that are likely to have flood-sensitive operational components, two of which serve rail functions, underneath the bridges or at ground level. The total cost of assets and customized depth-damage curves are developed using best engineering judgment provided by the NFS.
- **San Francisco Bay Railroad (SFBR).** The total value of SFBR physical infrastructure is based on a range provided by the asset owner. The depth-damage function was based on an extrapolation of the percent of trackway exposed. The assumption is that any exposed trackway requires repair or replacement. Revenue loss is based on the number of tons of cargo handled per day (provided by the asset owner) and the value of domestic rail value per ton (based on escalated values of 2015 figures from the U.S. Bureau of Transportation Statistics).
- Piers 92-96 Maritime Eco-Industrial Assets:
    - Pier 92-96 is mainly construction industry tenants, including **Cemex**, **Central Concrete** (formerly Bode), **Darling**, and **Hanson Aggregates**. Pier 92 is a 20-acre facility with a 1,700-foot-long berth. Pier 94-96 is used to store aggregate and support the concrete batch plant at Pier 92. Due to the costly nature of these facilities and potential for a large amount of inventory to be stored on site, the NFS requested tenant feedback to confirm replacement costs (structure and infrastructure), critical flood elevations, and facility configuration.
    - **Recology**. Pier 96 is also home to the CCSF's blue bin and commercial recycling, Recology. The total value of Recology physical infrastructure is based on an estimate provided by the asset owner. Revenue loss is based on the revenue per year estimate (converted to revenue per day) and the assumption (from the same source) that at even 6 inches of water, the facility would be at a complete standstill.

- Wastewater Assets: Southeast Treatment Plant and North Point Wet Weather Facility were identified. This included 12 wastewater pump stations within the San Francisco Waterfront Coastal Flood Study model areas. Rather than calculate physical damages to individual wastewater assets, the system was considered holistically to determine what future actions would need to be taken to reduce risk to the system. A Future With Project (FWP) benefit would be obviating these costs (referred to as a local cost foregone).

The following resources were used to gather additional information on the specialized assets identified for further investigation:

- The identification of **power asset** locations and square footage estimates are based on GIS data.
- Power asset replacement cost estimates are based on the Hazus valuation for high-voltage power substations in the *Multi-Hazard Loss Estimation Methodology Flood Model Hazus-MH Technical Manual*. Though the voltage of each of the substations present in the area is not confirmed, there are 115-kilovolt (kV) and 230-kV transmission lines in this region, and therefore the assumption is that these substations are in this range. The Hazus-MH Technical Manual does not specify the voltage range of low-, medium-, and high-voltage substations, ANSI standard C84.1-1989 specifies 115 kV and 230 kV to be the lower and upper bounds of the high-voltage range.
- **Rail trackway** replacement cost estimates were estimated by the agency using SFMTA bid prices for recent projects, including the 3rd Street Light Rail Transit Project (Segments: King Street to 22nd, 22nd to Jerrold), L-Taraval Transit Improvement Project, St. Francis Circle Project, and Church and Duboce contract. To date the estimates do not account for damages to the ground and sub-base due to flooding.
- **Piers 92-96** construction tenants provided feedback on replacement costs and flood vulnerability. The NFS's maritime division provided additional input. The inventory buildings included in these estimates were determined by buildings that were within the footprint of the POSF facility and POSF lease parcels. For those facilities without buildings (i.e., Hanson Aggregates), the NFS determined the location of key assets within the facility boundaries from tenant descriptions and aerial imagery.
- The **materials management asset** (Recology) replacement cost estimate was provided by a Recology representative. The inventory buildings included in this estimate were determined by buildings that were within the footprint of the POSF lease parcels and confirmed by inventory buildings references ("Recology" or "Recycle Central").
- **Fire station** replacement costs and service areas were provided by the San Francisco Fire Department.

3.1 Replacement Cost Updates

Per-square-foot replacement cost estimates were developed for power substations as follows.

- Power substations: $4,384 per square foot.
- Hazus-MH values a high-voltage substation at $50 million.
- Inflated from 2001 to FY2023 dollars using the Consumer Price Index inflation calculator.
- Applied the same location modifier as used for buildings (33%) to account for high construction costs in San Francisco.
- Assumed there are three substations (total of $150 million before inflation and location modifier) in the USACE study area (Bayshore Substation, Potrero Substation, and Hunter's Point Substation).
- Assumed that distributing the value by square foot is more appropriate than directly assigning the Hazus-MH value to each substation directly, as some appear to be larger facilities than others. Divided total by all square footage of buildings (and any other structures included in the building inventory) assigned to one of the substations to produce the per-square-foot estimate.

The asset replacement cost estimates developed using the above per-square-foot estimates, in addition to assets for which an asset-specific estimate was available, are presented in Table E-14.

Table E-14: Specialized Asset Replacement Cost Sources and Assumptions

Specialized Asset	Total Replacement Cost Estimate	Source and Assumptions
Bayshore Substation	$4,204,640	Based on the per-square-foot estimate for power substations detailed above, multiplied by the square footage of this substation in the GIS data.
Fire Station 1	$15,820,000	Based on Fire Station 16 cost from Fire Department.
Fire Station 4	$15,820,000	Based on Fire Station 16 cost from Fire Department.
Fire Station 8	$15,820,000	Based on Fire Station 16 cost from Fire Department.
Fire Station 9	$15,820,000	Based on Fire Station 16 cost from Fire Department.
Hunter's Point Substation	$14,249,300	Based on the per-square-foot estimate for power substations detailed above, multiplied by the square footage of this substation in the GIS data.

Specialized Asset	Total Replacement Cost Estimate	Source and Assumptions
Islais Creek Hybrid Motor Coach Facility	$58,357,359	Direct bid quote provided by SFMTA. The project was completed in 2019, so the assumption is that the cost estimates are in or near 2018 dollars.
Muni Metro East Operations Facility	$211,919,409	Based on Third Street Light Rail Monthly Progress Report September 2008 (SFMTA, 2008). Total Muni Metro East (MME) Facility Project Cost, inflated to 2018 dollars.
Potrero Substation - North of 23rd Street	$143,045,434	Based on the per-square-foot estimate for power substations detailed above, multiplied by the square footage of this substation in the GIS data.
Potrero Substation - South of 23rd Street	$128,230,547	Based on the per-square-foot estimate for power substations detailed above, multiplied by the square footage of this substation in the GIS data.
Rankin Wet Weather Pump Station	$236,283	Based on the per-square-foot estimate for pump stations detailed above, multiplied by the square footage of this pump station in the GIS data.
Recology	$39,550,000	Based on estimate from Recology.
Cemex	$19,775,000	The company confirmed that $10 million was a low-end estimate for the value of physical infrastructure (conveyors, equipment, silos, generators, buildings) on site. Using expert judgment, the NFS estimated replacement costs could be up to $25 million. The average of these values was taken as the most likely costs, with the range +/- 40%.
Central Concrete (formerly Bode)	$28,250,000	Based on expert judgment by the NFS.
Pasha	$606,296,911	The NFS confirmed building inventory cost using Marshall and Swift methodology matches NFS expert judgment. Considered the contents and structure for all the buildings on the lease parcel.
Darling	$77,969,512	The NFS confirmed building inventory cost using Marshall and Swift methodology matches NFS expert judgment. Considered the contents and structure for all the buildings on the lease parcel.

3.2 Unique Methodologies

3.2.1 BART and SFMTA Embarcadero Station Underground Transit

Both BART and SFMTA extensive underground transit systems are vulnerable to floodwater that overtops the Embarcadero seawall and progresses inland to the Financial District. Once breached, impacts to the underground Market Street Subway extends beyond the San Francisco Waterfront Coastal Flood Study boundary. As such, the NFS, USACE, and transit agencies collaborated to leverage existing assessments and identify consequences related to direct physical damage and disruption time expected due to different flood events. Collaboration consisted of multiple working sessions to review flow models, identify exposed system components and vulnerabilities, and establish an approach to accurately estimate physical damage and restoration time that causes system disruption. All estimates presented herein have been developed in coordination with BART and SFMTA, who have signed off on these analyses as the best available representation of vulnerability and consequence.

The assessment approach is as follows:

- Establish Flood Pathways and Volume of Water. BART and USACE developed a flood model to establish how water enters the underground system travels through connections between the BART and SFMTA Light Rail Transit (LRT) Subway systems. BART's model extends from the northern section of the Transbay Tube to Civic Center Station, encompassing Embarcadero Station concourse, Montgomery Station concourse, tunnels and platforms, BART's Transbay Tube, and SFMTA's Muni Metro Turnaround and Portal. BART's model was extended to better capture additional damages to the SFMTA system.[2]
- Establish Direct Damages. For BART, the cost identified by the agency in the BART Sea-Level Rise and Flooding Resiliency Study were used. BART's methodology was based on asset exposure and vulnerability. For SFMTA, based on the flooding sequence established, the cost to replace specific assets damaged by both flowing and standing water are calculated for key water elevations and plotted as stage-damage functions. The methodology to identify asset replacement costs for each agency include a range to account for uncertainty. These stage-damage functions and the total damageable value of each system are key inputs into the G2CRM flood model.
- Restoration Curves and Ridership Assumptions. Repair times estimated by the NFS and transit agencies to return the system to pre-disaster conditions, as well as ridership effects during restoration are presented. Key thresholds of 25% partial service restoration and 100% full-service restoration are used to simplify estimation. Initial estimation was provided to the agencies by the NFS for refinement by agency experts. Given the complexity of the systems involved, these are meant to be order of magnitude estimates to show the relative difference between events.

BART and SFMTA are two separate, yet interrelated, underground systems. Damage estimates and lost trips vary for each system. As such, four different G2CRM assets and four customized curves to estimate impacts were developed: BART damage, BART revenue loss, SFMTA damage, and SFMTA revenue loss. Table E-15, Table E-16, and

[2] While additional portions of BART's system were considered in terms of volume, no additional damages were considered to the BART system.

Table E-17 provide brief details on development of G2CRM inputs, including replacement costs and customized curves.

Table E-15: BART and SFMTA Damageable Value and Revenue Loss Estimates

Agency and Consequence	Most Likely Damageable Value	Minimum Damageable Value	Maximum Damageable Value	Notes
BART Physical Damage	$310,000,000	$180,000,000	$430,000,000	Asset damage was determined for a series of water elevations and volume estimates using BART's asset inventory data available at the time of the study. If an asset was made of materials that were damageable by saltwater, it was assumed those assets would require replacement. A multiplication factor was applied to inventory values to equate the replacement cost. The most likely damageable value is the expected damage for the highest water elevation evaluated by BART's flood model (12.2 feet NAVD88). A +/- 40% difference is applied to estimate the minimum and maximum damageable value of BART systems affected.
BART Revenue Loss	$460,000,000	$220,000,000	$900,000,000	Value represents the total revenue that BART may lose as a function of ridership loss due to system damage at the 12.9 feet water level. The NFS and agencies assume that Embarcadero Station will be significantly damaged at this event and there is a minimum of 3-month emergency repairs to restore 25% operating capacity. The remaining 75% will be restored over an additional fifteen months. Revenue loss was estimated by evaluating the number of riders impacted by that time and applying an assumed fare of $3.67 per rider.
SFMTA Physical Damage	$700,000,000	$420,000,000	$980,000,000	Damage was determined based on SFMTA's assumptions of specific assets that would be impacted by saltwater, and the cost to replace those assets. SFMTA provided estimated costs for furnishing and installation, plus additional cost

Agency and Consequence	Most Likely Damageable Value	Minimum Damageable Value	Maximum Damageable Value	Notes
				factors for asset removal, engineering, inefficiencies, and contingency. A +/- 40% difference is applied to estimate the minimum and maximum damageable value of SFMTA systems affected.
SFMTA Revenue Loss	$450,000,000	$300,000,000	$720,000,000	Similar to BART, this value represents ridership loss due to system damage at 12.9ft water levels. Because the Muni Metro Turnaround is damaged, the time to restore 25% partial capacity is 18 months, and full 100% capacity is 3 years.
Note: these values represent assets exposed and vulnerable to flood water in the underground transit systems only. They do not include surface track impacts. Values are rounded to two significant figures.				

Both spatial and non-spatial G2CRM inputs are provided for BART and SFMTA assets. As part of the non-spatial data, 12 depth-damage and depth-restoration curves were created for the four assets, representing minimum, most likely, and maximum curves. The curves were developed by comparing the critical flood elevation of the system, 10.34 feet NAVD88, to the water elevations modeled in BART's Flood Study to identify approximate flood depths above grade that would translate to a volume of water in the system. The NFS then interpolated between the depths to find 0-, 1-foot, 2-foot, and 3-foot percent of total damage or revenue loss expected. This damage or loss was compared to the damageable value (or highest revenue loss) to find the percent loss for the curves. Because significant damage occurs within a few feet of flooding, the damage curves are compressed. Due to the overall uncertainty in the analysis, a +/-15% is applied to the most likely damage curve to estimate minimum and maximum curves.

Table E-16: BART and SFMTA Curve Assumptions

Water Level	Depth[a]	BART Damage ($ million)	% of Max[b]	BART Revenue Loss ($ million)	% of Max[b]	SFMTA Damage ($ million)	% of Max[b]	SFMTA Revenue Loss ($ million)	% of Max[b]
10.7	0.36	90	0.29	32	0.07	100	0.14	23	0.05

Water Level	Depth[a]	BART Damage ($ million)	% of Max[b]	BART Revenue Loss ($ million)	% of Max[b]	SFMTA Damage ($ million)	% of Max[b]	SFMTA Revenue Loss ($ million)	% of Max[b]
11.1	0.76	150	0.48	61	0.13	130	0.19	27	0.06
11.8	1.46	250	0.81	120	0.26	160	0.23	34	0.08
12.2	1.86	310	1	180	0.39	360	0.51	190	0.42
12.9	2.56	310	1	460	1	700	1	450	1
14.2	3.66	310	1	460	1	700	1	450	1

[a]Depth as compared to a 10.34 critical flood elevation for the BART and SFMTA systems.
[b]Maximum being the loss estimated for 12.9-foot water level, the limit of BART's flood model.
Values rounded to two significant figures.

Table E-17: Depth-Damage Functions for Specialized BART and SFMTA Market Street Subway Assets

	BART Physical Damages			BART Revenue Loss			SFMTA LRT Subway Physical Damages			SFMTA Revenue Loss		
	Min (-15%)	Mean	Max (+15%)	Min (-15%)	Mean	Max (+15%)	Min (-15%)	Mean	Max (+15%)	Min (-15%)	Mean	Max (+15%)
Below (-1)	0	0	0	0	0	0	0	0	0	0	0	0
-1	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
1	0.51	0.59	0.68	0.15	0.18	0.20	0.17	0.20	0.23	0.06	0.07	0.08
2	0.85	1	1	0.44	0.51	0.59	0.52	0.61	0.70	0.46	0.54	0.62
3	1	1	1	1	1	1	1	1	1	1	1	1
Above 3	1	1	1	1	1	1	1	1	1	1	1	1

3.2.2 Increased Cost of Transportation

The increased cost of transportation methodology estimates the increased cost of commuting expected to occur if transbay service such as BART and regional commuter ferries (WETA and Golden Gate Ferry) experience long-term disruption after a flood event. This methodology assumes that transbay private transportation is more expensive than BART or commuter ferries because instead of a simple fare, private transportation requires paying for gas, insurance, and car maintenance. Additionally, the cost for ridesharing from companies such as Uber or Lyft is much more expensive than public transit. For this study, the additional cost to travelers who normally take BART or commuter ferries is based on the BART and SFMTA Market Street Subway restoration time estimates and the transportation delay model detailed below. Regional buses were not considered for the increased cost of transportation methodology, as it is assumed their service continues shortly after a flood event recedes.

BART serves 290,000 passengers per day traveling from the East Bay to San Francisco, while WETA and Golden Gate Ferry serve 7,200 and 8,200 per day, respectively. According to BART, their service reduces commuting costs from the East Bay to Downtown San Francisco by $5,800 per year, per worker. It is assumed that users of other regional transit options such as ferries see similar savings. Daily, this averages to $16.29. If users are unable to use regional public transit options and must drive or use ridesharing options instead, that additional cost of alternate transit modes can be captured as National Economic Development (NED) losses.

The increased cost of transportation methodology is based on the number of BART and ferry transbay riders that would still travel to the city after a flood event, using private vehicles or ridesharing options available. The number of riders that would shift transit modes were estimated using the following assumptions:

- Approximately 607,300 transbay trips are taken per day, 50% of which are through BART, WETA, and Golden Gate Ferry.
- If a flood event damages BART and commuter ferry systems, full-service disruption may range from 2 weeks to 12 weeks. Assumptions on downtime post flood event for public regional transit modes are shown in Table E-18.
- The transit system in general is at capacity. If BART and the regional ferries are not able to operate, trips will be lost because not all displaced riders will be able to drive and some travelers may choose not to take trips due to system delays. After 30 days, it is likely that the transit system will stabilize and regain some sort of efficiency.
- The transit system would likely accommodate 55 to 60% of existing transbay trips through the first 30 days of system disruption. All remaining transbay trips for these 30 days would occur through vehicular traffic on the Bay Bridge. Half of the remaining transbay trips are likely displaced BART and ferry riders, similar to the existing travel patterns.

- Remaining transbay trips over a 30-day period are summed and divided by two to account for displaced BART and ferry trips. The daily regional trips from transit riders are divided by two again to account for a single person taking a round trip. The average daily population continuing to travel transbay that are displaced from BART and ferry systems is then multiplied by $16.29, the average daily cost of travel without BART services. These assumptions are summarized in Table E-19. The extra daily cost is then multiplied by 30 to assume 1 month of severe transit service disruption.

Table E-18: Regional Transit Ridership Loss Assumptions

Mode		10.7-foot Water Level	11.8-foot Water Level	12.9-foot Water Level	14.2-foot Water Level
Regional Transit	BART	5 weeks until full-service restoration. 2 weeks with no trains running, 3 additional weeks with trains running at 25%.	20 weeks until full-service restoration. 4 weeks with no trains running, 16 additional weeks with trains running at 25%.	12 weeks with no trains running, assuming significant damage to Embarcadero Station. After this time, trains run at partial capacity until service is restored, estimated at 9 months to 3 years.	12 weeks with no trains running, assuming significant damage to Embarcadero Station. After this time, trains run at partial capacity until service is restored, estimated at 9 months to 3 years.
	Commuter Ferries	One day of service interruption assumed. Assumed that boarding from alternate berths will offset impacts to Ferry Building pier and two terminals.	Full-service disruption for 1 day because of widespread flooding and road closures, making pier inaccessible. Ferry terminals have likely sustained some damage and may resume at 50% capacity by docking elsewhere along the waterfront.	Full-service disruption for 1 day because of widespread flooding and road closures, making pier inaccessible. Ferry terminals have likely sustained some damage and may resume at 50% capacity by docking elsewhere along the waterfront.	Full-service disruption for 1 day because of widespread flooding and road closures, making pier inaccessible. Ferry terminals have likely sustained some damage and may resume at 50% capacity by docking elsewhere along the waterfront.
Note: Restoration and ridership loss assumptions are based on damages modeled for the BART and SFMTA Market Street Subway, which do not model impacts after a 12.2-foot flood elevation. Therefore, the 12.9- and 14.2-foot water level assumptions for restoration and ridership loss do not extrapolate past the Market Street Subway damage estimates.					

Table E-19: Increased Cost of Transportation Calculations

Water Level (feet)	Daily Average Transbay Trips Still Taken	Daily Average Transbay Trips Attributed to Displaced Regional Transit Riders	Daily Round Trips Shifted	Daily Extra Cost ($)	30-Day Losses ($)
10.7	380,000	190,000	94,000	1,500,000	46,000,000
11.8	330,000	170,000	83,000	1,400,000	41,000,000
12.9	330,000	170,000	83,000	1,400,000	41,000,000
14.2	330,000	170,000	83,000	1,400,000	41,000,000

Note: Daily average transbay trips still taken are based on transportation delay model estimates, which assume a 30-day system disruption maximum for all water levels. The daily average transbay trips still taken are similar for water levels higher than 10.7 feet NAVD88 are similar because restoration time for BART and ferry systems are longer than 30 days.

As ridership numbers are driven by BART and SFMTA underground transit, once these systems restoration times are longer than 30-days, minimal change is seen in the model (within rounding error).

Initially, the number of trips shifting modes and additional costs of transit seems that they should grow as more disruption is seen across the system. However, the transportation delay model and the increased cost of transportation estimates assume that as overall congestion and delay times become more extreme, more riders choose to stay home, leading to more trips lost as systems take longer to come back online. As such, the increased cost of transportation losses decrease with higher water levels since fewer people are traveling with greater system disruption (Table E-19).

The costs calculated in Table E-19 are the basis for the G2CRM inputs as a unique asset. The replacement cost for the asset entry represents the maximum increased cost of transportation calculated: $46 million. A plus or minus 40% uncertainty was applied to the $46 million, giving a range from $28 million to $65 million for the minimum and maximum replacement cost estimates. To develop the custom depth-damage curve for G2CRM use, the results for different water elevations were mapped to depth based on the critical elevation for the BART system, or 10.34 feet NAVD88 (see Table E-20). The percent of maximum for each depth was then interpolated into a depth-damage curve for input in the non-spatial template; this is delineated in Table E-21. An additional plus and minus 15% uncertainty was applied to the mean depth-damage function given the high level of uncertainty around these estimations.

Table E-20: Increased Cost of Transportation Curve Assumptions

Water Level (feet)	Depth (feet)[a]	Increased Cost of Transportation ($ million)	% of Maximum[b]
10.7	0.36	46	1
11.8	1.46	41	.88
12.9	2.56	41	.88
14.2	3.86	41	.88

[a] Depth as compared to a 10.34 critical flood elevation for the SFMTA surface trackway.
[b] Maximum being the loss estimated for 10.7 water level (inverse curve).

Table E-21: Depth-Damage Functions for Increased Cost of Transportation

Depth (feet)	Min (-15%)	Mean	Max (+15%)
Below (0)	0	0	0
0	0	0	0
1	0.79	0.93	1
2	0.75	0.88	1
Above 2	0.75	0.88	1

3.2.3 SFMTA Central Subway

The methodology to establish physical damage and revenue losses incurred by SFMTA follows that implemented through the BART and SFMTA Market Street Subway described in Section 3.3.1. Two specialized assets were developed for this system—damage estimates and revenue loss. At this time, revenue loss is considered in the RED account.

The Central Subway project, which opened in 2023, will serve over 35,000 new customers per day. Central Subway brought the T Third Street light rail line from the 4th Street and King Station to a new subway running beneath 4th and Stockton streets, terminating at Chinatown Station on Washington and Stockton. The new service line route is visible on Figure E-5. This new service connects residents, visitors and businesses from Bayview, South of Market, and Mission Bay to Financial District, Union Square, Moscone Center, and Chinatown. The Central Subway cuts travel times in half along congested Stockton Street and 4th Street while enhancing connections to BART, Muni Metro and Caltrain. The route moves along 4th Street, through a tunnel near Harrison Street, beneath Market Street, and under Stockton Street to the intersection of

Stockton and Washington streets. The Central Subway is vulnerable to flooding through a portal at 4th Street near Bryant Street.

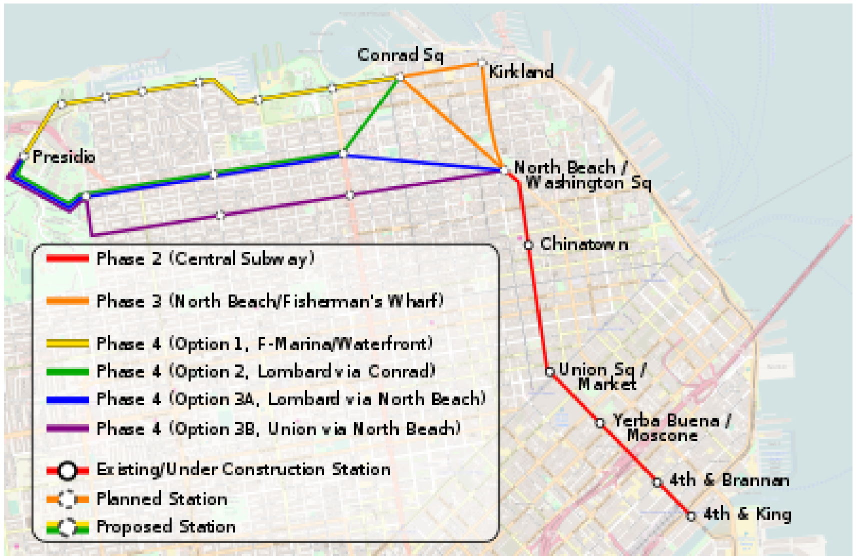


Figure E-5: Central Subway Map

The key steps of the methodology to develop the specialized direct physical damage and loss of revenue include:

- Establish Flood Pathways and Volume of Water. Once water enters the Central Subway system, it may affect tunnel infrastructure and two stations. For the purposes of this study, the Central Subway was treated as hydraulically disconnected from the BART and SFMTA Market Street Subway. The hydraulic analysis was conducted using a similar methodology as the Embarcadero Station underground transit analysis. SFMTA then reviewed the flooding extents within the system and provided damage estimates for three flood elevations. Once water enters the system at 4th Street near Bryant Street, it begins to pool at a low point between the Yerba Buena/Moscone Station and Union Square/Market Street Station. From there, it slowly rises to fill the tunnel between the two stations, eventually doing damage to the stations as well.
- Establish Direct Damages. Based on the flooding sequence established, the cost to replace specific assets damaged by both flowing and standard water are calculated for key water elevations and plotted as stage-damage functions. The methodology to identify asset replacement costs include a +/- 40% range to account for uncertainty. The stage-damage function and the total damageable value of the system are key inputs into the G2CRM flood model.
- Restoration Curves and Ridership Assumptions. Repair times were estimated by the NFS and agency to return the system to pre-flood conditions. Key thresholds

of 25% partial service restoration and 100% full-service restoration are used to simplify estimation. Given the complexity of the systems involved, these are meant to be order of magnitude estimates to show the relative difference between events. The total riders used for revenue loss was the additional 35,000 customers the new line is expected to serve, in addition to those riders that may already be included in the Market Street estimates.

Table E-22 provides the replacement cost assumptions for these two specialized assets.

Table E-22: SFMTA Central Subway Damageable Value and Revenue Loss (RED) Estimates

Agency and Consequence	Most Likely Damageable Value	Minimum Damageable Value	Maximum Damageable Value	Notes
SFMTA Central Subway Physical Damage	$200 million	$120 million	$280 million	Damage was determined based on SFMTA's assumptions of specific assets that would be impacted by saltwater and the cost to replace those assets. SFMTA provided estimated costs for furnishing and installation, plus additional cost factors for asset removal, engineering, inefficiencies, and contingency. A +/- 40% difference is applied to estimate the minimum and maximum damageable value of SFMTA systems affected.
SFMTA Central Subway Revenue Loss	$10 million	$7.6 million	$13 million	This value represents ridership loss due to system damage at 14.5-foot water levels. Restoration time to 25% capacity ranges from 6 to 10 weeks, with full restoration taking 3 to 5 months.
Note: these values represent assets exposed and vulnerable to flood water in the underground transit systems only. They do not include surface track impacts. Values are rounded to two significant figures.				

Depth-damage curves were developed by comparing the critical flood elevation of the system, 13.8 feet NAVD88, to the water elevations modeled in USACE's calculations to identify approximate flood depths above grade that would translate to a volume of water in the system. The agency provided estimates for 13.8-, 14.1-, and 14.5-foot water levels, as shown in Table E-23. The NFS then interpolated between the depths to find 0- and 1-foot percent of total damage or revenue loss expected. This damage or loss was compared to the damageable value (or highest revenue loss) to find the percent loss for the curves. Because significant damage occurs within 1 foot of flood depth above ground, the damage curves are compressed even more so than the Embarcadero Station underground transit curves. Due to the overall uncertainty in the analysis, a +/- 15% is applied to the most likely damage curve to estimate minimum and maximum curves, as shown in

Table E-24.

Table E-23: SFMTA Central Subway Curve Assumptions

Water Level (feet)	Depth[a] (feet)	SFMTA Central Subway Physical Damage ($ million)	% of Maximum[b]	SFMTA Central Subway Revenue Loss ($ million)	% of Maximum[b]
13.7	-0.1	0	0	0	0
13.8	0.0	51	0.25	3.4	0.33
14.1	0.3	61	0.30	4.5	0.44
14.5	0.7	200	1	10	1
15.0	1.2	200	1	10	1

[a]Depth as compared to a 13.8 critical flood elevation for the SFMTA Central Subway underground system.

[b]Maximum being the loss estimated for 14.5-foot water level.

Values rounded to two significant figures.

Table E-24: Depth-Damage Functions for SFMTA Central Subway Specialized Assets

Depth (feet)	SFMTA Central Subway Physical Damages			SFMTA Central Subway Revenue Loss		
	Min (-15%)	Mean	Max (+15%)	Min (-15%)	Mean	Max (+15%)
Below (-1)	0	0	0	0	0	0
-1	0	0	0	0	0	0
0	.22	.25	.29	.28	.33	.38
1	.85	1	1	.85	1	1
2	1	1	1	1	1	1
Above 2	1	1	1	1	1	1

3.2.4 SFMTA Light Rail Transit Surface Track

SFMTA operates the KT, E, and F lines in the San Francisco Waterfront Coastal Flood Study Model areas, shown on Figure E-6. The KT Line is a light rail vehicle (LRV) line provides commuter service from Ingleside (K Line) to Bayshore Boulevard (T Line), considered the same line as it passes through the Market Street corridor (underground, resurfaces at the portal along the Embarcadero before crossing into the Southern Waterfront). Historic Rail Routes E and F serve Market Street and the Embarcadero between Market Street and Fisherman's Wharf. The historic lines run the length of the Embarcadero, sharing trackway with LRT vehicles south of the Muni Portal. Both use standard gauge track.

Light green indicates KT lines (LRV). Blue indicates the EF lines (historic streetcar). Dark green indicates where KT and EF share surface track

Figure E-6: KT and EF Line Locations

The critical flood elevation of the surface track is at grade, with portions of rail below grade exposed. The tracks have a 2-inch flood depth threshold for operability. Inundation above this level would cause a line to stop service based on track visibility restrictions. Tracks are sensitive to saltwater inundation which would increase corrosion. Electrical systems are also highly sensitive to any form of inundation. It is assumed that any interaction with saltwater will require eventual track replacement.

SFMTA estimated the total cost of the surface track vulnerable to flooding for three water levels: 10.7 feet NAVD88, 11.8 feet NAVD88, and 13.8 feet NAVD88. In their cost estimates, SFMTA identified at which water levels various special trackway would become exposed, as special trackway is significantly higher in cost. Special trackway considered included turnouts (frog, switch, and closure rail), single cross-overs, double cross-overs, and ½ grand union. All other components were based on a percentage of linear feet of the total surface track exposed. SFMTA's cost estimates were based on bid prices from recent projects (3rd Street Light Rail Transit Project (Segments: King Street to 22nd, 22nd to Jerrold, L-Taraval Transit Improvement Project, St. Francis Circle Project, and Church and Duboce).

In addition to the estimates for furnish and install, added cost factors were applied. Again, a plus or minus 40% uncertainty factor was used to find the range of total replacement costs, as shown in Table E-25. As these lines rely on the Muni Metro Turnaround, any lost ridership for these systems was included in the SFMTA Embarcadero Station lost revenue estimates.

Table E-25: Direct Physical Damages to SFMTA LRT Surface Track by Stillwater Elevation

Water Level (feet)	Furnish and Install Estimates ($)	Additional Cost Factors (Removal, Engineering, Contingency, Inefficiency) ($)	Total Losses ($)
10.7	90,000,000	82,000,000	170,000,000
11.8	170,000,000	150,000,000	320,000,000
13.8	240,000,000	220,000,000	450,000,000
Note: asset removal was included as a line item in the furnish and install estimate, and so was not included as an additional cost factor.			

Table E-26: SFMTA LRT Surface Track Damageable Value Estimates

Agency and Consequence	Most Likely Damageable Value ($)	Minimum Damageable Value ($)	Maximum Damageable Value ($)	Notes
SFMTA LRT Surface Track Physical Damage	450,000,000	270,000,000	630,000,000	To date the estimates do not account for damages to the ground and sub-base due to flooding. Additional outreach to the agency would be needed to identify portions of the system that may not be vulnerable to flooding or saltwater corrosion. SFMTA provided estimated costs for furnishing and installation, plus additional cost factors for engineering, inefficiencies, and contingency. A +/- 40% difference is applied to estimate the minimum and maximum damageable value of SFMTA systems affected.

Table E-27 shows the depth-damage curve assumptions, while Table E-28 applies an additional plus or minus 15% uncertainty for the triangular distribution in G2CRM.

Table E-27: SFMTA Surface Track Curve Assumptions

Water Level (feet)	Depth (feet)[a]	SFMTA Surface Track ($ million)	% of Maximum[b]
10.7	1.2	170	.38
11.8	2.3	320	.71
13.8	4.3	450	1.0

[a]Depth as compared to a 9.5 critical flood elevation for the SFMTA surface trackway.
[b]Maximum being the loss estimated for 13.8-foot water level, the maximum that SFMTA assessed.

Table E-28: Depth-Damage Functions for SFMTA Surface Track

Depth (feet)	SFMTA Surface Track Physical Damages		
	Min (-15%)	Mean	Max (+15%)
Below (-1)	0	0	0
-1	0	0	0
0	0	0	0
1	0.27	0.32	0.37
2	0.53	0.62	0.72
3	0.71	0.83	0.96
4	0.82	0.96	1.0
5	.94	1.0	1.0
6	1.0	1.0	1.0
Above 6	1.0	1.0	1.0

Additional key attributes and assumptions for SFMTA Light Rail Transit Surface Track are as follows:

- **FirstFloorElevation.** Set to 9.5 feet NAVD88, the approximate depth at which the track is first exposed (near the Ferry Building, Figure E-7) based on the DEM.

Minimum and maximum are then minus and plus the margin of error associated with the DEM (0.6 foot)

Figure E-7: Location of SFMTA Surface Track Critical Flood Location

- **TimeToRebuildP1.** 28 days (4 weeks). Set to match estimate of SFMTA underground transit, or the most likely time to 25% serviceability for the 10.7 SWE. These lines are dependent on the Muni Metro Turnaround, considered in this estimate.
- **TimeToRebuildP2.** 42 days (6 weeks). Set to match the estimate of SFMTA underground transit, or the most likely time to 25% serviceability for 11.8 SWE. These lines are dependent on the Muni Metro Turnaround, considered in this estimate.
- **TimeToRebuildP3.** Set to 365 days (1 year). This is less than the underground transit assumption, as not all surface trips are dependent on the station. Instead, it is driven by the approximate lead time of special trackwork, as indicated by the agency.

3.2.5 Loss of Fire Station Services

Four fire stations are located within model areas 3 and 4 in the Southern Waterfront. Fire stations provide a wide range of services including firefighting, search and rescue, public shelter, and emergency medical services. FEMA has developed a methodology to monetize the value of fire station services that captures how a temporary loss of function of a fire station will affect fire losses such as direct physical damage, human injuries, and indirect losses. The methodology assumes that if a fire station is temporarily out of service, then another fire station will serve the population and response time will increase.

Loss of fire station services are estimated by defining the additional response time that may occur if fire station service is disrupted, establishing the population served by the non-operational station, and determining the dollar loss expected due to the shutdown.

G2CRM inputs were developed by estimating the value of each individual fire station as a proxy for the asset replacement cost input and converting the Hazus restoration time curve for GOV2 (emergency response) into a percentage-based curve. Details and assumptions used to establish the value of the fire station and transition the time-curve to a percentage-curve are further described in Table E-29, Table E-30, and Table E-31.

Table E-29: Fire Station Replacement Cost Proxy

Input	Input Value	Notes
Service Population	Fire Station 1: 961,498 Fire Station 4: 3,287 Fire Station 8: 3,662 Fire Station 9: 3,676	Service populations for each fire station vary. These populations were obtained by overlaying fire station service areas with 2016 Census estimates. Fire station service areas were provided by the San Francisco Fire Department.
Pre-event Response Time	5 minutes	Pre-event response time is assumed to be 5 minutes for each station, according to San Francisco Fire Department input.
Post-event Response Time	Fire Station 1, 4, 8: 20 min Fire Station 9: 10 min	Given that the service areas for Fire Stations 1, 4, and 8 are proximate to each other, it is assumed that response times in these areas would take longer if disruption in service occurred. Timeframes were obtained according to San Francisco Fire Department input.
National Average Fire Incidents per Capita	0.004	According to the National Fire Protection Association, the total number of national fire incidents per capita is equal to 0.0040 per year, or four incidents per 1,000 people. This value is recommended for use per FEMA methodology.
Average Dollar Loss Per Incident	$6,794	FEMA's methodology recommends using $3,845 as a standard value of dollar loss from the Air Force Protection Cost Risk Analysis Study. The standard value is provided in 1993 dollars, and was adjusted upwards to account for inflation using the Bureau of Labor Statistics Consumer Price Index Inflation Calculator.
Fire Incidents per Year	Fire Station 1: 3,846 Fire Station 4: 13 Fire Station 8: 15 Fire Station 9: 15	Estimated for each fire station using the service population and the National Average Fire Station Incidents per capita.
Daily increase in dollar loss due to fire station closure	Fire Station 1: $44,389 Fire Station 4: $151 Fire Station 8: $169 Fire Station 9: $54	The increase in dollar loss due to fire station disruption is estimated by establishing pre-disruption and post-disruption dollar loss per incident using the probability of loss, number of fire incidents per year, and the average dollar loss per incident. The difference between pre-disruption and post-disruption dollar loss is then divided by 365 for a daily value.

Input	Input Value	Notes
Daily Indirect Losses	Fire Station 1: $48,828 Fire Station 4: $166 Fire Station 8: $185 Fire Station 9: $59	Indirect losses refer to the costs of temporary housing, missed work, and lost business if property damage is incurred. FEMA recommends to add 10% to the daily dollar loss to account for this loss in accordance with National Fire Protection Association studies.
Daily Casualties	Fire Station 1: $94,549 Fire Station 4: $323 Fire Station 8: $360 Fire Station 9: $115	According to National Fire Protection Association estimates, direct and indirect property losses due to fire totaled $14.9 billion in 2011, while the total losses for deaths and injuries were estimated to be $31.7 billion. That gives a ratio of 2.13 in losses for deaths and injuries per dollar of property loss.
Total Daily Loss	Fire Station 1: $143,377 Fire Station 4: $490 Fire Station 8: $546 Fire Station 9: $175	The additional costs of daily indirect losses and daily casualties are added together for a total daily value of firefighting services per station. These daily values were multiplied by the largest disruption time available in the Hazus restoration time curve for GOV2 occupancies, 750 days, for the replacement cost proxy. Minimum and maximum asset values represent a +/- 40% difference from the most likely asset value.

Table E-30: Fire Station Replacement Cost Proxy

Asset	Most Likely Asset Value	Minimum Asset Value	Maximum Asset Value
Fire Station 1	$107,532,877	$64,519,726	$150,546,028
Fire Station 4	$367,593	$220,556	$514,630
Fire Station 8	$409,547	$245,728	$573,365
Fire Station 9	$131,487	$78,892	$184,082

Table E-31: Fire Station Economic Activity Loss Curve

Depth	Gov 2 Restoration Curve (Days)	Percent of Maximum Restoration Time (Most Likely Curve)	Percent of Maximum Restoration Time (Minimum Curve)	Percent of Maximum Restoration Time (Maximum Curve)
0	0	0	0	0
1	120	0.16	0.10	0.22
2	180	0.24	0.14	0.34
3	240	0.32	0.19	0.45
4	360	0.48	0.29	0.67

Depth	Gov 2 Restoration Curve (Days)	Percent of Maximum Restoration Time (Most Likely Curve)	Percent of Maximum Restoration Time (Minimum Curve)	Percent of Maximum Restoration Time (Maximum Curve)
5	480	0.64	0.38	0.90
6	517.5	0.69	0.41	1
7	555	0.74	0.44	1
8	592.5	0.79	0.47	1
9	630	0.84	0.50	1
10	660	0.88	0.53	1
11	690	0.92	0.55	1
12	720	0.96	0.58	1
13	750	1	1	1

3.2.6 Bridge Damage

There are four bridges (Figure E-8) that are likely to have flood-sensitive rail operation components underneath the bridges or at ground level. This includes the Peter Maloney Bridge on 4th Street over Mission Creek, Lefty O'Doul Bridge over Mission Creek, the Illinois Street Bridge over Islais Creek, and 3rd Street Bridge over Islais Creek.

Assumed vulnerabilities at these bridges include mechanical and electrical equipment and controls as well as structural elements within the water column. For the purpose of establishing baseline damages to the bridges, it is assumed that all mechanical and electrical equipment subject to flood waters requires full replacement. Without detailed study of the bridge drawings but based upon engineering judgment it is assumed that 25% of this equipment is at or protected to roadway level, 50% of it is less than 6 inches above roadway level, 75% is less than 12 inches above roadway level and 100% is less than 24 inches above roadway level.

Structural components are not immediately damaged due to floodwaters but exposure to saltwater will decrease the service life of the structure (i.e., coatings, road beds, bearings, etc.). To simplify inclusion of this effect, it is assumed that 5% of the total structural cost of the bridge is damaged at roadway level, 10% is damaged at 6 inches above roadway, 15% damaged at 12 inches above roadway and 20% damaged at 24 inches above roadway.

Using these assumptions and engineering opinion of bridge and mechanical asset valuation, the NFS developed preliminary replacement costs and depth-damage curves to evaluate physical bridge damage in G2CRM. Costs are based on recent construction work or original construction values, pulled from available data sources. Where recent repair and retrofit work is used as a proxy cost, these costs are factored to represent a full bridge replacement value. Table E-32, Table E-33, and Table E-34 contain information on the replacement costs and custom curves created.

Islais Creek

Mission Creek

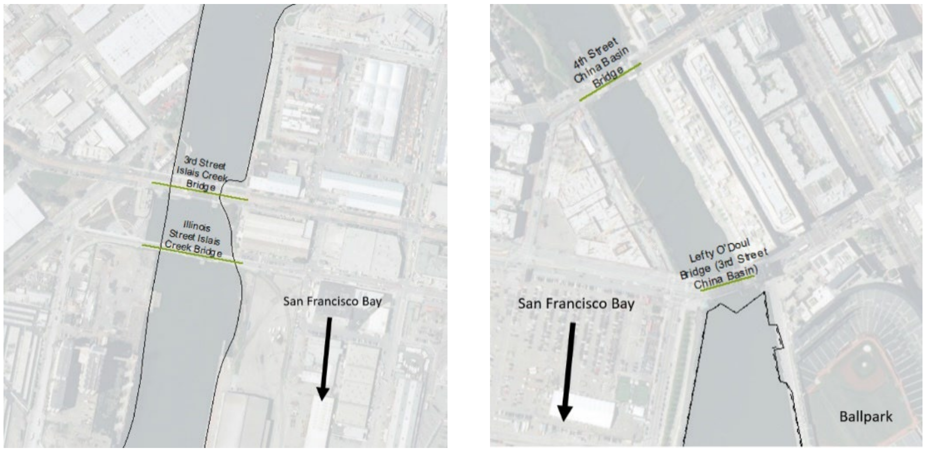


Figure E-8: Four Bridges over Mission Creek and Islais Creek

Table E-32: Bridge Replacement Cost Estimates

Bridge Asset	Total Construction Cost, Year (Estimate)	2018 Construction Cost	2018 Mechanical/Electrical Cost	Notes
Lefty O’Doul Bridge over Mission Creek	$27 million, 2019	$54,000,000	$48,600,000	Cost from recent repair work. Increased by 50% to account for original elements not included in the repairs. Assumed 10% of the cost is mechanical and electrical because there is no rail over the bridge.
Peter Maloney Bridge on 4th Street over Mission Creek	$34 million, 2003	$66,057,143	$52,845,714	Cost from improvements made to the bridge, increased by 70% to account for original elements. As there is transit rail over the bridge, it is assumed that 20% of the cost is mechanical

Bridge Asset	Total Construction Cost, Year (Estimate)	2018 Construction Cost	2018 Mechanical/Electrical Cost	Notes
				and electrical components.
3rd Street Bridge over Islais Creek	$80 million, 2019	$133,333,333	$106,666,667	Cost from current reconstruction work, increased by 60%. 20% of the cost is assumed to be mechanical and electrical components.
Illinois Street Bridge over Islais Creek	$25 million, 2006	$31,250,000	$25,000,000	Cost from bridge designer. 20% of the cost is assumed to be mechanical and electrical components.

Bridge replacement costs and engineering judgment of percent damage provided by the NFS.

Table E-33: Bridge Damage Estimates

Roadway Elevation	Lefty O'Doul Bridge over Mission Creek		Peter Maloney Bridge on 4th Street over Mission Creek		3rd Street Bridge over Islais Creek		Illinois Street Bridge over Islais Creek	
	Structural Damage	**Mechanical Damage**	**Structural Damage**	**Mechanical Damage**	**Structural Damage**	**Mechanical Damage**	**Structural Damage**	**Mechanical Damage**
At Roadway	$972,000	$1,350,000	$1,056,914	$3,302,857	$2,133,333	$6,666,667	$500,000	$1,562,500
Roadway + 6 inches	$1,944,000	$2,700,000	$2,113,829	$6,605,714	$4,266,667	$13,333,333	$1,000,000	$3,125,000
Roadway + 12 inches	$3,888,000	$4,050,000	$4,227,657	$9,908,571	$8,533,333	$20,000,000	$2,000,000	$4,687,500
Roadway + 24 inches	$7,776,000	$5,400,000	$8,455,314	$13,211,429	$17,066,667	$26,666,667	$4,000,000	$6,250,000

Table E-34: Bridge Customized Depth-Damage Curve

Roadway Elevation	Lefty O'Doul Bridge over Mission Creek		Peter Maloney Bridge on 4th Street over Mission Creek		3rd Street Bridge over Islais Creek		Illinois Street Bridge over Islais Creek	
	Total Damage	Percentage of Replacement Cost[a]	Total Damage	Percentage of Replacement Cost[a]	Total Damage	Percentage of Replacement Cost[a]	Total Damage	Percentage of Replacement Cost[a]
At Roadway	$2,322,000	0.043	$4,644,000	0.086	$7,938,000	0.147	$13,176,000	0.244
Roadway + 6 inches	$4,359,771	0.066	$8,719,543	0.132	$14,136,229	0.214	$21,666,743	0.328
Roadway + 12 inches	$8,800,000	0.066	$17,600,000	0.132	$28,533,333	0.214	$43,733,333	0.328
Roadway + 24 inches	$2,062,500	0.066	$4,125,000	0.132	$6,687,500	0.214	$10,250,000	0.328

[a]Replacement cost comparison is the 2018 construction cost

3.2.7 San Francisco Bay Railroad Damages and Revenue Loss

The SFBR serves POSF Piers 80, 92, 94, and 96, and the POSF's railyard (see Figure E-9). One of the principal services is to transport contaminated soils from San Francisco construction projects to a landfill out-of-state. SFBR interchanges exclusively with Union Pacific Railroad and has the capacity to store 300 cars, and the means to load or unload over 60 rail cars per day. SFBR cargo includes aggregates, ash, bio-diesel, tallow, cement, steel, containerized cargo and waste.

According to Republic Services (owners of the SFBR), the estimated total value of SFBR in the San Francisco Waterfront Coastal Flood Study area is approximately $10 - $20 million, including track, switches, generators, and equipment. These values represent the minimum and maximum replacement cost inputs for G2CRM; $15 million is the most likely input.

To generate the most likely depth-damage function, GIS data was used to estimate the percent of track exposed to floodwater under a series of flood depths (1 foot to 9 feet of flooding in 1-foot increments). The average additional track-exposed-per-foot of flooding was used to extrapolate beyond 9 feet. Keeping in line with the SFMTA track assumptions, this analysis assumes that SFBR assets exposed to saltwater will require repair or replacement. Two additional depth-damage functions were developed to represent +/- 15% of the most likely depth-damage function.

The SFBR facility handles approximately 1,000 – 3,000 tons of cargo per day. According to the Bureau of Transportation Statistics, the value of domestic rail value per ton per day is $332.45 (escalated to 2018 dollars from 2015 figures). Therefore, assumed minimum, most likely, and maximum assumptions for revenue for SFBR are estimated at $332,453 per day, $664,907 per day, and $997,361 per day, respectively.

According to the asset owner, 10% of the physical infrastructure would be compromised and require replacement at 6 inches of water. For establishing a depth revenue loss function, the assumption is that the track is integrated enough that 10% of the physical infrastructure being compromised would halt operations for at least 1 week. This is likely a conservatively low estimate of disruption if the facility were flooded. Nevertheless, the NFS multiplied the daily values by seven to account for weekly revenue, rounding the values, and entered the revenue loss curve as a simple step function – going from 0% loss at 0 foot of flooding to 100% at 1 foot of flooding.

Figure E-9: San Francisco Bay Railroad Location

3.2.8 Hanson Aggregates Direct Physical Damages

As the physical infrastructure on the site consists of mostly equipment (conveyors, rail, electrical, etc.), physical damages for Hanson Aggregates were estimated by the company. The NFS used the average of the ranges provided by the company as the most likely full replacement value, as shown in Table E-35. As of now, estimates do not include the value of the materials stored on site. Aerial imagery of the equipment on both sites is shown on Figure E-10.

For Pier 92, the assets are distributed across the site, in the form of moveable equipment, semi-permanent equipment, holding ponds and other infrastructure. Much of the equipment (cranes, etc.) are tall and would not be greatly affected by a few feet of floodwater. Additionally, around 50% of the site is above the 16.5-foot flood elevation and would not be exposed during the storms in question. As such, it was estimate that 60% of the total value would be exposed to flooding, with 50% vulnerable to a few feet of flooding (electrical portions of equipment, equipment that may require inspection, cleaning, minor repair, or equipment that may need to be eventually repaired or replaced due to corrosion from saltwater). Taken together, the maximum losses from the highest elevation are then 30% of the total value, vulnerable at a 16.5-foot flood elevation. The NFS then estimated the portion of the maximum losses for lower water levels to arrive at a depth-damage curve, decreasing by 5% for every foot reduction in water level. The critical elevation of the site was determined to be 8.5 feet, with minimal damage happening until waters reach 13.5 feet. Based on the mean depth-damage curve, an uncertainty of plus or minus 15% was applied. Table E-36 shows the resulting curves.

For Pier 94, the key assets are an offloading conveyor, as well as a rail bed and electrical infrastructure. These assets are linear, roughly in the center of the site, and run perpendicular to the Bay (Figure E-10). The infrastructure is slightly raised from the site around it. Much of the offloading conveyor infrastructure is significantly elevated from grade, so total damageable value was estimated as 25%. Based on a critical flood elevation of 10.7 feet for the site, it was assumed that only minor clearing and inspection would be needed for the first 3 feet of floodwater. With 4 or more feet of flooding, the portions of the asset exposed to flooding would need to be repaired or replaced. The rail and electrical equipment are located on either side of the conveyor. Consistent with the SFMTA LRT trackway assumptions, it is assumed that any trackway exposed to saltwater will need to be eventually replaced. As the site has little variation in elevation, the resulting depth-damage functions for both of these elements is quite steep, and then flattens out. Again, plus or minus 15% was used for the range for the depth-damage functions for both these assets, as shown in Table E-36.

Not to scale

Figure E-10: Hanson Aggregates Pier 92 (left) and Pier 94 (right)

Table E-35: Hanson Aggregates Infrastructure Replacement Costs

Pier	Asset	Minimum Asset Value ($)	Most Likely Asset Value ($)	Maximum Asset Value ($)
Pier 92	Physical assets on site	5,000,000	7,500,000	10,000,000
Pier 94	Offloading conveyor (40-inch-wide stacking)	5,000,000	7,500,000	10,000,000
Pier 94	Rail Bed and Electrical Infrastructure	10,000,000	15,000,000	20,000,000

Table E-36: Hanson Aggregate Loss Curves

Depth	Pier 92[a]			Pier 94: Conveyor[b]			Pier 94: Rail and Electric[b]		
	Min (15%)	Mean	Max (+15%)	Min (15%)	Mean	Max (+15%)	Min (15%)	Mean	Max (+15%)
0	0	0	0	0	0	0	0	0	0
1	0.021	0.025	0.029	0.043	0.050	0.058	0.085	0.1	0.12
2	0.028	0.033	0.038	0.043	0.050	0.058	0.085	0.1	0.12
3	0.035	0.042	0.048	0.043	0.050	0.058	0.13	0.15	0.18
4	0.043	0.050	0.058	0.17	0.20	0.23	0.85	1	1
5	0.13	0.15	0.17	0.21	0.25	0.29	1	1	1
6	0.17	0.20	0.23	0.21	0.25	0.29	1	1	1
7	0.21	0.25	0.29	0.21	0.25	0.29	1	1	1
8	0.26	0.30	0.35	0.21	0.25	0.29	1	1	1
Above 8	0.26	0.30	0.35	0.21	0.25	0.29	1	1	1

[a]Depth as compared to a critical elevation of 8.5 feet

[b]Depth as compared to a critical elevation of 10.7 feet

3.2.9 Recology Revenue Loss

Physical damages for Recology, including the Recycle Central facility, are captured through the building inventory. However, given the unique nature of this facility, revenue loss is estimated based on information provided by a Recology representative. According to Maurice Quillen, General Manager of the San Francisco Transfer Station, the annual revenue of the facility is $46 million. Mr. Quillen indicated that with even 6 inches of flooding, there could be significant potential impacts, depending on the amount of inventory on-hand and the extraordinary disposal costs associated with handling contaminated products. The description of a 6-inch flood event at the facility suggested that even this relatively low water level could “bring the facility to a complete standstill.” Using this feedback, the NFS used FEMA expected flood restoration times for IND2 (industrial) occupancy codes to estimate how long disruption may occur if Recology were to flood. The IND2 restoration curve has a step function from 0 to 150 days at 1 foot and does not vary beyond that. Therefore, the restoration curve was converted to a stepped depth-damage curve by dividing 150 by 365 to estimate the percentage of Recology’s annual revenue loss if the facility were disrupted for 150 days.

3.2.10 Chase Center

The Chase Center, a new billion-dollar basketball arena for the Golden State Warriors, was initially included in the structure inventory as an asset with a damageable structure value of $1.4 billion. The Warriors have confirmed that the Chase Center is currently floodproofed and that, in the face of increased flood risk, that the owners will take additional floodproofing action in order to mitigate or prevent damage. As such, the only cost to the Chase Center within the model is the one-time $5 million floodproofing cost that is triggered by a storm with a maximum stage height of 11 feet.

Once the monthly water level reaches 15 feet due to sea level change (SLC), accessibility concerns drive a new assumption that that area would be retreated from. If the Chase Center becomes inaccessible from storm events, there will be both the loss of the structure and the land, as well as RED impacts. This suite of impacts is discussed in the FWOP analysis.

3.2.11 Transportation Delay

Transportation delay costs were calculated using the methodology outlined in IWR Report 91-R-12 *Value of Time Saved for Use in Corps Planning Studies: A Review of the Literature and Recommendations* (IWR 1991). The NFS worked closely with transportation agencies to determine the number of trips that would be disrupted within the transportation system after a storm event. Ridership numbers were tabulated by the type of trip (recreational, vacation, work, or other), with different numbers recorded for weekdays and weekends.

The following equation was used to estimate delay costs, summed over a 30-day period:

$$Delay\ Cost = \sum_{i=1}^{n} Population_i * Delay\ Time * Hourly\ Income * Trip\ Income\ Percent_i$$

where population is the number of people who take a particular type of trip (work, recreational, vacation, other), delay time is the average time, in hours, of the delay, hourly income is the mean household income in San Francisco County, and trip income percent is the percent of the value of the mean hourly household income that is lost (this is based on the type of trip being taken and how long the delay is).

Estimates for the delay time for the closure of stations were derived with the help of expert opinion. One way these assumptions were made was by creating a regional transportation model that determined how riders would shift to walking, biking, and other personal transit modes such as scooters after a closure of the BART or Muni. Different delay assumptions were used for trips within the San Francisco Peninsula and Transbay.

Peninsula trip delays were determined to be an average of 25 minutes on the first day after a flood event, then drop to 20 and then 15 minutes as the transportation system finds a new equilibrium and, later, as limited service returns to the BART and Muni (see

Table E-37). Transbay trip delays were determined to be 65 minutes on the first day, 60 the second, 55 between days 3 and 14, and 45 between days 15 and 30 (Table E-38). These assumptions were based off modelling with the MTC travel demand model for travel times with and without BART and the assumption that 50% of users would stay home in the event of flooding. General commuter times were derived from the *BART's Role in the Region* Report (2016).

Table E-37: Average Transportation Delay, 10.7 feet storm event

Location	Day 1	Day 2	Day 3-14	Day 15-30
San Francisco Peninsula	25 minutes	20 minutes	15 minutes	15 minutes
Transbay Trips	65 minutes	60 minutes	55 minutes	45 minutes

Table E-38: Average Transportation Delay, 11.8 feet storm event and up

Location	Day 1	Day 2	Day 3-14	Day 15-30
San Francisco Peninsula	25 minutes	20 minutes	15 minutes	15 minutes
Transbay Trips	65 minutes	60 minutes	55 minutes	55 minutes

Reduction in ridership was estimated using similar methodology. These numbers assume that, once the surge capacity of BART and SFMTA is reached, the trips will shift to alternate modes of transportation such as walking and/or biking. Some trips will be lost as commuters work from home and not undertake personal/recreation-based trips due to system congestion. Table E-39 sets forth the system mobility consequences and assumptions developed by the NFS's project delivery team based on stakeholder input.

Table E-39: Reduction in Ridership, San Francisco Area Transportation Networks

Location	Water Level	Day 1	Day 2	Day 3-14	Day 15-30
San Francisco Peninsula	10.7 SWL	53%	13%	13%	13%
	11.8 SWL	96%	16%	16%	16%
	12.9 SWL	96%	16%	16%	16%
	14.2 SWL	96%	16%	16%	16%
Transbay Trips	10.7 SWL	43%	43%	43%	30%

	11.8 SWL	47%	43%	43%	43%
	12.9 SWL	47%	43%	43%	43%
	14.2 SWL	47%	43%	43%	43%

The income percent adjustment factor for each type of trip was derived from IWR Report 91-R-12 (IWR 1991). Social/recreation trips are worth approximately 23% of the wage rate. Work trips are approximately 53% of the wage rate. Personal business trips account for about 14% of the wage rate, and other trips account for approximately 8% of the hourly wage rate. The transportation delay costs were summed over a 30-day period for all four water levels. It was assumed that transportation efficiency would revert to pre-flood levels after the 30-day period.

In the analysis, trips were broken down by the type of trip taken (Peninsula weekday, Transbay weekday, Peninsula weekend, Transbay weekend) and time from the flood event (day 1, day 2, days 3-14, and days 15-30) for both 10.7- and 11.8-foot water levels.

shows an example of this process for the peninsula weekday trips on the day after a 10.7-foot flood event. The trips taken come from percentages from an SFMTA survey that say, of the 525,550 daily weekday peninsula trips, how many are of each type (work, recreation, etc.). The reduction in passengers comes from Table E-41.

Table E-40 and the average delay comes from Table E-39. The percent of hourly income is from IWR 91-R-12 (IWR 1991).

Table E-40: Example: Weekday Transportation Loss, Peninsula Trips

Purpose of trip	Trips Taken	Reduction in Passengers	Average Delay (hours)	SF Hourly Wage Rate	Percent of Hourly Income	Delay Cost ($)
Social/Recreation	110,366	0.53	0.42	34.81	23%	196,694
Work	110,366	0.53	0.42	34.81	53%	453,251
Personal Business	99,855	0.53	0.42	34.81	14%	108,324
Other	204,965	0.53	0.42	34.81	8%	127,057

This process was then repeated for transbay trips and weekend trips (there were shown to be approximately 40% the number of weekday trips on weekends) for the four different time periods and the two different water levels examined (10.7 feet and 11.8 feet). Losses for each type of trip, for each time period, and for both weekdays and weekends were then summed to generate total losses. Uncertainty was built into this process by using a maximum total ridership of 25% more and a minimum of 25% less.

Table E-41: Transportation Delay Losses by Water Level

Water Level	Transportation Delay ($)
10.7 feet	34,725,000
11.8 feet and up	45,787,000

These damages by water level were used to build stage-damage curves and, from there, depth-percent damage curves in a manner consistent with the methodologies discussed above.

The methodology discussed above closely follows the methodology in IWR Report 91-R-12 *Value of Time Saved for Use in Corps Planning Studies*, but what it looks to estimate is transportation losses driven by storm events. It is unlikely that the assumptions made above will hold if Relative Sea Level Change leads to high-frequency flooding from tidal events or a large amount of retreat from the waterfront. In these cases, a permanent rebalancing of the transportation network would be required. An estimation of the capital costs of large-scale changes to the transportation network are made in Section 5.3.1, but the impacts on transportation delay are not estimated. Similarly, the impact of the construction of the potential measures discussed in Section 7 on the transportation delay are only discussed qualitatively.

3.2.12 Recreational Opportunities

The San Francisco waterfront offers a diversity of unique recreational opportunities, including the Embarcadero promenade, Bay Trail, waterfront tourism attractions such as Pier 39 and Fisherman's Wharf, a unique historic district, ferry tour opportunities, sporting events, and waterfront parks and greenspace. All 7.5 miles of POSF property is considered public trust land as it gives the public the opportunity to access the water visually and physically. As water levels increase due to sea level rise, the accessibility of recreational opportunities at the waterfront will decrease and deter public usage. Disruption at the waterfront would reshape the recreational opportunities which services the public and attracts tourism.

An FWOP condition threatens waterfront accessibility and continued use of the area as-is. The Unit Day Value (UDV) method presents an opportunity to demonstrate the recreational value of the waterfront that is at risk with increases in coastal flood risk. The UDV method and expected restoration time for recreational assets at the waterfront will be used to estimate recreational opportunity losses due to coastal flooding.

UDV method is the approximate average of willingness to pay for recreational resources. UDV methodology utilizes point values to assign to recreational opportunities based on measurement standards described for the five criteria of activities: recreational experience; availability of opportunity; carrying capacity; accessibility; and environmental quality. The sum of points for each recreational opportunity is then converted to a dollar value per day, or UDV. Points are allocated on the type of recreation, whether it is classified as generalized or specialized recreation. Using UDV, the estimate recreational benefits over the project lifetime can be projected.

Recreation benefits are evaluated in accordance with ER 1105-2-100 *Planning Guidance Notebook* and EGM 20-03 *Unit Day Values for Recreation for Fiscal Year 2020* (USACE 2000, 2020) (though the results were updated to the FY2023 price level). Recreation benefits are considered incidental NED benefits and can only account for a maximum of 50% of total NED benefits. Note that UDV is not recommended for areas where there are over 750,000 annual visits; the San Francisco waterfront has more than that number, but UDV was chosen as a methodology anyway due to the ease of use and the low likelihood that recreational benefits would impact plan selection.

3.2.13 Methodology

The approach encompasses two main efforts. After identifying assets, the first effort was to assign monetary value to established recreation assets using the UDV method. The second effort entailed creating depth-damage curve for input into the G2CRM model. As such, the following steps were taken:

1. Identification of all recreational opportunities per reach. All recreational opportunities were identified using the Problems, Opportunities, Objectives, and Constraints. These highlight assets within the study area by reach, including those which are nonrecreational. Potential asset-based recreation opportunities were identified, along with open spaces.
2. Assigning UDV by recreational category. After all recreation opportunities were identified, they were grouped into recreational categories: general recreation, general fishing, specialized fishing and hunting, and other specialized recreation other than fishing and hunting. The quality of overall recreational experience per category was then evaluated based on the following criteria: recreational experience; availability of opportunity; carrying capacity; accessibility; and environmental quality. Point values were assigned as criteria were evaluated. The sum of points per category was then converted into UDV to provide an estimated willingness to pay.
3. Identify if the recreational opportunity is dependent on a structure or open space. The recreational opportunities were then classified based on those whose function depends (to at least some extent) on buildings, and those that rely solely on open space (such as parks, roads, or piers). While coastal flooding may only impact roadways and parks for a few hours, with a day of clean up for larger events, those activities that depend on physical structures have the potential for much larger disruption times while damage is being restored.

4. Estimate restoration time and disruption. As noted in the previous step, two main methods of identifying a downtime associate with various flood elevations were used. Downtime assumptions by recreational opportunity are detailed in Table E-42.
    - **Open space recreational opportunities.** For those activities that rely solely on open space, it was assumed that 25% of all open space recreational users would be lost for 1 day for the 10.7-foot water level and lower. For these water levels, flooding usually only lasts a few hours until the tide retreats, and the areas impacted are relatively small. Bicycle trips can to some extent reroute, and park occupancy density in non-flooded locations can temporarily increase to account for displaced users. For the 11.1 foot and higher events, there is assumed to be 1 day of interruption to allow time for floodwaters to recede and minor cleanup to occur. In addition to longer periods of flooding, the flood extent itself is much more widespread, affecting most of the shoreline. Access becomes an issue, and it is assumed that recreators will be displaced from the waterfront at large. These assumptions are consistent with roadway clean-up and accessibility assumptions.
    - **Building-dependent recreational opportunities.** The basis for the estimates for the recreational opportunities that depend on buildings was the restoration times established for the buildings. It should be noted that generally, these restoration times include business interruption time modifiers, with the exception of those assets classified as maritime. These time modifiers assume that some assets will be able to relocate rather than close. Restoration times were determined by water level for 12 water levels. The total for the recreational opportunity was then adjusted as necessary based on expert judgement on how recreational opportunity may rebound as rebuilding occurs.

Table E-42: Disruption Estimates by Recreational Opportunity

Reach/Model Area	Recreational Opportunity	Maximum Downtime (days of disruption with a 16.5-foot water level)	Disruption Assumptions
Reach 1	South End Rowing Club and Dolphin Rowing Club	447	Full benefit loss for duration of building closures due to structural damage. Downtime impacts begin at 13.3 feet.

Reach/Model Area	Recreational Opportunity	Maximum Downtime (days of disruption with a 16.5-foot water level)	Disruption Assumptions
	Pier 31.5 – Ferry excursions (Park Cruise)	45	Full benefit loss for 1 day of closure then 50% capacity until building is fully restored. Downtime impacts begin at 12.9 feet.
	Pier 33 – Ferry excursions (Alcatraz)	45	Full benefit loss for 1 day of closure then 50% capacity until building is fully restored. Downtime impacts begin at 12.9 feet.
	Pier 39 -Bay Trail Water Launch	62	Full benefit loss for 1 day of closure then 50% capacity until building is fully restored. Downtime impacts begin at 11.8 feet.
	Pier 39: Aquarium of the Bay	631	Full benefit loss for duration of building closure. Downtime impacts begin at 11.8 feet.
	San Francisco Bay Sportfishing	172	Full benefit loss for duration of building closure. Downtime impacts begin at 12.9 feet.
	Pier 43 Arch	1	Dependent on open space. The promenade (and arch) is exposed beginning at 10.0 feet, and 25% of visitors are assumed lost. Downtime 1 day starting at 11.1 feet.
	Bike (including Bay Trail and Blue Greenway)	1	Dependent on open space. In this reach, disruption to bike paths begins at 10.7 feet (assuming reroutes possible for minimal flooding below this level that would not impact usage). Downtime of 25% of 1 day is assumed for 10.7 feet, increasing to full loss for 1 day beginning at 11.1 feet.
	Fisherman's Wharf Area (General Recreation)	1	Dependent on open space. Disruption begins at 10.0 feet; however it is not considered to impact general use for longer than a couple hours of the day (25% of 1 day). General recreation is anticipated to experience full disruption for 1 day beginning at water level 11.1 feet.
Reach 2	Pier 15/17 Exploratorium	570	It is assumed the Exploratorium will experience full closure beginning at water level 12.9 feet.
	Bike (including Bay Trail and Blue Greenway)	1	Dependent on open space. In this reach, disruption to bike paths begins at 8.9 feet (assuming reroutes possible for minimal flooding below this level that would not impact usage). Downtime of 25% of 1 day is assumed from 8.9 to 10.7 feet, increasing to full loss for 1 day beginning at 11.1 feet.

Reach/Model Area	Recreational Opportunity	Maximum Downtime (days of disruption with a 16.5-foot water level)	Disruption Assumptions
	General Recreation	1	Dependent on open space. Disruption begins at 8.9 feet; however, it is not considered to impact general use for longer than a couple hours of the day (25% of 1 day). General recreation is anticipated to experience full disruption for 1 day beginning at water level 11.1 feet.
Reach 3	Chase Center/Bayfront Park	1	One day of full disruption. The Oracle Center is not anticipated to suffer structural damage. Flooding may cause access impacts beginning at water level 14.2 feet.
	Oracle Park	546	Full benefit loss for 180 days (6 months), after which 50% capacity is assumed until the building is fully restored. Service disruption will begin at water level 12.8 feet.
	Bike (including Bay Trail and Blue Greenway)	1	Dependent on open space. In this reach, disruption to bike paths begins at 9.6 feet (assuming reroutes possible for minimal flooding below this level that would not impact usage). Downtime of 25% of 1 day is assumed from 9.6 to 10.7 feet, increasing to full loss for 1 day beginning at 11.1 feet.
	General Recreation Values	1	Dependent on open space. Disruption begins at 7.5 feet; however, it is not considered to impact general use for longer than a couple hours of the day (25% of 1 day). General recreation is anticipated to experience full disruption for 1 day beginning at water level 11.1 feet.
Reach 4	Bike (including Bay Trail and Blue Greenway)	1	Dependent on open space. In this reach, disruption to bike paths begins at 8.9 feet (assuming reroutes possible for minimal flooding below this level that would not impact usage). Downtime of 25% of 1 day is assumed from 8.9 to 10.7 feet, increasing to full loss for 1 day beginning at 11.1 feet.
	General Recreation	1	Dependent on open space. Disruption begins at 7.5 feet; however, it is not considered to impact general use for longer than a couple hours of the day (25% of 1 day). General recreation is anticipated to experience full disruption for 1 day beginning at water level 11.1 feet.

5. Estimate users per day affected by water level. The number of users per day for various recreational assets and uses was identified using a variety of resources based on the best available resource from the POSF's existing planning efforts. Then, as appropriate, the number of users affected for each of the 12 water levels was calculated as a percent of the total.
   - **Total Daily Users.** Because the type of activities varied widely, so did resources estimating users for each recreational activity and/or asset. Estimates were gathered using data developed by the NFS, local resources, various publicly available images such as Google Street View, and expert judgement. Sources are noted by asset, along with the daily users estimated in Table E-43. Annual values were converted to daily values where needed.

   Additionally, the peak daily outdoor occupancies for buildings and marine structures were also leveraged where possible. As these were "snapshot" or hourly values, the following conversion rate was used:

   *Daily visitors = (Peak hour visitors * 6 hours)/ 0.68*

   This conversion was based on the 2015-2016 Exploratorium Analysis made available by the NFS. The simplifying assumption that other recreational opportunities follow the same distribution curve was made.
   - Affected users by water level. Again, this calculation varied by asset. For the majority of assets, this was simply a percentage of total users, as indicated in the restoration time assumptions in Table E-42. The exception is the general recreation calculations for Reaches 2, 3, and 4. As these general recreation uses include multiple assets and users may be able to substitute between assets, an additional weighting based on the percentage of open space inundated was applied, on top of the downtime assumptions. For example, if 10% of the total park area was affected for a portion of 1 day (i.e., a 10.7-foot water level or less), the total affected users would then be the total users multiplied by the percent inundated, then multiplied by 0.25 to account for 75% of the users affected using alternative recreation assets or uses in the area.

Table E-43: Daily User Estimates by Recreational Opportunity

Reach	Recreational Opportunity	Users Per Day	Source and Assumptions
Reach 1	South End Rowing Club and Dolphin Rowing Club	200	Expert judgment based on a review of total Club memberships and event schedules.

Reach	Recreational Opportunity	Users Per Day	Source and Assumptions
	Pier 31.5 – Ferry excursions (Park Cruise)	250	Estimate from the Alcatraz Ferry Embarkation Project, as presented to the NFS.
	Pier 33 – Ferry excursions (Alcatraz)	4,930	Estimate from the Alcatraz Ferry Embarkation Project, as presented to the NFS.
	Pier 39 -Bay Trail Water Launch	10,960	Estimated via Pier 39 Press Release.
	Pier 39: Aquarium of the Bay	1,370	Daily use derived from annual visitors documented in Aquarium of the Bay Press Kit.
	San Francisco Bay Sportfishing	6	Based on one daily trip at boat maximum number passengers, per the company website.
	Pier 43 Arch	970	The NFS outdoor occupancy estimate for Pier 43, adjusted to a daily count
	Bike (including Bay Trail and Blue Greenway)	1,600	The daily bike users from determined by the NFS and was weighted based on length by reach. As such, a portion of the daily Embarcadero bike users was assigned to this reach.
	Fisherman's Wharf Area (General Recreation)	38,000	Fisherman's Wharf Area is assumed to cover the general recreation counts.
Reach 2	Pier 15/17 Exploratorium	4,590	Total visitors per day is from the 2015/2016 Exploratorium Analysis pedestrian count for Pier 15.
	Bike (including Bay Trail and Blue Greenway)	2,700	The daily bike users from determined by the NFS and was weighted based on length by reach. As such, a portion of the daily Embarcadero bike users was assigned to this reach.
	General Recreation	41,000	This value is estimated through analysis done by the NFS.
Reach 3	Chase Center/Bayfront Park	9,030	The normal users per day assumption is 50% of the seat capacity of the Chase Center. This assumes that the venue has an event approximately 75% of the time (from past schedules), but not all events draw full capacity. It is assumed people attending the Chase Center will also utilize Bayfront Park.
	Oracle Park	20,960	Daily users were estimated at 50% of the seat capacity of Oracle Park. This assumes that the venue has an event approximately 75% of the time (from past schedules), but not all events draw full capacity

Reach	Recreational Opportunity	Users Per Day	Source and Assumptions
	Bike (including Bay Trail and Blue Greenway)	5,300	The daily bike users from determined by the NFS and was weighted based on length and then multiplied by the total length of "through" routes (i.e., counting redundant routes only once) to arrive at an approximate number of users per reach.
	General Recreation Values	7,650	This value is estimated through analysis done by the NFS.
Reach 4	Bike (including Bay Trail and Blue Greenway)	3,300	The daily bike users from determined by the NFS and was weighted based on length and then multiplied by the total length of "through" routes (i.e., counting redundant routes only once) to arrive at an approximate number of users per reach.
	General Recreation	3,500	Expert judgement based on various publicly available images such as Google Street View. The estimate is mainly comprised of Heron's Head Creek visitors. Cargo Way and Islais Creek parks account for a portion of the count. Parks outside of the flood zone are not considered in the estimate.

6. **Calculate total loss per water level**. Steps 1 through 5 build to the calculation of total recreational value loss per water level based on disruption time and reduction in waterfront access. Total losses are calculated by water level, as:

*Value lost = affected users * UDV * downtime per water level*

The total recreation value lost provided in Table E-44 displays the resulting economic impact at the maximum downtime scenario (a 16.5-foot water level). The mean and a 40% margin of error are used to capture the range of economic impact at maximum downtime per recreational opportunity.

Table E-44: Recreational Loss Inputs and Total Losses by Recreational Opportunity

Reach	Recreational Opportunity	Affected Users (people per day)	Benefits ($ per person per day)	Maximum Downtime (days)	Total Recreational Value[a] (Mean +/- 40%)
Reach 1	South End Rowing Club and Dolphin Rowing Club	200	$10.59	447	$1,000,000 ($610,000 - $1,400,000)

Reach	Recreational Opportunity	Affected Users (people per day)	Benefits ($ per person per day)	Maximum Downtime (days)	Total Recreational Value[a] (Mean +/- 40%)
	Pier 31.5 – Ferry excursions (Park Cruise)	247	$25.54	45	$140,000 ($85,000 - $200,000)
	Pier 33 – Ferry excursions (Alcatraz)	4,932	$25.54	45	$140,000 ($85,000 - $200,000)
	Pier 39 -Bay Trail Water Launch	10,959	$25.54	62	$8,700,000 ($5,200,000 - $12,000,000)
	Pier 39: Aquarium of the Bay	1,370	$25.54	631	$9,100,000 ($5,500,000 - $13,000,000)
	San Francisco Bay Sportfishing	6	$25.54	172	$41,000 ($25,000 - $58,000)
	Pier 43 Arch	970	$10.59	1	$10,000 ($6,000 - $14,000)
	Bike (including Bay Trail and Blue Greenway)	1,600	$10.59	1	$17,000 ($10,000 - $24,000)
	Fisherman's Wharf Area (General Recreation)	24,383	$10.59	1	$400,000 ($240,000 - $560,000)
Reach 2	Pier 15/17 Exploratorium	4,597	$9.79	570	$26,000,000 ($15,000,000 - $36,000,000)
	Bike (including Bay Trail and Blue Greenway)	2,700	$9.79	1	$26,000 ($16,000 – $37,000)
	General Recreation	4,733	$9.79	1	$480,000 ($290,000 - $680,000)
Reach 3	Chase Center/Bayfront Park	9,032	$9.42	1	$85,000 ($51,000 - $120,000)
	Oracle Park	20,958	$9.42	546	$72,000,000

Reach	Recreational Opportunity	Affected Users (people per day)	Benefits ($ per person per day)	Maximum Downtime (days)	Total Recreational Value[a] (Mean +/- 40%)
					($43,000,000 - $100,000,000)
	Bike (including Bay Trail and Blue Greenway)	5,300	$9.42	1	$50,000 ($30,000 - $70,000)
	General Recreation Values	4,650	$9.42	1	$69,000 ($41,000 - $96,000)
Reach 4	Bike (including Bay Trail and Blue Greenway)	3,300	$7.43	1	$25,000 ($15,000 - $34,000)
	General Recreation	3,500	$7.43	1	$18,000 ($11,000 - $26,000)

[a] The total value is the value of the 16.5-foot water level. Other water levels will be a percentage of this total value.

4. G2CRM Input Discussion

The previous sections discussed the methodology surrounding identifying assets, assigning them occupancy types, determining their structure and content values, and deciding upon their depth-percent damage curves. This section discusses the asset inventory interacts with the other inputs in G2CRM—storms, system elements, and run parameters. It will also show how the inventory looks in the aggregate by displaying various descriptive statistics. Finally, there will be a discussion of the dynamic inventory parameters, which dictate when a structure is assumed to be floodproofed in order to prevent erroneous repetitive damage.

4.1 Storms

G2CRM simulates storms using Monte Carlo simulation. Storms are sampled from a storm suite of synthetic storms using frequencies dictated by assigned seasonal parameters. The life-cycle model generates a plausible set of storm conditions, calculates various coastal engineering parameters, performs a series of engineering and economic computations, determines the individual damage mechanisms, and concludes with economic outputs. Note that each total water level includes surge, tide, sea level rise, and wave components. Details on the creation of the storm suite and the assignment of sampling parameters can be found in *Appendix B: Engineering*.

SLC is incorporated into the G2CRM coastal processes in accordance with ER 1100-2-8162 *Incorporating Sea Level Change in Civil Works Programs* (USACE 2013). Guidance calls for an analysis of three SLC scenarios: Low (Historic), Intermediate, and High (see Figure E-11). The Low value is based on extrapolation of the local historic sea level rise rate, while the Intermediate and High values are based on the National Research Council sea level rise predictive Curves I and III, respectively.

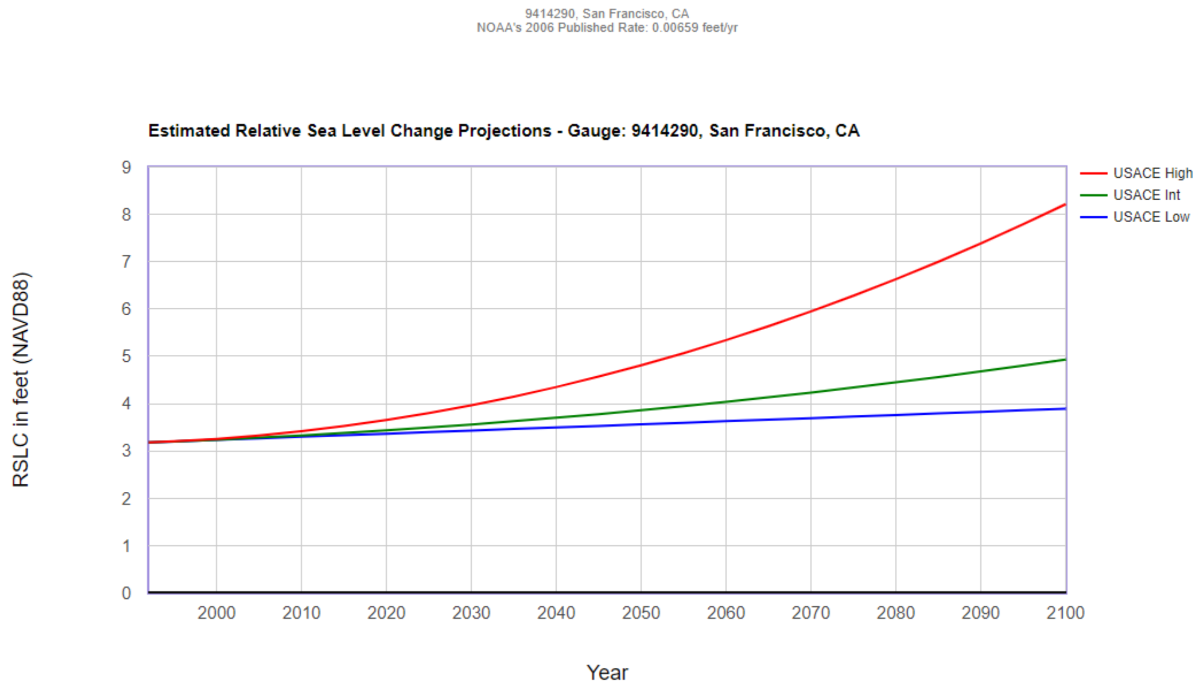


Figure E-11: Projected Sea Level Rise, Gauge 9414290, San Francisco, CA

It is important to note that the three defined SLC curves are merely representative of the entire envelope of future sea level rise conditions and it is not presumed that the future will follow any one SLC scenario exactly. At this time, each of the three SLC curves (and every implicit SLC curve between them) is considered an equally likely future condition.

SLC is ingrained into G2CRM modeling to describe the vulnerability of the study area, evaluate the project performance of proposed measures under various SLC conditions, assess the economic viability of proposed measures under various SLC conditions, and identify design components (e.g., adaptability) to minimize adverse consequences across various possible futures.

Additional discussion of the storm inputs and SLC can be found in the *Appendix B: Engineering*.

4.2 System

As discussed in Section 2, the study area was divided into four hydraulically independent reaches, which were then subdivided into seven total Model Areas to account for the existing seawall. Model Areas one through four were based on identifiable geographic references, specific wave action within each Model Area, and major differences in physical structure inventory. Model Areas five through seven are the waterfront areas in front of Model Areas one through three, respectively, and were separated into their own unique model areas to differentiate between structures in front of the existing seawall and structures behind it.

The existing seawall is modeled in G2CRM as a bulkhead Protective System Element (PSE). The existing wall itself is built at grade, meaning it has no pool.[3] The heights of the PSEs in the four protected Model Areas are listed in Table E-45. These heights were compiled in two ways: by looking at the Adapting to Rising Tide maps, which show overtopping and inundation depths at various total water levels, and by looking at elevation profiles along the waterfront. Additional discussion of the methodology to determine PSE heights can be found in *Appendix B: Engineering*.

Table E-45: Heights of the PSEs by Model Area

Model Area	Elevation (feet NAVD88)
1	9
2	8.5
3	9
4	7

In the FWP condition, structural measured are modeled as bulkheads within the System section of the G2CRM model. These measures are discussed further in Section 7.

4.3 Assets

The asset inputs for G2CRM are the non-spatial and spatial asset files and the Evacuation Planning Zones file. The asset files allow point-based structures to be assigned to model areas and be associated with water levels directed by the storm inputs. Damages are assigned based on the interaction between the water level, the FFE of the asset, the value of the asset, and the depth-percent damage curve assigned to the asset.

The depth-percent damage curve determines at what height (relative to a structure's first floor elevation) damage begins and how much damage (as a percentage of the structure's total value) occurs. The non-spatial asset file links the various occupancy types to their respective minimum, most likely, and maximum depth-percent damage curves. For unique assets within the inventory, bespoke depth-percent damage curves were created (see Section 3). For the rest of the structures in the inventory, FEMA, IWR, and NACCS depth-percent damage curves for structure and content damage were assigned based on structure type. (A discussion of assignment of structure type can be found in Section 2.) If a structure was a high-rise (5 or more floors), it was given either

[3] For this reason, Volume-stage functions (VSFs) were not designed for the model areas. VSFs account for the time it takes for a storm to "fill up" the available storage on land before water levels begin to increase, but with long-duration storms and minimal storage area, VSFs were deemed unnecessary for this study. This is true with both the existing seawall and the proposed Future With-Project measures.

the NACCS 4A or 4B classification, depending on whether or not it had a basement. Otherwise, it was assigned a depth-percent damage curve based on its first-floor occupancy type.

Table E-46: Assignment of Depth-Percent Damage Curves by Structure Type

Depth-Percent Damage Curve	First-Floor Occupancy Type	Description	Count
IWR-Prototype-4	RES4	Hotel/Motel: One Story	92
IWR-Prototype-5	COM7	Medical Office: One Story	7
IWR-Prototype-6	COM6	Hospital: One Story	10
IWR-Prototype-7	COM3/COM4	Office Building: One Story	689
IWR-Prototype-20	REL1	Religious Facility: One Story	15
IWR-Prototype-21	EDU1/EDU2	School, One Story	43
IWR-Prototypes-10/11/12-Composite	COM1	Composite function for retail buildings	347
IWR-Prototypes-8/9/19-Composite	COM8	Composite function for Single-Story Recreation, Restaurants	89
FEMA-COM10	COM10	Parking Garages	112
FEMA-COM5	COM5	Banks	8
FEMA-GOV-Composite	GOV1/GOV2	Composite function for GOV1 and GOV2	107
FEMA-IND-Composite	IND1/IND2/IND3/IND5/ VACANT	Composite function for industrial structures	2,006
NACCS-Prototype-1A-1	RES3 (A-F), Single Story	One-story apartment, no basement	117
NACCS-Prototype-1A-3	RES3 (A-F), Multistory	Three-story apartment, no basement	1,396
NACCS-Prototype-4A	High-rises with basements (labeled MR/HR and SV)	Urban high-rise	22
NACCS-Prototype-4B	High-rises without basements (labeled MR/HR and NSV)	Beach high-rise	9
NACCS-Prototype-5A	RES1 single story, no basement	Single-story residence, no basement	327

Depth-Percent Damage Curve	First-Floor Occupancy Type	Description	Count
NACCS-Prototype-5B	RES1 multistory, no basement	Two-story residence, no basement	133
NACCS-Prototype-6A	RES1 single story, with basement	Single-story residence with basement	116
NACCS-Prototype-6B	RES1 multistory, with basement	Two-story residence with basement	63

Note that the count doesn't equal the count for the study because of assets that have bespoke depth-percent damage curves.

The largest single group of depth-percent damage curves is for industrial assets. Though it is likely the various different types of industrial structures within the study area take damage in different ways, the lack of existing industrial depth-percent damage curves and the difficulty of assigning damages based on inundation height to unique structures, even with high-fidelity data on structure type, makes the assignment of curves for this structure type rather coarse. Still, within G2CRM, the depth-percent damage curves are put in as a triangle distribution (minimum, maximum, and most likely curve), so the Monte Carlo simulation will allow for variability in depth-percent damage curve assignment, leading to a range of outcomes. The "true value" of damage should be in that range. And, though IND assets make up a third of the structure inventory, their average structure value is much smaller than other asset categories; as such, refining those curves would be unlikely to have a large impact to results and, therefore, to decision making.

One of the most important structure classes within the analysis is the high-rises, as they are high-value structures that are often low-lying. One problem encountered while using the NACCS-prototype 4A curve was that the curve assigns damages down to 7 feet below a structure's assigned first floor elevation (FFE). The Project Delivery Team (PDT) had to determine if this was an accurate representation of how damage occurs to these structures. It was determined that having damage begin 7 feet below a structure's FFE would likely overstate damages. Investigation of study area high-rises did not suggest that flooding was likely to occur significantly below FFE. Though the NACCS curve begins at -7 feet, this investigation determined it was unlikely for water to actually penetrate the structure at that depth.

The PDT changed the begin-damage point for high-rises to -1, thereby truncating the curve and preventing damage from occurring below -1 foot below a structure's FFE. This is shown visually on Figure E-12: now, when the water level is below -1 foot below a high-rise's FFE, the structure takes no damage, but when the water reaches -1 foot, the structure immediately takes all the damage that would have been gradually occurring between -7 and -1 foot (e.g., on the most likely curve, it would immediately take 13% damage). This methodology does not adjust or shift the depth-percent damage curve; it simply truncates it, which was deemed the appropriate due to the study area being a dense urban environment. The model is sensitive to the selection of zero point, though, and it remains a source of uncertainty within the project.

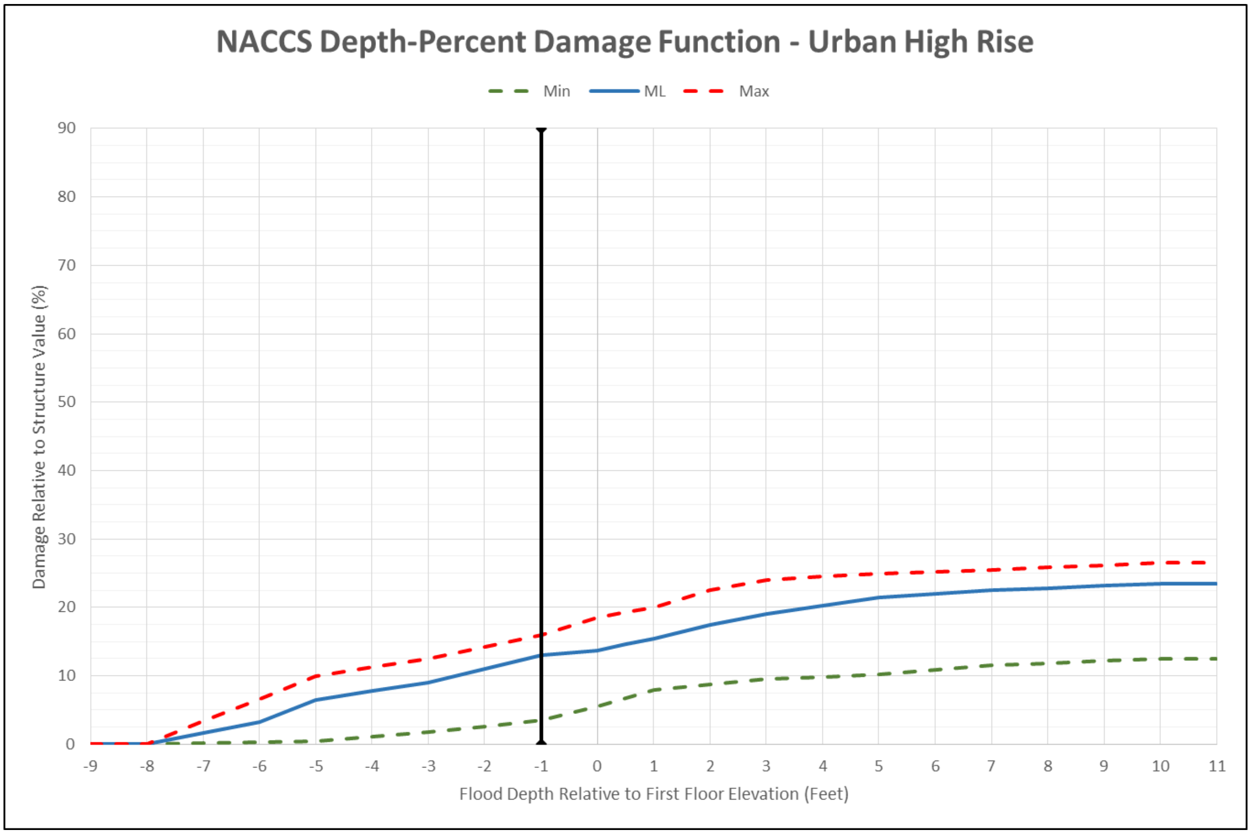


Figure E-12: Truncation of the NACCS 4A "Urban High-rise" Depth-Percent Damage Curve

A related concern is that there were numerous "low spots" in the study area. In these areas, assets would have low ground elevations (as determined using the bare-Earth LiDAR) and could take damage while still being hydrologically disconnected from the hazard. This occurs because G2CRM is a bathtub model: if the water level experienced by a model area is higher than that of an asset's FFE, that asset will take damage, regardless of where the hazard and asset are spatially located. To remedy this, the DEM was smoothed using ArcMap. Doing this raised any local low spots to the height of the surrounding land. This potentially slightly undercounts damage at an asset (since, when the water reaches its FFE, it should take a larger amount of damage due to the water depth being artificially reduced) but ensures that the asset begins taking damage at the right water elevation, which is substantially more relevant to correctly calculating damages.

The non-spatial asset file also determines whether structure types can be elevated after taking damage. Because the study area is urban, many of the assets are high-rises, industrial, and commercial structures. As such, it was decided that assets would not be raised after they took damage, but instead floodproofed. To do this within G2CRM, structures were assumed to be floodproofed once they passed either the cumulative damage threshold or the number of rebuilds threshold and a present value (PV) floodproofing cost was assigned. These dynamic inventory toggles and floodproofing costs are discussed in Section 4.4.

The non-spatial asset file holds many of the inputs that allow the model to determine life loss, including inputs for occupancy type surge lethality and the Evacuation Planning Zone shapefile. These inputs have not been used within this study. To date, no life loss has occurred due to coastal storms along the San Francisco waterfront in the study area. As noted in the Review Plan, direct casualties due to storms are expected to be extremely low because of the nature of coastal storms in the area and the layout of the San Francisco waterfront, which enable sufficient time and means for effective egress from the waterfront to high ground. Water levels in habitable areas are likely to be, at maximum, 2 feet above ground level; if the water is slow-moving, that represents low risk to life. The FWOP assumes retreat from the waterfront as sea levels rise, and this retreat will continue the low risk to life in storm and tidal events. The PDT suspects that life loss associated with storms is more likely to be indirect, caused by a loss of services, transportation interruption, etc., though this is not possible to model within G2CRM. Additionally, life loss from seismic events is a concern in the study area, but this is also not modeled within G2CRM.

The non-spatial asset file also includes tabs for construction type and foundation type. Information about construction type and foundation type was used to assign depth-percent damage curves and to determine replacement values for structures but that part of the non-spatial asset file does not directly interface with anything within G2CRM.

Table E-47 shows the number of structures in each model area and the total structure depreciated replacement values and content values in each model area. Model Area 3 contains the most structures and, as such, more than 50% of the structure value. Model Area 2, on the other hand, only contains less than 10% of the inventory's structures but has more than 25% of the structure value. This is due to the high-value assets in the model area, including Embarcadero Station and many high-rises. The three Model Areas that lie bayward of the existing seawall have few assets and, as such, relatively small amount of structure value (though these are structures that are low-lying and vulnerable). Figure E-13 shows the relative asset depreciated replacement values of the various model areas.

Table E-47: Number of Structures and Damageable Structure Depreciated Replacement Value by Model Area

Model Area	Number of Structures	Structure Value ($)	Content Value ($)
1	648	2,466,065,000	1,506,936,000
2	573	10,379,308,000	9,814,218,000
3	2,713	19,622,022,000	11,535,297,000

Model Area	Number of Structures	Structure Value ($)	Content Value ($)
4	1,708	4,395,640,000	2,128,377,000
5 (Unprotected)	58	280,603,000	130,971,000
6 (Unprotected)	13	330,181,000	195,822,000
7 (Unprotected)	36	264,655,000	114,439,000
TOTAL	5,749	37,738,474,000	25,426,060,000

Note that some assets lie outside the bounds of the model areas. These assets will not take damage but are rolled up in other descriptive statistics.

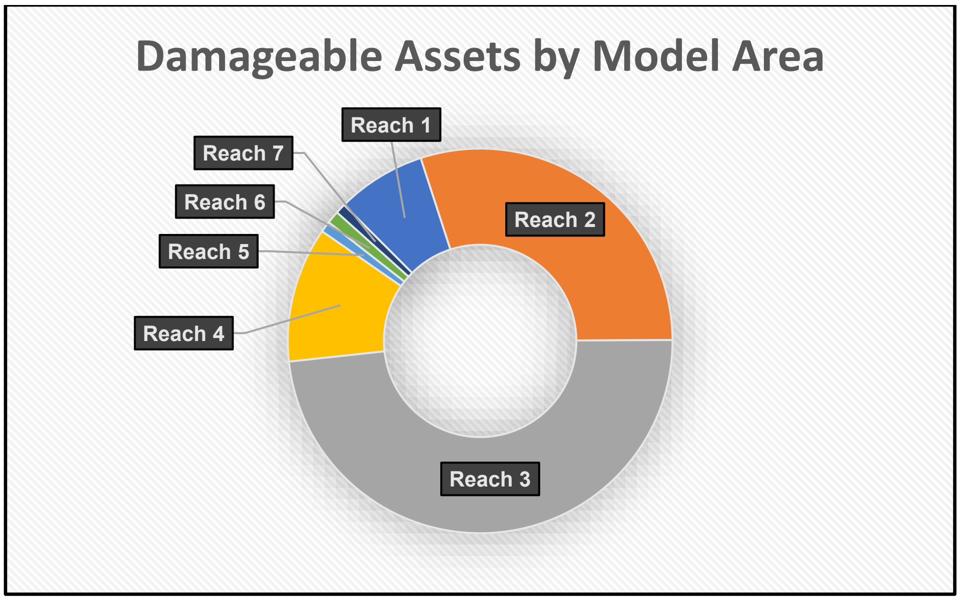


Figure E-13: Damageable Assets by Model Area

Another way to consider the value of the inventory is by the statistical weight of the individual structures or groups of structures. Figure E-14 shows the 5,749 assets in the structure inventory sorted by structure value and separated into ten deciles of roughly 550 structures each. The first decile is the 550 assets with the highest structure value, the second decile is the 550 structures with the next-highest structure value, and so on. If the structures were of roughly the same value, we would see a bar graph with roughly equal bars. Instead, we see that the top decile here is enormously more valuable than the other deciles. This shows that this is a structure inventory that is top-heavy: there are many high-value assets that skew the descriptive statistics.

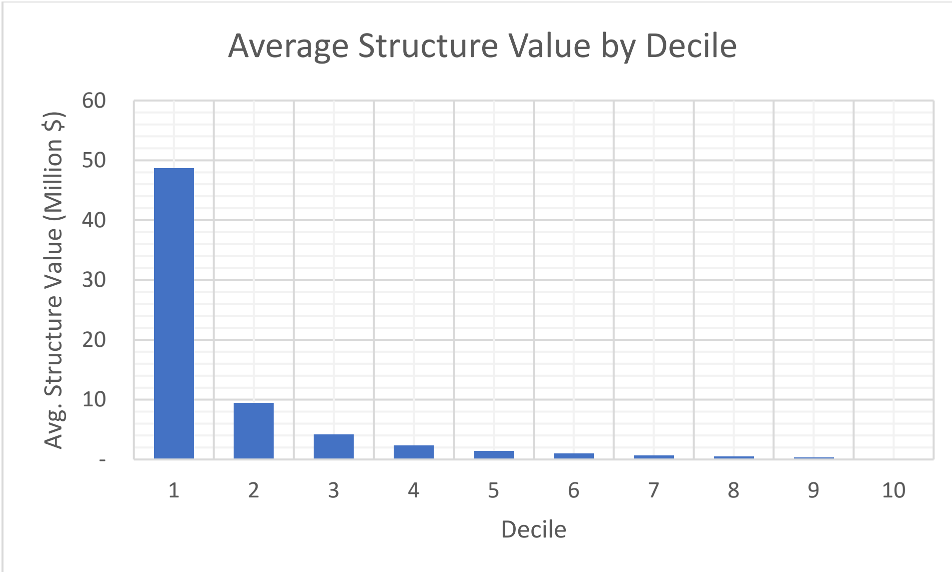


Figure E-14: Damageable Assets by Decile

Table E-48 shows the structure and content values by aggregated first-floor occupancy type. An additional two occupancy types, HIGH and SPECIAL, have been added here for ease of viewing descriptive statistics. HIGH consists of structures that have 5 or more floors, while SPECIAL structures are the assets discussed in Section 3 (not including pumps, substations, or other structures more suitable to be classified as IND but that required special analysis). HIGH structures make up 40% of the inventory structure value, even though they make up just 6% of the inventory. Structures classified as IND make up a third of the structures in the inventory, but only a fraction of the damageable structure value.

Table E-48: Structure and Content Values by Aggregated First-Floor Occupancy Type

Occupancy Type	Count	Structure Value ($)	Content Value ($)
COM	1,128	6,694,919,000	6,785,972,000
EDU	35	626,537,000	250,615,000
GOV	103	613,450,000	245,380,000
HIGH	349	15,529,812,000	12,832,959,000
IND	1,917	6,941,679,000	2,776,672,000
REL	15	37,117,000	14,847,000
RES	2,103	4,956,948,000	2,478,474,000
SPECIAL	37	2,248,294,000	5,255,000

Occupancy Type	Count	Structure Value ($)	Content Value ($)
VACANT	62	89,719,000	35,888,000
TOTAL	**5,749**	**37,738,475,000**	**25,426,062,000**

4.4 Dynamic Inventory and Floodproofing

Within the G2CRM, dynamic inventory thresholds are used to project changes in an asset inventory over time due to rational responses to coastal storm risk. In simpler terms, these dynamic inventory thresholds dictate when structures should stop taking damage within the model because, in reality, they will have been rationally modified in some way to lower their coastal risk. These thresholds exist to prevent the counting of unrealistic, indefensible repetitive damages—damages that are calculated within the model but are based on rebuilding decisions rational economic actors would not be expected to make (e.g., rebuilding the exact same structure in perpetuity despite multiple catastrophic losses).

Both in reality and within the model, when a structure takes catastrophic damage during a single storm event or significant repetitive damage from several storm events, it may be elevated, floodproofed, or condemned (abandoned). The dynamic inventory thresholds define the conditions that would result in protective actions being taken. For the study area, it is considered unlikely that structures would be immediately permanently abandoned, condemned, or razed when first exposed to coastal storm risk. Thus, when structures reach a dynamic inventory trigger point (explained below) and stop taking damage within the model, they are assumed to be initially elevated or floodproofed.[4] The tools the user has to specify when these structures are elevated or floodproofed in G2CRM are the cumulative damage threshold, the significant damage threshold, and the number of rebuilds. Their definitions are below:

- The cumulative damage threshold: when a structure takes a certain amount of damage, relative to its structure value, it is "removed" from the inventory.
- The significant damage threshold: the amount of damage a structure needs to take in a single event for the model to consider it a "rebuild."
- The number of rebuilds: how many rebuilds a structure can undergo before it is "removed" from the inventory.

These thresholds cannot be set using existing on-the-ground data in the study area, as the study area has not seen repeated flooding events. Therefore, to naively set these thresholds, preliminary G2CRM model runs were actuated with an early version of the asset inventory. When the model was run with relaxed thresholds (4x cumulative damage threshold, 25% significant damage threshold, 20 rebuilds, High RSLC) as a

[4] Additional methodologies are available outside G2CRM for evaluating monetary losses for structures that are no longer "usable" even after major retrofits. This may be due to accessibility issues. Impacts could include abandonment, condemnation, and/or razing. These are discussed in Section 6.2.

sensitivity test, most structures experienced damage in dozens of separate events over the course of 100 years. A histogram of those results can be seen on Figure E-15. The sensitivity test shows that relaxed dynamic inventory thresholds do not properly represent rational asset owner behavior. Some assets experienced damage over 50 times during the period of analysis before taking any protective measures to limit their coastal storm risk. This does not represent a defensible projection of future conditions. And while the sensitivity test does not help inform what the dynamic inventory thresholds should be, it does show why the thresholds are required for a more accurate projection of the asset inventory.

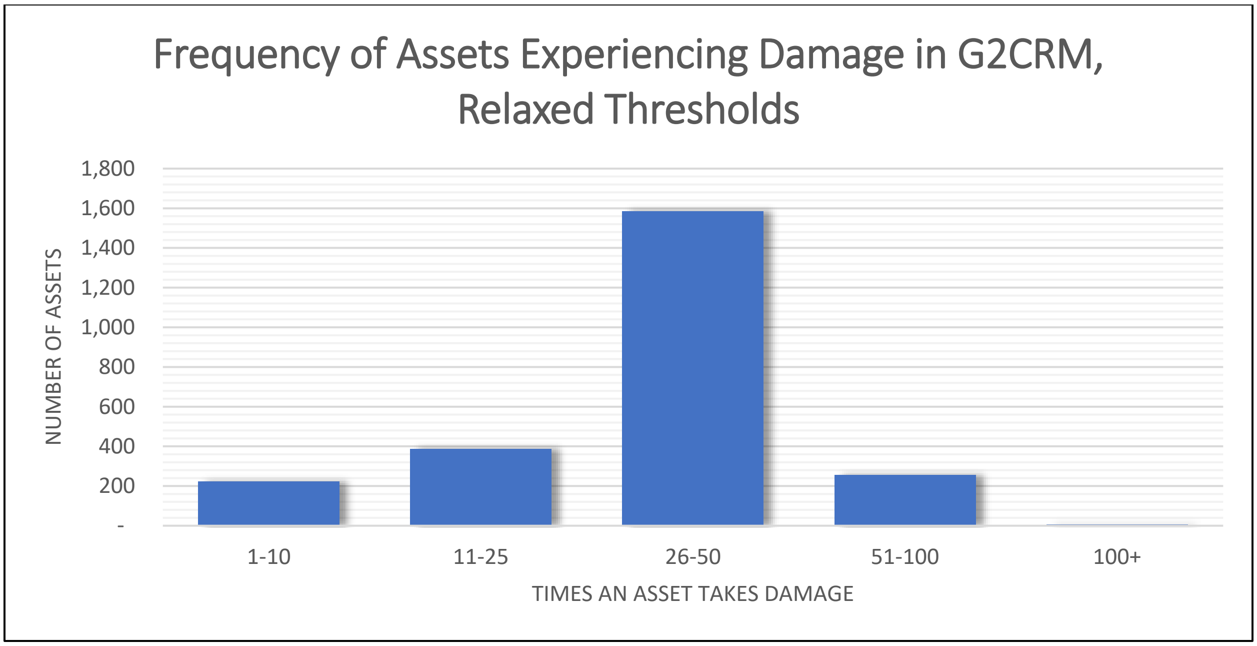


Figure E-15: Preliminary Sensitivity Test with Relaxed Rebuild Thresholds

When deciding upon dynamic inventory thresholds, best practice is to be agnostic to the modeled damages and instead attempt to ensure that the thresholds selected result in the structure inventory reacting defensibly and realistically to the hazards of coastal storm risk.

Figures E-16 through Figure E-22 show the results of multivariate sensitivity tests of the significant damage threshold, allowable number of rebuilds threshold, and the cumulative damage threshold, performed using G2CRM and post-processed using Python code. The damage numbers are included to help ordinally describe the interactions between the various thresholds—how they are interconnected and the points at which the different thresholds dominate the others. Each figure has damage on the y-axis and the cumulative damage threshold on the x-axis. The various lines plot the damage at each cumulative damage threshold (.75 to 4) for a different number of rebuilds, from 6 to 20. Each chart varies by what the significant rebuild threshold was set to; they run from 3% to 25%. Each point on each line on each chart specifies a unique set of thresholds (cumulative damage, significant rebuild, number of rebuilds) and shows the total damage for that set of thresholds. Note that the testing in this section specifically looks at the High RSLC curve, as the stress on the selection of these parameters occurs due to SLC.

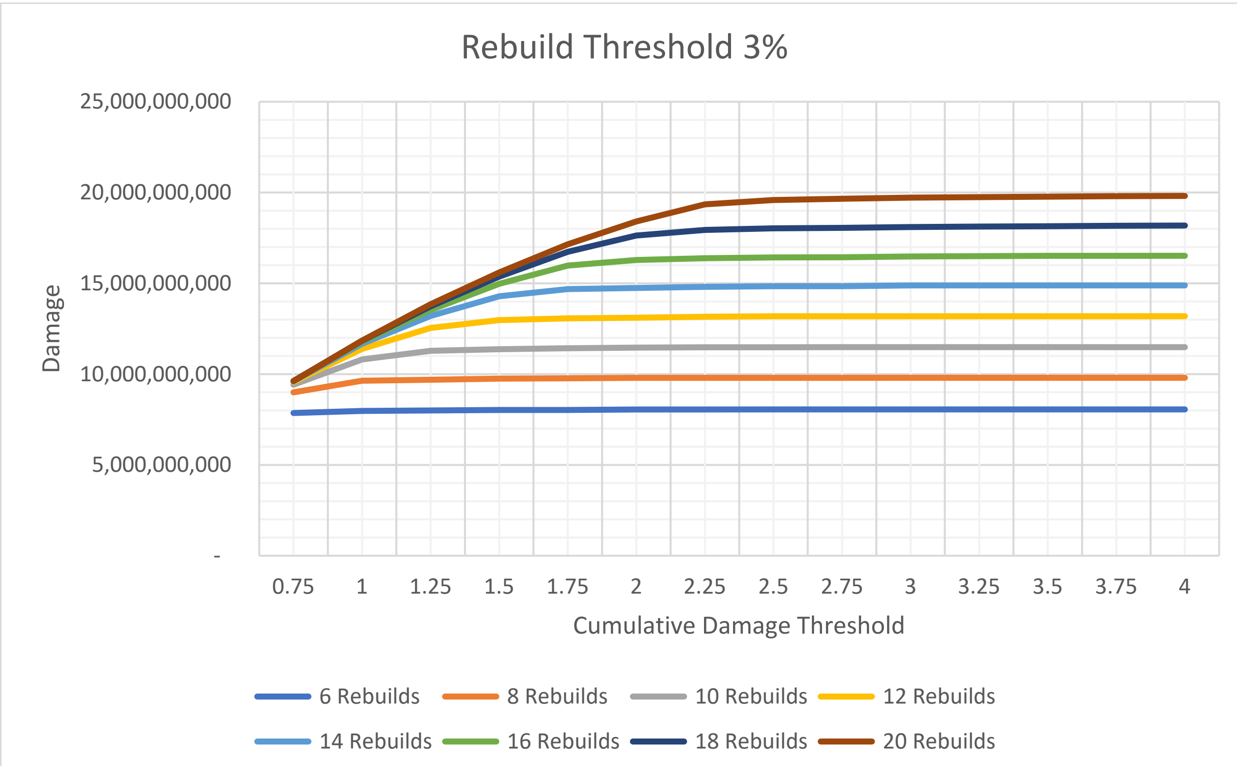


Figure E-16: Multivariate Sensitivity Testing – 3% Rebuild Threshold

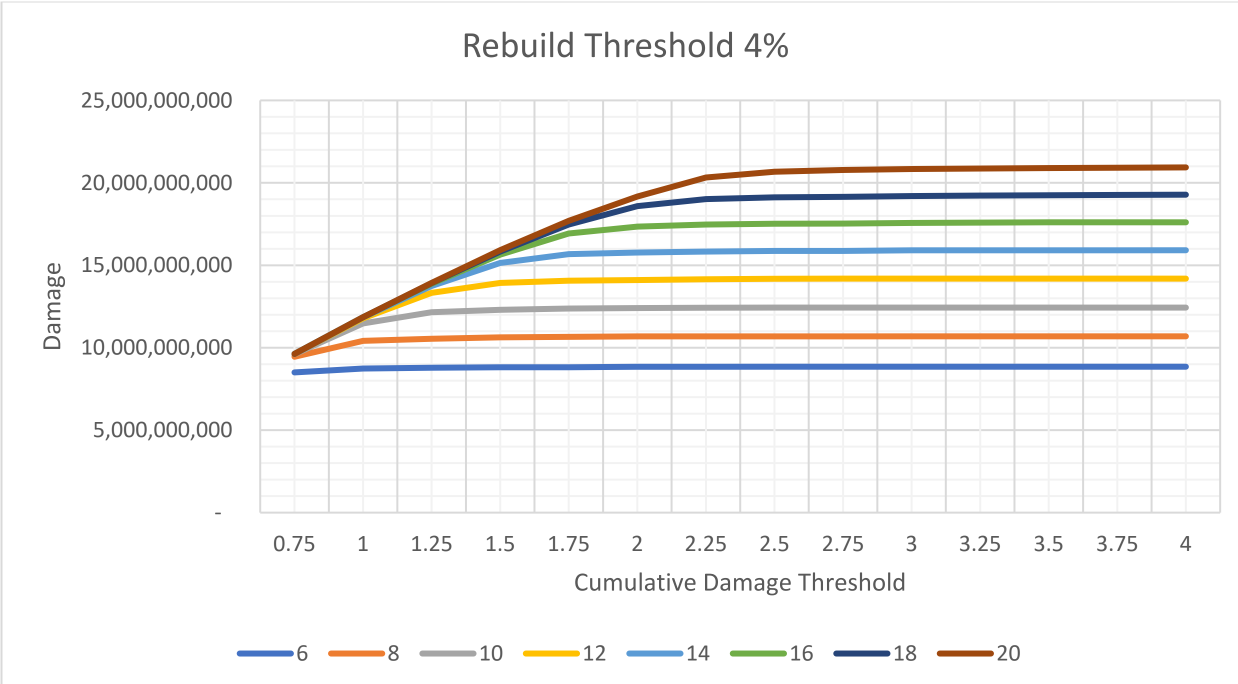


Figure E-17: Multivariate Sensitivity Testing – 4% Rebuild Threshold

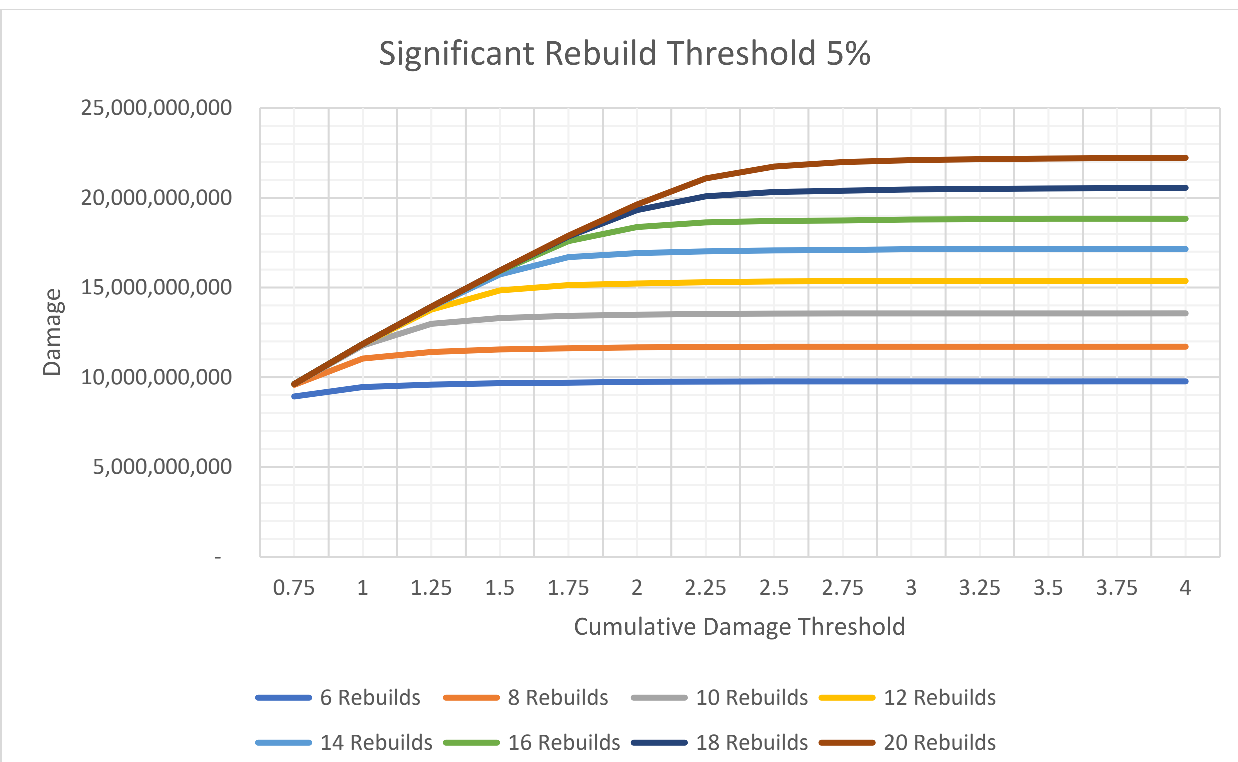


Figure E-18: Multivariate Sensitivity Testing – 5% Rebuild Threshold

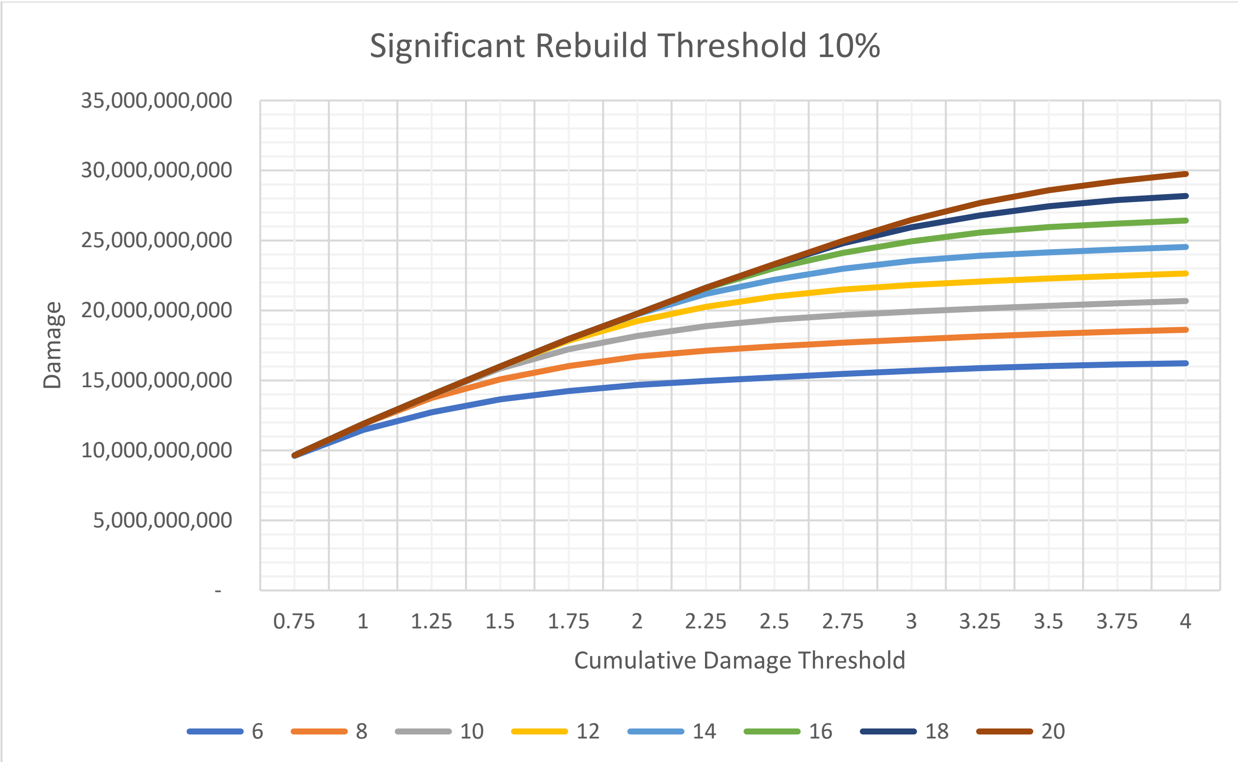


Figure E-19: Multivariate Sensitivity Testing – 10% Rebuild Threshold

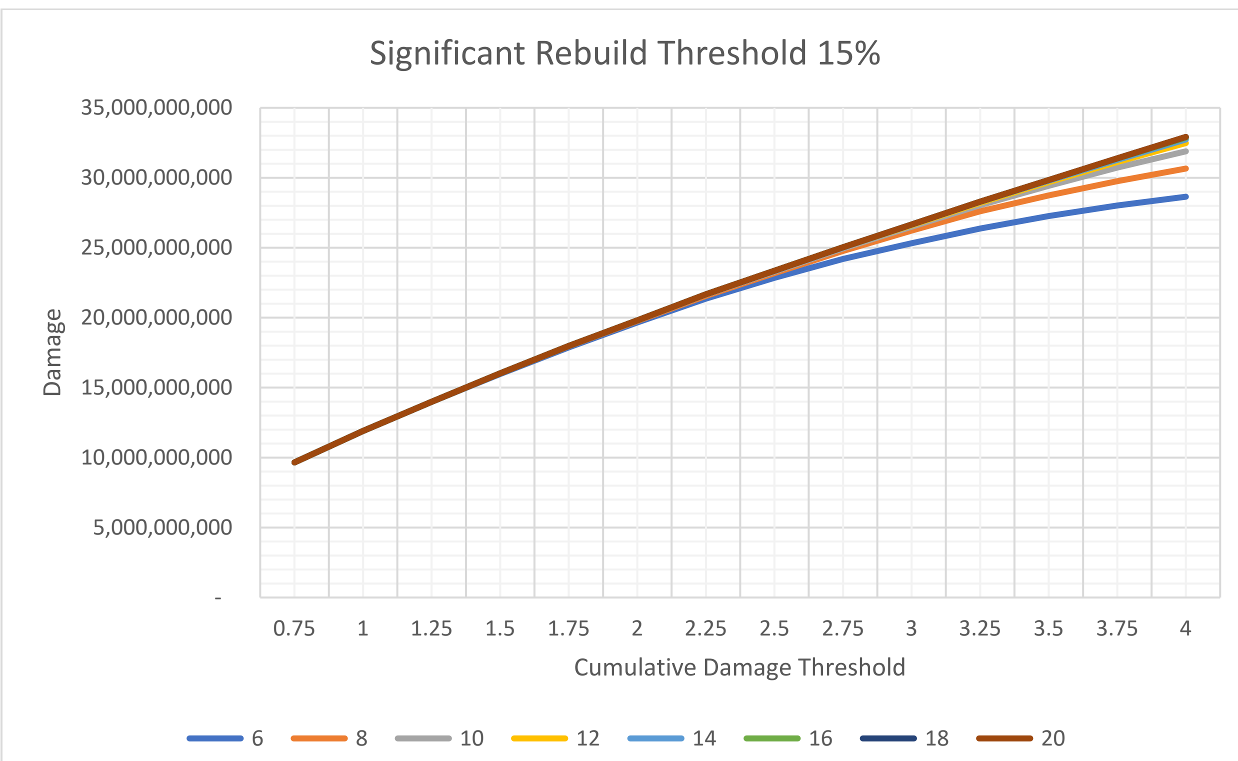


Figure E-20: Multivariate Sensitivity Testing – 15% Rebuild Threshold

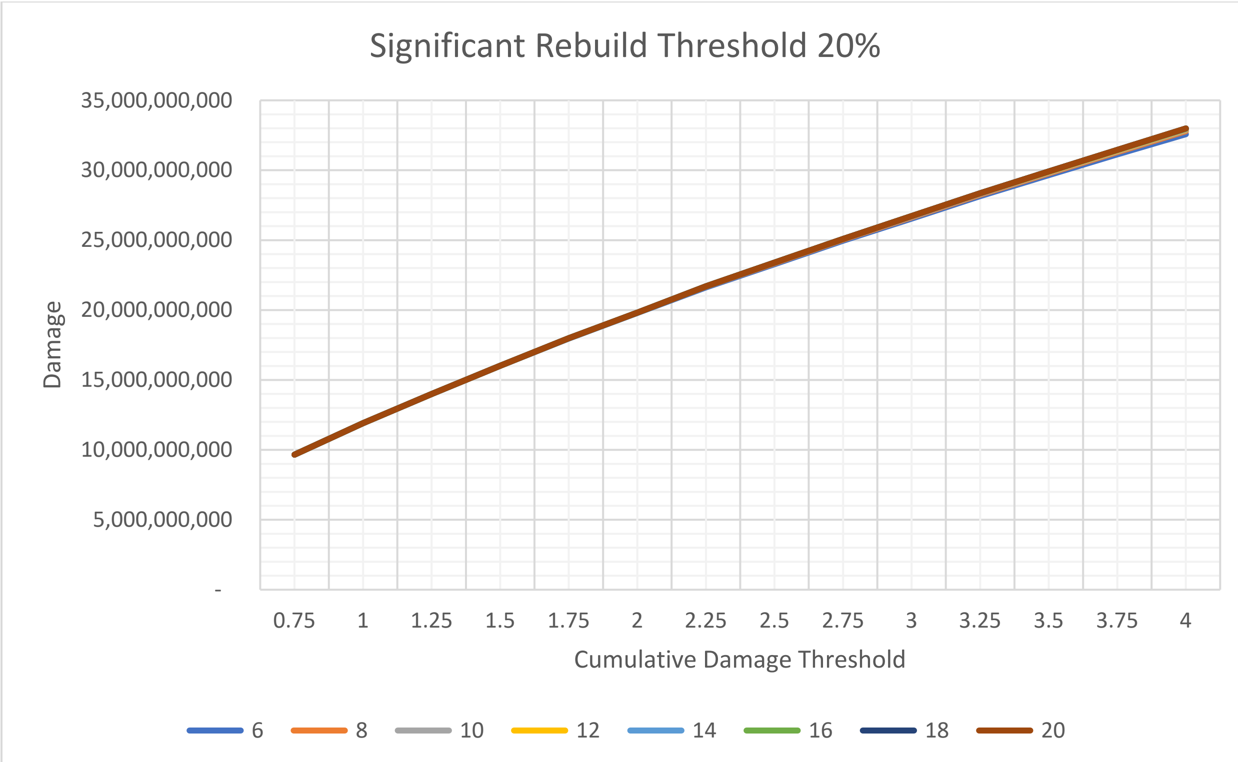


Figure E-21: Multivariate Sensitivity Testing – 20% Rebuild Threshold

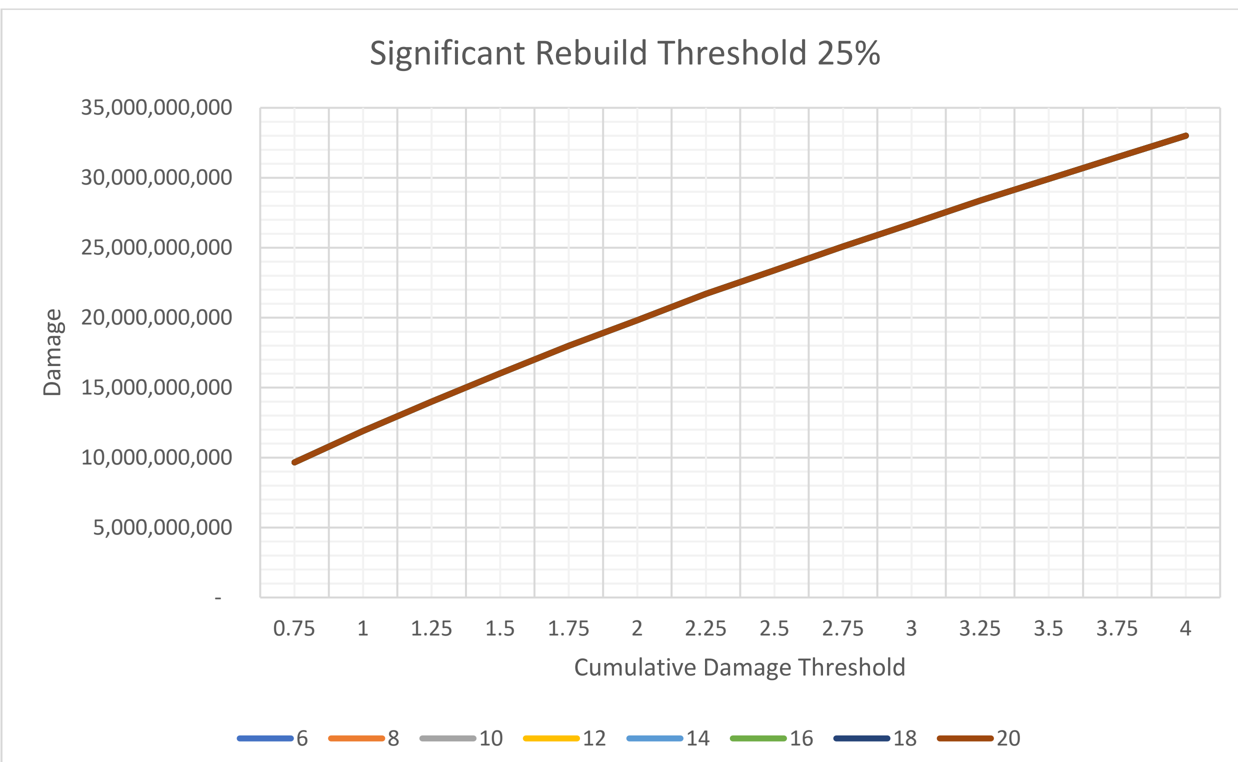


Figure E-22: Multivariate Sensitivity Testing – 25% Rebuild Threshold

There are many important takeaways from these sets of graphs. The first is that the selection of these thresholds is important. At the low end, PV damages are below $10 billion, while at the high end, they are almost $35 billion.

The next takeaway is that, in some cases, some thresholds dominate others. When the significant rebuild threshold is above 20%, the number of rebuilds assigned doesn't matter, and when the significant rebuild threshold is 5% and the number of rebuilds is low, the cumulative damage threshold doesn't matter. These outcomes can be explained by the fact that, broadly, structures in the inventory don't take large amounts of damage in individual events. One reason for this is the hydrologic environment: while east-coast environments have hurricanes that can cause very high water levels, in the study area the flooding events are caused primarily by SLC (note that the difference in water levels between the 1-year and 1% annual exceedance probability (AEP) event is only 2 feet).

Additionally, the structures in the structure inventory that drive damage are assets that have relatively flat depth-percent damage curves. For instance, the NACCS 4B curve, used for urban high-rises, maxes out at 16.5% damage, meaning that, with a rebuild threshold of 20%, assets with that designation will never reach that threshold. Therefore, with that rebuild threshold, only the cumulative damage function will affect whether those assets are "removed" from the inventory. Understanding how the thresholds interact and under what circumstances they cap damage is necessary for correctly assigning them.

When rebuilds are capped at a low number, what constitutes a rebuild becomes more important. If a rebuild is defined as a damaging event of 5% or more, the cumulative damage threshold matters very little: structures will usually be "removed" by hitting their rebuild limit. As the definition of a rebuild changes, the cumulative damage threshold becomes relevant. Defining a rebuild as 25% damage or more leads to only a handful of structures being "removed" based on hitting the rebuild limit, even when that limit is six. (And even with these removals, some are caught first by the cumulative damage threshold; it depends where that parameter is set.) Figure E-23 shows these interactions. As opposed to Figure E-16 through Figure E-22, number of rebuilds is static while the cumulative damage threshold (x-axis) and the significant rebuild threshold (the lines) are allowed to vary.

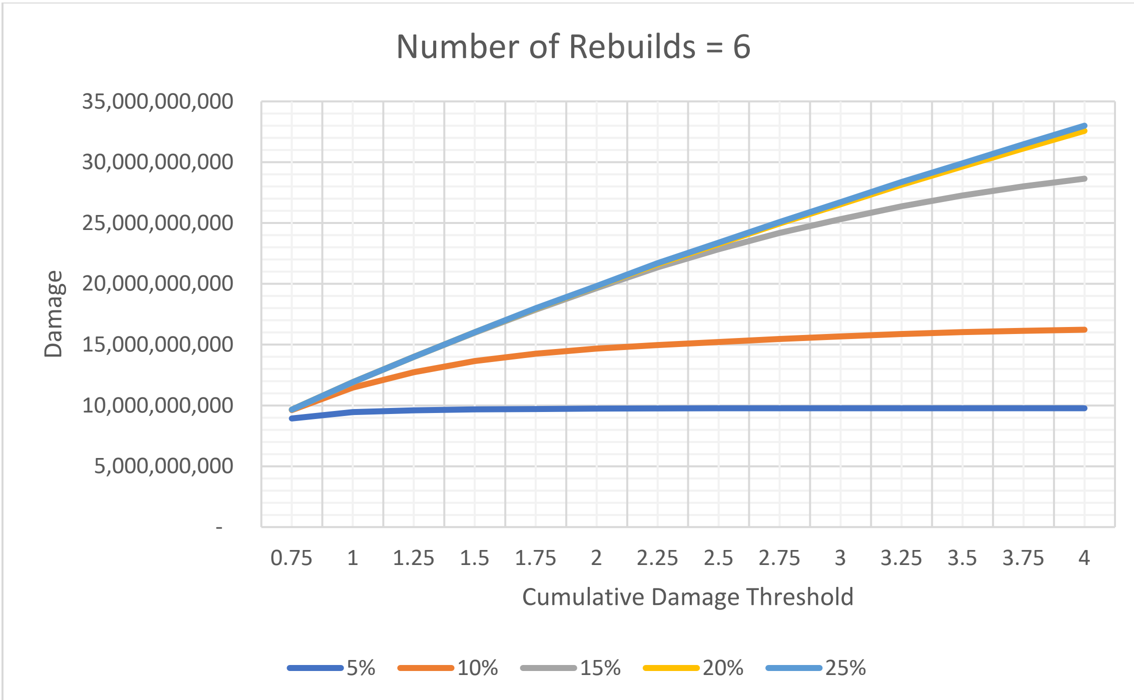


Figure E-23: Multivariate Testing of Rebuild Thresholds, Rebuilds = 6

Alternatively, when rebuilds are set to a high number (see Figure E-24), the cumulative damage threshold becomes more important. In some cases, the rebuild limit *can't* be exceeded before the cumulative damage threshold is exceeded (e.g., if each rebuild is 20% of an asset's value and the cumulative damage threshold is 2, then a maximum of 10 rebuilds can occur before the cumulative damage threshold is reached).

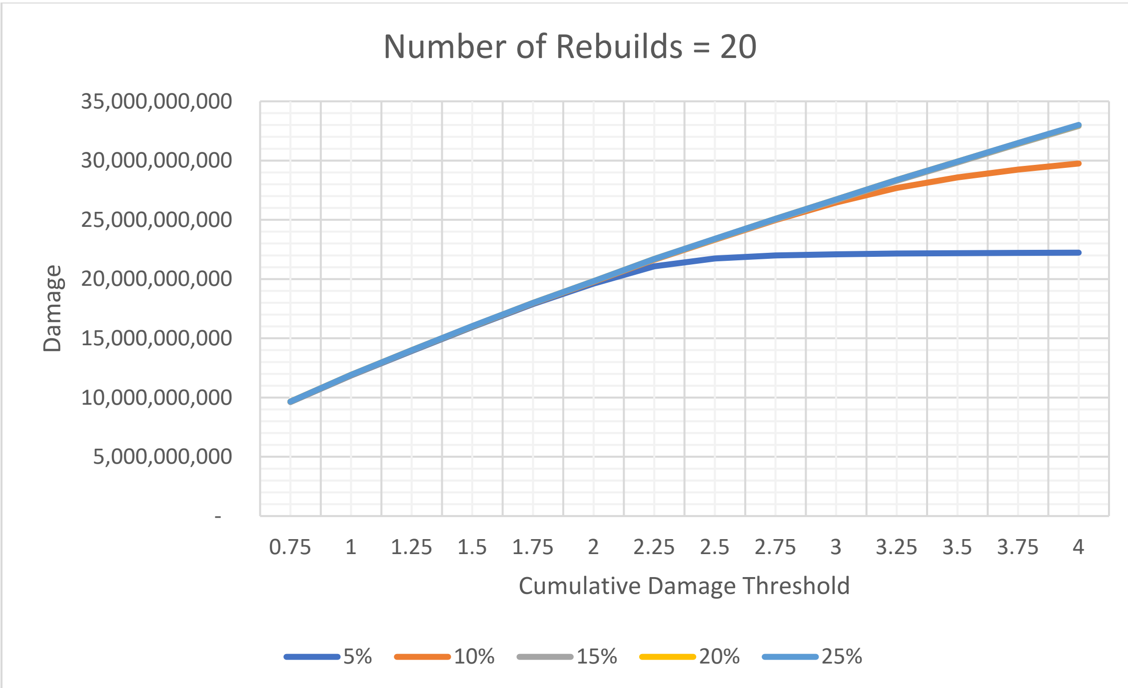


Figure E-24: Multivariate Testing of Rebuild Thresholds, Rebuilds = 20

Figure E-23 and Figure E-24 present results from the multivariate testing and show total damage to the whole inventory as the thresholds change. Alternatively, looking at how damage occurs to one asset over the course of the study timeframe can also be useful. Figure E-25 shows one asset, PEC.200052, whose damageable value is $45 million. In this relaxed test, damage is capped at eight times structure value, a rebuild is classified as 5% damage, and rebuilds are capped at 20. Between 2024 and 2080, the asset takes damage 53 times but never once over 11% of its structure value. Starting in 2051, it takes damage almost every year and frequently takes damage multiple times a year. It takes damage until 2080, when it hits the 20 rebuild limit.

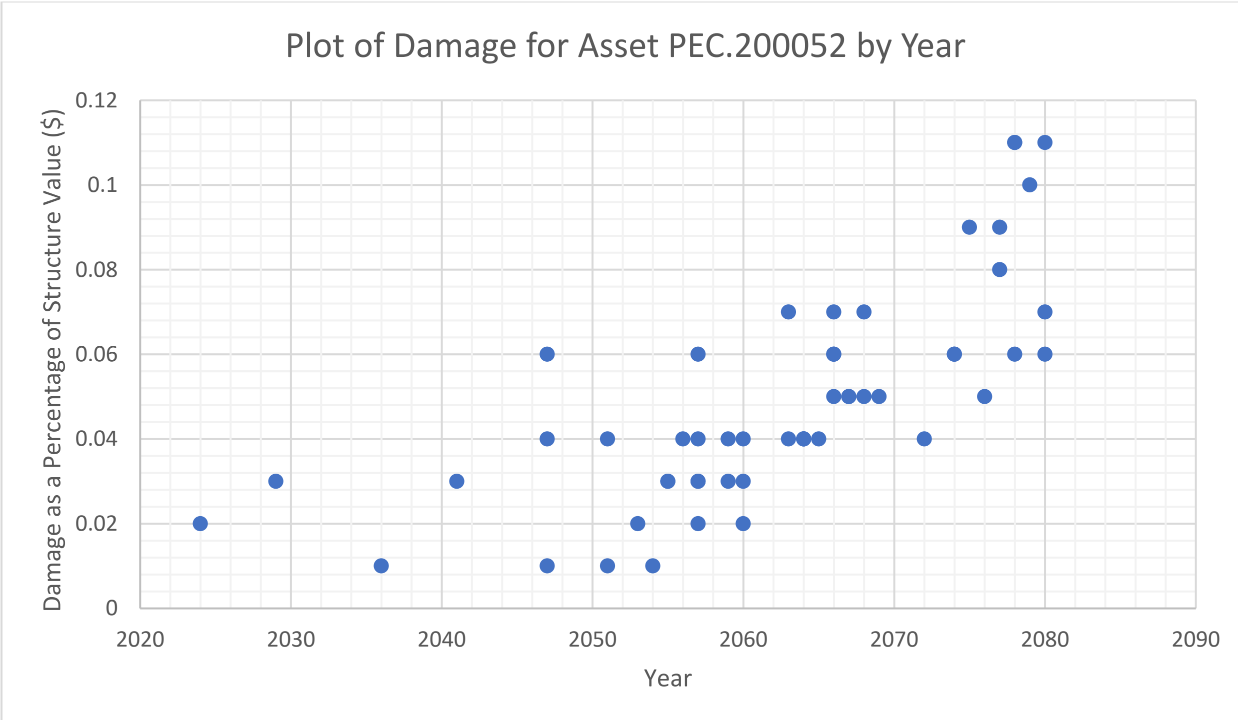


Figure E-25: Damage from One Iteration for One Asset with Relaxed Rebuild Assumptions

This follows from the assumptions baked into the storm suite and the depth-percent damage curve assigned. This asset is classified as F-RES3F-RES3F-NSV-MR-U and it uses the aforementioned NACCS 4B depth-percent damage curve. It requires more than 1 foot of water to be above its FFE for it to take more than 5% damage. Initially, the asset can take small amounts of damage from rare events (the damaging event in 2024 is a 50-year storm) but, as SLC occurs, it begins taking small amounts of damage from more and more frequent events. Rare events will still cause more damage but SLC turns rare events into common events quickly under the High RSLC curve. This particular iteration did not contain a 100-year storm event, but even with 100-year storms the story would be very similar.

When the significant rebuild threshold is set to 5%, in this iteration there are 10 rebuilds by 2074. Of note is that there are 32 damaging events that occur to this asset before it reaches 10 rebuilds, meaning that these damages can only be controlled using the significant rebuild threshold (and, to a lesser extent, the cumulative damage threshold). By the time the second rebuild occurs in this scenario, the asset has taken damage 30 times. The asset cumulatively takes 100% of its structure value in damage by 2057 (coincidentally, at the same time as its second rebuild) and 200% its structure value by 2078 (having taken damage 47 times).

The example above shows the occurrence of frequent damage below some potential significant rebuild thresholds. On average, structures that are “removed” from the inventory with proposed naïve settings (5% rebuild, 10 rebuilds, 2x cumulative damage threshold) take damage 19 times before “removal.” That implies an average of nine damaging events per asset below the 5% rebuild threshold, with most of them occurring before rebuilds begin. Dropping the significant damage threshold to 3% or 4% changes the average number of damaging events to 15 and 17, respectively.

The cumulative damage threshold in this model has been shown to not be a large factor. Of interest, though, is the number of rebuilds. One way to judge what this should be set to is the time lag between damaging events. For most of the structures in the inventory, the time between the first rebuild and the removal from the inventory is between 11 and 20 years. Note that this is not the time between the first damaging event and the removal: as shown, damaging events under 5% of the total structure damage often occur before the first rebuild happens.

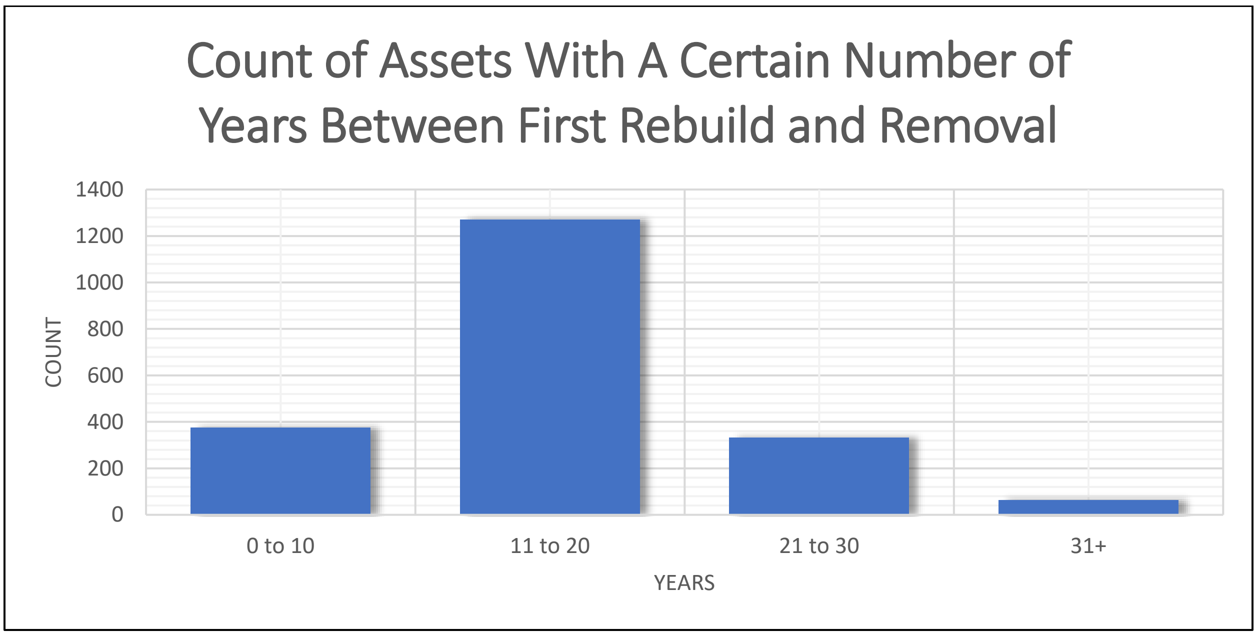


Figure E-26: Time Lag Between First Rebuild and Removal

Alternatively, we can look at the time between the final rebuild (penultimate damaging event over 5%) and the “removal” from the inventory in the final damaging event. For most structures, that time is 1 year or both events occur in the same year.

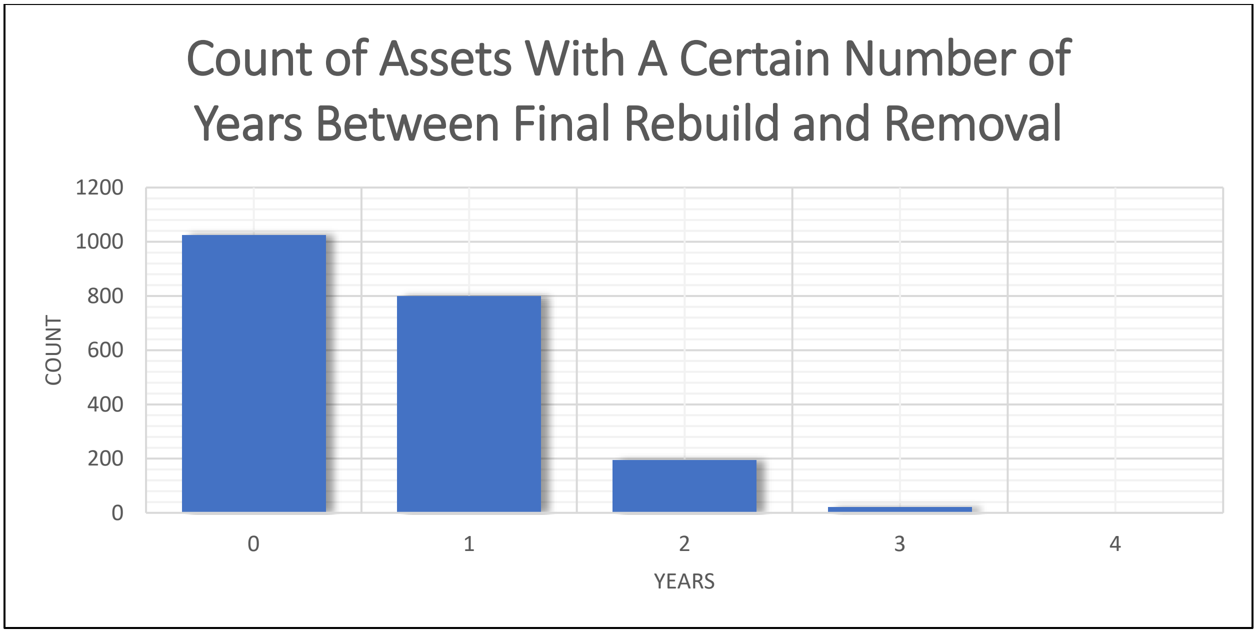


Figure E-27: Time Lag Between Final Rebuild and Removal

One potential concern when deciding upon a number of rebuilds threshold is that past rebuilds may not impact a homeowner's current decision to rebuild again if previous rebuild actions happened distantly in the past. Figure E-26 and Figure E-27 together tell a story that, for most of the assets in the inventory, this is not the case. Ten rebuilds typically happen within 10 to 20 years of each other and the final rebuild is usually within 1 year of the "removal" from the inventory. Again, this doesn't consider damaging events that are not counted as rebuilds (average of nine additional damaging events per structure). Asset PEC.200052, shown in Figure E-25, has an above average span of time between first rebuild and removal (27 years), but it is constantly damaged before and during that time with sub-5% events.

One last way to visualize the thresholds is how they impact removals over time and space. Figure E-28 shows the spread of asset removals over one iteration during the period of analysis. First, low-lying assets along Mission and Islais Creeks are removed. With additional SLC, more assets in Reaches 3 and 4 are removed, while assets in the Embarcadero also start being removed. As most assets in the study area are built at grade, the path of removals tracks closely to the topography of the study area; a banded topographic map is also provided for comparison.

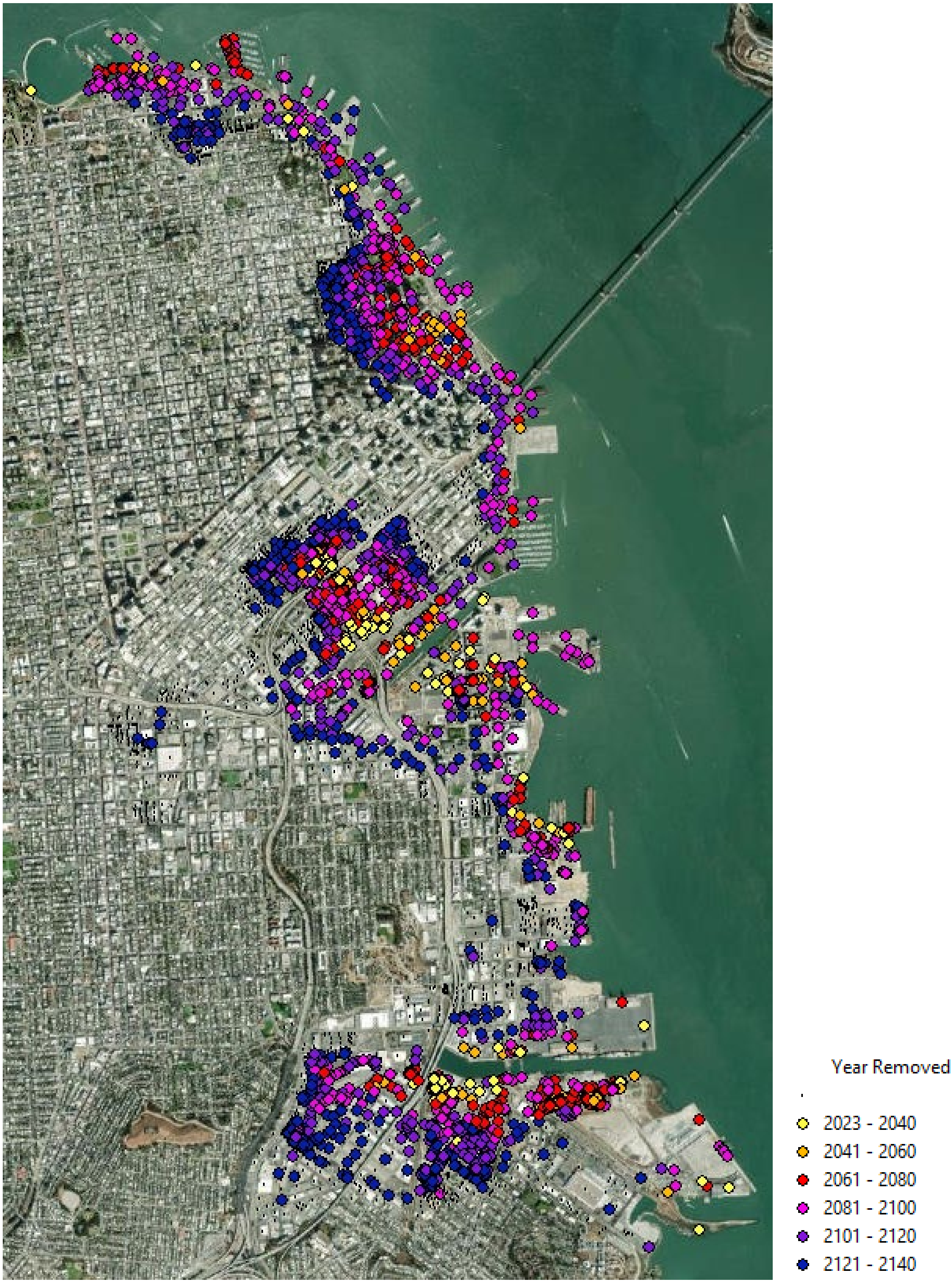


Figure E-28: Year of Removal for Assets, High SLC Curve

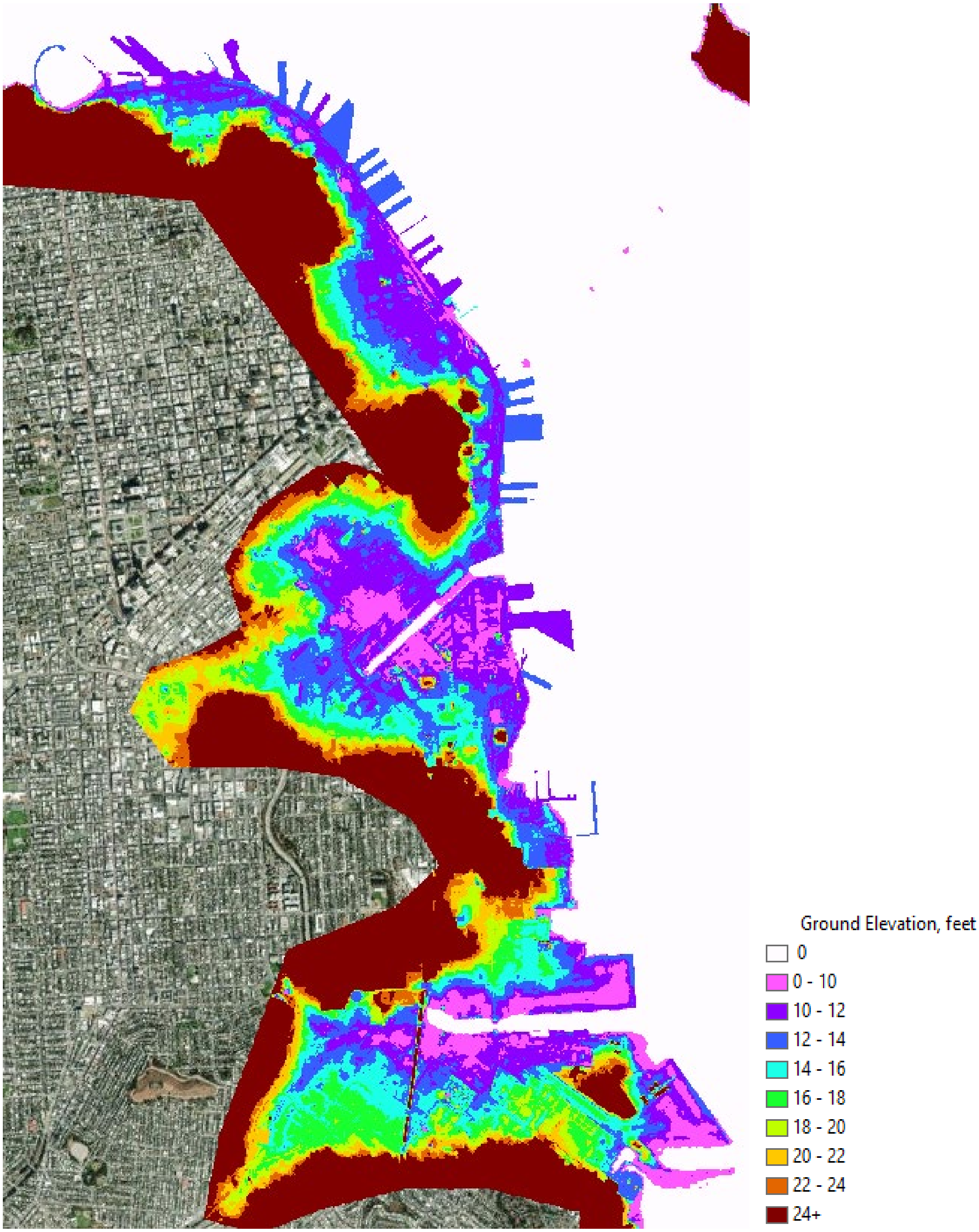
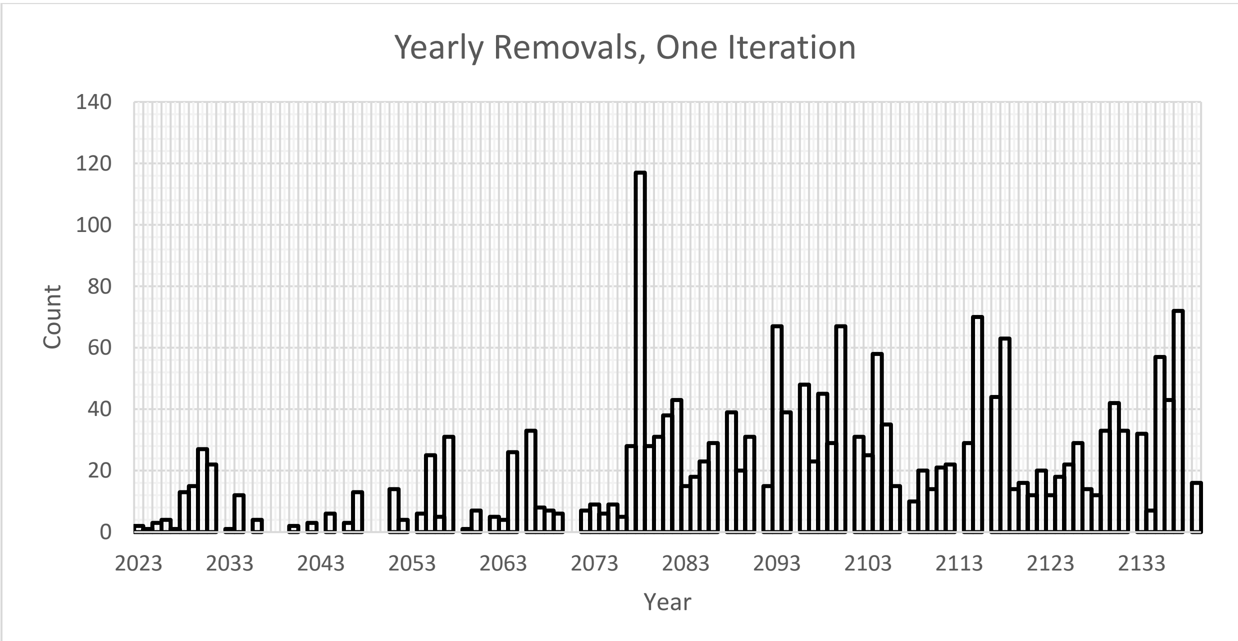
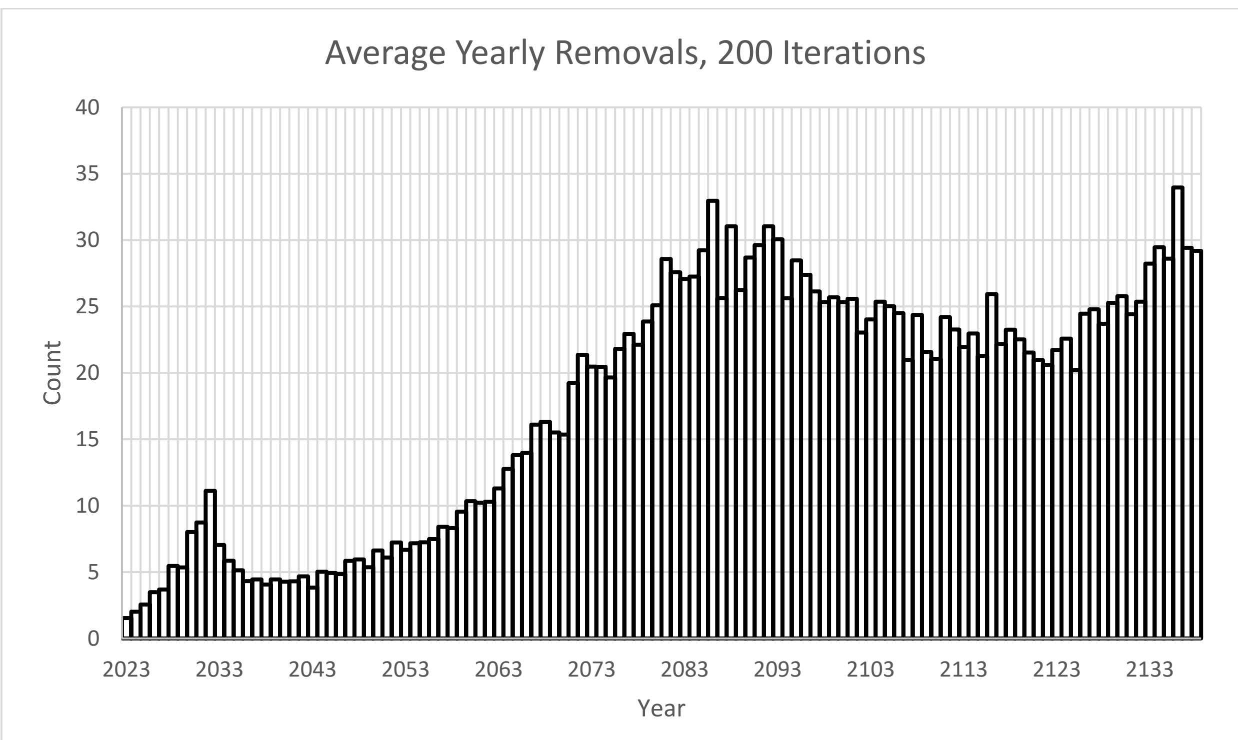


Figure E-29: Bare-Earth DEM Showing Ground Elevation

The following three line charts (Figure E-30) show the average removals over the period of analysis. The first shows yearly removals over one iteration, while the second shows average yearly removals over 200 iterations. The final chart shows the cumulative removals over time.





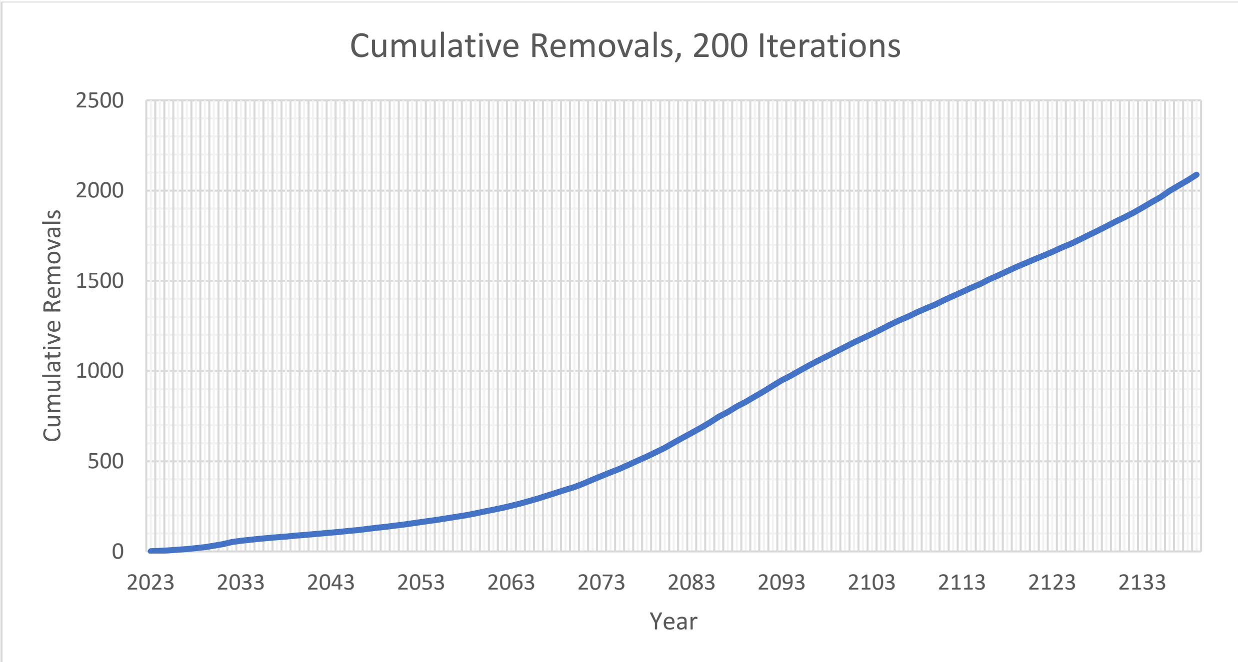


Figure E-30: Visualizing Removals Over Time, High SLC Curve

Any damages that are reported from a model are undergirded by the assumptions used to generate those results. With G2CRM, one major assumption is how asset owners will react to low-damage, high-frequency events. The model must represent the most likely FWOP scenario; as such, it should be defensible and consistent with plan formulation. The above discussion documents not only how these nuanced decisions radically affect total damages, but also the challenges of modeling damage to an asset inventory in the face of High RSLC over 117 years.

Additional testing was done to refine the selection of the significant rebuild threshold. Figure E-31 shows damaging events by time for PEC.000401, an F-COM4-COM4-NSV-MR-U asset. The set of gray, orange, and blue dots together show the damaging events before the asset is removed when the significant rebuild threshold is set to 4%, while the orange and gray dots together show the damaging events when the significant rebuild threshold is set to 3% and the gray dots alone show when the threshold is set to 2%.

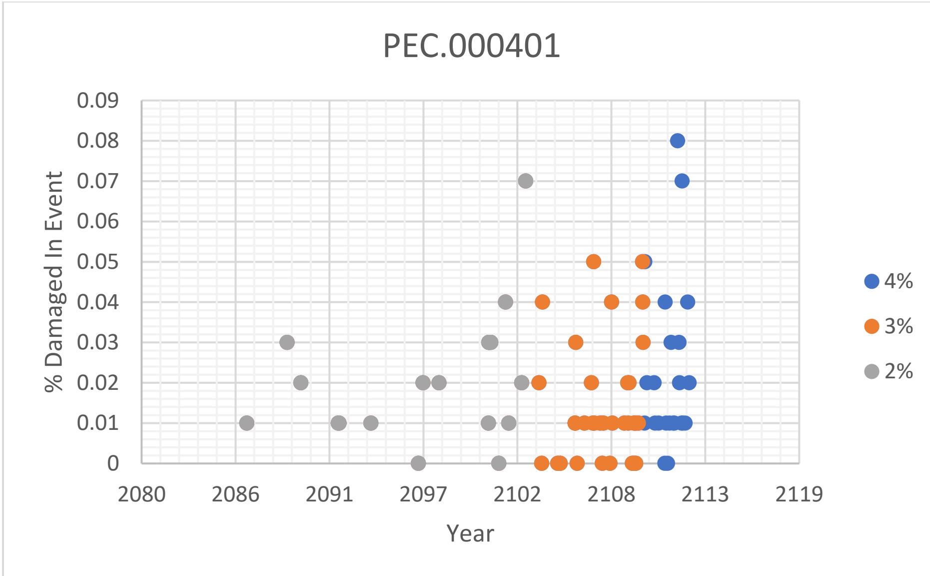


Figure E-31: Damaging Events for PEC.000401 Based on Significant Damage Threshold

Reducing the significant damage threshold to 3% removes 21 damaging events, all which would take place over 3 years. Reducing it to 2% removes another 34 events. The high number of damaging events is because the depth-percent damage curve for this type of asset is very shallow (for instance, the most likely damage when the asset is flooded to 1 foot above FFE is 4.5%). Still, a 2% loss for this asset ends up being $700,000 (in future value); incurring numerous of those losses while assuming no action might not be correct.

For other types of assets, the reduction makes a smaller difference (Figure E-32):

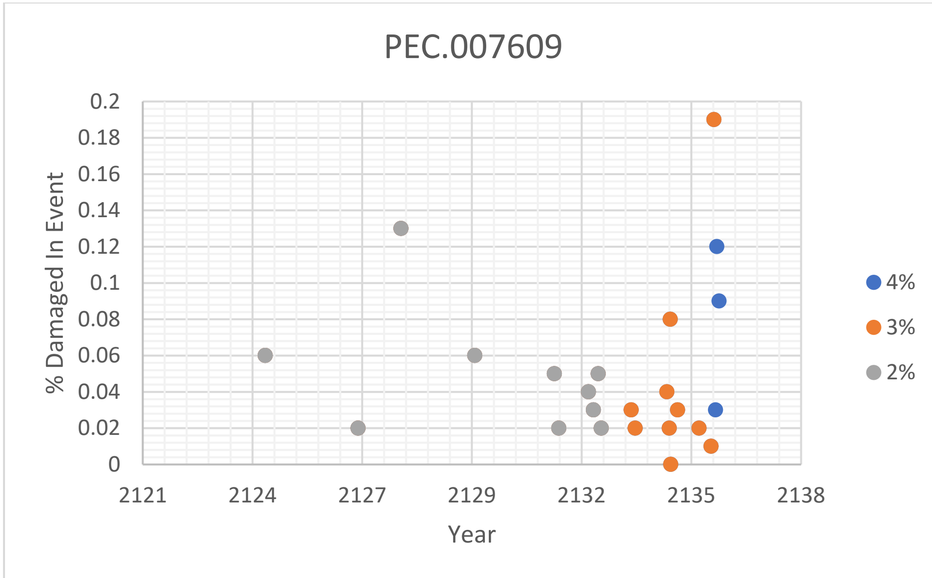
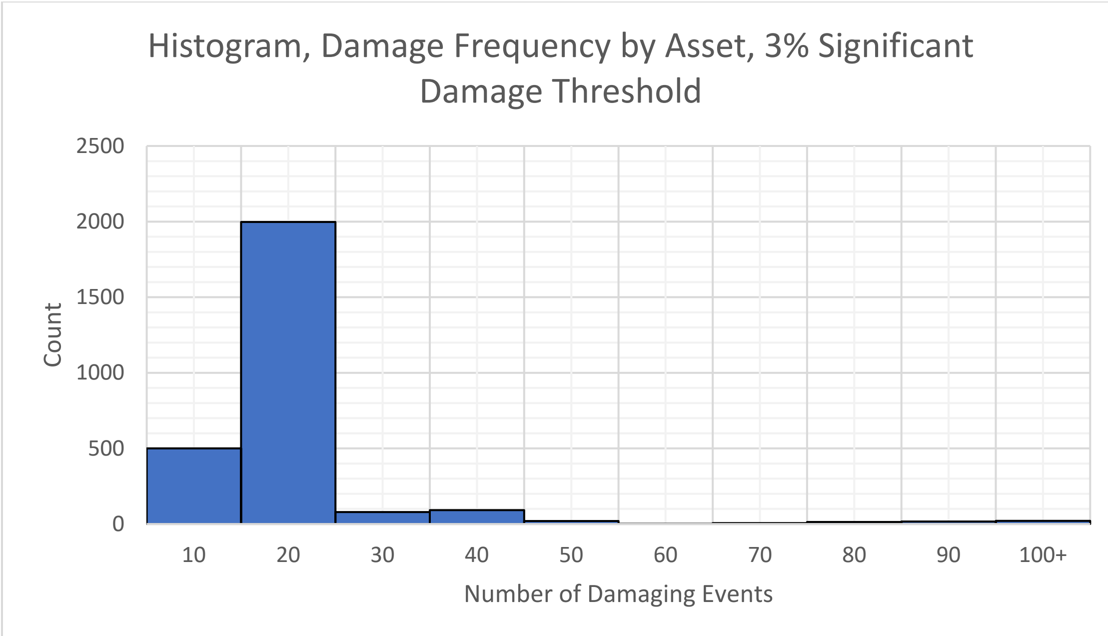


Figure E-32: Damaging Events for PEC.007609 Based on Significant Damage Threshold

This asset type (F-COM1-COM1-NSV-LR-U) has a steeper depth-percent damage curve and therefore has fewer sub-4% damaging events. As such, reducing the significant damage threshold from 4% to 3% only removes three damaging events. For both 4% and 3%, though, there are still 15 damaging events between 2132 and 2135 (2135 being the final year for 3% and the penultimate year for 4%). Moving it down to 2% removes 10 more events, though there are still 6 damaging events in its final 2 years.

Another way to cap repetitive damages would be to lower the number of rebuilds (currently set at 10). This isn't recommended, as early in the study period, this may miss realistic damages (when damages occur spaced out temporally) and later may not effectively cap repetitive damages (when SLC can make there be frequent low-damage events). Using the significant damage threshold to cap these damages avoids these issues.

Figure E-33 shows the histograms for damage frequency by asset when the significant damage threshold is set to 3% and 2%.



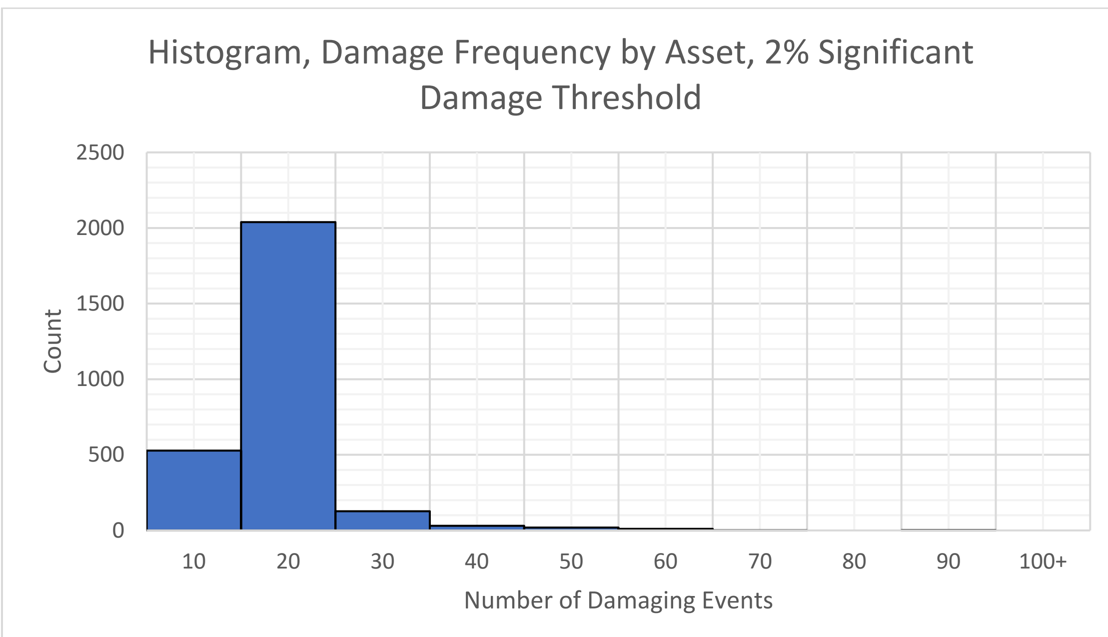


Figure E-33: Histograms Showing Damaging Events by Significant Damage Threshold

The tails, which show assets taking damage more than 20 times, have many fewer assets in them when the threshold is reduced. Assets like PEC.000401, shown in Figure E-31, are outliers (as discussed, because of the shape of their depth-percent damage curves), while more assets resemble PEC.007609. Reducing the significant damage threshold to 3% from 4% moves preliminary NED losses from $14.001 billion to $12.583 billion. Lowering it to 2% drops losses to $11.326 billion.

What is deemed the “correct” significant damage threshold depends on one’s definition of “significant”; if low-level flooding will not impact people’s behavior, then these events are rightly not counted as rebuilds within G2. As such, the PDT has selected a significant damage threshold of 3%.

SFMTA, BART, and the Chase Center do not use the floodproofing costs or the dynamic inventory thresholds discussed above. For them, the cumulative damage threshold was set at 50%. These thresholds line up with evidence provided by SFMTA and BART that show that, after a single high-damage event, there would likely be protective measures put in place. The costs for protective measures for Embarcadero Station were also provided by SFMTA and BART. The costs are $8 million for SFMTA and $2 million for BART, with a $315,000 deployment cost. The Chase Center’s floodproofing cost is a one-time, $5 million cost. There is ongoing analysis for these assets regarding damages that occur after floodproofing, but these damages are not included in the G2CRM results discussed in Section 5 (though under the High SLC curve, access to the Chase Center may be impacted; this is discussed in Section 6). These settings all exist in order to minimize unreasonable repetitive damages.

When a structure exceeds one of the dynamic inventory thresholds, it is assumed to be floodproofed. These floodproofing costs are discussed in Section 5.1.1.

4.5 Run Conditions

The G2CRM life-cycle model requires various assumptions to be made that affect the model runs. Those assumptions have been documented in Table E-49. For a discussion of the Sea Level Change assumptions see *Appendix J: Climate*. Discussion of individual fields continues below.

Table E-49: Run Conditions

Field Name	Input	Explanation
Iterations	100	Model achieves convergence before 100 iterations
Duration (Years)	117	100-year project duration plus the 17 years between the present year and the base year
Random Seed	5550121	Should not matter, but has been kept constant to compare short runs results to each other
Start Month	1	Selected by PDT
Base Month	1	Selected by PDT
Interest Rate	.025	Determined by EGM 23-01 (USACE 2023) (will be updated to 2.75% for the next draft of this report)
SLC Basis Year	1992	See *Appendix B: Engineering*
SLC Basis Month	1	See *Appendix B: Engineering*

Field Name	Input	Explanation
SLC Rate	-	All three sea level curves were tested within the model, following guidance in ER 1100-2-8162 (USACE 2013); See *Appendix B: Engineering*
Low/Intermediate/High SLC	-	All three sea level curves were tested within the model, following guidance in ER 1100-2-8162 (USACE 2013)
Start Year	2023	Selected by PDT as most appropriate start year
Base Year	2040	Selected by PDT as most appropriate base year
Calculate Depreciation	No	San Francisco structures are likely to be maintained (though depreciation is used to calculate depreciated replacement values; see Section 2)
Raise Structures	No	Assets not assumed to be raised. Dynamic inventory toggles are used to mitigate repetitive damage
Calculate Assets	Yes	Must use assets to calculate damage
Use Benefits Base	Yes	All assets are in the benefit base
Cumulative Damage Removal	Yes	Cumulative damage removal works to mitigate repetitive damage
Calculate Life Loss	No	Life loss has not been calculated at this stage of the project (see Section 4.3)

100 iterations were deemed sufficient upon looking at the rolling average of PV damages from iteration to iteration. After 100 iterations, the average iteration difference was just over 0%. Because much of the damage in the G2CRM model is deterministic (i.e., it’s driven by SLC, not by the series of storms that occurs), the mean total PV damage converges rather quickly. Best practice recommends at least a hundred iterations, as additional iterations still help describe the distribution of the results around the mean, but more than a hundred—which may be necessary when damages are driven by rare, extreme events—was deemed to be unnecessary. The rolling PV damage average is shown on Figure E-34.

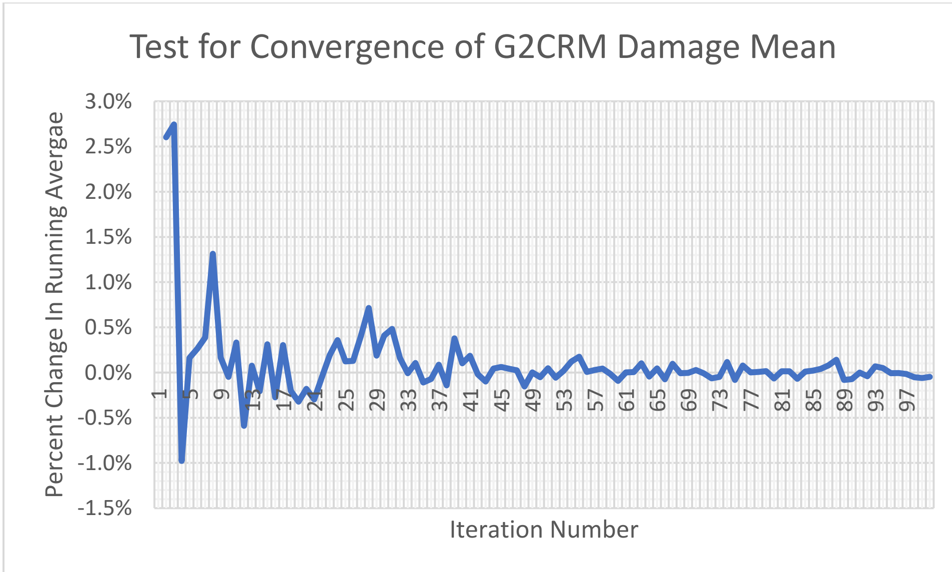


Figure E-34: Rolling Average of Present Value Damages by Iteration

Depreciation was not selected in the run conditions, meaning that the structures within the model do not lose value over time from anything other than storm events. This decision was made because of the unique nature of the study area. Instead of assuming depreciation, a more reasonable assumption is that there will be upkeep of existing structures, since many of the structures are high-value residential and commercial structures, historical older structures, and critical San Francisco infrastructure.

FWP condition damages were calculated over a 100-year period of analysis with an FY2023 Project Evaluation and Formulation Rate (Discount Rate) of 2.5%. This discount rate will be updated to the FY2024 discount rate in the next draft of this report.

5. Non-G2CRM Benefit Categories

FWOP condition damages are used as the base condition and potential project alternatives are measured against this base to evaluate project effectiveness and cost efficiency. Over the course of the period of analysis, though, there will be costs incurred that go beyond the damages calculated within G2CRM. Some of these additional damages are retreat costs that are not tied to individual structures, while other categories of damages come from system effects that have many interdependencies that cannot be modeled properly in G2CRM. The different categories of impacts not modeled within G2CRM include:

- Losses stemming from retreat from the floodplain (cost of floodproofing, condemnation costs, and land loss)
- Existing operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) costs for the existing coastal defense infrastructure (this category also includes potential losses from seismic events to that infrastructure)
- Situations where SLC may require large amounts of capital investment to maintain the service of major interconnected city services (San Francisco Public Utilities Commission (SFPUC), SFMTA)
- Losses in the other non-NED benefit categories (RED, Other Social Effects [OSE], and Environmental Quality [EQ])

Unique methodologies have been developed to quantify FWOP damages across these various benefit categories and determine FWP benefits. A discussion of each of these categories and the techniques that were used to quantify benefits follows.

5.1 Cost of Retreat

As SLC occurs, areas that currently have minimal or no coastal storm risk will be exposed to more frequent flooding. When an area is subject to repetitive flooding, it is assumed that there will be changes to the behavior of individual stakeholders that creates a reduction in risk or damage. These assumptions are necessary to ensure that indefensible repetitive damages are not captured, much in the way the rebuild thresholds are used to cap repetitive inundation damages (see Section 4.4). There are many different retreat costs that are captured within this analysis.

For reference, Figure E-35 shows the 1% AEP floodplains under the High RSLC curve. The red polygon is the 2065 floodplain, the yellow 2090, the green 2115, and the blue 2140.

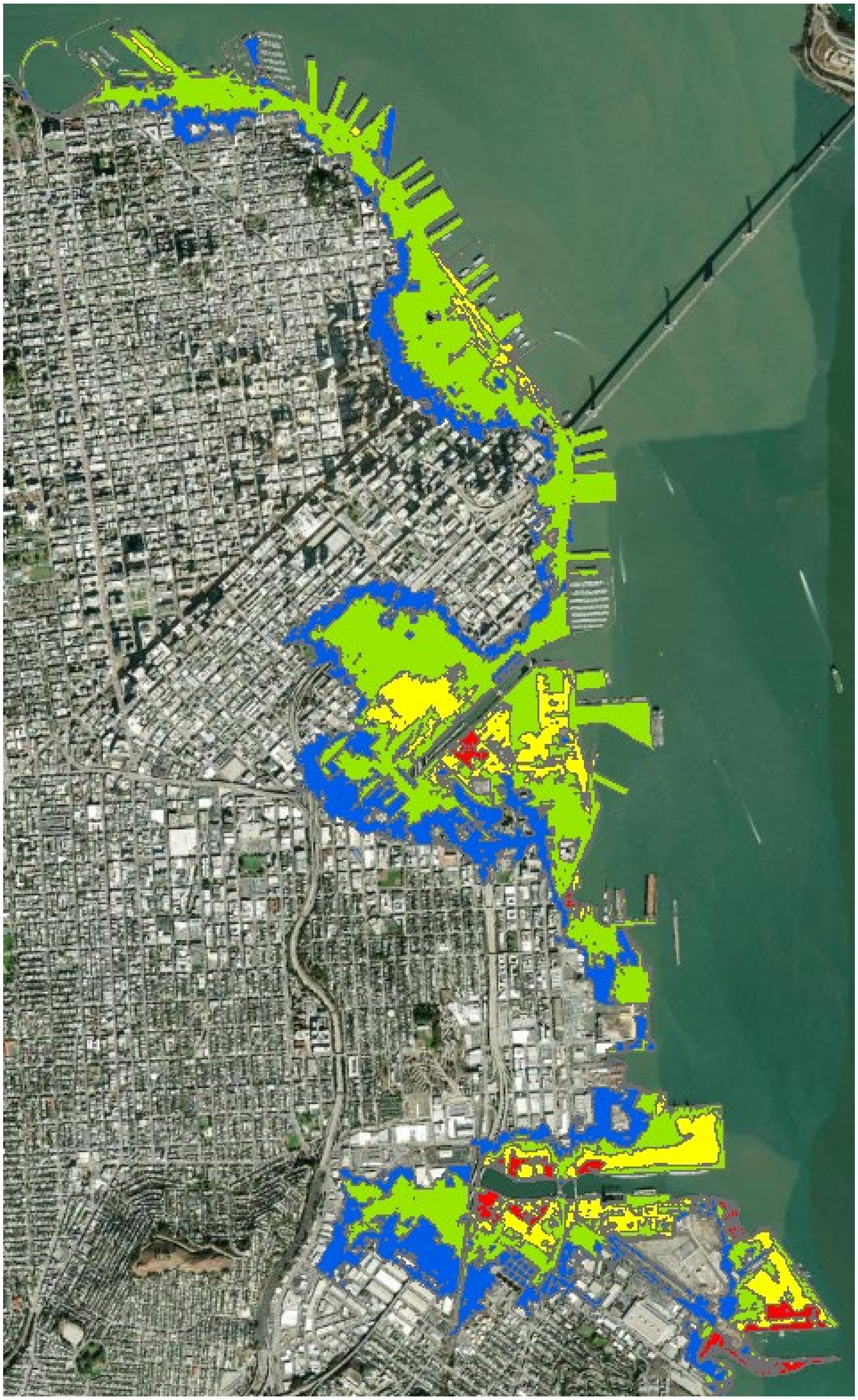


Figure E-35: High RSLC 1% AEP Floodplains Over Time

The assumptions surrounding FWOP retreat are as follows. Within G2CRM, structures take damage until they reach either their number of rebuilds threshold or their cumulative damage threshold (meaning the asset can no longer take damage within the model). When this occurs, the asset is assumed to be floodproofed, which implies that it can no longer take physical damage. The cost of the floodproofing is the first non-G2CRM cost (i.e., it is calculated outside of the model). After that, the structure is assumed to be functional until SLC forces it into the 1-month floodplain. At that point, the asset is assumed to be no longer useable, and its structure value is considered a full loss (the second non-G2CRM cost). Additionally, any land which becomes exposed to the 1-month flood elevation is assumed to go from its current value to zero (the final non-G2CRM retreat cost). A discussion of each of these costs is below, along with a discussion of how the costs were derived and calculated.

5.1.1 Floodproofing Costs

As mentioned, when a physical asset reaches one of the asset removal thresholds in G2CRM, that asset is assumed to be floodproofed. As this floodproofing could be made unnecessary in a FWP condition, preventing that floodproofing qualifies as a local cost foregone and an NED benefit. To calculate the expected cost of the floodproofing, the G2CRM results were used to determine when, on average, each asset was removed from the inventory. The per-asset floodproofing cost, derived from a dollar-per-square-foot cost provided by cost engineering multiplied by the footprint of the asset, was then discounted to the base year. Finally, it was weighted by the probability that the asset was removed from the inventory, since not all of the assets were removed in each iteration.

The formula for calculating the per-unit floodproofing cost is below:

$$
\begin{aligned}
&Floodproofing\ Cost \\
&\qquad = P(Asset\ Reaches\ Removal\ Threshold) * \overline{Year\ Removed} \\
&\qquad * Dollar\ Per\ Square\ Foot * Footprint\ in\ Square\ Feet
\end{aligned}
$$

The dollar-per-square-foot measure was determined by USACE Cost Engineers. On a per-measure basis, the unit costs were:

- Ring Wall: $23 per square foot
- Dry Floodproofing: $21 per square foot
- Wet Floodproofing: $202 per square foot

Using the costs above and considering the composition of assets that were to be given nonstructural treatment in the FWOP, a composite dollar-per-square-foot unit cost of $45 was created for use in this analysis.

Table E-50 shows the number of assets expected to require floodproofing based on the average year removed of the asset.

Table E-50: Number of Assets Floodproofed by SLC Curve by Decade

Decade	High SLC	Int. SLC	Low SLC
2040s	18	7	5
2050s	97	4	2
2060s	239	14	6
2070s	252	7	8
2080s	253	29	9
2090s	248	80	4
2100s	209	74	24
2110s	233	173	73
2120s	284	211	133
2130s	576	274	101
Total	**2,409**	**873**	**365**

As this number includes assets that are probabilistically floodproofed (instead of just the assets that are removed every iteration), the numbers represent the maximum numbers of assets that may need floodproofing. Under the High SLC curve, all assets with a floodproofing year before 2130 are deterministically floodproofed, since the last 10 years of SLC ensure that the damages to those vulnerable assets occur in each iteration. For the Low SLC curve, though, there is much more uncertainty in whether any particular asset will require floodproofing; as such, fewer of the assets are deterministically floodproofed (i.e., the floodproofing action is determined based on which storms are selected from the storm suite and is not as driven by SLC). Figure E-36 show this dynamic for the Low and High SLC curves.

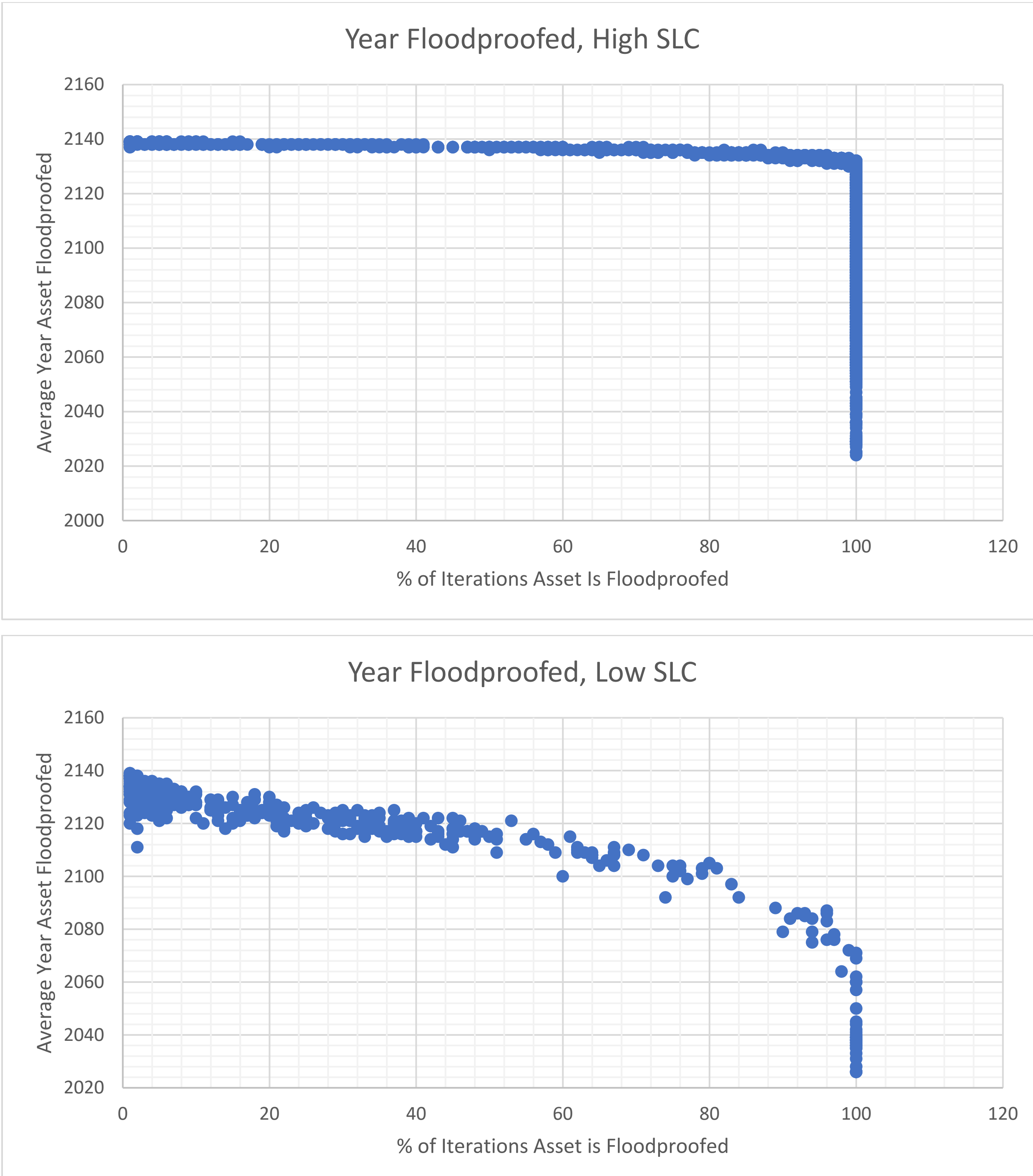


Figure E-36: Probability Assets are Floodproofed Under Low and High SLC Curves

G2CRM provides the information above in that the year the asset is assumed to be floodproofed is the same year that it exceeds one of the rebuild thresholds within the model. The probability that an asset is floodproofed is equal to the number of iterations it is removed from the inventory over the total number of iterations, and the average removal year is the average of the years the asset is removed in iterations where the asset exceeds a rebuild threshold.

The last piece of information needed to compute the floodproofing costs in the FWOP is the square footage of the asset. A discussion of this can be found in Section 2 while the FWOP results from this analysis can be found in Section 6.2.1.

5.1.2 Asset Removal (Condemnation)

The second piece of retreat is the removal of highly vulnerable assets. Assets first stop taking damage once they pass one of the G2CRM removal thresholds; at this point, they are assumed to be floodproofed. Though this stops the asset from taking physical damage, concerns over frequent, repetitive flooding and its impact on access to the structure still exist. As such, once an asset becomes vulnerable to the 1-month flood event, it is assumed to be condemned. Note that, even when the condemnation occurs, the asset is still not expected to take damage; when an asset becomes vulnerable to the 1-month event, the water elevation in the 1% AEP event will still be well below the failure point for the nonstructural measures. Regardless, impacts to access caused by high-frequency tidal flooding are such that the building is assumed to no longer be useable.

To determine when these assets would be removed, the stillwater elevation at the 1-month event for the four reaches for each RSLC curve was calculated for each year in the study timeframe (2023 to 2140). This was compared to each asset's ground elevation (not its FFE). The year where the water elevation was higher than the ground elevation was considered the condemnation year. The counts for these removals are shown in Table E-51.

Table E-51: Number of Assets Removed by SLC Curve by Decade

Decade	High SLC	Int. SLC	Low SLC
2040s	16	6	0
2050s	11	0	1
2060s	21	4	0
2070s	61	2	0
2080s	354	4	6
2090s	391	14	0
2100s	270	6	0
2110s	238	8	0
2120s	271	12	0

2130s	267	8	2
Total	**1,900**	**64**	**9**

Note that this analysis uses the stillwater elevation, which does not include waves. This is a conservative assumption, and including waves moves up the time of asset removal and adds in additional assets for removal.

The assumption about what floodplain will trigger removals is one that is not based on empirical data. It is not, however, an assumption that the results are sensitive to. Making it the 1-week instead of the 1-month floodplain, for example, does not have a large effect on the results. Assets are removed in large numbers only under the High SLC curve, and under that SLC regime, assets move very quickly from the 1-month to 1-week floodplain. This is both because those floodplains are close to each other in terms of water levels and because of the high rate of change under that curve.

The losses from asset removal are the full value of the structure, plus 10% for the physical demolition of the asset. The content value is not assumed to be lost when the asset is condemned.

This FWOP schema, whereby assets take damage, are floodproofed, and then are removed, follows with the assumptions that floodproofing will be done in an ad-hoc, responsive manner and that removals will only occur when it is no longer tenable for people to continue using the assets. The first step of floodproofing ensures that repetitive, indefensible damages are not counted (but that the cost of preventing those damages is captured in the FWOP), while the condemnation piece ensures that the model doesn't assume usability of structures that are permanently or semi-permanently inundated. Moreover, this correctly models the consequences of no coordinated action in a High SLC scenario: the incremental loss of the San Francisco waterfront.

5.1.3 Land Loss

The economic theory behind land loss as an NED category is laid out in ER 1105-2-100 *Planning Guidance Notebook* (USACE 2000). Though it is typically used for beachfront studies where erosion may result in physical land loss, in this study, “land loss” is assumed once the land cannot support structures due to the aforementioned concerns about high-frequency flooding. At this point, the land value is assumed to go to zero, as the land has been deintensified from a high-value urban use to a lower value use. This assumption was made in coordination with the USACE Real Estate team. The USACE Real Estate team also derived current land values for the land in the study area. Those land values can be seen in Table E-52. The PDT expects that these land values will continue to be refined before publication of the final report.

Table E-52: Land Loss Values by Location

Location Name	Land Value ($ per square foot)		Location Name	Land Value ($ per square foot)
Aquatic Park	151.62		Pier 80	39.53
Fisherman's Wharf	180.73		Islais Creek 1	136.06
Pier 31 to 35	83.24		Islais Creek 2	158.35
NE Waterfront	201.75		Islais Creek 3	84.93
Ferry Building	48.38		Islais Creek 4	94.56
South Beach	16.5		Islais Creek 5	54.43
Mission Creek	77.23		Islais Creek 6	40.37
Mission Rock	15.78		Cargo Way	113.03
Mission Bay	19.38		Herons Head	0.05
Pier 70	42.32			

An example of the land value polygons from Reach 1 are shown on Figure E-37. Though the polygons extend over water, only the land itself is captured in the analysis (this is done by cutting the land polygons using the 1-month floodplains, which only show inundated landward areas). Note that the land loss polygons run from the water line to the landward edge of the study area, implying no difference in land values closer to or farther away from the water's edge.

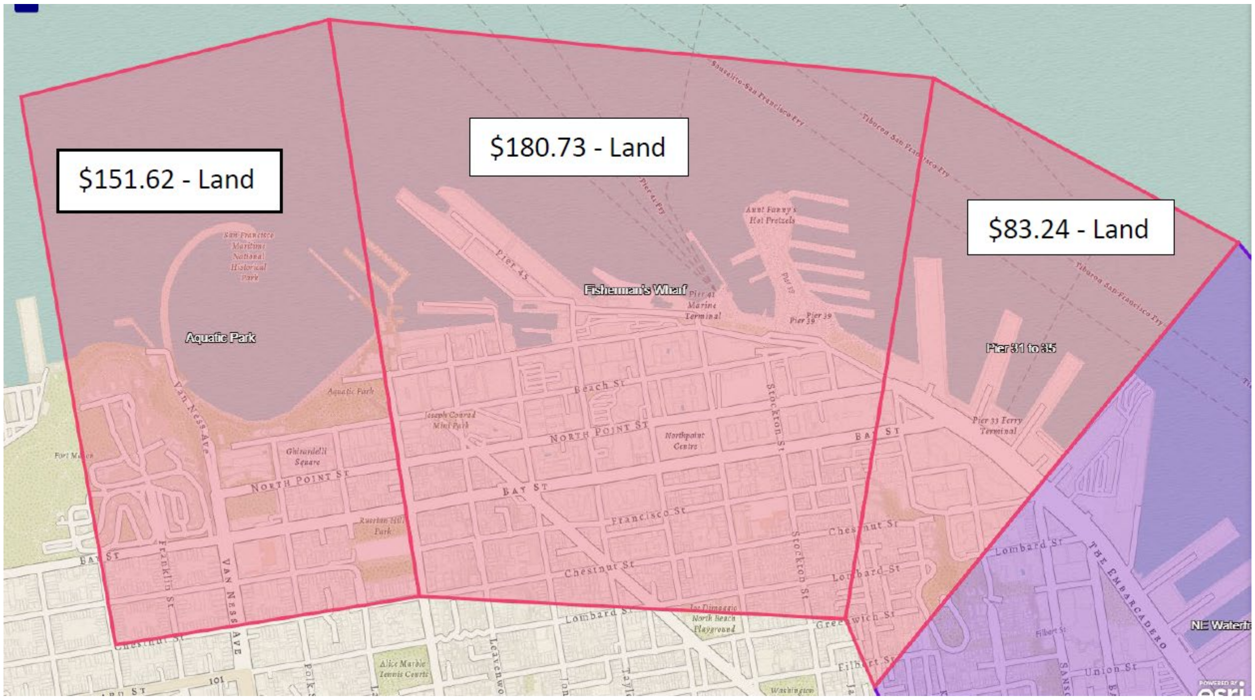


Figure E-37: Example of FWOP Land Values (Reach 1)

5.2 OMRR&R and Seismic

OMRR&R costs associated with all of the FWP alternatives are quantified and included in the evaluation of project benefits versus total project costs. Therefore, it is important to quantify the reasonably expected OMRR&R cost attributed to the existing coastal flood defenses for the FWOP condition as a comparative evaluation metric and offsetting benefit (local cost foregone).

5.2.1 Infrastructure Considered for OMRR&R Quantification

The San Francisco shoreline infrastructure is subdivided into several categories, but the OMRR&R quantification for the FWOP condition will focus on the shoreline infrastructure defined as coastal flood defenses, due to the distinct difference in OMRR&R expenditure for the FWOP and FWP conditions:

- Coastal Flood Defenses are defined as natural or engineered shoreline features that retain the landward extent of the city and resist erosion, wave runup and overtopping of the Bay into the built environment. Along the Embarcadero, the coastal flood defense is defined by a rock dike (approximately 100 feet wide and 30 feet tall), which retains the filled land and serves as the foundation for a concrete bulkhead wall and pile supported bulkhead wharves. In the Southern Waterfront, similar bulkhead walls and wharves serve as coastal flood defenses and maritime terminals at discrete locations. These wall and wharf segments of shoreline will be the focus of the OMRR&R quantification. The Southern

Waterfront coastal flood defenses also include engineered armored slopes, shoreline coastal wetlands, and naturally eroding slopes along the edge of historically reclaimed Baylands, but these are not considered primary drivers for the FWOP OMRR&R, and therefore, will not be specifically addressed herein.

- Piers are defined as the typically pile supported substructures that run perpendicular to the shoreline and create fingers into the Bay. The piers are accessed by crossing the bulkhead wharves and currently serve a mix of public serving, commercial and maritime uses. It is currently uncertain if the piers will be treated differently in the FWOP and FWP scenarios; therefore, the OMRR&R quantification does not currently account for the anticipated FWOP expenditure to maintain and operate the piers through the period of analysis.
- Bulkhead and Shed Buildings are defined as the buildings that sit atop the wharf and pier substructures. These buildings, many of which are historic resources, are a primary economic driver for the POSF since they provide leasable space. The OMRR&R for the buildings is conservatively not quantified since the purpose of the Study is coastal storm risk management, which may or may not offset the OMRR&R expenditure of the POSF for building structures along the shoreline. It is noted that many wharves support historic bulkhead buildings, making it impossible to replace or substantially alter the existing bulkhead wall and wharf without addressing the buildings.
- Maritime Infrastructure are defined as the structures and equipment that sustains the maritime industry at the POSF. This includes breakwaters that protect marinas, guide piles, gangways and floats that enable land-to-vessel access, and cranes that can be used to offload goods. It is uncertain how differently the FWOP and FWP conditions will be for this infrastructure; therefore, these elements are not quantified for the FWOP OMRR&R.
- Adjacent Infrastructure Systems are defined as the major city-serving infrastructure immediately adjacent to the shoreline including utilities (SFPUC combined sewer system, potable and fire water systems, electrical system, natural gas, telecommunications) and transit systems (SFMTA light rail network, bridges crossing Islais and Mission Creeks, waterfront roadways including the Embarcadero, bike lanes, and pedestrian promenades and walkways). The FWP is likely to impact these adjacent infrastructure systems, thereby impacting the OMRR&R expenditure over the period of analysis. However, quantifying the FWOP value of this expenditure is not included in this phase of the study, an economically conservative assumption that may be revisited post-Tentatively Selected Plan (TSP).

5.2.2 FWOP Factors Considered in OMRR&R Quantification

The FWOP condition related to the POSF's coastal flood defense structures will be driven by several factors. It is important to identify the assumptions made for each of these factors to understand the quantification of the expected OMRR&R expenditures. The following factors considered include:

- Economic and Business Case
- Coastal Flooding and Sea Level Rise (bulkhead buildings with substructures—already in G2CRM)
- Earthquakes
- Age and Condition of Existing Structures

5.2.2.1 Economic and Business Case

The POSF is an enterprise agency within CCSF, meaning that revenues generated through rent, maritime fees and other income streams are used to fully fund the POSF's annual budget (Operating and Capital). To remain functional as an enterprise agency, the POSF must consider economic viability as a key component of all decisions and actively pursue opportunities to grow its business and revenue streams. However, forecasting POSF growth for the FWOP condition would be highly speculative and inconsistent with the economic approach taken for the broader CCSF inventory. For the purpose of the OMRR&R quantification, it is assumed that the POSF will continue to utilize all maritime infrastructure to its maximum extent and that economic activity will remain consistent with the 2019 baseline established as part of the broader economics work. These values may be used to forecast the economic impacts related to some of the other OMRR&R drivers as described in subsequent sections.

5.2.2.2 Coastal Flooding and Sea Level Rise

As a coastal storm risk management study, the primary purpose of the study is to evaluate the benefit of a federal investment that will reduce the damages and disruption caused by coastal flood events. The FWOP condition assumes that the POSF and tenants utilizing the bulkhead buildings and sheds will reactively respond to damaging events, which will require post-event clean up, displacement of people and businesses as well as repairs for the flood damages. It is expected that such an event will bring Federal disaster aid to help fund repairs for the physical damage. Evaluation of the damages over the study period of analysis will use the same thresholds as the land-based building assets which will trigger proactive investment in floodproofing, when 10 damaging events that exceed 3% of the asset value occur. (This reactive response is currently modeled in the G2CRM planning model; see Section 4.4.)

When monthly flooding reaches an asset, the asset is assumed to be bought out, abandoned, and demolished such that services will be lost. For the purposes of the OMRR&R calculation, the coastal flooding and sea level rise response assumed for the FWOP will be used to cap the OMRR&R expenditures related to age and condition or earthquakes, to ensure that these expenses are not forecast beyond the point at which these structures are assumed to be lost due to monthly inundation. This will present a variable related to sea level rise for the OMRR&R calculation, whereby on the low curve the OMRR&R will continue throughout the full period of analysis, while the high curve

OMRR&R will be phased out by approximately 2100 as coastal flooding inundates coastal flood defense infrastructure on a monthly basis. However, due to discounting, the resulting value are expected to be similar.

5.2.2.3 Earthquakes

The San Francisco waterfront is located within a high seismic region, with existing maritime infrastructure and coastal flood defenses that do not meet modern seismic standards and are vulnerable to earthquake damage and failure. Projections from the USGS *UCERF3: A New Earthquake Forecast for California's Complex Fault System* (2015) indicate that the San Francisco region has a 72% likelihood of a magnitude 6.7 earthquake occurring within 30 years and a 20% likelihood of a magnitude 7.5. The POSF's MHRA of the Northern Waterfront assessed expected physical damages to the coastal risk reduction infrastructure using probabilistic earthquake hazard levels ranging from a 43-year to 975-year return period based on the latest regional models.

As previously described in Section 5.2.2.1, the POSF intends to utilize the existing infrastructure to the maximum extent possible to fund the enterprise agency and serve the people of California as part of the Public Trust (1968 Burton Act). As such, it is assumed the POSF will rebuild all structures damaged from an earthquake, looking to Federal and State disaster aid programs for funding. However, in order to evaluate the effect of the FWP condition, the rebuild after an earthquake is focused solely on the coastal flood defense structures (i.e., bulkhead wall and wharf substructure).

Based upon the high likelihood of an earthquake occurring during the study period (2040 to 2140), it is considered prudent to factor the repairs and replacements resulting from an earthquake as part of the OMRR&R quantification. This is especially true for the coastal flood defense structures that will see substantially lower earthquake damages if replaced with any of the proposed FWP alternatives, thereby reducing a future Federal expenditure. The MHRA provides substantial information related to expected damages to the wharves from various earthquake levels such that OMRR&R expenditure related to earthquakes can be simplified to an annualized value to account for the probability of occurrence and factor in the appropriate discounting throughout the period of analysis. This information from the MHRA is the basis for earthquake damages used in this quantification.

However, in order to use the MHRA information for the study, the damage estimates need to be adjusted and extrapolated. Depending on the original wharf structure type, the MHRA used a range of $400 per square foot to $660 per square foot, as the representative unit rate to repair or replace the existing wharf following an earthquake. However, this cost range reflects the cost to return the structure to their as-built condition, which is different than how a modern, code-compliant wharf that is subject to the known seismic hazard would be constructed. The cost estimate for replacement of pile supported wharves used in evaluation of the FWP alternatives uses a unit rate of $1000 per square foot as a baseline to reflect the installation of new piles, construction of new pile caps and deck once the existing structure and building has been removed from the project site. The resulting replacement cost to rebuild all coastal defense wharf structures is approximately $2.0 billion.

For the purpose of the OMRR&R quantification, the baseline wharf replacement costs used for the FWP alternatives is utilized to ensure consistency across the study, reflect changes to pricing since completion of the MHRA in 2020, and account for the increased cost of a code-compliant, modern structure. However, in addition to the update of the wharf construction unit rate, the following factors and allowances have been applied to account for increased scope of work as well as contingency for unknowns.

- Demolition of damaged structures ($80 per square foot) – additional scope to account for full removal or partial demolition of existing earthquake damaged structures from the location of the new construction. Unit rate from FWP alternative cost estimates used.
- The need to work around adjacent buildings and infrastructure (5% premium) – premium applied to account for increased difficulty of constructing a new wharf within a constrained environment with critical city utilities and Federally-recognized historic structures. The assumed factor is intended to represent this increased complication which would be reflect in a contractor's bid price for this work.
- Logistical constraints due to citywide damage (5% premium) – following major earthquake, widespread city damage is expected to burden the supply chain and induce challenges during the reconstruction process, the assumed factor is intended to represent this increased inefficiency that would be reflected in a contractor's bid price for this work.
- Labor force limitations following major disaster (10% premium) – following a major earthquake, there will be widespread demand for skilled construction labor, which is expected to constrain resources and require additional cost to secure necessary services. The assumed factor is intended to represent the premium required to secure reliable and experienced labor force necessary to complete the work.
- Expansion of scope beyond the wharf substructure (10% premium) – the unit rate and quantities are based only on the wharf substructure; however, earthquake damage will extend to the bulkhead wall, rock dike and infrastructure crossing the wharf zone. Reconstruction of the wharf at a minimum requires scope to mitigate damages to the wall and remedy damages to crossing infrastructure (i.e., utilities, structural joints, architectural surfaces, etc.). The typical wharf width is 45 feet, therefore an additional 10% factor is added to factor in an additional ~5 feet for repairs and replacement to these integral adjacencies.

The resulting unit rate of $1,440 per square foot is used in conjunction with MHRA damage ratios (43-year, 100-year, 225-year, and 975-year probabilistic events) as a rough approximation of the cost to repair and replace structures. As a benchmark using this assumed unit rate, the total cost of fully replacing all coastal flood defense structures (wharves and walls) is approximately $2.9 billion accounting for 46 acres of coastal flood defense wharf structures along approximately 4.5 miles of shoreline.

Additionally, because the MHRA was only completed for the Northern Waterfront, no equivalent information exists for coastal flood defense structures in the Southern Waterfront (south of Mission Creek). Therefore, the MHRA results were extrapolated based upon review of the Initial Southern Waterfront Earthquake Assessment and professional judgment. Representative structures from the Northern Waterfront were selected to characterize the seismic performance (i.e., damage versus event relationship) of the Southern Waterfront facilities and used to determine the expected value of earthquake damages. The Initial Southern Waterfront Earthquake Assessment indicates that the Southern Waterfront structures are likely to see high damage from a frequent earthquake, defined as an event with a return period between 43 and 100 years, due to lateral spreading and liquefaction potential of underlying soils. Therefore, structures with this characteristic were selected from the MHRA data and utilized for their fragility relationships (i.e., inertial and kinematic intensity versus damage ratios).

Using the annualized value determined from these data sources, the cost of recovery from a seismic event is captured as an expected part of the OMRR&R life-cycle cost of the existing infrastructure such that reduction of such expenditure can be factored into the comparison of alternatives. The extent of recovery, repair and rebuilding following a seismic event is highly uncertain and dependent upon many variables, including the point in time at which an earthquake and subsequent recovery occurs. Therefore, it is not possible to factor infrastructure upgrades that would change the coastal flood risk, age and condition factors (subsequently described), or multiple earthquakes that may be expected as part of this OMRR&R quantification utilized to reflect the expected cost to repair or replace coastal defense structures following an earthquake. However, the annualized earthquake damages for individual structures are capped when that structure has reached a threshold for coastal flood risk (i.e., monthly inundation) or age and condition risk (i.e., maximum expected useful life), to avoid quantifying damages to structures that are not reasonably expected to be in service for

As a means of maintaining economic conservatism, and to avoid conflicts with WRDA 2020, Section 152 language regarding calculation of non-seismic benefits, this OMRR&R quantification does not include physical damage to:

- the historic building structures that sit atop the existing coastal flood defense infrastructure
- piers outside of the coastal flood defense system
- adjacent infrastructure systems that will see damage from a major seismic event, such as the Embarcadero roadway, light rail trackway and combined sewer system transport storage box.

5.2.2.4 Age and Condition

The existing Embarcadero seawall and bulkhead, which constitute approximately 50% of the coastal flood defense structures along the study area, were constructed between

1880 and mid-1930s. As such, many of these structures are expected to reach the end of their useful life before the end of the study period (2140). Along the southern half of the study area, the coastal flood defense structures were constructed between approximately 1910 and 1970. Based on professional judgment by the POSF's structural engineering group, it is assumed that the expected useful life for historic reinforced concrete wharf structures in the harsh marine environment is approximately 60 years. However, with rehabilitation and repair, it is assumed that the useful life could be extended at least another 50 years, at which point the use conditions may need to be modified based upon actual condition. The end of useful life is highly uncertain and will not have a clear boundary but rather present a spectrum of possible outcomes. To simplify this spectrum for the purposes of the OMRR&R calculation, the PDT will assume an average maximum useful life of 130 years. Informal input from several members of the American Society of Civil Engineers Protection and Rehabilitation of Waterfront Structures subcommittee indicated that 100 to 150 years of maximum useful life was reasonable if the structures were properly detailed, and maintenance was diligently performed.

The assumed 130 years aligns well with this range of values. Finger piers are assumed to have a longer maximum useful life of 150 years because they are not subject to the same frequency and intensity of wave runup and splash that the wharves are subject to (though the OMRR&R of piers is not considered for this calculation).

Some of the pier and wharf structures have been invested in over the last two decades, while others remain in a deteriorating as-built condition. While the ideal solution would be for the POSF to replace the aging structures to restart the life cycle, the financial constraints of being an enterprise agency beholden to the Public Trust (1968 Burton Act) do not make this a reasonable assumption in the absence of a Federal funding (FWP). Additionally, if the POSF were to replace the structures the project would consider the sea level rise and seismic risks previously discussed, thereby closely resembling the FWP scenario.

For the FWOP scenario, it is reasonable to assume that the POSF, and CCSF, will fund rehabilitation and repairs to the existing coastal flood defense structures such that they are each able to reach their maximum useful life (i.e., 130 years total, simplified to earliest end of life date in year 2050 for calculations). To estimate the appropriate value for the FWOP scenario, the POSF's capital expenditures over the past 5 years was analyzed to approximate a reasonable value that the POSF alone could contribute to repair and rehabilitation of the existing coastal defense infrastructure. The POSF's capital budget varies substantially year by year depending upon funding and need. Table E-53 shows the recorded capital expenditure from 2018 through 2022 by year, which is used to determine an average value.

Table E-53: POSF Capital Expenditures (2018 to 2022)

Year	Total Capital Expenditure ($ million)
2018	2.6

2019	1.2
2020	37.1
2021	21.8
2022	4.0
5 Year Total	66.8
Annual Average	**13.4**

Based on assessment of the last 5 years, the POSF averages a total of $13.4 million in capital expenditure. However, the available POSF capital reflects only one source of funding that will contribute to the OMRR&R of the CCSF's bayside coastal defense. As a self-funded enterprise agency, the POSF typically does not rely on other CCSF sources for funding capital projects, but the essential nature of the coastal defenses is assumed to generate funding from other CCSF sources increasing the available budget for OMRR&R. The extent of this contribution is currently unknown, but reasonably assumed as a 1:1 match to the capital funding provided by the POSF. Therefore, for the sake of this OMRR&R quantification, an annual OMRR&R budget of $26.8 million, will be assumed to maintain the coastal flood defenses for the CCSF.

As an economically conservative estimate, it is assumed that the CCSF will help the POSF to ensure that a minimum of this $26.8 million is annually invested in the repair and rehabilitation of the aging coastal flood defense structures to ensure that they reach the maximum useful life. Based on this assumption, it is assumed that the following square footages and percent of structures will reach their maximum useful life by end of the decades as shown in Table E-54**.**

Table E-54: Square Footage and Percentage of Maritime Structures and Coastal Flood Defenses Reaching Maximum Useful Life by End of Decade

Decade	Square Footage At End of Maximum Useful Life		Square Footage Remaining		Cumulative Percentage	
	Wharves	Piers	Wharves	Piers	Wharves	Piers
Pre-2030	-	-	1,975,632	5,176,296	100%	100%
2030s	-	-	1,975,632	5,176,296	100%	100%
2040s	-	-	1,975,632	5,176,296	100%	100%
2050s	916,898	421,708	1,058,734	4,754,589	54%	92%
2060s	31,029	216,938	1,027,705	4,537,651	52%	88%
2070s	48,726	1,587,599	978,979	2,950,052	50%	57%
2080s	572,848	1,832,214	406,131	1,117,838	21%	22%
2090s	-	246,379	406,131	871,460	21%	17%
2100s	-	-	406,131	871,460	21%	17%
2110s	145,093	145,826	261,037	725,634	13%	14%
2120s	106,080	398,080	154,958	327,554	8%	6%
2130s	7,202	277,731	147,756	49,824	7%	1%
2140s	6,635	38,813	141,120	11,011	7%	0%
2150s	141,120	-	-	11,011	0%	0%
Total	1,975,632	5,165,285	-	-	-	-

In the FWOP scenario, and some FWP scenarios, the age and condition of maritime structures and coastal flood defenses will lead to gradual loss of maritime services, business revenue, contributing elements to several recognized historic districts over the next century. In some cases, this will be in advance of the coastal flooding and sea level rise tipping points that would also result in the loss of those assets and services.

The loss of these services due to coastal flooding and sea level rise is calculated through the NED metrics of land loss and asset condemnation but does not occur until an asset is flooded on a monthly basis, which typically does not occur until after 2070 for the high curve sea level rise scenario. The OMRR&R calculation could show the loss of these services at an earlier point in time, which would be more impactful to the expected damages due to the time value of money.

To account for this age and condition factor in evaluation of the FWOP and FWP NED damages, the dates determined as the maximum useful life may be used to dynamically alter the G2CRM inventory, whereby the building structures atop these coastal defense structures will be removed from the inventory based upon the governing hazard (coastal flooding or age and condition). The resulting removal will ensure that the loss of business function (RED loss) will be properly located with respect to timing of the study period, and that physical damages are not predicted to occur beyond the maximum useful life of the structure (NED loss). This opportunity will be explored post-TSP.

5.3 System Losses: SFMTA and SFPUC

5.3.1 SFMTA

In the FWOP scenario, SFMTA's assumed response to protect citywide transit can be broken into two distinct phases: 1) near-term protection for episodic events and 2) long-term system reconfiguration.

In the near-term protection phase, it is assumed that asset-level protection and deployable floodproofing is implemented to prevent physical damage during infrequent, extreme storm events. These actions are currently believed to be reasonably captured with the G2CRM analysis: they are prompted by physical damage, which occurs under all three SLC curves, and are incurred once the rebuild thresholds for the assets have been exceeded.

In the long-term reconfiguration phase, there are substantial areas of the city that are regularly below water at high tide, requiring relocation of core transit infrastructure components. These are not physical damages, but instead are degradations of access to the transit system. As such, these impacts are not captured within G2CRM. Instead, the cost of relocation must be determined and applied based on a trigger threshold. It is assumed that these costs are only incurred under the Intermediate and High SLC curves.

Through coordination with SFMTA, a scope of work in the FWOP condition was determined. Actions must only be taken under the Intermediate and High SLC curve; under the Low SLC curves, these actions will not be necessary. This is another place where damage and adaptation are specifically driven by SLC and not by infrequent coastal storm events. The suite of potential actions from SFMTA to respond to SLC are shown spatially on Figure E-38.

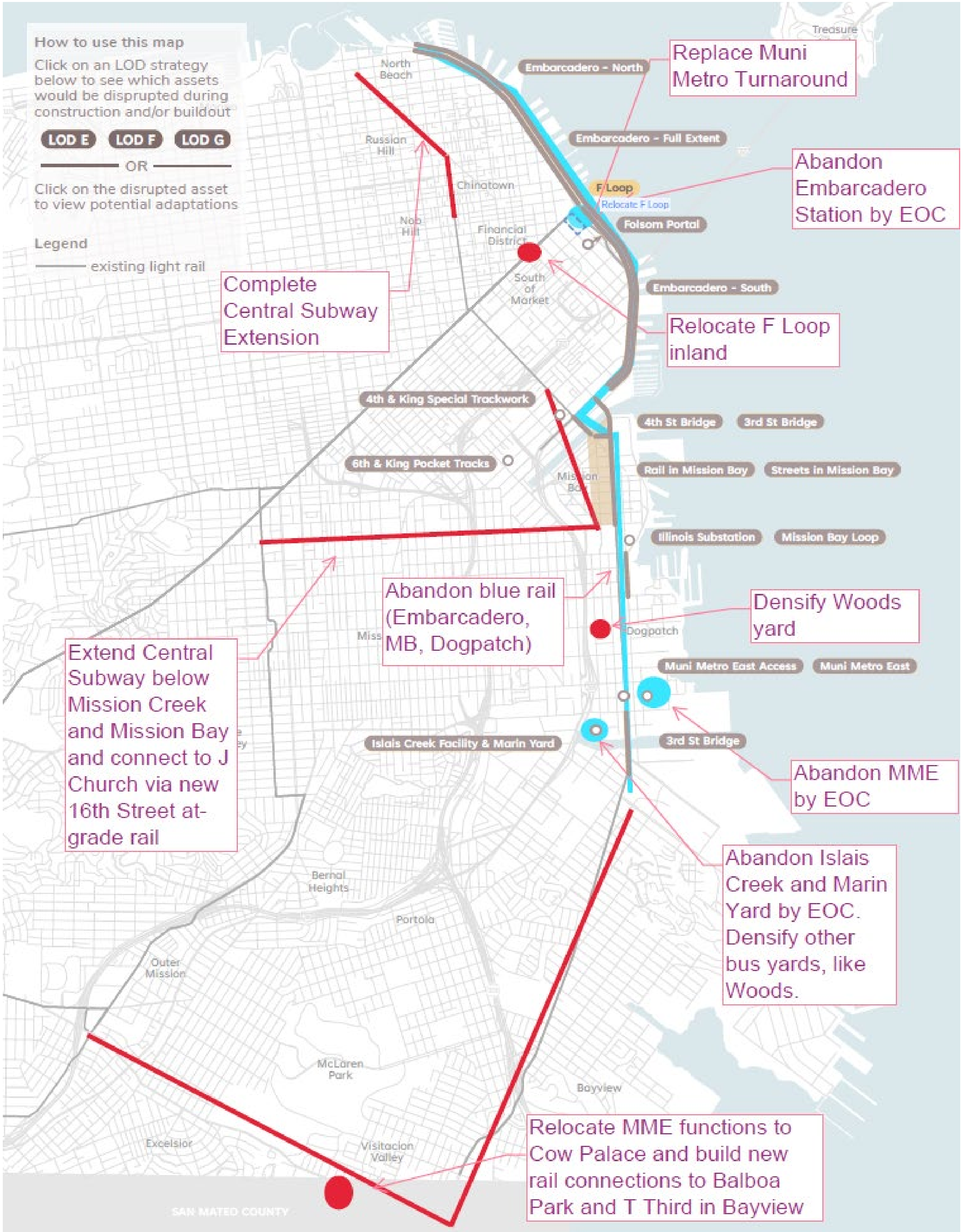


Figure E-38: SFMTA FWOP Scope of Work

The PDT did not attempt to estimate repetitive damage to these assets. Though some of these assets are in the inventory and do take direct damage from infrequent events, they are assumed to be floodproofed after taking damage. The concern about repetitive flooding impacting service and requiring retrofits is what this analysis seeks to capture. Permanent roadway or track flooding will require capital investment to maintain the integrity of the existing system, and obviating those investments through a Coastal Storm Risk Management (CSRM) project represents a local cost foregone and an NED benefit.

Additional information on individual FWOP retrofits can be found in the “SFMTA Waterfront Resiliency Transportation Assessment Adaptations Menu” (SFMTA 2023).

5.3.2 SFPUC

In the FWOP condition, parts of the bayside edge of San Francisco will be reclaimed by the Bay due to sea level rise. For the USACE Low RSLC rate the impacts of this changed condition on the existing wastewater infrastructure will not be realized until after the study period. On the USACE High RSLC rate, the existing wastewater system will start to realize these impacts gradually over time. The SFPUC has projected that the network of combined sewer overflows that function by gravity alone will be severely degraded with 1.5 feet of RSLC (projected in 2050 for High curve) and no longer functional with 3.5 feet of RSLC (projected in 2080 for High curve). This impact to the current system would affect more than 500,000 residents and workers within the city.

To mitigate this impact, the SFPUC has scoped a conceptual design that would ensure wastewater services are provided for residential units and businesses outside the floodplain in a safe, effective, and compliant manner. The concept involves construction of new storage and conveyance boxes at higher elevations, pump stations, and combined sewer outfalls that originate from higher elevations to push against the higher Bay conditions. The cost of this scope is estimated to be $6.95 billion (2023 USD) using a combination of cost book unit rates, historic estimates for similar scopes within the SFPUC jurisdiction, contractor markup, and cost contingency values determined during the Abbreviated Risk Assessment.

The PDT formulated a range of FWP alternatives that utilize measures to different scales and along different alignments to evaluate benefits, costs, and impacts. This results in differing inland drainage implications and associated scope of work to manage pluvial and fluvial water sources landward of the line of defense to ensure the coastal storm risk mitigation system does not negatively affect inland drainage. The inland drainage scope of work was determined by the PDT using a simplified HEC-RAS model of surface flow which utilized general assumptions about the existing drainage system, expected rainfall intensity and solutions to mitigate negative excessive ponding behind the coastal defenses (i.e., pumps, storage basins or culverts).

It is assumed that the difference in cost between the FWOP expenditure and the inland drainage expenditure for the FWP condition is a local cost foregone and is therefore applicable as an NED benefit. These differences have not been considered at this stage of the study, though future efforts could seek to quantify these benefits for the final report.

6. FWOP Results: National Economic Development Damages

As discussed in Section 2, G2CRM links the predictive capability of hydraulic and hydrologic modeling with project area infrastructure information, structure and content damage functions, and economic valuations to estimate the total damages under various proposed alternatives while accounting for risk and uncertainty. G2CRM is an object-oriented probabilistic life cycle analysis model using event-driven Monte Carlo simulation. This allows for incorporation of time-dependent and stochastic event-dependent behaviors such as SLC, tide, and structure raising and removal. The model output is then used to determine the net NED benefits of each project alternative in comparison with the No-Action Plan, or FWP condition.

Storm damage is defined as the monetary loss to contents and structures incurred as a direct result of inundation caused by a storm of a given magnitude and probability. It also includes downstream damages, such as damages that result from a loss of public transportation, fire services, wastewater, or other critical infrastructure. Retreat that occurs due to repetitive flooding driven by SLC is also captured as an NED loss.

As a life-cycle model, in which G2CRM models each storm for each year of the 100-year period of analysis over hundreds of possible future conditions, the structure inventory is not kept static, but instead designed to react rationally to the occurrence and impacts of storm events. Structures are rebuilt after every storm event unless a subsequent storm hits before a structure's Time-To-Rebuild has elapsed. Structures are floodproofed within the inventory once their cumulative damage threshold or number of rebuilds threshold has been surpassed (though the cost of that floodproofing is calculated outside of the model and is discussed in Section 4.4). Structure values are assumed static, as depreciation is assumed to be zero, though during rebuilds their values may be lower than their starting depreciated replacement value. The results are shown in FY2023 dollars, though this will be updated to FY2024 in the next iteration of this appendix.

With current inputs, the San Francisco Waterfront Coastal Flood Study study area experiences over $22.5 billion in FWOP PV damages over a 100-year period of analysis under the High SLC curve, $5.9 billion under the Intermediate SLC curve, and $3.6 billion under the Low SLC curve. Results are preliminary and are subject to change. It is also important to note that the described damages below only display the sections of the municipality that intersect with the study area. Damages within the municipality that are outside the study area are neither included nor quantified.

Impacts are highest in Model Areas 2 and 3, contributing the majority of total NED damages. The structure damages (which, within G2CRM, include damages to specialized assets, such as the BART and the SFMTA) make up the much of the loss.

As mentioned earlier, FWP condition damages are used as the base condition and potential project alternatives are measured against this base to evaluate the project effectiveness and cost efficiency. What follows is a discussion of the results across the various benefit categories, including ones captured in G2CRM (including inundation damages and impacts to recreation) and ones captured in spreadsheet models outside of G2CRM (including retreat costs, OMRR&R, and SFTMA).

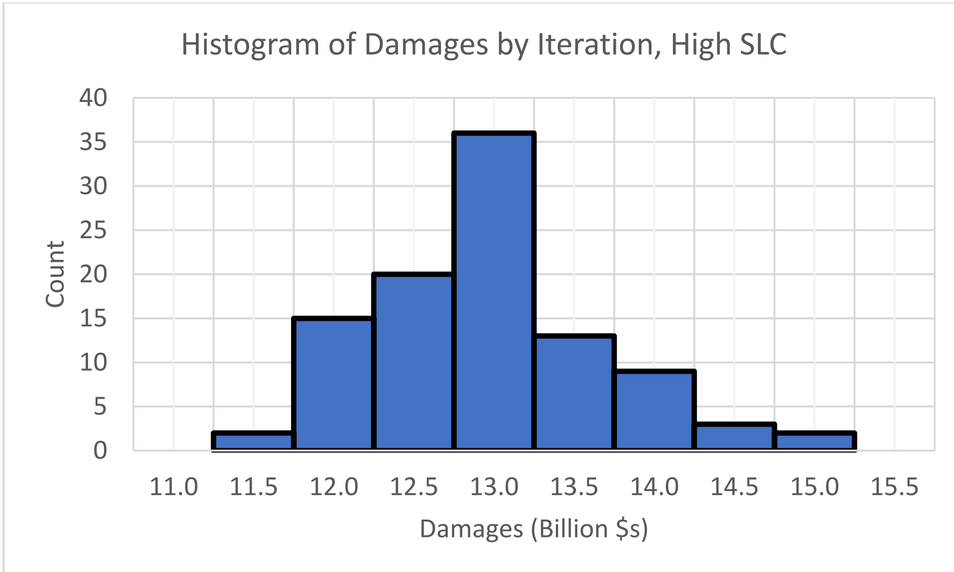
6.1 Inundation Results (G2CRM)

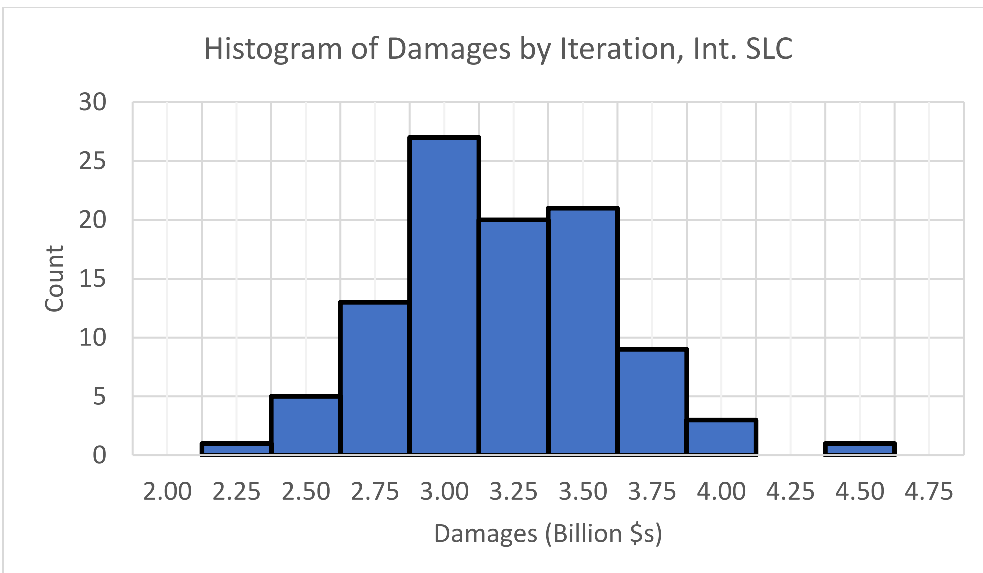
The San Francisco Waterfront Coastal Flood Study study area experiences a total of $12.3 billion in FWOP PV damages over a 100-year period of analysis under the High SLC curve, $3.0 billion under the Intermediate SLC curve, and $992 million under the Low SLC curve. These totals can be seen in Table E-55.

Table E-55: Structure and Content Damages by Model Area (PV, $)

Model Area	High SLC	Int. SLC	Low SLC
1	526,331,000	36,619,000	508,000
2	4,500,252,000	1,044,480,000	216,793,000
3	5,786,014,000	1,617,941,000	599,229,000
4	1,039,913,000	281,087,000	158,418,000
5 (Unprotected)	152,205,000	13,459,000	3,868,000
6 (Unprotected)	180,620,000	8,724,000	-
7 (Unprotected)	156,866,000	28,626,000	14,045,000
TOTAL	**12,342,201,000**	**3,030,936,000**	**992,861,000**

Figure E-39 show the damages by iteration by SLC curve. As mentioned, each of the sets of results come from 100 iterations of 117 years each, though the damages are only counted for the period of analysis (2040 – 2139).


Histogram of Damages by Iteration, High SLC
Count
40
35
30
25
20
15
10
5
0
11.0
11.5
12.0
12.5
13.0
13.5
14.0
14.5
15.0
15.5
Damages (Billion $s)


Histogram of Damages by Iteration, Int. SLC
Count
30
25
20
15
10
5
0
2.00
2.25
2.50
2.75
3.00
3.25
3.50
3.75
4.00
4.25
4.50
4.75
Damages (Billion $s)

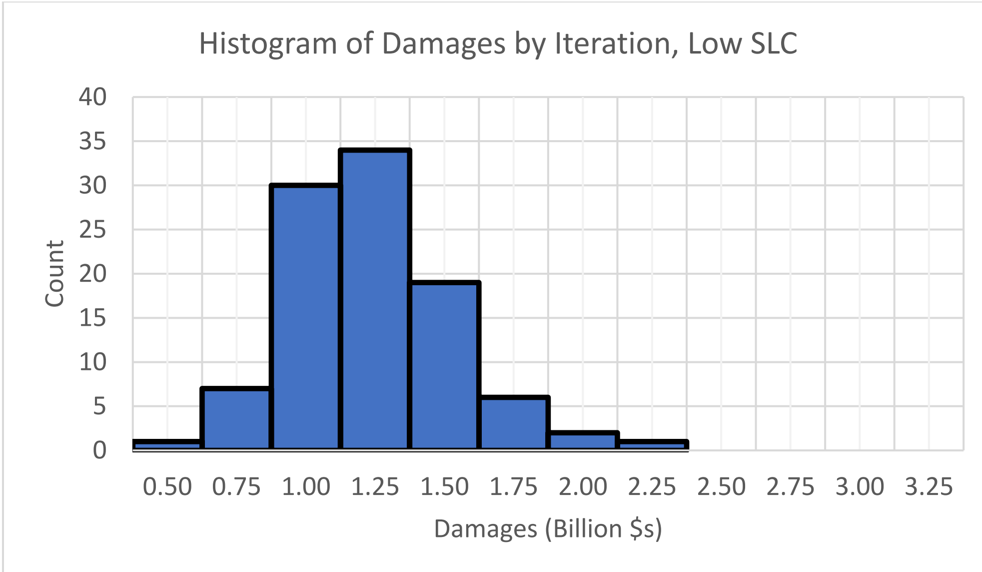


Figure E-39: Histogram of Damage by Iteration, All SLC Curves

Average yearly damages can be found on Figure E-40 and Figure E-41. The increase in damages over time is driven by SLC, though there is also a decline in damages that occurs due to the removal of repetitive-damage structures from the inventory (see Section 4.4) and discounting of future damages. Though convergence of the overall mean occurs before 100 iterations, it is possible higher-iteration runs would smooth the curves below, though the overall trends (increase from SLC, eventual decrease due to discounting and structures passing their dynamic inventory thresholds) would still hold. The increase in damages is more pronounced in the future value graph, due to the lack of discounting. For the Intermediate and Low curves, the yearly damages either increase slightly or decrease.

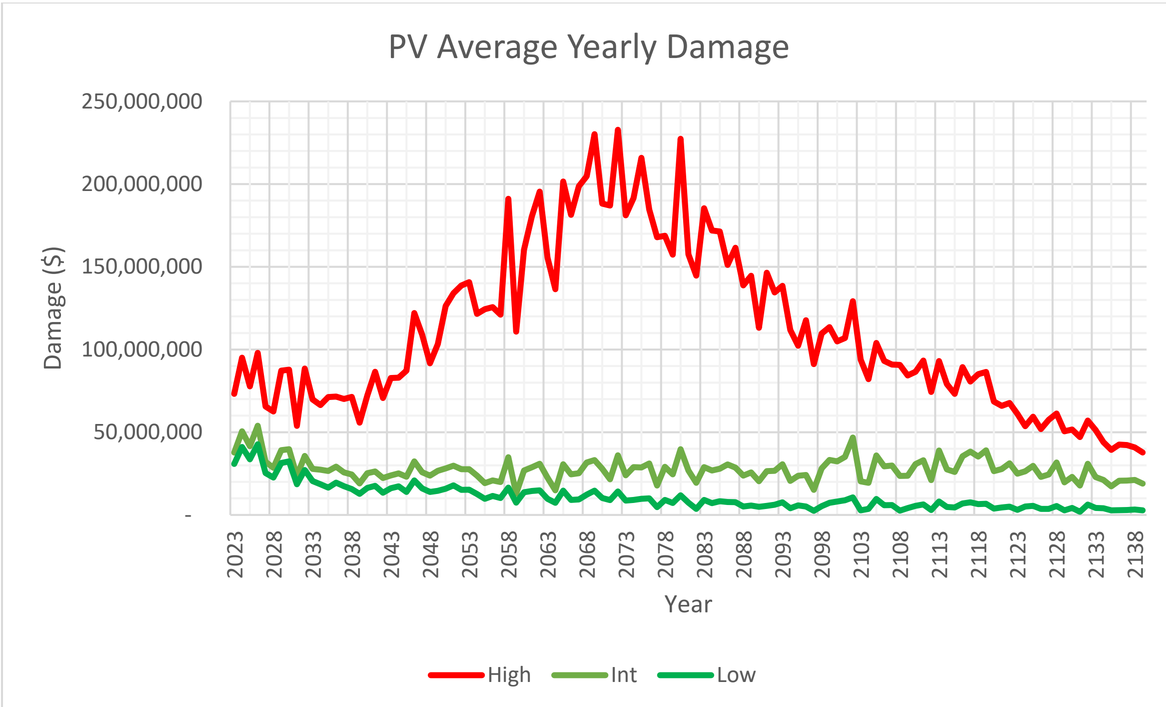


Figure E-40: Present Value of Average Yearly Damages, High SLC, 100 Iterations

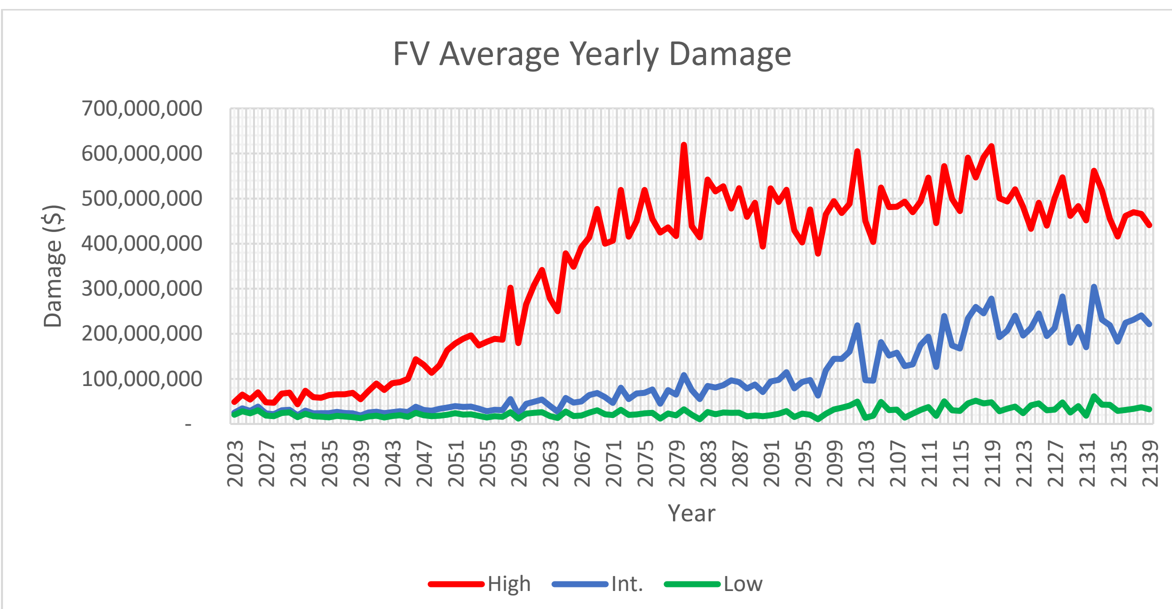


Figure E-41: Future Value of Average Yearly Damages, High SLC, 100 Iterations

Another way to consider damage is damage by occupancy type. Table E-56 shows aggregated damage by first-floor occupancy type under the High SLC curve. A big takeaway is that almost 50% of the damage in the study area occurs to high-rises. This is unsurprising, as they have a proportionally higher average value and lower FFEs. The commercial assets make up the next-largest percentage of the damages.

Table E-56: Total Damage and Number of Structures Damaged by Occupancy Type (High SLC)

Occupancy Type	Total Damage	Percent of NED Damage Total	Number of Structures Damaged	Total Number of Structures in Inventory	Percent of Structures Damaged
COM	2,917,020,000	22%	752	1,048	72%
EDU	173,054,000	1%	21	38	55%
GOV	62,019,000	0%	50	103	49%
HIGH	6,057,137,000	45%	278	389	71%
IND	1,777,130,000	13%	1,057	1,910	55%
REL	1,781,000	0%	8	15	53%
RES	1,396,541,000	10%	629	2,148	29%
SPECIAL	1,060,390,000	8%	13	14	93%
VACANT	4,710,000	0%	33	61	54%

Note that these damages include damages before the base year.

Looking specifically at high-rise damages, we can see a lot of variability in damage between structures. Though 278 high-rises are damaged and those damages contribute 45% of the total damages, not all structures contribute equally. Table E-57 shows the count of high-rise damages in different “buckets,” shown on a logarithmic scale. This shows that, even within the category of high-rises, there are individual structures or groups of structures whose very high amount of damage outweighs the damages from many other structures.

Table E-57: High-Rise Average Damages

Average Damage ($)	Count	Total Damage
Below 100,000	33	877,000
Between 100,000 and 1 Million	31	12,610,000
Between 1 and 10 Million	73	391,772,000
Between 10 and 100 Million	134	4,292,417,000
Above 100 Million	8	1,359,461,000

How does a high-rise take over $100 million in damage? Consider the two large, high-value residential structures on the south side of Mission Creek (in Model Area 3). They are both in low-elevation locations and take damage early in the study timeframe, meaning their damages are discounted less. Despite low levels of flooding that cause losses that are only single-digit percentages of structure value, each event's losses are still in the tens of millions of dollars (due to the high structure value of the assets). Because these events occur numerous times, the structure damage balloons to the hundreds of millions of dollars.

Figure E-42 and Figure E-43 display High SLC curve damages on a structure-by-structure basis in 25-year periods to spatially display the damages. Yellow dots represent assets that take between $100,000 and $1 million in PV damage in that 25-year span, orange dots between $1 million and $10 million of damage, and red dots take $10 million or more of damage. As the sea level rises, damages move inland as assets closer to the water are removed.

Figure E-42: Damage by Asset, 2040-2064 and 2065-2089

Figure E-43: Damage by Asset, 2090-2114 and 2115-2139

Damages to the numerous bespoke assets discussed in Section 3 are shown in Table E-58. Physical damages to the SFMTA light rail transit and the damages to Embarcadero Station for BART and SFMTA contribute hundreds of millions of dollars in damages under the High SLC curve. There are also damages under the Intermediate and Low SLC curves, but they occur later in the study time period and, as such, have a smaller present value. Note that for physical assets, these losses are just the physical losses themselves: these damages do not consider additional damages stemming from the cost of retreat.

Table E-58: Damage to Specialized Assets

Specialized Asset	High SLC	Int SLC	Low SLC
SFMTA Embarcadero Station Physical Damage	282,851,000	147,037,000	59,899,000
SFMTA Light Rail Transit Physical Damage	209,643,000	87,424,000	18,988,000
SFMTA Central Subway Physical Damage	137,812,000	2,156,000	<1,000,000
BART Embarcadero Station Physical Damages	202,017,000	115,453,000	61,745,000
Transportation Delay	106,159,000	62,046,000	34,633,000
3rd Street Bridge Damage	71,925,000	8,663,000	<1,000,000
Increased Transit Cost	106,159,000	38,119,000	18,819,000
Peter Maloney Bridge Damage	64,005,000	28,202,000	7,801,000
Hanson Pier Damage	25,192,000	16,536,000	10,213,000
Lefty O'Doul Bridge Damage	32,870,000	12,406,000	2,183,000
Illinois Street Bridge Damage	23,913,000	7,770,000	<1,000,000
SFBR Physical Damage	4,417,000	<1,000,000	<1,000,000

6.1.1 Recreation Losses

The results from the G2CRM model runs show $82 million in damages to recreational opportunities under the High SLC curve, $15 million under the Intermediate curve, and just over $1 million under the Low curve. One reason for this is the high FFEs (in feet NAVD88) of the various recreational opportunities. For instance, there can be up to $72 million in a single damaging event Oracle Park, but this damage begins at 12.9 feet of flooding—a height that happens infrequently and, when it does, happens later in the study timeframe, leading to discounting of the damages. The recreational opportunities that are impacted at lower water levels, like the bike trails in Reach 2, take much less damage, either because of low usage or low UDVs for the activities done in those areas. Table E-59 shows the average PV damages for each of the recreational opportunities detailed in Section 3.2.12.

Table E-59: Recreational Losses, High SLC

Reach/Model Area	Recreational Opportunity	High SLC	Int SLC	Low SLC
Reach 1	South End Rowing Club and Dolphin Rowing Club	453,000	8,000	0
	Pier 31.5 - Ferry excursions (Park Cruise)	126,000	3,000	0
	Pier 33 - Ferry excursions (Alcatraz)	126,000	2,000	0
	Pier 39 -Bay Trail Water Launch	2,467,000	0	0
	Pier 39: Aquarium of the Bay	2,616,000	3,000	0
	San Francisco Bay Sportfishing	16,000	1,000	0
	Pier 43 Arch	28,000	9,000	1,000
	Bike (including Bay Trail and Blue Greenway)	44,000	10,000	0
	Fisherman's Wharf Area (General Recreation)	1,183,000	384,000	29,000
Reach 2	Pier 15/17 Exploratorium	12,134,000	387,000	0
	Bike (including Bay Trail and Blue Greenway)	121,000	107,000	100,000
	General Recreation	446,000	384,000	362,000
Reach 3	Chase Center/Bayfront Park	226,000	79,000	7,000
	Oracle Park	61,468,000	13,818,000	127,000
	Bike (including Bay Trail and Blue Greenway)	236,000	208,000	195,000
	General Recreation Values	125,000	121,000	113,000
Reach 4	Bike (including Bay Trail and Blue Greenway)	111,000	98,000	92,000
	General Recreation	45,000	44,000	43,000

6.2 Retreat Costs

6.2.1 Floodproofing Losses

Floodproofing losses were calculated on the asset level using output from G2CRM. Once assets passed an asset removal threshold (cumulative damage threshold or number of rebuilds, see Section 4.4), they were assumed to be floodproofed and the asset-level floodproofing costs were applied to them. The floodproofing costs were $45 per square foot, which was a combination of the cost engineering costs for three different measures: ring wall ($23 per square foot), dry floodproofing ($21 per square foot), and wet floodproofing ($202 per square foot). These costs were then discounted back to the base year. The reach-level totals for each SLC curve can be found in Table E-60.

Table E-60: FWOP Floodproofing Costs by SLC Curve ($)

Reach	High SLC	Int. SLC	Low SLC
1	26,694,000	1,121,000	152,000
2	58,956,000	6,766,000	389,000
3	147,223,000	8,999,000	6,957,000
4	70,716,000	2,089,000	12,587,000
Total	**303,589,000**	**8,975,000**	**20,085,000**

6.2.2 Removal of Assets (Condemnation)

Removal of assets was calculated by determining the year under each SLC curve when the ground elevation at the centroid of an asset was in the 1-month floodplain. At that point, the structure value of the asset was considered a full loss and an additional 10% of the structure value was added to represent the cost of demolition of the asset. Those costs were then brought back to the base year. These losses are shown across the three SLC curves in Table E-61.

Table E-61: FWOP Removal Costs by SLC Curve

	FWOP High	FWOP Int.	FWOP Low
2040 – 2064	381,078,000	3,052,000	-

2065 – 2089	1,272,716,000	8,939,000	685,000
2090 – 2114	2,503,992,000	111,044,000	-
2115 – 2139	1,076,795,000	47,759,000	30,000
TOTAL	5,234,581,000	170,794,000	715,000

As with the floodproofing costs, the costs are substantially higher under the High SLC curve than either of the other two. This is because SLC is the main driver of retreat; without SLC, it is unlikely that many existing assets will be driven to floodproof or leave the floodplain by the existing hazard. Table E-51 shows that 1,900 assets will be in the 1-month floodplain under the High curve; these are the assets that are assumed to be removed. The large number of assets that are vulnerable to the High rate of SLC change helps to explain why the condemnation costs under that curve are so high (over $5 billion, or almost 25% of the total FWOP NED damages). Note that the structure value of those removed structures is over $20 billion, demonstrating that the discounting on the loss (i.e., moving the value of the loss back to the base year) reduces the PV loss significantly.

6.2.3 Land Loss

Land loss was calculated by overlaying the 1-month floodplain polygons with the land loss polygons in 25-year increments, starting in 2040. That allowed each part of the 1-month floodplain, calculated in square feet, to be multiplied by its associated dollar-per-square-foot metric detailed above. For future periods, the previously calculated land loss was subtracted from the total land loss to ensure there was no double counting (e.g., the 2040 and 2065 land loss was subtracted from the 2090 land loss, etc.). Table E-62 shows land loss in future value across the four reaches and in the five 25-year time periods.

Table E-62: FWOP Land Loss Under the High SLC Curve (FV, $)

	2040	2065	2090	2115	2140	Total
Reach 1	7,469,000	3,631,000	33,829,000	579,623,000	249,058,000	873,610,000
Reach 2	939,000	1,183,000	49,555,000	758,618,000	292,109,000	1,102,404,000
Reach 3	10,322,000	23,514,000	242,241,000	767,267,000	554,541,000	1,597,885,000
Reach 4	42,705,000	108,270,000	400,296,000	761,264,000	819,353,000	2,131,888,000
Total	61,435,000	136,598,000	725,921,000	2,866,772,000	1,915,061,000	5,705,787,000

Spreading these damages evenly across the 25-year periods and discounting back to the base year provides a PV waterfront-wide land loss under the High SLC curve of

$1.256 billion. Despite the values shown in Table E-62 being shown in future value, the land loss in 2140 is lower than the land loss in 2115 in three of the four reaches. This is despite the escalating rate of change in sea level. This can be explained by looking at the topography of the study area: there is much more land lost in the third 25-year period than in the final in three of the four reaches.

Under the Intermediate SLC curve, the damages are just under $100 million in PV in total across the waterfront. Under the Low SLC curve, the 1-month floodplain does not overlap with the study area and land loss values were not calculated.

6.2.4 Retreat Cost Totals

The rolled-up PV G2CRM damage and retreat damages, broken down by reach, SLC, and timeframe, are shown in Table E-63.

Table E-63: FWOP Retreat Cost Totals ($, PV)

High	2040-2089	2090-2140	Total
1	31,682,000	381,564,000	413,246,000
2	434,488,000	2,058,308,000	2,492,796,000
3	1,310,706,000	1,666,951,000	2,977,657,000
4	446,953,000	449,820,000	896,773,000
Total	**2,223,829,000**	**4,556,643,000**	**6,780,472,000**

Int.	2040-2089	2090-2140	Total
1	4,660,000	4,166,000	8,826,000
2	1,306,000	9,785,000	11,091,000
3	21,861,000	153,017,000	174,878,000
4	47,555,000	71,096,000	118,651,000
Total	**75,382,000**	**238,064,000**	**313,446,000**

Low	2040-2089	2090-2140	Total
1	48,000	104,000	152,000
2	165,000	224,000	389,000
3	3,584,000	3,373,000	6,957,000
4	10,756,000	2,481,000	13,237,000
Total	**14,553,000**	**6,182,000**	**20,735,000**

6.3 SFMTA System Costs

For the SFMTA system facing the Intermediate or High rate of SLC, there is expected to be a long-term reconfiguration phase. This is because there will be areas of the city that are regularly below water at high tide, requiring relocation of core transit infrastructure components. The types of actions and the costs associated with them are shown in this section.

The necessary actions to maintain the service of the transportation network have been conceptualized and scoped, but the timing of these actions is still shown at a very high level. As such, the actions are shown as either the middle of the period of analysis or the end of the period of analysis (“Mid” and “EOC” in Table E-64). Costs labeled “Mid” are incurred under both the Intermediate and High SLC curves, though the timing for each is different. Costs labeled “EOC” are only incurred under the High SLC curve toward the end of the period of analysis. The costs were developed by SFMTA, though they should also be considered high-level, conceptual costs.

Table E-64: SFMTA Adaptations with Costs

Reach	Time	Name of Adaptation	Cost (FV)
1	EOC	Central Subway Extension	$800,000,000
2	Mid	Temporary street grates/vent covers (50 covers)	$27,100,000
2	Mid	Temporary flood gates for Embarcadero Station entrances (6 entrances)	$6,500,000
2	Mid	Temporary flood gate for Folsom Portal	$40,500,000
2	Mid	Ductbank Reinforcement	$24,900,000
2	Mid	Signal and Controller Cabinets	$4,000,000
2	EOC	Relocate F Loop for continued Historic Streetcar operation on Market	$33,800,000
2	EOC	Replace Muni Metro Turnaround	$554,400,000
3	Mid	King Street Substation reinforcement	$9,600,000
3	Mid	Illinois Street Substation reinforcement	$9,600,000
3	EOC	Connect Mission Bay Tunnel to J-Church via 16th Street	$455,900,000
3	EOC	Central Subway Mission Bay Tunnel	$1,402,400,000
4	Mid	Islais Creek Facility Reinforcement	$11,400,000
4	EOC	Relocate Islais Creek and 1399 Functions	$382,500,000
4	EOC	Connect T Third and Balboa Park to new Cow Palace Rail Yard	$621,700,000
4	EOC	Relocate MME functions to Cow Palace	$616,000,000
N/A	Mid	15 Bayview Hunters Point Express	$600,000
N/A	Mid	Temporary service plans and traffic control	$6,000,000
N/A	EOC	Streetscape Improvements	$200,000,000
N/A	EOC	Signal Updates	$22,500,000

As implementation is assumed to take time, the costs for those two sets of actions have been pegged to specific dates. For the High curve, the “Mid” actions are assumed at 2065 (25% of the way through the period of analysis) and the “EOC” actions are assumed at 2115 (75% of the way through the period of analysis). For the Intermediate curve, the “Mid” actions are assumed at 2115. All costs are discounted back to the base year. In the FWP, any measures that protect the SFMTA asset assumes that the FWOP costs are not incurred. For measures that are overtopped, the costs are assumed to be deferred until the time the measure becomes in danger of being overtopped.

Under the Intermediate curve, the PV costs of retrofitting the system are just over $20 million, while under the High curve, those costs are $857 million.

6.4 OMRR&R

Based on the methodology described in Section 5.2.2, a spreadsheet was used to compile relevant information from various sources, including the MHRA, G2CRM asset inventory, Initial Southern Waterfront Earthquake Assessment, structural drawings, and other reports to determine FWOP losses attributable to OMRR&R and earthquake losses. This information included construction dates, square footage, elevations, expected earthquake damage ratios, and expected coastal flood inundation timelines. Individual structure values were sorted based upon their classification as “coastal flood defenses” or “piers,” then the flood inundation timeline was used to delineate the point at which no further investment (earthquake or age and condition repair) would be made in that facility. The earthquake damages are summed based upon the expected return period, then annualized to reasonably represent the probability of occurrence on an annual basis. The annualized earthquake damage values and the expected $26.8 million maintenance figure for age and condition are programmed into a spreadsheet to account for discounting over the period of analysis. The resulting FWOP values, both future and PV, for OMRR&R are provided in Table E-65.

Table E-65: Total OMRR&R Values by Sea Level Rise Scenario for All Reaches

FWOP SLR Scenario	Future Value			Present Value		
	Maint	Earthquake	Total	Maint	Earthquake	Total
LOW	$ 2,706,800,000	$ 2,270,103,693	$ 4,976,903,693	$ 1,008,058,021	$ 1,604,638,206	$ 2,612,696,227
INT	$ 2,706,800,000	$ 2,270,103,693	$ 4,976,903,693	$ 1,008,058,021	$ 1,604,638,206	$ 2,612,696,227
HIGH	$ 2,706,800,000	$ 2,182,415,162	$ 4,889,215,162	$ 1,008,058,021	$ 1,585,516,821	$ 2,593,574,842

The PV of earthquake damage is slightly less than the cost of full replacement, which reflects the likelihood of a major earthquake that will require substantial repair and replacement, or multiple smaller earthquakes occurring during the period of analysis. As part of this multi-Federal Authority study, the inclusion of earthquake-related damages in the OMRR&R expenditure is also an important factor since project actions that mitigate these costs directly offset a potential future Federal expenditure that may come in the form of disaster aid following an earthquake or pre-disaster mitigation grant funding through a separate federal program.

Additionally, these FWOP OMRR&R expenses offset the OMRR&R expenses associated with the FWP alternatives. While the FWOP represents an ultimate loss in functionality of several critical CCSF components, it is considered reasonable to assume that there would be significant OMRR&R expenditure in the FWOP condition to enable the aging and seismically vulnerable shoreline to function as long as possible in the absence of a Federal project.

6.5 Total FWOP Damages

A summary of the FWOP Damages for the San Francisco Waterfront Coastal Flood Study study area can be found in Table E-66, Table E-67, and Table E-68. Those tables show damages broken down by SLC curve, reach, and the damage driver (inundation, retreat, OMRR&R, or SFMTA). As discussed above, inundation represents the physical damages to structure and contents caused by flooding that are captured within G2CRM; retreat represents the FWOP floodproofing, condemnation, and land loss costs; OMRR&R represents the operations and maintenance costs to the existing flood control infrastructure and the costs of rebuilding after a seismic event; and SFMTA shows the costs of retrofitting the existing rail infrastructure in the face of rising sea levels.

Table E-66: Total FWOP Damages by Damage Type, High SLC (PV, $)

Reach	Inundation	Retreat	OMRR&R	SFMTA	Total
1	678,536,000	413,246,000	371,323,000	125,545,000	1,588,650,000
2	4,680,872,000	2,492,797,000	512,039,000	164,028,000	7,849,736,000
3	5,942,880,000	2,977,657,000	291,914,000	304,995,000	9,517,446,000
4	1,039,913,000	896,773,000	1,435,124,000	262,198,000	3,634,008,000
Total	**12,342,201,000**	**6,780,473,000**	**2,610,400,000**	**856,766,000**	**22,589,840,000**

Table E-67: Total FWOP Damages by Damage Type, Int. SLC (PV, $)

Reach	Inundation	Retreat	OMRR&R	SFMTA	Total
1	50,079,000	8,825,000	371,323,000	-	430,227,000
2	1,053,204,000	11,091,000	512,039,000	-	1,576,334,000
3	1,646,567,000	174,878,000	291,914,000	-	2,113,359,000
4	281,087,000	118,652,000	1,435,124,000	-	1,834,863,000
Total	**3,030,937,000**	**313,446,000**	**2,610,400,000**	**-**	**5,954,783,000**

Table E-68: Total FWOP Damages by Damage Type, Low SLC (PV, $)

Reach	Inundation	Retreat	OMRR&R	SFMTA	Total
1	4,377,000	152,000	371,323,000	-	375,852,000
2	216,793,000	389,000	512,039,000	-	729,221,000
3	600,092,000	6,957,000	291,914,000	-	898,963,000
4	158,418,000	13,237,000	1,435,124,000	-	1,606,779,000
Total	**979,680,000**	**20,735,000**	**2,610,400,000**	**-**	**3,610,815,000**

The study area takes over $22 billion in present value damage under the High SLC curve, almost $6 billion in PV damage under the Intermediate SLC curve, and $3.6 billion in PV damage under the Low SLC curve. Of note under the Low curve is that 72% of those damages are in the OMRR&R category, meaning less than 30% of the total damage is due to flooding or rising sea levels forcing retreat. Under the High curve, though, the majority of the damage (84%) is driven by flooding and retreat (since those increase with SLC while the OMRR&R costs are agnostic to SLC).

7. Future With Project Array of Alternatives

This section provides a brief discussion of the alternatives in the context of the economic analysis. A thorough understanding of the alternatives helps to contextualize the FWP results, found in Section 8, as well as the hybridization discussed in Section 9 that allows for the selection of a robust TSP. A more comprehensive look at the formulation of the alternatives and specifics about the individual alternatives in each reach can be found in the *Appendix B: Engineering*.

The FWP measures were formulated with various objectives in mind. One objective was to scope different plans to different rates of relative SLC; this allowed the opportunity to gauge the opposing risks of over- or under-building when testing the different plans under each curve. Different plans also reacted differently to increasing SLC. Alternatives D, E, F, and G were all made to be adaptive, with a second action occurring in 2090. This second action both increased the finished elevation of the structural measure, thereby providing a higher level of protection, but also, in some cases, changed the alignment. The 2090 alignments were designed either to defend the shoreline (Alternative E), manage the water (Alternative F), or partially retreat from high-risk areas (Alternative G).[5]

These different alignments provide different sets of benefits. The benefits of protecting as much of the waterfront as possible are straightforward: assets in those areas can remain in place and productive economic activity can continue in those areas. Major interconnected systems, such as the rail and wastewater systems that are integrated in the study area, will not have to take any additional action. Retreat, on the other hand, requires the removal of structures from the retreated areas and a loss of the land that is now exposed and frequently flooded. The benefits of retreat, though, are that the cost of the measure can be reduced, since more set-back alignments can have lower costs. Additionally, retreat allows for the creation of natural areas and a reduction in potential life safety risk from overtopping or failure events. Balancing the desire to protect with

The alternatives are listed in Table E-69. The table shows both a first action, expected in 2040, and a second action designed to respond to SLC expected in 2090.

Table E-69: Alternatives A-G, First and Second Actions

Alternative Name	Alternative Description	First Action (2040)	Second Action (2090)
A	No Action	No Action	No Action
B	Nonstructural	Nonstructural in 2040 and 2065	Nonstructural in 2090 and 2115
C	Defend, Scaled for Lower Risk	13.5 feet	No action
D	Defend, Scaled for Low-Moderate Risk	13.5 feet	15.5 feet
E	Defend Existing Shoreline, Scaled for Higher Risk	15.5 feet	19 feet
F	Manage the Water, Scaled for Higher Risk	15.5 feet	19 feet
G	Partial Retreat, Scaled for Higher Risk	15.5 feet	19 feet

5 Note that, within G2CRM, the Model Areas were re-cut to represent different alignments. The results still roll up to the Reach level consistently, allowing for valid comparisons of Reach-wide performance.

Note that the difference between Alternatives E, F, and G have to do with alignments, not the height of the alternatives,[6] while Alternatives C and D have lower initial heights. Diagrams of these measures, both in 2040 and 2090, can be found in *Appendix B: Engineering*.

Each structural plan provides comprehensive inundation protection initially in the Northern Waterfront (Reaches 1 and 2), as a 2-foot wall along the piers and a wall along the waterfront protects all assets in the inventory. In the Southern waterfront, 2090 actions in Alternatives F and G moves the alignments back, exposing low-lying areas to flooding; as such, buyouts would be necessary if choosing one of those alternatives. Additionally, there are no structural defenses bayward of the line of defense (like the low walls around the piers), meaning there is a small amount of residual inundation risk in Reaches 3 and 4.

Those 2090 actions are not deterministic within the analysis. They are meant to be responsive to SLC, so if the rate of SLC is low, the adaptations are not necessary. If the rate of change is intermediate, Alternatives E through G don’t need the adaptation (as their initial elevations are higher) but Alternative D still does, as water can reach above 13.5 feet NAVD88 during the 100-year period of analysis. The rigidity with which the 2040 and 2090 actions are assumed is relaxed in later discussions about phasing and optimization. The decision about second actions is one that will require monitoring, as it is contingent on the realized rate of SLC. A discussion about monitoring, as well as a related discussion about the time it takes to bring adaptations online, can be found in the Integrated Feasibility Report and Environmental Impact Statement.

Both the structural and nonstructural measures were developed by the PDT engineers. Within the economic analysis, there are three facets that reduce damage.

- The first is the crest elevation of the measure. Under the High RSLC curve, measures with lower crest elevations can be overtopped later in the study period, leading to high amounts of damage. In some cases, overtopping can lead to damages that are higher than in the FWOP. Despite the damages being pushed forward in time (thereby making them lower in PV), the per-event damages are higher once overtopping occurs because the water depths assets are exposed to are substantially higher.
- The second is the alignment of the measures. Different alignments provide protection for different assets, both in 2040 and 2090. Unprotected areas require retreat under the High SLC curve, meaning the structures in those areas will have to be removed and the land value will be considered an NED loss. Measures that provide more protection (i.e., are closer to the shoreline) tend to be more expensive, but this cost may be justified due to protected high-value

[6] There are also nuances on a reach-by-reach level about what the initial elevation is. For more information on this, see Appendix B: Engineering. In the economic analysis, as water never reaches 15.5’ NAVD88 in the first 50-year period, there is no risk of overtopping. Building to a higher height initially does not provide additional benefits (in any benefit category) in that first period, and as the assumption is that the 2nd phase always occurs in 2090, a simplification of 15.5’ waterfront-wide is sufficient for the economic analysis.

land and structures, ensuring continued economic activity in those areas, and preventing hazardous, toxic, and radioactive waste (HTRW) sites from becoming inundated.

- The third is whether the plans replace the wharves. As replacement of the wharves changes the OMRR&R costs, plans with wharf replacement change the reduction in FWOP OMRR&R costs and the seismic damage expected to the existing piers.

The evaluation of the benefits of each of the FWP conditions requires considering the impacts of each of the differences in the plans. The crest elevation and alignment impact which assets are flooded and when those impacts occur, while the wharf replacement impacts the OMRR&R costs. The first two differences can be analyzed within G2CRM, while the third is a spreadsheet exercise. Retreat, as measured by the need for asset floodproofing and asset removal, is also a function of crest elevation and alignment, and these benefit streams are also accounted for outside of G2CRM (though they leverage results from G2CRM).

7.1 Nonstructural

Nonstructural measures fall into four broad groups resulting from the inventory and screening process including Acquisition/Relocation, Building Retrofit (floodproofing, elevations), Land Use Management (zoning changes, undeveloped land preservation), and Early Flood Warnings (evacuation planning, emergency response systems). Refinements to the National Flood Insurance Program (including increasing homeowner participation and increasing municipal protection in the Community Rating System) also represent a nonstructural opportunity, though they are outside the scope and authority of this assessment. Each measure type has a varying level of storm damage reduction function and adaptive capacity, and a complete nonstructural alternative would include each of the four measures as necessary to optimize CSRM benefits. For this analysis, though, due to the nature of the inventory (primarily commercial and industrial asset), building retrofits—specifically floodproofing—were the only measure considered to reduce CSRM risk.

Building retrofits, while effective in reducing the potential risk for storm damage to that specific structure, have no positive impact on reducing storm damage risk to surrounding property, vehicles, or infrastructure. Furthermore, access and evacuation may still be impacted with the implementation of building retrofits. While this section details the cost and benefits analysis for implementing only nonstructural measures, the most likely optimal alternative will ultimately incorporate nonstructural as a supplemental measure to structural measures to buy down residual risk.

Identifying structures eligible for building retrofits focused on identifying structures with exposure to the inundation hazard. Structures with high vulnerability to coastal storm damage, whether due to geographic conditions or FFE, were considered prime candidates for building retrofits.

A phased nonstructural plan was considered essential for this study area. This was for two reasons. One is that the main driver of risk is SLC. Floodproofing structures in 2040 that aren't at risk until there are multiple feet of SLC is a poor way to line up costs and benefits in time. As nonstructural retrofits can be done relatively quickly, a better strategy is to wait until the risk changes and only then invest in the nonstructural measures. This is possible due to the speed at which structures can be retrofit with dry floodproofing, wet floodproofing or ring levees.[7] This differs from structural measures, where construction times can run into the decades.

Another reason nonstructural intervention may be effective in this study area is because of the nature of the hazard. The difference in water level between the 1-month event and the 100-year event is only 2 feet, and since dry floodproofing tends to provide protection 3 feet above the asset's FFE, this means that the dry floodproofing is unlikely to be overtopped while an asset is occupied. By the time the dry floodproofing would be at risk of failure, the footprint of the asset would be semi-permanently or permanently flooded and there would be issues with entry/egress that would lead to the asset meeting this project's criteria for condemnation.

Nonstructural is good at reducing damages from inundation but doesn't impact retreat, which is driven by issues of repetitive flooding that changes access, and it doesn't impact the OMRR&R or system-based damage category. To first order, then, the NED benefits of nonstructural can be considered the total inundation FWOP damages. Considering the RED and OSE accounts, the RED losses, which are driven by business interruption, are also heavily reduced since businesses can rebound more quickly from flood events if they don't take physical damage. The OSE account is more difficult to quantify: many of the metrics used to evaluate OSE are based on exposure and floodproofing doesn't change exposure (i.e., the path of the water does not change). Though there is likely a tangible reduction in OSE impacts from floodproofing, the evaluation of these benefits is more difficult. It should be noted that structural measures that do not permit water to enter communities and therefore do not expose residents to the disruptions of flooding (even if their buildings do not take physical damage) will tend to do better in the RED and OSE categories than nonstructural measures. These evaluations can be seen in *Sub-Appendix E.1: RED Report* and *Sub-Appendix E.2: OSE Report*.

Two separate nonstructural plans were devised, referred to as Alternative B Intermediate and Alternative B High. Alternative B Intermediate was scoped to the Intermediate RSLC curve while Alternative B High was scoped to the High RSLC curve. Each assumes multiple actions over the 100-year period of analysis, beginning in 2040 and proceeding in 25-year increments. Again, this differs from the structural plans, which have at most two actions (2040 and 2090).

To derive these plans, two trigger thresholds were considered.

- The first was the 100-year floodplain 25 years from the implementation year. All of the assets in this floodplain were targeted for floodproofing. As the G2CRM

[7] Ring levees are technically not considered a nonstructural measure, though they behave in a similar fashion to dry floodproofing. Some areas may benefit from local, small-scale ring levees instead of widespread floodproofing; these decisions will need to be made in PED.

storm suite has the 100-year (1% AEP) event as the largest event, this means that there would be no residual risk from inundation.

- The second was for assets that would be in the 1-month floodplain by 25 years after the implementation year. These assets were assumed to be acquired and condemned, as these floodplains would have to be exposed to very frequent flooding and would need to be retreated from by the next implementation period.

A tabular description of the nonstructural plan can be found in Table E-70, along with the number of assets that would be floodproofed or removed in each 25-year timeframe under each rate of SLC.

Table E-70: Proactive Floodproofings and Removals in Alternative B High and Alternative B Intermediate

Year	Floodproofing Action	# Floodproofings		Acquisition Action	# Removals	
		Int. SLC	High SLC		Int. SLC	High SLC
2040	Assets in 2065 1% AEP Floodplain	60	520	Assets in 2065 1-month Floodplain	8	42
2065	Assets in 2090 1% AEP Floodplain	117	595	Assets in 2090 1-mont Floodplain	8	418
2090	Assets in 2115 1% AEP Floodplain	254	440	Assets in 2115 1-month Floodplain	19	747
2115	Assets in 2140 1% AEP Floodplain	315	749	Assets in 2140 1-month Floodplain	26	587

Note that the nonstructural plans were determined by referencing the ground elevation (for removals) or the FFE (for floodproofings) against the 1-month or 100-year, respectively, stillwater elevation. This is different than the water levels that are used within G2CRM, as those water levels include wave runup and suggests there may be some residual risk in these plans.

As discussed, the nonstructural plans are considered to zero out inundation damages. This simplification misses residual risk that may come from storms larger than the 100-year event that are not included in the G2CRM inventory. The nonstructural plan also zeros out the FWOP retreat cost for reactive floodproofing (floodproofing individuals undertake in an ad hoc manner in response to repeated flood damages) and the loss of the structures as homeowners leave the floodplain. These actions are now proactively taken, meaning they occur earlier in time. For example, a homeowner might stay in the floodplain and be flooded numerous times in the FWOP before floodproofing, but under Alternative B, their structure is proactively protected. There is a “benefit” of not having the FWOP floodproofing loss, but there is a corresponding cost (provided by cost engineering) of doing that action earlier.

The above discussion regarding proactive floodproofing is true with buyouts as well, which is another part of the retreat from the floodplain benefit category. Instead of assets being abandoned as they repeatedly flood, Alternative B ensures that these assets are proactively protected and then retreated from without having them incur flood damages. An important difference in the bookkeeping, then, is where costs and benefits come from. Cost Engineering provided a Total Project Cost Summary that included costs for the floodproofing done in Alternative B, but they did not provide a cost for the buyouts. As such, the difference between the buyout cost in Alternative B and the condemnation cost in the FWOP is considered a disbenefit, since the buyout costs happen as many as 25 years earlier in Alternative B and therefore are more expensive than they would be in the FWOP.

A discussion of the differences between the FWOP condition and Alternative B can be found in Table E-71. It also includes if the loss category is considered on the benefits side (which may include FWOP losses) or on the cost side.

Table E-71: Conceptual Differences in Costs and Benefits Between FWOP and Alternative B

	FWOP	**Alternative B**
Inundation Losses	Occur until an asset reaches removal threshold (cumulative damage/number rebuilds), considered a benefit (loss)	Reduced to zero due to proactive floodproofing, considered a benefit
Floodproofing	Reactive, considered a benefit (loss)	Proactive, considered a cost
Condemnation	Reactive, considered a benefit (loss)	Proactive, considered a disbenefit (loss)
Land Loss	Calculated when land is in 1-month floodplain, considered a disbenefit (loss)	Calculated when land is in 1-month floodplain, considered a disbenefit (loss)

Alternative B, though it eliminates flooding damages and removes reactive floodproofing and retreat in favor of a holistic, proactive plan, does not impact the land loss that comes from retreat, nor the seismic concerns or the OMRR&R costs for the existing seawall, nor the system impacts from flooding to the SFMTA and SFPUC infrastructure. Under the High SLC curve, coordinated local action will be needed to mitigate those impacts at the cost of billions of dollars.

7.2 First Action, Structural

As mentioned, the 2040 structural action has three main decisions that directly influence the benefits: alignment, crest elevation, and whether the wharves are replaced. Other nuanced considerations, such as the materials used, may impact costs; these considerations are discussed throughout *Appendix B: Engineering*.

In Reaches 1 and 2, the alignments are very similar for Alternatives C through G. In Reach 2, Alternatives E, F, and G differ in whether the seawall is built “in the wet” or “in the dry,” but that decision doesn’t impact the assets that are protected and, therefore, does not change the benefits calculation (though it has a large impact on costs).

In Reaches 3 and 4, the alignments vary considerably, even for the first action. Alternatives C, D, and E are the most bayward, thereby providing protection for the most assets. Alternative F uses water management structures across the two creeks; this initial alignment is more landward than Alternative E and leaves some areas bayward of the new line of defense. Alternative G ties into high ground even further back, leaving more areas around the creeks and in the southern part of Reach 3 unprotected. This is the most initial retreat of any of the alternatives in this initial array. These alignments can be seen on Figure E-44, Figure E-45, and Figure E-46 and in detail in *Appendix B: Engineering*, which depicts the inundation maps for the FWOP and FWP conditions.

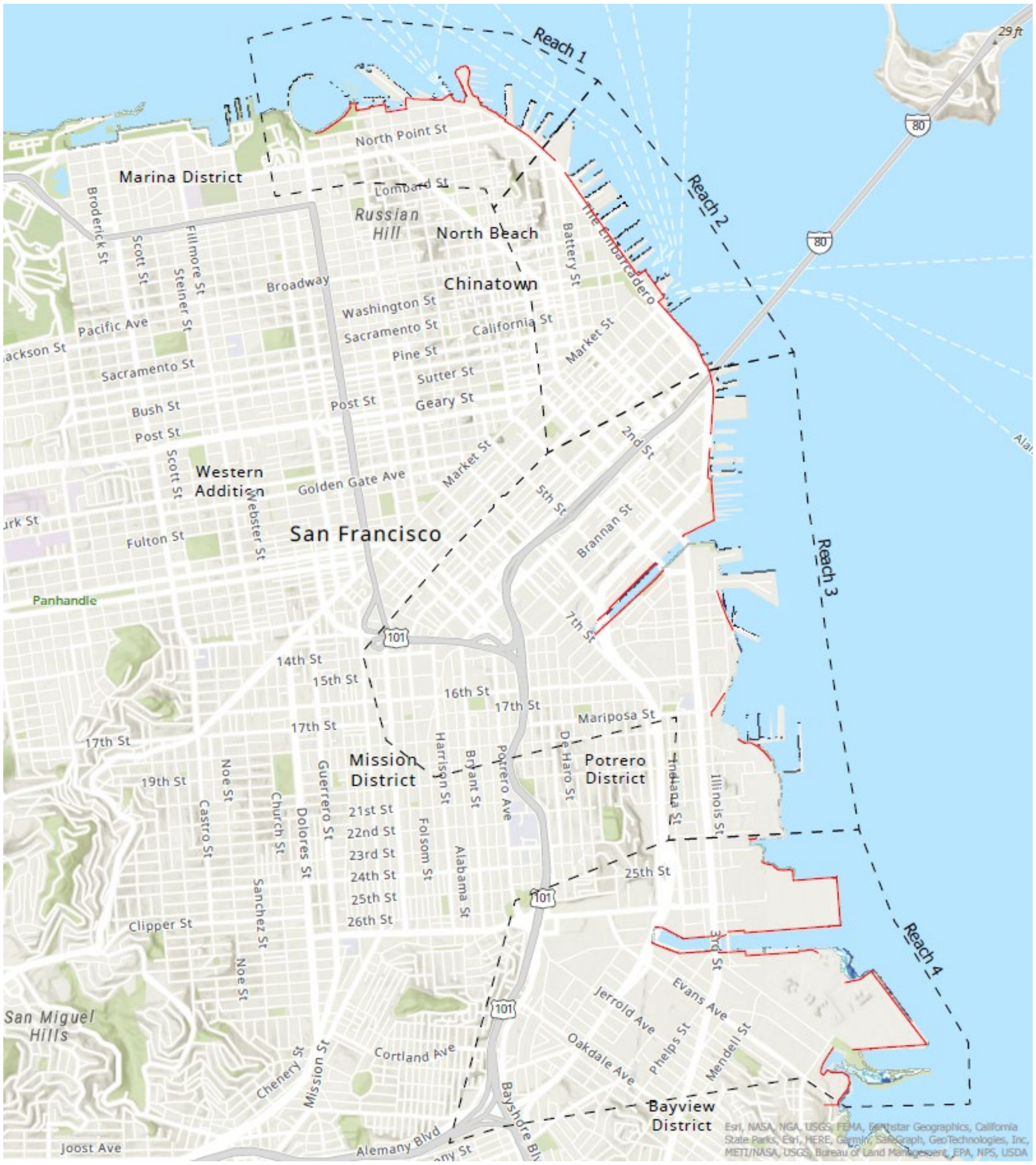


Figure E-44: Alignment of Alternatives C, D, and E (2040)

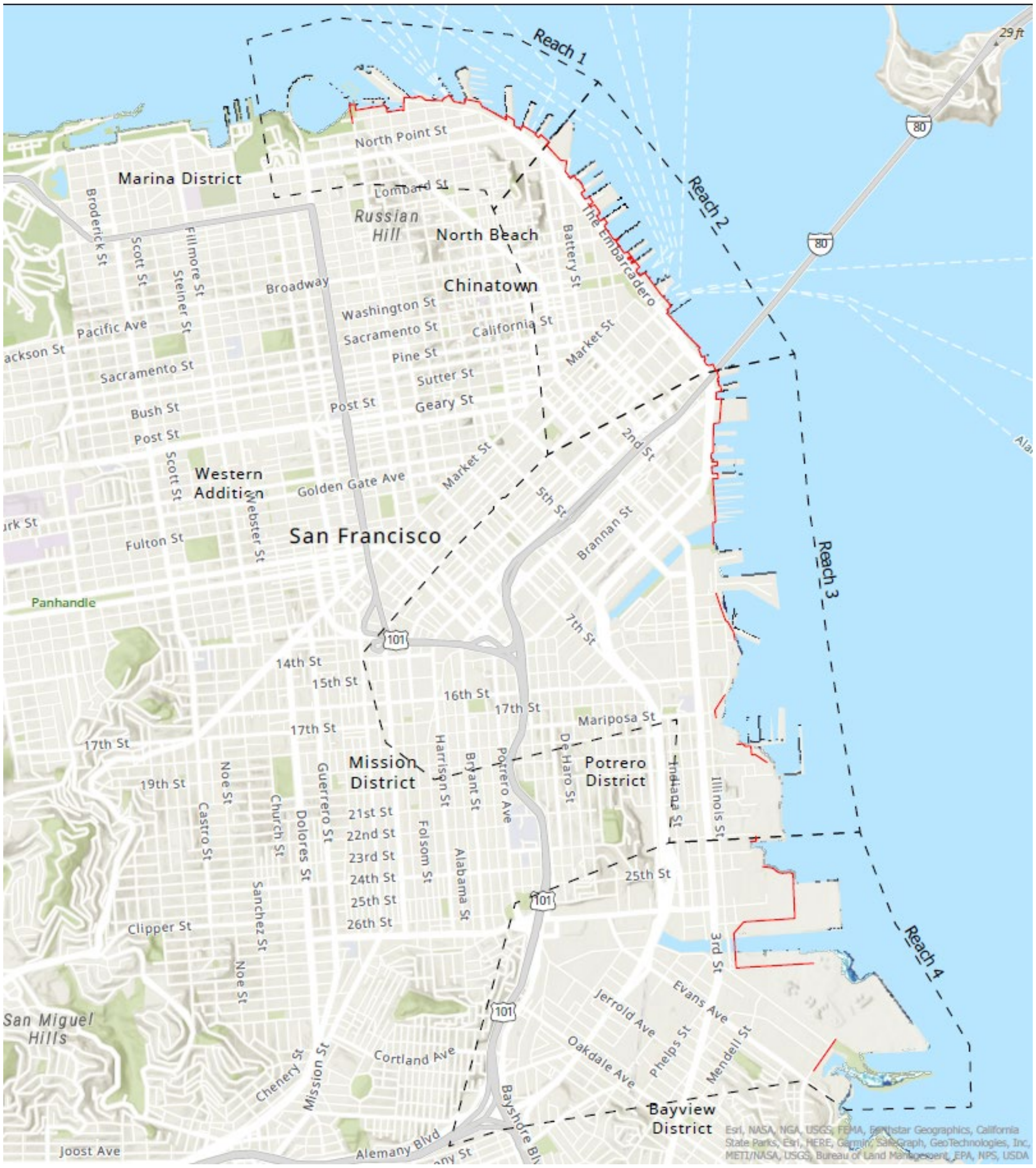


Figure E-45: Alignment, Alternative F, 2040

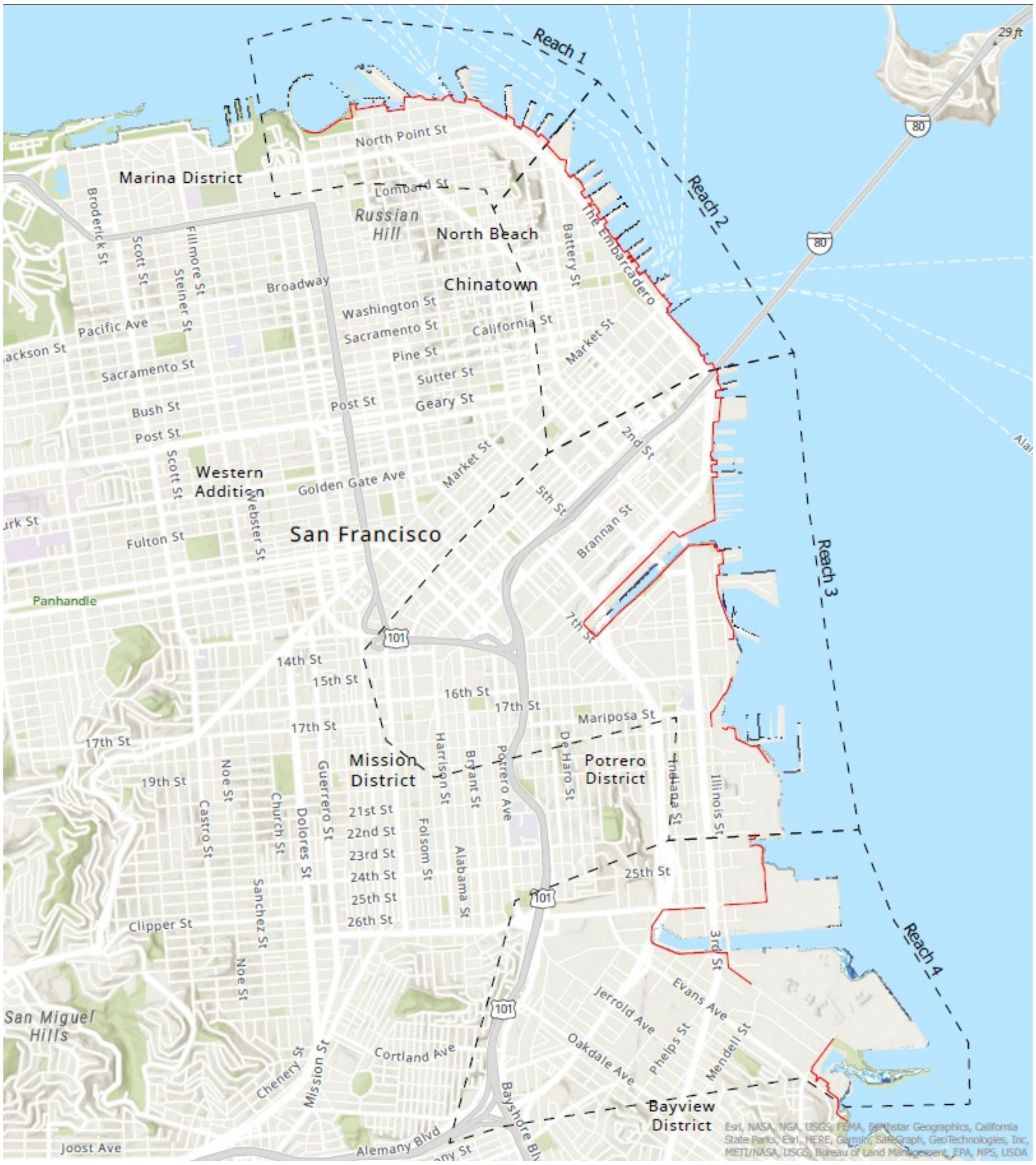


Figure E-46: Alignment, Alternative G, 2040

The first action heights are either 13.5 feet NAVD88 (for Alternatives C and D) or 15.5 feet NAVD88 (for Alternatives E through G). These heights were determined by scoping to two different rates of SLC: the 13.5 feet was scoping to a “lower” rate while the 15.5 feet was scoped to a “higher” rate. They were not pegged exactly to the Low, Intermediate, or High SLC curves, though the performance of Alternatives C and D is better under the Low and Intermediate curves while the performance of Alternatives E through G is better under the High curve.

Under the Low and Intermediate RSLC curves, the 13.5 feet crest elevation is sufficient for preventing overtopping until 2090. Under the High RSLC curve, though, Alternatives

C and D can be overtopped by rare events starting at the end of the 2060s. Overtopping events cause significantly more damage than typical FWOP events, since instead of sea levels steadily rising and retreat occurring as assets are inundated with low levels of water, sea levels rise behind the wall while the inventory remains in place. After an overtopping event, assets can have 4 feet of water at their ground elevation, causing significantly more damage than the lower levels of water that would happen in FWOP flooding events. With a crest elevation of 15.5 feet, though, there are no overtopping events through 2090.

Regarding wharf replacement, only Alternatives E through G do this. Alternative E does the most wharf replacement while Alternatives F and G do some; the impacts to the OMRR&R benefit category are predicated on this action.

A note about the first action: the first action will be made with minimal knowledge about what rate of SLC will be expected over the next 50 years. Looking at how the lower elevation alternatives perform against the lower rates of change or how the higher elevation alternatives perform against the higher rates of change is useful, but because SLC is exogenous, it is particularly important to note how the measures perform when faced with scenarios that the measures *were not* designed for. This allows the PDT to evaluate the risks of over- and under-building and can help facilitate decision making with all three curves in mind. Second actions (discussed below) will be taken with more certainty about the rate of SLC, but the PDT does not have that luxury while taking the first action.

7.3 Second Action, Structural

The 2090 second actions for the structural plans vary in the same ways the 2040 actions do: in alignment, crest elevation, and whether or not the wharves are replaced.

Alternative C has no 2090 action. Under the Low SLC curve, this is sufficient, but under the Intermediate SLC curve the 13.5 feet elevation can be overtopped by the 2130s. As mentioned, under the High SLC curve, Alternative C is overtopped before 2090.

Alternative D has a 2090 action to raise the level of protection in place to 15.5 feet. This is not overtopped under the Low or Intermediate SLC curves, though under the High SLC curve, it is overtopped in the 2110s. Alternative D also includes the replacement of wharf structures along the Embarcadero in Reaches 1, 2, and part of 3 as a component of the coastal flood risk reduction measure. In the evaluation of OMRR&R benefits this is considered to have marginal influence, since most of the existing wharf structures will be beyond their expected useful life, such that this action would provide a flood risk reduction benefit but not the OMRR&R benefits a similar 2040 action would create.

Alternatives E through G raise the level of protection from 15.5 feet to 19 feet. The 19-foot level of protection can be overtopped in rare events at the end of the period of analysis under the High SLC curve. Alternative E goes to 19 feet in place, but Alternatives F and G have additional retreat. The alignments of Alternative F and G can be seen on Figure E-47 and Figure E-48. Note that the alignments for Alternatives C, D, and E do not change, either because the adaptation was built in place or because there is no 2090 addition.

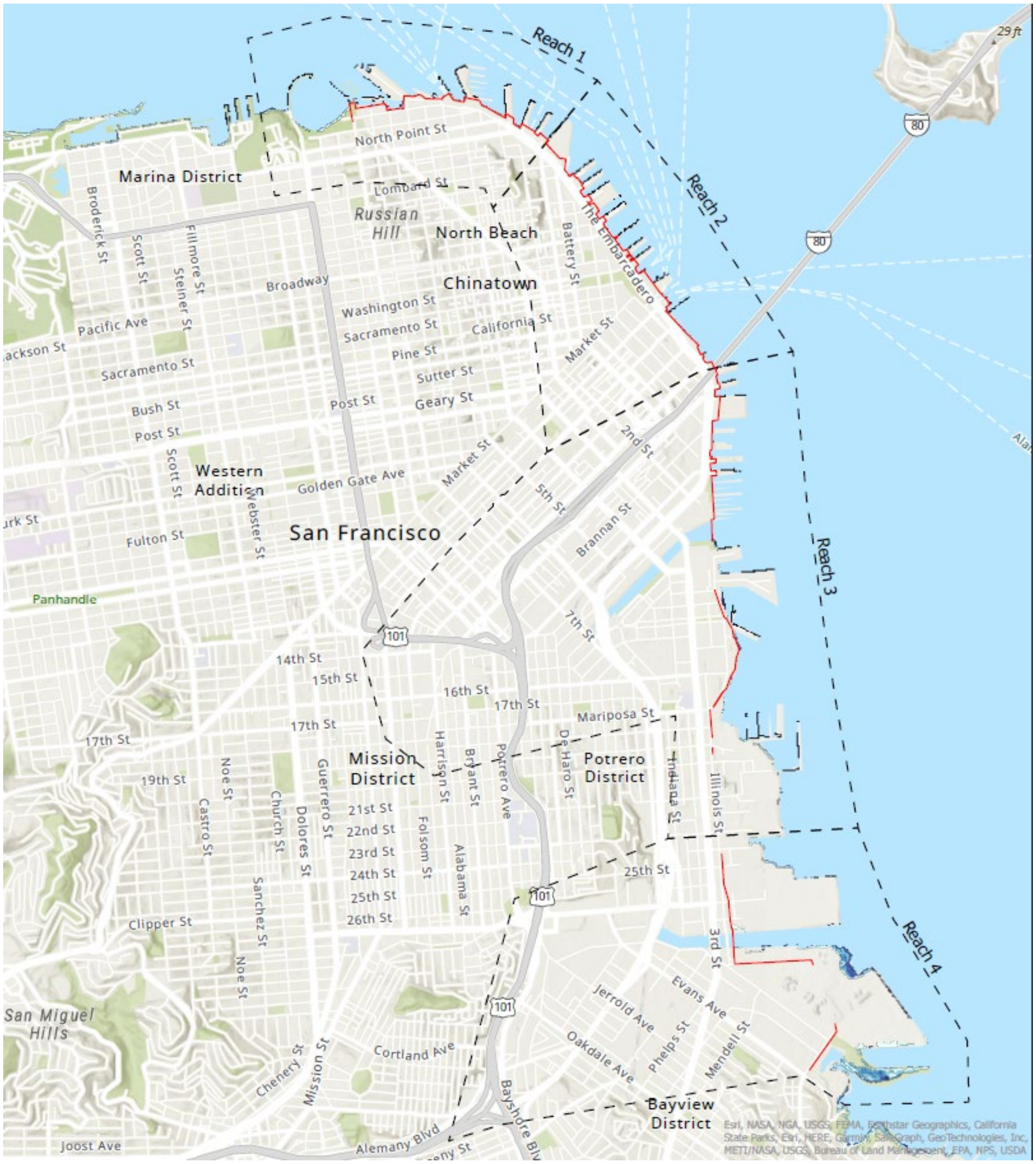


Figure E-47: Alignment, Alternative F, 2090

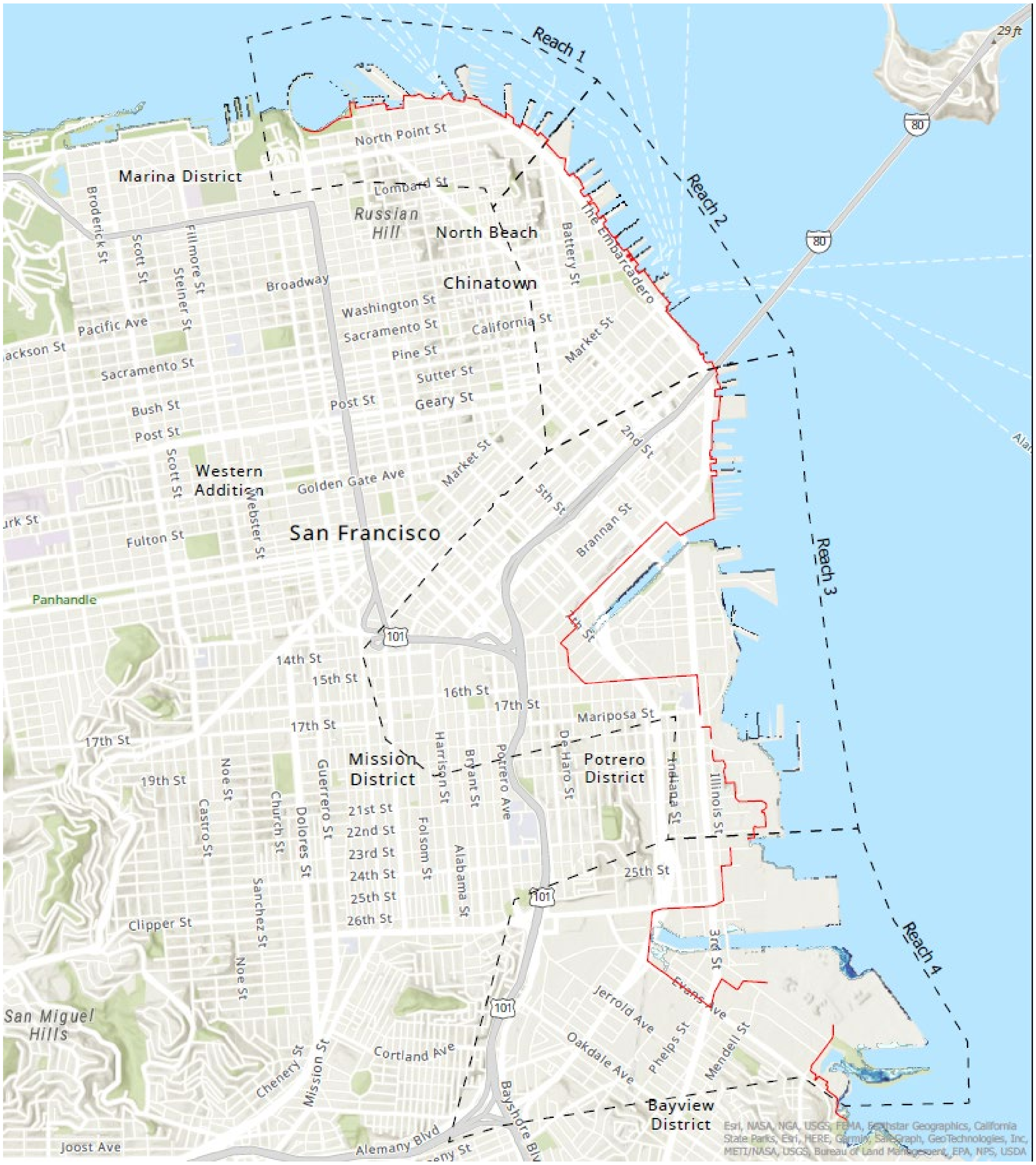


Figure E-48: Alignment, Alternative G, 2090

7.4 Adaptation

To simplify the analysis, the initial array of alternatives considered actions only in 2040 and 2090. In actuality, if a higher rate of SLC was realized, an adaptive action could be built. As an example, consider if Alternative D was built in 2040. Alternative D has a second action in 2090 to go to 15.5 feet, but if the High rate of SLC is what is realized, vulnerability from overtopping exists before the second action occurs. That second action could be done earlier in the period of analysis to buy down the new risk presented from the High rate of SLC.

In the same way, if Alternative D was raised to 15.5 feet to protect against a High rate of RSLC, that raised structure would be vulnerable to overtopping in the 2110s. An additional adaptation, such as building Alternative E or retreating from the area that is now at risk from overtopping, would be available to reduce risk. A variety of actions may be cost-justified at this point to respond to the new, higher rate of risk.

As shown above, an adaptation could be going to the second action of a plan earlier or later (thereby relaxing the 2040/2090 binary framework) or “pivoting” to a larger plan from a smaller plan. These refinements that reflect alternative paths that can be taken after a first action are explored more in Section 9, as the lessons that were learned from the initial array were applied to select a first action that could be resilient under a variety of future conditions.

7.5 Costs

The costs for the plans are shown in Table E-72 through Table E-79 by reach. The first four tables show the cost of the 2040 action, while the second four tables show the cost of the full reach-level plan (meaning 2040 actions and 2065, 2090, and 2115 actions where applicable). Under the High RSLC curve, the assumption is that the higher cost would represent the total, while under the Intermediate and Low RSLC curves, the cost would only include the 2040 action. (An exception to this is Alternative D, where the 2090 action is needed under the Intermediate RSLC curve.) Note that these costs do not include seismic costs; as stated in WRDA 2022 Section 152, as amended, the seismic costs are not considered when calculating net benefits for this study.

The Real Estate costs were provided by the PDT’s Real Estate team; the derivation of those costs is discussed in *Appendix F: Real Estate Plan*. The estimates on construction duration were provided by the Engineering team; a discussion of those estimates can be found in *Appendix C: Cost Engineering*. The OMRR&R rates were also estimated by the Engineering team. The nonstructural alternatives are assumed to have no OMRR&R (though this assumption may be revised in the future, as there may be expenses associated with storing equipment like flood shields, stop logs, and panels), while the structural alternatives used an OMRR&R rate of 0.5% of the capital cost per year. An exception to this is Alternative F in Reaches 3 and 4, where the water management structures were assumed to have a higher OMRR&R rate of 2% per year.

Table E-72: Costs, Reach 1 Without Seismic, 2040 ($000s)

Plan	Total Construction	Duration (Months)	IDC	Subtotal Average Annual Cost (AAC)	OMRR&R	Total AAC
B Int.	16,196	3	33	478	-	478
B High	79,320	3	164	2,341	-	2,341
C	127,108	72	9,758	4,031	636	4,667
D	92,602	96	9,674	3,012	463	3,475
E	3,246,873	180	678,917	115,631	16,234	131,865
F	1,964,731	180	410,823	69,970	9,824	79,794
G	1,071,822	180	224,117	38,171	5,359	43,530

Table E-73: Costs, Reach 2 Without Seismic, 2040 ($000s)

Plan	Total Construction	Duration (Months)	IDC	Subtotal AAC	OMRR&R	Total AAC
B Int.	20,685	3	43	611	-	611
B High	109,778	3	226	3,240	-	3,240
C	203,803	72	15,646	6,464	1,019	7,483
D	119,155	96	12,448	3,876	596	4,472
E	4,097,548	180	856,792	145,926	20,488	166,414
F	7,477,883	180	1,563,615	266,310	37,389	303,699
G	2,898,048	180	605,978	103,208	14,490	117,698

Table E-74: Costs, Reach 3 Without Seismic, 2040 ($000s)

Plan	Total Construction	Duration (Months)	IDC	Subtotal AAC	OMRR&R	Total AAC
B Int.	319,421	3	658	9,428	-	9,428
B High	632,903	3	1,305	18,680	-	18,680
C	385,243	72	29,574	12,218	1,926	14,144
D	345,323	96	36,076	11,234	1,727	12,960
E	4,350,434	180	909,670	154,932	21,752	176,684
F	2,539,303	180	530,965	90,432	50,786	141,218
G	1,911,662	180	399,726	68,080	9,558	77,638

Table E-75: Costs, Reach 4 Without Seismic, 2040 ($000s)

Plan	Total Construction	Duration (Months)	IDC	Subtotal AAC	OMRR&R	Total AAC
B Int.	47,679	3	98	1,407	-	1,407
B High	120,125	3	248	3,545	-	3,545
C	745,630	72	57,240	23,648	3,728	27,376
D	814,898	96	85,134	26,510	4,074	30,584
E	4,038,817	180	844,511	143,834	20,194	164,028
F	746,511	180	156,094	26,586	14,930	41,516
G	1,584,375	180	331,291	56,424	7,922	64,346

Table E-76: Costs, Reach 1, All Actions Without Seismic ($000s)

Plan	Total Construction	Duration (Months)	IDC	Subtotal AAC	OMRR&R	Total AAC
B Int.	32,985	3	68	974	-	974
B High	199,350	3	411	5,884	-	5,884
C	127,108	72	9,758	4,031	636	4,667
D	191,173	96	19,972	6,219	956	7,175
E	3,369,530	180	704,564	119,999	16,848	136,847
F	1,971,113	180	412,157	70,197	9,856	80,053
G	1,104,739	180	230,999	39,343	5,524	44,867

Table E-77: Costs, Reach 2 Without Seismic, All Actions ($000s)

Plan	Total Construction	Duration (Months)	IDC	Subtotal AAC	OMRR&R	Total AAC
B Int.	78,264	3	161	2,310	-	2,310
B High	601,180	3	1,239	17,744	-	17,744
C	203,803	72	15,646	6,464	1,019	7,483
D	448,469	96	46,852	14,589	2,242	16,832
E	4,341,251	180	907,750	154,605	21,706	176,311
F	7,483,373	180	1,564,763	266,505	37,417	303,922
G	2,913,151	180	609,136	103,746	14,566	118,312

Table E-78: Costs, Reach 3 Without Seismic, All Actions ($000s)

Plan	Total Construction	Duration (Months)	IDC	Subtotal AAC	OMRR&R	Total AAC
B Int.	409,445	3	844	12,085	-	12,085
B High	1,443,015	3	2,974	42,590	-	42,590
C	385,243	72	29,574	12,218	1,926	14,144
D	598,300	96	62,505	19,463	2,991	22,455
E	4,601,727	180	962,215	163,881	23,009	186,890
F	2,883,613	180	602,960	102,694	57,672	160,366
G	2,213,234	180	462,784	78,820	11,066	89,886

Table E-79: Costs, Reach 4 Without Seismic, All Actions ($000s)

Plan	Total Construction	Duration (Months)	IDC	Subtotal AAC	OMRR&R	Total AAC
B Int.	73,384	3	151	2,166	-	2,166
B High	306,609	3	632	9,050	-	9,050
C	745,630	72	57,240	23,648	3,728	27,376
D	1,015,130	96	106,052	33,023	5,076	38,099
E	4,197,848	180	877,765	149,498	20,989	170,487
F	1,141,645	180	238,717	40,657	22,833	63,490
G	1,839,560	180	384,650	65,512	9,198	74,710

Though the seismic costs are not used in benefit calculation due to the WRDA language, they are still real costs that are incurred. Additionally, the amount of cost that is attributed to “seismic” is not equal across measures; some measures have a larger percentage of their total cost considered seismic while others have a lower percentage. For example, 86% of the cost of Alternative D is considered seismic while only 36% of the cost of Alternative G is considered seismic (though the seismic costs are relatively close in cost between the structural plans). In plan selection, then, the marginal costs including seismic between plans should be considered. For reference, the first costs with seismic are provided in Table E-80 and Table E-81. A discussion of these costs is included in *Appendix A: Plan Formulation Appendix* and *Appendix C: Cost Engineering*.

Table E-80: Reach-Level Construction Costs Including Seismic (2040, $, PV)

	1	2	3	4
B Int	16,196	20,685	319,421	47,679
B High	79,320	109,778	632,903	120,125
C	684,152	3,241,445	1,591,405	6,098,915
D	624,781	2,604,581	1,748,036	6,548,713
E	4,484,113	9,588,049	5,853,343	5,962,299
F	2,509,042	10,212,220	3,556,641	1,538,850
G	1,364,499	4,248,196	2,561,430	4,031,910

Table E-81: Reach-Level Construction Costs Including Seismic (2040 through 2115, $, PV)

	1	2	3	4
B Int	32,985	78,264	409,445	73,384
B High	199,350	601,180	1,443,015	306,609
C	684,152	3,241,445	1,591,405	6,098,915
D	723,352	2,933,894	2,001,013	6,748,945
E	4,606,770	9,831,753	6,104,636	6,121,330
F	2,515,459	10,217,741	3,924,345	1,944,970
G	1,421,188	4,381,083	2,922,690	4,337,770

8. Future With Project Results

This section details the methodology and results of investigating the alternatives detailed in Section 7 under the three rates of RSLC. Table E-82, Table E-83, and Table E-84 show the economic analysis results for the alternatives discussed above. Economic examination uses a 100-year period of analysis with the FY2023 Federal Discount Rate of 2.5%.

The costs and results shown are presented as deterministic values but are actually the means for a distribution of outcomes. Results by iteration from G2CRM are shown afterwards to leverage uncertainty in key inputs such as foundation height, depreciated replacement value, depth-percent damage functions, and storm sequencing to take a range of values rather than a deterministic variable. Monte Carlo modeling provides a range of future scenarios to estimate the overall distribution of future results for each proposed alternative. Other benefit categories do not have uncertainty explicitly built into them but should also be considered to be probabilistic, not deterministic. They are not tied to uncertainty storm sequences, though, as they are instead linked to the SLC rate. That rate is inherently uncertain, though the damages realized under the SLC rate are modeled deterministically.

Using the distributions of NED results by alternative can inform the decision-making process by attaching uncertainty to what are often considered deterministic values. Instead of asserting that the identified plan is necessarily the NED plan, the plan can instead be selected with a level of confidence attached to it. Additionally, plan selection should be achieved not only with NED results by alternative, but with acknowledgment of other relevant decision metrics such as residual risk, adaptability to SLC, reliability, and life safety. Because the results vary so much by SLC curve, the study is not scoped to any one curve and, as such, NED plans are identified for each SLC curve.

8.1 Inundation Results

Like in the FWOP analysis, the inundation result losses come from G2CRM. For assets behind the line of defense, there will not be inundation damages until either the line of defense moves and those assets are retreated from or the line of protection is overtopped. As mentioned, overtopping from the 1% AEP can occur by 2070 under the Intermediate curve for Alternative C and by 2110 under the high curve for Alternative D. Alternatives E, F, and G can be overtopped by the end of the study time frame, though this does not happen deterministically. Under the Intermediate curve, Alternative C can be overtopped by 2130.

Table E-82, Table E-83, and Table E-84 show the inundation losses by plan and by reach for each SLC curve.

Table E-82: FWP Inundation Losses, High SLC (PV, $)

Alternative	1	2	3	4	Total

FWOP	678,536,000	4,680,872,000	5,942,880,000	1,039,913,000	**12,342,201,000**
C	669,970,000	4,581,577,000	5,564,548,000	1,104,009,000	11,920,104,000
D	653,440,000	4,239,384,000	5,321,022,000	1,095,605,000	11,309,451,000
E	18,806,000	132,306,000	674,900,000	130,623,000	956,635,000
F	18,711,000	132,626,000	568,782,000	208,728,000	928,847,000
G	3,585,000	34,962,000	825,528,000	338,535,000	1,202,610,000

Table E-83: FWP Inundation Losses, Int. SLC (PV, $)

Alternative	1	2	3	4	Total
FWOP	50,079,000	1,053,204,000	1,646,567,000	281,087,000	**3,030,937,000**
C	-	6,948,000	110,025,000	32,035,000	149,008,000
D	-	-	83,808,000	28,622,000	112,430,000
E	-	-	78,683,000	16,917,000	95,600,000
F	-	-	37,071,000	93,319,000	130,390,000
G	-	-	713,994,000	234,769,000	948,763,000

Table E-84: FWP Inundation Losses, Low SLC (PV, $)

Alternative	1	2	3	4	Total
FWOP	4,377,000	216,793,000	600,092,000	158,418,000	979,680,000
C	-	-	15,325,000	8,384,000	23,709,000
D	-	-	17,309,000	6,274,000	23,583,000
E	-	-	14,998,000	7,764,000	22,762,000
F	-	-	4,490,000	62,661,000	67,151,000
G	-	-	65,361,000	113,341,000	178,702,000

The residual risk that exists for the various measures primarily stems from two places. One is in the unprotected areas; those are the areas bayward of the line of defense in Reaches 3 and 4. While bayward areas in Reaches 1 and 2 are expected to be defended through nonstructural measures or ring levees, the areas in Reaches 3 and 4 are not and as such take damage under all three SLC curves. Refinements to buy down this residual risk are expected before the final report.

The other source of residual risk is overtopping. Areas that are defended do not have changes to the inventory (floodproofing/retreat), and as such, overtopping poses them great risk. One of the main lessons of this exercise is that measures that defend will accrue benefits, but if the measures that defend begin to fail, those benefits will likely be "given back" as high-damage events become more and more likely. Note that, though Alternative C is overtopped under the Intermediate SLC curve, this is not true in Reach 1 as the water levels are slightly lower than in the other reaches.

Figure E-49 shows the damages by alternative over the course of the study period for the High SLC curve.

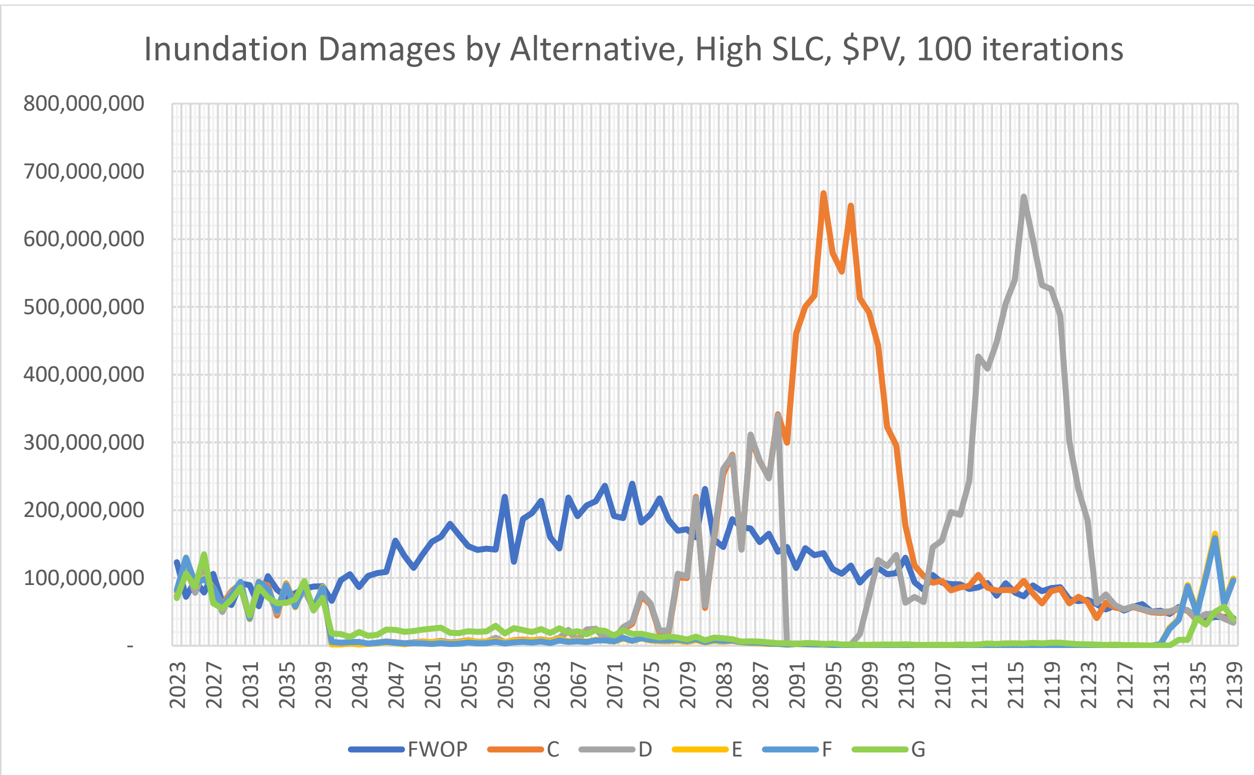


Figure E-49: Damages by Alternative, PV Dollars

First, the two large spikes are the damages from overtopping of Alternatives C and D. They are both overtopped in rare (but progressively more common) events before 2090 (note that the grey and red lines perfectly overlap) but after 2090, Alternative D goes to 15.5 feet while Alternative C stays at 13.5 feet. For Alternative C, overtopping events become more frequent and the average yearly damages increase to being substantially more than the FWOP damages. This occurs with Alternative D as well, though it is only once SLC makes the 15.5 feet wall vulnerable to frequent overtopping events.

Of interest is that, by the end of the study time period, even the 19 feet wall heights of E, F, and G can be overtopped. It is only in rare events, which is why the uptick in damages is small, but the damage in those events is catastrophic. For Alternative G, the damages are slightly lower; this is because the area that is retreated from won't be damaged in the overtopping events, reducing the damage pool.

Other than the damages from overtopping and the risk to assets in Reaches 3 and 4 that are bayward of the alignment, there is little residual risk as retreat is considered proactive in the FWP condition (meaning that, in the areas in Alternative F and Alternative G that are between the 2040 and 2090 alignment, the assumption is that those assets are proactively condemned when the line of defense is moved landward).

8.2 Retreat Results

Retreat within the model looks specifically at the cost of floodproofing, the cost of retreating from vulnerable areas, and the loss of the land. Table E-85 and Table E-86 only show the High and the Intermediate curves, as the retreat costs under the Low SLC curve are approximately equal in the FWOP and FWP conditions.

Table E-85: FWP Retreat Losses, High SLC (PV, $)

Plan	1	2	3	4	Total
FWOP	218,041,000	2,217,767,000	2,489,096,000	327,594,000	5,252,499,000
B High	299,639,000	3,020,259,000	3,373,327,000	456,607,000	7,149,832,000
C	207,263,000	1,993,659,000	1,997,357,000	266,016,000	4,464,296,000
D	165,566,000	1,502,328,000	1,533,726,000	218,013,000	3,419,633,000
E	37,718,000	44,056,000	61,026,000	10,775,000	153,576,000
F	40,417,000	44,056,000	133,262,000	106,346,000	324,080,000
G	37,718,000	44,056,000	1,769,654,000	197,355,000	2,048,784,000

Table E-86: FWP Retreat Losses, Int. SLC (PV, $)

Plan	1	2	3	4	Total
FWOP	859,000	813,000	122,377,000	31,072,000	155,122,000
B Int.	953,000	1,421,000	180,946,000	43,121,000	226,441,000
C	859,000	813,000	4,490,000	-	6,163,000
D	859,000	813,000	4,395,000	-	6,068,000
E	68,000	-	2,984,000	3,586,000	6,637,000
F	68,000	-	4,395,000	14,374,000	18,837,000
G	68,000	-	4,490,000	19,223,000	23,780,000

Note that, for the nonstructural alternatives, the removal costs are higher in each reach than in the FWOP under the same SLC curve condition. This is due to the removals being preemptive instead of being driven by damaging events; this means they occur earlier in time and are not discounted as much, leading to their values in PV dollars being higher.

Also of note is the difference between Alternatives E, F, and G under the High SLC curve. Alternative F has more retreat than Alternative E, leading to higher costs for asset removals, but Alternative G in Reaches 3 and 4 has substantially more retreat, especially in areas with higher value assets, that results in very high retreat costs.

While asset removals total in the billions of dollars under the High curve, on the Intermediate they are an order of magnitude lower. Because the measures sufficiently protect the assets and there are no 2090 retreating actions, the FWP asset removal costs are substantially lower and distinguishable only by small differences in the initial alignments.

8.3 OMRR&R

The presented OMRR&R values will not be fully mitigated in the FWP scenario, especially for the alternatives that do not replace the existing coastal flood defense structures with new structures (Alternatives B, C, and D). The FWP scenario will also have expected OMRR&R values assigned which will be assumed as a percentage of the capital construction cost. For the high curve alternatives (E, F, G) with capital construction costs greater than $10 billion, the annual OMRR&R burden is likely on the order of $30 million plus larger investments at 10- or 25-year intervals for major repairs, resulting in OMRR&R values that should be offset by values (Maintenance and Earthquake) presented for the FWOP scenario.

To better understand how this FWOP quantification is applied to the evaluation of benefits, Table E-87 is intended to provide an indication of where the OMRR&R expenditures differ between the FWOP and FWP conditions and where the OMRR&R

expenditures are currently not quantified to maintain economic conservatism and support risk informed decision making.

Utilizing the methodology and tools compiled for quantification of the FWOP OMRR&R values, the expected OMRR&R expenditure associated with each FWP alternative was calculated. Since the various FWP alternatives have not been fully detailed and designed, several assumptions have been made to enable a risk informed calculation that relies on existing information and professional judgment of the PDT. For the FWP alternatives, it is assumed that where coastal defense structures are re-constructed, they are built in a manner that meets modern seismic design codes and standards whereby earthquake risk such as lateral spreading and liquefaction are potentially mitigated. Additionally, it is assumed that the cost of annual maintenance for each FWP alternative that replaces elements of the current coastal defense structure is tracked and accounted for on the cost side; therefore, to avoid double counting, the maintenance cost carried for the FWP OMRR&R calculations has been reduced where applicable to reflect expenditure on only existing structures that remain in place. The following assumptions are specific to each group of alternatives and will be used to complete the quantification of expected FWP OMRR&R expenses.

Table E-87: Summary of FWOP and FWP OMRR&R Expenditures by Category for All Reaches

	SLR Scenario	Present Value		
		Maintenance	Earthquake	Total
A (FWOP), B, C & D	LOW	$ 1,008,058,021	$ 1,604,638,206	$ 2,612,696,227
	INT	$ 1,008,058,021	$ 1,604,638,206	$ 2,612,696,227
	HIGH	$ 1,008,058,021	$ 1,585,516,821	$ 2,593,574,842
E	LOW	$ -	$ 16,098,525	$ 16,098,525
	INT	$ -	$ 16,098,525	$ 16,098,525
	HIGH	$ -	$ 15,027,715	$ 15,027,715
F & G	LOW	$ 411,886,761	$ 1,141,824,258	$ 1,553,711,018
	INT	$ 411,886,761	$ 1,141,824,258	$ 1,553,711,018
	HIGH	$ 411,886,761	$ 1,140,753,448	$ 1,552,640,209

8.3.1 Alternatives B, C, and D

This group consists of the nonstructural alternative and two lower SLC curve structural alternatives that consist of a narrower range of CSRM measures. In general, both the structural and nonstructural measures rely upon the existing coastal defense structure as a foundational element for the added protection, and thus do not offset the future OMRR&R expenditure related to either annual maintenance or earthquake risk. As such, the OMRR&R expenditure will be taken as the same value as the FWOP condition. Note that Alternative D does intend to replace the existing wharf structures in year 2090; however, due to the age of the wharves and likelihood that these structures have already exceeded their useful life, this has limited impact on the quantification of OMRR&R expenditures and therefore was not accounted for in this calculation.

8.3.2 Alternative E

This alternative has a line of defense that follows the existing shoreline, which results in the replacement of all existing coastal defense structures. To represent the replacement of existing structures with modern, code-compliant structures in the quantification of earthquake damages, the fragility relationships established for the Brannan Street Wharf constructed less than 15 years ago were utilized. This extrapolation allowed the quantification to reflect the improved structural performance and the decrease in the lateral spreading and liquefaction potential associated with the scope of work identified for Alternative E. Additionally, the annual maintenance cost for the coastal defense structures was decreased to $0 because all coastal defense structures are replaced in this alternative and that the OMRR&R cost associated with the alternative is accounted for on the cost side as a percentage of the capital cost of construction.

8.3.3 Alternatives F and G

This group of alternatives consists of two higher RSLC curve structural alternatives that replace a portion of the existing coastal defense structures and retreat from other portions of the existing shoreline. Where existing coastal defense structures are replaced in the Northern Waterfront, the OMRR&R quantification for these alternatives will utilize the same assumptions as Alternative E. However, within the Southern Waterfront, the existing coastal defense structures are not replaced therefore there will be no change to the earthquake performance or need for annual maintenance (assuming that these structures are not left to self-demolish along the shoreline). The annual maintenance value used for FWOP condition has been factored based upon the area of existing coastal defense structures in the Northern Waterfront compared to the area in the Southern Waterfront, which equates to approximately 40% of the total and scaled annual value of $11 million.

8.3.4 FWOP and FWP Results

The quantitative results for both the FWOP and FWP OMRR&R expenditure is included in Table E-87 for each group of FWP condition and each RSLC scenario. These results convey the benefit of replacing existing coastal defense structures as part of the FWP alternatives through significant reduction in the annual maintenance expenditure as well as reduced earthquake risk. The resulting earthquake risk for comparison of the earthquake-related OMRR&R values for Alternatives E, F, and G show that wharves in the Southern Waterfront are key drivers of the total value, which reflects their typically longer remaining useful life and anticipated high seismic vulnerability. A significant number of Northern Waterfront coastal defense structures reach the end of their maximum useful life at 2050 and therefore are lesser contributors to the earthquake-related OMRR&R values.

8.4 SFMTA System Benefits

A discussion of the FWOP actions needed and their respective costs can be found in Table E-64. The different alternatives proposed by the PDT may make some of those actions unnecessary. Alignments that are set back from the Bay may not protect all of the SFMTA assets, though, leaving them vulnerable and necessitating adaptive actions.

The actions that still need to be taken under the different FWP plans are marked with an "X" in Table E-88.

Table E-88: FWP SFMTA Adaptations Needed by Plan

Reach	Name of Adaptation	C/D/E	F	G
1	Central Subway Extension	x		x
2	Temporary street grates/vent covers (50 covers)	x		x
2	Temporary flood gates for Embarcadero Station entrances (6 entrances)	x		x
2	Temporary flood gate for Folsom Portal			
2	Ductbank Reinforcement	x		x
2	Signal and Controller Cabinets	x		x
2	Relocate F Loop for continued Historic Streetcar operation on Market	x		x
2	Replace Muni Metro Turnaround	x		x
3	King Street Substation reinforcement			x
3	Illinois Street Substation reinforcement			x
3	Connect Mission Bay Tunnel to J-Church via 16th Street			x
3	Central Subway Mission Bay Tunnel			x
4	Islais Creek Facility Reinforcement	x	x	x
4	Relocate Islais Creek and 1399 Functions	x		x
4	Connect T Third and Balboa Park to new Cow Palace Rail Yard	x		x
4	Relocate MME functions to Cow Palace			

For Alternative C and D under the High curve, the measures push the need for adaptation into the future, but the adaptation is still necessary once the measure begins to be overtopped. For Alternative E, building higher in place continues to provide a sufficient level of protection. Alternative G has more retreat in Reaches 3 and 4 and, as such, there is more residual risk to the SFMTA system. Alternative F, which is the preferred plan for SFMTA, provides protection to almost all of the at-risk assets in the system.

The residual risk to the SFMTA system is shown in Table E-89 for each FWP alternative.

Table E-89: Residual Risk to SFMTA System by Alternative, High Curve

High	1	2	3	4	Total
FWOP and B	125,545,000	164,028,000	304,995,000	262,198,000	856,766,000
C	125,545,000	151,872,000	302,729,000	260,853,000	840,999,000
D	125,545,000	124,635,000	297,652,000	257,838,000	805,670,000
E	125,545,000	126,019,000	-	163,740,000	415,304,000
F	-	-	-	6,149,000	6,149,000
G	125,545,000	126,019,000	299,817,000	163,740,000	715,121,000

8.5 Final Results

The net NED benefits for each plan in each reach under each SLC curve are shown in Table E-90, Table E-91, and Table E-92.

Table E-90: Final Results by Alternative, High SLC (PV, $)

Reach	Damages	Benefits, 2040-2089	Benefits, 2090 - 2140	Total Benefits	Cost	Net Benefits
FWOP						
1	1,588,652					
2	7,849,737					
3	9,517,445					
4	3,634,010					
Total	22,589,844					
Alternative B						
1	965,019	320,645	302,988	623,633	199,761	423,872
2	3,912,400	2,954,739	982,598	3,937,337	602,419	3,334,918
3	4,311,573	3,742,436	1,463,436	5,205,872	1,445,989	3,759,883
4	2,652,393	559,020	422,597	981,616	307,241	674,375
Total	11,841,385	7,576,840	3,171,619	10,748,458	2,555,410	8,193,048
Alternative C						
1	1,580,163	242,517	(234,028)	8,489	158,443	(149,954)
2	7,506,866	2,823,902	(2,481,032)	342,870	254,046	88,824
3	8,308,682	3,245,086	(2,036,323)	1,208,763	480,214	728,549
4	3,479,951	636,362	(482,303)	154,059	929,445	(775,386)
Total	20,875,662	6,947,867	(5,233,686)	1,714,181	1,822,148	(107,967)
Alternative D						
1	1,586,766	250,491	(248,605)	1,886	243,597	(241,711)
2	6,539,669	2,871,974	(1,561,906)	1,310,068	571,451	738,617
3	7,478,140	3,330,010	(1,290,705)	2,039,305	762,370	1,276,935
4	3,086,263	624,576	(76,829)	547,747	1,293,505	(745,758)

Reach	Damages	Benefits, 2040-2089	Benefits, 2090 - 2140	Total Benefits	Cost	Net Benefits
Total	18,690,838	7,077,051	(3,178,045)	3,899,006	2,870,923	1,028,083
Alternative E						
1	434,452	629,372	524,828	1,154,200	4,646,090	(3,491,890)
2	556,059	4,038,925	3,254,752	7,293,678	5,985,951	1,307,727
3	807,670	5,340,475	3,369,300	8,709,775	6,345,109	2,364,666
4	355,028	2,302,578	976,403	3,278,982	5,788,219	(2,509,237)
Total	2,153,209	12,311,350	8,125,283	20,436,635	22,765,369	(2,328,734)
Alternative F						
1	143,882	628,371	816,399	1,444,770	2,717,876	(1,273,106)
2	265,043	4,072,426	3,512,267	7,584,693	10,318,477	(2,733,784)
3	891,773	5,342,893	3,282,779	8,625,672	5,444,607	3,181,065
4	1,983,223	676,750	974,037	1,650,787	2,155,563	(504,776)
Total	3,283,921	10,720,440	8,585,482	19,305,922	20,636,523	(1,330,601)
Alternative G						
1	247,125	629,371	712,156	1,341,527	1,523,273	(181,746)
2	293,399	4,038,724	3,517,614	7,556,338	4,016,810	3,539,528
3	3,211,672	4,822,057	1,483,717	6,305,774	3,051,726	3,254,048
4	2,488,744	416,542	728,723	1,145,265	2,536,484	(1,391,219)
Total	6,240,940	9,906,694	6,442,210	16,348,904	11,128,293	5,220,611

Table E-91: Final Results by Alternative, Int. SLC (PV, $)

Reach	Damages	Benefits, 2040-2089	Benefits, 2090 - 2140	Total Benefits	Cost	Net Benefits
FWOP						
1	430,228					
2	1,576,334					
3	2,113,359					
4	1,834,863					
Total	5,954,784					
Alternative B						
1	379,122	8,313	42,793	51,106	33,053	18,053
2	516,973	441,633	617,729	1,059,362	78,425	980,937
3	496,361	968,112	648,886	1,616,998	410,289	1,206,709
4	1,543,737	205,661	85,465	291,126	73,535	217,591
Total	2,936,193	1,623,719	1,394,873	3,018,592	595,302	2,423,290
Alternative C						
1	378,356	8,839	43,032	51,871	158,443	(106,572)
2	520,896	441,632	613,806	1,055,438	254,046	801,392
3	412,917	935,608	764,834	1,700,442	480,214	1,220,228
4	1,488,067	208,834	137,961	346,795	929,445	(582,650)
Total	2,800,236	1,594,913	1,559,633	3,154,546	1,822,148	1,332,398
Alternative D						
1	377,690	9,058	43,480	52,538	243,597	(191,059)
2	513,925	441,644	620,765	1,062,409	571,451	490,958
3	385,153	934,090	794,116	1,728,206	762,370	965,836
4	1,484,098	212,878	137,886	350,764	1,293,505	(942,741)

Reach	Damages	Benefits, 2040-2089	Benefits, 2090 - 2140	Total Benefits	Cost	Net Benefits
Total	2,760,866	1,597,670	1,596,247	3,193,917	2,870,923	322,994
Alternative E						
1	7,566	338,392	84,270	422,662	4,476,963	(4,054,301)
2	5,422	872,866	698,046	1,570,912	5,649,920	(4,079,008)
3	91,219	1,184,823	837,317	2,022,140	5,998,613	(3,976,473)
4	51,478	1,555,588	227,796	1,783,384	5,568,938	(3,785,554)
Total	155,685	3,951,669	1,847,429	5,799,098	21,694,434	(15,895,336)
Alternative F						
1	7,698	338,331	84,198	422,529	2,709,077	(2,286,548)
2	5,532	872,791	698,011	1,570,802	10,310,908	(8,740,106)
3	154,799	1,114,885	843,675	1,958,560	4,794,508	(2,835,948)
4	1,583,793	147,784	103,286	251,070	1,409,502	(1,158,432)
Total	1,751,822	2,473,791	1,729,170	4,202,961	19,223,995	(15,021,034)
Alternative G						
1	7,566	338,392	84,270	422,662	1,477,886	(1,055,224)
2	5,532	872,791	698,011	1,570,802	3,995,985	(2,425,183)
3	836,737	994,949	281,674	1,276,623	2,635,903	(1,359,280)
4	1,739,360	82,868	12,634	95,502	2,184,621	(2,089,119)
Total	2,589,195	2,289,000	1,076,589	3,365,589	10,294,395	(6,928,806)

Table E-92: Final Results by Alternative, Low SLC (PV, $)

Reach	Damages	Benefits, 2040-2089	Benefits, 2090 - 2140	Total Benefits	Cost	Net Benefits
FWOP						
1	375,852					
2	729,221					
3	898,963					
4	1,606,779					
Total	3,610,815					
Alternative B						
1	371,323	2,528	2,000	4,528	16,229	(11,701)
2	512,039	125,851	91,331	217,182	20,728	196,454
3	291,914	411,219	195,830	607,049	320,079	286,970
4	1,435,775	141,510	29,495	171,005	47,778	123,227
Total	2,611,051	681,108	318,656	999,764	404,814	594,950
Alternative C						
1	371,323	2,528	2,000	4,528	158,443	(153,915)
2	512,040	125,850	91,332	217,182	254,046	(36,864)
3	307,239	403,161	188,563	591,724	480,214	111,510
4	1,443,508	136,071	27,200	163,271	929,445	(766,174)
Total	2,634,110	667,610	309,095	976,705	1,822,148	(845,443)
Alternative D						
1	371,323	2,528	2,000	4,528	117,996	(113,468)
2	512,039	125,851	91,331	217,182	151,831	65,351
3	309,223	402,711	187,028	589,739	440,020	149,719
4	1,441,398	137,248	28,133	165,381	1,038,365	(872,984)

Reach	Damages	Benefits, 2040-2089	Benefits, 2090 - 2140	Total Benefits	Cost	Net Benefits
Total	2,633,983	668,338	308,492	976,830	1,748,212	(771,382)
Alternative E						
1	2,128	331,581	42,143	373,724	4,476,963	(4,103,239)
2	4,983	556,930	167,308	724,238	5,649,920	(4,925,682)
3	17,328	648,488	233,146	881,634	5,998,613	(5,116,979)
4	14,440	1,483,971	108,368	1,592,339	5,568,938	(3,976,599)
Total	38,879	3,020,970	550,965	3,571,935	21,694,434	(18,122,499)
Alternative F						
1	2,128	331,581	42,143	373,724	2,709,077	(2,335,353)
2	4,983	556,930	167,308	724,238	10,310,908	(9,586,670)
3	115,034	558,014	225,914	783,928	4,794,508	(4,010,580)
4	1,497,785	85,208	23,786	108,994	1,409,502	(1,300,508)
Total	1,619,930	1,531,733	459,151	1,990,884	19,223,995	(17,233,111)
Alternative G						
1	2,128	331,581	42,143	373,724	1,477,886	(1,104,162)
2	4,983	556,930	167,308	724,238	3,995,985	(3,271,747)
3	175,905	527,394	195,663	723,057	2,635,903	(1,912,846)
4	1,548,466	47,118	11,196	58,314	2,184,621	(2,126,307)
Total	1,731,482	1,463,023	416,310	1,879,333	10,294,395	(8,415,062)

There are a number of crucial takeaways from the results. Starting with the Low and Intermediate curves, not one of the large-scale plans (Alternatives E, F, or G) has positive net NED benefits. Alternatives C and D are competitive with nonstructural in Reaches 2 and 3 (areas with more, higher-valued assets at current or near-term risk) while nonstructural is the only solution with positive net NED benefits in Reaches 1 and 4 (and, under the Low curve, even the Intermediate nonstructural plan has negative net NED benefits—speaking to the low existing risk in that reach).

Under the High curve, however, the larger plans are more competitive. Almost every plan has positive net NED benefits in Reaches 2 and 3 under that curve, though on average the structural plans that are scaled to the higher rate of SLC tend to do better. Nonstructural is competitive in all reaches. In Reaches 1 and 4, there are structural alternatives that are close to having a 1 benefit-to-cost (BCR), despite the fact that they don't receive more inundation benefits than the smaller alternatives until much later in the study timeframe. Alternative B is the NED plan in Reach 3, despite both Alternatives F and G being very close in net NED benefits.

The plans that maximize net NED benefits by reach by SLC curve are shown in Table E-93.

Table E-93: NED Plan by Reach Under Each SLC Curve

Reach	High SLC	Int. SLC	Low SLC
1	B High	B Int.	No Action
2	G	B Int.	B Int.
3	B High	C	B Int.
4	B High	B Int.	B Int.

9. Lessons Learned and Development of Maximum Total Net Benefits Plan

Though Section 8 details the determination of the NED plan, the January 5, 2021, Policy Directive "Comprehensive Documentation of Benefits in Decision Document" also directs the PDT to identify a Maximum Total Net Benefits Plan (MTNBP), which accounts for RED, OSE, and EQ benefits in addition to NED benefits. Beyond the four accounts, other decision metrics such as residual risk, long-term exceedance probability, RSLC adaptability, reliability/fragility, and life safety risk informed the identification of the TSP. This section outlines the lessons learned from the NED analysis and discuss the creation of a MTNBP and the decision of the TSP.

As mentioned, one of the main additional decision metrics will be SLC adaptability. In Section 8, the PDT decided upon three NED plans that differed based on the SLC curve considered, but because the TSP will be decided upon without knowledge of the future

SLC curve, a plan that performs well under all rates of change must be chosen. Note that plans that perform well under multiple rates of SLC are unlikely to be the NED plan under any one SLC curve, since a plan that is specifically geared to performing well under a particular SLC curve will have higher net NED benefits than one that pays for adaptability or overbuilds earlier in the study period to ensure protection against a rate of change not realized. There is no available methodology for deciding upon an NED plan that considers multiple rates of SLC change (typically, USACE studies consider SLC only as a sensitivity test), which is why SLC will be explicitly discussed in this section to support development of a TSP.

There are also opportunities to optimize the existing plans to perform better in terms of NED benefits under the prevailing RSLC scenario. Subreach changes to alignments, design, or scaling can reduce costs while maintaining or minimally impacting the benefits. Changes to the implementation date of adaptive measures will change when costs are incurred and better align costs and benefits in time. These optimizations will be evaluated further in the next study phase, though they will be discussed qualitatively below and may support further refinement of a TSP. There also remains the possibility that future optimizations and analysis of the identified TSP may reveal that the selected plan is also the true NED plan in some scenarios.

Other planning considerations were used in this phase of the study to help in plan selection. ER 1105-2-100 *Planning Guidance Notebook* (USACE 2000) mentions that plans are supposed to be formulated in consideration of four criteria described in the 1983 Economic and Environmental Principles and Guidelines for Water and Related Land Implementation Studies (also known as the P&G): completeness, effectiveness, efficiency, and acceptability (US WRC 1983).

- Completeness is the extent to which the alternative plans provide and account for all necessary investments or other actions to ensure the realization of the planning objectives, including actions by other Federal and non-Federal entities.
- Effectiveness is the extent to which the alternative plans contribute to achieve the planning objectives.
- Efficiency is the extent to which an alternative plan is the most cost-effective means of achieving the objectives.
- Acceptability is the extent to which the alternative plans are acceptable in terms of applicable laws, regulations, and public policies.

9.1 Lessons Learned

The following bullets represent some of the lessons learned over the course of the initial analysis of the array of alternatives.

- SLC is the main driver of inundation risk over the study period. Though the initial engineering suggested that this would be the case due to the relatively small contribution of storm surge to the total water level in storm events, the G2CRM modeling confirmed this. The interfacing of the storm suite and the economic asset inventory suggested that there is existing risk to the study area from infrequent storm events, but the predominant flood risk comes from SLC which may make infrequent events today a monthly or daily occurrence in the future.

- Aligning costs and benefits in time helps to maximize net NED benefits. While it may seem efficient to build higher in one phase to have flood risk reduction measures in place for the future, the analysis demonstrated that building to 15.5 feet or even 19 feet in the initial years is only justified by offsetting risks that occur much later in the study period, if at all. If possible, building to a lower level and then raising the crest elevation when risk increases would be the optimal approach in response to both present and future flood hazards. However, other factors such as constructability, disruption, and community and environmental impacts must also be weighed as part of the formulation decision under the total benefit framework.
- Overtopping of a FWP measure leads to catastrophic damages. Building a measure may shift damages later in time by preventing near- and medium-term damages, but the reduction in hazard means assets don’t take protective actions (floodproofing/retreat). Hence, when overtopping occurs, it is in a floodplain with many vulnerable assets. Moreover, the water levels are much higher because the coastal defense measure has allowed water to build up behind it; when overtopping occurs, then, water levels are much higher at the FFEs of the asset. This leads to much higher damages. Figure E-49 shows that the benefits accrued before overtopping are “given back” once the measure begins to be overtopped. Preventing overtopping or retreating once the measure is expected to be overtopped will provide more opportunities to maximize net NED benefits.
- The NED OMRR&R benefits, which stem from changes to the existing OMRR&R costs of the extant coastal infrastructure between the FWOP to the FWP, constitute a smaller part of the benefits pool under the High SLC curve but a larger part of the benefits pool under the Intermediate and Low curves. This is because those benefits differ only marginally by SLC curve. Note that other “seismic benefits” (outside of the risk to the existing coastal infrastructure) have not been calculated in the NED account to avoid conflict and duplication through the treatment of project costs per WRDA 2020, Section 152; these benefits are instead qualitatively or semi-quantitatively defined within the OSE account.
- In parallel with implementation considerations, identification of the TSP must also recognize the incremental cost associated with raising the level of protection. Due to the high level of investment below ground to stabilize seismically unstable soils, the incremental cost of increasing crest elevation may factor into plan refinements at a later stage. The PDT considered options where smaller-scale measures were built without doing ground improvement but were instructed by the Vertical Team that anything that was built in a seismic region would need to

meet USACE seismic codes (meaning plans without ground improvement would not meet the P&G's Acceptability criterion).

- Measures that may cost-effectively reduce risk but are likely to face serious opposition pose a schedule risk. Despite Alternative F having the highest net NED benefits of any measure under the High curve in Reach 3 and being competitive with nonstructural in Reach 4, there were concerns about using water management structures across Mission and Islais Creeks. The concerns included that these structures would impact HTRW sites, create water quality concerns, and face opposition from regulatory agencies and the public. There were also concerns about the deployment and reliability of an actively managed flood defense and the issue of the high OMRR&R burden on the NFS.

9.2 Refinement of Net NED Plans Using Lessons Learned

To maximize net benefits, costs must be aligned with benefits in time and measures must be of adequate scale to not be overtopped. As such, the PDT considered what kinds of lower-cost, adaptable structures could be built initially. The existing suite of alternatives were formulated to allow evaluation of different risk reduction approaches across a range of uncertain future conditions, which allowed for identification of cost-effective solutions for each RSLC curve. They did not, however, fit the bill for aligning the timing of intervention with the arrival of risk. Alternatives E, F, and G all reduced risk from hazards that did not yet exist and Alternatives C and D weren't sufficiently adaptable to address a potential High rate of SLC. Note that, for the High SLC curve, a large initial action was recommended, while for the lower rates of change, a smaller (or no) initial action was recommended. Because SLC is exogenous, the rate of change will not be known before having to make an initial action. Therefore, for a first action to be considered successful in this environment, it needs to perform well at different rates of SLC. Adaptive actions can be planned for the future, but the first actions are permanent, such that they cannot be undone if a lower rate of SLC is realized and the level of protection (and amount of investment) was too high.

As such, the PDT considered if Alternative D could be adapted in 2090 to the higher height of Alternative E/F/G; in essence, moving from a lower-protection plan (13.5 feet) to a higher-protection one (19 feet). Such a plan would allow a lower-cost alternative to be built initially but allow for a suite of adaptations that is scaled to perform under changing risks in different ways.

Building Alternative D provides an opportunity for a suite of actions that can occur in the future:

- No action. Building to 13.5 feet is sufficient under the Low SLC curve.
- Build the 2nd action of Alternative D. This raises the crest elevation to 15.5 feet and is sufficient under the Intermediate SLC curve. The timing of this move can vary based on the realized rate of change. Under the USACE Intermediate curve, the first action is sufficient out to 2130, but a slightly higher rate of change may necessitate sooner action.

- Replace Alternative D with Alternative E or G, built to 19 feet. If observed risk is tracking on the High curve, this move would be necessary by the 2070s to prevent the risk of overtopping of the initial measure. It pushes the high level of cost into the future (making it more attractive from a cost-benefit point of view because of discounting) but also doesn't incur the cost unless the High rate of change is realized.

Different rates of SLC will necessitate different second actions, meaning the costs are different based on SLC. As discussed, this is true for Alternatives D through G (because the planned 2090 adaptation may or may not be necessary) but it is also true for any NED-maximizing plan, as second actions are uncertain based on whether or not they are necessary (depending on SLC) and when that second action cost is incurred. Unhooking the second action from 2090 allows for an analysis that understands SLC is uncertain and that many different futures exist. Under some rates, a second action may be needed sooner, while under other rates, it may be needed later or not at all.

Note that USACE does not have a methodology for maximizing net NED benefits across SLC curves. Instead, studies typically optimize net NED benefits under one SLC curve and check performance against the other two curves as a sensitivity test. This study has not selected one curve to optimize under and has instead identified three separate NED plans, one for each curve and with three separate sets of first actions. As the first action must be undertaken under conditions of uncertainty, the NED analysis has not provided a clear-cut action to recommend; instead, what is known is that the selected plan must perform well under all three SLC curves. A plan that performs well under all three curves will likely not be the NED plan under any one curve, since it may involve building larger earlier to be responsive to medium-term SLC risks or paying for the optionality of future adaptive measures. If future risks do not come to pass (under, say, the Low SLC curve), these earlier expenditures will not provide benefits. Still, performing well (if not optimally) under many potential SLC scenarios is preferable to performing optimally under some SLC scenarios but poorly under others.

Alternative D is cost-justified under all three SLC curves for Reaches 2 and 3, though it doesn't perform as well under the High curve because it is overtopped. The structural measures in Reaches 1 and 4 are only justified under the High curve since there are relatively few structures at risk in the near-term in those reaches. Nonstructural is mostly cost-justified under all three curves, but nonstructural does not perform as well under the High curve later in the period of analysis because assets that were retrofit become permanently or semi-permanently inundated. In most cases, measures that are scaled to the hazard (i.e., that reduce the flood risk without being overbuilt) are justified, and as the flood risk hazard increases, the benefits of potential measures rise faster than the cost of the measures.

What this suggests, then, is that smaller initial actions (Alternative B and Alternative D) are sufficient in the near-term to reduce the flood hazard, but that larger structural measures might need to be brought online to maintain that level of protection under the High SLC curve. This framework can be seen in Table E-94.

Table E-94: First and Potential Second Actions, Hybrid Plan

Reach	First Action	Second Action Low	Second Action Int.	Second Action High
1	Alternative B	N/A	Alternative B (Additional NS)	Alternative G (19 feet)
2	Alternative D (13.5 feet)	N/A	Alternative D (15.5 feet)	Alternative G (19 feet)
3	Alternative D (13.5 feet)	N/A	Alternative D (15.5 feet)	Alternative G (19 feet)
4	Alternative B	N/A	Alternative B (Additional NS)	Alternative G (19 feet)

Paying slightly more for Alternative D to ensure the adaptability of the measure means that the plan is overbuilt for the Low curve (i.e., there would be higher net NED benefits by just building Alternative C). Nonetheless, having the optionality to build to 15.5 feet, which is needed under both the Intermediate curve and many of the infinite curves between the Intermediate and High curves, was considered by the PDT to be worth the additional upfront investment, especially since the cost delta between Alternative C and Alternative D is small.

This framework has positive net NED benefits for every reach for every SLC curve. This plan does well in lining up costs and benefits in time, as it ensures that structural measures are used initially in places with many assets with high vulnerability while nonstructural is used where there is less density of vulnerability and then scales structural measures as risk increases. Alternative D is preferable to Alternative C because it can be adapted and, when more protection is needed, Alternative G is preferred to Alternative E because it is substantially cheaper. The net NED benefits between Alternatives E and G are close to each other in the Southern Waterfront, and as such, it is possible the total benefits analysis, which brings in the RED, OSE, and EQ accounts, will lead to preferring Alternative E, which has less retreat, over Alternative G. Strictly in terms of net NED benefits, though, Alternative G is preferred.

For reference, the second actions under the High SLC curve are all moves to 19 feet in one stage (i.e., the 1st and 2nd actions of Alternative G would be built at once in 2090). This means the costs are approximately the total cost of the sum of the first and second actions. In PV, though, the costs are substantially lower; instead of the first action of Alternative G being built in 2040, it is built in 2090, which discounts the cost by 50 years.

This framework relies on monitoring to determine the rate of SLC and the changing risk. There also need to be “trigger thresholds” that dictate when a second action will be undertaken. These thresholds need to respond to the real-world difficulties of construction, including how long it will take to have a project approved, permitted, and built. These thresholds will be determined in the next phase of the study, and additional discussion of these topics can be found in the Integrated Feasibility Report and Environmental Impact Statement.

9.3 Total Benefit Analysis

The analysis in Section 9.2 specifically looks at NED benefits: the benefits stemming from preventing retreat, preventing inundation losses, and from protecting the various existing networks in the study area (SFMTA, SFPUC, and the existing coastal defense system). Bringing in the other benefit categories, though, can help facilitate additional discussion regarding the measures.

The RED, OSE, and EQ benefits are discussed comprehensively in *Sub-Appendix E.1: RED Report*, *Sub-Appendix E.2: OSE Report*, and *Appendix D: Environmental and Cultural Resources*, respectively. An extensive discussion of how these benefit categories were used to derive a MTNBP can be found in the Integrated Feasibility Report and Environmental Impact Statement and *Appendix A: Plan Formulation*. To determine RED and OSE benefit categories, the PDT relied on the Institute of Water Resources materials *Handbook on Applying "Other Social Effects" Factors in Corps of Engineers Water Resources Planning* (09-R-4), *Regional Economic Development (RED) Procedures Handbook* (2011-RPT-01), and *Other Social Effects: A Primer* (2013-R-02) (IWR 2009, 2011, 2013). An abbreviated discussion of the methodologies used to determine these benefits can be found below.

9.3.1 Other Social Effects

The OSE account is one of four accounts set forth by the P&G (US WRC 1983). In addition to OSE, the P&G includes three other accounts: NED, RED, and EQ. Collectively, the four accounts evaluate all significant effects of a plan on the project area and beyond.

The OSE FWOP analysis is comprised of five categories: health and safety, economic vitality, social connectedness, community identity, and social vulnerability, in accordance with USACE guidance. The PDT developed metrics to describe the FWOP condition impacts in each of those five categories. Those metrics, along with the way in which they were measured, can be seen in Table E-95.

Table E-95: Overview of OSE Categories and Metrics

Category	Measures	Measure Type	Description
Health and Safety	Exposed Population	#	Residential population within flood extent (including homeless population)
	Emergency Staging Areas	#	Access to emergency staging areas before and during events
	Contaminated Sites	#	Contaminated and capped sites within flood extent

Category	Measures	Measure Type	Description
	Public Health Indicators	#	Asthma, heart disease, low birth weight, and COVID-19 infections and deaths within the project area
	Displaced Population	#	Residential population residing within vulnerable buildings (temporary displacement expected with >1 foot of flood depth)
	Shelter Needs	#	Residential population that may require shelter due to age, income, and other factors
	Contaminated Sites Health Impacts	abc	Likely impact of hazardous material release on public health, given existing public health indicators
Economic Vitality	Small, minority-owned, legacy businesses	#, abc	Disadvantaged businesses exposed to flooding, including data on earnings, commuting statistics, and disadvantaged businesses.
	Housing Affordability Indicators	#, abc	Rentership statistics, affordable housing unit locations within the flood extent
Social Connectedness	Mental Stress and Anxiety	$	Represent stress factors as a product of damage to people's homes, and quantifies treatment costs to residents
	Lost Productivity	$	Represents lost income to residents who work and must deal with flood loss in their homes
	Transit Corridors and Recreation Exposure	#, abc	Public transit routes, ridership counts, bike and pedestrian routes, open space daily visit counts within the flood extent
	Public transit users	#	Number of people who commute using public transit.
Community Identity	Community Services	#, abc	Includes CCSF-owned facilities such as police stations, fire stations, libraries, community centers, health centers and clinics
	Cultural/Historic Assets	#, abc	Cultural and historic assets in the flood extent: cultural heritage districts, places of worship, landmarks and historic places
Social Vulnerability and Resiliency	Underserved Communities	#, abc	Social vulnerability indices and statistical significance of children, elderly, minority populations, poverty status, disabilities, linguistic isolation, single parents
	Disproportionate Effects on Underserved Communities	abc	Evaluate where consequences in other social factors (displacement, health impacts, job exposure, stress factors, community access, open space availability) may be felt more intensely.

These metrics identify how social well-being could change in the absence of a solution to a water resources issue, and how social well-being could be affected by the alternative solutions identified by the PDT. A complete discussion of the quantification of these metrics in both the FWOP and the FWP can be found in *Sub-Appendix E.2: OSE Report*.

9.3.2 Regional Economic Development

Per IWR's *Regional Economic Development Procedures Handbook* (2011-RPT-01) (IWR 2011), RED impacts are defined as the transfers of economic activity within a region or between regions in the FWOP and for each alternative plan. Spending in an area can spur economic activity, leading to increases in employment, income, and output of the regional economy, while chronic or catastrophic flooding can lead to regional losses of employment and income. IWR 2011-RPT 01 defines three types of RED impacts:

- **Direct effects** are the impacts direct federal expenditure have on industries that directly support the new project. Labor and construction materials are considered the direct components of a project.
- **Indirect effects** represent changes to secondary industries that support the direct industry. For example, rock quarries used in making cement could be considered indirect pieces of a project.
- **Induced effects** are changes in consumer spending patterns caused by changes in employment and income within the direct and indirect industries. The additional income earned by workers may be spent in numerous different ways within the region.

Beyond direct, indirect, and induced output loss, RED impacts include employment losses (described as the number of full-time equivalent jobs lost), and transportation and industrial revenue loss for transportation and industrial systems. These benefits were calculated in the FWOP and the FWP across all three USACE SLC curves. A summary table showing key takeaways by reach can be found below. Table E-96 shows many different types of impacts that affect the RED account.

Table E-96: Economic Profile Key Takeaways by Reach

Profile	Reach 1	Reach 2	Reach 3	Reach 4
Employment and Income				
Demographics	High percentage of older workers Low percentage of high paying jobs	High educational attainment Higher percentage of high paying jobs	Higher percentage of Hispanic or Latino workers	High percentage of older workers Low percentage of high paying jobs Higher percentage of Black or African

Profile	Reach 1	Reach 2	Reach 3	Reach 4
	Higher percentage of Hispanic or Latino workers			American workers and Hispanic or Latino workers Lower educational attainment
Main Employment Sectors	Retail Trade, Accommodation and Food Services Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services industry Finance and Insurance	Administration and Support Waste Management and Remediation Information Educational Services Professional, Scientific, and Technical Services	Construction Wholesale Trade Transportation and Warehousing Accommodation and Food Services
Inflow/Outflow and Commuting Trends	Has a net job inflow of 6,100, the lowest of the reaches.	Largest net inflow of jobs: 220,000 Draws a large number of workers from across the Bay Area due to large inflow	Large net inflow of jobs: 110,000 Draws a large number of workers from across the Bay Area due to large inflow	Net job inflow of 14,000 Draws a high proportion of its commuters from Equity Priority Communities
Critical Infrastructure				
Transportation	Muni EF lines (historic streetcar), cable cars, buses SFMTA Kirkland Division Muni Maintenance Facility	BART rail lines, Embarcadero and Montgomery Street Stations, and Transbay Tube Muni EF lines (historic streetcar), KT lines (LRV), cable cars, buses	BART rail lines Muni EF lines (historic streetcar), Muni KT lines (LRV), buses Caltrain's San Francisco Station and rail lines	BART rail lines Muni KT lines (LRV), buses Muni Maintenance Facilities: Muni Metro East, Burke Warehouse, 1399 Marin, and Islais Creek Division Caltrain rail lines SFBR, serving Piers 80, 92, 94, and 96, and the POSF's railyard (the Intermodal Container Transfer Facility)
Utilities	Wastewater assets include the North Shore Pump Station, the North Point Wet Weather Facility, the Fort	Wastewater assets include several buried assets, including the Jackson Transport	Low-pressure assets include Bay Bridge Pump Station.	Wastewater assets include encompasses the Booster Pump Station, the Southeast Lift Station, the Islais Creek

Profile	Reach 1	Reach 2	Reach 3	Reach 4
	Mason Tunnel, and one CSD	Storage Box, the North Shore Force Main, and three CSDs	Wastewater assets include the North Channel Transport Storage Box, the Channel Pump Station, the Channel Force Main, the smaller Harriet Street and Mariposa pump stations, and several CSDs	Transport Storage Box, and the Southeast Treatment Plant. Recology facility on Pier 96

Building on the data collected in Table E-96, the PDT developed categories and metrics to describe the RED impacts to employment, income, and critical infrastructure within and outside of the study area. Those metrics, along with the way in which they were measured, can be seen in Table E-97.

Table E-97: Overview of RED Categories and Measures

Category	Measure	Measure Type	Description
Benefits from Construction	Primary Impacts	$	Local capture measures what percentage of federal spending is captured within the impact area. It is calculated by applying the level-specific (local, state, or national) Local Purchase Coefficients to the expenditures for each industry and aggregating the local capture across all industries. As such, the local capture (also called primary impacts) is equal to the monetary direct effect of federal spending.
	Secondary Impacts	$	Secondary impacts, which include indirect and induced impacts, are multiplier effects on top of the direct impacts. These impacts include payments to industries that support the directly affected industries, while induced effects occur when workers associated with the direct and indirect industries spend their salaries in the impact area, creating additional jobs and income.
Impacts to Critical Infrastructure	Transportation Revenue Loss	$	Revenue losses affect an agency's ability to continue to provide the same level of service. Revenue loss was established for three primary transportation assets: SFMTA, BART, and the SFBR facility. Regional ferry ***BART***. BART is expected to lose ridership and revenue due to system disruption caused by flood damage. Revenue losses are estimated using disruption time estimates until partial and

Category	Measure	Measure Type	Description
			full capacity of the system can be restored. Disruption time estimates were developed using Hazus data and expert judgement and were confirmed appropriate by BART. ***Muni***. SFMTA is expected to lose Muni ridership and revenue due to system disruption caused by flood damage at Embarcadero Station and Central Station. Revenue losses are estimated using disruption time estimates until partial and full capacity of the system can be restored. Disruption time estimates were developed using Hazus data and expert judgement and were confirmed appropriate by SFMTA. ***SFBR***. The SFBR facility handles 1,000 – 3,000 tons of cargo per day. Analysts used Bureau of Transportation Statistics value of domestic rail per daily ton to estimate lost revenue associated with facility disruption due to flooding.
	Utility Revenue Loss	$	Utility impacts were established for three primary public and private utilities dealing with potable water, the combined sewer system, and waste management. ***Potable Water.*** Flood damage expected at the Bay Bridge LPW pump station will disrupt potable water service to Treasure Island and Yerba Buena Island. SFPUC may experience revenue losses as the agency will not collect service fees because of reduction in potable water use. Revenue losses use total daily demand, cost per gallon, and functional downtime to estimate loss. ***Combined Sewer System***. FEMA has established a standard value per person per day of associated Gross Domestic Product that may be lost due to disruption in wastewater treatment service. The Southeast Treatment Plant treats about 80% of the sewage in San Francisco, serving the entire San Francisco Waterfront Coastal Flood Study population during dry weather and much of it during wet weather as well. Outage at the treatment plant shouldn't cause loss of service to the residents and businesses of San Francisco, however, it could result in quantities of wastewater being dumped directly into the San Francisco Bay, depending on the length of the outage. The proposed approach to estimate economic impacts of loss of utility service is sourced from FEMA benefit-cost analysis methodologies that employ functional downtime of utility systems, the service area population, and daily per-capita estimates of Gross Domestic Product (GDP). ***Waste Management***. Revenue loss for Recology is estimated based on information provided by a Recology representative. Analysts used the annual revenue of the facility and restoration times from Hazus to estimate how much annual

Category	Measure	Measure Type	Description
			revenue may be lost if the facility were damaged by coastal flooding.
Direct Economic Impacts	Direct Economic Output Losses	$	Output represents the value of industry production and includes labor income factors (employee compensation and proprietor income), taxes on production and imports, other property income, and any intermediate inputs. For industries that do not hold inventory, output equals revenues. For industries that do hold inventory, output equals revenues less the value of goods sold. Direct output losses are modeled in G2CRM.
	Direct Job Losses	#	Jobs represent all full-time, part-time, and temporary employment opportunities available on average within an industry, as calculated with IMPLAN. This metric is not a specific job count but represents a localized average of *likely employment statistics* based on annual economic activity. IMPLAN job counts are usually larger than many other sources because they account for all full-time, part-time, and seasonal jobs where other data sources do not.
Cascading Regional Economic Impacts	Indirect and Induced Economic Output Losses	$	See above for description of *Direct Economic Output Losses*. Indirect and induced output losses are modeled through IMPLAN using the G2CRM direct output losses as a model input. This metric demonstrates the impacted industries that contribute the most to national GDP.
	Indirect and Induced Job Losses	#	See above for description of *Direct Job Losses*. Indirect and induced job losses are modeled through IMPLAN using the G2CRM direct output losses as a model input.

These metrics identify the impacts to regional economies in the absence of a solution to a water resources issue, and how these effects could be reduced by the alternatives identified by the PDT. A complete discussion of the quantification of these metrics in both the FWOP and the FWP can be found in *Sub-Appendix E.1: RED Report*. An ordinal ranking of the performance of the different plans by metrics for each SLC curve can be found in Table E-98 through Table E-106.

9.4 Maximizing Total Net Benefits

The PDT considered the recent directive to identify a MTNBP and the broad study objectives of the NFS as an opportunity to assess a comprehensive set of benefits to inform the ultimate plan selection. Accordingly, the PDT developed over 40 benefit metrics across RED, OSE, and EQ metrics, discussed in Section 9.3 and in *Appendix E1.1: RED Report* and *Appendix E1.2: OSE Report*. These were calculated based on unique methodologies that are described in detail in the various referenced materials. These metrics vary by space and time, as well as by SLC curve.

The PDT recognized that the newly developed metrics varied in significance to the selection of the plan but considered their development to be an opportunity to advance the understanding of quantification and comparison of total benefits. It was acknowledged that due to the large number of metrics developed, some benefits categories reflected study objectives and would likely be decision drivers while some would be more informative than decisional.

As can be seen in the NED analysis, the NED plan is selected simply by subtracting the costs of the alternatives from the NED benefits by alternative to find which plan has the highest net benefits. Selection of a MTNBP is not so straightforward: the Jan 5, 2021, Policy Directive Comprehensive Documentation of Benefits in Decision Document states the need to determine “a plan that maximizes net total benefits across all benefit categories,” but this is made challenging because benefits are non-monetary while the costs remain monetary. As they do not have the same units, they cannot simply be subtracted from each other to determine the MTNBP. Additionally, these metrics must be considered across the various SLC curves; just as there was a separate NED plan for each SLC curve, the MTNBP is also likely to vary by curve.

There exist suites of techniques to aggregate benefit categories that do not have the same units, including monetized OSE and multiple-criteria decision analysis (MCDA). These techniques can support comparison between inherently disparate metrics, but they have their own sets of challenges. For instance, an issue that can arise with MCDA is that it may require weighting (either explicitly or implicitly), which can create concerns with the defensibility of the weights used. Such a technique may provide an answer, but that answer may come out of a “black box” and be driven by hard-to-see and hard-to-judge assumptions.

Of note is that the PDT did not know *a priori* how a MTNBP would be selected. The PDT acknowledged that some situations may be so complex as to require MCDA, but it was not assumed that the San Francisco Waterfront Coastal Flood Study would necessitate it. Instead, the PDT aimed to quantify a broad array of metrics in the four benefit categories and see how the various plans performed in the different plan dimensions. Regardless of how the MTNBP was decided on, it was clear that the quantification of the benefits would provide the backbone of the justification of the plan. Once the results were available, the PDT would see if there were plans that clearly dominated other plans (similar to the CE/ICA framework). If many metrics were correlated, this could also potentially lead to generalizations that could be made that could support decision making. In cases where two efficient plans were to be considered, providing both the cost difference and the “benefits basket” of quantified, non-dollar denominated benefits that the marginal cost would “purchase” could allow for transparent tradeoffs to be considered.

After the quantification of the RED, OSE, and EQ metrics, the PDT created “decisions driver” matrices to help in the visualization of the metrics by plan, reach and SLC curve. The “decision drivers” matrices included only a subset of the RED and OSE metrics quantified. Working with a smaller number of metrics was assumed to simplify decision making, but the PDT did not want to cull metrics arbitrarily. Metrics were removed from consideration for a variety of reasons:

- The metric didn't change between the FWOP and any of the FWP conditions. This occurred when the damage occurred outside the lines of defense (meaning there would be no change from the FWOP to the FWP) or if there were no damages seen in the FWOP or FWP (for instance, maritime losses were considered but were minimal in the FWOP, meaning there would be no significant difference in the FWP).
- The metric was determined to not be important to the NFS or PDT. This was not possible to determine before seeing the FWOP and FWP impacts, but in some cases, the PDT could say that the difference in impacts was not worth justifying a tradeoff of NED benefits or project performance. For example, the RED metrics, while critically important to those who suffer RED losses, were determined to not support robust decision making, though they were imperative for describing the FWOP and FWP conditions. This can be considered giving these metrics zero weight.

Within the decision drivers matrix, individual cells within the matrix were shown with a color to show the comparative value for each metric under each alternative under each SLC curve. The multiple benefits were numerically scored in units appropriate to the metric, and color coded; this process is discussed in *Sub-Appendix E.1: RED Report* and *Sub-Appendix E.2: OSE Report*. The colors are used purely to allow for a simplified evaluation of metrics at a glance; robust decision making requires a deeper understanding of these impacts. The decision drivers matrices, then, are reductive tools to describe performance across an array of metrics. The colors (green being "good," red being "less good") allow the viewer to see where plans differ and allowed the Economics team to visually show where benefits were correlated and what tradeoffs existed. The Economics team facilitated conversations with the full PDT using the matrices but brought in complementary information, including the actual magnitude of effects and when impacts would be expected, to support robust decision making.

Table E-98 through Table E-106 show the matrices used in the analysis. The High and Intermediate SLC curve decision drivers matrices are shown on the reach level while the Low SLC curve's matrix is shown on the Waterfront scale. *Sub-Appendix E.1: RED Report* and *Sub-Appendix E.2: OSE Report* discuss each metrics used in the matrices in more detail, including what the FWOP conditions are and how the scoring criteria were generated to assign ordinal rankings to each plan in the array of alternatives. Table E-98 through Table E-106 help show differences, but understanding the total benefit FWOP and FWP conditions is one of many necessary conditions to arriving at a Maximum Total Net Benefits Plan.

Table E-98: Reach 1, High SLC, Comprehensive Benefits Matrix

Category	Items	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
RED Account							
Business Economic Disruptions	Reduced Business Disruption Benefits						
OSE Account							
Health and Safety	Coastal Life Safety Risk						
	Seismic Life Safety Risk and Resilience						
	Compromised Disaster Response Assets						
Economic Vitality	Job Access						
	Maritime						
Social Connection	Public transit mobility						
Community Identity	Community and Cultural Assets						
	Historic Asset and District Designation						
Social Vulnerability and Resiliency	Vulnerable Pop Exposure						
	Disproportionate effects on vulnerable communities						
	Permanently Displaced Population						

Category	Items	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
	Affordable Housing Exposed						
EQ Account							
Physical Environment	HTRW Contaminated Sites						
	Carbon Sequestration						
	Water Quality						
	EWN to reduce wave runup						
Biological Environment	Habitat (NNBF)						
	Threatened and Endangered Species						

Table E-99: Reach 2, High SLC Curve, Comprehensive Benefits Matrix

Category	Items	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
RED Account							
Business Economic Disruptions	Reduced Business Disruption Benefits						
OSE Account							
Health and Safety	Coastal Life Safety Risk						
	Seismic Life Safety Risk and Resilience						
	Compromised Disaster Response Assets						
Economic Vitality	Job Access						
	Maritime						
Social Connection	Public transit mobility						
Community Identity	Community and Cultural Assets						
Social Vulnerability and Resiliency	Vulnerable Pop Exposure						
	Disproportionate effects on vulnerable communities						
	Permanently Displaced Population						
	Affordable Housing Exposed						
EQ Account							

Category	Items	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Physical Environment	HTRW Contaminated Sites						
	Carbon Sequestration						
	Water Quality						
	EWN to reduce wave runup						
Biological Environment	Habitat (NNBF)						
	Threatened and Endangered Species						

Table E-100: Reach 3, High SLC Curve, Comprehensive Benefits Matrix

Category	Items	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
RED Account							
Business Economic Disruptions	Reduced Business Disruption Benefits						
OSE Account							
Health and Safety	Coastal Life Safety Risk						
	Seismic Life Safety Risk and Resilience						
	Compromised Disaster Response Assets						
Economic Vitality	Job Access						
	Maritime						
Social Connection	Public transit mobility						
Community Identity	Community and Cultural Assets						
Social Vulnerability and Resiliency	Vulnerable Pop Exposure						
	Disproportionate effects on vulnerable communities						
	Permanently Displaced Population						
	Affordable Housing Exposed						
EQ Account							

Category	Items	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Physical Environment	HTRW Contaminated Sites						
	Carbon Sequestration						
	Water Quality						
	EWN to reduce wave runup						
Biological Environment	Habitat (NNBF)						
	Threatened and Endangered Species						

Table E-101: Reach 4, High SLC Curve, Comprehensive Benefits Matrix

Category	Items	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
RED Account							
Business Economic Disruptions	Reduced Business Disruption Benefits						
OSE Account							
Health and Safety	Coastal Life Safety Risk						
	Seismic Life Safety Risk and Resilience						
	Compromised Disaster Response Assets						
Economic Vitality	Job Access						
	Maritime						
Social Connection	Public transit mobility						
Community Identity	Community and Cultural Assets						
Social Vulnerability and Resiliency	Vulnerable Pop Exposure						
	Disproportionate effects on vulnerable communities						
	Permanently Displaced Population						
	Affordable Housing Exposed						
EQ Account							

Category	Items	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Physical Environment	HTRW Contaminated Sites						
	Carbon Sequestration						
	Water Quality						
	EWN to reduce wave runup						
Biological Environment	Habitat (NNBF)						
	Threatened and Endangered Species						

Table E-102: Reach 1, Int. SLC Curve, Comprehensive Benefits Matrix

Category	Items	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
RED Account							
Business Economic Disruptions	Reduced Business Disruption Benefits						
OSE Account							
Health and Safety	Coastal Life Safety Risk (Overtopping)						
	Seismic Life Safety Risk and Resilience						
	Compromised Disaster Response Sites						
Economic Vitality	Job Access						
	Maritime Metrics						
Social Connection	Public transit mobility						
Community Identity	Community and Cultural Assets						
Social Vulnerability and Resiliency	Vulnerable Pop Exposure						
	Disproportionate effects on vulnerable communities						
	Permanently Displaced Population						
	Affordable Housing						
EQ Account							

Category	Items	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Physical Environment	HTRW Contaminated Sites						
	Carbon Sequestration						
	Water Quality						
	EWN to reduce wave runup						
Biological Environment	Habitat (NNBF)						
	Threatened and Endangered Species						

Table E-103: Reach 2, Int. SLC Curve, Comprehensive Benefits Matrix

Category	Items	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
RED Account							
Business Economic Disruptions	Reduced Business Disruption Benefits						
OSE Account							
Health and Safety	Coastal Life Safety Risk (Overtopping)						
	Seismic Life Safety Risk and Resilience						
	Compromised Disaster Response Sites						
Economic Vitality	Job Access						
	Maritime Metrics						
Social Connection	Public transit mobility						
Community Identity	Community and Cultural Assets						
Social Vulnerability and Resiliency	Vulnerable Pop Exposure						
	Disproportionate effects on vulnerable communities						
	Permanently Displaced Population						
	Affordable Housing						
EQ Account							

Category	Items	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Physical Environment	HTRW Contaminated Sites						
	Carbon Sequestration						
	Water Quality						
	EWN to reduce wave runup						
Biological Environment	Habitat (NNBF)						
	Threatened and Endangered Species						

Table E-104: Reach 3, Int. SLC Curve, Comprehensive Benefits Matrix

Category	Items	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
RED Account							
Business Economic Disruptions	Reduced Business Disruption Benefits						
OSE Account							
Health and Safety	Coastal Life Safety Risk (Overtopping)						
	Seismic Life Safety Risk and Resilience						
	Compromised Disaster Response Sites						
Economic Vitality	Job Access						
	Maritime Metrics						
Social Connection	Public transit mobility						
Community Identity	Community and Cultural Assets						
Social Vulnerability and Resiliency	Vulnerable Pop Exposure						
	Disproportionate effects on vulnerable communities						
	Permanently Displaced Population						
	Affordable Housing						
EQ Account							

Category	Items	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Physical Environment	HTRW Contaminated Sites						
	Carbon Sequestration						
	Water Quality						
	EWN to reduce wave runup						
Biological Environment	Habitat (NNBF)						
	Threatened and Endangered Species						

Table E-105: Reach 4, Int. SLC Curve, Comprehensive Benefits Matrix

Category	Items	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
RED Account							
Business Economic Disruptions	Reduced Business Disruption Benefits						
OSE Account							
Health and Safety	Coastal Life Safety Risk (Overtopping)						
	Seismic Life Safety Risk and Resilience						
	Compromised Disaster Response Sites						
Economic Vitality	Job Access						
	Maritime Metrics						
Social Connection	Public transit mobility						
Community Identity	Community and Cultural Assets						
Social Vulnerability and Resiliency	Vulnerable Pop Exposure						
	Disproportionate effects on vulnerable communities						
	Permanently Displaced Population						
	Affordable Housing						
EQ Account							

Category	Items	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Physical Environment	HTRW Contaminated Sites						
	Carbon Sequestration						
	Water Quality						
	EWN to reduce wave runup						
Biological Environment	Habitat (NNBF)						
	Threatened and Endangered Species						

Table E-106: Waterfront-Wide, Low SLC Curve, Comprehensive Benefits Matrix

Category	Items	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
RED Account							
Business Economic Disruptions	Reduced Business Disruption Benefits						
OSE Account							
Health and Safety	Coastal Life Safety Risk (Overtopping)						
	Seismic Life Safety Risk and Resilience						
	Compromised Disaster Response Sites						
Economic Vitality	Job access						
	Maritime						
Social Connectetion	Public transit mobility						
Community Identity	Community and Cultural Assets						
Social Vulnerability and Resiliency	Vulnerable Population Exposure						
	Disproportionate effects on vulnerable communities						
	Permanently Displaced Population						
	Affordable Housing Exposed						

Category	Items	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
EQ Account							
Physical Environment	HTRW Contaminated Sites						
	Carbon Sequestration						
	Water Quality						
	EWN to reduce wave runup						
Biological Environment	Habitat (NNBF)						
	Threatened and Endangered Species						

One takeaway from the NED analysis, described in Sections 6 through 8, is that the benefits that come from preventing inundation damages tends to support plans that prevent those damages. Alternative C and Alternative D can be justified in 2040, while Alternatives E, F, and G can be justified once there is a moderate about of SLC. A major takeaway from the decision drivers matrix is that many of the RED and OSE metrics are highly correlated with the NED inundation benefits, since all of the RED and the majority of the OSE metrics are also based on exposure to flooding.

If there is a strong correlation between NED, RED, and OSE benefits, a few generalizations can be made.

- If a measure has negative net NED benefits but provides relief from flooding, it is possible that the addition of RED/OSE benefits would support an assertion that it has positive net total benefits (i.e., RED/OSE benefits can “make up” the negative net NED benefits).
- If two plans have equal positive net NED benefits, the one that provides more flood protection will have higher RED and OSE benefits as well, perhaps arguing that the higher flood protection plan is the MTNBP.
- If a plan has positive net NED benefits, it is even more defensible than it appears in the NED analysis because of the additive RED and OSE benefits.

Of the above takeaways, the only one that influenced the MTNBP development was the second bullet. In the Southern Waterfront, Alternative G has higher net NED benefits than Alternative E, but Alternative G has a large amount of retreat in 2090. This implies Alternative E provides higher flood protection for those areas and that the additional RED and OSE benefits it achieves may “make up” the difference in net NED benefits. In Reach 4, Alternative E and Alternative G have almost the same net NED benefits (separated by less than $100 million), but Alternative G is slightly higher; it can be argued, then, that Alternative E has higher net total benefits. In Reach 3, Alternative G has over $400 million more net NED benefits than Alternative E; is it worth it to sacrifice those net benefits (or, rather, incur the higher cost of Alternative E) to reap the additional RED and OSE benefits? That question is difficult to answer objectively, but it should be kept in mind as the analysis continues.

Another key takeaway has to do with nonstructural versus structural solutions. Many of the RED and OSE metrics are based on exposure. Structural measures typically transform risk, removing the hazard but potentially leaving communities vulnerable to overtopping or measure failure. Nonstructural, though, prevents the damage from exposure but does not prevent the disruption of flood events within the community as previously indicated. These disruptions are likely to be disproportionally felt by disadvantaged communities, who often do not have the resources to mitigate these impacts (even if a nonstructural plan has prevented physical damage to assets in the community). As such, RED and OSE benefits may not be correlated with NED benefits for nonstructural plans, meaning a structural plan in Reaches 1 or 4 may outperform the nonstructural first actions in terms of net total benefits.

Beyond the metrics that were correlated with NED benefits are metrics not correlated with the NED benefits. The uncorrelated other benefit categories may justify actions beyond the current actions determined in Table E-93 and altered through the correlation analysis (i.e., moving from Alternative G to Alternative E in Reaches 3 and 4), including using structural measures instead of nonstructural measures or building to higher crest elevation earlier in the period of analysis.

Some of the metrics that are not correlated with flood risk are detailed below:

- ***Seismic:*** A small portion of seismic benefits can be found in the NED discussion of the OMRR&R of the existing coastal defense system, but there are seismic impacts to life safety on the wharves and piers and in the waterfront areas. In the FWP, the reduction of these impacts is tied to whether or not the vulnerable wharf structures are replaced, especially along the Embarcadero. Projects that replace seismically vulnerable, aging waterfront structures with new, code-compliant structures will inherently reduce the life safety risk of waterfront assets. Additionally, the inclusion of substantial ground improvement in areas vulnerable to lateral spreading and liquefaction will reduce subsurface seismic hazards, thereby influencing the seismic performance of nearby structures. Alternatives C and D do not replace these wharves immediately (Alternative D does in 2090) while Alternatives E through G replace them in 2040. Whether or not the wharves are replaced will impact life safety and resilience.
- ***Resiliency:*** a relevant factor for this study is that the adaptations to measures require time to come online. It is a concern that, if a higher rate of SLC is realized, a new measure will take time to be authorized, designed and constructed such that the residual risk during that period will result in high levels of damages. One way to ensure resiliency is to overbuild in the present so that, when a higher risk is realized, there isn't the need to take another action that might be slow to be constructed. Adaptation strategies (e.g., the 2nd action of Alternatives D through G) build in the potential for quick increases in crest elevation, but the strategies that don't build upon initially constructed risk management structures but instead build new works may be slower. A larger question here is about what will be authorized with the Chief's Report. If only the first action is authorized, then the second action will take longer to come online because of the need for it to be authorized by Congress again. A discussion of this is provided in the Integrated Feasibility Report and Environmental Impact Statement.
- ***Economic Justice:*** Impacts to vulnerable communities in some cases will track with inundation. In Reach 4, however, where Alternative B is expected to buy down much of the risk of inundation, there is an argument to be made for investment in a structural solution earlier. Flood risk has multiple economic impacts on the community and its residents, and those impacts are amplified in vulnerable communities whose income and wealth provide less resiliency than communities with higher income residents. Equity Priority Communities are census tracts that have a significant concentration of underserved population, such as households with low incomes and people of color; these tracts, along

with the 1% AEP flood extents, can be seen on Figure E-50. Employment is often tied to community and long-term cultivation of opportunities, rather than professional training that can easily be relocated. Access to employment can be transit dependent and impacts to transit can cause proportionally large income losses in vulnerable communities. Lastly, one of the largest factors that contribute to generational wealth is homeownership and the appreciation of the family home over time. Vulnerability to flood hampers appreciation and requires continued repair and investment for those fortunate enough to be homeowners. While benefit-cost ratios may more easily justify investment in higher value communities, a more nuanced evaluation of the benefits of reducing risk in vulnerable communities can justify longer lines of defense or additional or higher scaled measures in applicable areas.

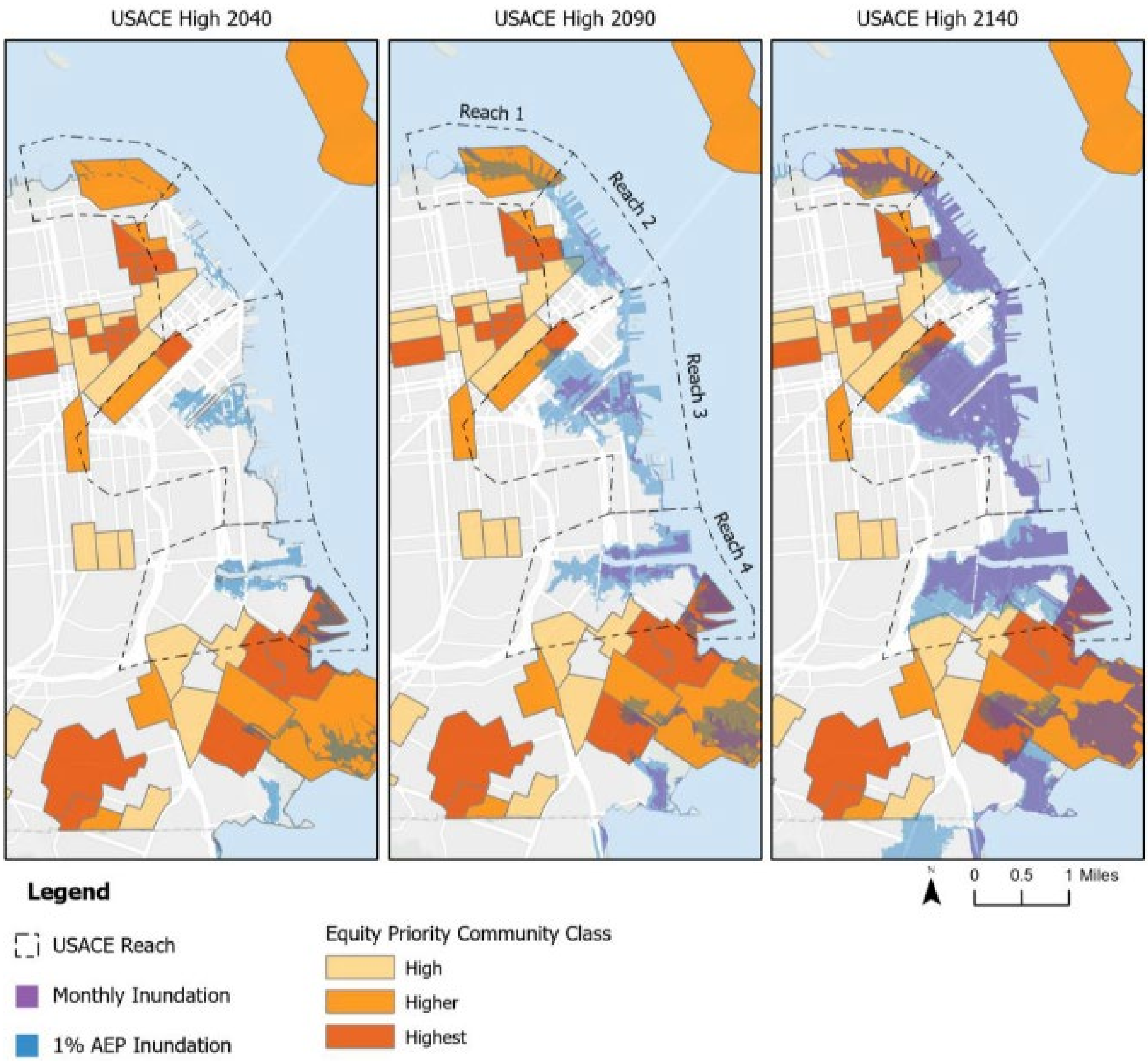


Figure E-50: Equity Priority Communities in the Study Area

- ***Concerns with Disruptions:*** Constructing structural measures across the San Francisco waterfront is a large-scale undertaking that will have many key impacts. Disruptions to transit, both public and private, are expected, which will hamper the ability of people to move about the city. These negative impacts have not been quantified, but there is an argument for, in high-traffic areas, constructing a larger measure to not have to repeatedly disrupt the study area. In a case like Reach 2, this would mean constructing Alternative G (15.5 feet) immediately instead of Alternative D (13.5 feet). This loss of optionality and earlier cost is traded off with the opportunity to only disrupt the functioning of the city once.

- ***Compromised Disaster Response Assets:*** In areas where nonstructural actions are recommended, disaster response assets—staging areas, boat launches, mobile hospitals, fire truck connections and more disaster-related sites—may no longer be accessible during storm events. This may compromise the CCSF's ability to respond to disasters by making it challenging for emergency personnel, supplies, and equipment to reach affected areas. This is one of the types of assets where reducing physical damage through nonstructural means may not be sufficient. Instead, protecting disaster response assets with physical solutions will allow them to function properly and provide value to the waterfront and the city. Considering these assets will support the determination that an alternative achieves an overall study objective related to post-disaster capacity and resilience.
- ***Historic Districts, including community identify and culturally significant landmarks:*** Areas along the Northern Waterfront are cultural and historic assets with significance to the community and region, including several assets on the National Register of Historic Places. These places drive the regional economy as tourist attractions. Alternatives that preserve or sustain the function and existence of these landmarks contribute net total benefits and may not be correlated with dollar denominated benefits that accrue due to reduced flood damages in the study area.
- ***Concerns with Water Management Structures:*** As mentioned at the beginning of Section 9, Alternative F was screened in Reaches 3 and 4 due to acceptability concerns with the water management structures across Islais and Mission Creeks. Though those alternatives do a good job of reducing flooding in those areas, the multifaceted concerns about the alternative were such that it was not carried forward.
- ***Maritime Berthing:*** The maritime functions key driver comprises exposure to deep draft berthing and backland area, two critical components of an operable maritime port. Several maritime business lines rely on these components of maritime infrastructure to ensure the maritime industry remains viable. The study area is home to all major POSF operations within the city, and therefore of critical importance to evaluate the FWOP and FWP effects for each alternative. The PDT evaluated the FWP impacts on these areas, and like with the disaster response assets, these are impacts that cannot be reduced with nonstructural measures.

9.5 Selecting a Maximum Total Net Benefits Plan

The discussion in Section 9.4 suggests potential changes to the strategy that attempts to maximize net NED benefits across SLC curves laid out in Table E-94. The leading reasons for these are:

- RED and OSE benefits correlated with flood risk may support Alternative E in the Southern Waterfront, since its alignment is more bayward than Alternative G and, as such, it provides more protection for more assets, land, and people.
- Nonstructural alternatives prevent physical damage but do an incomplete job of preventing RED and OSE losses that may stem from disruption. This may support structural instead of nonstructural first actions in Reaches 1 and 4.
- Vulnerable communities in Reach 4 who live and work around the Islais Creek, Pier 94-96 and Heron's Head subareas may be impacted by flooding in ways that a nonstructural solution does not mitigate. Disadvantaged communities have less resilience to these impacts; this can be thought of as a "multiplier effect" to the disruption impact discussed above.
- Seismic concerns in all four reaches may support replacement of wharves, providing life safety benefits and extending the life of some culturally significant landmarks. Replacing wharves also presents the opportunity to preserve maritime berths across the waterfront.
- Resiliency concerns in all four reaches may support larger construction earlier in the project timeframe, ensuring that measures are resilient throughout the period of analysis.
- Disaster response assets may not function in areas where nonstructural solutions are chosen. In Reach 4, there are disaster response assets that will face vulnerability in 2040, including assets on located by Pier 92 and 94-96 by Islais Creek and Heron's Head Park.
- Major disruptions from construction should be minimized when possible. One way to do this is by building easily adaptable structures or building resilient structures that provide sufficient defense for a long period of time regardless of SLC curve. This is particularly important in Reach 2, where the Embarcadero, a major transportation corridor, will be impacted by construction.

Cost-effective (pareto efficient) plans that achieve each of these goals must be identified. These plans may differ from the plans that maximize net NED benefits. "Cost effectiveness" means that, for each metric, there is a least-cost plan that achieves a desired level of output. A set of cost-effective plans by reach is shown below, each one efficiently improving the output of at least one non-NED metric:

- *Structural (Alternative D) in Reaches 1 and 4 instead of nonstructural (Alternative B) as an initial action.* This buys down the RED and OSE risks from disruption and provides particular benefits to disadvantaged communities in Reach 4.
- *Alternative E as a 2nd Action under the High SLC Curve in Reaches 3 and 4.* This reaps the benefits of not retreating from the waterfront, protecting businesses, people, maritime function, and disaster response assets.

- *Alternative E or G as a 1st Action in Reaches 1 through 4*. This provides resiliency to the waterfront against all rates of SLC and provides the most seismic life safety and maritime benefits. This will also mean that a 2nd major construction will be avoided under the High SLC curve, since the larger initial actions can be more easily adapted to a higher crest elevation.

All of the plans shown above are pareto efficient, though pareto efficiency is a necessary, not sufficient, condition for selecting a plan. Note that both Alternative C and Alternative F are not mentioned above. For Alternative C, this is because of the lack of adaptability, implying it is not a plan that will provide good outcomes under all rates of SLC. For Alternative F, it is because of the acceptability concerns discussed earlier.

The PDT decided first that Alternative E would be a better 2nd action than Alternative G in Reaches 3 and 4. This decision was made knowing that the net NED benefits between Alternative E 2nd action and Alternative G 2nd action are reasonably close (Alternative G had $100 million more in net benefits in Reach 3 and $400 million in Reach 4, though both plans have positive net NED benefits). Alternative E protects 292 assets that Alternative G would retreat from (195 in Reach 3 and 97 in Reach 4), but that also means that thousands of people will be saved from the impact of retreat, millions of dollars in RED benefits will be saved (190 of the assets in the area that would be retreated from are commercial or industrial), and in Reach 4, disadvantaged communities won’t have their homes and jobs displaced. The differences in OSE and RED benefits between Alternative E and Alternative G are described in more detail in *Sub-Appendix E.1: RED Report* and *Sub-Appendix E.2: OSE Report*.

Additionally, the PDT intends to refine Alternative E post-TSP. Lessons learned during the design of Alternatives E, F, and G provided more insight into ways to align and construct a cost-effective plan. Leveraging these lessons is expected to lead to a lower-cost plan with minimal changes in benefits with hybridizations on the subreach level. This work could make Alternative E 2nd action have higher net NED benefits than Alternative G 2nd action. Regardless, because of the clear additional benefits from Alternative E 2nd action in the Southern Waterfront, it was chosen as the MTNBP as an adaptive action in the face of High SLC.

When considering whether to “go big” with the first action in the name of resiliency in Reaches 3 and 4, the PDT had to evaluate how feasible doing multiple adaptive actions was. If a first action could be a smaller construction but a larger coastal defense system could be brought online in response to the High rate of SLC, then the costs of the larger construction are not worth incurring up front. When discussing replacing the wharves for maritime and life safety benefits (another benefit of “going big” early), the PDT decided that these benefits were generally small across the reaches (in the life safety category) or could be deferred to the later time period (for maritime benefits), except for a few localized areas that could be addressed with subreach level plan refinements. As such, incurring the additional cost in 2040 to build a larger plan across the entirety of Reach 3 and 4 is not expected to maximize total net benefits.

This is not true in Reach 2. In Reach 2, the seismic life safety risk is considered more severe due to the Embarcadero’s function as a lifeline for the city. Life safety risk is also expected to be higher in the high-traffic wharves and piers in Reach 2. Finally, the construction disruption is expected to be most impactful in Reach 2 as construction will impact the Embarcadero, likely shutting down lanes of traffic and impacting public transportation. Mitigating this risk by building something comprehensive instead of disrupting the Embarcadero multiple times with construction is a large benefit to the city. As such, Alternative G is recommended as the 1st action in Reach 2.

The PDT had to decide whether nonstructural or structural was the correct 1st action in Reaches 1 and 4, as nonstructural maximized net NED benefits while structural presented numerous other sources of benefits in the RED and OSE categories. This difficult decision came down to the number of exposed assets at various flood heights, the composition of those assets, the number of people exposed, and the existing resiliency of the communities. With these factors in mind, it was decided that Alternative B would remain the first action for Reach 1 while Alternative D would maximize net total benefits in Reach 4.

The MTNBP can be seen in Table E-107:

Table E-107: MTNBP First and Second Actions

Reach	First Action	Second Action Low	Second Action Int.	Second Action High
1	Alternative B	N/A	Alternative B (Additional NS)	Alternative G 19 feet
2	Alternative G 15.5 feet	N/A	N/A	Alternative G 19 feet
3	Alternative D 13.5 feet	N/A	Alternative D 15.5 feet	Alternative E 19 feet
4	Alternative D 13.5 feet	N/A	Alternative D 15.5 feet	Alternative E 19 feet

The costs of the MTNBP under all three SLC scenarios can be seen in Table E-108 through Table E-110.

Table E-108: Cost of 2040 Action, MTNBP (PV, $000s)

Reach	Plan	Total Construction	Duration (months)	IDC	Subtotal AAC	OMRR&R	Total AAC
1	B High 2040	61,737	3	127	1,822	-	1,822
2	G	2,972,349	180	621,514	105,854	14,862	120,716
3	D 1st	367,809	96	38,425	11,965	1,839	13,804
4	D 1st	736,256	96	76,918	23,951	3,681	27,633

Table E-109: Additional Cost of Future Actions, Intermediate SLC Curve (PV, $000s)

Reach	Plan	Total Construction	Duration (months)	IDC	Subtotal AAC	OMRR&R	Total AAC
1	B 2065	884	3	2	26	-	26
2	N/A	-	-	-	-	-	-
3	D 2nd	250,504	96	26,171	8,149	1,253	9,402
4	D 2nd	197,948	96	20,680	6,439	990	7,429

Table E-110: Additional Cost of Future Actions, High SLC Curve (PV, $000s)

Reach	Plan	Total Construction	Duration	IDC	Subtotal AAC	OMRR&R	Total AAC
1	G 1st and 2nd	315,725	180	66,018	11,244	1,579	12,823
2	G 2nd	2,076	180	434	74	10	84
3	E 1st and 2nd	1,366,740	180	285,784	48,674	6,834	55,507
4	E 1st and 2nd	1,187,852	180	248,378	42,303	5,939	48,242

The benefits from the MTNBP, especially as they differ from the plans that maximize net NED benefits (described in Table E-94), have been described above and in *Sub-Appendix E.1: RED Report* and *Sub-Appendix E.2: OSE Report*. The costs and benefits of this plan can be seen in Table E-1112 by reach for each of the SLC curves. Highlighted lines represent scenarios in which the net NED benefits are positive (and, therefore, that the BCR is above one).

Table E-111: Costs and Benefits for the MTNBP by Reach (PV, $000s)

By Reach		NED Benefits	Costs	Net NED Benefits	BCR
1	Low	4,528	61,864	-57,336	0.07
	Int	51,106	62,750	-11,644	0.81
	High	1,341,527	497,203	844,324	2.70
2	Low	724,238	4,098,435	-3,374,197	0.18
	Int	1,570,802	4,098,435	-2,527,633	0.38
	High	7,556,338	4,101,298	3,455,040	1.84
3	Low	589,739	468,671	121,068	1.26
	Int	1,728,206	787,870	940,336	2.19
	High	8,709,775	2,353,206	6,356,569	3.70
4	Low	165,381	938,157	-772,776	0.18
	Int	350,764	1,190,387	-839,623	0.29
	High	3,278,982	2,576,031	702,951	1.27

The results of the MTNBP creation are complex, as costs and benefits vary across curves and across the 100-year period of analysis. A few key takeaways are described below:

- Reach 3 is justified based on NED benefits under all three curves. This speaks to the high existing vulnerability of assets within Reach 3 and the comparatively low cost of the first action necessary to provide protection.
- Reach 2 has negative net NED benefits under both the Low and the Intermediate SLC curves. This is expected, as the NED analysis suggested a smaller initial plan would do better at aligning the costs with the benefits that were measured in time. The RED, OSE, and EQ analysis suggested additional reasons to favor a larger project initially in Reach 2.

- Reach 4 is also negative in terms of net NED benefits under all the Low and Intermediate curves. This is also expected, considering only nonstructural was justified in that reach when considering net NED benefits under those curves. As a large part of the NED analysis is done by computing benefits based on structure and content values and lower-income areas have lower-valued assets that take less damage, only considering NED benefits can lead to underinvestment in lower-income areas and exacerbation of existing inequalities. The RED and OSE analysis suggested a structural measure in Reach 4 maximized total net benefits.
- Reach 1 continues to be nonstructural at first. The scale of the first action for the recommended nonstructural plan is the 2065 High 1% AEP event. This leads to overinvestment under the Low and Intermediate SLC curve but provides additional resilience in the short term if a higher rate of rise is realized. Future work will seek to optimize the initial action to attempt to maximize benefits across all three curves. As nonstructural retrofits are comparatively easy to identify and plan based on risk and exposure, it may make sense to reduce the amount of nonstructural recommended for 2040 and rely on an implementation plan that is tied to observed sea level rise trends.
- The costs and benefits in this analysis are still tied to 2040 and 2090 actions. Relaxing this assumption—for instance, by making the 2nd action of Alternative D under the Intermediate curve occur in 2130—does a better job of aligning costs and benefits in time. After the first action is taken, the decision about when and whether to adapt the measure can be optimized for a variety of criteria. The framework used here is a simplification, and as such, higher net benefits could be had by relaxing and refining this assumption.
- Additional optimizations of the measures on the subreach level are expected to be done between the release of the draft and final reports. An indication of these optimizations is expected to be identified at the Agency Decision Milestone. These optimizations are aimed at reducing the costs of the measures, reducing environmental impacts and maintaining or improving benefits associated with the measures. It is expected that the savings may be highest in Reach 4, helping to continue to justify the use of a structural measure there.
- There are infinite potential SLC curves between the Low and the High curve. USACE uses the three curves as a simplification for analysis, but the MTNBP performs best looking at a curve somewhere between the Intermediate and the High curve (this is close to the California Likely curve, which is one curve used by the state for regulatory and planning purposes). It is important to recognize that this plan has been chosen based on its resiliency across the different curves.

10. Conclusion

Using current figures, the TSP is expected to provide mean Average Annual Net Benefits of -$68.6 million, with a Benefit-to-Cost ratio of .62 and 37.9% in Residual Damages under the Intermediate RSLC curve. This contrasts to the NED plan, which has Average Annual Net Benefits of $77.4 million, a BCR of 5.65, and Residual Damages of 47.9%. The TSP was selected to maximize total net benefits, and the additional benefit streams in the RED, OSE, and EQ accounts are considered to justify the additional cost.

Furthermore, the TSP is the more adaptable plan. When considering the High RSLC curve, the TSP provides positive net NED benefits. The TSP is also expected to outperform the NED plan for many curves between the Intermediate and the High curve. Finally, refinements of the TSP are expected to reduce costs, potentially revealing it as the NED plan.

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SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CA

DRAFT APPENDIX E.1 – REGIONAL ECONOMIC DEVELOPMENT REPORT

JANUARY 2024

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

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Acronyms and Abbreviations

Acronym	Definition
AEP	Annual Exceedance Probability
BART	Bay Area Rapid Transit
Bay	San Francisco Bay
CCSF	City and County of San Francisco
FEMA	Federal Emergency Management Agency
FWOP	Future Without Project
FWP	Future With Project
G2CRM	Generation 2 Coastal Risk Model
GDP	Gross Domestic Product
IO	Input-Output
IWR	Institute for Water Resources
LPC	Local Purchase Coefficient
LPW	Low-Pressure Water
LRV	Light Rail Vehicle
MMT	Muni Metro Turnaround
Muni	San Francisco Municipal Railway
NAVD88	North American Vertical Datum of 1988
NED	National Economic Development
OPC	California Ocean Protection Council
OSE	Other Social Effects
P&G	Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies

POOCC	Problem, Opportunity, Objective, Constraint, and Consideration
POSF	Port of San Francisco
RECONS	Regional Economic System
RED	Regional Economic Development
SFBR	San Francisco Bay Railroad
SFMTA	San Francisco Municipal Transportation Agency
SFPUC	San Francisco Public Utilities Commission
SFWCFS	San Francisco Waterfront Coastal Flood Study
SLC	sea level change
SLR	Sea Level Rise
TSB	Transport Storage Box
UCSF	University of California San Francisco
USACE	U.S. Army Corps of Engineers

Section E.1-1. Introduction

This report describes the potential regional economic impacts of coastal flooding and sea level rise for the San Francisco Waterfront Coastal Flood Study (SFWCFS). Also known as Regional Economic Development (RED), the report is intended to identify how economic impacts from flooding in the SFWCFS area may affect the Bay Area and larger California economy without any flood mitigation. The regional economic impacts discussed in this report represent future without project (FWOP) conditions, along with the residual losses expected with each mitigation alternative evaluated in the SFWCFS.

Quantitative components of the analysis focus on the direct impacts to businesses in terms of revenue loss, output loss, and job loss. Direct revenue and output losses were modeled using the Generation 2 Coastal Risk Model (G2CRM), while the input-output (IO) software IMPLAN was used to quantify direct job losses, along with the indirect and induced consequences these direct impacts have on jobs and economic output considering the larger California economy. Key sectors that depend on the economic activity at the waterfront are discussed. Qualitative impacts to key transportation and utility infrastructure are discussed, monetizing impacts where appropriate.

Because the area is still recovering from the COVID-19 pandemic, values presented in this report, such as job, ridership, or population counts, typically represent pre-pandemic conditions.

These various assessments provide a framework of potential regional economic disruption and long-term impacts due to coastal flooding and SLR. The methodologies, assumptions, and results are structured as follows:

- **Section E.1-1, Introduction.** Presents the principles and guidance behind the RED account analysis and introduces the SFWCFS study area.
- **Section E.1-2, Economic Profiles.** Presents existing economic conditions across reaches, including discussions on real estate and recent development projects, employment and income statistics, geographical commuting patterns, and critical infrastructure.
- **Section E.1-3, Methodology.** Provides an overview of the RED metrics of interest, data sources, flood hazard data, and methodologies used in the RED analysis.
- **Section E.1-4. FWOP Analysis and Results.** Presents potential consequences in terms of revenue losses for critical transportation and utility assets, direct output and job losses in the project area, and cascading regional output and job losses in the nine-county Bay Area and California.
- **Section E.1-5. Future With Project (FWP) Results.** Summarizes the benefits of each of the six alternatives evaluated in the FWP analysis for each RED metric of interest.
- **Section E.1-6. Summary.** Provides summary matrices of the key takeaways from the analysis.

- **Section E.1-7. References.** Documents sources used to develop this assessment.

E.1-1.1 Principles and Guidelines

The RED evaluation is one of four accounts set forth by the U.S. Army Corps of Engineers (USACE) Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, also known as the P&G (US WRC, 1983). In addition to RED, the P&G includes three other accounts: National Economic Development (NED), Other Social Effects (OSE), and Environmental Quality. Collectively, the four accounts evaluate all significant effects of a plan on the project area and beyond.

The P&G ensures that the formulation and evaluation of water resources studies are completed effectively and consistently by federal agencies. Recently, the Assistant Secretary of the Army for Civil Works instructed that feasibility studies “identify, analyze, and maximize all benefits in the NED, RED, and OSE (ASA(CW), 2020).” These instructions indicate that RED and OSE impacts will play a larger role in plan formulation and evaluation than historically documented to date. Therefore, this RED report includes a significant level of quantitative evaluation, including IO modeling to support the presentation of indirect and induced impacts, in addition to direct impacts to the study area.

The Institute for Water Resources (IWR) RED Procedures Handbook (2011-RPT-01) defines RED impacts as regional losses in employment and/or income under the FWOP condition. Based on guidance from this handbook, the RED analysis evaluates the regional economic consequences of coastal flooding and SLR using Federal Emergency Management Agency (FEMA) benefit-cost analysis methodologies. These methods are further described in Section E.1-3.

Per IWR 2011-RPT-01 *Regional Economic Development Procedures Handbook* (March 2011), RED impacts are defined as the transfers of economic activity within a region or between regions in the FWOP and for each alternative plan. Spending in an area can spur economic activity, leading to increases in employment, income, and output of the regional economy, while chronic or catastrophic flooding can lead to regional losses of employment and income. IWR 2011-RPT 01 defines three types of RED impacts:

- *Direct effects* are the impacts direct federal expenditure have on industries that directly support the new project. Labor and construction materials are considered the direct components of a project.
- *Indirect effects* represent changes to secondary industries that support the direct industry. For example, rock quarries used in making cement could be considered indirect pieces of a project.
- *Induced effects* are changes in consumer spending patterns caused by changes in employment and income within the direct and indirect industries. The additional income earned by workers may be spent in numerous different ways within the region.

E.1-1.2 Study Area

The SFWCFS study area extends 7.5 miles from Aquatic Park to Heron's Head Park. The study area is divided into four reaches as shown on Figure E.1-1, based on identifiable geographic references, specific wave action within each reach, and major differences in the built environment and physical assets and infrastructure present. Each reach is also comprised of sub-areas to enable the development of alternatives at the scale necessary for the San Francisco waterfront. The RED analysis is mostly presented at the reach level, though references may be made to a subarea where appropriate.

Figure E.1-1: SFWCFS Study Area

E.1-1.3 Alternative Descriptions

The RED analysis evaluated seven mitigation strategy alternatives, described in more detail in the engineering documentation. Alternative A represents the No Action, or FWOP scenario. Alternative B represents a nonstructural option aimed at providing floodproofing for all buildings, essentially eliminating all residual losses. Alternatives C and D are designed toward a lower rate of SLR, while Alternatives E, F, and G are designed with a higher design flood elevation in mind. Table E.1-1 provides a high-level summary of these alternatives.

Figure E.**1-2** and Figure E.1-3 show projected flood inundation resulting from the 1% AEP in the project area in the case of a USACE high SLC curve, at the time horizon of 2090 for future without projects and each of the alternatives. Exposure maps for each alternative alignment are included in *Appendix B.1.8 – San Francisco Waterfront Inundation Maps.*

Table E.1-1: Alternatives A-G, First and Second Actions

Name	Short Description	First Action (2040)	Second Action (2090)	Long Description
A	No Action	No Action	No Action	Takes no actions to reduce flood risks beyond projects that are already approved.
B	Nonstructural	Nonstructural in 2040 and 2065	Nonstructural in 2090 and 2115	Moves people and assets away from the risk, uses nonstructural measures (such as floodproofing) to reduce risks, and allows water to move freely rather than constructing traditional structural solutions.
C	Defend, Scaled for Lower Risk	13.5 feet	No action	Adapts the shoreline to withstand 1.5 feet of sea level rise using a combination of structural and nonstructural measures. This includes raising creek shorelines and using deployable flood defense structures to maintain maritime access and uses.
D	Defend, Scaled for Low-Moderate Risk	13.5 feet	15.5 feet	Adapts shoreline to withstand 1.5 feet of sea level rise with the possibility of building higher closer to 2090.
E	Defend Existing Shoreline, Scaled for Higher Risk	15.5 feet	19 feet	Preservers a waterfront that looks and functions much as it does today by raising the shoreline.
F	Manage the Water, Scaled for Higher Risk	15.5 feet	19 feet	Creates an active system for managing flooding by heavily relying on machinery.
G	Partial Retreat, Scaled for Higher Risk	15.5 feet	19 feet	Works with natural flooding patterns by using a combination of structural measures, floodproofing, and managed retreat from the highest risk areas.

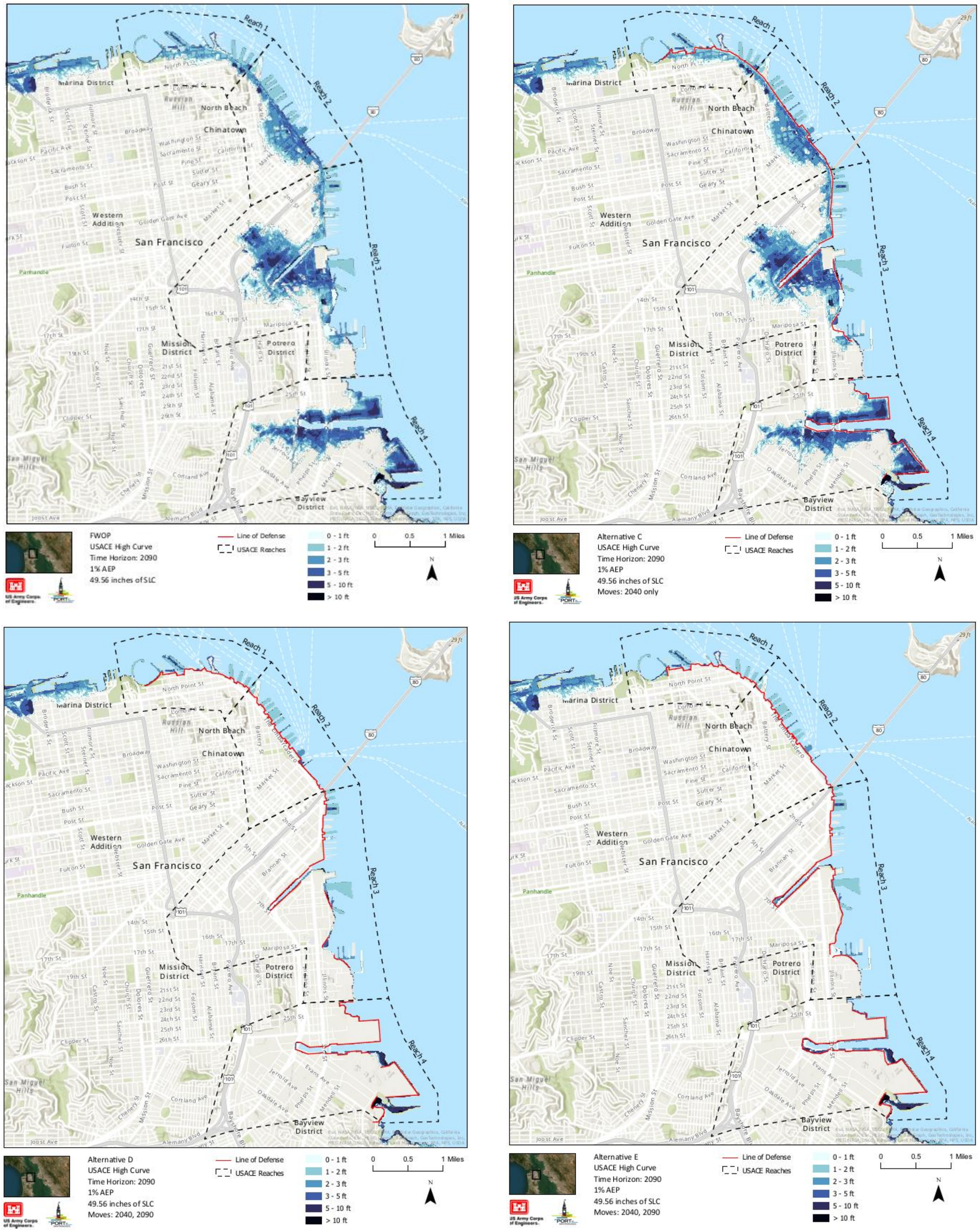


Figure E.1-2: FWOP, Alternative C, Alternative D, and Alternative E San Francisco Waterfront Inundation Maps

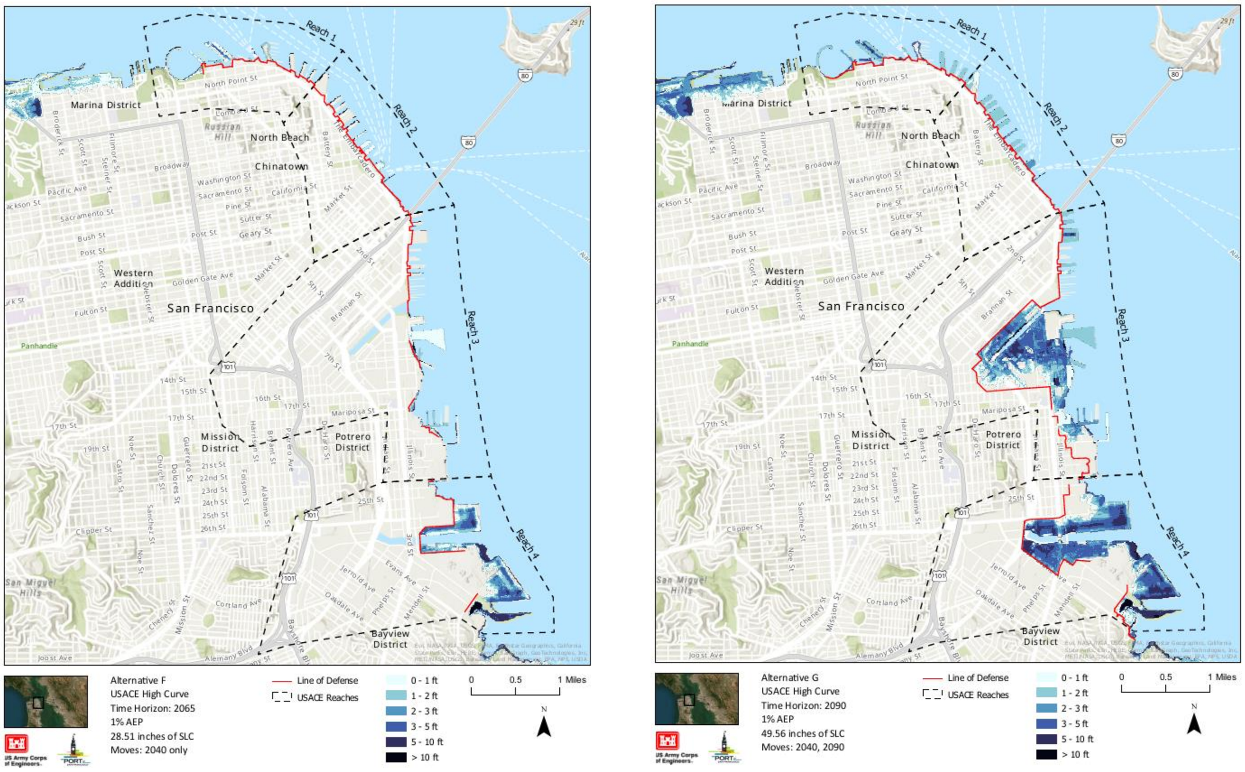


Figure E.1-3: Alternative F and Alternative G San Francisco Waterfront Inundation Maps

Section E.1-2. Economic Profiles

This section presents a discussion of baseline economic indicators and metrics, including employment and income statistics and critical infrastructure within each reach of the SFWCFS area. Key employment trends and demographics across the Bay Area were analyzed with the OnTheMap Application which uses Longitudinal Employer Household Dynamics (LEHD) Origin-Destination Employment Statistics (U.S. Census, 2019). The dependence of vulnerable populations on the employment opportunities and critical infrastructure that serve this area are discussed. Comparisons are made across the four reaches for these existing economic conditions.

E.1-2.1 Employment and Income

Examining the employment and income statistics for the SFWCFS area is essential to understanding the strengths and weaknesses underlying each reach, and the importance of each reach to the economies of San Francisco and the Bay Area. Table E.1-2 provides the population of and number of jobs within each reach, compared to San Francisco and California totals. In each reach and the waterfront as a whole, there are significantly more people employed than living in the area. The SFWCFS area is an essential employment hub for San Francisco.

It is also important to understand the makeup of the workforce along the waterfront. San Francisco has an aging population, as well as the highest level of income inequality in

California. While household income for white families is over $150,000, household income for Black/African American families is $39,000 a year (U.S. Census, 2020). Income is associated with many adverse health outcomes and community resiliency (SFDPH, 2017), and elderly populations are at an increased risk for many health outcomes associated with extreme weather events, including cardiovascular illness and respiratory disease. For a full discussion on vulnerable populations within the study area, see the *Sub-Appendix: E.2: OSE Report*.

Table E.1-2: Overall Population and Employment for the Study Area, Compared to San Francisco Totals

Area	Residential Population [a]		Employment (Number of Jobs) [b]	
	Count	Percent of SFWCFS	Count	Percent of SFWCFS
Study Area Total	86,000	100%	310,000	100%
Reach 1	11,000	13%	10,000	3%
Reach 2	15,000	17%	180,000	59%
Reach 3	47,000	55%	100,000	34%
Reach 4	13,000	15%	14,000	4%
San Francisco Total	870,000	-	770,000	-
California Total	40,000,000	-	17,000,000	-

[a] U.S. Census Bureau, American Community Survey 5-Year Estimates Data Profiles, 2019

[b] U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics (Beginning of Quarter Employment, 2nd Quarter of 2002-2019).

The San Francisco workforce has similar characteristics to the California workforce, with a few key distinctions. In general, San Francisco has a highly educated workforce, high paying jobs, and a very diverse workforce in terms of race (particularly with a higher proportion of Asian workers than in the rest of California). The waterfront is an essential employment center for San Francisco, containing roughly 40 percent of the city's jobs Many San Francisco residents commute into the SFWCFS area for work (see Data Source: U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics (Beginning of Quarter Employment, 2nd Quarter of 2002-2019). Note: Overlay arrows to not indicate directionality of workflow between home and employment locations.

The study area shares some of San Francisco's workforce characteristics but has a higher portion of workers with vulnerability characteristics. Data on the workforce characteristics for each reach was derived from U.S. Census Data and is presented in Table E.1-3.

Reaches 1 and 4 have higher percentages of workers aged 55 or older (~25%) than the rest of the SFWCFS area (~16%). Reaches 1 and 4 also have significantly lower percentages of jobs paying over $3,333 per month. The waterfront workforce as a whole has a similar racial composition to San Francisco but Reach 4 has a higher percentage of Black or African American workers than other reaches and the city. Reaches 2 and 3 have higher percentages of Hispanic or Latino workers than San Francisco as a whole.

There is high variability in educational attainment of workers across reaches. Reach 2 has a higher percentage of workers with a Bachelor’s or advanced degree, which is reflected in the high percentage of High paying jobs. This makes sense, given Reach 2’s inclusion of the Financial District. All other reaches have lower percentages of workers with a Bachelor’s or advanced degree than San Francisco, with particularly low percentages in Reaches 1 and 4. Reach 4 has a higher percentage of workers with less than a high school education than any other reach, San Francisco, and even California as a whole. Educational attainment is correlated with health, income, and resilience. Those with lower levels of education attainment are more likely to be estranged from government services and are more vulnerable to the health impacts of natural hazard events.

Table E.1-3: Baseline Employment Indicators for the Study Area, Compared to San Francisco Totals[a]

Metric	Reach 1	Reach 2	Reach 3	Reach 4	Study Area Total	San Francisco Total	California Total
Jobs by Worker Age (percent of all jobs)							
29 or younger	22%	22%	23%	20%	22%	21%	22%
Age 30 to 54	55%	62%	61%	56%	61%	59%	55%
Age 55 or older	23%	15%	16%	25%	16%	20%	23%
Jobs by Earnings (percent of all jobs)							
$1,250 per month or less	15%	6.0%	10%	13%	8.1%	13%	20%
$1,251 to $3,333 per month	25%	9.8%	14%	24%	12%	18%	30%
More than $3,333 per month	60%	84%	75%	63%	79%	70%	50%
Jobs by Worker Race (percent of all jobs)							
White Alone	62%	61%	60%	63%	61%	58%	72%
Black or African American Alone	6.3%	5.6%	7.0%	9.8%	6.3%	7.1%	6.8%

Metric	Reach 1	Reach 2	Reach 3	Reach 4	Study Area Total	San Francisco Total	California Total
American Indian or Alaska Native Alone	0.8%	0.6%	0.7%	1.1%	0.6%	0.7%	1.3%
Asian Alone	27%	28%	28%	22%	28%	30%	17%
Native Hawaiian or Other Pacific Islander Alone	0.5%	0.4%	0.5%	0.8%	0.5%	0.5%	0.5%
Two or More Race Groups	3.2%	3.7%	3.8%	3.6%	3.7%	3.7%	3.0%
Jobs by Worker Ethnicity (percent of all jobs)							
Not Hispanic or Latino	78%	87%	84%	72%	85%	83%	65%
Hispanic or Latino	22%	13%	16%	28%	15%	17%	35%
Jobs by Worker Educational Attainment (percent of all jobs)							
Less than high school	13%	6.7%	9.3%	16%	8.7%	10%	15%
High school or equivalent, no college	16%	12%	13%	18%	13%	14%	16%
Some college or Associate degree	21%	19%	21%	24%	20%	21%	23%
Bachelor's degree or advanced degree	28%	40%	34%	22%	37%	34%	24%
Educational attainment not available (workers aged 29 or younger)	22%	22%	23%	20%	22%	21%	22%
Jobs by Worker Sex (percent of all jobs)							
Male	49%	55%	55%	68%	55%	52%	51%

Metric	Reach 1	Reach 2	Reach 3	Reach 4	Study Area Total	San Francisco Total	California Total
Female	51%	45%	45%	32%	45%	48%	49%

[a] U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics (Beginning of Quarter Employment, 2nd Quarter of 2002-2019).

The SFWCFS area has a diverse range of industry sectors, but the Professional, Scientific, and Technical Services industry represents over one-fourth of the workforce. Workers in this sector are primarily located in Reach 2, which also has a large portion of Finance and Insurance jobs. The Reach 1 workforce is dominated by Retail Trade, Accommodation and Food Services, and Professional, Scientific, and Technical Services. Reach 3 has a high proportion of Administration & Support, Waste Management and Remediation, Information, Educational Services, and Professional, Scientific, and Technical Services. Reach 4 has a very different industry composition than the other reaches, and is primarily composed of Construction, Wholesale Trade, Transportation and Warehousing, and Accommodation and Food Services. Data Source: U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics (Beginning of Quarter Employment, 2nd Quarter of 2002-2019).

Note: Overlay arrows do not indicate directionality of work flow between home and employment locations.

Figure E.1-4 shows the number of workers commuting into and out of each reach in the study area, as well as those that stay within each reach. A much larger number of people commute into the study area than commute out (net job inflow of 350,000), demonstrating the importance of the study area as an employment center. Reach 2 has the largest inflow of commuters, with a net job inflow of over 200,000. This large inflow is due to the proximity to the Financial District which acts as an economic hub within San Francisco. Reach 3 also has a large net job inflow of over 100,000, while Reaches 1 and 4 are slightly more balanced, with net job inflows of 6,100 and 14,000, respectively.

Reach 1

Net Job Inflow: 6,100

Reach 2

Net Job Inflow: 220,000

Reach 3

Net Job Inflow: 110,000

Reach 4

Net Job Inflow: 14,000

Data Source: U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics (Beginning of Quarter Employment, 2nd Quarter of 2002-2019). Note: Overlay arrows do not indicate directionality of work flow between home and employment locations.

Figure E.1-4: Employment Inflow and Outflow by Study Area

E.1-2.2 Critical Infrastructure

The following sections describe critical infrastructure systems that support the waterfront, including public transportation and utility systems. Critical infrastructure is an essential economic driver for the study area. Both public transportation and utilities provide essential services to the people who live and work in the SFWCFS area, while connecting the waterfront to the Bay Area at large. This section is intended to provide a basic understanding and key data to carry forward into the RED analysis.

The regional public transportation system is essential to the waterfront's identity as an employment hub and driver of economic activity for the region. The regional transportation system supports a large influx of workers into the city, many of whom represent minority or low-income populations. As a result, businesses in the SFWCFS area can draw from more diverse pools of employees. Disadvantaged populations have greater accessibility to the waterfront and to high paying jobs, helping bridge the gap in housing inequalities that are prevalent in the region. Understanding the presence and impact of critical infrastructure within the SFWCFS area sets the stage for further analysis on the impacts of SLR.

E.1-2.2.1 Transportation

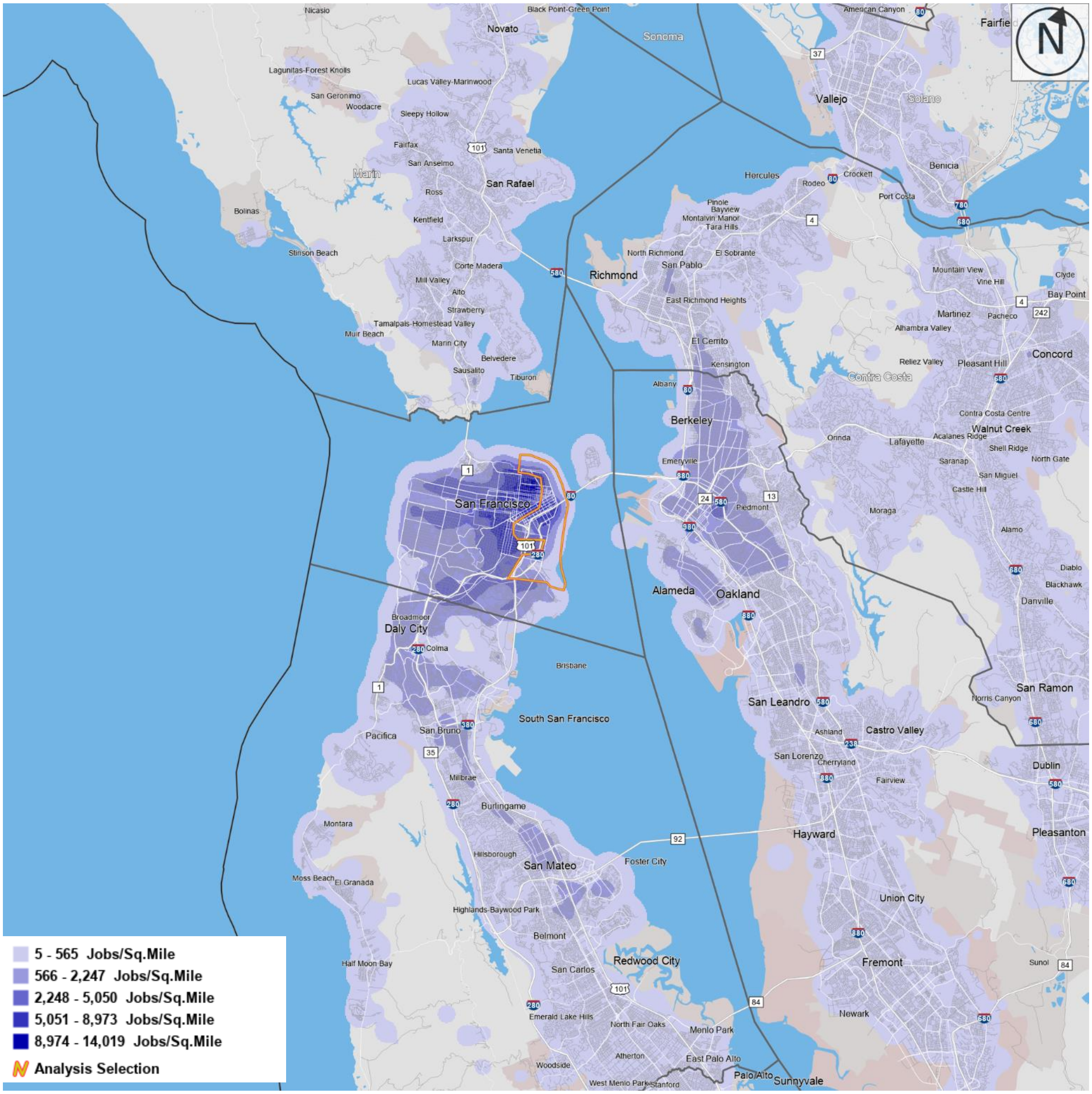
The Bay Area has become a metropolitan area with a population of more than 7.7 million in nine counties, linked by bus, rail, and ferry service (U.S. Census, 2020). San Francisco is centrally located between the two other major cities in the region – San Jose and Oakland – and serves as an economic hub for business and entertainment activity. The mobility systems that depend on the waterfront include throughways and connections that are essential to the region and the state.

San Francisco is locally served by the San Francisco Municipal Railway (Muni), which is run by the San Francisco Municipal Transportation Agency (SFMTA). The Muni network includes buses, surface and subway light rail (Metro trains), historic streetcars and iconic cable cars. The regional public transportation system servicing the Bay Area is composed of rail (Bay Area Rapid Transit [BART]) and Caltrain), ferry (Water Emergency Transportation Authority and Golden Gate Ferry), and regional buses (AC Transit SamTrans, Golden Gate Transit) (CH2M/Arcadis, 2020h). Each of these systems, particularly BART and Muni, serve as lifelines to the city and region. These systems support the dense urban development pattern that characterizes the city and support equitable access to the waterfront. Additionally, the systems enable large numbers of lower-income workers to commute to their jobs from neighborhoods and communities across the Bay Area, supporting a more diverse workforce (SFWG 2017).

In addition to these systems, San Francisco has an extensive shared road network, which includes the Embarcadero and connected bike and pedestrian trails. These shared roadways serve business and recreational visitors connecting to various modes or accessing nearby Bay Bridge on-ramps as well as the Bay Trail that rings the Bay with contiguous cycling and pedestrian access (CH2M/Arcadis, 2020h). While the shared roadways are an important asset to the city, this report is focused on those transportation systems most vulnerable to flooding, such as BART and Muni.

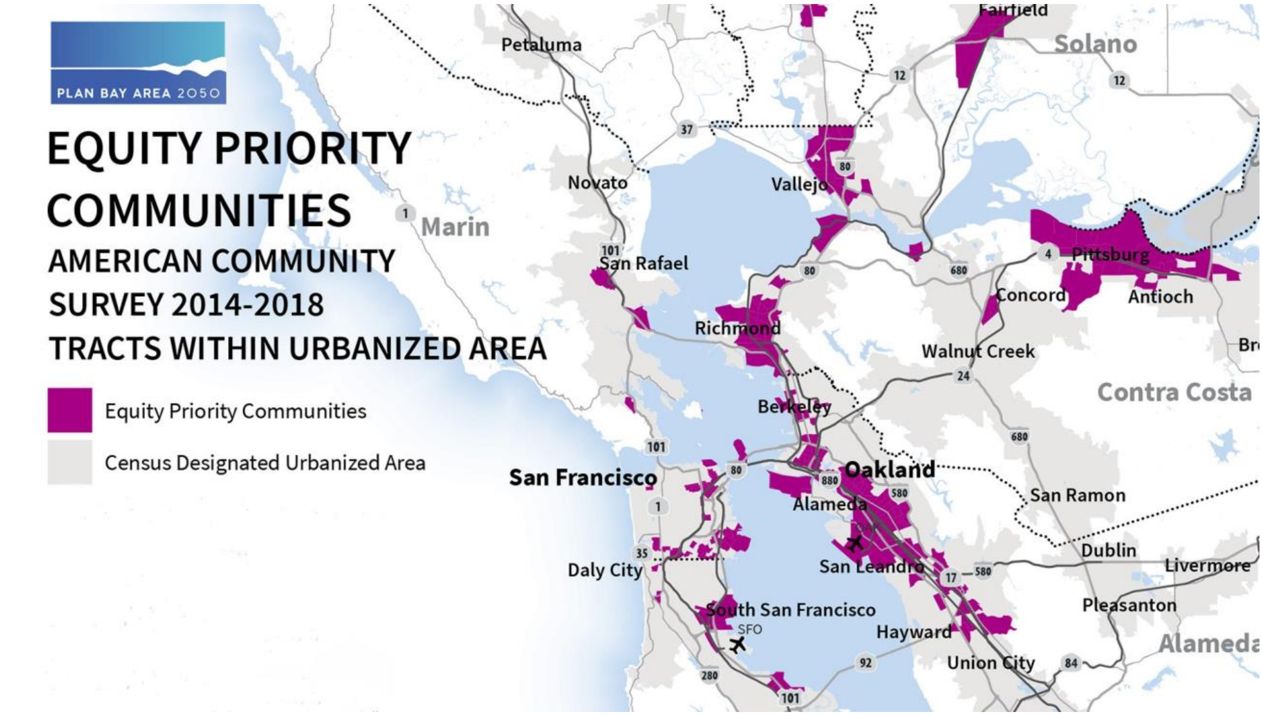
E.1-2.2.1.1 Commuting Trends

Employment trends from U.S. Census show a large influx of workers commuting into the SFWCFS area each day, as detailed on Figure E.1-5. This high level of mobility is enabled by the Bay Area's extensive regional public transportation system, and the high concentration of workers at the waterfront supports the importance of the SFWCFS area as an employment center for not only San Francisco, but the entire Bay region.



Source: U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics (Beginning of Quarter Employment, 2nd Quarter of 2002-2019).

Figure E.1-5: Commuting Trends into the Study Area



Source: Plan Bay Area 2050, based on U.S. Census 2018 American Community Survey Data

Figure E.1-6: Equity Priority Communities

There is a large overlap between the areas from where workers commute and Equity Priority Communities (MTC/ABAG, 2021). This overlap includes communities near Daly City, South San Francisco, San Mateo, Alameda, and Oakland, as well as areas of San Francisco directly south of the waterfront (Figure E.1-6). In particular, Reach 4 draws a high proportion of its commuters from Equity Priority Communities such as South San Francisco, Daly City, and southeast San Francisco. Coastal flooding and SLR that affects public transit in the SFWCFS will impact workers throughout the Bay Area. The waterfront provides jobs for disadvantaged populations, who may then be more severely impacted from public transportation service disruptions. In general, more disadvantaged populations will feel wage losses more acutely. Hourly jobs are more at risk of lost wages than salaried jobs, and many times there may not be options to work remotely (such as in the restaurant industry). Vulnerable populations may also have less options in terms of alternate means of transportation—any disruption in public transportation could mean lost work.

The Bay Area faces many challenges related to housing, which have a disproportionate impact on the region’s low-income population. These challenges include (among others) rising housing costs and decreasing affordability and a spatial mismatch between the location of jobs and housing. The housing costs in Bay Area metro centers (San Francisco, Oakland, and San Jose) are extremely high, with most affordable Bay Area homes located in inland communities. The result of these challenges is that the regional public transportation system is essential to connecting affordable housing to employment centers (MTC/ABAG, 2021).

E.1-2.2.1.2 BART

BART connects the San Francisco Peninsula with Berkeley, Oakland, Fremont, Walnut Creek, Dublin/Pleasanton and other cities in the East Bay, as well as Daly City and Millbrae to the south. Additionally, BART serves two international airports—San Francisco International Airport and Oakland International Airport—which in turn connect the region nationally and internationally. Since San Francisco's freeway system is constrained, BART allows more people (at higher capacity) to pass through key regional corridors. By providing an alternate mode of transportation to the Bay Bridge, BART helped the Financial District become a key regional employment center.

Prior to the COVID-19 pandemic BART had a weekday average ridership of roughly 410,000. Ridership dropped off sharply during the pandemic but has been steadily increasing, reaching over 130,000 (34% of pre-pandemic levels) in January of 2023 (BART, 2023). Before the pandemic, a quarter of downtown workers relied on BART for their commute (BART, 2016). Two BART stations (Embarcadero Station and Montgomery Street Station) as well as portions of the Transbay Tube are located in Reach 2. Over 290,000 riders passed through the Embarcadero Station and the Transbay Tube each weekday prior to the COVID-19 pandemic (Wong, 2020),[1] representing over 65% of BART's total riders. The Embarcadero Station has a high risk of flooding, resulting in 65% of all BART trips at risk of disruption. BART has identified the SFWCFS as a local adaptation effort that can help inform their path forward and is committed to continue their engagement with both the Port of San Francisco (POSF) and USACE.

BART's ridership demographics represent the larger regional area it serves. This is particularly true in terms of minority populations: 62% of riders identify as a minority, on par with the 61% of people within BART's service area (BART et al., 2020). While BART's overall income distribution is similar to that of the region, BART serves a higher proportion of low-income households. Twenty-five percent of BART riders reported an annual household income of $30,000 or less, compared to 20% regionally. This is balanced by lower representation in the highest income bracket, with only 32% of BART users reporting annual household incomes above $100,000, compared to 40% regionally. BART also serves Richmond, San Jose, and Pittsburg, all regional Equity Priority Communities (MTC and ABAG, 2021). BART's average weekday limited English proficiency ridership is 10%, slightly less than the 18% estimated within the service boundary (BART et al., 2020).

BART also keeps regional transportation affordable and is essential to meeting transportation demand. On average, prior to the COVID-19 pandemic, BART riders saved $6,300 annually compared to commuters who rely on cars (BART, 2016). With the regional bus and ferry systems already at or near capacity, there are limited

[1] This ridership number is representative of all trips that pass through the Embarcadero (not just passengers with Embarcadero Station as the destination), MWY line (West Oakland to Millbrae). Figure based on 2016 weekday (one-way) trips. Assuming most users take BART for both ways, 145,000 unique users are dependent on the seawall protecting this Study Area

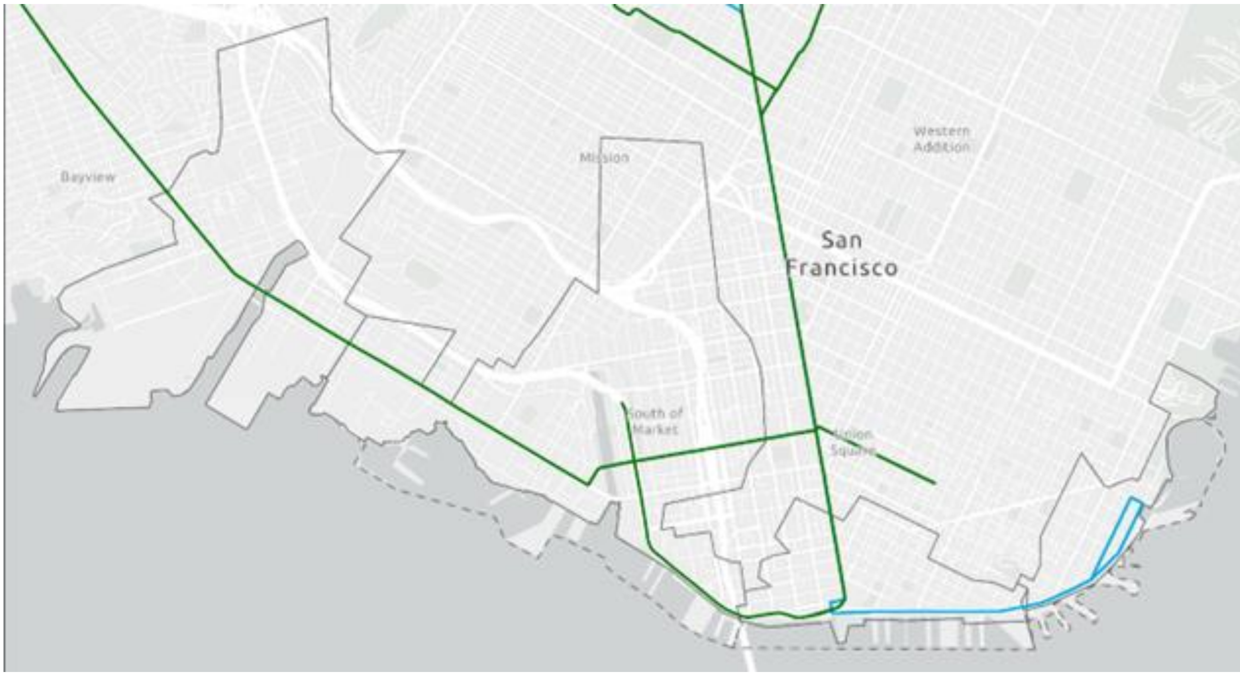
affordable alternatives. As such, BART helps keep the Bay Area accessible to lower-income households.

E.1-2.2.1.3 Muni

Muni is the transit division of SFMTA, and an important part of the integrated transportation network in San Francisco. The Muni is made up of a diverse fleet of buses, subway and surface light rail (Muni Metro), historic streetcars, and cable cars that service all corners of the city. SFMTA's average daily transit ridership prior to the COVID-19 pandemic was approximately 700,000 passengers. Pre-pandemic ridership for all light rail surface and subway lines within the study area was approximately 170,000 trips per day based on SFMTA ridership data.

The light rail track runs along all 7.5 miles of the study area parallel to the waterfront, servicing subway and surface light rail vehicles (LRVs) as well as historic streetcars. Muni Metro transitions from surface to subway at the Muni Portal near Howard Street and the Embarcadero, in Reach 2. It then runs underground along Market Street, sharing four of the nine subway stations with BART. BART is generally operated at the lowest level underground, with Muni Metro located between BART and the surface streets.

SFMTA operates the KT, E and F lines in the SFWCFS area, shown on Figure E.1-7. The K Line is a light rail vehicle (LRV) line providing commuter service between Balboa Park and Embarcadero Stations and is vital for Ingleside and West Portal neighborhoods. The T-Third Line runs between Sunnydale and Chinatown-Rose Pak station via Central Subway and is a critical north-south transportation route for Bayview residents. Third Street and the T-Third Line cross Islais Creek on the 3rd Street Bridge (also known as Islais Creek Bridge and Legon Hagop Nishkian Bridge). The KT line has an average pre-pandemic weekday ridership of 41,700 passengers. Historic Streetcar Routes E and F serve Market Street and the Embarcadero between Market Street and Fisherman's Wharf. The historic lines run the length of the Embarcadero, sharing trackway with light rail vehicles south of the Muni Portal. As of the date of this report, the E-Embarcadero streetcar route is suspended until further notice. Average pre-pandemic weekday cable car ridership is 16,600 passengers (trips), with 3,900 on the California Street line, the line with a terminus downtown (SFMTA, 2017). Both the Historic Streetcars and cable cars are popular with tourists, helping them navigate the many attractions along the Embarcadero.



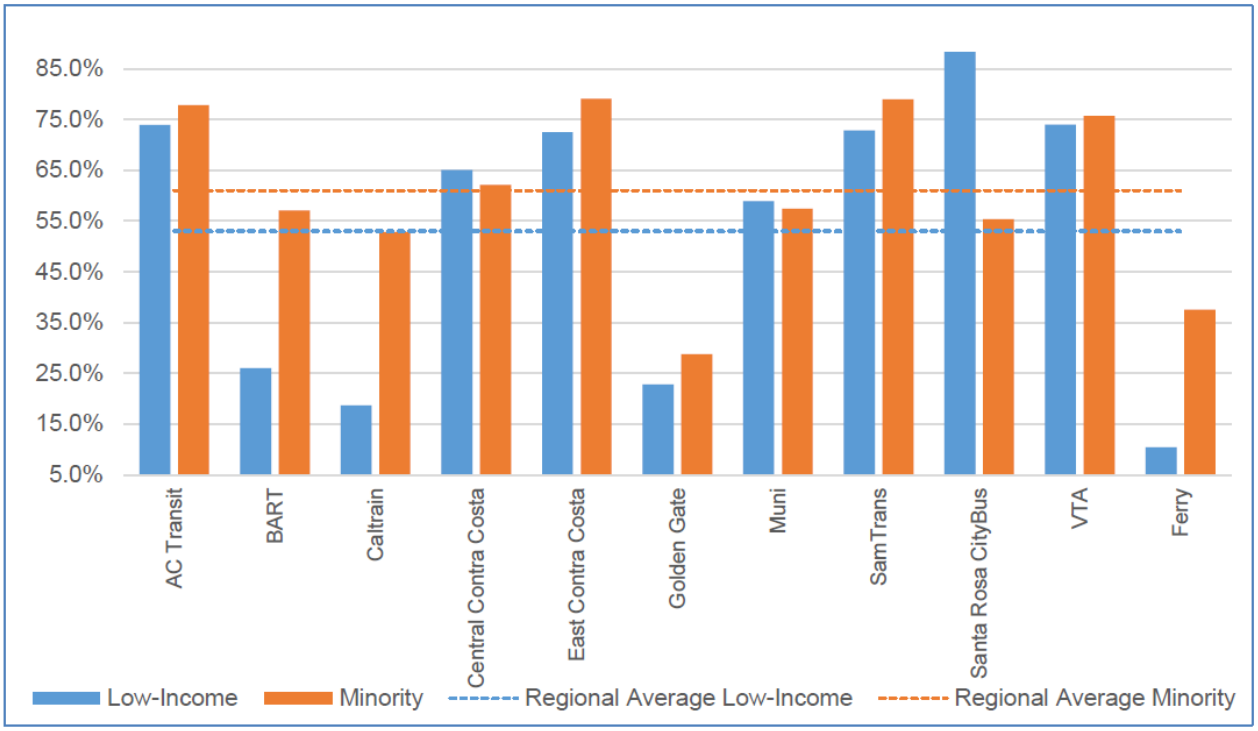
Source: San Francisco Planning Department, 2019

Figure E.1-7: Light Rail Vehicle (KT) and Historic Streetcar (EF) Line Locations Within the Study Area

Note: Light green indicates KT lines (LRV). Blue indicates the EF lines (historic streetcar). Dark green indicates where KT and EF share surface track. Cable car routes not shown.

The Muni Metro recently completed the expansion through the Central Subway Project, which expanded subway service through the South of Market Neighborhood, Union Square, and Chinatown, increasing public transportation to and from some of the city's busiest, most densely populated areas and connecting to the Caltrain and BART systems (CCSF, 2020a). These three new underground stations and one above-ground station expand service to over 35,000 new customers per day. Central Subway brings the T-Third Street light rail line from its existing 4th Street and King Station into a new subway running beneath 4th and Stockton streets, terminating at Chinatown Station on Washington and Stockton. The Central Subway cuts travel times in half along congested Stockton Street and 4th Street while enhancing connections to BART, Muni Metro and Caltrain.

While low-income and minority populations have a higher reliance on transit, this dependence varies widely between different operators and counties. Muni accounts for about 53% of all transit trips for low-income and 42% for minority populations. Muni carries a high share of low-income and minority populations in the region; almost 60% of Muni's riders are low-income and over 55% are minorities. The share of minority and low-income riders by transit operator for the Bay Area is shows on Figure E.1-8.



Source: 2012-2015 MTC Transit Surveys, Multiple Transit Operator Surveys, presented in the Plan Bay Area 2040

Figure E.1-8: Share of Minority and Low-Income Riders by Transit Operator, Bay Area

Muni maintenance facilities are also located in the study area. One of the most important maintenance locations, Muni Metro East, is located in Reach 4. This facility is a 13-acre storage and operations and maintenance facility where LRVs are repaired and maintained. Significant expansions for the site are planned, and large portions of the parcel are low-lying and have experienced precipitation-driven flooding. Other maintenance facilities within the study area include Burke Warehouse, 1399 Marin, and Islais Creek Division in Reach 4, and Kirkland Division in Reach 1 (CCSF, 2020a).

E.1-2.2.1.4 San Francisco Bay Railroad

The San Francisco Bay Railroad (SFBR) serves POSF Piers 80, 92, 94, and 96, and the POSF's railyard (the Intermodal Container Transfer Facility). Pier 80 is primarily used for cargo imports and exports. One of the principal services of the SFBR is to transport contaminated soils from San Francisco construction projects to a landfill out-of-state. The SFBR facility handles 1,000 – 3,000 tons of cargo per day (Kendall, 2020).

E.1-2.2.1.5 Caltrain

Twenty-seven transit operators function in the Bay Area, all of which serve to connect communities throughout the region to economic centers. Of those 27, there are three main regional transit agencies that serve San Francisco other than those listed above: AC Transit (bus), SamTrans (bus), and Caltrain (rail). Within the SFWCFS area, Caltrain is particularly vulnerable to the impacts of SLR and flooding. Caltrain provides commuter rail service along the San Francisco Peninsula, through the South Bay to San Jose and Gilroy. Average pre-pandemic weekday ridership for Caltrain in 2019 was 63,600 passengers (Caltrain 2019). Caltrain's San Francisco Station is located at the intersection of 4th Street and King Street, which is within Reach 3 of the study area. The San Francisco Station accounted for over 15,000 mid-weekday boardings on average in 2019, making it the busiest of all Caltrain stations (Caltrain 2019). In the future, passenger rail service is expected to increase due to Caltrain electrification efforts and high-speed rail improvements (CCSF, 2020a). Over 50% of Caltrain riders are minorities, and almost 20% are low-income (MTC and ABAG, 2017a).

E.1-2.2.2 Utilities

Daily economic activity and development projects depends on reliable utility service. This section briefly describes the low-pressure (potable) water and combined sewer present in the SFWCFS area. Other utilities such as natural gas and electric power are also critical, however limited data is available to discuss specific exposure and vulnerabilities.

E.1-2.2.2.1 Potable Water

Potable, or low-pressure water (LPW) is vital to the community's development and daily functions. All types of businesses—office buildings, hotels, restaurants, and industry—depend on potable water to stay open. The San Francisco Public Utilities Commission (SFPUC) Water Enterprise operates San Francisco's water distribution system, which includes reservoirs and storage tanks, pump stations, fire hydrants, distribution pipelines, isolation valves, and automatic air valves. In the SFWCFS, critical LPW assets include the Bay Bridge Pump Station, water mains, low-pressure fire hydrants, and automatic air valves (CH2M/Arcadis, 2020h).

From a coastal flooding perspective, the Bay Bridge Pump Station is most vulnerable to flood damage (and service disruption) while underground pipes are vulnerable to rising ground water. The Bay Bridge Pump Station, located in Reach 3, is the sole provider of potable water to Treasure Island and Yerba Buena Island. If the facility is damaged, around 3,200 residential customers could lose potable water service (U.S. Census, 2020). Additionally, a large redevelopment project is underway for this area, included an estimated 8,000 new residences in addition to commercial and retail space (CCSF, 2022). While there are plans to add water tanks on Yerba Buena Island to help meet this new demand for both potable water and fire protection, a larger population will only increase the importance of implementing redundancy in the system (CCSF, 2015).

E.1-2.2.2.2 Combined Sewer System

The wastewater system is a combined sewer system within the SFWCFS area and is a critical service provided by the City and County of San Francisco (CCSF). This system collects, transports, and treats stormwater and sanitary sewage. Again, wastewater is critical to attracting and maintaining residents, commerce, and industry. While disruption to wastewater may not be felt directly at the point of use, it is still a critical public service. In addition to providing wastewater service to SFPUC customers, the wastewater system is also an essential drainage system for the city; together, the collection system and outfalls prevent public streets, sidewalks, parks, and public/private facilities from flooding during winter. Any flooding that could occur from an overtaxed system due to coastal flooding and SLR could impact the ability for residents, workers, and visitors to access shops and businesses, decreasing revenues.

Some of the CCSF's most critical wastewater conveyance and treatment facilities are in the SFWCFS area. This includes transport storage boxes (TSBs), tunnels, a force main, combined sewer gravity main, combined sewer discharge (CSD) structures, pump stations, and two treatment facilities. These assets are arranged by reach as follows:

- Reach 1 critical wastewater assets consist of the North Shore Pump Station, the North Point Wet Weather Facility, the Fort Mason Tunnel, and one CSD.
- Reach 2 contains several buried assets, including the Jackson TSB, the North Shore Force Main, and three CSDs.
- Reach 3 includes the North Channel TSB, the Channel Pump Station, the Channel Force Main, the smaller Harriet Street and Mariposa pump stations, and several CSDs.
- Reach 4 encompasses the Booster Pump Station, the Southeast Lift Station, the Islais Creek TSB, and the Southeast Treatment Plant.

Generally, wastewater flows from Reach 1 to Reach 4 for treatment. As such, the estimated service population grows with each reach as you move south (Table E.1-4). Wastewater assets in Reach 4 serve over two-thirds of San Francisco and have the farthest-reaching effect on the city's population. Reach 2 is not included for two reasons, first there are no wastewater treatment assets within Reach 2 and second, is that the North Shore and Channel Basin cover Reach 2 and there is not a separate basin specific to that reach.

Table E.1-4: Wastewater Service Population Assumptions

Reach	Key Assets	Area/ Basin Served	Total Estimated Service Population
Reach 1	North Shore Pump Station North Point Wet Weather Treatment Facility Fort Mason Tunnel	North Shore	58,000
Reach 3	Channel Pump Station Mariposa Pump Station Harriet Street Pump Station	North Shore and Channel	400,000+
Reach 4	Booster Pump Station Southeast Lift Station Southeast Treatment Plant Bruce Flynn Pump Station	North Shore, Channel, and Islais Creek	580,000+

E.1-2.2.2.3 Waste Management

Recology, or Recycle Central, is located on Pier 96 (Reach 4), and provides collection and disposal of municipal solid waste, recycling, and organics/compost to commercial and residential customers in California. The facility, which opened in 2002, was designed and constructed in partnership with the CCSF and is a key asset to the CCSF's zero waste goal. Recology covers over 185,000 square feet and processes about 750 tons of material each day, employing over 180 people, many from the nearby Bayview Hunters Point neighborhood.

E.1-2.3 Summary

The economic profiles discussed above provide key contextual details. The data present in the above sections is summarized by reach in Table E.1-5. The current and future economic context has been laid out to help facilitate planning decisions in the future. Section E.1-3.5 and Section E.1-5 will continue to build on these baseline economic profiles with monetized regional economic consequence.

Table E.1-5: Economic Profile Key Takeaways by Reach

Profile	Reach 1	Reach 2	Reach 3	Reach 4
Real Estate and Development Projects				
Ongoing and Planned Projects	Blue Greenway Plan Implementation	Blue Greenway Plan Implementation Teatro ZinZanni 88 Broadway / 735 Davis Street Embarcadero Enhancement Project	Blue Greenway Plan Implementation Pier 70 Area and Crane Cove Park (subdistrict of Pier 70) Mission Rock Potrero Power Station Mixed-Use Project (PPS) HOPE SF, Potrero Terrance and Annex	Blue Greenway Plan Implementation Piers 80-96 Maritime Eco-Industrial Strategy HOPE SF, Hunters View
Employment and Income				
Demographics	High percentage of older workers Low percentage of high paying jobs Higher percentage of Hispanic or Latino workers	High educational attainment Higher percentage of high paying jobs	Higher percentage of Hispanic or Latino workers	High percentage of older workers Low percentage of high paying jobs Higher percentage of Black or African American workers and Hispanic or Latino workers Lower educational attainment
Main Employment Sectors	Retail Trade, Accommodation and Food	Professional, Scientific, and Technical	Administration & Support Waste Management	Construction Wholesale Trade Transportation and

Profile	Reach 1	Reach 2	Reach 3	Reach 4
	Services Professional, Scientific, and Technical Services	Services industry Finance and Insurance	and Remediation Information Educational Services Professional, Scientific, and Technical Services	Warehousing Accommodation and Food Services
Inflow/Outflow and Commuting Trends	Has a net job inflow of 6,100, the lowest of the reaches.	Largest net inflow of jobs: 220,000 Draws a large number of workers from across the Bay Area due to large inflow	Large net inflow of jobs: 110,000 Draws a large number of workers from across the Bay Area due to large inflow	Net job inflow of 14,000 Draws a high proportion of its commuters from Equity Priority Communities
Critical Infrastructure				
Transportation	Muni EF lines (historic streetcar), cable cars, buses SFMTA Kirkland Division Muni Maintenance Facility	BART rail lines, Embarcadero and Montgomery Street Stations, and Transbay Tube Muni EF lines (historic streetcar), KT lines (LRVs), cable cars, buses	BART rail lines Muni EF lines (historic streetcar), Muni KT lines (LRVs), buses Caltrain's San Francisco Station and rail lines	BART rail lines Muni KT lines (LRVs), buses Muni Maintenance Facilities: Muni Metro East, Burke Warehouse, 1399 Marin, and Islais Creek Division Caltrain rail lines SFBR, serving Piers 80, 92, 94, and 96, and the POSF's railyard (the Intermodal Container Transfer Facility)

Profile	Reach 1	Reach 2	Reach 3	Reach 4
Utilities	Wastewater assets include the North Shore Pump Station, the North Point Wet Weather Facility, the Fort Mason Tunnel, and one CSD	Wastewater assets include several buried assets, including the Jackson TSB, the North Shore Force Main, and three CSDs.	Low-pressure assets include Bay Bridge Pump Station. Wastewater assets include the North Channel TSB, the Channel Pump Station, the Channel Force Main, the smaller Harriet Street and Mariposa pump stations, and several CSDs.	Wastewater assets include encompasses the Booster Pump Station, the Southeast Lift Station, the Islais Creek TSB, and the Southeast Treatment Plant. Recology facility on Pier 96

Section E.1-3. Methodology

The RED analysis builds on the economic profiles presented in Section E.1-2 and evaluates potential regional economic impacts due to coastal flooding and SLR at each of the four reaches. The evaluation includes qualitative and quantitative assessments of impacts through four key RED categories: benefits from construction, impacts to critical infrastructure, direct economic impacts, and cascading regional economic impacts. The assessment for each indicator reviews the importance of the indicator, the cumulative present value of losses across each time horizon, and relevant qualitative findings.

Table E.1-6 provides a brief overview of the key RED measures by category, while the rest of this chapter describes the data and resources, the coastal flood hazard data, and an overview of the methodology and key assumptions for each RED measure evaluated.

Table E.1-6: Overview of RED Categories and Measures

Category	Measure	Measure Type	Description
Impacts to Critical Infrastructure	Transportation Revenue Loss	$	Revenue losses affect an agency’s ability to continue to provide the same level of service. Revenue loss was established for three primary transportation assets: SFMTA, BART, and the SFBR facility. ***BART***. BART is expected to lose ridership and revenue due to system disruption caused by flood damage. Revenue losses are estimated using disruption time estimates until partial and full capacity of the system can be restored. Disruption time estimates were developed using Hazus data and expert judgement and were confirmed appropriate by BART. ***Muni***. SFMTA is expected to lose Muni ridership and revenue due to system disruption caused by flood damage at Embarcadero Station and Central Station. Revenue losses are estimated using disruption time estimates until

Category	Measure	Measure Type	Description
			partial and full capacity of the system can be restored. Disruption time estimates were developed using Hazus data and expert judgement and were confirmed appropriate by SFMTA. ***SFBR***. The SFBR facility handles 1,000 – 3,000 tons of cargo per day. Analysts used Bureau of Transportation Statistics value of domestic rail per daily ton to estimate lost revenue associated with facility disruption due to flooding.
	Utility Revenue Loss	$	Utility impacts were established for three primary public and private utilities dealing with potable water, the combined sewer system, and waste management. ***Potable Water.*** Flood damage expected at the Bay Bridge LPW pump station will disrupt potable water service to Treasure Island and Yerba Buena Island. SFPUC may experience revenue losses as the agency will not collect service fees because of reduction in potable water use. Revenue losses use total daily demand, cost per gallon, and functional downtime to estimate loss. ***Combined Sewer System***. FEMA has established a standard value per person per day of associated gross domestic product (GDP) that may be lost due to disruption in wastewater treatment service. The proposed approach to estimate economic impacts of loss of utility service is sourced from FEMA benefit-cost analysis methodologies that employ functional downtime of utility systems, the service area population, and daily per-capita estimates of GDP. Revenue losses were estimated for the Channel Pump Station, the North Shore Pump Station, and the Bruce Flynn pump station. ***Waste Management***. Revenue loss for Recology is estimated based on information provided by a Recology representative. Analysts used the annual revenue of the facility and restoration times from Hazus to estimate how much annual revenue may be lost if the facility were damaged by coastal flooding.
Direct Economic Impacts	Direct Economic Output Losses	$	Output represents the value of industry production and includes labor income factors (employee compensation and proprietor income), taxes on production and imports, other property income, and any intermediate inputs. For industries that do not hold inventory, output equals revenues. For industries that do hold inventory, output equals revenues less the value of goods sold. Direct output losses are modeled in Generation 2 Coastal Risk Model (G2CRM).
	Direct Job Losses	#	Jobs represent all full-time, part-time, and temporary employment opportunities available on average within an industry, as calculated with IMPLAN. This metric is not a specific job count but represents a localized average of

Category	Measure	Measure Type	Description
			likely employment statistics based on annual economic activity. IMPLAN job counts are usually larger than many other sources because they account for all full-time, part-time, and seasonal jobs where other data sources do not.
Cascading Regional Economic Impacts	Indirect & Induced Economic Output Losses	$	See above for description of *Direct Economic Output Losses*. Indirect and induced output losses are modeled through IMPLAN using the G2CRM direct output losses as a model input. This metric demonstrates the impacted industries that contribute the most to national GDP.
	Indirect & Induced Job Losses	#	See above for description of *Direct Job Losses*. Indirect and induced job losses are modeled through IMPLAN using the G2CRM direct output losses as a model input.

E.1-3.1 Data and Resources

The RED analysis leverages several key resources and data from investigations conducted by the POSF, the CCSF, and partner agencies such as BART. Primary data and resources for this assessment include the following:

- The *Regional Economic Development (RED) Procedures Handbook* acted as guiding principles throughout the RED analysis. Secondarily, the IWR *Economics Primer* (09-R-3) was referenced.
- Sea-level Rise and Flooding Resiliency Study, (BART 2020). This study evaluates risk from SLR on BART underground infrastructure, including expected physical damages.
- Buildings – Coastal Flood Exposure, Vulnerability, and Consequences Report (CH2M/Arcadis, 2020a). This report was developed for the POSF Embarcadero Seawall Program and presents many of the exposure and consequence methodologies employed herein.
- Economic Cost of Inaction (CH2M/Arcadis, 2020c). This report was developed for the POSF Embarcadero Seawall Program and presents similar methodologies using IMPLAN.
- Coastal Flood Hazard Assessment and Mapping (CH2M/Arcadis, 2020b). The Embarcadero Seawall Program developed coastal flood hazard models for 12 inundation maps created with water levels ranging from 8.9 feet to 16.5 feet North American Datum of 1988 (NAVD88). More detail on the coastal flood hazard data is presented in Section E.1-3.2.

- Utility and Mobility Systems – Earthquake and Coastal Flood Exposure, Vulnerability, and Consequences Report (CH2M/Arcadis, 2020h). Also developed as part of the Embarcadero Seawall Program, this report establishes many of the assumptions around impacts to utility and mobility critical infrastructure and cascading consequences.
- G2CRM Asset Inventory (CH2M/Arcadis, 2020d). The G2CRM inventory of buildings and infrastructure assets established the locations of residential structures, infrastructure facilities, and businesses. Additionally, revenue loss methodology was established for unique infrastructure assets as part of this effort (see the G2CRM Building Inventory Data Documentation [CH2M/Arcadis, 2020e]).
- U.S. Census Bureau 2020 American Community Survey 5-year Estimates (U.S. Census Bureau, 2020). The U.S. Census provides counts by census block group that were used to estimate population exposure.
- Problems, Opportunities, Objectives, Constraints, and Considerations (POOCCs) (CH2M/Arcadis, 2020f). The POOCCs were referenced when describing the physical and social conditions present within the SFWCFS area.
- San Francisco's SLR Vulnerability and Consequences Assessment (CCSF, 2020a). This assessment describes the vulnerability of public buildings and infrastructure to SLR and coastal flooding and the consequences on people, the economy, and the environment. The completion of this assessment supports San Francisco in making forward progress on meeting the goals of the San Francisco SLR Action Plan (CCSF 2016).

E.1-3.2 Coastal Flood Hazard Data

San Francisco is vulnerable to many aspects of coastal flooding, including present-day tidal events and flooding during storms, SLR that increases the magnitude of future tides and storms, and the addition of wind-generated waves that can increase the height and extent of a flood during a storm event. Today, king tides overtop the seawall and flood the Embarcadero Promenade a few times a year with a 6.5-foot tide level, causing nuisance flooding and sometimes closure of portions of the Promenade. More significant flooding occurs when high tides coincide with storm events. Right now, these events are infrequent and only last for a few hours. With SLR, king tides and storm events coupled with wind-waves will increase in magnitude, causing more damaging flood events to occur more frequently and for longer durations.

Current USACE guidance on incorporating sea level change (SLC) (2019), requires that planning studies and engineering designs consider alternatives that are formulated and evaluated for three USACE defined SLC curves that represent "Low," "Intermediate," and "High" rates of future SLC (USACE 2019a). The USACE SLC curves are based on science presented in the National Research Council's 2012 report, using best available science at the time of publication (IPCC 2007, NRC 2012, USACE 2019a).

G2CRM models analysis outputs based on storm simulations and a Monte Carlo algorithm across the USACE SLC curves. Table E.1-7 shows the anticipated increase in sea level (in feet) since 1992 under various projections for the time horizons evaluated in this analysis, and Table E.1-8 translates those water levels to the 1% annual exceedance probability (AEP) event flood elevation (in feet NAVD88). The table is organized from most conservative (swift) to least conservative (slow) SLR projections. For example, the California Ocean Protection Council (OPC) 1:200 chance projection predicts 1.1 feet of SLR by 2035, while the USACE Low projection predicts that 1.1 feet of SLR may not occur until later in the next century, after the period of analysis.

For the purposes of this study, the RED analysis only reflects losses expected under the USACE SLC projections.

Table E.1-7: Anticipated Increase in Sea Level (in Feet) Across Time Horizons and SLC Curves

Time Period	OPC 1:200 Chance	**USACE High**	OPC Likely	**USACE Intermediate**	**USACE Low**
2040	1.4	1.1	0.8	0.5	0.3
2065	3.3	2.4	1.8	0.9	0.4
2090	5.8	4.1	2.9	1.4	0.6
2115	8.6	6.3	4.1	2.1	0.8
2140	11.7	9.0	5.3	2.9	0.9

Notes: Cell color scheme identifies similar SLR increments. Bolded values for USACE curves represent the sea level change curves evaluated in this analysis.

Table E.1-8: Anticipated 1% AEP Flood Elevations (in Feet NAVD88) Across Time Horizons and SLC Curves

Time Period	OPC 1:200 Chance	**USACE High**	OPC Likely	**USACE Intermediate**	**USACE Low**
2040	10.8	10.6	10.3	9.9	9.7
2065	12.7	11.8	11.2	10.4	9.9
2090	15.3	13.6	12.4	10.9	10.1
2115	18.1	15.8	13.6	11.6	10.2
2140	21.2	18.5	14.8	12.3	10.4

Notes: Cell color scheme identifies similar SLR increments. Bolded values for USACE curves represent the sea level change curves evaluated in this analysis.

E.1-3.3 Revenue Losses for Critical Infrastructure

Impacts to critical infrastructure captured by the RED account are calculated in G2CRM and are generally expressed in terms of revenue loss to specific public and private transportation and utility assets. This section describes the assumptions regarding the functional downtime inputted into the G2CRM model for assessing revenue loss to critical infrastructure.

E.1-3.3.1 Transportation

As described in Section E.1-2.2.1, the regional and local transportation system provided by BART, Muni, and the SFBR is essential to the waterfront's identity as an employment hub and driver of economic activity for the region. As seen in the ongoing coronavirus pandemic, disruption in transit service and therefore reduced fees collected will result in significant revenue losses for the agencies. This reduction in revenue can exacerbate physical damages caused by flooding and result in reduced or foregone maintenance or further reduction in service provided elsewhere. This section reviews potential agency revenue losses experienced by BART, Muni, and the SFBR due to coastal flooding in the SFWCFS area.

E.1-3.3.1.1 BART

The critical flood elevation for the Embarcadero Station, located in Reach 2, is around 10.3 feet NAVD88, which is surpassed by the 1% AEP event by 2040 in the USACE High SLC scenario and by 2140 in the USACE Low scenario. Flooding at this station could put 65% of all BART trips at risk of disruption. Emergency repairs and permanent restoration necessary after damage is incurred will likely cause disruption to both BART and Muni service. BART service disruption will likely cause regional impacts long after floodwaters recede. Table E.1-9 details the impacts that various flood elevations may have on the functional downtime of the station. If Embarcadero Station is significantly damaged, it is assumed it will take a minimum of 3 months to open at 25% capacity while repairs continue, and full recovery of the station may take up to 3 years (CH2M/Arcadis, 2020h). Because of the limited redundancy and lengthy disruption times to the system, any flooding has the potential to cause severe disruption to the regional economy. BART has calculated that even one day of disruption would cause $17.4 million per weekday in total passenger lost wages for this area (BART et al., 2020). While some riders may be able to transition to remote work, wage losses to other riders could be felt for weeks. If service disruption continued for an extend period the area may experience long-term increased congestion, longer transit times, and a potentially a shift in workforce outside of the city.

Table E.1-9: BART Estimated Functional Downtime by Water Level

Flood Elevation (feet)	Time Horizon, USACE High	Time to Partial 25% Capacity in Weeks (no trains running)	Time to Full 100% Capacity in Weeks
10.7	1% AEP with 1.1 feet SLR (~2040)	2 weeks (1 to 3 weeks)	5 weeks (3 to 8 weeks)
11.8	1% AEP with 2.2 feet SLR (~2060)	4 weeks (3 to 5 weeks)	20 weeks (10 to 30 weeks)

12.9	1% AEP with 3.3 feet SLR (~2080)	12 weeks (10 to 14 weeks)	1.5 years (9 months to 3 years)

Disruption time estimates were developed using Hazus data and expert judgement and were confirmed appropriate by BART (CH2M/Arcadis, 2020h).

As noted in Section E.1-2.2.1.2, BART supports the SFWCFS as a regional employment center by allowing more people (at higher capacity) to travel through key corridors. The city's transportation system is generally at capacity, and the Bay Bridge cannot handle the 290,000 Transbay trips that BART supports if service were suspended. Disruptions would impact travelers by increasing commute times, reducing work hours, and requiring potentially more costly mobility solutions (CCSF, 2020a). BART has estimated that without their service, congestion on freeways throughout the region would increase by a factor of five (BART, 2016). More likely, many users would simply not make the trip otherwise taken.[2] As such, the current commuting patterns are not sustainable without BART.

E.1-3.3.1.2 Muni

While portions of SFMTA's transit system may rebound from a flood event quickly, the Muni light rail surface and subway and historic streetcars may see disruption for a substantial time after a coastal flood event. As such, lost trips will lead to agency lost revenue. Ridership losses to cable cars and historic streetcars specifically may more broadly impact the tourism industry up and down the Embarcadero.

Muni's underground system shares similar vulnerabilities as those discussed for BART, with the Embarcadero Station presenting the largest vulnerability to coastal flood hazards. In addition to the underground Muni subway, the above-ground light rail and historic streetcars depend on a key piece of underground infrastructure—the Muni Metro Turnaround (MMT). The underground MMT is a vital set of tracks and switches just east of Embarcadero Station that are used to route the trains in the corridor (CH2M/Arcadis, 2020h).[3] Because of this dependency, a significant portion of the public transportation modes that Muni operates are vulnerable to flooding at relatively low water levels and can experience significant downtimes. Table E.1-10 details the impacts that various flood elevations may have on the functional downtime of each SFMTA asset. With a 10.7-foot flood elevation, Muni service from Embarcadero Station may be disrupted anywhere from 4 to 8 weeks during repairs. This downtime may increase to 1.5 to 3 years with a 12.9-foot flood elevation, or the 1% AEP event with 3.3 feet of SLR. In addition to the Embarcadero Station, flooding may also enter the new Central Subway in Reach 3. This recent addition to the Muni system aims to serve over 35,000 new customers per day, and is vulnerable to a 14.2-foot flood elevation, or the 1% event with 4.6 feet of SLR under the USACE High SLR curve, as shown in Table E.1-10. With restoration times in the months to years, depending on the severity and length of the

[2] Increased cost of transportation and transportation delay times are included under the NED account.
[3] It is also known as the Embarcadero Turnaround.

flood event, the surface and subway light rail, and historic streetcars will likely not be able to continue to operate as they do today in the FWOP conditions.

Table E.1-10: SFMTA Functional Downtime by Water Level

Flood Elevation (feet)	Time Horizon, USACE High	Embarcadero Station[a]		Central Subway[b]	
		Time to Partial 25% Capacity[c]	Time to Full 100% Capacity	Time to Partial 25% Capacity[c]	Time to Full 100% Capacity
10.7	1% AEP with 1.1 feet SLC (2040)	4 weeks (3-5 weeks)	8 weeks (6-10 weeks)	-	-
11.8	1% AEP with 2.2 feet SLC (2060)	6 weeks (5-7 weeks)	12 weeks (10-14 weeks)	-	-
12.9	1% AEP with 3.3 feet SLC (2080)	18 months (12-22 months)	3 years (2-5 years)	-	-
14.2	1% AEP with 4.6 feet SLC (2095)	18 months or more	3 years or more	3 weeks	8 weeks
15.2	1% AEP with 5.6 feet SLC (2110)	18 months or more	3 years or more	2 months	4 months

a Embarcadero Station disruption time estimates were developed using Hazus data and expert judgement and were confirmed appropriate by SFMTA (CH2M/Arcadis, 2020h).

b Central Subway disruption times estimates were developed by SFMTA.

c. No trains running.

While the Muni Embarcadero Station and MMT are in Reach 2, impacts to these key assets would be felt across all four reaches. 170,000 current riders depend on these assets. This includes the T-Third Line that (dependent on the MMT) specifically serves Bayview residents, a higher portion of which are vulnerable. SFMTA transit disruptions would also negatively impact tourism industry revenue. Cable cars and the historic streetcars are popular tourist attractions in and of themselves, in addition to providing transportation to tourist attractions and local San Francisco businesses (CCSF, 2020a). In addition, with 2.2 feet of SLR, the subgrade for the Embarcadero roadway and light rail surface tracks may be continuously saturated. This is expected to increase the rate of subgrade degradation leading to a surge in maintenance and operation costs.

It is generally expected that other SFMTA travel modes will be more resilient or see more limited disruption. Diesel buses are highly adaptable given that they run on fuel, can stop almost anywhere to load and unload passengers, and can easily reroute around hazards. In terms of electric buses (electric trolley), specific routes may be affected, however non-flooded routes could continue to operate if electrical disruptions are localized (CH2M/Arcadis, 2020h). Muni buses are often listed as a possible alternative mode during construction or during short- or long-term disruption of other regional and local modes of transit; however, there are only a limited number of buses, and bus yards. The Federal Transit Authority only allows SFMTA to have a 20% reserve bus fleet, which is not large enough to substitute rail or trolley service without pulling buses from other revenue lines, diminishing service on those lines. Driver availability after flood events may also be a limiting factor (CCSF, 2020a).

Given the above, it is likely that SFMTA will see much additional revenue due to increased bus service after a flood event, which is not captured in this analysis.

E.1-3.3.1.3 San Francisco Bay Railroad

According to the Bureau of Transportation Statistics (2017), the value of domestic rail value per ton per day is $332.45 (escalated to 2018 dollars from 2015 figures). According to the asset owner, the 10% of the physical infrastructure would be compromised and require replacement at 6 inches of water.

E.1-3.3.2 Utilities

Coastal flooding and SLR is a particular concern for the potable water, combined sewer systems, and waste management in San Francisco. The systems could be affected by overland coastal flooding that impacts critical above-ground facilities and infiltrates the underground systems through maintenance holes and catch basins, in addition to impacts for buried pipelines due to rising groundwater. Service disruption to potable water and wastewater services will also impact the ability for SFPUC to collect fees, and reduced revenue may impact the agency's ability to maintain its systems. These impacts are explored below.

E.1-3.3.2.1 Potable Water

The reliability of potable water is necessary for many industries across all reaches. If a short- or long-term water shortage occurs, potable water-dependent industries will be impacted. This entails many of the industries and businesses prevalent within the region, including office buildings, hotels, restaurants, and other industries within the affected area (CCSF, 2020a). Maintaining potable water operations to meet daily demand is therefore essential to the region's economic prosperity.

SFPUC's Bay Bridge Pump Station is located within Reach 3 and provides potable water to Treasure Island and Yerba Buena Island and is vulnerable to flooding at the 14.2-foot flood elevation and above. There is currently no redundant service to the islands. If the facility is damaged, around 3,100 residential customers would lose service. (U.S. Census, 2020). Capturing direct revenue loss of a utility is important to the authority's or agency's overall operation, and follows a simple formula:

$$\begin{aligned} &Direct\ Revenue\ Loss \\ &\qquad = Total\ Daily\ Demand\ (gallons) * \$\ Per\ Gallon * Functional\ Downtime \end{aligned}$$

Water rates for Treasure Island and Yerba Buena are not the same as elsewhere in SFPUC's services area, because the service is provided wholesale to the Treasure Island Development Authority rather than the end user. SFPUC provides water service to Treasure Island and Yerba Buena Island for $9.86 per 1,000 gallons used, according to a 2017 Treasure Island Development Authority resolution authorizing the adjustment of fees for utility users on Treasure Island and Yerba Buena Island (Treasure Island Development Authority, 2017). According to SFPUC's most recent annual report, the average potable water usage per person, per day is 41 gallons, significantly below California's statewide average (SFPUC, 2019). Because the population is entirely reliant on the Bay Bridge Pump Station for servicing potable water to Treasure Island and Yerba Buena Island, it was determined based on Hazus utility damage functions that a water level of 14.2 could correspond to a 130-day outage, as shown in Table E.1-11.

Table E.1-11: Bay Bridge Pump Station Estimated Functional Downtime by Water Level

Flood Elevation (feet)	Time Horizon, USACE High	Functional Downtime (Days)
12.9	1% AEP with 3.3 feet SLC (2080)	0
14.2	1% AEP with 4.6 feet SLC (2095)	130
15.2	1% AEP with 5.6 feet SLC (2110)	260

Disruption time estimates were developed using Hazus data and expert judgement (CH2M/Arcadis, 2020h).

In terms of water mains, SLR will continue to stress the system, requiring increased investment by the utility. Corrosion from rising groundwater could shorten life expectancy of buried pipes and require more frequent repair or replacement. Repair and replacement cycles would shorten as groundwater levels rise along with sea levels and frequency of inundation of Bay water increases. If buried pipelines are compromised, saltwater infiltration from increased groundwater levels may occur and affect the quality of drinking water (CH2M/Arcadis, 2020h).

E.1-3.3.2.2 Combined Sewer System

The wastewater system is a combined sewer system within the SFWCFS area and is a critical service provided by the CCSF. This system collects, transports, and treats stormwater and sanitary sewage.

Any flooding impacts to the Southeast Treatment Plant (Reach 4) could result in a disruption of treatment or partial treatment. A priority would likely be placed on preventing the direct discharge of untreated wastewater to the Bay and the prevention of sewer backups. Local businesses within impacted service areas may be forced to close temporarily until wastewater services can resume, resulting in economic consequences to the community, including lost business revenue, lost tourist revenue, and lost workdays for residents and commuters (CCSF, 2020a).

The Southeast Treatment Plant treats about 80% of the sewage in San Francisco, serving over 580,000 people during dry weather and much of it during wet weather as well. Outage at the treatment plant shouldn't cause loss of service to the residents and businesses of San Francisco, however, it could result in quantities of wastewater being dumped directly into the Bay, depending on the length of the outage.

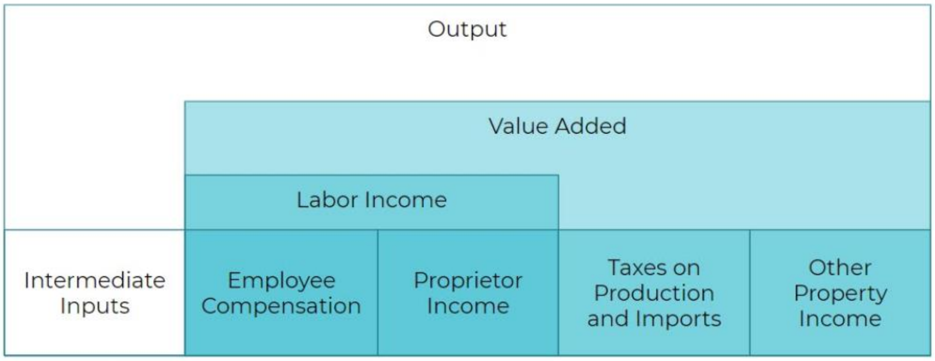
SFPUC has acknowledged that the system will likely require a major reconfiguration if SLR projections are realized over the next century. This is due both to saltwater intrusion through manholes and catch basins as water overtops the seawall, and the gravity-fed system's reduced ability to discharge and function as designed. The time frame for reconfiguring the mainly gravity-fed system is not clear and requires further evaluation as climate models are updated and changes are made throughout the city. Any effort by SFWCFS to stop coastal flood waters from overtopping the current shoreline may extend the life of the combined sewer system when paired with planned SFPUC upgrades to the combined sewer discharges. SFPUC aims to address assets wholistically while planning for SLR, and therefore, revenue loss to these assets were not captured in the RED analysis.

E.1-3.3.2.3 Waste Management

Recology, or Recycle Central, is located on Pier 96, and provides collection and disposal of municipal solid waste, recycling, and organics/compost to commercial and residential customers in California. The company provided their annual revenue at approximately $46 million (Quillen, 2020). Additionally, a Recology representative indicated that with even 6 inches of flooding, there could be significant potential impacts, depending on the amount of inventory on-hand and the extraordinary disposal costs associated with handling contaminated products. The description of a 6-inch flood event at the facility suggested that even this relatively low water level could "bring the facility to a complete standstill." Analysts used the annual revenue of the facility and restoration times from Hazus to estimate how much annual revenue may be lost if the facility were damaged by coastal flooding. However, given the unique nature of this facility, revenue loss is estimated based on information provided by the Recology representative.

E.1-3.4 Direct Economic Impacts

Damage to structures can have direct impacts on the economy, including non-recoverable and non-transferrable loss of sales and revenues due to business closure. A direct impact is an initial change in an industry as the result of an event, such as a flood. Direct output loss refers to reduced sales and production value because of functional disruption of a building's use. The output loss metric demonstrates the impact to industries that contribute most to GDP. As demonstrated on Figure E.1-9, output comprises employee labor income (in terms of employee compensation and proprietor income), taxes on production and import, other property income, and intermediate inputs (i.e., consumption of goods and services that are imported or purchased from other industries).



Source: IMPLAN, 2017.

Figure E.1-9: Components of Economic Output and Value Added

Flood damage to physical assets may also lead to job losses, as buildings may close during restoration. Jobs discussed below account for annual full-time, part-time, and temporary employment opportunities that may be affected in an industry, modeled through IMPLAN. The IMPLAN analysis accounts for regional economic benefit transfers, and thus the job losses reflect potential long-term job disruption *after* business relocation occurs. However, the job impacts presented in this analysis may not fully capture the site-specific nature of many employment opportunities within the SFWCFS area.

Direct economic output losses are modeled in G2CRM, using custom depth-damage functions created for each building. These depth-damage functions were derived from methodologies described in the *Coastal Flood Exposure, Vulnerability, and Consequences Report* (CH2M/Arcadis, 2020a) and the *Economic Cost of Inaction* (CH2M/Arcadis, 2020c). To start, the zip-code level annual economic output data from IMPLAN for over 500 unique sectors were aggregated into the following fourteen groupings. Similarly, buildings in the SFWCFS were also grouped to these categories, based on the use type assigned to each building. For mixed-use buildings, the bottom floors may have been assigned a different category than the upper floors. This allowed analysts to determine an average daily economic output value per square foot, which was then applied to the total square footage of the lower and upper floors of each building.

- Commercial
- Construction
- Education
- Fishing and Marinas
- Government
- Health Care
- Hotels
- Industrial
- Office Building
- Real Estate
- Religious and Community Organizations
- Residential
- Warehousing and Storage
- Water Transportation

As described in the *Coastal Flood Exposure, Vulnerability, and Consequences Report* (CH2M/Arcadis, 2020a), these daily output values per building were applied to restoration time curves from the Hazus-MH 2.1 Flood Technical Manual (FEMA, 2015), using business interruption time modifiers and recapture factors (also from the Hazus-MH 2.1 Flood Technical Manual) for a range of water surface elevations at each building. These new curves were scaled by the largest impacts to each building, resulting in custom depth-damage functions for each building, which were in turn used as inputs to the G2CRM model.

Direct output losses modeled in G2CRM were then re-aggregated to the 14 sectors and inputted back into IMPLAN to model direct job impacts, as well as the cascading regional economic effects.

E.1-3.5 Cascading Regional Economic Effects

Direct losses in revenues and employment lead to indirect and induced effects felt across the region. Cascading regional economic impacts include indirect and induced impacts on economic output and jobs. Indirect effects represent impacts on business-to-business purchases in the supply chain, whereas induced effects stem from changes in household income spending, after removal of taxes, savings, and commuter income, as summarized on Figure E.1-10. For this analysis, IMPLAN was used to model the regional economic activity affected by each of the four reaches due to coastal flooding. This analysis was completed for the nine-county Bay Area and at the California scale to understand how much of these larger regional impacts will likely be felt in San Jose-San Francisco-Oakland area.

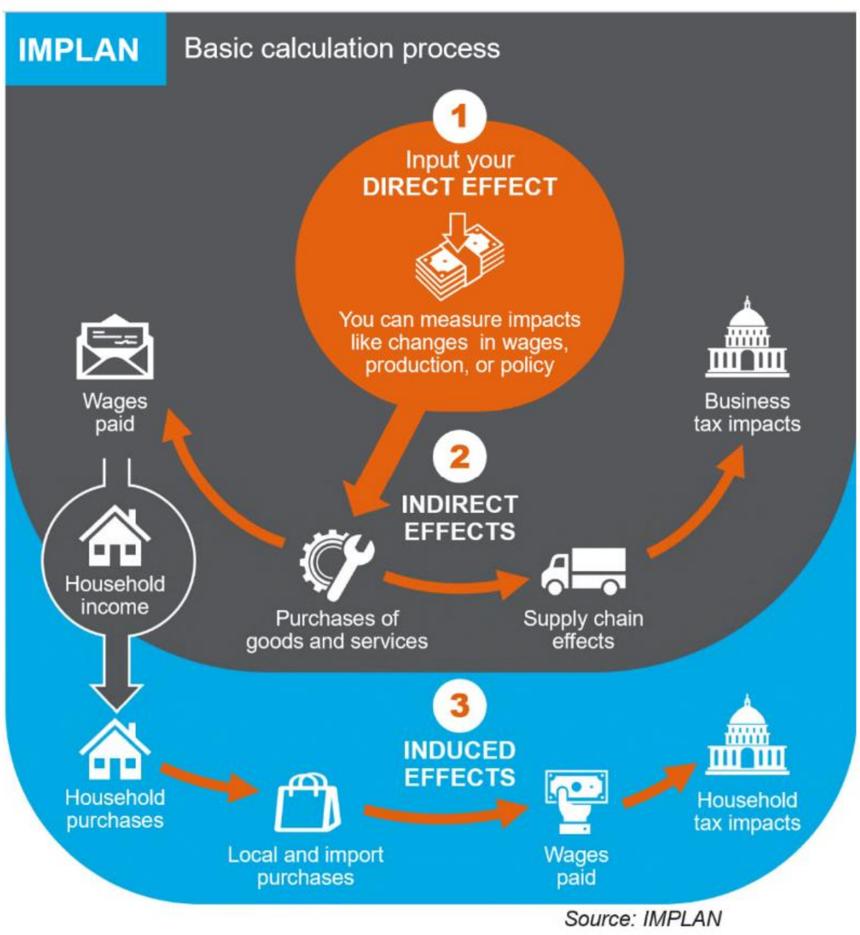


Figure E.1-10: IMPLAN Process Flow Diagram

As established in Section E.1-2, people are commuting into the SFWCFS area from across the Bay region. The effects of lost wages will likely be felt by business region wide as people have less income to spend. Similarly, lost business revenue means that less will be spent elsewhere in the supply chain. The methodology to estimate economic disruption losses assumes that retail, office, and restaurants can easily relocate and resume business elsewhere if a structure is damaged and cannot be occupied during repair. However, the POSF hosts a high proportion of entertainment and cultural and industrial and maritime buildings, which are dependent on the waterfront and cannot easily relocate. While this was partially captured in the analysis, it is likely that the values presented below are conservative, and additional reduced visitor spending on recreation-related activities might be felt. Additionally, the IMPLAN analysis is meant to provide a level of detail associated with feasibility-level study and does not capture the full impact to some of the highly specialized maritime functions present at the POSF.

E.1-3.6 Additional Notes

This section describes some additional relevant information regarding the RED analysis methodology, including the process for addressing repetitive flood loss and benefits from construction.

E.1-3.6.1 Repetitive Flood Loss

As sea level change occurs, areas that currently have minimal or no coastal storm risk will be exposed to more frequent flooding. When an area is subject to repetitive flooding, it is assumed that there will be changes to the behavior of individual stakeholders that creates a reduction in risk or damage. These assumptions are necessary to ensure that indefensible repetitive damages are not captured, much in the way the rebuild thresholds are used to cap repetitive inundation damages. The RED analysis follows the NED methodology for removing assets from the inventory as they experience repetitive flooding impacts; see the *Economic and Social Considerations* Appendix for more information on this methodology.

E.1-3.6.2 Benefits from Construction

While it is qualitatively important to understand the benefits of construction, other metrics based on reduction in restoration time described in this methodology (such as revenue loss, direct economic impacts, and cascading regional economic effects) are better suited to differentiate between alternatives. However, analysts did undergo an exercise to understand the direct, indirect, and induced impacts associated with construction spending using the USACE Regional Economic System (RECONS) certified regional economic model, as described below. This methodology was not directly used to support the selection of alternatives in the FWP analysis.

The RECONS model uses IMPLAN modeling system software to trace the economic ripple, or multiplier, effects of project spending in the study area. The model is based on data collected by the U.S. Department of Commerce, the U.S. Bureau of Labor Statistics, and other federal and state government agencies. Nationally developed input-output tables represent the relationships between the many different sectors of the economy to allow an estimate of changes in economic activity on the larger economy brought about by spending in the project area. Estimates are provided for three levels of geographic impact area: local, state, and national.

Within RECONS, the direct effects are equal to “local capture.” Local capture measures what percentage of federal spending is captured within the impact area. It is calculated by applying the level-specific (local, state, or national) Local Purchase Coefficients (LPCs) to the expenditures for each industry and aggregating the local capture across all industries. For example, labor costs may be entirely captured at the local level (if the laborers all live locally), while something like cement manufacturing may only be captured at the state or national level (meaning federal spending on cement manufacturing is not a direct effect for the locality). Both the LPCs and the spending profile (the proportions of construction dollars spent in different sectors) are preset within RECONS; the LPCs vary by location, while the spending profiles vary based on the type of project. More information on LPCs, spending profiles, and the different types of effects measured within RECONS can be found in the *RECONS 2.0 User Guide (April 2019)*.

Though it is a transfer (and, as such, not an NED benefit), the federal funding spent in a community represents a benefit when it is captured locally. As such, the local capture (also called primary impacts) is equal to the monetary direct effect of federal spending. Secondary impacts, which include indirect and induced impacts, are multiplier effects on top of the direct impacts. These impacts include payments to industries that support the directly affected industries, while induced effects occur when workers associated with the direct and indirect industries spend their salaries in the impact area, creating additional jobs and income.

The primary and secondary impact multipliers are listed in the Table below and should be applied to the initial federal outlay (i.e., multiplying the multiplier by the initial outlay yields the primary or secondary impact).

Table E.1-12. Primary and Secondary Impact Multipliers

	Primary Impact	Secondary Impact
Local	.77	.45
State	.87	.95
US	.95	1.76

Using the multipliers shown **Table E.1-12Error! Reference source not found.**, direct and secondary benefits can be estimated for any given level of spending. For example, if $1,000 were spent in San Francisco, $770 (.77 * $1,000) of it would be captured locally (direct benefits), which would then provide $450 (.45 * $1,000) of secondary benefits. This would yield $1,220 of local RED benefits on spending of $1,000. It should be intuitive that the impacts increase as the scale (locality, state, U.S.) becomes larger, since more of the impacts are internalized within the larger area, thereby continuing to provide compounding benefits.

Spending in the study area will also spur job growth. On average, each $170,000 spent in the study area will directly create one job and indirectly create a third of another on the local level. On the national level, that amount of spending would create a total of 2.9 jobs (directly and indirectly). This implies that both the nonstructural and structural alternatives considered in this study would create thousands of jobs locally, regionally, and nationally.

Section E.1-4. FWOP Analysis and Results

This section summarizes the FWOP G2CRM results for revenue losses and direct output losses, as well as the IMPLAN results for the direct job losses and cascading regional economic effects.

E.1-4.1 Revenue Losses for Critical Infrastructure

As described in Section E.1-2, the SFWCFS supports key critical public services that serve all of San Francisco and the Bay Area. This section reviews the regional economic impacts of disruptions to transportation infrastructure and utilities, including BART, Muni, water, and waste collection facilities. These impacts are quantified through agency revenue losses due to service disruption and potential economic activity losses due to disruptions in wastewater treatment services. The direct revenue losses from coastal flooding, estimated using G2CRM, for each of these critical infrastructure assets are summarized in Table E.1-13, Table E.1-14, and Table E.1-15 for each of the SLC scenarios.

Critical Infrastructure	**2023 - 2040**	**2040 - 2065**	**2065 - 2090**	**2090 - 2115**	**2115 - 2140**	**Total**
BART	$39,000,000	$160,000,000	$9,500,000	$0	$0	$200,000,000
SFMTA	$16,000,000	$120,000,000	$25,000,000	$0	$0	$170,000,000
SFBR	$830,000	$6,000,000	$1,300,000	$0	$0	$8,200,000
Bay Bridge Pump Station	$0	$18,000	$890,000	$780,000	$0	$1,700,000
North Shore Pump Station	$0	$0	$1,200,000	$11,000,000	$0	$12,000,000
Bruce Flynn Pump Station	$0	$330,000	$11,000,000	$4,300,000	$0	$16,000,000
Channel Pump Station	$91,000	$4,500,000	$8,200,000	$2,700	$0	$13,000,000
Recology	$83,000,000	$0	$0	$0	$0	$83,000,000
Total	*$140,000,000*	*$290,000,000*	*$58,000,000*	*$16,000,000*	*$0*	*$500,000,000*

Critical Infrastructure	2023 - 2040	2040 - 2065	2065 - 2090	2090 - 2115	2115 - 2140	Total
BART	$8,600,000	$25,000,000	$46,000,000	$18,000,000	$2,600,000	$100,000,000
SFMTA	$2,500,000	$13,000,000	$31,000,000	$20,000,000	$4,000,000	$71,000,000
SFBR	$160,000	$480,000	$1,500,000	$1,200,000	$280,000	$3,600,000
Bay Bridge Pump Station	$0	$0	$0	$4,700	$38,000	$43,000
North Shore Pump Station	$0	$0	$0	$0	$30,000	$30,000
Bruce Flynn Pump Station	$0	$0	$12,000	$75,000	$730,000	$810,000
Channel Pump Station	$160	$120,000	$740,000	$1,700,000	$1,600,000	$4,200,000
Recology	$74,000,000	$1,300,000	$0	$0	$0	$75,000,000
Total	*$85,000,000*	*$40,000,000*	*$79,000,000*	*$41,000,000*	*$9,300,000*	*$250,000,000*

Table E.1-13: Present Value of Revenue Loss for USACE High SLC (Values Rounded)

Critical Infrastructure	2023 - 2040	2040 - 2065	2065 - 2090	2090 - 2115	2115 - 2140	Total
BART	$39,000,000	$160,000,000	$9,500,000	$0	$0	$200,000,000
SFMTA	$16,000,000	$120,000,000	$25,000,000	$0	$0	$170,000,000
SFBR	$830,000	$6,000,000	$1,300,000	$0	$0	$8,200,000
Bay Bridge Pump Station	$0	$18,000	$890,000	$780,000	$0	$1,700,000
North Shore Pump Station	$0	$0	$1,200,000	$11,000,000	$0	$12,000,000
Bruce Flynn Pump Station	$0	$330,000	$11,000,000	$4,300,000	$0	$16,000,000
Channel Pump Station	$91,000	$4,500,000	$8,200,000	$2,700	$0	$13,000,000
Recology	$83,000,000	$0	$0	$0	$0	$83,000,000
Total	*$140,000,000*	*$290,000,000*	*$58,000,000*	*$16,000,000*	*$0*	*$500,000,000*

Table E.1-14: Present Value of Revenue Loss for USACE Int SLC (Values Rounded)

Critical Infrastructure	2023 - 2040	2040 - 2065	2065 - 2090	2090 - 2115	2115 - 2140	Total
BART	$8,600,000	$25,000,000	$46,000,000	$18,000,000	$2,600,000	$100,000,000
SFMTA	$2,500,000	$13,000,000	$31,000,000	$20,000,000	$4,000,000	$71,000,000
SFBR	$160,000	$480,000	$1,500,000	$1,200,000	$280,000	$3,600,000
Bay Bridge Pump Station	$0	$0	$0	$4,700	$38,000	$43,000
North Shore Pump Station	$0	$0	$0	$0	$30,000	$30,000
Bruce Flynn Pump Station	$0	$0	$12,000	$75,000	$730,000	$810,000
Channel Pump Station	$160	$120,000	$740,000	$1,700,000	$1,600,000	$4,200,000
Recology	$74,000,000	$1,300,000	$0	$0	$0	$75,000,000
Total	*$85,000,000*	*$40,000,000*	*$79,000,000*	*$41,000,000*	*$9,300,000*	*$250,000,000*

Table E.1-15: Present Value of Revenue Loss for USACE Low SLC (Values Rounded)

Critical Infrastructure	2023 - 2040	2040 - 2065	2065 - 2090	2090 - 2115	2115 - 2140	Total
BART	$5,100,000	$7,400,000	$12,000,000	$9,900,000	$6,300,000	$41,000,000
SFMTA	$1,300,000	$3,700,000	$5,200,000	$5,700,000	$4,800,000	$21,000,000
SFBR	$90,000	$99,000	$190,000	$320,000	$280,000	$980,000
Bay Bridge Pump Station	$0	$0	$0	$0	$0	$0
North Shore Pump Station	$0	$0	$0	$0	$0	$0
Bruce Flynn Pump Station	$0	$0	$0	$0	$19	$19
Channel Pump Station	$0	$17,000	$47,000	$86,000	$130,000	$280,000
Recology	$68,000,000	$1,700,000	$0	$0	$0	$70,000,000
Total	*$75,000,000*	*$13,000,000*	*$18,000,000*	*$16,000,000*	*$11,000,000*	*$130,000,000*

E.1-4.2 Direct Economic Impacts

Figure E.1-11 summarizes the present value of cumulative direct output losses over time for each SLC curve, as calculated by G2CRM. Under the High SLC scenario, higher rates of cumulative damages are seen between 2060 and 2090, and again after 2120. Both the Intermediate and Low scenarios show much lower rates of risk in the first few years. In the Intermediate scenario, losses are expected to generally increase over time, while losses generally stay steady over time in the Low scenario. These trends are due to a combination of the cumulative threshold and floodproofing assumptions made in G2CRM as well as the nature of the floodplain. The lower rate of cumulative damages in the High scenario after 2090 is because many buildings by that point are exposed to such high risk that they are assumed to either floodproof or leave the floodplain. However, by the 2115-2140 period, losses start to increase again as additional high-output buildings in the Financial District are impacted.

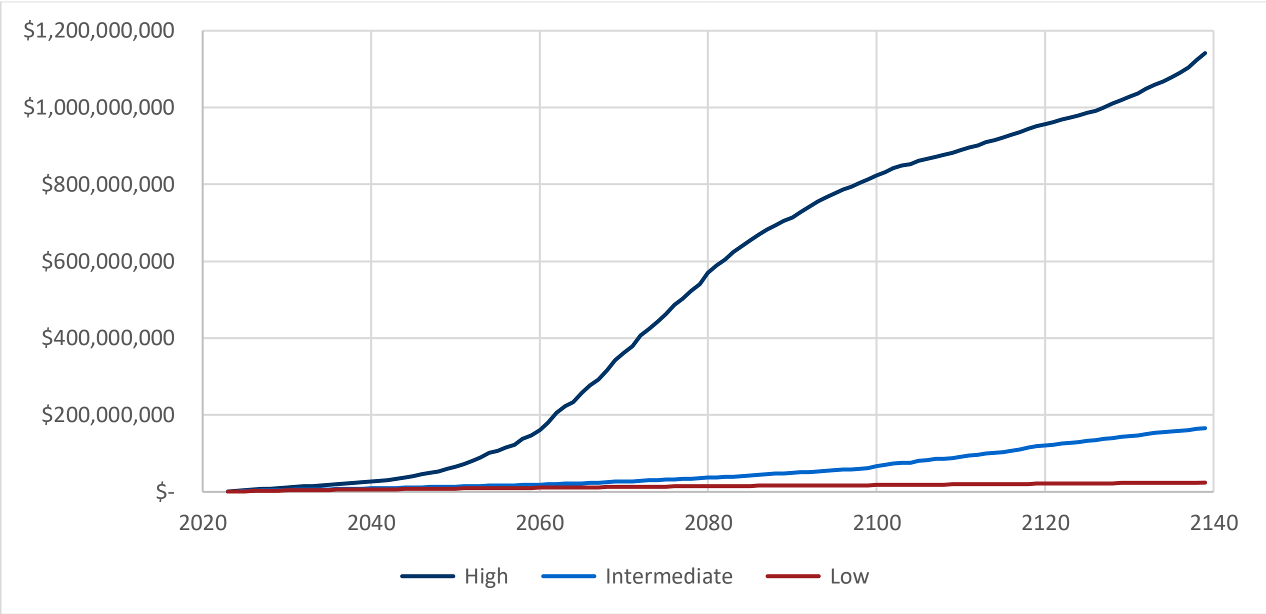


Figure E.1-11: Cumulative Residual Losses Over Time

Impacts to employee compensation and intermediate inputs (i.e., consumptions of goods and services that are imported or purchased from other industries) represent the largest proportion of direct output losses across the study area, at 38% and 32%, respectively (Figure E.1-12).

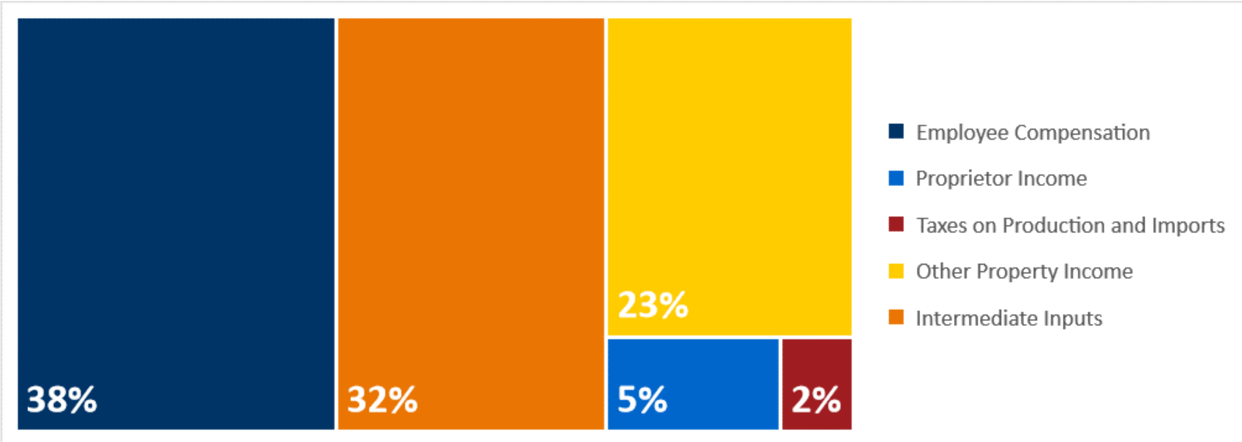


Figure E.1-12: Breakdown of Direct Output Losses in SFWCFS

As shown in

Table E.1-16 through Table E.1-18 and following the flooding patterns, Reach 3 sees the most losses under the lowest rate of SLC, contributing to nearly half ($12 million) of the total $24 million of direct economic loss in the SFWCFS. With increasing rates of SLC, overall impacts are expected to increase dramatically, resulting in $170 million of expected direct output losses in the Intermediate scenario, and over $1.1 billion in the High scenario. As flood extents become more widespread, Reach 2 sees the highest proportion of losses, as it includes the Financial District, with a high density of jobs and economic activity, incurring nearly 70% of the impacts for both the Intermediate and the High scenarios.

Table E.1-19 through

Table E.1-21 break these values down further by industry, showing that office buildings would be the most impacted. Generally, the highest direct output losses occur in office-based industries, again, concentrated mostly in Reaches 2 and 3. The health care (i.e., the University of California San Francisco [UCSF] Medical Center at Mission Bay), residential (property management and leasing), and commercial industries are the highest impacted in the High and Intermediate SLC scenarios, whereas warehousing and storage industries in Reach 4 make up a large proportion of the losses incurred in the Low SLC scenario.

Table E.1-16: Direct Output Losses by Time Period, USACE High SLR (Values Rounded)

Time Period	Reach 1	Reach 2	Reach 3	Reach 4	Total
2023 - 2040	$20,000	$4,700,000	$14,000,000	$6,200,000	$25,000,000
2040 - 2065	$290,000	$150,000,000	$50,000,000	$3,000,000	$210,000,000
2065 - 2090	$2,700,000	$400,000,000	$68,000,000	$4,300,000	$470,000,000
2090 - 2115	$2,600,000	$100,000,000	$100,000,000	$2,400,000	$210,000,000
2115 - 2140	$2,500,000	$120,000,000	$99,000,000	$2,800,000	$230,000,000
Total	*$8,200,000*	*$780,000,000*	*$340,000,000*	*$19,000,000*	*$1,100,000,000*

Table E.1-17: Present Value of Direct Output Losses by Time Period, USACE Intermediate SLC (Values Rounded)

Time Period	Reach 1	Reach 2	Reach 3	Reach 4	Total
2023 - 2040	$8,800	$590,000	$4,500,000	$3,500,000	$8,600,000
2040 - 2065	$7,600	$3,600,000	$7,500,000	$2,000,000	$13,000,000
2065 - 2090	$35,000	$16,000,000	$9,800,000	$730,000	$27,000,000
2090 - 2115	$120,000	$43,000,000	$9,700,000	$460,000	$53,000,000
2115 - 2140	$290,000	$55,000,000	$7,600,000	$560,000	$64,000,000
Total	*$470,000*	*$120,000,000*	*$39,000,000*	*$7,200,000*	*$170,000,000*

Table E.1-18: Present Value of Direct Output Losses by Time Period, USACE Low SLC (Values Rounded)

Time Period	Reach 1	Reach 2	Reach 3	Reach 4	Total
2023 - 2040	$7,400	$270,000	$3,000,000	$2,800,000	$6,100,000
2040 - 2065	$1,800	$860,000	$3,100,000	$1,500,000	$5,500,000
2065 - 2090	$3,700	$1,300,000	$2,600,000	$630,000	$4,500,000
2090 - 2115	$5,000	$2,000,000	$1,900,000	$170,000	$4,000,000
2115 - 2140	$7,000	$2,500,000	$1,300,000	$81,000	$4,000,000
Total	*$25,000*	*$6,900,000*	*$12,000,000*	*$5,100,000*	*$24,000,000*

Table E.1-19: Present Value of Direct Output Losses by Industry, USACE High SLC (Values Rounded)

Industry	Reach 1	Reach 2	Reach 3	Reach 4	Total
Commercial	$2,300,000	$9,400,000	$28,000,000	$1,400,000	$41,000,000
Education	$11,000	$540	$920,000	$88,000	$1,000,000
Fishing and Marinas	$110,000	$0	$0	$0	$110,000
Government	$1,500	$32,000	$910,000	$190,000	$1,100,000
Health Care	$0	$0	$76,000,000	$540,000	$76,000,000
Hotels	$1,600,000	$6,700,000	$440,000	$52	$8,700,000
Industrial	$47,000	$70,000	$3,000,000	$4,700,000	$7,800,000
Office Building	$1,400,000	$760,000,000	$150,000,000	$4,600,000	$910,000,000
Religious and Community	$610,000	$1,500,000	$9,300,000	$37,000	$11,000,000
Residential	$2,000,000	$5,100,000	$69,000,000	$140,000	$76,000,000
Warehousing and Storage	$230,000	$23,000	$3,000,000	$7,000,000	$10,000,000
Water Transportation	$0	$130,000	$0	$0	$130,000
Total	*$8,200,000*	*$780,000,000*	*$340,000,000*	*$19,000,000*	*$1,100,000,000*

Table E.1-20: Present Value of Direct Output Losses by Industry, USACE Intermediate SLC (Values Rounded)

Industry	Reach 1	Reach 2	Reach 3	Reach 4	Total
Commercial	$280,000	$1,900,000	$4,000,000	$190,000	$6,300,000
Education	$390	$0	$150,000	$100	$150,000
Fishing and Marinas	$8,600	$0	$0	$0	$8,600
Government	$290	$8,200	$150,000	$12,000	$170,000
Health Care	$0	$0	$4,400,000	$480	$4,400,000
Hotels	$26,000	$1,200,000	$45,000	$0	$1,300,000
Industrial	$5,400	$1,600	$700,000	$2,100,000	$2,800,000
Office Building	$81,000	$110,000,000	$8,800,000	$530,000	$120,000,000
Religious and Community	$49,000	$220,000	$2,600,000	$0	$2,900,000
Residential	$0	$870,000	$18,000,000	$160	$18,000,000
Warehousing and Storage	$13,000	$3,600	$830,000	$4,400,000	$5,200,000
Water Transportation	$0	$17,000	$0	$0	$17,000
Total	*$470,000*	*$120,000,000*	*$39,000,000*	*$7,200,000*	*$170,000,000*

Table E.1-21: Present Value of Direct Output Losses by Industry, USACE Low SLC (Values Rounded)

Industry	Reach 1	Reach 2	Reach 3	Reach 4	Total
Commercial	$8,500	$420,000	$1,500,000	$120,000	$2,100,000
Education	$0	$0	$10,000	$0	$10,000
Fishing and Marinas	$160	$0	$0	$0	$160
Government	$0	$240	$56,000	$1,300	$58,000
Health Care	$0	$0	$1,100,000	$0	$1,100,000
Hotels	$42	$32,000	$32,000	$0	$64,000
Industrial	$930	$140	$260,000	$1,500,000	$1,800,000
Office Building	$5	$6,400,000	$1,800,000	$150,000	$8,300,000
Religious and Community	$8,300	$48,000	$140,000	$0	$200,000
Residential	$0	$27,000	$6,900,000	$0	$6,900,000

Industry	Reach 1	Reach 2	Reach 3	Reach 4	Total
Warehousing and Storage	$7,100	$430	$100,000	$3,400,000	$3,500,000
Water Transportation	$0	$770	$0	$0	$770
Total	*$25,000*	*$6,900,000*	*$12,000,000*	*$5,100,000*	*$24,000,000*

Coastal flooding under the USACE Low SLC scenario is not expected to have a large impact on jobs in the long-term, however, IMPLAN projects that the economic losses associated with flooding are equivalent to roughly 3,400 jobs by 2140 in the High SLC scenario. As seen in the output losses trends, job losses are concentrated in Reaches 2 and 3, with the office building, commercial, and health care industries anticipated to see the most overall job impacts, regardless of SLC scenario.

The impacts in the commercial industry, which includes restaurants, shops, and other service jobs, reflect the area's high dependence on tourism and is important to consider from an equity perspective as many service industry jobs are hourly or gratuity-based. Additionally, workers in these industries are not able to work remotely and so any disruption would lead to lost wages. Generally, these jobs are less resilient to natural hazards and business closure as they are location-specific and there is limited to no ability to work remotely or receive benefits during disruption. Though Reach 4 generally has lower anticipated job losses than Reaches 2 or 3, the increased development presently occurring and planned in this area may cause increased job losses due to coastal flooding in the future.

Direct job losses are summarized by time period in Table E.1-22, with total job losses broken down by industry for each SLC scenario in Table E.1-23. Similar to direct output losses, job impacts in the Low SLC scenario are an order of magnitude lower than the Intermediate SLC scenario, which are in turn an order of magnitude lower than the High SLC scenario.

Table E.1-22: Direct Job Losses by Time Period and SLC Curve

Time Period	USACE High SLC	USACE Intermediate SLC	USACE Low SLC
2023 - 2040	63	25	19
2040 - 2065	560	32	13
2065 - 2090	1,200	73	11
2090 - 2115	770	140	11
2115 - 2140	760	170	11
Total	*3,400*	*440*	*65*

Table E.1-23: Direct Job Losses by Industry and SLC Curve

Industry	USACE High SLC	USACE Intermediate SLC	USACE Low SLC
Commercial	300	46	15
Education	10	1	0
Fishing and Marinas	1	0	0
Government	6	1	0
Health Care	680	39	10
Hotels	51	7	0
Industrial	16	6	4
Office Building	2,200	300	20
Religious and Community Organizations	59	15	1
Residential	56	14	5
Warehousing and Storage	27	14	9
Total	*3,400*	*440*	*65*

E.1-4.3 Cascading Regional Economic Effects

As with the direct output losses, the highest indirect and induced output losses also occur in office, commercial, and residential industries. Roughly 70% of the overall cascading impacts across the state are felt in the nine-county Bay Area region. These cascading impacts are almost equally distributed between indirect and induced losses, with Reaches 2 and 3 again contributing to the largest effects overall. In the High SLC scenario, cascading regional impacts across the state have nearly the same total impact as the direct output losses ($1.1 billion), demonstrating the vast impact that losses in the SFWCFS will have on the California economy.

As businesses lose income, secondary effects in changes to supply change spending cause additional indirect job losses. As workers lose wages, this decreases household spending leading to induced job losses. These indirect and induced job losses are felt across a larger region and array of sectors than the direct job losses as effects trickle through the regional economy. Impacts discussed here are captured for the larger region of California, though it is expected that most of these impacts (around 60%) will be felt in the more immediate Bay Area.

Indirect job losses account for roughly 40% of the regional job losses. Most regional job impacts are seen in the office, commercial, and health care industries. Most of the cascading regional job impacts are due to the direct losses in the Financial District in Reach 2 in the mid- to late-century time frame (2065-2090).

Table E.1-24 through

Table E.1-29 summarize cascading regional output losses for the two regions by time period, reach, and SLC curve, while

Table E.1-30 through

Table E.1-32 summarize results by industry, reach, and SLC curve. Table E.1-33 then summarizes cascading regional job losses by reach and time period for each SLC curve, while Table E.1-34 presents the breakdown of indirect and induced job losses by industry and SLR curve.

Table E.1-24: Summary of Present Value of Output Losses in Bay Area, Time Period, USACE High SLC (Values Rounded)

Time Period	Reach 1		Reach 2		Reach 3		Reach 4		Total	
	Indirect	**Induced**	**Indirect**	**Induced**	**Indirect**	**Induced**	**Indirect**	**Induced**	**Indirect**	**Induced**
2023 - 2040	$8,200	$6,600	$1,800,000	$1,700,000	$3,400,000	$2,400,000	$2,300,000	$1,700,000	$7,400,000	$5,800,000
2040 - 2065	$110,000	$110,000	$58,000,000	$55,000,000	$14,000,000	$12,000,000	$1,100,000	$830,000	$73,000,000	$69,000,000
2065 - 2090	$950,000	$980,000	$150,000,000	$140,000,000	$23,000,000	$20,000,000	$1,600,000	$1,400,000	$170,000,000	$170,000,000
2090 - 2115	$860,000	$950,000	$38,000,000	$36,000,000	$34,000,000	$38,000,000	$770,000	$800,000	$73,000,000	$76,000,000
2115 - 2140	$570,000	$340,000	$46,000,000	$44,000,000	$32,000,000	$35,000,000	$970,000	$910,000	$79,000,000	$81,000,000
Total	*$2,500,000*	*$2,400,000*	*$290,000,000*	*$280,000,000*	*$110,000,000*	*$110,000,000*	*$6,700,000*	*$5,600,000*	*$410,000,000*	*$400,000,000*

Table E.1-25: Summary of Present Value of Output Losses in Bay Area, Time Period, USACE Intermediate SLC (Values rounded)

Time Period	Reach 1		Reach 2		Reach 3		Reach 4		Total	
	Indirect	Induced	Indirect	Induced	Indirect	Induced	Indirect	Induced	Indirect	Induced
2023 - 2040	$3,400	$2,600	$220,000	$210,000	$1,100,000	$850,000	$1,300,000	$930,000	$2,600,000	$2,000,000
2040 - 2065	$3,400	$3,000	$1,400,000	$1,300,000	$1,800,000	$1,300,000	$750,000	$560,000	$3,900,000	$3,200,000
2065 - 2090	$14,000	$13,000	$6,100,000	$5,900,000	$2,600,000	$2,300,000	$270,000	$200,000	$9,000,000	$8,300,000
2090 - 2115	$44,000	$44,000	$16,000,000	$15,000,000	$3,000,000	$2,700,000	$170,000	$130,000	$19,000,000	$18,000,000
2115 - 2140	$100,000	$110,000	$21,000,000	$20,000,000	$2,500,000	$2,200,000	$200,000	$170,000	$23,000,000	$22,000,000
Total	*$170,000*	*$170,000*	*$44,000,000*	*$43,000,000*	*$11,000,000*	*$9,400,000*	*$2,700,000*	*$2,000,000*	*$58,000,000*	*$54,000,000*

Table E.1-26: Summary of Present Value of Output Losses in Bay Area, Time Period, USACE Low SLC (Values Rounded)

Time Period	Reach 1		Reach 2		Reach 3		Reach 4		Total	
	Indirect	Induced	Indirect	Induced	Indirect	Induced	Indirect	Induced	Indirect	Induced
2023 - 2040	$2,900	$2,200	$100,000	$99,000	$800,000	$630,000	$1,000,000	$740,000	$1,900,000	$1,500,000
2040 - 2065	$810	$690	$320,000	$310,000	$720,000	$500,000	$550,000	$410,000	$1,600,000	$1,200,000
2065 - 2090	$1,600	$1,400	$470,000	$460,000	$630,000	$460,000	$240,000	$180,000	$1,300,000	$1,100,000
2090 - 2115	$2,100	$1,900	$730,000	$700,000	$500,000	$420,000	$63,000	$47,000	$1,300,000	$1,200,000
2115 - 2140	$2,900	$2,700	$950,000	$910,000	$360,000	$330,000	$30,000	$22,000	$1,300,000	$1,300,000
Total	*$10,000*	*$8,900*	*$2,600,000*	*$2,500,000*	*$3,000,000*	*$2,300,000*	*$1,900,000*	*$1,400,000*	*$7,500,000*	*$6,200,000*

Table E.1-27: Summary of Present Value of Output Losses in California, Time Period, USACE High SLC (Values Rounded)

Time Period	Reach 1		Reach 2		Reach 3		Reach 4		Total	
	Indirect	Induced	Indirect	Induced	Indirect	Induced	Indirect	Induced	Indirect	Induced
2023 - 2040	$10,000	$9,400	$2,200,000	$2,500,000	$4,100,000	$3,500,000	$2,900,000	$2,400,000	$9,300,000	$8,400,000
2040 - 2065	$140,000	$160,000	$73,000,000	$80,000,000	$17,000,000	$18,000,000	$1,400,000	$1,200,000	$92,000,000	$99,000,000
2065 - 2090	$1,200,000	$1,400,000	$190,000,000	$210,000,000	$28,000,000	$29,000,000	$2,000,000	$2,000,000	$220,000,000	$240,000,000
2090 - 2115	$1,100,000	$1,400,000	$48,000,000	$53,000,000	$43,000,000	$54,000,000	$1,000,000	$1,200,000	$93,000,000	$110,000,000
2115 - 2140	$680,000	$500,000	$58,000,000	$63,000,000	$41,000,000	$51,000,000	$1,300,000	$1,300,000	$100,000,000	$120,000,000
Total	*$3,200,000*	*$3,400,000*	*$370,000,000*	*$400,000,000*	*$130,000,000*	*$160,000,000*	*$8,600,000*	*$8,100,000*	*$520,000,000*	*$570,000,000*

Table E.1-28: Summary of Present Value of Output Losses in California, Time Period, USACE Intermediate SLC (Values Rounded)

Time Period	Reach 1		Reach 2		Reach 3		Reach 4		Total	
	Indirect	Induced	Indirect	Induced	Indirect	Induced	Indirect	Induced	Indirect	Induced
2023 - 2040	$4,200	$3,600	$280,000	$300,000	$1,400,000	$1,200,000	$1,700,000	$1,400,000	$3,300,000	$2,900,000
2040 - 2065	$4,400	$4,400	$1,700,000	$1,900,000	$2,200,000	$2,000,000	$940,000	$790,000	$4,800,000	$4,600,000
2065 - 2090	$19,000	$19,000	$7,700,000	$8,400,000	$3,200,000	$3,300,000	$350,000	$290,000	$11,000,000	$12,000,000
2090 - 2115	$57,000	$63,000	$20,000,000	$22,000,000	$3,800,000	$3,900,000	$220,000	$190,000	$24,000,000	$26,000,000
2115 - 2140	$130,000	$150,000	$26,000,000	$29,000,000	$3,200,000	$3,200,000	$260,000	$250,000	$30,000,000	$32,000,000
Total	*$220,000*	*$240,000*	*$56,000,000*	*$61,000,000*	*$14,000,000*	*$14,000,000*	*$3,400,000*	*$2,900,000*	*$74,000,000*	*$78,000,000*

Table E.1-29: Summary of Present Value of Output Losses in California, Time Period, USACE Low SLC (Values Rounded)

Time Period	Reach 1		Reach 2		Reach 3		Reach 4		Total	
	Indirect	Induced	Indirect	Induced	Indirect	Induced	Indirect	Induced	Indirect	Induced
2023 - 2040	$3,600	$3,100	$130,000	$140,000	$990,000	$910,000	$1,300,000	$1,100,000	$2,500,000	$2,200,000
2040 - 2065	$1,100	$1,000	$410,000	$440,000	$870,000	$730,000	$700,000	$580,000	$2,000,000	$1,800,000
2065 - 2090	$2,100	$2,100	$600,000	$660,000	$760,000	$670,000	$300,000	$250,000	$1,700,000	$1,600,000
2090 - 2115	$2,800	$2,800	$930,000	$1,000,000	$610,000	$610,000	$81,000	$67,000	$1,600,000	$1,700,000
2115 - 2140	$3,800	$3,900	$1,200,000	$1,300,000	$450,000	$470,000	$38,000	$32,000	$1,700,000	$1,800,000
Total	*$13,000*	*$13,000*	*$3,300,000*	*$3,600,000*	*$3,700,000*	*$3,400,000*	*$2,400,000*	*$2,000,000*	*$9,400,000*	*$9,000,000*

Table E.1-30: Total Present Value of Regional Output Losses by Industry, USACE High SLC (Values Rounded)

Industry	Bay Area					California				
	Reach 1	Reach 2	Reach 3	Reach 4	Total	Reach 1	Reach 2	Reach 3	Reach 4	Total
Commercial	$630,000	$65,000,000	$26,000,000	$1,300,000	$93,000,000	$900,000	$94,000,000	$37,000,000	$1,900,000	$130,000,000
Construction	$110,000	$4,200,000	$3,900,000	$110,000	$8,300,000	$130,000	$6,200,000	$4,800,000	$150,000	$11,000,000
Education	$74,000	$7,500,000	$3,000,000	$150,000	$11,000,000	$84,000	$8,900,000	$3,500,000	$180,000	$13,000,000
Fishing and Marinas	$11,000	$560,000	$240,000	$12,000	$820,000	$15,000	$840,000	$350,000	$18,000	$1,200,000
Government	$99,000	$11,000,000	$3,900,000	$350,000	$15,000,000	$150,000	$16,000,000	$5,900,000	$490,000	$22,000,000
Health Care	$300,000	$36,000,000	$14,000,000	$720,000	$51,000,000	$420,000	$49,000,000	$20,000,000	$990,000	$70,000,000
Hotels	$4,200	$580,000	$200,000	$10,000	$800,000	$13,000	$1,800,000	$610,000	$31,000	$2,400,000
Industrial	$390,000	$39,000,000	$16,000,000	$1,300,000	$57,000,000	$740,000	$75,000,000	$30,000,000	$2,400,000	$110,000,000
Office Building	$2,100,000	$290,000,000	$98,000,000	$5,300,000	$400,000,000	$2,600,000	$360,000,000	$120,000,000	$6,500,000	$490,000,000

Industry	Bay Area					California				
	Reach 1	Reach 2	Reach 3	Reach 4	Total	Reach 1	Reach 2	Reach 3	Reach 4	Total
Real Estate	$420,000	$37,000,000	$17,000,000	$840,000	$55,000,000	$540,000	$52,000,000	$22,000,000	$1,200,000	$75,000,000
Religious and Community Organizations	$37,000	$4,000,000	$1,600,000	$78,000	$5,700,000	$52,000	$5,900,000	$2,300,000	$110,000	$8,300,000
Residential	$460,000	$54,000,000	$21,000,000	$1,100,000	$76,000,000	$580,000	$68,000,000	$26,000,000	$1,400,000	$96,000,000
Warehousing and Storage	$230,000	$20,000,000	$9,000,000	$920,000	$30,000,000	$360,000	$34,000,000	$15,000,000	$1,400,000	$50,000,000
Water Transportation	$5,700	$720,000	$270,000	$15,000	$1,000,000	$5,600	$710,000	$260,000	$15,000	$990,000
Total	*$4,900,000*	*$570,000,000*	*$210,000,000*	*$12,000,000*	*$800,000,000*	*$6,600,000*	*$770,000,000*	*$290,000,000*	*$17,000,000*	*$1,100,000,000*

Table E.1-31: Total Present Value of Regional Output Losses by Industry, USACE Intermediate SLC (Values Rounded)

Industry	Bay Area					California				
	Reach 1	Reach 2	Reach 3	Reach 4	Total	Reach 1	Reach 2	Reach 3	Reach 4	Total
Commercial	$43,000	$10,000,000	$2,400,000	$490,000	$13,000,000	$63,000	$14,000,000	$3,400,000	$690,000	$19,000,000
Construction	$3,700	$640,000	$740,000	$39,000	$1,400,000	$5,000	$940,000	$830,000	$56,000	$1,800,000
Education	$5,500	$1,100,000	$290,000	$56,000	$1,500,000	$6,100	$1,400,000	$330,000	$65,000	$1,800,000
Fishing and Marinas	$780	$86,000	$23,000	$4,000	$110,000	$1,100	$130,000	$33,000	$6,100	$170,000
Government	$7,000	$1,700,000	$360,000	$160,000	$2,200,000	$10,000	$2,400,000	$540,000	$220,000	$3,100,000
Health Care	$21,000	$5,400,000	$1,200,000	$250,000	$6,900,000	$29,000	$7,500,000	$1,700,000	$350,000	$9,500,000
Hotels	$290	$89,000	$17,000	$3,500	$110,000	$890	$270,000	$52,000	$11,000	$340,000
Industrial	$27,000	$6,000,000	$1,500,000	$520,000	$8,000,000	$52,000	$11,000,000	$2,800,000	$970,000	$15,000,000
Office Building	$140,000	$44,000,000	$9,500,000	$2,000,000	$56,000,000	$170,000	$55,000,000	$12,000,000	$2,400,000	$69,000,000

Industry	Bay Area					California				
	Reach 1	Reach 2	Reach 3	Reach 4	Total	Reach 1	Reach 2	Reach 3	Reach 4	Total
Real Estate	$34,000	$5,700,000	$1,700,000	$320,000	$7,700,000	$43,000	$7,900,000	$2,200,000	$440,000	$11,000,000
Religious and Community Organizations	$2,600	$610,000	$150,000	$28,000	$790,000	$3,700	$890,000	$210,000	$40,000	$1,100,000
Residential	$32,000	$8,200,000	$1,800,000	$380,000	$10,000,000	$41,000	$10,000,000	$2,300,000	$490,000	$13,000,000
Warehousing and Storage	$18,000	$3,000,000	$860,000	$410,000	$4,300,000	$28,000	$5,100,000	$1,400,000	$600,000	$7,200,000
Water Transportation	$400	$110,000	$23,000	$5,200	$140,000	$390	$110,000	$23,000	$5,500	$140,000
Total	*$340,000*	*$87,000,000*	*$20,000,000*	*$4,600,000*	*$110,000,000*	*$460,000*	*$120,000,000*	*$27,000,000*	*$6,300,000*	*$150,000,000*

Table E.1-32: Total Present Value of Regional Output Losses by Industry, USACE Low SLC (Values Rounded)

Industry	Bay Area					California				
	Reach 1	Reach 2	Reach 3	Reach 4	Total	Reach 1	Reach 2	Reach 3	Reach 4	Total
Commercial	$2,200	$580,000	$630,000	$340,000	$1,600,000	$3,200	$840,000	$880,000	$480,000	$2,200,000
Construction	$260	$38,000	$260,000	$27,000	$330,000	$360	$55,000	$280,000	$39,000	$380,000
Education	$360	$68,000	$65,000	$39,000	$170,000	$400	$79,000	$76,000	$46,000	$200,000
Fishing and Marinas	$31	$5,200	$5,900	$2,800	$14,000	$43	$7,700	$8,500	$4,300	$21,000
Government	$500	$97,000	$87,000	$120,000	$300,000	$710	$140,000	$130,000	$160,000	$430,000
Health Care	$1,100	$320,000	$310,000	$180,000	$800,000	$1,600	$430,000	$420,000	$250,000	$1,100,000
Hotels	$15	$5,100	$4,200	$2,400	$12,000	$47	$16,000	$13,000	$7,600	$36,000
Industrial	$1,600	$350,000	$380,000	$370,000	$1,100,000	$3,000	$670,000	$730,000	$690,000	$2,100,000
Office Building	$8,000	$2,600,000	$2,500,000	$1,400,000	$6,400,000	$10,000	$3,200,000	$3,000,000	$1,700,000	$7,800,000

Industry	Bay Area					California				
	Reach 1	**Reach 2**	**Reach 3**	**Reach 4**	**Total**	**Reach 1**	**Reach 2**	**Reach 3**	**Reach 4**	**Total**
Real Estate	$2,200	$340,000	$400,000	$230,000	$970,000	$2,900	$470,000	$510,000	$310,000	$1,300,000
Religious and Community Organizations	$170	$36,000	$34,000	$19,000	$89,000	$240	$52,000	$49,000	$28,000	$130,000
Residential	$1,700	$480,000	$450,000	$270,000	$1,200,000	$2,200	$600,000	$570,000	$340,000	$1,500,000
Warehousing and Storage	$1,100	$180,000	$230,000	$300,000	$710,000	$1,700	$310,000	$360,000	$440,000	$1,100,000
Water Transportation	$21	$6,300	$5,800	$3,600	$16,000	$21	$6,200	$5,800	$3,900	$16,000
Total	*$19,000*	*$5,100,000*	*$5,300,000*	*$3,300,000*	*$14,000,000*	*$26,000*	*$6,800,000*	*$7,100,000*	*$4,500,000*	*$18,000,000*

Table E.1-33: Regional Job Losses by Time Period and SLC Curve

Time Period	Bay Area			California		
	USACE High SLC	**USACE Intermediate SLC**	**USACE Low SLC**	**USACE High SLC**	**USACE Intermediate SLC**	**USACE Low SLC**
2023 - 2040	50	17	13	82	29	21
2040 - 2065	530	27	11	890	44	17
2065 - 2090	1,300	65	9	2,100	110	15
2090 - 2115	570	140	9	950	240	15
2115 - 2140	610	170	10	1,000	290	16
Total	*3,000*	*420*	*52*	*5,100*	*710*	*86*

Table E.1-34: Regional Job Losses by Industry and SLC Curve

Industry	Bay Area			California		
	USACE High SLC	USACE Intermediate SLC	USACE Low SLC	USACE High SLC	USACE Intermediate SLC	USACE Low SLC
Commercial	850	120	14	1,300	180	21
Construction	40	7	2	63	10	2
Education	100	14	2	130	18	2
Fishing and Marinas	11	2	0	17	2	0
Government	94	13	2	130	18	3
Health Care	380	51	6	600	81	9
Hotels	6	1	0	21	3	0
Industrial	100	15	2	320	45	6
Office Building	1,100	150	17	1,900	270	30
Real Estate	190	26	3	300	42	5
Religious and Community Organizations	41	6	1	70	10	1
Residential	61	8	1	97	13	2
Warehousing and Storage	79	11	2	160	23	4
Water Transportation	1	0	0	1	0	0
Total	*3,000*	*420*	*52*	*5,100*	*710*	*86*

Jobs represent all full-time, part-time, and temporary employment opportunities available on average within an industry. Note this is not a specific job count, but again represents a localized average of *likely employment statistics* based on annual economic activity.

E.1-4.4 Total Regional Economic Development Impacts

Total FWOP impacts across the five primary RED measures are summarized in Table E.1-35 and

Table E.1-36.

In the High SLC scenario, direct and cascading regional output losses account for most of the monetized RED impacts, each contributing $1.1 billion toward the $2.7 billion overall impacts. Though the revenue losses for critical infrastructure comprise only roughly 20% of the overall impacts in this scenario, at lower rates of SLC, the relative importance of revenue losses increases to over 40% of the overall impacts in the Intermediate scenario, and over 75% with low rates of SLC. This change in relative importance is seen because of the rebuild thresholds applied to buildings (see E.1-3.6.1 for more information on repetitive flood loss) and the fact that we do not assume floodproofing of critical facilities. Total losses drop to $570 million in the Intermediate scenario, and down to $172 million in the Low SLC scenario.

Across all SLC scenarios, cascading regional job impacts account for roughly 60% of the total expected job losses. In the lowest scenario, job impacts are expected to be minimal, totaling 150 jobs from 2023 to 2140, caused mostly by impacts in Reach 3. However, under the Intermediate SLC scenario, the overall anticipated losses increase to 1,200 jobs, and with under the High SLC scenario, 8,500 jobs are expected to be impacted across the state.

Table E.1-35: Total Present Value of FWOP RED Impacts in USD (Values Rounded)

SLC Curve	Reach	Revenue Losses for Critical Infrastructure	Direct Output Losses	Cascading Regional Output Loss (CA)	Total Losses
USACE High SLC	Reach 1	$12,000,000	$8,200,000	$6,600,000	$26,800,000
	Reach 2*	$370,000,000	$780,000,000	$770,000,000	$1,920,000,000
	Reach 3	$23,000,000	$340,000,000	$290,000,000	$653,000,000
	Reach 4	$99,000,000	$19,000,000	$17,000,000	$135,000,000
	Study Area	*$500,000,000*	*$1,100,000,000*	*$1,100,000,000*	*$2,700,000,000*
USACE Intermediate SLC	Reach 1	$30,000	$470,000	$460,000	$960,000
	Reach	$170,000,000	$120,000,000	$120,000,000	$410,000,000

SLC Curve	Reach	Revenue Losses for Critical Infrastructure	Direct Output Losses	Cascading Regional Output Loss (CA)	Total Losses
	2*				
	Reach 3	$7,900,000	$39,000,000	$27,000,000	$73,900,000
	Reach 4	$76,000,000	$7,200,000	$6,300,000	$89,500,000
	Study Area	*$250,000,000*	*$170,000,000*	*$150,000,000*	*$570,000,000*
USACE Low SLC	Reach 1	$0	$25,000	$26,000	$51,000
	Reach 2*	$61,000,000	$6,900,000	$6,800,000	$74,700,000
	Reach 3	$1,300,000	$12,000,000	$7,100,000	$20,400,000
	Reach 4	$70,000,000	$5,100,000	$4,500,000	$79,600,000
	Study Area	*$130,000,000*	*$24,000,000*	*$18,000,000*	*$172,000,000*

* Note: SFMTA assets span both Reaches 2 and 3, but revenue loss is recorded for Reach 2

Table E.1-36: Total FWOP Job Losses

SLC Curve	Reach	Direct Job Losses	Cascading Regional Job Loss (CA)	Total Job Loss
USACE High SLC	Reach 1	35	31	66
	Reach 2	1,900	3,600	5,500
	Reach 3	1,400	1,400	2,700
	Reach 4	57	77	130
	Study Area	*3,400*	*5,100*	*8,500*
USACE Intermediate SLC	Reach 1	3	2	5
	Reach 2	300	550	850
	Reach 3	120	130	250
	Reach 4	19	28	47
	Study Area	*440*	*710*	*1,200*
USACE Low SLC	Reach 1	-	-	0

	Reach 2	19	32	51
	Reach 3	33	33	66
	Reach 4	13	20	33
	Study Area	*65*	*86*	*150*

Section E.1-5. Future With Project Results

This section compares the residual losses from each alternative evaluated in the FWP for each RED metrics. Residual losses represent the remaining RED impacts after flood mitigation rather than the benefits gained from each alternative. These impacts can be attributed either to assets being outside of the line of protection, or, in some cases in the high SLC scenario, flooding that overtops the line of protection. As discussed in **Error! Reference source not found.** and presented for FWOP in **Error! Reference source not found.**, revenue losses and direct output losses were modeled in G2CRM, while the direct job losses and cascading regional economic effects were modeled using IMPLAN. Exposure maps for each alignment can be found in **Error! Reference source not found.** and *Appendix B.1.8 – San Francisco Waterfront Inundation Maps*.

E.1-5.1 Revenue Losses for Critical Infrastructure

Under every SLC scenario, with implementation of Alternative B, the nonstructural option, it is assumed that all critical infrastructure would be protected.

Additionally, all critical infrastructure falls within the lines of protection of Alternatives C, D, and E, but some assets are not protected in other alternatives. For instance, the Recology facility (Reach 4) remains outside of Alternatives F and G, and the Channel Pump Station (Reach 3) as well as the Bruce Flynn Pump Station (Reach 4) lie outside the line of Alternative G protection.

Some residual risk to critical infrastructure remains under Alternatives C and D, which are meant to protect against lower rates of SLC under the High scenario. This is due to overtopping, which causes losses to equal or exceed those in the FWOP scenario. Residual RED losses in F and G differ due to the difference in alignment in Reach 3.

Table E.1-37,

Table E.1-38, and

Table E.1-39 summarize the remaining revenue loss by reach for each alternative.

Table E.1-37: Present Value of FWP Revenue Losses for Critical Infrastructure by Reach – High SLC Scenario (Values Rounded)

Alternative	Reach 1	Reach 2	Reach 3	Reach 4	Total
FWOP	$12,000,000	$370,000,000	$23,000,000	$99,000,000	$500,000,000
C	$13,000,000	$390,000,000	$24,000,000	$99,000,000	$520,000,000
D	$15,000,000	$350,000,000	$22,000,000	$100,000,000	$490,000,000
E	$0	$0	$0	$0	$0
F	$0	$0	$0	$99,000,000	$99,000,000
G	$0	$0	$13,000,000	$99,000,000	$110,000,000

Table E.1-38: Present Value of FWP Revenue Losses for Critical Infrastructure by Reach – Int SLC Scenario (Values Rounded)

Alternative	Reach 1	Reach 2	Reach 3	Reach 4	Total
FWOP	$30,000	$170,000,000	$7,900,000	$76,000,000	$250,000,000
C	$0	$0	$0	$0	$0
D	$0	$0	$0	$0	$0
E	$0	$0	$0	$0	$0
F	$0	$0	$0	$76,000,000	$76,000,000
G	$0	$0	$4,200,000	$76,000,000	$80,000,000

Table E.1-39: Present Value of FWP Revenue Losses for Critical Infrastructure by Reach – Low SLC Scenario (Values Rounded)

Alternative	Reach 1	Reach 2	Reach 3	Reach 4	Total
FWOP	$0	$61,000,000	$1,300,000	$70,000,000	$130,000,000
C	$0	$0	$0	$0	$0
D	$0	$0	$0	$0	$0
E	$0	$0	$0	$0	$0
F	$0	$0	$0	$70,000,000	$70,000,000
G	$0	$0	$280,000	$70,000,000	$70,000,000

E.1-5.2 Direct Economic Impacts

Under the High SLC scenario, with implementation of Alternative B, the nonstructural option, there would be an expected 98% reduction in RED losses, with most of the residual losses occurring in Reaches 3 and 4. Though Reach 3 has the largest absolute value of residual losses, over 96% of losses are avoided, whereas Reach 4 only has 67% of losses avoided in terms of direct output losses. Office buildings are expected to have the highest portion of residual risk under Alternative B, though warehousing and storage industries have the lowest percentage (59%) of losses avoided expected compared to FWOP.

Both Alternative C and D, which are meant to protect against lower rates of SLR, would be expected to *increase* the direct economic impacts when compared to the FWOP condition in the High SLC scenario, totaling in $1.4 billion and $1.2 billion of direct output losses, respectively, compared to the $1.1 billion of losses expected with a FWOP condition. Alternative C has the greatest negative impacts on Reach 2, increasing impacts by 27%, while Alternative D has the greatest negative impacts on Reach 1, increasing impacts by 10%. Both alternatives would disproportionately impact government buildings more than any other industry, roughly doubling the impacts compared to FWOP. Office buildings are also expected to have a significant increase in direct output losses in Alternative C, while the health care industry is likely to be hit significantly more in Alternative D when compared to FWOP.

Alternatives E, F, and G all aim to protect to a higher rate of SLC. Alternative E, which aims to preserve the waterfront by raising shorelines, and Alternative F, which creates an active system for managing floodwater, are each expected to perform similarly in the High SLC scenario, each providing over 85% reduction in risk, leaving $160 million and $150 in residual losses, respectively. Alternative G, which aims to align with natural watersheds, is expected to provide a 92% reduction in risk, leaving a total of $92 million in residual direct output losses. Each of these three alternatives reduce the highest proportion of risk (94%) on Reach 2,and leave the most proportional residual losses to the fishing and marinas, government, and warehousing and storage industries.

Across all alternatives, Reaches 2 and 3 are expected to have the most residual impacts in terms of absolute value of direct output losses, while Reach 4 tends to have the highest proportion of residual losses remaining. In general, most of the residual losses are from buildings on land rather than over piers. Though office buildings tend to have the highest absolute value of residual losses across alternatives, followed by residential, commercial, and health care industries, the fishing and marinas, government, and warehousing and storage industries tend to have the highest proportion of residual impacts compared to FWOP.

Table E.1-40 and Table E.1-41 summarize the direct output losses in the High SLC scenario for each alternative across reaches and industries, respectively, with total cumulative losses over time plotted on Figure E.1-13.

Table E.1-40: Present Value of FWP Direct Output Losses by Reach – High SLC Scenario (Values Rounded)

Alternative	Reach 1	Reach 2	Reach 3	Reach 4	Total
FWOP	$8,200,000	$780,000,000	$340,000,000	$19,000,000	$1,100,000,000
B	$38,000	$4,700,000	$15,000,000	$6,200,000	$25,000,000
C	$8,800,000	$990,000,000	$360,000,000	$20,000,000	$1,400,000,000
D	$9,000,000	$790,000,000	$360,000,000	$19,000,000	$1,200,000,000
E	$1,200,000	$45,000,000	$110,000,000	$8,600,000	$160,000,000
F	$1,400,000	$45,000,000	$95,000,000	$7,300,000	$150,000,000
G	$1,200,000	$45,000,000	$39,000,000	$7,100,000	$92,000,000

Table E.1-41: Present Value of FWP Direct Output Losses by Industry – High SLC Scenario (Values Rounded)

Industry	FWOP	B	C	D	E	F	G
Commercial	$41,000,000	$2,400,000	$41,000,000	$41,000,000	$12,000,000	$11,000,000	$6,700,000
Education	$1,000,000	$6,000	$1,200,000	$1,200,000	$270,000	$270,000	$45,000
Fishing and Marinas	$110,000	$81	$17,000	$8,200	$100,000	$100,000	$100,000
Government	$1,100,000	$72,000	$2,400,000	$2,200,000	$590,000	$590,000	$130,000
Health Care	$76,000,000	$830,000	$73,000,000	$88,000,000	$17,000,000	$17,000,000	$4,300,000
Hotels	$8,700,000	$60,000	$8,700,000	$7,200,000	$340,000	$340,000	$330,000
Industrial	$7,800,000	$2,100,000	$7,100,000	$6,300,000	$3,500,000	$2,600,000	$2,500,000
Office Building	$910,000,000	$6,100,000	$1,100,000,000	$930,000,000	$92,000,000	$85,000,000	$53,000,000
Religious/ Comm. Org.	$11,000,000	$160,000	$12,000,000	$9,800,000	$2,800,000	$2,700,000	$2,600,000
Residential	$76,000,000	$9,600,000	$89,000,000	$84,000,000	$24,000,000	$24,000,000	$18,000,000
Warehousing and Storage	$10,000,000	$4,200,000	$6,100,000	$5,800,000	$6,700,000	$4,300,000	$4,300,000
Water Transportation	$130,000	$300	$440	$440	$110,000	$110,000	$110,000
Total	*$1,100,000,000*	*$25,000,000*	*$1,400,000,000*	*$1,200,000,000*	*$160,000,000*	*$150,000,000*	*$92,000,000*

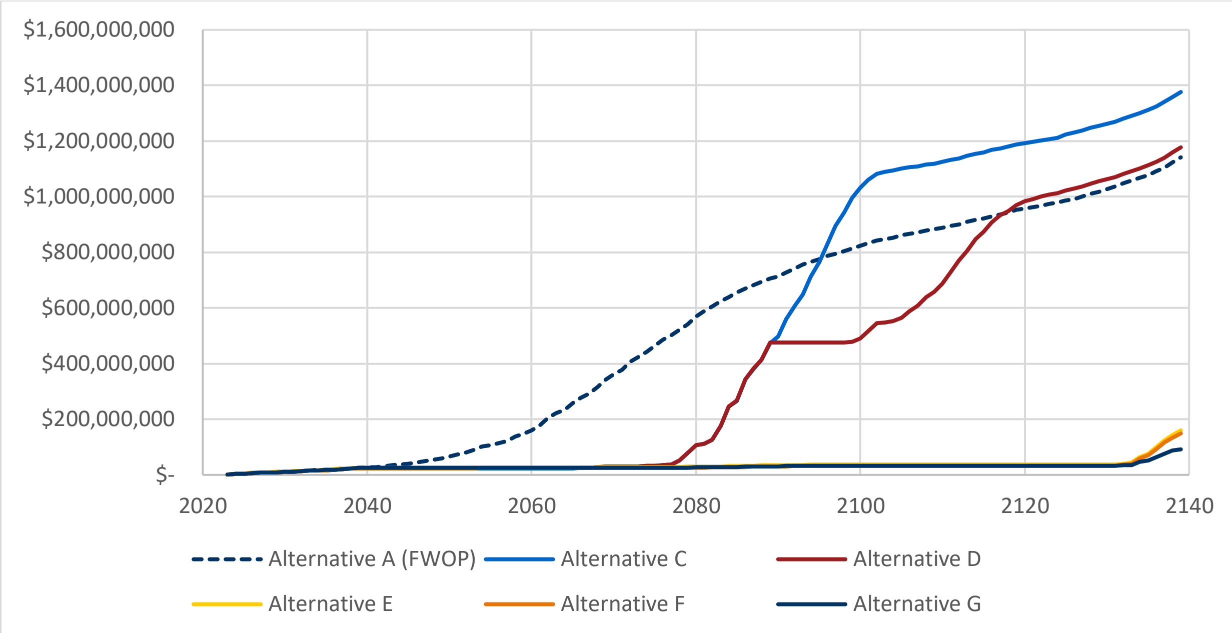


Figure E.1-13: Present Value of Cumulative Residual Losses of USACE High SLC

Under the Intermediate SLC scenario, with implementation of Alternative B, the nonstructural option, all impacts would be mitigated.

Alternative C (defend, scaled for lower risk) which aims to adapt the shoreline to withstand 1.5 feet of sea level rise using a combination of structural and nonstructural measures, would expect to have a 94% decrease in direct output losses. Both Alternative D (defend, scaled for low-moderate risk), which also protects against 1.5 feet of sea level rise but aims to be adaptable for building higher in the 2090-time frame, and Alternative E (defend existing shoreline, scaled for higher risk) performed slightly better than Alternative C, reducing direct output losses by 96%. Alternative F (manage the water, scaled for higher risk) prevents similarly 93% of direct output losses. Direct losses in the warehousing and storage industry account for most of the residual losses in Alternatives C, D, E, and F.

Alternative G (partial retreat, scaled for higher risk) leaves the largest portion of residual direct output losses, with $26 million in direct output losses remaining, compared to the $170 million seen in FWOP. Direct losses in the residential industry account for most of the residual losses in Alternative G.

As with the high scenario, Reach 2 sees the most reduction in RED losses under intermediate SLC projections, with over 99% of direct RED losses avoided across all alternatives. Though Reach 3 tends to have higher absolute values of residual direct output losses, Reach 4 sees the lowest proportion of protection across all alternatives.

Table E.1-42 and Table E.1-43 summarize the direct output losses in the Intermediate SLC scenario for each alternative across reaches and industries, respectively, with total cumulative losses over time plotted on Figure E.1-14.

Table E.1-42: Present Value of FWP Direct Output Losses by Reach – Intermediate SLC Scenario (Values Rounded)

Alternative	Reach 1	Reach 2	Reach 3	Reach 4	Total
FWOP	$470,000	$120,000,000	$39,000,000	$7,200,000	$170,000,000
B	$0	$0	$0	$0	$0
C	$320,000	$1,500,000	$4,700,000	$3,000,000	$9,500,000
D	$180,000	$1,300,000	$2,500,000	$2,900,000	$6,900,000
E	$180,000	$550,000	$2,800,000	$2,900,000	$6,500,000
F	$180,000	$550,000	$4,400,000	$6,100,000	$11,000,000
G	$180,000	$550,000	$19,000,000	$6,500,000	$26,000,000

Table E.1-43: Present Value of FWP Direct Output Losses by Industry – Intermediate SLC Scenario (Values Rounded)

Industry	FWOP	B	C	D	E	F	G
Commercial	$6,300,000	$0	$2,000,000	$1,600,000	$1,300,000	$1,100,000	$1,500,000
Education	$150,000	$0	$5,300	$0	$0	$0	$120,000
Fishing and Marinas	$8,600	$0	$9,100	$9,200	$9,100	$9,100	$9,100
Government	$170,000	$0	$32,000	$7,300	$6,500	$6,400	$150,000
Health Care	$4,400,000	$0	$290,000	$0	$0	$0	$3,100,000
Hotels	$1,300,000	$0	$22,000	$20,000	$19,000	$20,000	$34,000
Industrial	$2,800,000	$0	$1,500,000	$1,500,000	$1,600,000	$2,000,000	$2,300,000
Office Building	$120,000,000	$0	$1,600,000	$1,100,000	$810,000	$2,900,000	$5,000,000
Religious/ Comm. Org.	$2,900,000	$0	$310,000	$130,000	$130,000	$140,000	$130,000
Residential	$18,000,000	$0	$1,500,000	$480,000	$480,000	$480,000	$8,800,000
Warehousing and Storage	$5,200,000	$0	$2,200,000	$2,100,000	$2,100,000	$4,600,000	$5,000,000
Water Transportation	$17,000	$0	$17,000	$17,000	$19,000	$19,000	$19,000
Total	*$170,000,000*	*$0*	*$9,500,000*	*$6,900,000*	*$6,500,000*	*$11,000,000*	*$26,000,000*

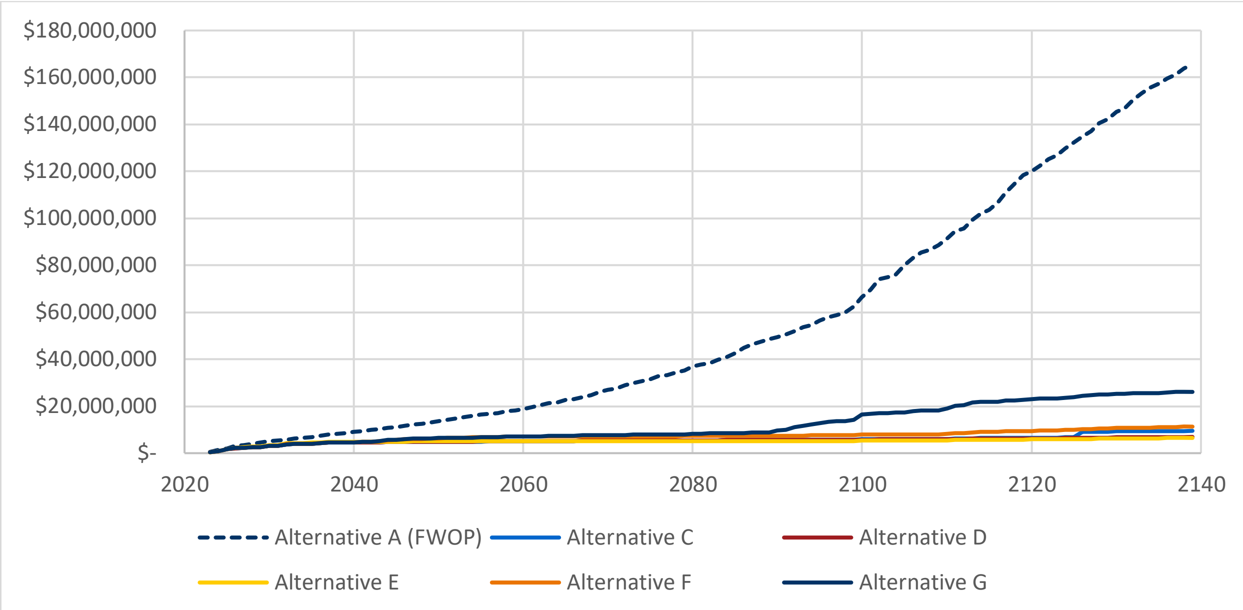


Figure E.1-14: Present Value of Cumulative Residual Losses of USACE Intermediate SLC

Similar trends are seen under the Low SLC scenario as with the Intermediate SLC scenario. Once again, with the implementation of Alternative B, all impacts would be mitigated. Alternatives C and D, which both aim to protect to lower rates of SLC, perform similarly well, each reducing over 80% of the risk compared to FWOP, with roughly $4 million in direct output losses remaining across all reaches. Alternative E, which aims to hold the line and protect against higher rates of SLC, also performs similarly to Alternatives C and D, once again leaving roughly $4 million in residual direct output losses. Alternative F results in a 76% reduction in RED losses compared to FWOP, while Alternative G leaves the most residual direct output losses, resulting in a reduction of only 60%.

Industrial industries account for the largest residual direct output losses in Alternatives C, D, and E, followed by commercial and warehousing and storage industries. For Alternative F and G, warehousing and storage industries comprise the largest portion of the residual losses.

Table E.1-44 and Table E.1-45 summarize the direct output losses in the High SLC scenario for each alternative across reaches and industries, respectively, with total cumulative losses over time plotted on Figure E.1-15.

Table E.1-44: Present Value of FWP Direct Output Losses by Reach – Low SLC Scenario (Values Rounded)

Alternative	Reach 1	Reach 2	Reach 3	Reach 4	Total
FWOP	$25,000	$6,900,000	$12,000,000	$5,100,000	$24,000,000
B	$0	$0	$0	$0	$0
C	$21,000	$640,000	$1,200,000	$2,200,000	$4,100,000
D	$16,000	$530,000	$1,200,000	$2,200,000	$4,000,000
E	$20,000	$140,000	$1,400,000	$2,200,000	$3,800,000
F	$20,000	$140,000	$1,200,000	$4,400,000	$5,800,000
G	$20,000	$140,000	$4,800,000	$4,600,000	$9,600,000

Table E.1-45: Present Value of FWP Direct Output Losses by Industry – Low SLC Scenario (Values Rounded)

Industry	FWOP	B	C	D	E	F	G
Commercial	$2,100,000	$0	$1,000,000	$960,000	$980,000	$740,000	$920,000
Education	$10,000	$0	$0	$0	$0	$0	$6,100
Fishing and Marinas	$160	$0	$170	$170	$170	$170	$170
Government	$58,000	$0	$1,800	$1,300	$1,300	$1,300	$30,000
Health Care	$1,100,000	$0	$0	$0	$0	$0	$580,000
Hotels	$64,000	$0	$17,000	$17,000	$17,000	$17,000	$23,000
Industrial	$1,800,000	$0	$1,200,000	$1,200,000	$1,300,000	$1,400,000	$1,500,000
Office Building	$8,300,000	$0	$540,000	$530,000	$330,000	$320,000	$500,000
Religious/ Comm. Org.	$200,000	$0	$37,000	$36,000	$37,000	$36,000	$36,000
Residential	$6,900,000	$0	$230,000	$230,000	$230,000	$230,000	$2,800,000
Warehousing and Storage	$3,500,000	$0	$990,000	$990,000	$990,000	$3,100,000	$3,300,000
Water Transportation	$770	$0	$1,200	$1,200	$1,200	$1,200	$1,200
Total	*$24,000,000*	*$0*	*$4,100,000*	*$4,000,000*	*$3,800,000*	*$5,800,000*	*$9,600,000*

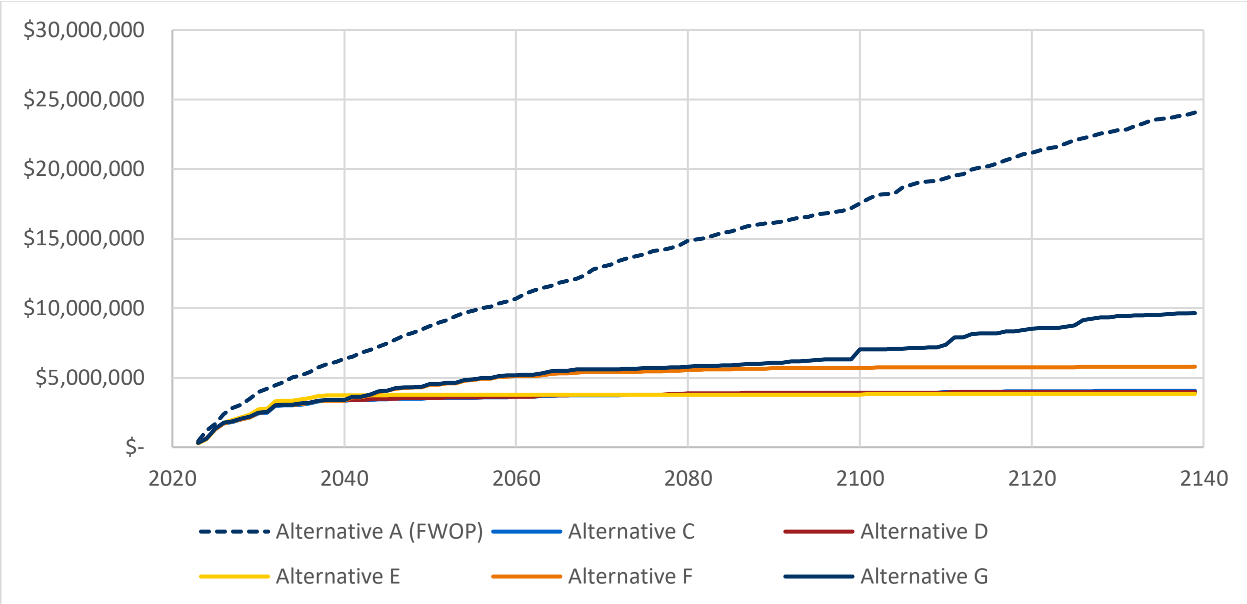


Figure E.1-15: Present Value of Cumulative Residual Losses of USACE Low SLC

Trends for residual direct job impacts follow those of the direct output losses, with Alternative C and D inducing job losses in the High SLC scenario. Alternative G generally leaves the highest residual job losses in the Intermediate and Low scenarios, though performs better than Alternatives E and F in terms of job loss in the High SLC scenario. Though Table E.1-46 summarizes total residual direct job impacts, the trends over time (not shown) indicate that under the high SLC scenario, Alternative C and D experience the greatest amount of job loss in the 2090 – 2115 period, whereas the greatest job loss occurs in 2065 – 2090 under FWOP conditions.

Table E.1-46: FWP Direct Job Impacts by Alternative

Alternative	USACE High SLC	USACE Intermediate SLC	USACE Low SLC
FWOP	3,400	440	65
B	64	-	-
C	3,900	33	14
D	3,500	24	14
E	530	22	14
F	500	33	18
G	260	78	28

E.1-5.3 Cascading Regional Economic Effects

In the High SLC scenario, with implementation of Alternative B, there would only be $18 million of residual cascading economic losses compared to the $1.1 billion FWOP losses, representing a 98% reduction in RED losses. As seen in the direct output losses, Reach 3 produces the largest absolute value of residual indirect and induced losses, though Reach 4 has the lowest percentage (67%) of losses avoided.

Once again, both Alternative C and D, which are meant to protect against lower rates of SLR, would be expected to *increase* the direct economic impacts when compared to the FWOP condition in the High SLC scenario. Alternative C again has the greatest negative impacts on cascading impacts from Reach 2, increasing impacts by 27%, while Alternative D has the greatest negative cascading impacts from Reach 1, increasing overall regional economic impacts in the state by 10%. Overall, Alternatives E, F, and G each reduce roughly 90% of the cascading regional economic impacts, and the ratio of residual losses to the FWOP impacts are generally consistent across industries, unlike trends in direct output losses.

Office industries see the largest proportion of residual cascading impacts across the state for all alternatives, followed by commercial, industrial, and residential industries. Tables E.1-47 and E.1-48 summarize the cascading regional impacts for each alternative by reach and industry, respectively, for the high SLC scenario.

Table E.1-47: Present Value of FWP Indirect and Induced Output Losses by Reach in CA – High SLC Scenario (Values Rounded)

Alternative	Reach 1	Reach 2	Reach 3	Reach 4	Total
FWOP	$6,600,000	$770,000,000	$290,000,000	$17,000,000	$1,100,000,000
B	$36,000	$4,700,000	$7,700,000	$5,400,000	$18,000,000
C	$7,200,000	$980,000,000	$300,000,000	$18,000,000	$1,300,000,000
D	$7,600,000	$790,000,000	$300,000,000	$17,000,000	$1,100,000,000
E	$1,200,000	$45,000,000	$88,000,000	$7,600,000	$140,000,000
F	$1,400,000	$45,000,000	$79,000,000	$6,400,000	$130,000,000
G	$1,200,000	$45,000,000	$27,000,000	$6,200,000	$79,000,000

Table E.1-48: Present Value of FWP Indirect and Induced Output Losses by Industry in CA – High SLC Scenario (Values Rounded)

Industry	FWOP	B	C	D	E	F	G
Commercial	$130,000,000	$2,100,000	$160,000,000	$140,000,000	$18,000,000	$16,000,000	$9,700,000
Construction	$11,000,000	$460,000	$13,000,000	$12,000,000	$2,000,000	$1,900,000	$1,200,000
Education	$13,000,000	$190,000	$15,000,000	$13,000,000	$1,700,000	$1,500,000	$920,000
Fishing and Marinas	$1,200,000	$20,000	$1,500,000	$1,300,000	$170,000	$160,000	$93,000
Government	$22,000,000	$430,000	$26,000,000	$23,000,000	$3,000,000	$2,700,000	$1,700,000
Health Care	$70,000,000	$1,000,000	$84,000,000	$72,000,000	$9,200,000	$8,500,000	$4,900,000
Hotels	$2,400,000	$33,000	$3,000,000	$2,500,000	$300,000	$280,000	$170,000
Industrial	$110,000,000	$2,100,000	$130,000,000	$110,000,000	$15,000,000	$14,000,000	$8,200,000
Office Building	$490,000,000	$7,500,000	$600,000,000	$510,000,000	$62,000,000	$57,000,000	$35,000,000
Real Estate	$75,000,000	$1,200,000	$90,000,000	$78,000,000	$10,000,000	$9,600,000	$5,700,000
Religious and Community Organizations	$8,300,000	$120,000	$10,000,000	$8,500,000	$1,100,000	$1,000,000	$590,000
Residential	$96,000,000	$1,400,000	$120,000,000	$99,000,000	$13,000,000	$12,000,000	$6,800,000
Warehousing and Storage	$50,000,000	$1,100,000	$60,000,000	$51,000,000	$7,200,000	$6,600,000	$4,000,000
Water Transportation	$990,000	$15,000	$1,200,000	$1,000,000	$130,000	$120,000	$70,000
Total	*$1,100,000,000*	*$18,000,000*	*$1,300,000,000*	*$1,100,000,000*	*$140,000,000*	*$130,000,000*	*$79,000,000*

Because Alternative B mitigates all direct output losses in both the Intermediate and Low SLC scenarios, cascading regional impacts are also eliminated across all reaches and industries. Alternatives C, D, and E perform better in the Low scenario than Alternatives F and G, with the former all reducing roughly 80% of the cascading regional impacts, and the latter two reducing only 73% and 62%, respectively. Compared to FWOP, Reach 2 has the highest proportion of avoided losses across alternatives, with nearly all of the impacts mitigated in the Intermediate scenario. In the Low SLC scenario, Alternatives C and D reduce just over 90% of the cascading regional impacts from Reach 2, while alternatives E, F, and G reduce 98% of the risk in terms of indirect and induced output losses.

Once again, the ratio of residual losses to the FWOP impacts are generally consistent across industries, and office industries see the largest proportion of residual cascading impacts across the state for all alternatives, followed by industrial and then commercial industries. Table E.1-49 and

Table E.1-50 summarize the cascading regional impacts for each alternative by reach and industry, respectively, for the Intermediate SLC scenario, while

Table E.1-51 and Table E.1-52 summarize impacts for the Low SLC scenario.

Table E.1-49: Present Value of FWP Indirect and Induced Output Losses by Reach in CA – Intermediate SLC Scenario (Values Rounded)

Alternative	Reach 1	Reach 2	Reach 3	Reach 4	Total
FWOP	$460,000	$120,000,000	$27,000,000	$6,300,000	$150,000,000
B	$0	$0	$0	$0	$0
C	$320,000	$1,400,000	$3,600,000	$2,600,000	$7,900,000
D	$190,000	$1,200,000	$2,100,000	$2,500,000	$6,000,000
E	$190,000	$550,000	$2,300,000	$2,600,000	$5,600,000
F	$200,000	$550,000	$3,900,000	$5,400,000	$10,000,000
G	$180,000	$550,000	$12,000,000	$5,700,000	$19,000,000

Table E.1-50: Present Value of FWP Indirect and Induced Output Losses by Industry in CA – Intermediate SLC Scenario (Values Rounded)

Industry	FWOP	B	C	D	E	F	G
Commercial	$19,000,000	$0	$960,000	$720,000	$660,000	$1,200,000	$2,300,000
Construction	$1,800,000	$0	$120,000	$70,000	$67,000	$100,000	$450,000
Education	$1,800,000	$0	$90,000	$67,000	$61,000	$110,000	$210,000
Fishing and Marinas	$170,000	$0	$10,000	$7,700	$7,000	$11,000	$21,000
Government	$3,100,000	$0	$210,000	$170,000	$160,000	$300,000	$470,000
Health Care	$9,500,000	$0	$470,000	$350,000	$320,000	$580,000	$1,200,000
Hotels	$340,000	$0	$14,000	$11,000	$9,900	$19,000	$36,000
Industrial	$15,000,000	$0	$1,000,000	$850,000	$820,000	$1,300,000	$2,300,000
Office Building	$69,000,000	$0	$3,100,000	$2,300,000	$2,100,000	$4,000,000	$7,700,000
Real Estate	$11,000,000	$0	$600,000	$450,000	$410,000	$730,000	$1,400,000
Religious and Community Organizations	$1,100,000	$0	$56,000	$41,000	$38,000	$68,000	$130,000
Residential	$13,000,000	$0	$650,000	$490,000	$450,000	$810,000	$1,600,000
Warehousing and Storage	$7,200,000	$0	$580,000	$480,000	$460,000	$790,000	$1,300,000
Water Transportation	$140,000	$0	$6,900	$5,300	$4,900	$8,700	$16,000
Total	*$150,000,000*	*$0*	*$7,900,000*	*$6,000,000*	*$5,600,000*	*$10,000,000*	*$19,000,000*

Table E.1-51: Present Value of FWP Indirect and Induced Output Losses by Reach in CA – Low SLC Scenario (Values Rounded)

Alternative	Reach 1	Reach 2	Reach 3	Reach 4	Total
FWOP	$26,000	$6,800,000	$7,100,000	$4,500,000	$18,000,000
B	$0	$0	$0	$0	$0
C	$24,000	$610,000	$960,000	$1,900,000	$3,500,000
D	$19,000	$520,000	$990,000	$1,900,000	$3,400,000
E	$23,000	$130,000	$1,200,000	$1,900,000	$3,300,000
F	$22,000	$130,000	$970,000	$3,900,000	$5,000,000
G	$23,000	$130,000	$2,800,000	$4,000,000	$7,000,000

Table E.1-52: Present Value of FWP Indirect and Induced Output Losses by Industry in CA – Low SLC Scenario (Values Rounded)

Industry	FWOP	B	C	D	E	F	G
Commercial	$2,200,000	$0	$420,000	$410,000	$390,000	$570,000	$810,000
Construction	$380,000	$0	$39,000	$38,000	$37,000	$52,000	$150,000
Education	$200,000	$0	$38,000	$37,000	$35,000	$53,000	$73,000
Fishing and Marinas	$21,000	$0	$4,500	$4,300	$4,200	$5,500	$7,600
Government	$430,000	$0	$94,000	$92,000	$89,000	$170,000	$200,000
Health Care	$1,100,000	$0	$200,000	$200,000	$190,000	$280,000	$400,000
Hotels	$36,000	$0	$6,300	$6,100	$5,700	$8,700	$12,000
Industrial	$2,100,000	$0	$550,000	$540,000	$530,000	$730,000	$940,000
Office Building	$7,800,000	$0	$1,300,000	$1,300,000	$1,200,000	$1,900,000	$2,700,000
Real Estate	$1,300,000	$0	$250,000	$240,000	$230,000	$370,000	$510,000
Religious and Community Organizations	$130,000	$0	$24,000	$23,000	$22,000	$32,000	$46,000

Industry	FWOP	B	C	D	E	F	G
Residential	$1,500,000	$0	$280,000	$280,000	$260,000	$390,000	$550,000
Warehousing and Storage	$1,100,000	$0	$300,000	$290,000	$290,000	$460,000	$560,000
Water Transportation	$16,000	$0	$3,200	$3,200	$3,000	$4,300	$5,900
Total	*$18,000,000*	*$0*	*$3,500,000*	*$3,400,000*	*$3,300,000*	*$5,000,000*	*$7,000,000*

Once again, trends for residual regional cascading job impacts follow those of the direct output losses and cascading regional economic impacts, with Alternative C and D inducing regional job losses in the High SLC scenario. Alternative G generally leaves the highest residual job losses in the Intermediate and Low scenarios, though performs better than Alternatives E and F in terms of cascading regional job loss in the High SLC scenario (Table E.1-53).

Table E.1-53: Present Value of FWP Indirect and Induced Job Impacts by Alternative

Alternative	USACE High SLC	USACE Intermediate SLC	USACE Low SLC
FWOP	5,100	710	86
B	82	-	-
C	6,100	36	16
D	5,200	28	16
E	660	25	15
F	620	46	23
G	370	88	32

E.1-5.4 Total RED Impacts

Total FWP impacts across the three primary RED measures are summarized in Table E.1-54 and

Table E.1-55.

In the High scenario, under Alternatives C and D, direct and cascading regional output losses again account for most (more than 80%) of the remaining monetized RED impacts, whereas in Alternatives F and G, the residual revenue losses from unprotected critical infrastructure contributes a much larger proportion (25-40%) of the total residual losses.

In the Low and Intermediate scenarios, the revenue losses from the Recology facility, the Channel Pump Station, and the Bruce Flynn Pump Station contribute the largest proportion of residual losses under Alternatives F and G.

Table E.1-54: Total Present Value of FWP RED Impacts in USD (Values Rounded)

SLC Curve	Alternative	Revenue Losses for Critical Infrastructure	Direct Output Losses	Cascading Regional Output Loss (CA)	Total Residual Losses
USACE High SLC	FWOP	$500,000,000	$1,100,000,000	$1,100,000,000	$2,700,000,000
	B	$0	$25,000,000	$18,000,000	$43,000,000
	C	$520,000,000	$1,400,000,000	$1,300,000,000	$3,200,000,000
	D	$490,000,000	$1,200,000,000	$1,100,000,000	$2,800,000,000
	E	$0	$160,000,000	$140,000,000	$300,000,000
	F	$99,000,000	$150,000,000	$130,000,000	$380,000,000
	G	$110,000,000	$92,000,000	$79,000,000	$280,000,000
USACE Intermediate SLC	FWOP	$250,000,000	$170,000,000	$150,000,000	$570,000,000
	B	$0	$0	$0	$0
	C	$0	$9,500,000	$7,900,000	$17,000,000
	D	$0	$6,900,000	$6,000,000	$13,000,000
	E	$0	$6,500,000	$5,600,000	$12,000,000
	F	$76,000,000	$11,000,000	$10,000,000	$98,000,000
	G	$80,000,000	$26,000,000	$19,000,000	$130,000,000
USACE Low SLC	FWOP	$130,000,000	$24,000,000	$18,000,000	$170,000,000
	B	$0	$0	$0	$0
	C	$0	$4,100,000	$3,500,000	$7,600,000
	D	$0	$4,000,000	$3,400,000	$7,400,000
	E	$0	$3,800,000	$3,300,000	$7,100,000
	F	$70,000,000	$5,800,000	$5,000,000	$81,000,000

SLC Curve	Alternative	Revenue Losses for Critical Infrastructure	Direct Output Losses	Cascading Regional Output Loss (CA)	Total Residual Losses
	G	$70,000,000	$9,600,000	$7,000,000	$87,000,000

Table E.1-55: Total FWP Job Losses

SLC Curve	Alternative	Direct Job Losses	Cascading Regional Job Loss (CA)	Total Job Loss
USACE High SLC	FWOP	4,900	5,100	9,900
	B	85	82	170
	C	5,700	6,100	12,000
	D	5,000	5,200	10,000
	E	710	660	1,400
	F	660	620	1,300
	G	370	370	740
USACE Intermediate SLC	FWOP	660	710	1,400
	B	-	-	-
	C	44	36	80
	D	32	28	60
	E	29	25	54
	F	44	46	90
	G	95	88	180
USACE Low SLC	FWOP	87	86	170
	B	-	-	-
	C	19	16	35
	D	19	16	34
	E	18	15	33
	F	23	23	46
	G	34	32	66

Section E.1-6. Summary

This analysis reviews qualitative and quantitative RED measures across the SFWCFS, including both direct as well as indirect and induced losses. The results summarized below confirm much of what is anecdotally known: that flooding in the SFWCFS study area will have a significant economic toll on San Francisco, as well as the region (and California) more broadly. Impacts were assessed through three key RED measure categories: revenue losses for critical infrastructure, direct economic impacts, and cascading regional economic effects.

Key takeaways from the RED analysis for the primary metrics are presented below:

1. **Revenue Impacts to Critical Infrastructure.** Critical infrastructure is prevalent throughout the study area, with vulnerable mobility and water and wastewater assets concentrated in Reaches 2, 3, and 4. Damage and disruption to these systems will likely result in agency revenue losses, which could exacerbate the long-term provision of services that are essential to a functioning waterfront.
    - BART estimates that even one day of disruption would cause $17.4 million per weekday in total passenger lost wages for this area (BART et al., 2020).[4] While some riders may be able to transition to working remotely, wage losses to other riders would be felt for weeks.
        - If public transportation service disruption continued for an extend period the area may experience long-term increased congestion, longer transit times, and a potentially a shift in workforce outside of the city.
        - Sea levels may increase 5.6 feet by 2110 (USACE High curve). Assuming no mitigation action is taken prior to this time frame, the Embarcadero Station will likely see flooding multiple times a year. With restoration times in the months to years, BART, Muni surface and subway light rail, and Muni historic streetcars will not be able to continue to operate as they do today.
        - SFPUC's Bay Bridge Pump Station is vulnerable later in the century, potentially affecting Treasure and Yerba Buena Islands; however, redevelopment is currently happening on Treasure Island increasing service redundancy.
    - Under every SLC scenario, with implementation of Alternative B (the nonstructural option), it is assumed that all critical infrastructure would be protected.
    - All critical infrastructure falls within the lines of protection of Alternatives C, D, and E, but some assets are not protected in other alternatives. For instance, the Recology facility (Reach 4) remains outside of Alternatives F and G, and the Channel Pump Station (Reach 3) as well as the Bruce Flynn Pump Station (Reach 4) lie outside the line of Alternative G protection.
    - Some residual risk to critical infrastructure remains under Alternatives C and D, which are meant to protect against lower rates of SLR under the High scenario. This is due to overtopping, causing risk to increase compared to the FWOP scenario.

[4] MWY line (West Oakland to Millbrae).

2. **Direct Economic Impacts.** Business operations may be disrupted because of a flood event and subsequent building damage, which then results in wages lost by employees and business income lost in the form of business sales, proprietor income, and revenues (after payroll). Property owners may lose rental income if they lease space or need to pay rent on a new space if they directly use the space (owner-occupied). In addition to direct job losses, as businesses lose income, secondary effects in changes to supply change spending cause additional indirect job losses. As workers lose wages, this decreases household spending leading to induced job losses. Overall key takeaways from the analysis include:
    - Under FWOP losses, in the High SLC scenario, total present value direct economic impacts may reach up to $1.1 billion across the SFWCFS area, with nearly all losses anticipated to occur in Reach 2 (68%) and Reach 3 (29%). In the Intermediate SLC scenario, total losses are anticipated to be closer to $170 million, with a similar split across Reach 2 (72%) and Reach 3 (24%). In the Low SLC scenario, however, anticipated losses are only $24 million, with the largest impacts seen in Reach 3 (50%), less anticipated impacts in Reach 2 (only 23%), and a significant portion of risk in Reach 4 (21%).
    - In the High SLC scenario under FWOP conditions, direct output losses steadily increase before peaking in the 2065-2090 period. Direct output losses taper off after 2090 due to a combination of the cumulative threshold and floodproofing assumptions made in G2CRM as well as the nature of the floodplain. However, frequent flooding caused by SLR, even if buildings are protected, can impact existing land uses and access to the SFWCFS study area.
    - The highest direct output losses occur in office-based industries, based mostly in Reaches 2. The health care industry sees large losses in Reach 3, due to impacts at the UCSF medical center. The commercial sector sees the highest impacts in Reach 1, including retail and restaurants in the Fisherman’s Wharf neighborhood. Reach 4 has most impacts in the industrial and warehousing/storage sectors. Overall, the largest job impacts are expected to be in the office, health care, and commercial sectors.
    - If critical infrastructure and business are down/disrupted, a shift to telecommuting may be seen for many jobs in the Financial District. However, impacts to the commercial sector along the waterfront could impact tourism and potentially cause relocation of these jobs out of the city.
    - Impacts to employee compensation and intermediate inputs represent the largest proportion of direct output losses across the study area.

In the FWOP scenario, increased flood risk in the study area will have the most direct economic impact in the Financial District and Downtown San Francisco (Reach 2). Direct losses felt in Reach 2 and throughout the study area will have reverberating impacts throughout San Francisco and the Bay Area – demonstrating that the region's economy is dependent on the city's waterfront. While not specifically modeled, it is expected that the combined impact of disrupted businesses and critical mobility and utility infrastructure will result in a trend towards telecommuting for office-based services and that could reduce inflow/outflow of people to the waterfront. Nevertheless, approximately 23% of the waterfront economy is also location-dependent and comprised of retail and professional services, education, fishing, industrial uses, or water transportation. These industries have a reduced opportunity for telecommuting if there were long-term disruption expected post-flood. After 2090, these types of industries will be more vulnerable to disruptions from frequent flooding, and business owners may opt to relocate from the waterfront to protect their interests. In both scenarios – where some businesses increase remote work opportunities and others potentially relocate – could decentralize the strong economy and job opportunities currently present at the waterfront.

- Alternative B (nonstructural option) provides an expected 98% reduction in RED losses under High SLC scenario, with most of the remaining losses occurring in Reaches 3 and 4. Office buildings have the highest portion of residual risk, while warehousing and storage industries have the lowest percentage of losses avoided compared to the existing condition. Under Intermediate and Low SLC scenarios, Alternative B mitigates all impacts.
- Alternatives C (defend, scaled for lower risk) and D (defend, scaled for low-moderate risk), aimed at protecting against lower rates of SLC, increase direct economic impacts compared to the existing condition in the High SLC scenario. Alternative C has the greatest negative impacts on Reach 2, while Alternative D has the greatest negative impacts on Reach 1. Both alternatives disproportionately impact government buildings and office buildings compared to other industries.
- Alternatives E (defend existing shoreline, scaled for higher risk) and F (manage the water, scaled for higher risk), which aim to protect against a higher rate of SLC, provide over 85% reduction in risk in the High SLC scenario. Alternative G (partial retreat, scaled for higher risk), which aligns with natural watersheds, provides a 92% reduction in risk. Under the intermediate and low SLC scenarios, however, Alternatives E and F provide more RED risk reduction than Alternative G. Fishing and marinas, government, and warehousing and storage industries have the most proportional residual losses across these three alternatives.

- Trends for residual job impacts follow those of direct output losses.

3. **Cascading Regional Economic Effects.** Direct losses in revenues and employment then lead to indirect and induced effects felt across the region. These regional economic impacts were modeled using IMPLAN, capturing losses within the larger boundary of California. As the POSF hosts a high proportion of cultural and industrial functions which are dependent on the waterfront, the values presented below are conservative. Additional reduced visitor spending on recreation-related activities will likely be felt, and the specific losses felt to some specialized maritime functions may be under-represented or masked in the overall results. Still, the level of regional economic losses that stem from coastal flooding within the SFWCFS are significant and broad reaching.

    - Generally, total cascading regional impacts tend to roughly double the overall output losses. In the High SLC scenario, total cascading regional economic impacts may add an additional $1.1 billion across the state, with nearly all the cumulative impacts once again anticipated to be caused by impacts in Reach 2 (71%) and Reach 3 (27%). In the Intermediate SLC scenario, total cascading impacts are anticipated to be closer to $150 million, with a similar split across Reach 2 (78%) and Reach 3 (18%). In the Low SLC scenario, however, anticipated cascading losses are only $18 million, with the largest impacts caused by direct impacts in Reach 3 (38%), less anticipated impacts in Reach 2 (only 37%), and a significant portion caused by risk in Reach 4 (24%).
    - The largest contributors of the cascading regional output impacts are the intermediate inputs (35%), employee compensation (34%) and other property income (23%).
        - Roughly 75% of the cascading regional impacts throughout the state are expected to be felt in the nine-county Bay Area region, while about a third of those are anticipated to be felt in the SFWCFS project area alone.
        - The highest cascading indirect and induced regional output losses occur in office-based industries (~43% to ~50% across SLC scenarios), caused primarily by the direct impacts in Reach 2. Commercial, industrial, and residential sectors are all also expected to experience significant cascading impacts, each contributing 9% to 12% of the overall losses.
        - Cascading job impacts show similar trends to direct job impacts, with commercial industries expecting the largest impact throughout the state (35% to 38%), followed by commercial (25%) and health care industries (12%).

- Once again, Alternative B, implemented under High SLC scenario, results in a 98% reduction in RED losses of cascading regional economic effects, and full mitigation of all impacts in the Low and Intermediate scenarios. Trends for other cascading regional impacts by reach for each alternative tend to follow those for direct output losses, though the ratio of residual cascading regional economic effects to the FWOP values are generally consistent across industries, unlike trends seen in direct output losses.
- Office industries experience the highest proportion of residual cascading impacts across the state in all alternatives, followed by commercial, industrial, and residential industries.

Overall, the analysis of qualitative and quantitative RED measures across the SFWCFS confirms the significant economic toll that flooding in the study area will have on San Francisco and the broader region. The findings emphasize the vulnerability of critical infrastructure, the potential for disruption to business operations, and the cascading effects on regional economies. The results underscore the need for effective mitigation strategies to protect against sea level rise and minimize the potential economic impacts of flooding. By implementing alternatives such as nonstructural options and shoreline defense, the study area can significantly reduce the risk of economic losses. However, it is important to consider the potential long-term consequences, including the potential relocation of businesses and the decentralization of the waterfront economy. Overall, the analysis highlights the importance of proactive measures to safeguard critical infrastructure and mitigate the economic impacts of flooding in the SFWCFS Study Area.

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SAN FRANCISCO WATERFRONT COASTAL FLOOD STUDY, CA

DRAFT APPENDIX E.2

Other Social Effects Report

JANUARY 2024

USACE TULSA DISTRICT | THE PORT OF SAN FRANCISCO

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Acronyms and Abbreviations

ACS	American Community Survey
AEP	Annual Exceedance Probability
Bay	San Francisco Bay
Blk	Block, (Census Block Group)
EQ	Environmental Quality
FWOP	Future without project
FWP	Future with project
G2CRM	Generation 2 Coastal Risk Model
NAVD88	North American Datum of 1988
NED	National Economic Development
OPC	Ocean Protection Council
OSE	Other social effects
P&G	Principles & Guidelines
Port	Port of San Francisco
RED	Regional economic development
SF DPH	San Francisco Department of Health
SFWCFS	San Francisco Waterfront Coastal Flood Study
SLC	Sea level change
SLR	Sea level rise
USACE	U.S. Army Corps of Engineers

Section E.2-1. Introduction

This report describes the potential social effects of coastal flooding and sea level rise for the San Francisco Waterfront Coastal Flood Study (SFWCFS). Also known as Other Social Effects (OSE), the report identifies how social well-being could change in the absence of a solution to a water resources issue, and how social wellbeing could be affected by alternative solutions proposed in the SFWCFS. Based on USACE guidance, the OSE report evaluates the future without project (FWOP) and future with project (FWP) conditions on social settings in San Francisco including population distributions, health and safety, economic vitality, social connectedness, community identity, and social vulnerability and resiliency.

Qualitative descriptions, statistics, and economic impacts of coastal flooding and sea level rise upon social conditions are an important consideration Through an exposure and consequence assessment, this report discusses these impacts within the San Francisco Waterfront (SFW) study area for coastal storm risk studies and plan formulation for flood risk reduction. This report discusses these impacts within the SFW study area through an exposure and consequence assessment and presents the methodology, assumptions, and resulting analysis to convey potential social disruption impacts due to coastal flooding and sea level rise. This report is structured as follows:

- **Section 1, Introduction.** Presents the principles and guidance driving the OSE account analysis and the project study area.
- **Section 2, Community Profiles.** Communicates baseline conditions and trends in the study area, including population, social vulnerability characteristics, community identify, recent development projects, and community services.
- **Section 3, FWOP Methodology.** Provides an overview of the OSE exposure statistics and metrics of interest explored, including methodologies, resources, and flood hazard data used to conduct the OSE assessment.
- **Section 4, FWOP Analysis.** Presents findings of the OSE exposure analysis due to coastal flooding and sea level rise, including qualitative and quantitative descriptions of population distributions, health and safety, economic vitality, social connectedness, community identity, and social vulnerability and resiliency.
- **Section 5, FWOP Summary.** Summarizes the key take-aways from the FWOP analysis across three USACE sea level change (SLC) projections.
- **Section 6, FWP Analysis.** Presents the analysis findings, including data manipulation conducted, to understand varying OSE effects across 6 project alternatives in the SFW study area. The FWP analysis findings supported plan formulation to inform the development and selection of the Comprehensive Benefits Plan and Tentatively Selected Plan regarding social effects.
- **Section 7, References.** Documents sources used to develop this assessment.

This version of the OSE report analyzes both FWOP and FWP conditions for the SFWCFS. This report is intended to help understand the social consequences of coastal flooding and sea level rise. However, due to the limited nature of the analysis being mostly exposure-based, the OSE conditions reported herein should not be considered comprehensive of the total social cost San Francisco may experience as flood risk increases.

E.2-1.1 Principles and Guidelines

The OSE evaluation is one of four accounts set forth by USACE's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, also known as the P&G (US WRC, 1983). In addition to OSE, the P&G includes three other accounts: National Economic Development (NED), Regional Economic Development (RED), and Environmental Quality (EQ). Collectively, the four accounts evaluate all significant effects of a plan on the project area and beyond.

The P&G ensures that the formulation and evaluation of water resources studies are completed properly and consistently by federal agencies. Recently, the Assistant Secretary of the Army for Civil Works instructed that feasibility studies "identify, analyze, and maximize all benefits in the NED, RED, and OSE (ASA(CW), 2020)." These instructions indicate that RED and OSE impacts will play a larger role in plan formulation and evaluation than historically documented to date. This OSE report includes both qualitative and quantitative evaluations of social effects in the SFWCFS area.

The Handbook on Applying "Other Social Effects" Factors in Corps of Engineers Water Resources Planning (09-R-4) defines OSE impacts as social conditions which influence personal and group satisfaction, well-being, and happiness. Based on the guidance from this handbook and *Other Social Effects: A Primer* (IWR 2013), the OSE analysis evaluates social exposure and quantified social consequences of coastal flooding and sea level rise using a mixture of USACE and FEMA benefit-cost analysis methodologies. These methods are further described in Section 3 and Appendix A.

E.2-1.2 Study Area

The SFWCFS study area extends 7.5 miles from Aquatic Park to Heron's Head Park. The study area is divided into four reaches as shown in Figure E.2-1-1, based on identifiable geographic references, specific wave action within each reach, and major differences in the built environment and physical assets and infrastructure present. Each reach is also comprised of sub-areas to enable the development of alternatives at the scale necessary for the San Francisco waterfront. Reach delineations and associated sub-areas include the following:

- **Reach 1:** Covers Aquatic Park, Fisherman's Wharf, Pier 31 to Pier 35, and the North Beach neighborhood. This reach contains unique open space, recreational opportunities, historic resources, and tourism attractions that are recognized as global icons.
- **Reach 2:** Includes the Northeast Waterfront and Financial District. This area comprises a significant portion of the Embarcadero Historic District and includes popular sites such as the Exploratorium, Embarcadero Promenade, and the

San Francisco Ferry Building. Through this reach, many transportation hubs and businesses in the Financial District make this area central to San Francisco's economy.

- **Reach 3:** Contains South Beach, Mission Creek, Mission Rock, Mission Bay, and Pier 70, and includes the South Beach, SoMa, and Mission Bay neighborhoods. This area is known for the Giants' baseball stadium, Chase Center, and access to Mission Creek and the Bay. It is one of the most dense residential areas within the SFWCFS, with high numbers of affordable housing, vulnerable populations, and a number of community facilities such as the Delancey Street Foundation and SoMa Recreation Center, in addition to clusters of medical and biotech facilities. This reach is also the site of new mixed-use waterfront development projects such as Mission Rock and Pier 70 aimed to provide greater public access, jobs, services, and affordable housing opportunities.
- **Reach 4:** Encompasses Pier 80, Islais Creek, Cargo Way, Pier 96, and Heron's Head Park. This area is comprised of industrial uses along the waterfront and provides critical industrial, maritime, and commercial Port functions. The Islais Creek subarea and adjacent Potrero Hill, Bayview, and Hunters Point neighborhoods are ethnically diverse and have been subjected to considerable historical and environmental injustices. It also has strong economic and cultural life, with high rates of women- and minority-owned businesses, numerous community benefit organizations, worship centers, and arts and culture organizations.

The OSE analysis is presented at the reach level where feasible and where differing reach-level trends make sense for plan formulation considerations.

Figure E.2-1-1. SFWCFS Study Area Community Profiles

Section E.2-2. Community Profiles

Each reach within the SFWCFS presents unique social conditions, community composition, and development trends that are instrumental to understand when evaluating the impacts of coastal flooding and sea level rise and formulating plan alternatives. The reach-level community profiles provided herein explore existing population compositions, uses, community services, jobs, infrastructure, and recreational opportunities. The community profiles were developed using similar data sets and approaches as the *San Francisco's Sea Level Rise Vulnerability and Consequence Assessment* (CCSF, 2020). Population estimates have been updated to include 2019 ACS 5-year estimates from the U.S. Census Bureau.

E.2-2.1 Reach 1: North Beach and Fisherman's Wharf

Reach 1 is the northernmost of the SFWCFS area and covers Fort Mason and Aquatic Cove to Pier 29. Approximately 10,800 people live within the boundaries of Reach 1 in the neighborhoods of Russian Hill and North Beach. Reach 1 has the lowest residential population across the waterfront but is a highly popular area due to the famous Fisherman's Wharf tourist attractions such as Pier 39, Hyde Street Pier, Aquarium of the Bay, Bay excursion and passenger ferry terminals, and views of the Golden Gate Bridge. In addition to tourism attractions, Reach 1 provides water recreational opportunities through the Aquatic Park public beach and boat launch and is popular for open-water swimming and events. The Bay Trail is present across the SFWCFS area and connects many recreation resources and facilities in the Aquatic Park subarea. It is estimated about 45,000 people visit attractions in Reach 1 daily.

Roughly 13,000 jobs are located within Reach 1; employment opportunities are driven by the retail trade, accommodation and food service, and professional, scientific, and technical services industries. Jobs in the retail and food service industries are generally not resilient to disruption (regardless of source) because they rely on tourism, do not provide healthcare benefits, nor easily allow for telecommuting.

Critical utility and mobility infrastructure are also located within Reach 1. While buried utility lines are present throughout the waterfront and are vulnerable to higher groundwater levels because of sea level rise, two important wastewater treatment facilities are in this area. The North Shore Pump Station serves the North Shore drainage basin and conveys wastewater to the Channel Pump Station, which then conveys flows to the Southeast Treatment Plant. During wet weather, wastewater from the North Shore drainage basin is treated at the North Point Wet Weather Facility, also in Reach 1. The service area of these two assets extends beyond the SFWCFS and provide wastewater treatment services to approximately 58,000 people in San Francisco. Several Muni and regional bus lines also operate in Reach 1 and serve roughly 23,500 riders, including Muni light rail. These public transit options are important for transporting workers and tourists alike.

E.2-2.2 Reach 2: Financial District and the Northeastern Waterfront

Reach 2 covers a gateway portion of the San Francisco Waterfront from the base of the Bay Bridge in the south to the James R. Herman Cruise Terminal (Pier 27-29) in the north. This area represents the Bay Area's largest and densest job center, with considerable amounts of housing and commercial space, and popular destinations, such as the Exploratorium and the iconic Ferry Building. It also hosts a variety of maritime, commercial, and recreational uses, including ferry terminals and other transportation hubs. The Embarcadero offers popular recreational opportunities for residents and millions of annual visitors, including a continuous three-mile promenade with a network of public open spaces.

Reach 2 does not have a significant residential population compared to other reaches, (14,900 residents) but does have the largest employment statistics in the SFWCFS. Between the waterfront attractions and the Financial District, approximately 200,000 jobs are available in this area. These jobs are characterized by the finance and insurance industries in addition to the professional, scientific, and technical services industries. There are also many waterfront restaurants and cultural or visitor attractions. For example, the Ferry Building attracts nearly 40,000 shoppers every week, the Exploratorium attracts nearly 850,000 people per year, and the cruise terminals received 280,000 passengers in 2019 alone. Major recreational opportunities in Reach 2 include the Embarcadero Promenade and Bay Trail, Rincon Park, and Pier 14. All three spaces provide opportunities for workers and visitors alike to enjoy a leisurely waterfront stroll in the vicinity of Market Street and the Ferry Building.

Reach 2 contains significant city and regional transportation infrastructure and connection points, including the ferry terminals, two underground BART/Muni stations (e.g., Embarcadero and Montgomery Stations), multiple Muni bus lines, historic streetcars, cable cars, and ferry terminals. The Salesforce Transit Center (STC) is also located in this neighborhood, connecting Golden Gate Transit from Marin County, Alameda County Transit buses from the East Bay, and SamTrans buses from San Mateo County. Long-distance buses from beyond the Bay Area such as Greyhound and Amtrak, as well as the San Francisco Municipal Railway, also connect riders to San Francisco at the STC. The STC is the planned future northern terminus for Caltrain and California High Speed Rail. It is estimated that 78,000 people travel through these modes daily for work or pleasure, which are dependent on Reach 2 assets to maintain capacity and efficiency.

E.2-2.3 Reach 3: South of Market, Mission Bay, and Pier 70

Reach 3 covers the South of Market (SOMA) and Mission Creek areas of the Central Waterfront of San Francisco – between Pier 26 in the north and the former Potrero Power Plant in the south and including some of the Mission Creek watershed. The SOMA and Mission Bay neighborhoods include developing mixed-use neighborhoods on both sides of Mission Creek. The area includes extensive housing and commercial buildings as well as regional destinations including UCSF Mission Bay, Oracle Park (the Giant's baseball stadium), and Chase Center (an indoor arena used by the Golden State Warriors). Both Oracle Park and the Chase Center are also used for concerts and events.

Reach 3 is one of the densest residential areas of the SFWCFS (46,800 residents) with high numbers of vulnerable populations. Among all the reaches, Reach 3 has the greatest concentration of children, elderly, low-income, linguistically isolated, and non-white populations. There are several community assets that serve the area, including the recently opened Embarcadero Homeless Navigation Center, the Delancey Street Foundation, and the SoMa Recreation Center. New mixed-use waterfront development projects in the reach, including Mission Rock, Pier 70, and Potrero Power Station, aim to strengthen the waterfront and provide greater public access, jobs, services, and affordable housing to the area. Forty percent of rental units in the new Mission Rock mixed-use neighborhood are assigned for low- and moderate-income families. People also recreate along Mission Bay and Mission Creek, and the Blue Greenway supports increased recreation in Reach 3.

Approximately 120,000 jobs are present within Reach 3, which are concentrated in the administration and support, waste management and remediation, information, educational services, and professional, scientific, and technical services. This reach is also an important transportation corridor that connects jobs and resources to northern parts of the city through the T-Third Muni Metro line and roadways. As a result of the semi-industrial nature and industrial history of Reach3, there are very high rates of traffic and hazardous and solid waste. Reach 3 also includes city and regional infrastructure, including Caltrain 4th and King Station and railyards, future California High Speed Rail, the Bay Bridge touchdown, PG&E substation, the SFPUC's Channel Force Main, the Port's main maintenance facility, and a planned new Mission Bay Ferry Terminal. It is estimated that approximately 27,500 people travel through this area daily.

This subarea includes five wastewater pump stations and six combined sewer discharge outfalls. The biggest pump station is the Channel Pump Station. It operates continuously in both dry and wet weather, transporting wastewater pumped from the North Shore Pump Station and flows from the Channel drainage area. The pump station conveys wastewater through the Channel force main to the Southeast Treatment Plant, thereby serving both the North Shore Drainage Basin and the Channel drainage area (400,000+ people, nearly half the City population). In wet weather, combined flows are conveyed from the local drainage area to the Southeast Treatment Plant. Adaptive measures, such as backflow prevention, are currently being installed to prevent the inflow of Bay water into the discharge structures during periods of elevated water levels. However, maintaining outflow capacity during extreme wet-weather events as sea levels rise will require the addition of pumps in the future.

E.2-2.4 Reach 4: Northern Bayview, Islais Creek, Piers 80-96, and Heron's Head Park

Reach 4 includes the industrial zone surrounding Islais Creek and the northern portion of the Bayview residential area, the Port's marine cargo terminals and industrial operations within the Pier 80-96 Eco-Industrial Center, and Heron's Head Park. The area does not have a large residential population (13,300 people), nor does it have a comparatively high concentration of jobs (21,000). However, there are critical connections between the southern and northern parts of the City located in this reach, including the Illinois Street and 3rd Street drawbridges that cross Islais Creek in the Port's jurisdiction. Third Street, including the T-Third Light Rail Line, is a critical north-south transportation route for Bayview residents. Third Street and the T-Third Line cross Islais Creek on the 3rd Street Bridge (also known as Islais Creek Bridge and Legon Hagop Nishkian Bridge). Approximately 10,800 people use these facilities daily.

Reach 4's workforce is primarily made up of Construction, Wholesale Trade, Transportation and Warehousing, and Accommodation and Food Services. The Bayview Islais Creek neighborhood is ethnically diverse with large Black, Asian, and Latino populations, and has a strong African American cultural legacy. The neighborhood has a strong economic and cultural life, with high rates of women- and minority-owned businesses, numerous community benefit organizations, worship centers, and arts and culture organizations, such as the Bayview Opera House. Most of the reach is part of a newly created Cultural Heritage District, the African American Arts and Cultural District. The neighborhood has been subjected to significant historical and environmental injustices, and has high socially vulnerability, with high poverty, crime, unemployment, and hospitalization rates relative to San Francisco.

The Islais Creek watershed has environmental challenges due to the long-standing presence of industrial uses and freight transportation. The neighborhood contains areas identified by CalEnviroScreen as being in the top 10 percent in California for pollution burden from hazardous waste, solid waste, and impaired water. Reach 4 is largely included in the City's Environmental Justice Communities Map. Additionally, Reach 4 contains the Southeast Treatment Plant, San Francisco's largest wastewater treatment facility. This facility is responsible for treating flows from the City's Bayside in addition to minor flows from Daly City and Brisbane. The Southeast Treatment Plant operates 24 hours a day, 365 days a year, serving about two-thirds of San Francisco residents, or over 580,000 people as of 2016.

Section E.2-3. OSE FWOP Methodology

This section presents the OSE FWOP assessment approach, including categories of analysis, type of analysis, statistics and economic consequences explored, and data sources including coastal flood hazard resources. A detailed description of the methodologies used to execute the analysis is provided in Appendix A.

E.2-3.1 OSE FWOP Statistics and Measures of Interest

The OSE FWOP analysis is comprised of five categories: health and safety, economic vitality, social connectedness, community identity, and social vulnerability, in accordance with USACE guidance. Dimensions of interest are discussed in Table E.2-3-1, along with a brief methodology and data source description. The metrics and measures described below were identified broadly for FWOP in order to identify key trends and drivers to be used for plan formulation. In many cases, the measures below were combined and compared qualitatively to support decision-making. This process is described further in Sections E.2-6.

Table E.2-3-1. Overview of OSE Categories and Metrics

Category	Measures	Measure Type	Description
Health and Safety	Exposed Population	#	Residential population within flood extent (including homeless population)
	Disaster Response Sites	#	Access to disaster response sites before and during events

Category	Measures	Measure Type	Description
	Contaminated Sites	#	Contaminated and capped sites within flood extent
	Public Health Indicators	#	Asthma, heart disease, low birth weight, and COVID-19 infections and deaths within the project area
	Displaced Population	#	Residential population residing within vulnerable buildings (temporary displacement expected with >1 foot of flood depth)
	Shelter Needs	#	Residential population that may require shelter due to age, income, and other factors
	Contaminated Sites Health Impacts	Abc = Qualitative	Likely impact of hazardous material release on public health, given existing public health indicators
Economic Vitality	Small, minority-owned, legacy businesses	#, abc	Disadvantaged businesses exposed to flooding, including data on earnings, commuting statistics, and disadvantaged businesses.
	Housing Affordability Indicators	#, abc	Rentership statistics, affordable housing unit locations within the flood extent
Social Connectedness	Mental Stress and Anxiety	$	Represent stress factors as a product of damage to people's homes and quantifies treatment costs to residents
	Lost Productivity	$	Represents lost income to residents who work and must deal with flood loss in their homes
	Transit Corridors and Recreation Exposure	#, abc	Public transit routes, ridership counts, bike and pedestrian routes, open space daily visit counts within the flood extent
	Public transit users	#	Number of people who commute using public transit.
Community Identity	Community Services	#, abc	Includes city-owned facilities such as police stations, fire stations, libraries, community centers, health centers and clinics
	Cultural/Historic Assets	#, abc	Cultural and historic assets in the flood extent: cultural heritage districts, places of worship, landmarks, and historic places

Category	Measures	Measure Type	Description
Social Vulnerability and Resiliency	Underserved Communities	#, abc	Social vulnerability indices and statistical significance of children, elderly, minority populations, poverty status, disabilities, linguistic isolation, single parents
	Disproportionate Effects on Underserved Communities	abc	Evaluate where consequences in other social factors (displacement, health impacts, job exposure, stress factors, community access, open space availability) may be felt more intensely.

E.2-3.2 Data and Resources

The OSE FWOP analysis leverages several key resources and data from investigations conducted by the Port, City and County of San Francisco, and research documenting the study of flood-related social vulnerability trends and characteristics in case studies across the United States. Primary data and resources for this assessment include the following:

- Handbook on Applying “Other Social Effects” Factors in Corps of Engineers Water Resources Planning (09-R-4) and Other Social Effects: A Primer (2013-R-02) acted as guiding principles throughout the OSE analysis.
- Coastal Flood Hazard Assessment and Mapping created under the USACE Non-Structural alternative task. More detail on the coastal flood hazard data is presented in Sections E.2-3.3.
- G2CRM Asset Inventory (CH2M/Arcadis, 2023). The G2CRM inventory of buildings and infrastructure assets established the locations of residential structures, infrastructure facilities, and businesses.
- U.S. Census Bureau 2019 American Community Survey (ACS) 5-year Estimates (U.S. Census Bureau, 2019). The U.S. Census provides counts by census block group that were used to estimate population exposure.
- DataSF, Open Data Portal. Office of the Chief Data Officer, City and County of San Francisco.
- San Francisco’s Climate and Health Adaptation Framework 2017. Developed by the San Francisco Department of Public Health (SFDPH), the Climate and Health Adaptation Framework summarizes the SFDPH’s 2010 Climate and Health Program’s work over the last several years. The framework identifies strategies to engage San Francisco community stakeholders on creating solutions to reduce health disparities and climate health impacts. It also identifies vulnerable communities in San Francisco and how they will be impacted by coastal flooding.
- San Francisco’s Sea Level Rise Vulnerability and Consequences Assessment (CCSF 2020). This assessment describes the vulnerability of public buildings and

infrastructure to sea level rise and coastal flooding and the consequences on people, the economy, and the environment. The completion of this assessment supports San Francisco in making forward progress on meeting the goals of the San Francisco Sea Level Rise Action Plan (CCSF 2016).

E.2-3.3 Coastal Flood Hazard Data

San Francisco is vulnerable to many aspects of coastal flooding, including present-day tidal events and flooding during storms, sea level rise that increases the magnitude of future tides and storms, and the addition of wind-generated waves that can increase the height and extent of a flood during a storm event. Today, even in the absence of a storm event, king tides flood the Embarcadero Promenade a few times a year during the winter months, causing nuisance flooding and periodic closure of portions of the Promenade. More significant flooding occurs when high tides coincide with storm events. Right now, these events are infrequent and only last for a few hours. With sea level rise, king tides and storm events coupled with wind-waves will increase in magnitude, causing more damaging flood events to occur more frequently and for longer durations. Eventually, permanently higher tides will result in repetitive flooding in the absence of storm events, and flooding occurring every month will permanently impact infrastructure and livelihoods.

Current USACE guidance on incorporating sea level change (2019), requires that planning studies and engineering designs consider alternatives that are formulated and evaluated for three USACE defined sea level change (SLC) curves that represent “low,” “intermediate,” and “high” rates of future sea level change (USACE 2019a). The USACE SLC curves are based on science presented in the National Research Council’s 2012 report, using best available science at the time of publication (IPCC 2007, NRC 2012, USACE 2019a). For the OSE exposure analysis, the PDT developed coastal flood hazard models and inundation maps for 15 scenarios covering 5-time horizons across the 3 USACE sea level change curves, including:

- Time horizons: 2040, 2065, 2090, 2115, 2140
- Sea level change curves: USACE Low, USACE Intermediate, USACE High

Table E.2-3-2 presents the sea level rise projections (in feet) from 2040 through 2140 for each of the 3 USACE sea level change curves and the Ocean Protection Council (OPC) 1:200 and Likely SLC curves. The USACE projects represent sea level change relative to 1992 sea levels, and the OPC projections are relative to the average sea level between 1991 and 2009. When coupled with sea level rise, there are numerous flood exceedance probabilities that will result in flooding along the waterfront. The OSE FWOP analysis focuses on the 1% annual exceedance probability (AEP) and monthly occurrence of flooding; water elevations for the 1% AEP across SLC projections are provided in

Time Period	**OPC 1:200 Chance**	**USACE High**	**OPC Likely**	**USACE Intermediate**	**USACE Low**
2040	1.4	1.1	0.8	0.5	0.3
2065	3.3	2.4	1.8	0.9	0.4
2090	5.8	4.1	2.9	1.4	0.6

Time Period	OPC 1:200 Chance	USACE High	OPC Likely	USACE Intermediate	USACE Low
2115	8.6	6.3	4.1	2.1	0.8
2140	11.7	9.0	5.3	2.9	0.9

Notes: Cell color scheme identifies similar sea level rise increments. Bolded values for USACE curves represent the sea level change curves evaluated in this analysis.

Table E.2-3-3. This allows the PDT to evaluate exposure and consequences from flooding across multiple timescales and frequencies – ranging from temporary coastal storms to monthly high tide flooding. The exposure of social vulnerability and physical assets to coastal flooding with sea level rise was evaluated across all 3 USACE sea level change curves; however, the exposure findings and summaries presented in the FWOP sections are shown for the USACE High curve. A summary of the water-front wide FWOP conditions for the Intermediate and the Low SLC curves are presented in Sections E.2-5.

Table E.2-3-2. Anticipated Increase in Sea Level (in Feet) Across Time Horizons and SLR Curves

Time Period	OPC 1:200 Chance	USACE High	OPC Likely	USACE Intermediate	USACE Low
2040	1.4	1.1	0.8	0.5	0.3
2065	3.3	2.4	1.8	0.9	0.4
2090	5.8	4.1	2.9	1.4	0.6
2115	8.6	6.3	4.1	2.1	0.8
2140	11.7	9.0	5.3	2.9	0.9

Notes: Cell color scheme identifies similar sea level rise increments. Bolded values for USACE curves represent the sea level change curves evaluated in this analysis.

Table E.2-3-3. Anticipated 1% AEP Flood Elevations (in Feet NAVD88) Across Time Horizons and SLR Curves

Time Period	OPC 1:200 Chance	USACE High	OPC Likely	USACE Intermediate	USACE Low
2040	10.8	10.6	10.3	9.9	9.7
2065	12.7	11.8	11.2	10.4	9.9
2090	15.3	13.6	12.4	10.9	10.1
2115	18.1	15.8	13.6	11.6	10.2
2140	21.2	18.5	14.8	12.3	10.4

Section E.2-4. OSE FWOP Analysis

The OSE FWOP analysis builds on the community profiles presented in Sections E.2-2 and assesses the potential effects of coastal flooding and sea level rise on the social composition of each reach in the SFWCFS area. The evaluation includes qualitative and quantitative assessments of impacts through the lens of five OSE categories, sourced from USACE guidance: health and safety, economic vitality, social connectedness, community identity, and social vulnerability. The assessment for each indicator reviews the importance, existing data and analysis completed by the City and its partners, exposure and consequence statistics and losses (as applicable, noted in Table E.2-3-1 above), and summary findings by reach where appropriate.

E.2-4.1 Health and Safety

Health and safety conditions are critical in evaluating the welfare of the community. In San Francisco, coastal flooding and sea level rise will have cascading direct and indirect impacts on public health, housing, and city services. Direct health impacts may include respiratory illness, waterborne illness, and physical injuries, while indirect impacts can include power outages and disruption to water, wastewater, transportation, and communication systems that are essential to maintain access to health care and emergency response services (SFDPH, 2017a). Additionally, public health and safety could be impacted from legacy contaminated soils that become disturbed due to rising sea levels and groundwater levels.[1]

This section explores health and safety impacts through a review of the measures presented in Table E.2-4-1. Specific impacts to public health are closely linked to social vulnerability characteristics, which are further explored in Section E.2-4.5. Detailed descriptions of vulnerability characteristics are presented in Table E.2-4-1.

Table E.2-4-1. Health and Safety Indicator Descriptions

Category	Measures	Measure Type	Description
Health and Safety	Exposed Population	#	Residential population within flood extent (including homeless population)
	Displaced Population	#	Residential population residing within vulnerable buildings (>1 foot of flood depth). This represents people at risk of temporary displacement due to flood damage.
	Shelter Needs	#	Residential population that may require shelter due to age, income, and other factors
	Public Health Indicators	#	Asthma, heart disease, low birth weight, and COVID-19 infections and deaths within the project area
	Disaster Response Sites	#	Access to emergency staging areas and other disaster response sites before and during events
	Contaminated Sites	#, abc	Contaminated and capped sites within flood extent and the likely impact of hazardous material release on public health, given existing public health indicators

[1] Disruption of contaminated soils has not yet been explored in detail by USACE or the Port through the SFWCFS. This may be explored further through the Environmental Quality (EQ) account.

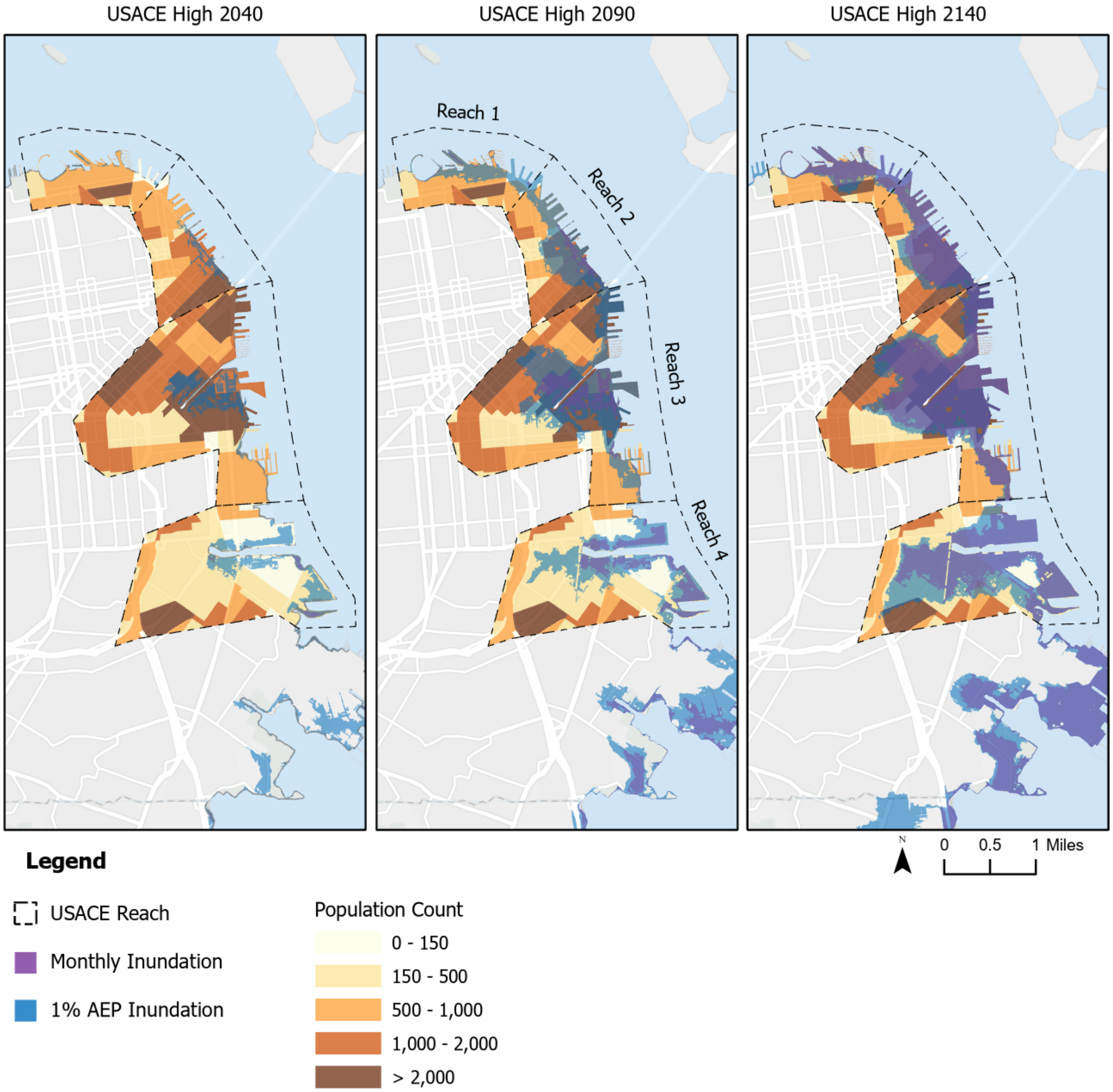
E.2-4.1.1 Population Impacts

Population exposure to coastal flooding and sea level rise is an important indicator of the extent that health and safety may be impacted after a flood event. The PDT reviewed exposed population statistics using American Community Survey Census information. Exposed population counts represent residents who live within the modeled flood extents for the USACE High Curve, and do not account for people who work or visit the SFWCFS for business or leisure.

American Community Survey, 2019 5-year estimates

Figure E.2-4-1 shows existing population density overlaid with three flood inundation maps representing 1% AEP and monthly flooding expected under the USACE High Curve in 2040, 2090, and 2140.[2] As described in Sections E.2-2, Community Profiles, Reach 3 has the largest residential population in the SFWCFS area. These maps confirm that the highest flooding impact to residential populations could be around Mission Creek in Reach 3. Islais Creek in Reach 4 is also impacted early and broadly; however, this area is less densely populated with industrial use being the most prevalent in the flood inundation extent.

[2] **Error! Reference source not found.** reflects 2019 census population values. Population counts are expected to continue rising before higher flood elevations expose these areas to flooding.



American Community Survey, 2019 5-year estimates

Figure E.2-4-1. Distribution of Total Population in the SFWCFS

Table E.2-4-2 also presents population impacts as counts of temporarily displaced residents, shelter needs, and homeless population exposure. These are additional social effects which are important to consider in plan formulation:

- Temporarily displaced resident counts include a factor of flood depth in addition to exposure. It is assumed that more than 1 foot of flood depth within a residential structure could require disruptive repairs that would impact the use of the building. The displaced residential population is approximately 30 to 40 percent of the exposed population counts in the near to medium time horizon (2040 to 2065), rising to nearly 70 percent of the exposed population by 2090, and 90 percent of the exposed population by 2140.
- Of the temporarily displaced population, a portion may require access to public shelter. Low-income households, minority populations, homeownership status, and young families and the elderly are more likely to seek emergency short-term shelter according to FEMA (2022). Additionally, homeless populations may also require shelter in a flood event. Over 2,300 people in the SFWCFS may require public shelter by 2090 for a 1 percent AEP event, including residents and homeless populations alike. Shelter needs range from 6 – 13 percent of the exposed population throughout the study area.
- Monthly flooding will influence both permanent and temporary displacement expectations. The PDT assumes that in the FWOP scenario, areas subject to monthly flooding will be relocated to accommodate floodwater. This permanent relocation would most likely be needed prior to this flooding occurring, which may pose additional challenges for vulnerable communities. Over time, population exposure to extreme events such as the 1 percent AEP will lessen as more people are permanently removed from the floodplain. Table 4-2 does not reflect this occurrence.

Reach 3 has the greatest exposure, residential displacement, and shelter needs across the waterfront, indicating a greater need for emergency and housing recovery services in Mission Bay in the future. Methodology details to identify exposed and temporarily displaced residential populations and estimate shelter needs are further discussed in Appendix A.

Table E.2-4-2. Population Impacts by Reach

Time Horizon	Reach 1	Reach 2	Reach 3	Reach 4	Total
Exposed Residential Population (count of people)[a] with 1-percent AEP flooding					
2040	63	832	3,745	305	4,944
2065	786	3,362	10,624	396	15,168
2090	1,283	4,709	15,965	558	22,514
2115	1,864	5,900	20,212	853	28,829
2140	2,604	6,657	23,374	1,435	34,070

Time Horizon	Reach 1	Reach 2	Reach 3	Reach 4	Total
Exposed Residential Population (count of people)[a] with monthly flooding, subject to permanent relocation					
2040	11	4	45	50	110
2065	20	15	293	135	462
2090	50	633	3,343	292	4,318
2115	1,112	4,120	13,795	450	19,478
2140	1,608	5,610	19,263	713	27,194
Temporarily Displaced Residential Population (count of people)[b] with 1-percent AEP flooding					
2040	0	0	1,837	0	1,837
2065	0	0	4,335	10	4,345
2090	0	3,697	12,570	61	16,327
2115	231	5,327	17,769	66	23,392
2140	1,232	6,599	22,177	227	30,235
Shelter Needs (count of people)[c] with 1-percent AEP flooding					
2040	0	0	233	0	233
2065	0	0	512	2	514
2090	0	428	1,505	11	1,944
2115	35	682	2,178	12	2,906
2140	199	834	2,787	32	3,852
Homelessness Population in the Study Area (count of people)[d]					
2040	0	7	50	50	105
2065	3	25	125	85	240
2090	5	35	205	120	360
2115	6	40	245	135	425
2140	7	45	275	145	470

[a] Limitations on measure. Counts only include residents within the study area and does not capture commuters or homeless populations.

[b] Limitations on measure. Counts based on residential building damages. Does not include homeless populations.

[c] Limitations on measure. Counts do not include homeless populations requiring shelter.

[d] Homeless population source is SFDPH, 2017b. The DPH report uses the 2015 San Francisco Homeless Count.

Note: Exposed, displaced, and shelter needs counts are based on the location and size of residential structures in the SFWCFS, and are based on 2019 ACS data.

The residential population of the SFWCFS area will continue to grow in the coming decades.

Table E.2-4-3 depicts the projected population trends between 2019 and 2040 to provide a sense of future population growth. The population in San Francisco is expected to increase by over 20 percent by 2040, and 35 percent by 2050. Reach 2, 3, and 4 populations may grow at a much higher rate according to data provided by the San Francisco Department of Health and Plan Bay Area population estimates: approximately 40 to 60 percent growth, representing nearly 40,000 new residents. The advancement of sea level rise, coupled with population growth, may substantially increase the risk of residential exposure, displacement, and shelter needs in the future.

Table E.2-4-3. Summary of Population and Vulnerable Population Trends (2019 - 2040)

	Population			Children (Under 18)			Residents (Over 65)		
	2019	2040	% Change	2019	2040	% Change	2019	2040	% Change
Reach 1	10,826	13,765	27%	1,094	555	49%	2,123	3,825	80%
Reach 2	14,896	21,885	47%	1,103	655	41%	2,644	6,980	164%
Reach 3	46,770	66,620	42%	4,615	2,485	46%	4,984	19,665	295%
Reach 4	13,254	21,335	61%	2,660	1,150	57%	1,720	5,290	208%
San Francisco	872,182	1,085,735	24%	117,212	47,325	60%	134,929	287,505	113%

E.2-4.1.2 Public Health Indicators

Pre-existing health conditions can change the assumed severity of health and safety consequences of flood events. Asthma, low birth weight, and cardiovascular disease are significant public health concerns in San Francisco and can indicate additional medical vulnerability and challenges that may be experienced by residents exposed to flooding. Residents with these public health issues may be more sensitive to flood exposure and disruption of critical and essential services in the wake of a flood event. Challenges can manifest in the following ways:

- Asthma is a chronic respiratory disease that particularly affects children, older adults, and low-income communities. Harvard Medical School research states that toxic chemicals disturbed by a flood event (such as asbestos, biotoxins, sewage, and heavy metals) as well as mold growth after a flood event, pose additional respiratory health challenges. Approximately 15 percent of people have asthma within their lifetime, and over 5,100 SFWCFS residents with asthma would be exposed to a 1-percent AEP event in 2140.
- Cardiovascular disease refers to blocked or narrowed blood vessels that can lead to heart attacks or other heart-related issues. Flood recovery can be an emotionally and physically challenging time – studies show that there was a 30 percent increase in the rate of heart attacks immediately after Hurricane Katrina. Over 1,700 study area residents with cardiovascular disease would be exposed with a 1-percent AEP event. These residents may be more reliant on access to medical or emergency care services during or after a flood event.
- Low birth weight is associated with adverse health outcomes such as developmental delays, chronic diseases, and infant mortality. Over 2,300 study area residents who were born at a low birth weight may be exposed to a 1-percent AEP event. Prenatal maternal stress caused by flooding could indirectly increase the prevalence of low birth weight in the study area, thereby potentially exacerbating pre-existing health conditions exhibited by the future population that would make them more susceptible to flood impacts.

As noted above, flooding can potentially increase rates of pre-existing health conditions in the SFWCFS. Exposure to a 1-percent AEP event may impact 45 percent of these residents in Reach 2 and 50 percent in Reach 3. Hospitalization rates with asthma and cardiovascular disease are higher in the Mission Creek (Reach 3) and Islais Creek (Reach 4) neighborhoods than others in the study area, indicating disparities in prevalence and the need for increased access to healthcare services (OEHHA, 2022).

E.2-4.1.3 Disaster Response Sites

The Port of San Francisco has some of the City's largest open properties that can serve as disaster response sites, including staging areas in an emergency. Staging areas are typically parking lots or piers, designated for short-term stockpiling of equipment, supplies, or debris. These areas should be relatively flat, ideally paved, and accessible *by trucks and forklifts. Port of San Francisco. 2019. Multi-Hazard Risk Assessment. Datasets used: Disaster Response Sites (Port), City Facilities (CCSF).*

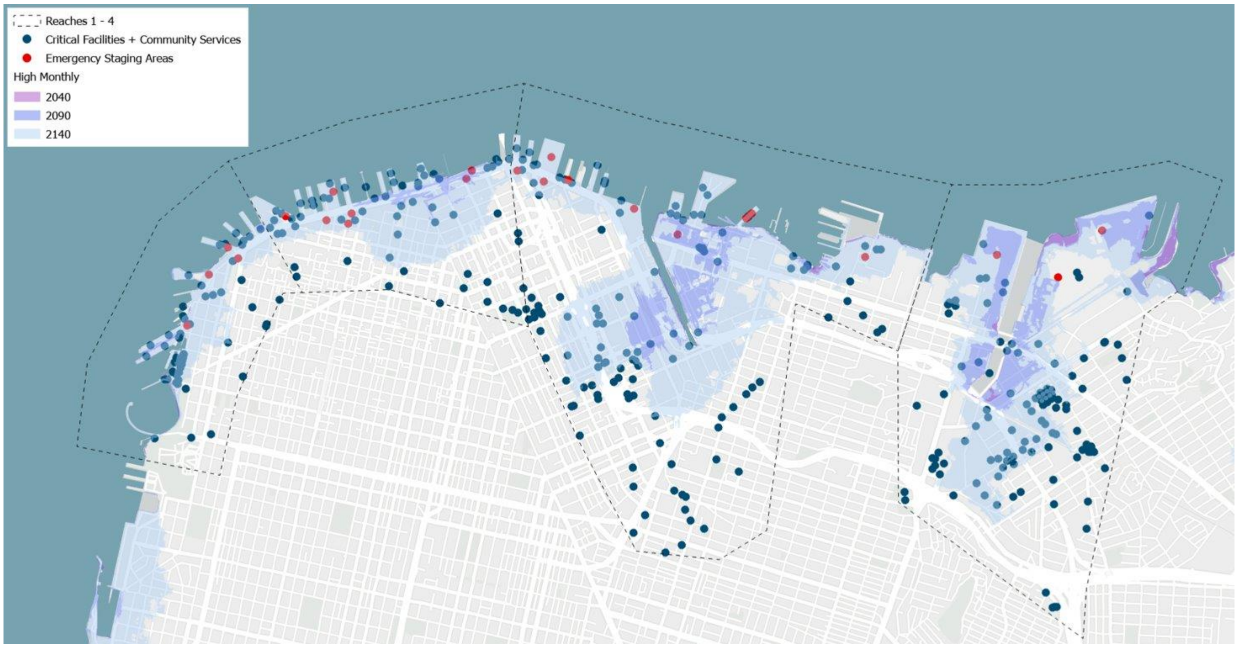
Figure E.2-4-2 shows the Port of San Francisco's disaster response sites in red, compared with monthly flood extents for 2040, 2090, and 2140 under the High SLC projection.[3] Due to San Francisco's dense urban environment, options for additional or new disaster response sites in the City are limited.

While disaster response sites are exposed to severe coastal events such as the 1 percent AEP, event durations are short and water typically recedes within a few hours. Prolonged monthly flooding at these sites will likely present challenges for the City in the future. If another incident type (such as an earthquake or a terrorism attack) were to occur during a monthly tide, access to sites for supplies and equipment will be limited. Disaster response sites in Reach 2, Reach 3, and Reach 4 will be exposed to monthly flooding first in 2090. By 2140, 80% of the designated disaster response sites will be exposed to monthly flooding under the USACE High SLC curve. Relocation of sites may be necessary and increase over time with frequent monthly exposure.

Table E.2-4-4. Exposed Disaster Response Sites by Reach

Time Horizon	Reach 1	Reach 2	Reach 3	Reach 4	Total
Disaster Response Sites Exposed to 1-percent AEP flooding					
2040	0	2	1	5	8
2065	6	8	8	8	30
2090	11	15	16	9	51
2115	11	15	17	9	52
2140	11	16	17	9	53
Disaster Response Sites Exposed to monthly flooding, indicating access issues and the potential need for relocation					
2040	0	0	0	0	0
2065	0	0	0	1	1
2090	0	1	1	5	7
2115	9	13	15	8	45
2140	11	15	17	9	52

[3] Additional exposure to critical facilities and community services are addressed in Sections E.2-4.4 of this report.



Port of San Francisco. 2019. Multi-Hazard Risk Assessment. Datasets used: Disaster Response Sites (Port), City Facilities (CCSF).

Figure E.2-4-2. Distribution of Disaster Response Sites, Critical Facilities, and Community Services

E.2-4.1.4 Contaminated Sites and Potential Public Health Concerns

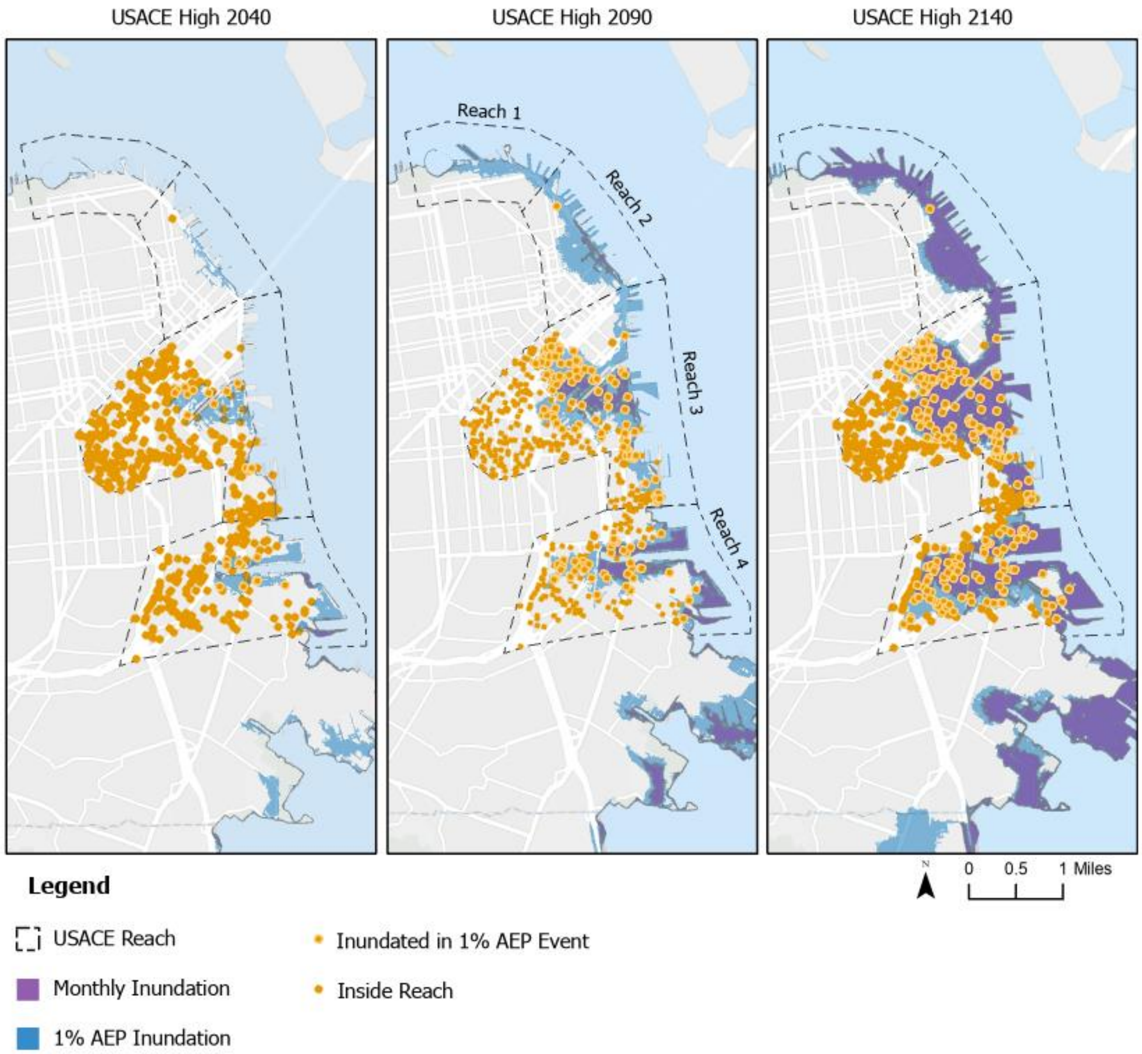
Contaminated sites are land with substances or materials that pose a health hazard to people and the environment. Even when remediated and capped, they are highly vulnerable to sea level rise and groundwater rise that could disturb the contaminated soils, releasing hazardous substances with potentially significant consequences on public health, the environment, and the local economy (CCSF, 2020).

There are approximately 491 contaminated sites in the study area, with the majority concentrated in Reaches 3 and 4. By 2040 23 sites, in Reaches 3 and 4 will be exposed to flooding in a 1-percent AEP event under the High SLC projection. By 2090, the number of sites increases to 137 and will expand into Reach 2. By 2140, 237 sites will be exposed (see San Francisco Office of Resilience and Capital Planning (ORCP). 2018. Hazards and Climate Resilience Plan.

Figure E.2-4-3).

Specifics related to types of on-site contaminants are not available. However, flooding of these sites could mobilize capped contaminants and strain local emergency resources to support cleanup and recovery. In addition to high cleanup and recovery costs, consequences include potential land loss, hindering further development and impacting local real estate. Flooding can also significantly impact water quality and wildlife, as well as expose local communities to substances that are harmful to public health and safety (CCSF, 2020).

According to Sections E.2-4.1.2, exposed people with pre-existing health conditions are highest in Reach 3. People with health conditions such as asthma, cardiovascular disease, and populations with high prevalence of low birth weights are potentially more vulnerable to medical complications if contaminants were disturbed. While not directly exposed to flooding, there are sites near Heron's Head Park that could cause serious ecological disruption if disturbed in the future.



San Francisco Office of Resilience and Capital Planning (ORCP). 2018. Hazards and Climate Resilience Plan.

Figure E.2-4-3. Distribution of Contaminated Sites

E.2-4.1.5 Health and Safety Findings

Health and safety risks to SFWCFS area residents are concentrated in Reach 2 and Reach 3. Seventy percent of total population exposure, displaced resident estimates, and shelter needs estimated across the study area are in Reach 3. This estimate will likely increase with future planned developments. For example, the Mission Rock development will create approximately 1,200 new rental homes in Reach 3, 40 percent of which will be affordable to low- and middle-income individuals and families (Port of San Francisco, 2020). **Error! Reference source not found.** provides health and safety findings and tipping points associated with High SLC projection; key highlights are listed below.

- Reach 3 is the first area across the waterfront to potentially have shelter needs and displaced population due to extreme events in 2040. Extreme events may impact South Beach and Mission Bay. Reach 3 also has an increased prevalence of pre-existing health conditions that could worsen due to severe and prolonged flood exposure.
- Another critical tipping point occurs in 2065, when almost 50% of the staging areas and disaster response assets will be impacted during an 1% AEP event - potentially requiring remaining staging areas to carry additional evacuation capacity during disasters.
- By 2090 in Reach 3, monthly flooding will expose several thousand people and many contaminated sites in the Mission Bay neighborhood, likely resulting in permanent relocation of the area. While the specific vulnerability of these sites is unknown, these sites are concentrated in the most populated areas in the waterfront with the highest prevalence of pre-existing health conditions (asthma, cardiovascular disease, low birth weights). Contaminants disturbed by monthly flooding could severely impact water quality and public health issues.
- 2090 represents a Reach 2 tipping point as extreme events generate temporary displacement and shelter needs and the Financial District and South Beach experience flooding.
- 2115 represents a Reach 1 tipping point as monthly flood exposure increases. Extreme events could start flooding North Beach and Telegraph Hill neighborhoods.
- Nearly all staging areas will be exposed to monthly flooding by 2115, indicating future accessibility challenges and the need to plan for additional disaster response sites. Additional sites may be difficult to find due to space needs.

Lastly, Reach 4 has limited residential population exposure, but is expected to grow by 61% by 2040, and could potentially increase the residential population within the future floodplain. Residential population will continue to be similar to Reach 2, according to projections by SFDPH.

Table E.2-4-5. OSE FWOP Health and Safety Findings and Tipping Points, USACE High Curve

Reach	2040	2065	2090	2115	2140
Reach 1	Limited residential population exposure (less than 5%) for the 1% AEP event. No temporary displacement or shelter needs expected, no emergency response assets exposed, and no exposed contaminated assets. Monthly flooding will expose 11 residents to potential permanent relocation.	7% of residents are exposed to the 1% AEP event. No displacement or shelter needs expected. Six emergency response assets are exposed to the 1% AEP. Monthly flooding will expose 20 residents to potential permanent relocation.	12% of residents are exposed to the 1% AEP event. No displacement or shelter needs expected. All 11 emergency response assets on Port property are exposed to the 1% AEP. Monthly flooding will expose 50 residents to potential permanent relocation.	*2115 represents a Reach 1 tipping point as monthly flood exposure increases. Extreme events could start flooding North Beach and Telegraph Hill neighborhoods. 17% of residents are exposed to the 1% AEP event. 35 residents may seek emergency shelter before an event, with 231 residents likely displaced after an event due to damage. Eleven emergency response assets are exposed to the 1% AEP. Monthly flooding will expose 1,112 residents (10% of the total Reach population). Nearly all (9) emergency response assets will have limited accessibility due to monthly flooding.	24% of residents are exposed to the 1% AEP event. 199 residents may seek emergency shelter before an event, with 1,232 residents (11%) likely displaced after an event due to damage. Eleven emergency response assets are exposed to the 1% AEP. Monthly flooding will expose 1,608 residents (15% of the total Reach population) to potential permanent relocation. All emergency response assets in the Reach will have limited accessibility due to exposure to monthly flooding.

Reach	2040	2065	2090	2115	2140
Reach 2	6% of residents are exposed to the 1% AEP event. No temporary displacement or shelter needs expected. Two emergency response assets are also exposed to severe coastal flooding. Monthly flooding will expose less than 5 residents to potential permanent relocation.	23% of residents are exposed to the 1% AEP event. No displacement or shelter needs expected. Eight emergency response assets are exposed to flooding. There is still limited exposure to monthly flooding (15 residents).	*2090 represents a Reach 2 tipping point as extreme events generate displacement and shelter needs and the Financial District and South Beach experience flooding. 32% of residents are exposed to the 1% AEP event. 428 people may seek emergency shelter before an event, with 3,697 people (25% of the Reach population) displaced during recovery. 15 emergency response assets are exposed to the 1% AEP event, as well as one contaminated site (Seawall Lo 333). Monthly flooding will expose 633 people to potential permanent relocation and 1 emergency response asset.	40% of residents are exposed to the 1% AEP event. 682 people may seek emergency shelter before an event, with 5,327 people (36% of the Reach population) may be displaced during recovery. 15 emergency response assets are exposed to the 1% AEP event, as well as one contaminated site (Seawall Lot 333). Monthly flooding will expose 4120 people (28% of the Reach population) to potential permanent relocation and 13 emergency response assets. People and assets in the monthly exposure area could be permanently relocated.	45% of residents are exposed to the 1% AEP event. 834 people may seek emergency shelter before an event, with 6,599 people (44% of the Reach population) may be displaced during recovery. 16 emergency response assets are exposed to the 1% AEP event, as well as one contaminated site (Seawall Lot 333). Monthly flooding will expose 5610 people (38% of the Reach population) to potential permanent relocation and 15 emergency response assets.

Reach	2040	2065	2090	2115	2140
Reach 3	*Reach 3 is the only one with shelter needs and temporary displacement estimates in 2040. Extreme events may impact South Beach and Mission Bay. Reach 3 also has increased prevalence of pre-existing health conditions that could worsen due to severe and prolonged flood exposure. 8% of residents are exposed to the 1% AEP event. 233 people may seek emergency shelter before an event, with 1,837 people temporarily displaced during recovery. One emergency response asset is also exposed to severe coastal flooding. Monthly flooding will expose 45 residents to potential permanent relocation.	23% of residents are exposed to 1% AEP event. 512 residents may seek emergency shelter before an event, with 4,335 people displaced during recovery (9% of the Reach population). 8 emergency response assets are exposed to severe coastal flooding. Monthly flooding will expose 293 residents to potential permanent relocation.	34% of residents are exposed to the 1% AEP event. 1,505 residents may seek emergency shelter, with 12,570 people displaced during recovery (27% of the Reach population). 16 emergency response assets and 4 contaminated sites are exposed to extreme events. Monthly flooding will expose 3,343 residents (7% of the Reach population) in Mission Bay, as well as 1 emergency response asset and 1 contaminated site. Repetitive inundation and groundwater flooding could spread contaminants. Severe public health and safety concerns may start to arise. People and assets could be permanently relocated	43% of residents are exposed to the 1% AEP event. 2,178 residents may seek emergency shelter, with 17,769 people displaced during recovery (38% of the Reach population). 17 emergency response assets and 4 contaminated sites are exposed to extreme events. 29% of residents are exposed to monthly flooding, as well as 15 emergency response assets and 1 to 2 contaminated sites. People and assets could be permanently relocated.	50% of residents are exposed to the 1% AEP event, nearly all of which could be displaced due to flood damage. Flooding has extended into the SoMa neighborhood. 2,787 residents may seek emergency shelter, and 17 emergency response assets and 5 contaminated sites are exposed to extreme events. 41% of Reach residents are exposed to monthly flooding, as are all 17 emergency response assets and 5 contaminated sites. People and assets could be permanently relocated.

Reach	2040	2065	2090	2115	2140
Reach 4	*Reach 4 has limited residential population exposure but is expected to grow by 61% by 2040. Limited residential population exposure (less than 5%) for the 1% AEP event. No temporary displacement, shelter needs, or contaminated assets expected. 5 emergency response assets could be exposed to extreme flooding. Monthly flooding will expose 50 residents to potential permanent relocation.	Limited residential population exposure (less than 5%) for the 1% AEP event. Very limited shelter needs and displacement are expected. 8 emergency response assets could be exposed to extreme flooding. Monthly flooding will expose 135 residents to potential permanent relocation.	Limited residential population exposure (less than 5%) for the 1% AEP event. 11 people may seek emergency shelter and 61 may be displaced. 9 emergency response assets could be exposed to extreme flooding. Monthly flooding will expose 292 residents, extending into Bayview and Hunter's Point. People could be permanently relocated.	6% of the population could be exposed to the 1% AEP event. 12 people may seek emergency shelter and 66 may be displaced. 9 emergency response assets could be exposed to extreme flooding. Monthly flooding will expose 450 (3%) of Reach residents to potential permanent relocation.	11% of the population could be exposed to the 1% AEP event. 32 people may seek emergency shelter and 227 may be displaced. 9 emergency response assets could be exposed to extreme flooding. Monthly flooding will expose 713 (5%) of Reach residents to potential permanent relocation.

E.2-4.2 Economic Vitality

Economic vitality refers to the capacity of the economy to provide a quality standard of living. Factors such as employment opportunities, income mix, poverty and unemployment dynamics, educational opportunities, and access to markets affect economic vitality and may be affected by a water resources issue or by solutions offered (09-R-4). Employment and income are discussed in the RED report. This section will address local businesses and housing affordability exposure and consequences in each reach. Detailed descriptions of economic vitality conditions are presented in Table E.2-4-6.

Table E.2-4-6. Economic Vitality Indicator Descriptions

Category	Measure	Measure Type	Description
Economic Vitality	Small, minority-owned, legacy businesses	#, abc	Disadvantaged businesses exposed to flooding, including data on earnings, commuting statistics, and disadvantaged businesses.
	Housing Affordability Indicators	#, abc	Rentership statistics, affordable housing unit locations within the flood extent

E.2-4.2.1 Disadvantaged Businesses

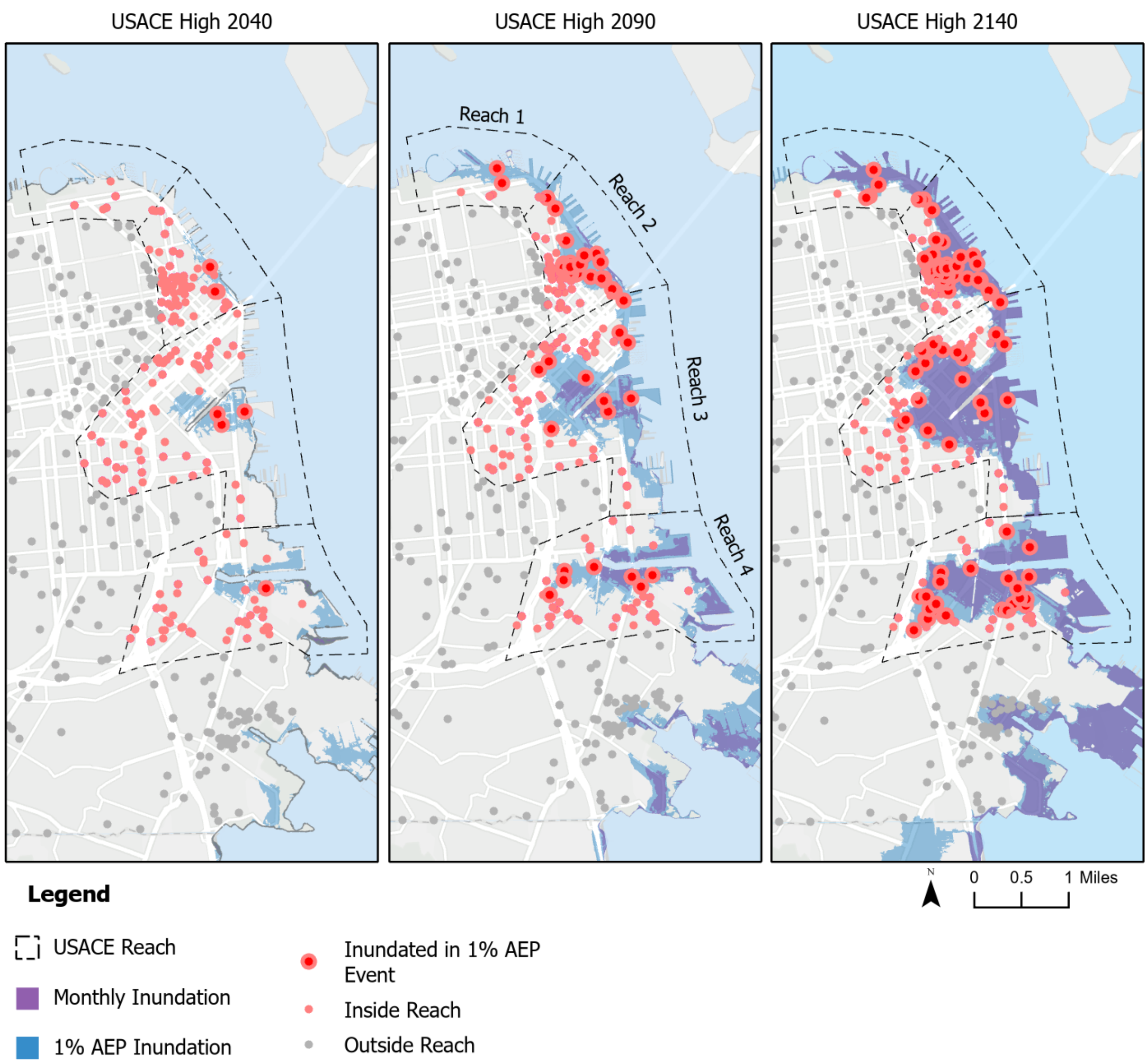
Disadvantaged businesses are part of a San Francisco certification program to help small businesses that have less working capital. Disadvantaged businesses are defined by size and minority ownership, including small and minority-ownership statistics, and are vital in maintaining a fair economy. According to FEMA, approximately 25 percent of businesses do not reopen after a disaster. Disadvantaged businesses may be disproportionately affected by coastal flooding and sea level rise in San Francisco – they may not have the resources to swiftly repair their space if it is damaged and may not have the capital to relocate and continue operations while their current space is being repaired. The City and County of San Francisco is committed to the participation of disadvantaged businesses in its contracting and purchasing efforts; an understanding of potential coastal flooding and sea level rise exposure and consequences for local businesses is critical.

Table E.2-4-7 and City and County of San Francisco (CCSF). 2021. 14B Local Business Enterprise Program.

Figure E.2-4-4 demonstrates the exposure of disadvantaged businesses in the SFWCFS under the High SLC projection. Reach 2 and 3 will have the highest number of disadvantaged businesses exposed to flooding during a 1-percent AEP event through all time horizons, which aligns with the highest job impacts within the Financial District of the SFWCFS. Reach 2 also has the highest number of disadvantaged businesses in the SFWCFS that will be exposed to repetitive monthly flooding after 2090. Exposure to repetitive monthly flooding may cause disadvantaged businesses to permanently relocate from the study area. Given affordability challenges for real estate in San Francisco, these businesses may relocate out of the city or close permanently.

Table E.2-4-7. Exposure of Disadvantaged Businesses Per Reach

Time Horizon	Reach 1	Reach 2	Reach 3	Reach 4	Total
Exposed Disadvantaged Businesses with 1-percent AEP flooding					
2040	0	12	4	2	18
2065	1	35	16	14	66
2090	2	83	24	18	127
2115	2	105	31	39	177
2140	5	123	77	66	271
Exposed Disadvantaged Businesses with Monthly flooding, indicating access issues and potential relocation					
2040	0	0	0	0	0
2065	0	0	0	0	0
2090	0	7	2	2	11
2115	1	41	20	17	79
2140	2	102	31	30	165



City and County of San Francisco (CCSF). 2021. 14B Local Business Enterprise Program.

Figure E.2-4-4. Distribution of Disadvantaged Businesses

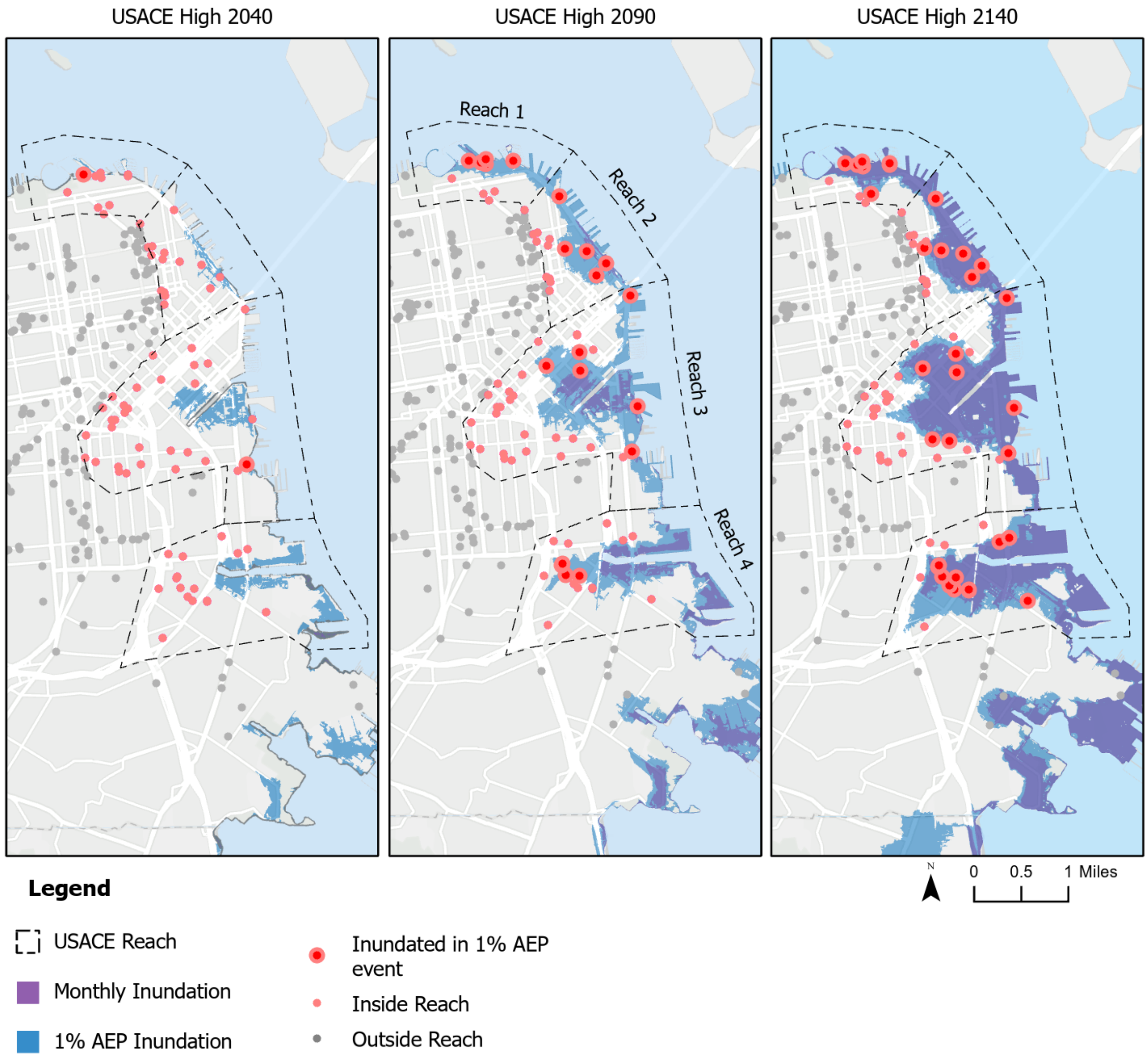
E.2-4.2.2 Legacy Businesses

Legacy Businesses are longstanding community-serving businesses that are recognized as valuable cultural assets to San Francisco by the Office of Small Business. Preserving Legacy Businesses is critical to maintaining what makes San Francisco a unique and special place. Legacy Businesses range in industry, size, tradition, history, products, and services; they are restaurants, retail stores, bars, service providers, manufacturers, artists and much more (San Francisco Office of Small Business, 2020).

Legacy Businesses must have operated in San Francisco for more than 20 years and be at risk of displacement to qualify for the program. These businesses are present across the entire SFWCFS (see San Francisco Office of Small Business. Legacy Business Registry.

Figure E.2-4-5). Several of the legacy businesses at the waterfront are regionally and nationally known, such as Alioto's, a seafood restaurant at Fisherman's Wharf in Reach 1. Reach 1 also includes SCOMA's, another famous restaurant, Boudin Bakery - San Francisco Sourdough (also present in Reach 2), and Pier 39 Ltd Partnership. A famous legacy business in Reach 2 is the Pier 23 Café, with its outdoor seating on the Pier, daily musical programming, and bar. Rebuilding Together San Francisco, located in Reach 3 close to the Bay Bridge, is a local affiliate of a national organization helps mobilize volunteers to provide home repair and renovation programs for neighbors, nonprofits, and community spaces. Reach 3 also includes the Bayview Boat club, providing youth sailing and community classes.

The risk of legacy business closure and displacement may increase with sea level rise. Additionally, legacy businesses may experience losses due to disruption of normal operations, which are captured quantitatively in the RED account as business interruption losses. Within the SFWCFS area, there are approximately 74 total legacy businesses. Approximately 43% (32) of the legacy businesses will be exposed to the 1-percent AEP event and 32% (24) with frequent, monthly flooding by 2140. Monthly flood exposure would likely result in permanent relocation for these businesses, potentially disrupting community identity and social cohesion. Legacy Businesses in Reach 1 are very close to the shoreline and will be exposed to flooding under the 1-percent AEP event by 2040 under using the High SLC projection. Given the long-standing history of these businesses and organizations, they are a key component of community identity that may be lost due to coastal flooding with sea level rise.



San Francisco Office of Small Business. Legacy Business Registry.

Figure E.2-4-5. Distribution of Legacy Businesses

E.2-4.2.3 Housing Affordability Indicators

San Francisco has historically struggled to maintain affordable housing. Home prices have nearly doubled since 2010 and more than quadrupled since the 1990's (CCSF, 2020). Median rents and home prices have soared since 2011. The Bay Area faces many housing challenges which have a disproportionate impact on the region's low-income population. In 2014, 37 percent of all San Francisco households were considered housing cost burdened; paying more than 30 percent of income for housing. This is much higher than the 22.5 percent national average (Veal and Spader, 2018). Of those households spending more than 30 percent of their income on housing costs, 52 percent earn less than $50,000 per year and 85 percent earn less than $100,000 per year (Bay Area Council Economic Institute, 2016).

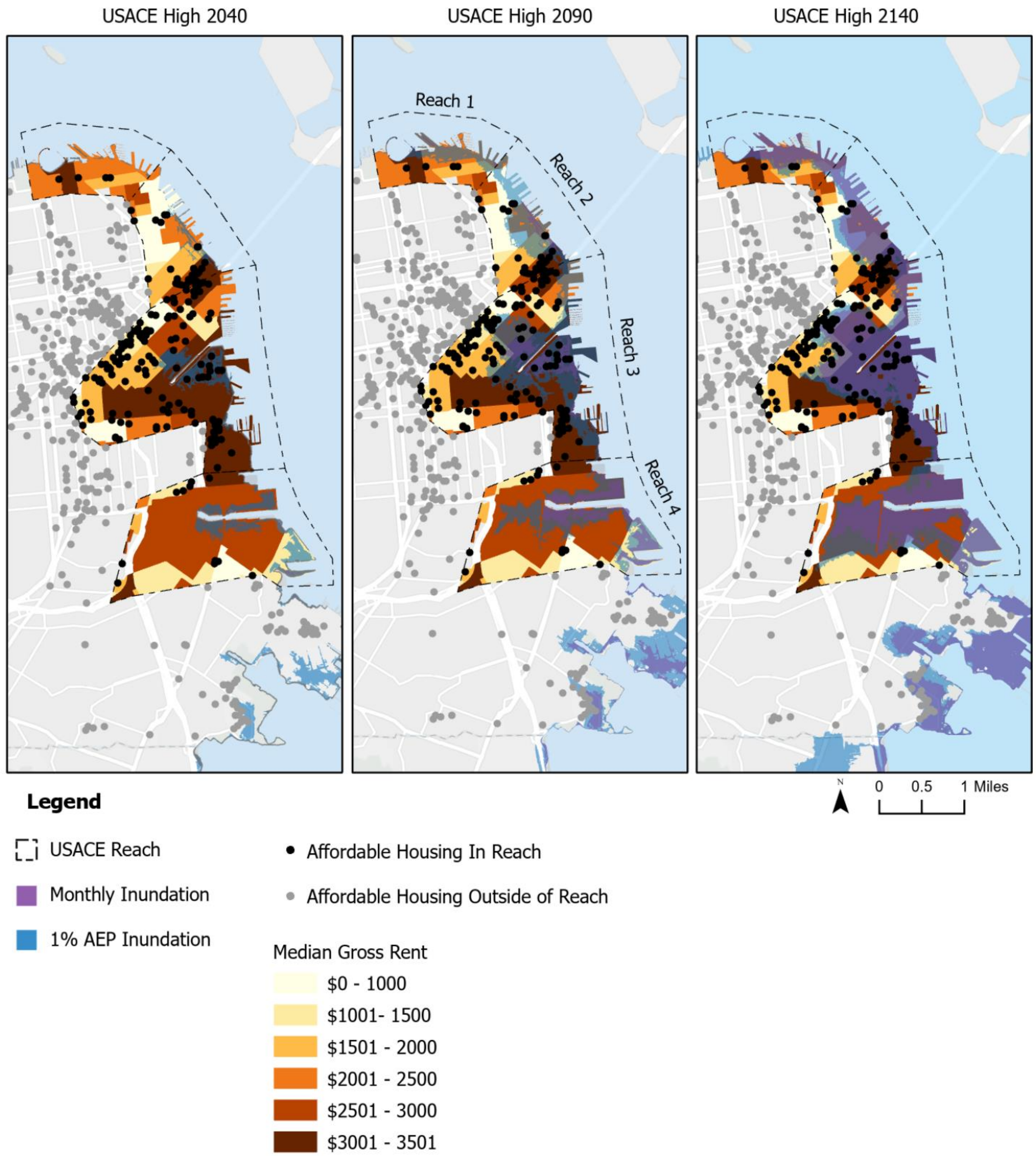
The study area's residential real estate market is dominated by renters. Approximately 68 – 70 percent of the study area's housing is renter-occupied. As shown in Mayor's Office of Housing and Community Development (MOHCD) and the Office of Community Investment and Infrastructure (OCII). 2021. Affordable Housing Pipeline. American Community Survey 2019.

Figure E.2-4-6, median gross rent across the waterfront is more than $1,500 per month. Each reach contains pockets where median rental costs exceed $3,000 per month – with a concentration of these areas in Reach 3. Mission Rock, Mission Creek, Mission Bay, and Pier 70 are all considered high rent neighborhoods. Even Islais Creek in Reach 4, including Hunters Point and Bayview, has median gross rent that exceeds $2,500 per month. Granular data is limited on housing cost-burdened households; however, it can be assumed that residents who face affordability challenges are more prevalent in Reach 3 and 4 due to higher levels of residential populations in those reaches.

San Francisco provides affordable housing in the study area through a variety of public and privately provided housing affordability programs. There are approximately 178 affordable housing sites in the study area, including future development sites. Mayor's Office of Housing and Community Development (MOHCD) and the Office of Community Investment and Infrastructure (OCII). 2021. Affordable Housing Pipeline. American Community Survey 2019.

Figure E.2-4-6 shows that 75 percent of the study area's affordable housing sites are concentrated in Reach 3, geographically associated with the highest rental prices. Affordable housing exposure to the 1-percent AEP event remains below 20% of the study area total (or 36 locations) until 2115, when over a quarter of the study area's affordable housing sites are exposed to severe coastal flooding. This increases to 37 percent (65 locations) by 2140. Exposure does not indicate vulnerability, but residents living in affordable housing sites that are damaged by a severe flood event may experience challenges finding alternate space for a comparable price while damage is being repaired.

Monthly flooding expected in 2090 under the USACE High Curve may also affect accessibility to affordable housing sites and the ability for people to thrive in these areas. By 2140, 25 percent of affordable housing sites will be exposed to monthly flooding, the majority of which are in Reach 3. Residents may choose to permanently relocate from the study area to avoid flooding and may not be able to relocate to another affordable housing site.



Mayor's Office of Housing and Community Development (MOHCD) and the Office of Community Investment and Infrastructure (OCII). 2021. Affordable Housing Pipeline. American Community Survey 2019.

Figure E.2-4-6. Distribution of Affordable Housing Sites and Median Rent Prices

E.2-4.2.4 Economic Vitality Findings

The OSE FWOP economic vitality measures explored in this section indicate potential flood-related consequences for local businesses and housing affordability challenges experienced by residents who may be displaced either temporarily or permanently. Potential consequences may arise in different ways across the waterfront, highlighting key economic vitality findings in Reach 2, Reach 3, and Reach 4 in the FWOP condition under the High SLC projection. These key findings include the following:

- Exposure counts for disadvantaged businesses are consistently higher in Reach 2 near the Ferry Building throughout all time horizons, representing 50 – 65 percent of exposed disadvantaged businesses for both the 1 percent AEP and monthly flood events. Nearly 20 disadvantaged businesses in the study area are exposed to the 1 percent AEP as early as 2040, with exposure more than tripling by 2065, and nearly doubling again by 2090.
- Monthly flood exposure of disadvantaged businesses is not expected until 2090, again concentrated in Reach 2. By 2115, nearly 80 DBEs may be exposed to monthly flooding and consider relocating out of the study area to protect their interests.
- The study area contains 74 legacy businesses. Nearly half of legacy businesses are in Reach 3. After 2090, exposure of legacy businesses is greater in Reach 4 due to a collection of such assets in the future floodplain in Bayview.
- Reach 3 exhibits the strongest potential to experience additional housing affordability challenges in a FWOP condition. South Beach, Mission Rock, Mission Bay, Mission Creek, and Pier 70 contain more affordable housing units than other waterfront reaches, as 75 percent of study area affordable housing is in Reach 3. Limited amounts of affordable housing locations are exposed to the 1 percent AEP event in 2040.
- By 2090, 32 of affordable housing sites in the study area will be exposed to the 1-percent AEP event. By 2140, 66 affordable housing sites will be exposed to the 1 percent AEP and 44 sites will be exposed to monthly flood events. Due to high demand and limited availability for affordable housing sites, residents who are affected by severe and repetitive flooding may not be able to find alternate affordable housing in the study area.

2065 is considered the first tipping point for economic vitality exposure and consequences in the study area as the 1 percent AEP event increases in magnitude due to sea level rise. However, monthly repetitive flooding presents a greater risk to economic vitality, as affordability challenges and limited fiscal resources could prompt local businesses and rent-burdened families to relocate as coastal flood risk worsens with sea level rise.

The potential complications presented by coastal flooding and sea level rise to the community’s economic vitality under the High Curve SLC projection are summarized by reach in the Table E.2-4-8 below.

Table E.2-4-8 Economic Vitality Findings and Tipping Points, USACE High Curve

Time Horizon	2040	2065	2090	2115	2140
Reach 1	Limited exposure and consequence expected that would affect economic vitality. One legacy business exposed to the 1% AEP event. No disadvantaged businesses or affordable housing exposure.	Limited exposure. One disadvantaged business and 2 legacy businesses exposed to the 1% AEP event. No monthly flood exposure. No exposure of affordable housing sites.	Limited exposure. Two disadvantaged businesses and 5 legacy businesses exposed to the 1% AEP event. No monthly flood exposure. No exposure of affordable housing units.	*2115 represents a Reach 1 tipping point as monthly flood exposure increases, although it remains limited compared to the rest of the study area. Two disadvantaged businesses s, 6 legacy businesses exposed to the 1% AEP. One disadvantaged business and 4 legacy businesses exposed to monthly flooding that could result in permanent relocation of local businesses.	Five DBEs, 7 legacy businesses, and 2 affordable housing sites exposed to the 1% AEP. Two affordable housing sites are exposed to monthly flooding and can potentially find temporary alternative space in the study area. Two disadvantaged businesses and 6 legacy businesses exposed to monthly flooding.
Reach 2	Limited number of disadvantaged businesses (12) exposed to the 1% AEP event. No legacy business exposed. Very limited number of affordable housing sites (2) impacted by the 1% AEP event.	*2065 represents a tipping point in Reach 2 as more local businesses are exposed to extreme flooding. 35 disadvantaged businesses and 3 legacy businesses exposed to the 1% AEP event. Limited number of affordable housing sites (4) exposed to the 1% AEP. Four affordable housing locations can likely find temporary alternative space in the study area. No monthly flood exposure.	Moderate number of disadvantaged businesses (83) and legacy businesses (5) exposed to the 1% AEP flood event. This represents 65% of all exposed disadvantaged businesses for this time horizon. Very limited number of affordable housing sites (6) exposed to the 1-percent AEP event. Two affordable sites are exposed monthly and occupants may permanently relocate.	Large number of disadvantaged businesses (105) and legacy businesses (5) exposed to the 1% AEP flood event. Limited number of affordable housing sites (10) exposed to the 1-percent AEP event. Four affordable sites exposed are monthly.	Large number of disadvantaged businesses (123) and legacy businesses (6) exposed to the 1% AEP flood event. This represents 45% of all exposed disadvantaged businesses for this time horizon. Limited number of affordable housing sites (13) exposed to the 1% AEP event. 10 affordable sites are exposed monthly.

Time Horizon	2040	2065	2090	2115	2140
Reach 3	Very limited number of disadvantaged businesses (4) and legacy businesses (1) exposed to the 1% AEP flood event. Limited number of affordable housing sites (6) impacted by the 1-percent AEP event.	Limited number of disadvantaged businesses (16) and legacy businesses (2) exposed to the 1% AEP flood event. Limited number of affordable housing sites (20) exposed to the 1% AEP event. No monthly flood exposure	*2090 represents a Reach 3 tipping point as monthly flooding exposes 5 affordable housing sites, and 26 sites are exposed to extreme flooding. Relocation to other affordable sites in the study area may become challenging. Limited number of disadvantaged businesses (24) and legacy businesses (6) exposed to the 1% AEP flood event. Very limited disadvantaged business (2) and legacy businesses (1) are exposed to monthly flooding.	Moderate number of disadvantaged businesses (31) and 6 legacy businesses are exposed to the 1% AEP flood event. Monthly flood exposure of DBE (20) and legacy business (4) may start to affect their ability to remain in the reach. A moderate number of affordable housing sites (37) and 9 impacted by the 1-percent AEP event. 24 affordable housing sites will be exposed to monthly flooding and maintaining affordable housing may become difficult in the reach.	Moderate number of disadvantaged businesses (77) and legacy businesses (8) are exposed to the 1% AEP flood event. Large number of affordable housing sites (49) are exposed to the 1% AEP event. This represents nearly 75% of the affordable housing sites exposed for this time horizon. 34 affordable sites are exposed to monthly flooding. Permanent relocation of affordability-challenged residents will likely occur.
Reach 4	Very limited number of disadvantaged businesses (2) exposed to the 1-percent AEP flood event. No affordable housing or legacy business exposed. Almost no affordable housing availability or exposure until 2140.	Limited number of disadvantaged businesses (14) exposed to the 1-percent AEP flood event. No affordable housing or legacy business exposed.	Limited number of disadvantaged businesses (18) and 4 legacy businesses exposed to the 1% AEP flood event. Two disadvantaged businesses may be exposed to monthly flooding.	*2115 represents a tipping point for Reach 4, as legacy business exposure quickly exceeds counts compared to other reaches. A moderate number of disadvantaged businesses (39) and 9 legacy businesses are exposed to the 1-percent AEP flood event. Monthly flooding may expose 2 legacy businesses and 17 DBEs.	Moderate number of disadvantaged businesses (66) and 11 legacy businesses are exposed to the 1% AEP flood event. Monthly flooding will expose 7 legacy businesses and 30 disadvantaged businesses. Local business may be challenged to remain in the study area. Very limited number of affordable housing locations (2) impacted by the 1% AEP event.

E.2-4.3 Social Connectedness

Social connectedness refers to the pattern of social networks within which individuals interact, also considered social capital. Typically, social connectedness is measured in participation of voters, community surveys, and community visions (IWR, 2013). San Francisco has been active in community engagement and resilience-building to increase awareness of flood risk.

In the OSE FWOP context, social connectedness refers to the community fabric among community members experiencing the impacts of flooding. Natural disasters can cause disruption to normal daily functions that threaten or cause the loss of health, social, and economic resources, which leads to psychological distress. Sections E.2-4.1 presented the potential risk of temporary and permanent residential displacement due to coastal flooding. Relocation may create the feeling of disconnectedness from the community or neighborhood. Impacts to social connectedness within the SFWCFS area is explored in this section. Ways of measuring these impacts include the cost of residential relocation, mental stress, lost productivity, impact to transit corridors, and impacts to open space. Detailed descriptions of vulnerability characteristics are presented in Table E.2-4-9.

Table E.2-4-9. Social Connectedness Indicator Descriptions

Category	Metric	Metric Type	Description
Social Connectedness	Mental Stress and Anxiety	$	Represent stress factors as a product of damage to people’s homes, and quantifies treatment costs to residents
	Lost Productivity	$	Represents lost income to residents who work and must deal with flood loss in their homes
	Transit Corridors and Recreation Exposure	#, abc	Public transit routes, ridership counts, bike and pedestrian routes, open space daily visit counts within the flood extent
	Commuting travel time	#	Exposed people with commute times greater than 30 minutes.
	Public transit users	#	Number of people who commute using public transit.

E.2-4.3.1 Lost Productivity and Stress Factors

Physical damage caused by coastal flooding can displace residents from homes, causing disruption to the real estate market and producing stress factors upon residents. These social connectedness impacts were quantified using FEMA Hazus and benefit-cost analysis methodologies (FEMA, 2016) and account for “stress factors.” Relocation and a damaged home may cause cascading impacts on community mental health and work productivity. Stress factors are a product of damage to people’s homes and are quantified as mental health treatment costs and lost income to workers, also known as mental stress and anxiety and lost productivity costs. Mental stress and anxiety costs estimate the cost of individuals seeking treatment post-flood. Lost productivity reflects an estimate of lost workdays for people whose residences are impacted by flooding and are experiencing mental stress and anxiety impacts. These values are estimated using per-capita standard value estimates developed by FEMA.

Table E.2-4-10 presents expected losses under the High SLC projection due to mental stress and anxiety and lost productivity impacts. These losses are based on temporarily displaced population estimates discussed in Sections E.2-4.1. Note that mental stress and anxiety and lost productivity impacts expected for the displaced population is not estimated for monthly flooding. The impacted populations would likely relocate prior to monthly flooding, which may reduce the impacts for extreme event impacts in later time horizons.

Table E.2-4-10. Social Connectedness Quantified Losses by Reach, 1% AEP Event

Time Horizon	Loss Type ($)	Reach 1	Reach 2	Reach 3	Reach 4	Total
2040	Mental Stress and Anxiety	-	-	$8,090,565	$24,459	$8,115,024
	Lost Productivity	-	-	$25,190,363	$74,452	$5,264,815
	Total	-	-	$33,280,928	$98,911	$33,379,839
2065	Mental Stress and Anxiety	-	$3,537,941	$25,435,248	$148,229	$29,121,419
	Lost Productivity	-	$11,031,421	$80,113,244	$451,206	$91,595,871
	Total	-	$14,569,362	$105,548,492	$599,435	$120,717,289
2090	Mental Stress and Anxiety	-	$10,541,511	$36,634,876	$150,772	$47,327,159
	Lost Productivity	-	$33,429,499	$116,271,730	$458,947	$150,160,176
	Total	-	$43,971,010	$152,906,606	$609,719	$197,487,335
2115	Mental Stress and Anxiety	$1,269,205	$14,181,699	$46,814,351	$177,852	$62,443,106
	Lost Productivity	$4,152,273	$45,108,751	$148,846,104	$541,376	$198,648,504
	Total	$5,421,478	$59,290,450	$195,660,455	$719,228	$261,091,611
2140	Mental Stress and Anxiety	$4,340,129	$16,751,812	$56,452,970	$691,414	$78,236,324
	Lost Productivity	$13,975,011	$53,511,487	$180,607,582	$2,193,887	$250,287,966
	Total	$18,315,140	$70,263,298	$237,060,552	$2,885,301	$328,524,291

Note: Limited to residences. Not inclusive of populations working in each reach. Future values are not discounted back to today's dollars to account for the time value of money.

Reach 3 has the highest levels of lost productivity and mental stress and anxiety, based on high temporary residential displacement levels within the Reach (see Table E.2-4-2). By 2065, Reach 3 is expected to experience losses of more than $105 million due to lost productivity and resident mental stress and anxiety from the 1-percent AEP event.

E.2-4.3.2 Transit Corridors and Recreation Exposure

Coastal flooding will have a significant impact on transit corridors and recreational areas in the SFWCFS area. One of the most consequential effects from coastal inundation is the disruption of transportation networks. Flooded roads, bridges, and rail lines can make it difficult or impossible for people and goods to move around, causing delays, cancellations, and increased costs for businesses and individuals. More frequent and large flood events can cause permanent damage to infrastructure, requiring costly repairs or even forcing entire transportation networks to be rerouted. People make over four million trips per day on a typical weekday to, from, and within San Francisco by various modes including walking, biking, public transit, and driving (CCSF, 2020). The overall transportation network includes public transportation routes provided by SFMTA, Bart, Caltrain, AC Transit and other agencies as well as bike and pedestrian routes. Additionally, coastal flooding could have a significant impact on recreational and open space in the SFWCFS area.

E.2-4.3.2.1 Transit Corridors

Any transportation network exposed to flooding will experience cascading impacts to operations and public capacity. Flooded roadways affect all transportation modes and can cause traffic congestion on alternate streets. Critical access in waterfront neighborhoods will be obstructed, affecting the ability to respond to emergencies and everyday life. A 1-percent AEP flood event in 2140 exposes almost 76 miles of San Francisco’s roadways, and monthly flooding exposes 56 miles.
The regional economic importance of transit corridors and mobility are further discussed in the *RED Report* while NED impacts (e.g., physical damage, transportation delay) are discussed in *Appendix E.* However, it is important to note that key regional and local transit infrastructure located in the SFWCFS are exposed and vulnerable to coastal flooding and sea level rise. These include the following:

- Bay Area Rapid Transit (BART). BART connects the San Francisco Peninsula with surrounding Bay area communities and provides service to two international airports. BART runs through Reach 2 and has a weekday average ridership of 440,000 passengers. The Embarcadero Station, which is the last station in the Peninsula before traversing the Bay to Oakland, is vulnerable to flooding and can become damaged and disrupted with a 1-percent AEP event by 2040.
- San Francisco Municipal Railway (Muni). Muni is the transit division of the San Francisco Municipal Transportation Agency (SFMTA). Muni is critical to local transit patterns and provides bus, subway and surface rail, streetcars, and cable cars that serve all corners of San Francisco. SFMTA’s average daily ridership between all modes is 700,000 passengers. Ridership for all alternatives in the SFWCFS is approximately 170,000 trips per day. Muni provides rail service throughout all Reaches on the KT, N, and F light rail lines. The T-Third line in

particular is a critical transportation route for Bayview residents, a traditionally underserved neighborhood. SFMTA recently expanded the T-Third line into a new subway that will terminate in Chinatown, providing mobility connections between two rich cultural areas. The KT line may be exposed to coastal flooding in Reach 2, 3, and 4. Muni also runs multiple bus lines through the SFWCFS area.

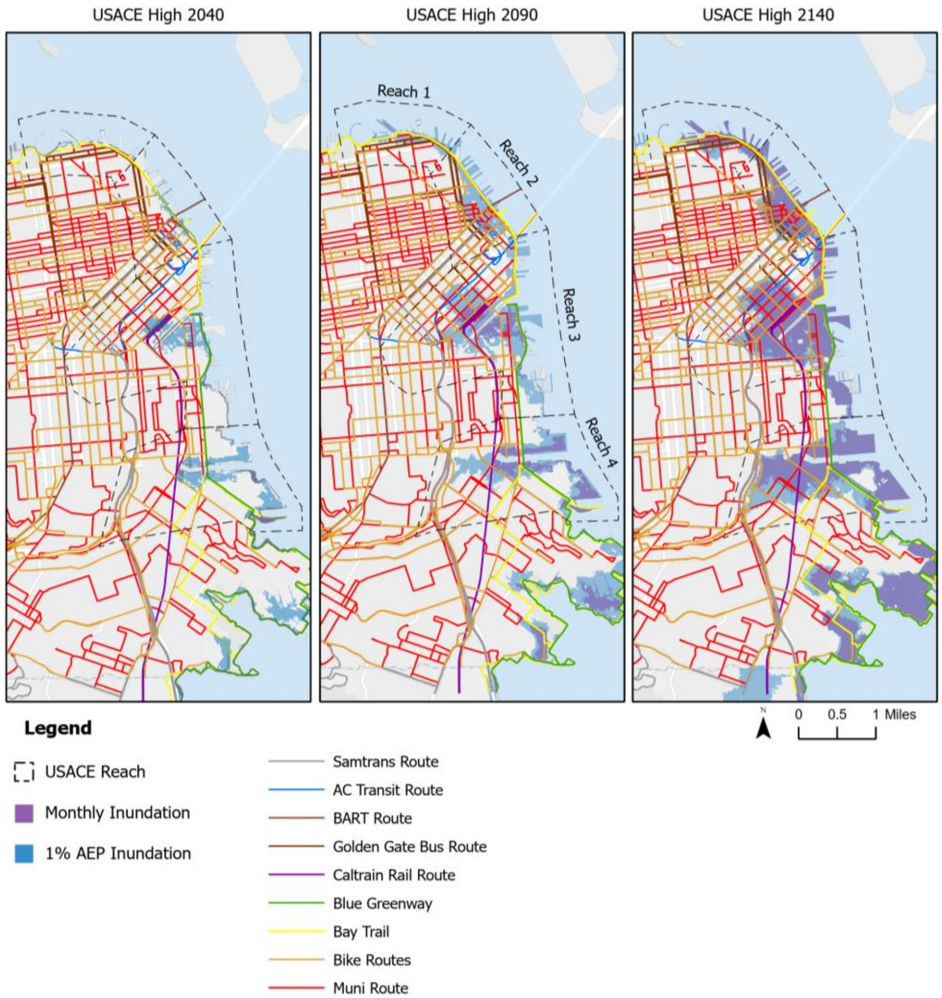
SFMTA routes will be the most exposed public transit routes in the waterfront, with over 15 miles exposed in a 1-percent AEP event by 2065 (see Table E.2-4-11 and City and County of San Francisco (CCSF). 2020. Sea Level Rise Vulnerability and Consequences Assessment. Dataset for SFMTA (Muni) includes all modes of transit.

Figure E.2-4-7). By 2140, approximately 34 miles of SFMTA routes will be affected during the 1-percent AEP event. By 2140, approximately 27 miles of the SFMTA network will be impacted by repetitive monthly flooding. People in affected vulnerable neighborhoods who are transit-dependent, elderly, or disabled will be the most impacted and left without access. Residents that rely on public transportation in the SFWCFS area will be directly affected by SFMTA disruption; by 2065, over 1,000 residents across the four reaches that rely on public transportation only (have no vehicle access) will be exposed to a 1-percent AEP event. The number of affected residents that rely on public transportation rises to over 2,500 by 2140.

Table E.2-4-11 Transit Exposure, USACE High Curve

Time Horizon	Reach 1	Reach 2	Reach 3	Reach 4	Total
Transit route exposure (Muni) (miles) with 1-percent AEP flooding					
2040	0.0	2.1	1.4	0.1	3.6
2065	2	6	6	1	15
2090	3.2	8.2	9.2	1.4	21.9
2115	3	9	13	3	29
2140	3.6	10.5	15.4	4.7	34.2
Transit route exposure (Muni) (miles) with monthly flooding, indicating access issues and the potential need for relocation					
2040	0	0	0	0	0
2065	0	0	0	0	0
2090	0	2	1	0	3
2115	3	7	8	1	19
2140	3.3	9.1	12.2	2.7	27.3

Time Horizon	Reach 1	Reach 2	Reach 3	Reach 4	Total
Population reliant on public transportation (no vehicle access) (count) with 1-percent AEP flooding					
2040	11	58	275	15	359
2065	81	246	729	20	1,075
2090	148	385	1113	27	1,673
2115	182	516	1,453	39	2,190
2140	212	617	1707	58	2,594



City and County of San Francisco (CCSF). 2020. Sea Level Rise Vulnerability and Consequences Assessment. Dataset for SFMTA (Muni) includes all modes of transit.

Figure E.2-4-7. Distribution of Transit Corridors and Recreation

The study area's major transit hubs and critical transit infrastructure, including storage and maintenance facilities, will also be significantly impacted by coastal flooding. The Embarcadero Station has a high risk of flooding during the 1 percent AEP event expected in 2040 under the USACE High Curve, resulting in 65 percent of all BART trips at risk of disruption. A Waterfront Resiliency Transportation Assessment conducted by SFMTA in 2022 demonstrates that by 2065, at least eight pieces of critical infrastructure will be exposed to the 1% AEP event, including F Market and Wharves, the Ferry Portal, 4th Street Bridge, T Third Street, 3rd Street Bridge, 6th and King Pocket Track, the Islais Creek Motor Coach Facility, and the 1399 Marin Street Facility (see SFMTA. 2022. Waterfront Resiliency and Transportation Assessment.

Figure E.2-4-8). The number rises to 14 by 2140, including additional facilities such as the Kirkland Yard, Muni Metro East, the 1570 Burke facility, Mission Bay Loop, Central Subway Portal, and the 4th and King Street stop (see SFMTA. 2022. Waterfront Resiliency and Transportation Assessment.

Figure E.2-4-9). Facility exposure to coastal flooding and sea level rise would likely result in compromised capacity of facility storage, maintenance, or operational capacity for the system. SFMTA estimates that between 2065 and 2090, 14 of the 18 facilities that serve the study area would experience at least periodic capacity issues due to either diminished access or facility damage. Between 2090 and 2115, all 18 assets would experience capacity issues. Twelve of these assets would experience complete disruption, including three substation portals, and Muni Metro turnaround, which affects the entire light rail system.

Due to the potential extent of impacts under the High SLC projection, SFMTA is likely to take action before extensive system damage and disruption occurs. In the near-term, asset level protection and deployable floodproofing will likely be implemented to prevent physical damage from extreme storm events. In the long-term, core transit infrastructure components may be reflected, impacting access to the transit system. The PDT assumes that existing assets will be floodproofed by 2065, and that route relocation and asset relocation will occur by 2040.

SFMTA. 2022. Waterfront Resiliency and Transportation Assessment.

Figure E.2-4-8. SFMTA Infrastructure Exposure, 1% AEP, 2065 USACE High Curve

SFMTA. 2022. Waterfront Resiliency and Transportation Assessment.

Figure E.2-4-9. SFMTA Infrastructure Exposure, 1% AEP, 2140 USACE High Curve

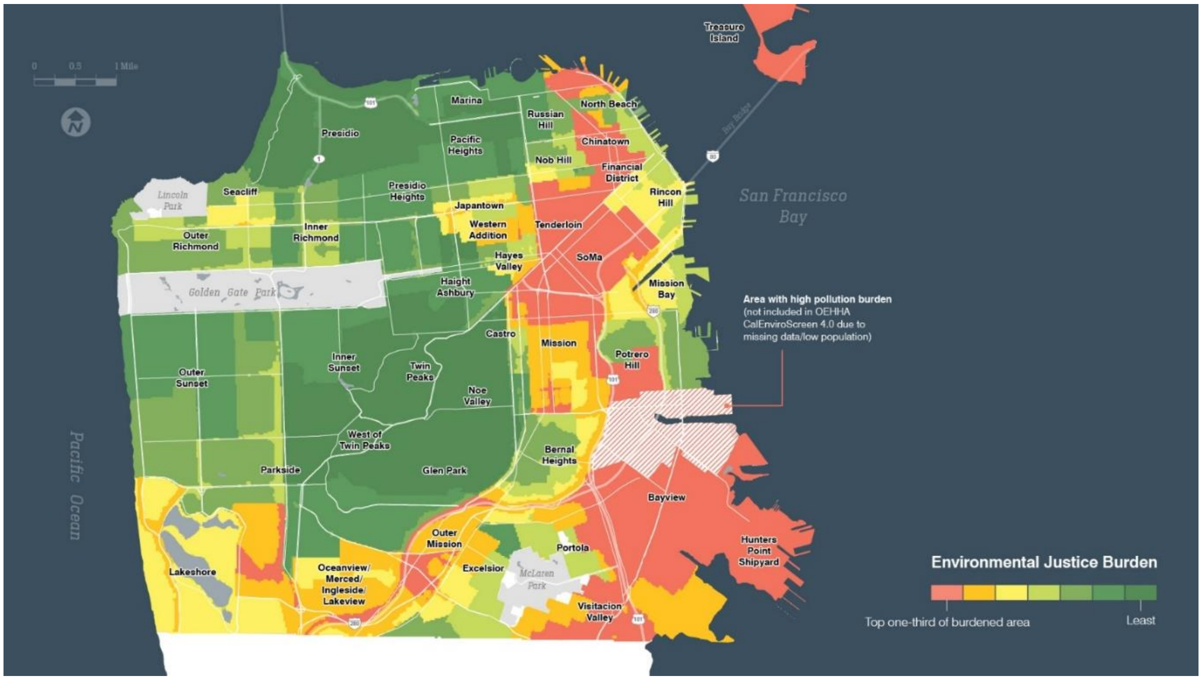
The SFMTA conducted a network analysis to model transit impacts if no actions were taken. The analysis considered travel time, transit performance issues, trip detours and increase in emissions, congestion, and mode shifting from transit to automobiles. The network analysis is linked to the assets and facilities analysis, and links and disruptions in one are reflected in the other.

Table E.2-4-12 shows the network analysis impacts to high, medium, and low-burden Environmental Justice Communities. While there are several indices and tools used to define disadvantaged communities, including the EPA's EJ Screen, CDC's Social Vulnerability Index, and the Council on Environmental Quality's Climate and Economic Justice Screening Tool, the network analysis used the City of San Fransisco's Environmental Justice Communities to assess transit impacts to disadvantaged communities because this index was developed specifically for the city. These Environmental Justice Communities represent areas of San Francisco that have higher pollution and are predominately low-income.[4] Due to the networked nature of SFMTA's system, it is likely that impacts to the system sustained in the study area will have mobility impacts to Environmental Justice Communities throughout the City (see SF Planning and CalEnviroScreen

Figure E.2-4-10). Nevertheless, many high burden Environmental Justice Communities are within the SFWCFS, including neighborhoods in Reach 2, including Chinatown and the Financial District, Reach 3, including SoMa and Portrero Hill, and nearly all of Reach 4. High burden communities will see a 56% increase in travel times by end of century, and 29% more vehicle miles traveled. 71% more roadways will be congested or at capacity in high burden communities, while public transit will see a high degree of degradation in high burden communities by end of century.

[4] Environmental Justice Communities mapped by San Francisco Planning Department, based on data from CalEnviroScreen.

Note that long-term system reconfiguration plan in FWOP may result in similar travel time and transit performance results.



SF Planning and CalEnviroScreen

Figure E.2-4-10. Environmental Justice Communities Map

Table E.2-4-12 Network Analysis, Environmental Justice Communities

EJ Community	Mid-Century	Mid-Century with Storm Surge	End of Century	End of Century with Storm Surge
% Change in Travel Time				
High Burden	15%	56%	56%	42%
Medium Burden	18%	66%	66%	47%
Low Burden	10%	27%	27%	21%
Change in Emissions and Road Safety (% change in vehicle miles traveled)				
High Burden	7%	29%	29%	29%
Medium Burden	11%	37%	37%	37%
Low Burden	4%	17%	17%	19%
Congestion (change in % of near or at-capacity roadways)				
High Burden	24%	71%	71%	41%
Medium Burden	28%	40%	40%	1%
Low Burden	43%	125%	125%	81%
Auto Mode Shift (shift from transit to auto)				
High Burden	Low	High	High	High

EJ Community	Mid-Century	Mid-Century with Storm Surge	End of Century	End of Century with Storm Surge
Medium Burden	Low	High	High	High
Low Burden	Low	High	High	High
Transit Degradation				
High Burden	Low	High	High	High
Medium Burden	Low	High	High	High
Low Burden	Low	Medium	Medium	High

E.2-4.3.2.2 Recreation Exposure

Pedestrian and cycling routes will also face impacts. The San Francisco Bay Trail is a planned 500-mile walking and bicycling path around the entire San Francisco Bay. Along its course, the trail will link 47 cities through nine counties, providing numerous connections to local employment hubs, transit, parks and open spaces, schools, and other civic centers. As of 2017, more than 300 miles of trail are open, consisting of off-road trails with a mix of surface types, as well as stretches of bike lanes and sidewalks (CCSF, 2020). About 7 miles of the Bay Trail in the waterfront will be frequently inundated with monthly flooding by 2140 and 8 miles will be exposed in a 1-percent AEP flood event. The Blue Greenway is the southern portion of the Bay Trail and the Bay Area Water Trail in Reach 2 and 3, and over 2 miles of this segment will be frequently inundated with monthly flooding by 2140. If these trails are temporarily, or eventually permanently inaccessible due to flooding, without protection or relocation to higher ground these trails could be lost. Residents could lose shoreline access, recreation opportunities, and non-motorized transportation corridors if trails are damaged or closed due to future flooding or erosion. For those with limited mobility or transportation options, the loss of trail segments in their neighborhoods could be significant, reducing the transportation and recreation opportunities provided.

Recreation access will be impacted, with 44 acres of exposed open space by 2040 during a 1-percent AEP event. Some parks are designed to accommodate flooding, such as recently opened parks in Reach 3 (Bayfront Park and Crane Cove Park). By 2090, parks such as Embarcadero Plaza and Ferry Park in Reach 2 will be exposed during a 1-percent AEP event. By 2140, nearly 120 acres of open space will be exposed during a 1-percent AEP event, limiting recreational opportunities for SFWCFS residents, workers, and the greater San Francisco community. Additional recreation space exposure is presented in Table E.2-4-13. Note that recreation exposure is addressed in the NED account as well.

Table E.2-4-13 Open Space Exposure (Acres), 1-Percent AEP Event, USACE High Curve

Time Horizon	Reach 1	Reach 2	Reach 3	Reach 4	Total
2040	1.89	8.14	10.14	23.89	44.06
2065	5.16	21.97	24.31	27.19	78.62

Time Horizon	Reach 1	Reach 2	Reach 3	Reach 4	Total
2090	10.18	25.31	35.00	31.07	101.57
2115	11.07	27.41	40.40	35.38	114.27
2140	11.28	28.43	42.01	38.22	119.94

E.2-4.3.3 Social Connectedness Findings

Coastal flooding expected under the High SLC projection may greatly impact social connectedness in the SFWCFS, causing disruption to the normal, daily function of community members and exacerbate psychological distress. Reach 3 may expect the highest levels of lost productivity and mental stress and anxiety, based on high residential displacement levels in Reach 3. By 2065, Reach 3 is expected to experience losses of more than $105 million due to lost productivity and resident mental stress and anxiety from the 1-percent AEP event. By 2140, Reach 3 residents will experience losses of more than $235 million due to lost productivity and mental stress and anxiety due to the 1-percent AEP event.

Regional and city transportation networks impacted by 1-percent AEP or monthly flooding in any reach can significantly reduce citywide public transit capacity. Coastal flooding will impact all forms of transportation across all four reaches beginning in 2040. SFMTA has identified key linchpin assets that are of highest priority to protect or maintain access include the Muni Metro East facility, The T-Third line, the Embarcadero transit, and roadway (including the Central Subway extension), and all four Mission Creek and Islais Creek bridges.

Additional social connectedness findings as they relate to mobility include:

- The largest exposure to mobility routes and open spaces will occur in Mission Bay (Reach 3).
- The Embarcadero Station has a high risk of flooding with monthly flooding by 2115 and by 2065 with a 1-percent AEP flood event, resulting in 65 percent of all BART trips at risk of disruption. The extent of transit disruption associated with the Embarcadero Station will likely warrant early floodproofing measures.
- By 2140, during a 1-percent AEP event, approximately 5,897 (40%) residents in the SFWCFS area using public transit to commute may be exposed to flooding while approximately 4,811 (33%) residents may be exposed during more frequent, monthly flooding. Disruption of the public transit system will severely impact these residents' mobility, particularly later in the study period when flooding becomes repetitive.
- About 7 miles of the Bay Trail in the waterfront will be frequently inundated with monthly flooding by 2140 and 8 miles will be exposed in a 1-percent AEP flood event.

Table E.2-4-14 shows the social connectedness summary and tipping points expected through the SFWCFS period of analysis under the USACE High Curve. Waterfront open space will be impacted as early as 2040, with 44 acres of open space experiencing flooding during a 1-percent AEP event. Waterfront open space in the Mission Bay and Dogpatch neighborhoods, such as Bayfront Park and Crane Cove Park, will experience flooding during a 1-percent AEP event.

Table E.2-4-14 Social Connectedness Summary and Tipping Points, USACE High Curve

Time Horizon	2040	2065	2090	2115	2140
Reach 1	No monetary losses due to residential stress factors. No Muni exposure with 1-percent AEP event; however, BART will potentially be flooded and cause congestion on SFMTA systems. Very limited commuter exposure (10 commuters) with 1-pecent AEP event. Limited open space exposure with 1-percent AEP event (<2 acres).	No monetary losses due to residential stress factors. F Market and Wharves stop impacted by 1-percent AEP event. Limited Muni exposure (2 miles) with 1-percent AEP event. Limited commuter exposure (126 commuters) with 1-pecent AEP event. Limited open space exposure with 1-percent AEP event (<5.5 acres).	No monetary losses due to residential stress factors. Moderate Muni exposure (3.2 miles) with 1-percent AEP event. Limited commuter exposure (200 commuters) with 1-pecent AEP event. Moderate open space exposure with 1-percent AEP event (>10 acres).	Limited monetary losses due to residential stress factors (<$5,500,000). Moderate Muni exposure (3 miles) with 1-percent AEP event. Limited commuter exposure (289 commuters) with 1-pecent AEP event. Moderate open space exposure with 1-percent AEP event (>11 acres).	Limited monetary losses due to residential stress factors (<$18,500,000). Kirkland Yard impacted by 1-percent AEP event. Moderate Muni exposure (3.6 miles) with 1-percent AEP event. Limited commuter exposure (405 commuters) with 1-pecent AEP event. Moderate open space exposure with 1-percent AEP event (>11 acres).

Time Horizon	2040	2065	2090	2115	2140
Reach 2	No monetary losses due to residential stress factors. Limited Muni exposure (2.1 miles) with 1-percent AEP event. Limited commuter exposure (97 commuters) with 1-pecent AEP event. Moderate open space exposure with 1-percent AEP event (>8 acres).	Limited monetary losses due to residential stress factors (<$15,000,000). Ferry Portal impacted by 1-percent AEP event. Moderate Muni exposure (6 miles) with 1-percent AEP event. Limited commuter exposure (388 commuters) with 1-pecent AEP event. Very significant open space exposure with 1-percent AEP event (>21 acres).	Moderate monetary losses due to residential stress factors (>$43,000,000). 25% of the residential population displaced during recovery (Table 7). Significant Muni exposure (8.2 miles) with 1-percent AEP event. Moderate commuter exposure (537 commuters) with 1-pecent AEP event. Very significant open space exposure with 1-percent AEP event (>25 acres).	*2115 represents a Reach 2 tipping point, as more than a third of residents are displaced during a 1-percent AEP event and stress factor losses total almost $60,000,000. Significant monetary losses due to residential stress factors (>$59,000,000). 36% of the residential population displaced during recovery (Table 7). Significant Muni exposure (9 miles) with 1-percent AEP event. 7 miles exposed during monthly event. Moderate commuter exposure (683 commuters) with 1-pecent AEP event. Very significant open space exposure with 1-percent AEP event (>27 acres).	Significant monetary losses due to residential stress factors (>$70,000,000). Significant Muni exposure (10.5 miles) with 1-percent AEP event. 9.1 miles exposed during monthly event. Moderate commuter exposure (783 commuters) with 1-pecent AEP event. Very significant open space exposure with 1-percent AEP event (>28 acres). Parks in Financial District such as Embarcadero Plaza and Ferry Park exposed during 1-percent AEP event.

Time Horizon	2040	2065	2090	2115	2140
Reach 3	*Reach 3 is the only reach with residential displacement in 2040, and the only reach with monetary stress losses over $1,000,000. Moderate monetary losses due to residential stress factors (>$43,000,000). Limited Muni exposure (1.4 miles) with 1-percent AEP event. Moderate commuter exposure (805 commuters) with 1-pecent AEP event. 10 acres of open space impacted, including public waterfront space in Mission Bay and Dogpatch.	Significant monetary losses due to residential stress factors (>$105,000,000). 4th Street Bridge, 6th and King Pocket Track, and T Third Street exposed during 1-pecent AEP event. Moderate Muni exposure (6 miles) with 1-percent AEP event. Significant commuter exposure (2,164 commuters) with 1-pecent AEP event. Very significant open space exposure with 1-percent AEP event (>24 acres).	Significant monetary losses due to residential stress factors (>$152,000,000). Significant Muni exposure (9.2 miles) with 1-percent AEP event. Very significant commuter exposure (3,176 commuters) with 1-pecent AEP event. Very significant open space exposure with 1-percent AEP event (>35 acres).	Extremely significant monetary losses due to residential stress factors (>$195,000,000). Very significant Muni exposure (13 miles) with 1-percent AEP event. 8 miles exposed during monthly flood event. Very significant commuter exposure (3,991 commuters) with 1-pecent AEP event. 2,746 commuters exposed to monthly event. Very significant open space exposure with 1-percent AEP event (>40 acres).	Extremely significant monetary losses due to residential stress factors (>$237,000,000), or 72% of total monetary stress losses. 4th and King Street stop, Central Subway Portal, and Mission Bay Loop exposed during 1-percent AEP event. Very significant Muni exposure (15.4 miles) with 1-percent AEP event. 12.2 miles exposed during monthly flood event. Very significant commuter exposure (4,503 commuters) with 1-pecent AEP event. 3,818 commuters exposed to monthly event. Very significant open space exposure with 1-percent AEP event (>42 acres).

Time Horizon	2040	2065	2090	2115	2140
Reach 4	Very limited monetary losses due to residential stress factors (<$100,000). Very limited Muni exposure (0.1 miles) with 1-percent AEP event. Very limited commuter exposure (38 commuters) with 1-pecent AEP event. Significant open space exposure with 1-percent AEP event (>23 acres).	Very limited monetary losses due to residential stress factors (<$600,000). 3rd Street Bridge, Islais Creek Motor Coach Facility, and the 1399 Marin Street Facility exposed during 1-pecent AEP event. Limited Muni exposure (1 mile) with 1-percent AEP event. Very limited commuter exposure (51 commuters) with 1-pecent AEP event. Very significant open space exposure with 1-percent AEP event (>23 acres).	Very limited monetary losses due to residential stress factors (<$610,000). Limited Muni exposure (1.4 miles) with 1-percent AEP event. Very limited commuter exposure (71 commuters) with 1-pecent AEP event. Very significant open space exposure with 1-percent AEP event (>31 acres).	Very limited monetary losses due to residential stress factors (<$720,000). Limited Muni exposure (3 miles) with 1-percent AEP event. Limited commuter exposure (120 commuters) with 1-pecent AEP event. Very significant open space exposure with 1-percent AEP event (>35 acres).	Limited monetary losses due to residential stress factors (<$2,200,000). Muni Metro East and the 1570 Burke facility exposed during 1-percent AEP event. Limited Muni exposure (4.7 miles) with 1-percent AEP event. Limited commuter exposure (206 commuters) with 1-pecent AEP event. Very significant open space exposure with 1-percent AEP event (>38 acres).

E.2-4.4 Community Identity

Community identity is understood as a sense of civic pride and willingness and ability to support restoration and recovery after a community shock. In other words, a tight-knit and culturally connected community is more willing to support one another in the event of flood impacts and participate in planning processes for recovery.

San Francisco has many neighborhoods that have evolved over time, and each has its own district culture and character. Even though many boundaries are fluid, the topography of the city and long-term concentration of cultural groups in certain neighborhoods still make them distinguishable. Community identity is represented in this report through exposure of community service facilities and cultural and historic assets. Detailed descriptions of the indicators and measures to establish exposure and consequences for community identity is detailed below in Table E.2-4-15.

Table E.2-4-15. Community Identity Indicator Descriptions

Category	Measure	Measure Type	Description
Community Identity	Community Services	#, abc	Includes city-owned facilities such as police stations, fire stations, libraries, community centers, health centers and clinics
	Cultural/Historic Assets	#, abc	Cultural and historic assets in the flood extent: cultural heritage districts, places of worship, landmarks, and historic places

E.2-4.4.1 Community Services

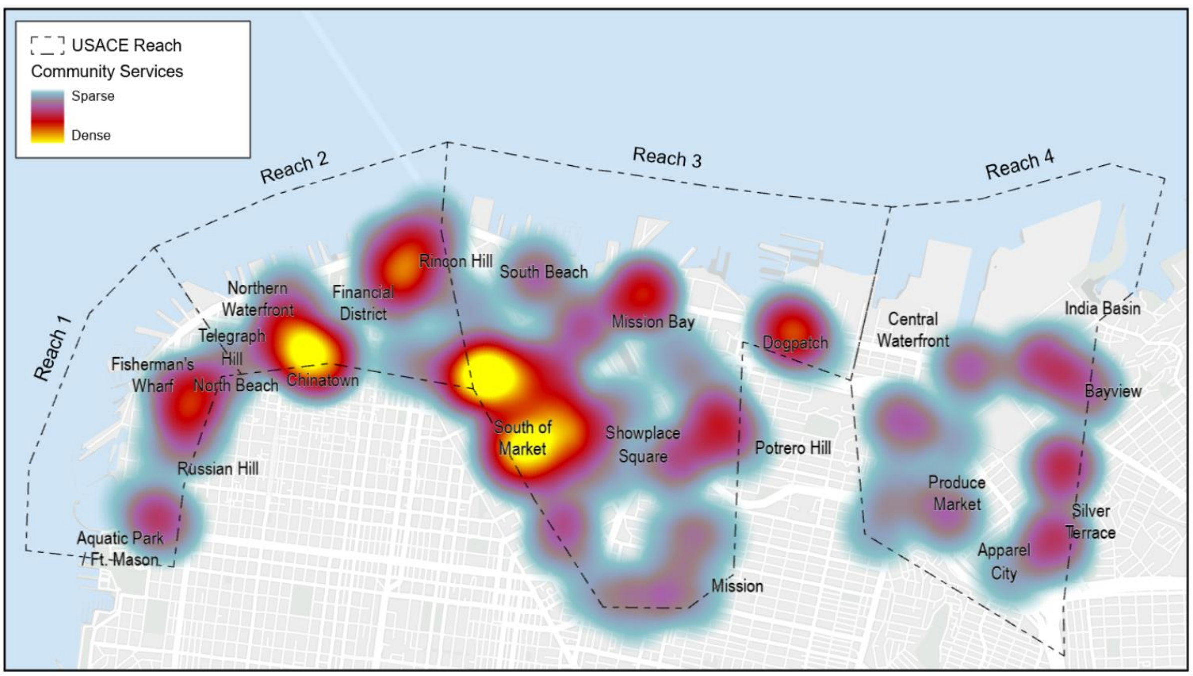
San Francisco is a densely populated city and has many important community-serving facilities, such as schools, libraries, public safety facilities, shelters, community centers, senior housing, and medical facilities. These assets are typically public venues where community members can gather to socialize, participate in recreational or educational activities, gain information, or seek support services. The prevalence of community services indicates a vibrant community and a strong sense of belonging, which can have physical and mental health benefits.

The study area has an abundance of facilities that support community services. Table E.2-4-16 provides the baseline number of such assets, including community centers, fire and police stations, libraries, schools and daycare, shelters, senior housing, and hospitals and clinics. City and County of San Francisco (CCSF). City Facilities, Schools, Health Care Facilities. United States Homeland Infrastructure Foundation-Level Data (HFILD). National Shelters.

Figure E.2-4-11 visualizes a heat map of such facilities, demonstrating that community-serving facilities are concentrated near Fisherman’s Wharf, Pier 70 and Portrero Point, and all throughout Islais Creek.

Table E.2-4-16. Existing Community Service Assets per Reach

Community Service Asset	Reach 1	Reach 2	Reach 3	Reach 4	Total
Community Centers	-	4	8	5	17
Police Stations and Public Safety Facilities	-	-	12	-	12
Fire Stations and Facilities	1	2	7	4	14
Schools and SFUSD Facilities	2	3	4	5	14
Libraries	-	-	2	-	2
Shelters	2	4	5	2	13
Senior Housing	1	2	1	-	4
Hospitals and Clinics	-	1	4	-	5
Total Community Service Assets	6	16	43	16	81



City and County of San Francisco (CCSF). City Facilities, Schools, Health Care Facilities. United States Homeland Infrastructure Foundation-Level Data (HFILD). National Shelters.

Figure E.2-4-11. Concentrations of Community Services

City and County of San Francisco (CCSF). City Facilities, Schools, Health Care Facilities. United States Homeland Infrastructure Foundation-Level Data (HFILD). National Shelters.

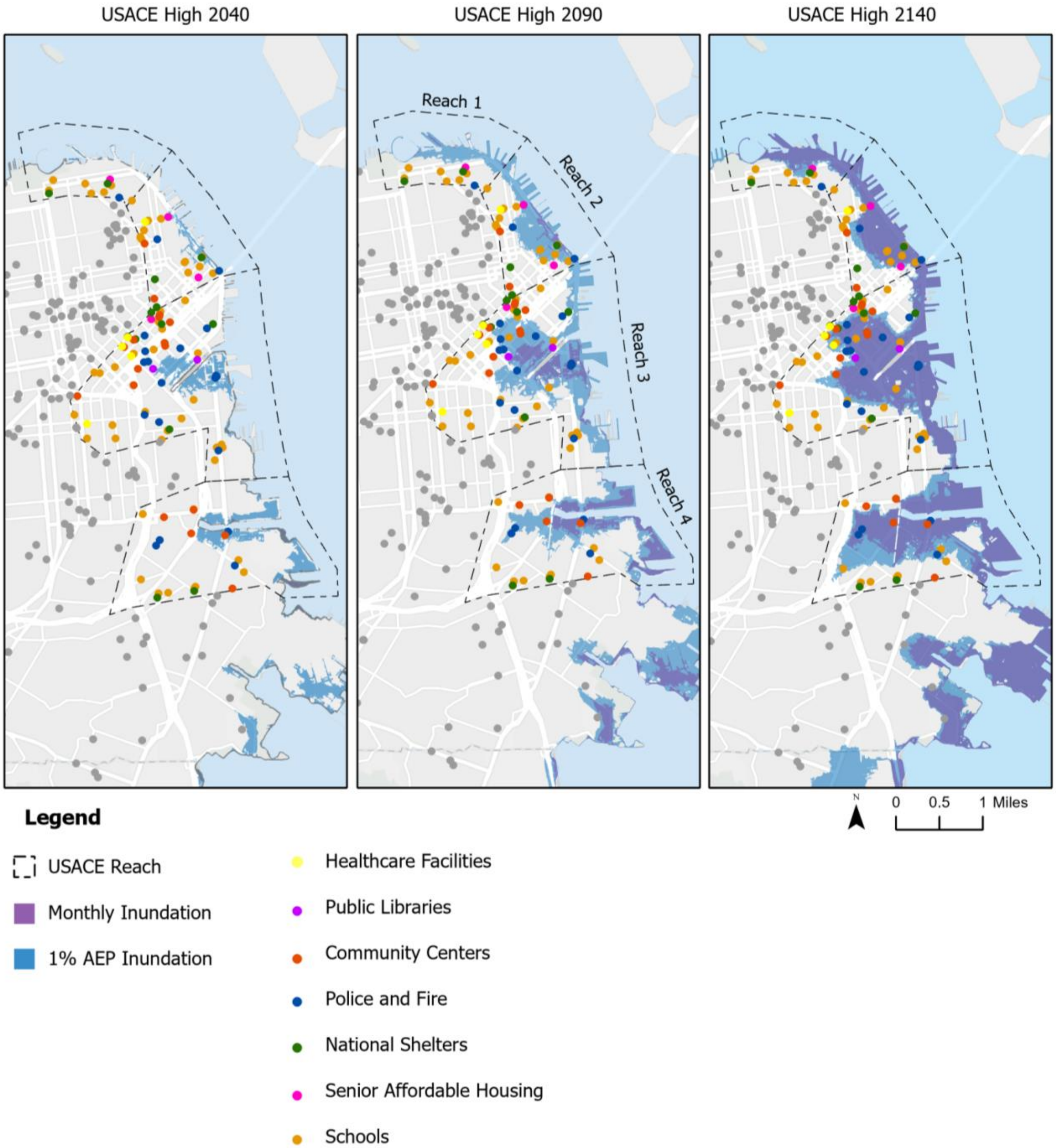
Figure E.2-4-12 below shows the flood exposure of community services in the study area under the High SLC projection. Coastal flood exposure of facilities and services in the waterfront can potentially exacerbate health and safety and social connectedness concerns across the waterfront. For example:

- Police and fire facilities are concentrated in Reach 3. Police and fire assets are exposed to extreme storms as early as 2040, when three of the study area fire stations could be exposed to the 1-percent AEP event under the USACE High Curve. Damage to these facilities could disrupt fire or police services, which frequently receive increased calls for incident response after a major flood event. By 2090, eight of the fire department assets and five of the police department assets in the study area are exposed to the 1-percent AEP event. Monthly flooding may affect accessibility and response times for these services in 2090 as well. Three of the fire assets and one percent of police asset is exposed to monthly flooding in 2090. Roadway flooding may affect ingress and egress from these facilities, and emergency response times from these facilities could be reduced during a monthly flood event.

- Schools and shelters are the most prevalent community service assets in the waterfront. There are approximately 67 schools and shelters across all four reaches. Schools commonly serve as emergency shelters, and both assets are typically information distribution points after a disaster to share recovery updates with the community. School and shelter exposure to the 1 percent AEP event under the High SLC projection remain below 20 percent of the total asset type through 2115. By 2140, fourteen schools and five shelters are exposed to severe flood events. Monthly flooding begins to affect schools and shelters in 2115, but exposure does not exceed 20 percent of total assets during the period of analysis. Impaired access to schools and shelters during this timeframe may affect the ability of nearby residents to seek safety in an incident and may restrict sharing of information.

- Community centers, libraries, and even senior housing facilities are also important day-to-day public facilities that serve educational and recreational purposes. These are the more common gathering places for community social interaction. One community center is exposed to the 1-percent AEP event in 2040; this increases to 27 percent asset type exposure by 2065 for a 1-percent AEP event. By 2115, 41 percent of study area community centers, libraries, and senior housing facilities are exposed to severe storms and coastal flooding. Flood damage repair is not traditionally expedited at these facilities, and long-term disruption while repairs are ongoing could hinder community recovery and resiliency after a flood event. Monthly flooding expected by 2115 may also affect community access to these facilities, and residents may search outside the study area for community gathering areas.

Healthcare facilities such as hospitals and clinics have limited exposure to coastal flooding and sea level rise in the study area.



City and County of San Francisco (CCSF). City Facilities, Schools, Health Care Facilities. United States Homeland Infrastructure Foundation-Level Data (HFILD). National Shelters.

Figure E.2-4-12. Community Services Exposure

E.2-4.4.2 Cultural and Historical Assets

Cultural and historical asset exposure is covered through three data sets: cultural heritage districts, places of worship, and historic assets.

E.2-4.4.2.1 Cultural Heritage Districts

San Francisco has identified specific cultural heritage districts to represent institutions of cultural significance throughout the city. The program aims to preserve and strengthen cultural assets and diverse communities, while also combating gentrification and displacement. San Francisco's Board of Supervisors recognizes several cultural heritage districts, all with unique social and historical associations and living traditions. While they have physical boundaries, the districts are primarily identified by the activities that occur within them, including commerce, services, arts, events, and social practices. A cultural heritage district does not currently hold any regulatory controls; however, the recognition has spurred community efforts facilitated by the Planning Department and the Mayor's Office of Economic and Workforce Development to develop strategies for sustaining the living culture of these places.

Three cultural districts are present in the SFWCFS study area, as shown in City and County of San Francisco (CCSF). 2018. Cultural Districts Program.

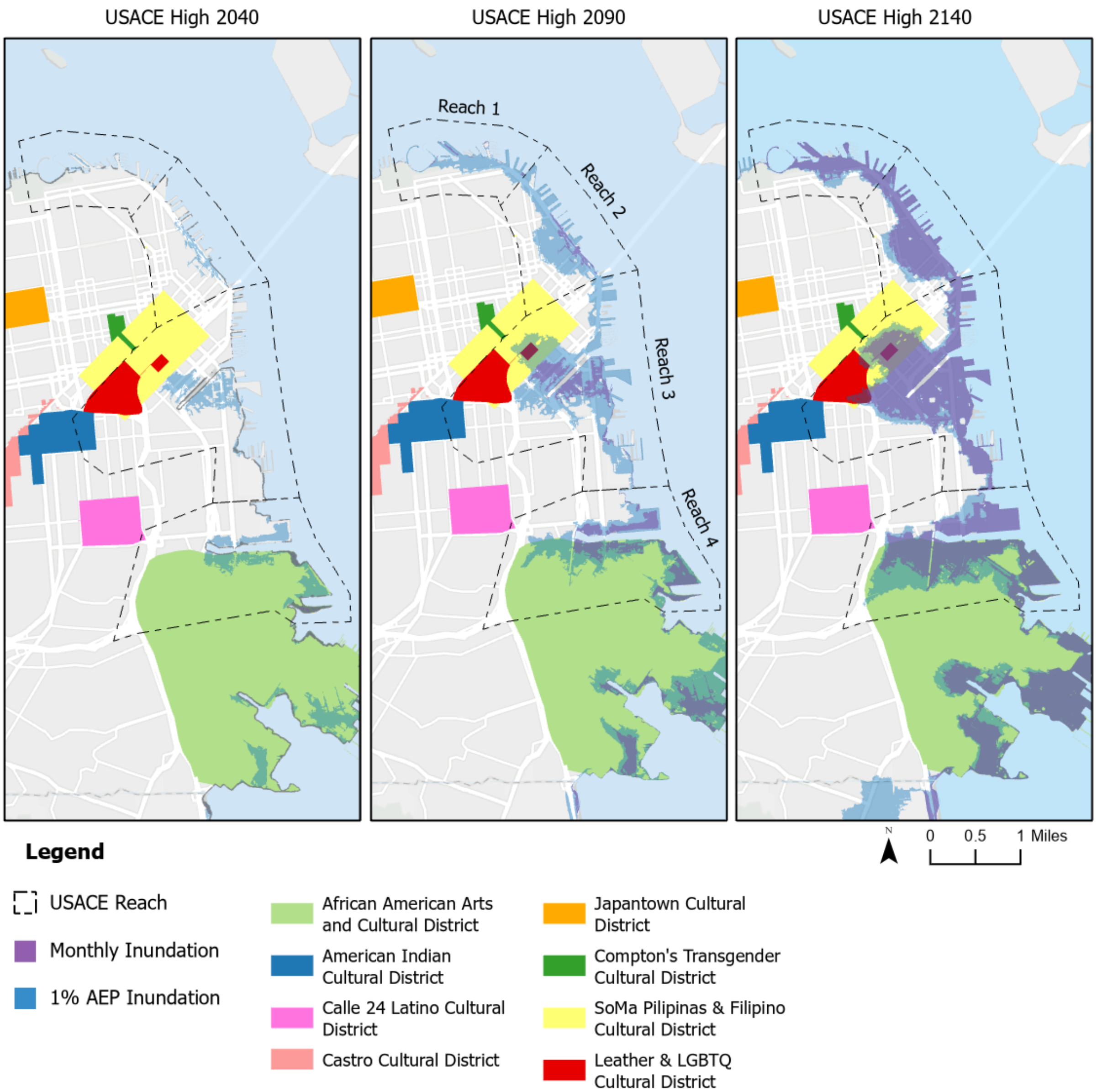
Figure E.2-4-13: the Leather and LBGTQ Cultural District, the Filipino Cultural Heritage District (also known as SoMa Pilipinas), and the African American Arts and Cultural District. The Leather and LBGTQ district is the world's first such district located in the SoMa neighborhood. The district's mission is to create an atmosphere of safety, creativity, vitality, and prosperity for LGBTQ participants, organizations, institutions, and commercial activity and seeks to augment and make sustainable housing, healthcare, commerce, community development, and cultural resources for its community. Home to thousands of Filipino families and seniors, SoMa Pilipinas is also a critical employment hub for Filipinos working in the hospitality, service, and financial sectors. The district is a gravitational cultural center for Filipinos in California, who comprise the largest and fastest growing Asian-Pacific Islander community in a state where 43% of the U.S. Filipino diaspora resides (California Cultural Districts, 2020).

The San Francisco African-American Arts & Cultural District is the largest of the three in the study area, a robust, economically vibrant Black community that adds to the multicultural urban fabric of San Francisco. Its mission is to advance, cultivate, enrich, and advocate for African-American equity, cultural stability, vibrancy, and economic vitality in San Francisco's African-American Arts Cultural District. (San Francisco's African-American Arts Cultural District, 2020).

Portions of the African American Arts and Cultural District may be exposed to coastal flooding and sea level rise as early as 2040 under the High SLC projection (see City and County of San Francisco (CCSF). 2018. Cultural Districts Program.

Figure E.2-4-13). By 2065, the SoMa Pilipinas and Filipino Cultural District and the Leather & LGBTQ Cultural District will also be exposed to the 1 percent AEP event under the USACE High Curve. The tipping point of cultural district exposure is 2090, as the number of acres exposed to the 1 percent AEP more than triples between 2065 and 2090.

Monthly flooding will expose portions of all three cultural districts by 2115. As stated throughout this report, monthly flooding is expected to disrupt critical infrastructure, impede access to emergency and community services, and could prompt permanent relocation of residents and businesses. Relocation and reduced access to community services are exactly the challenges that the districts are intended to address. Monthly flood exposure would decrease the district's ability to protect its community and provide a safe place for celebrating its unique cultural heritage.



City and County of San Francisco (CCSF). 2018. Cultural Districts Program.

Figure E.2-4-13. Cultural Districts in the SFWCFS Study Area

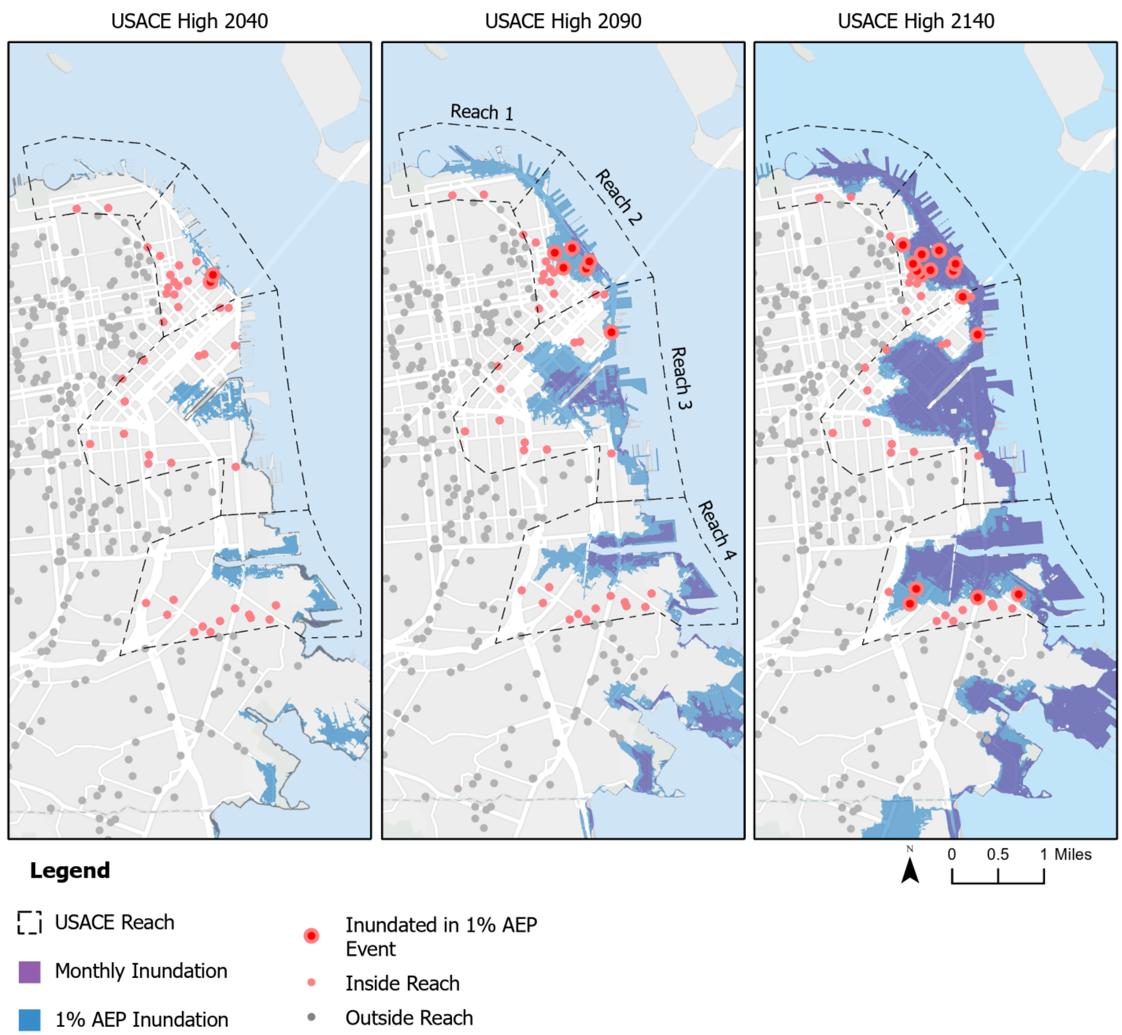
E.2-4.4.2.2 Places of Worship

Places of worship are important cultural assets, and their congregations provide physical infrastructure and complex social networks that can be leveraged for a wide range of issues, including disaster recovery and community resilience. Faith-based organizations can play a role in supporting sheltering, emergency response, and can provide non-traditional mechanisms for delivery assistance such as trauma support. The range of support services can vary from temporary shelter and food donations, to providing a conduit to receiving city-sponsored services (“Role of Faith-Based and Community Organizations in Providing Relief and Recovery Services after Hurricanes Katrina and Rita” n.d.).

There are 52 places of worship in the study area. Assets in United States Homeland Infrastructure Foundation-Level Data. Places of Worship.

Figure E.2-4-14 represent churches, temples, and mosques available for public use. Geographically, places of worship are evenly distributed between Reach 2, 3, and 4. Two assets in Reach 2 (13 percent of the Reach’s places of worship) are exposed to extreme storms as early as 2040 under the USACE High Curve. This jumps to 5 assets exposed to extreme flooding in Reach 2 by 2090, and 9 assets (60% of the Reach’s places of worship) by 2140. Extreme storm exposure in Reach 3 and 4 does not become significant until 2140: 2 places of worship in Reach 3 and 7 in Reach 4 may be exposed to coastal flooding. If any of these assets were damaged by coastal flooding, congregations would likely find alternative space to gather while the structures are being repaired. This could reduce community accessibility to recovery services and community support after an event, depending on where congregations relocate and if transit is disrupted.

Monthly flooding expected under the USACE High SLC projection will affect places of worship in Reach 2 and 3 starting in 2090. Exposure to monthly flooding could also prompt permanent relocation of these places of worship that typically serve as cultural anchors for the community.



United States Homeland Infrastructure Foundation-Level Data. Places of Worship.

Figure E.2-4-14. Distribution of Places of Worship

E.2-4.4.2.3 Historic assets

San Francisco was founded in 1776 when settlers from New Spain established the Presidio of San Francisco at the Golden Gate and Mission San Francisco de Asis a few miles away. The land is part of the ancestral homeland of the Ramaytush Ohlone, the original peoples of the San Francisco Peninsula. Although the American Indian Cultural District was established outside of the SFWCFS study area, the District is working with the Ramaytush to create a Ramaytush Ohlone Waterfront Trail and a cultural and sacred site database to help document and preserve sites throughout the city for the future. There are many areas of historical significance in the study area to note[5]:

- Reach 1: Aquatic Park Historic District; North Point Sewage Treatment Plant Historic District; portions of the San Francisco Cable Car Historic District.
- Reach 2: Northeast Waterfront Historic District; Telegraph Hill Historic District; Jackson Square Historic District; Upper Grant Avenue Historic District; Washington Square Historic District; portions of the San Francisco Cable Car District; New Montgomery-Mission-Second Street Conservation District
- Reach 3: South End Historic District; Bluxome Townsend Historic District; the Western SoMa Light Industrial and Residential Historic District; Union Iron Works Historic District; Third Street Industrial District; Dogpatch Historic District; Midcentury Recreational District
- Reach 4: India Basin Scow Schooner Boatyard; Hunter's Point Commercial Drydock Historic District

There are two nationally recognized historic districts within the Study Area: the Embarcadero Historic District, which begins at Pier 45 in Reach 1 and extends down to Pier 48 in Reach 3, and the Union Iron Works Historic District. The Embarcadero Historic District is the last largely intact historic break-bulk cargo port in the United States. This district and historic structures and sites (including the Port of San Francisco piers, buildings, and bulkhead wharves) are a fundamental part of the San Francisco waterfront's character. One of the most recognizable historical assets at the waterfront is the Port's Ferry Building, originally constructed on a bulkhead wharf and pier in 1903 and was historically used as a ferry terminal. Today, the Ferry Building is still a hub for ferry transportation and includes a public market and offices, as well as an internationally recognized icon and symbol of San Francisco.

Pier 70 is the site of the former Union Ironworks Shipyard on San Francisco's southern waterfront. This area represents the first steel shipyard on the West Coast, first established in 1884. Over the next three decades, the shipyard played an integral role in the United States' efforts to increase naval resources and bolster the nation's image as an international military power. By World War 1, the yard stood at the center of the shipbuilding industry on the West Coast. A crew of mostly skilled laborers produced dozens of warships and submarines that resulted in the United States' overwhelming success in World War I. During World War II, the site was used for ship repair and naval contracts and made a significant contribution to the war. The district now represents a unique collection of buildings from all periods of the steel shipbuilding industry in the United States.

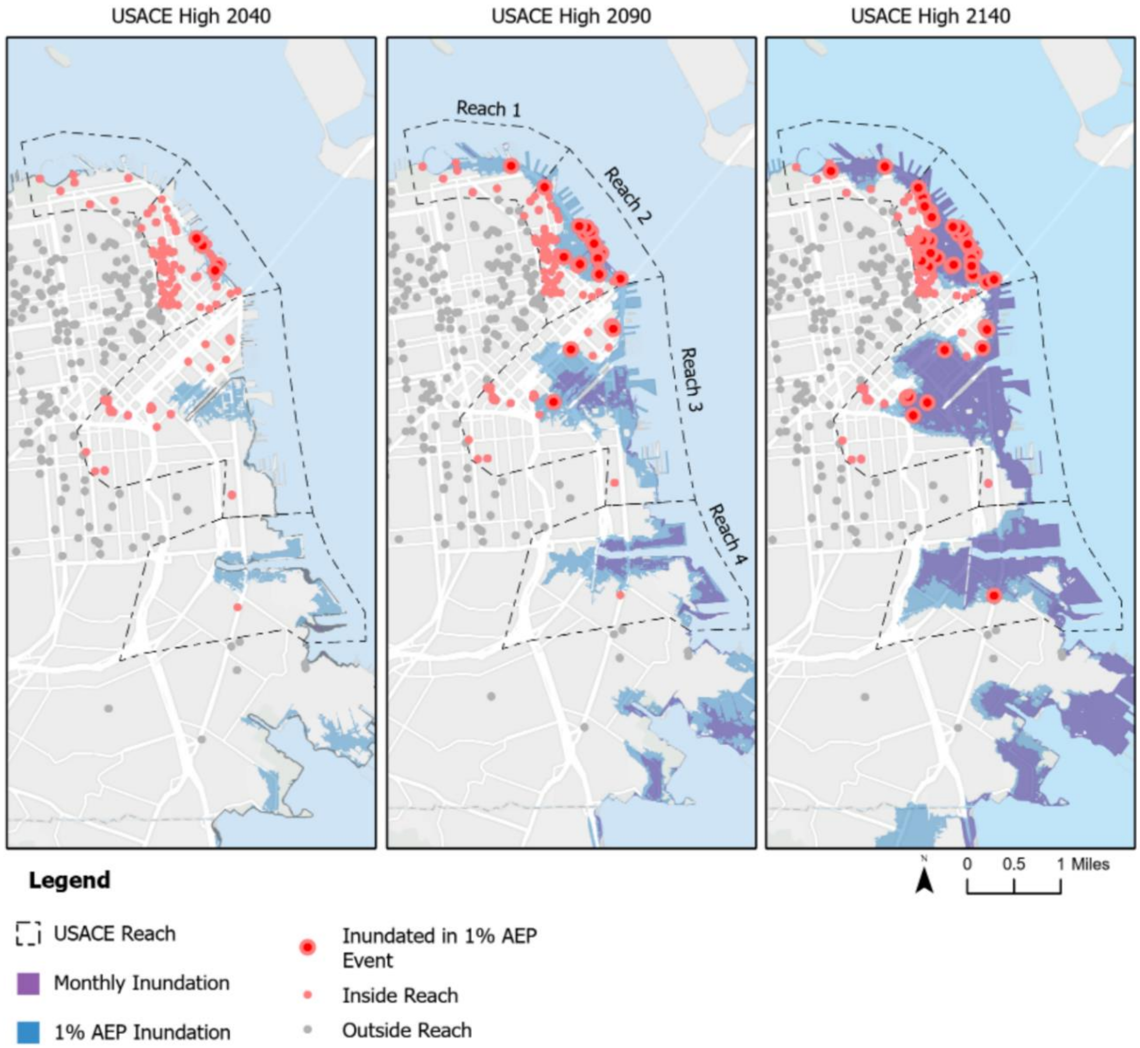
San Francisco Planning. Designated Landmark Registry. California Office of Historic Preservation. National Register of Historic Places.

[5] Districts listed are not a full list of historic districts in the SFWCFS study area. These include districts listed in Articles 10 and 11 of the San Francisco Planning Code and districts listed or eligible for listing in the California Register of Historical Resources and/or the National Register of Historic Places.

Figure E.2-4-15 displays historic assets and landmarks maintained in a registry by the City and County of San Francisco Planning Department. The registry serves to protect, preserve, enhance, and encourage continued utilization, rehabilitation, and adaptive use of significant cultural and historic resources. While this is not inclusive of all contributing historic resources in the Embarcadero Historic District, key structures (such as the Ferry Building) are included.

Historic assets and landmarks are concentrated in Reach 2, specifically near the Ferry Building and the Northeast Waterfront Historic District, which reflects waterfront storage and maritime activities that were an important aspect of San Francisco's working waterfront. There is limited exposure to coastal flooding and sea level rise until 2065, when approximately 12 percent of historic assets and landmarks in the study area are exposed to the 1 percent AEP under the USACE High Curve. This increases to nearly 30 percent exposed assets by 2115, and 51 percent by 2140. Exposure in Reach 2 comprises 70 – 80 percent of total exposed historic and landmark assets in the study area due to the concentration of such assets in the Reach. Monthly flood exposure will not likely affect historic assets until 2115 under the USACE High curve projection. By 2140, nearly 30 percent of total historic and landmark assets in the study area could be exposed to monthly flooding, which could impact asset access and contributing characteristics of historic assets.

Historic assets are a complicated component of floodplain management and flood risk reduction. For example, the National Flood Insurance Program (NFIP) requires that buildings damaged more than 50 percent of their value must be rebuilt in accordance with all applicable building codes. In the floodplain, this means structure elevation and potentially other upgrades that could negate the historic character of the asset. Many urban communities, such as Miami Beach, are developing guidance for protecting historic assets against flood risk. Nevertheless, widespread damage to structures and repetitive flooding could compromise historic district designations, which typically receive tax benefits and can serve as a source of tourism. This is particularly a concern for the Embarcadero Historic District and Union Iron Works District due to their proximity to the Bay.



San Francisco Planning. Designated Landmark Registry. California Office of Historic Preservation. National Register of Historic Places.

Figure E.2-4-15. Distribution of Historic Assets

E.2-4.4.3 Community Identity Findings

Community identity and cultural security are important factors in a social environment and can influence a community's willingness and ability to organize and recuperate from being impacted adversely. Examples of areas with strong community identity are the cultural heritage districts in Reaches 3 and 4; however, study area locations with concentrated community services and historical assets also signify strong community identity. Exposure of these assets and areas to coastal flooding and sea level rise indicates the potential for future community disruption that could threaten an area's ability to organize and continue work supporting communities.

Figure E.2-4-16 shows cultural districts overlaid with concentrations of cultural and historic assets exposed to the 1 percent AEP flood event by 2140 under the USACE High Curve. In addition to the designated cultural districts exposed to coastal flooding in Reach 3 and 4, Reach 2 also contains an exposed focus area of cultural and historic assets.

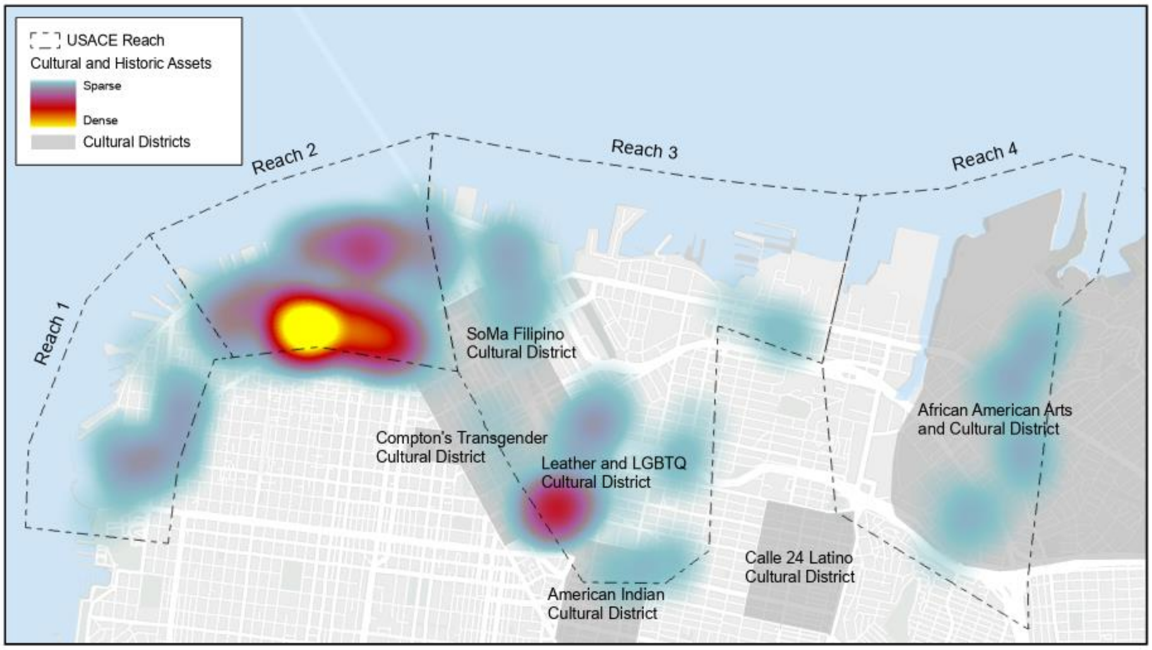


Figure E.2-4-16. Heatmap of Exposed Cultural and Historic Assets, 1 percent AEP by 2040, USACE High Curve

In addition to exposed cultural districts and historic assets, coastal flooding and sea level rise may affect community identity in the SFWCFS in the following ways:

- By 2065 under the USACE High Curve, 21 community service facilities may be exposed to the 1 percent AEP event. This represents 18 percent of all community service assets in the study area, and exposure may affect services provided in community centers, fire stations, libraries, police stations, schools, shelters, and senior housing. Over half of the exposed community service assets are in Reach 3.
- Community service facilities are exposed to monthly flooding by 2090 but reach a tipping point by 2115 under the USACE High curve with 24 facilities exposed (21 percent of all community service assets).

- Police and fire stations have the highest exposure rates across the community service facilities respective to their total presence and are concentrated in Reach 3. This can present challenges in both extreme events and with repetitive flooding. Damage to such facilities in an extreme event can result in disruption of services as damage is repaired, and response times to emergencies may suffer as a result. In the long-term, repetitive flooding can present access issues for both the stations and incident areas, which may require permanent relocation of such assets.
- Fire stations and fire suppression services are critical in the aftermath of an earthquake due to the potential for ruptured gas lines that can start fires. The exposure of these facilities to future coastal flooding and sea level rise is concerning, and assets should be protected. For example, Fire Station 4 and the San Francisco Police Department, including its Headquarters, are in a recently built Public Safety Building on 3rd St and Mission Rock Street in Reach 3, which will be exposed to the 1 percent AEP event in 2040 under the USACE High Curve.

There are many more community facilities in the study area, such childcare facilities, community health care centers and others, which could be examined further. However, the exposure analyzed herein illustrates that facilities and places that are vital to local community identity and resilience could be threatened and directly impacted by coastal flooding and sea level rise. Residents who are dependent on the array of services and community-oriented relationships that are supported by these facilities may seek such support elsewhere in a changing flood risk environment. Table E.2-4-17 below summarizes the potential exposure and consequences of coastal flooding and sea level rise in the study area as it relates to community identity.

Table E.2-4-17 Community Identity Findings and Tipping Points, USACE High Scenario

Time Horizon	2040	2065	2090	2115	2140
Reach 1	No exposure of community service assets, places of worship, historic places and landmarks to the 1% AEP event or monthly flooding.	No change from 2040.	No exposure of community service assets or places of worship to the 1% AEP event or monthly flooding. One historic asset is exposed to 1% AEP.	No change from 2090.	Two out of 10 community service assets are exposed to the 1% AEP event: 1 shelter and 1 senior housing building. Three historic places and landmarks are exposed as well (again out of 10). Disruption to community identity will likely be minimal.
Reach 2	One school and 1 shelter are exposed to 1% AEP event (out of 28 total). Two out of 15 places of worship are exposed, and 5 out of 31 historic assets are exposed to the 1% AEP event. No monthly flood exposure.	Five total community assets are exposed, plus 2 places of worship and 14 historic places and landmarks are exposed to the 1% AEP event. No monthly flood exposure.	Eight total community assets are exposed (5 are schools), plus 5 places of worship and 16 historic places and landmarks are exposed to the 1% AEP event. Two places of worship and 5 historic places and landmarks are exposed to monthly flooding. These assets may be permanently relocated due to repetitive flooding.	*2115 represents a tipping point of historic place and landmark exposure in Reach 2. Ten total community assets are exposed (35% of the Reach total), plus 5 places of worship and 28 historic places and landmarks (31% of Reach total) are exposed to the 1% AEP event. Six community assets are exposed to monthly flooding, half are schools. Four places of worship and 14 historic places and landmarks are also exposed to repetitive flooding. Monthly flooding may prohibit access and regular use of these facilities and begin to impact community identity.	Eleven total community assets are exposed, plus 9 places of worship (60% of the Reach total) and 54 historic places and landmarks (60% of Reach total) are exposed to the 1% AEP event. Nine community assets are exposed to monthly flooding, including both fire stations in the Reach. Fire response to incidents may be delayed due to limited access from repetitive flooding. Five places of worship and 25 historic places and landmarks are also exposed to monthly flooding and could be permanently relocated.

Time Horizon	2040	2065	2090	2115	2140
Reach 3	Four community service assets (3 fire stations and 1 police station) are exposed to the 1% AEP event. This represents 28% of fire and police assets in the reach. Emergency services may be disrupted after an event without support from other areas in the city. No places of worship or historical assets are exposed to either 1% AEP or monthly flooding.	*2065 represents a tipping point in Reach 2 as multiple assets that represent cultural and community identity are exposed to extreme flooding. A strong community identity can support recovery, but there may be limited sites available for community gatherings after an extreme flood event. The SoMa Pilipinas Filipino Cultural District and the Leather & LGBTQ District are partially exposed to the 1% AEP event. Thirteen community service assets are exposed, including 2 community centers, 4 fire stations, 1 library, 4 police stations, and 2 schools. One place of worship and 2 landmarks are also exposed.	The exposed acreage of SoMa Pilipinas Filipino Cultural District nearly doubles for a 1% AEP event from 2065. Fifteen community service assets are exposed to the 1% AEP event (25% of the Reach total). This includes over half of the fire stations and police stations in the reach. Five historic places and landmarks are also exposed. Monthly flooding may regularly affect services provided by 3 fire stations and 1 police station in the reach.	The exposed acreage of SoMa Pilipinas Filipino Cultural District nearly doubles again from the 2090 1% AEP event to the 2115 1% AEP event. The Leather & LGBTQ District exposure grows incrementally from 2090 1% AEP event and now reaches 17 acres. Both districts now have areas that are exposed to monthly flooding that could impact access and current uses in the area. Twenty-two community service assets are exposed to 1% AEP event; 14 of which are also exposed to monthly flooding. This includes two community centers, four fire stations, one library, five police stations, and two schools. One place of worship and 4 historic assets are also exposed to monthly flooding. It is likely that community identity in Reach 3 would shift as such assets are relocated or land uses change to accommodate flooding.	Over 180 acres of the SoMa Pilipinas Filipino Cultural District is exposed to the 1% AEP event, and nearly 40 acres of the Leather & LGBTQ Cultural District is also exposed. Significant acreage of both districts will experience repetitive flooding: 109 and 15 acres, respectively. Half of the community service assets in Reach 3 will be exposed to the 1% AEP event. Twenty of these are exposed to monthly flooding, including five fire stations, six police stations, and four schools. Once place of worship is exposed to monthly flooding, and 8 historic places and landmarks.

Time Horizon	2040	2065	2090	2115	2140
Reach 4	Exposure to the 1% AEP event is limited in Reach 4, except for portions of the African American Arts and Cultural District and one community center.	Over 550 acres of the African American Arts and Cultural District is exposed to the 1% AEP event, along with 2 community centers and 1 fire station. No places of worship or historic assets are exposed to flooding.	*2090 represents a tipping point in Reach 4 as monthly flooding affects a significant portion of the African American Arts and Cultural District (283 acres). Repetitive flooding is likely to change the community character and identity of the reach given the extent of exposure. Five community service assets are exposed to the 1% AEP; 1 community center is exposed to monthly flooding.	Over 1,000 acres of the African American Arts and Cultural District are exposed to the 1% AEP event, including 5 community assets, 1 place of worship, and 1 historic landmark. Monthly flooding will continue to impact significant acreage of the cultural district in Reach 5 (653 acres) and two community centers and two fire stations.	Minimal change in exposure of community identity assets except for the extent of flooding expected in the African American Arts and Cultural District for the 1% AEP and monthly flood events: 1304 and 965 acres, respectively.

E.2-4.5 Social Vulnerability

Not all residents of San Francisco will suffer climate change related health impacts evenly (SFDPH, 2017a). The degree to which a person is sensitive to climate exposures depends largely on established social, political, environmental, or economic inequalities. Factors that can exacerbate the impact of flooding and related health outcomes include socioeconomic factors and demographics such as age, race, income, and pre-existing health conditions; environmental factors such as tree cover and air pollution; exposure to pollution; infrastructure factors such as housing quality and overcrowding; access to neighborhood goods and services; and mobility capabilities (SFDPH, 2017a).

This section identifies vulnerable populations exposed to coastal flooding and sea level rise in the SFWCFS area using eight socioeconomic and demographic indicators. The different metrics used to describe the presence of vulnerable populations and their particular challenges related to flood exposure are introduced in Table E.2-4-18. The metric descriptions are derived from San Francisco’s Department of Public Health’s report on San Francisco’s Vulnerability to Flooding & Extreme Storms (SFDPH, 2016); however, data has been updated to reflect 2019 American Community Survey information available at the census block level.

Table E.2-4-18. Social Vulnerability Indicator Descriptions

Indicator	Description
Residents <18 years Old	Children (residents under 18 years of age) are vulnerable to both direct and indirect impacts of flood inundation and extreme storms. Very young children develop respiratory illness, malnutrition, exhaustion more easily, and require specialized items such as formula or diapers. Research has shown that children are particularly vulnerable to mental health stressors. Families supporting children are at additional risk for income loss and may require public assistance or resources to recover from a hazard event (SFDPH, 2016a).
Residents >65 years Old	Elderly residents are especially vulnerable to the health and social impacts of flood inundation. Residents over 65-years-old comprised nearly half of the deaths during and immediately after Hurricane Sandy. Elderly populations have been identified to be at increased risk of respiratory illness, foodborne and waterborne disease, and health impacts associated with power outages. They often depend on help under normal conditions and can become critically dependent during flood events and associated consequences (SFDPH, 2016a).
Minority (Non-white)	Because of historic and current economic, social, and political systemic inequities, populations of color are more likely to suffer from pre-existing health conditions, live in poor quality housing in high hazard exposure zones, and lack the political access and economic resources to prepare for and recovery from flood hazard events (SFDPH, 2016a).
Poverty Level Individual Below 200% of Poverty Level	Financially insecure households often lack the resources necessary to prepare for, mitigate, or recover from the health impacts of flood events. This population is more likely to be uncaptured by the health network and be hospitalized for preventable conditions (SFDPH, 2016a).

Indicator	Description
Individuals with High School Degree or Equivalent	Educational attainment is correlated with health, income, and resilience. Completion of formal education (e.g., high school) is a key pathway to employment and access to healthier and higher paying jobs that can provide food, housing, transportation, health insurance, and other necessities for a healthy life. (CDPH)
Linguistic Isolation	Linguistically isolated households are households in which no one 14 and over speak English only or speaks a language other than English at home and speaks English very well. Linguistic isolation may hinder protective behaviors during extreme weather and disasters by limiting access to or understanding of health warnings. Additionally, natural disasters and extreme weather can lead to disruptions to management of chronic conditions for people who are socially or linguistically isolated. (CDPH)
Households with Disability	Populations with physical or mobility disabilities are particularly dependent on local resources and services, and vulnerable to any disruption to those services. Analysis into the health impacts of Hurricane Sandy found this population to be highly correlated with income, age, social isolation, and poor housing quality (SFDPH, 2017a).
Single Parents	Single parent families were found to be more vulnerable due to resource availability and difficulties coping with disruptions to long-term care and services. (Green, 2007)

E.2-4.5.1 Vulnerable Population Exposure

A key component of an equitable planning process is understanding how coastal flooding and sea level rise may differentially impact communities especially if they exhibit characteristics of social vulnerability. Socially vulnerable populations often live in the highest-risk locations, including occupying substandard housing or unhoused, have relatively fewer resources to prepare for a flood, and lack the knowledge or social and political connections necessary to access resources that would speed their recovery (IWR, 2013). California has been at the forefront of equity-based planning and was one of the first states to codify environmental justice in statute. There are many state and regional databases and mapping platforms available for the San Francisco Bay Area to document areas with social vulnerability and environmental justice challenges, including the following:

- Bay Conservation and Development Commission (BCDC) Social Vulnerability Index:[6]
    - Regional-scale tool to understand community vulnerability to current and future flooding
    - Data source: American Community Survey; Block group scale
- CalEnviroScreen:[7]

[6] https://data.ca.gov/dataset/community-vulnerability-bcdc-20201

[7] https://oehha.ca.gov/calenviroscreen

  - State-wide tool to identify California communities that are most affected by various types of typically airborne pollutants
  - Data source: American Community Survey; Census tract scale
- Metropolitan Transportation Commission (MTC) Equity Priority Communities:[8]
  - Regional-scale tool to guide funding toward historically underserved communities
  - Data source: American Community Survey; Census tract scale

Each social vulnerability platform has pros and cons for use. For example, the BCDC social vulnerability index does not prioritize race and income as factors, while the geographic scale of the CalEnviroScreen tool is not granular enough to distinguish small pockets of vulnerable and disproportionately burdened Bay Area communities. The OSE analysis elected to use two datasets to inform vulnerable population exposure in the SFWCFS area: the MTC Equity Priority Communities, supplemented with American Community Survey data available at the block group level. This approach allows the Project Delivery Team (PDT) to perform automated exposure analysis to easily identify benefits to socially vulnerable populations for various project alternatives.

E.2-4.5.1.1 MTC Equity Priority Communities

Formerly called "Communities of Concern," Equity Priority Communities are census tracts that have a significant concentration of underserved populations in the Bay Area, such as households with low incomes and people of color. The Equity Priority Communities framework helps MTC make decisions on investments that meaningfully reverse the disparities in access to transportation, housing, and other community services. The Equity Priority Community dataset is based upon eight demographic variables: people of color, low-income, limited English proficiency, seniors 75 years and older, zero vehicle households, single parent families, people with a disability, and rent-burdened households. Each variable has a set threshold value and if the census tract population exceeds the threshold values, it is determined as an equity priority community. MTC organized the communities into three levels of priority community classes, with the priority level based on the percentages of demographic variables for the census tract. Figure E.2-*4-17* shows the Equity Priority Communities identified in San Francisco, displayed in pink and green. Six sub-areas in the SFWCFS study area meet the MTC Equity Priority Community criteria: Fisherman's Wharf (Reach 1), portions of the NE Waterfront and Ferry Building sub-areas (Reach 2), portions of Mission Creek (Reach 3), and Pier 94-96 and Heron's Head in Reach 4.

[8] https://mtc.ca.gov/planning/transportation/access-equity-mobility/equity-priority-communities

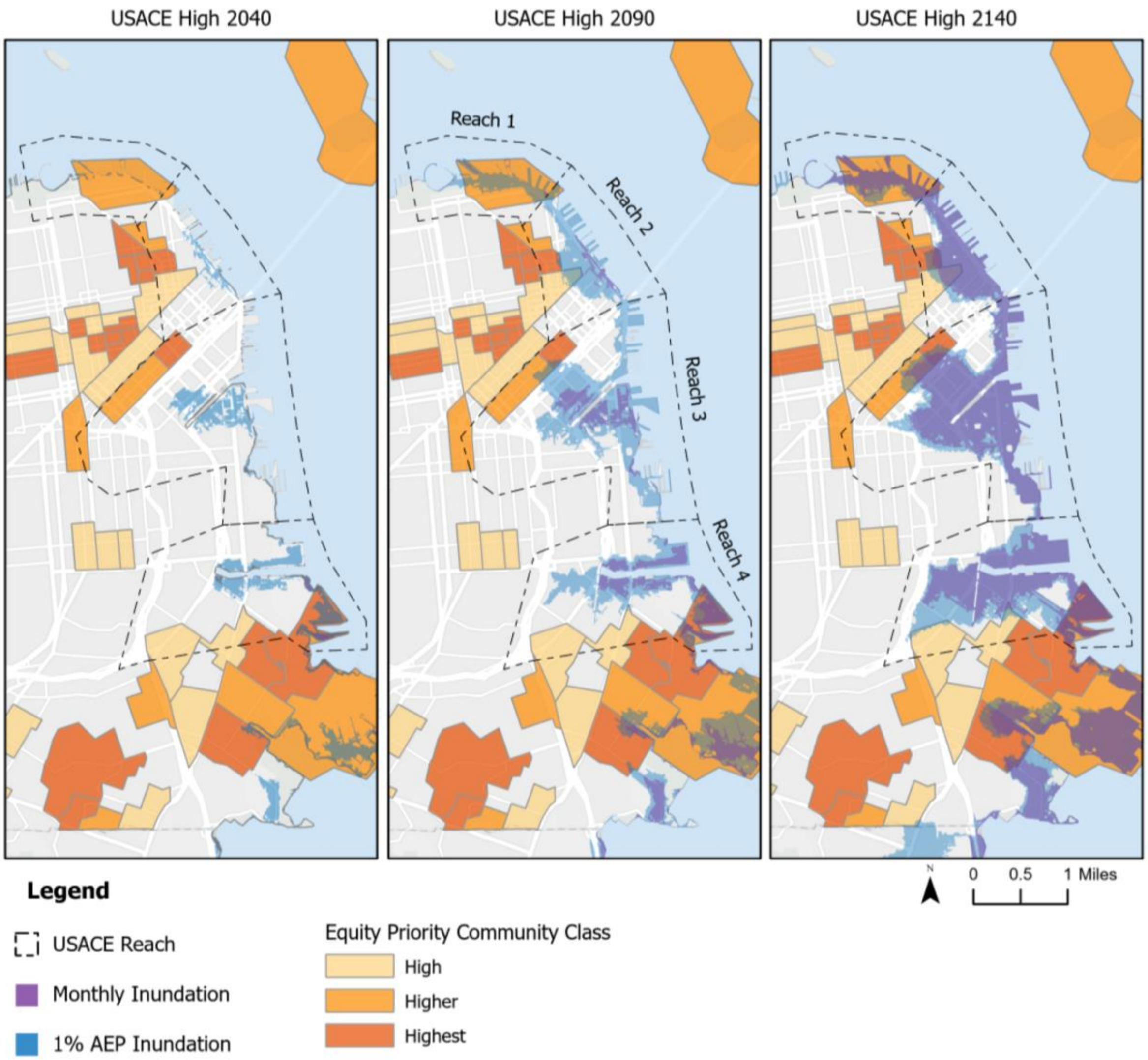


Figure E.2-*4-17*. MTC Equity Priority Communities in the SFWCFS

Table E.2-4-19. Equity Priority Community Population Exposure in a 1% AEP Flood Event, USACE High Curve

	Reach 1	Reach 2			Reach 3		Reach 4	
Equity Priority Community Class	**Higher**	**High**	**Higher**	**Highest**	**Higher**	**Highest**	**High**	**Highest**
Total Population	3,714	882	2,189	3,198	7,000	3,448	5,809	2,225
2040	134	1	0	0	0	0	0	494
2065	959	102	10	0	321	131	0	608
2090	1,906	222	162	301	572	362	40	796
2115	2,404	338	178	1,026	1,278	805	204	871
2140	2,805	443	178	1,762	2,135	1,396	727	902

There are communities in every reach at risk of flooding with a 1-percent AEP flood event. Table E.2-4-19 shows 1-percent AEP flooding in 2040, 2090, and 2140 overlaid with the equity priority communities. The priority levels are high, higher, and highest. A higher priority community in Reach 1 faces significant flooding by 2090, exposing 2,805 (76%) people by 2140; the highest demographic variables in this community are people of color (52%) and zero vehicle households (48%). One of the highest priority communities in the SWFRS, located by Heron’s Head in Reach 4, faces the highest and earliest risk of exposure. Over 105 acres and 902 (41%) people of this community in Reach 4 are at risk of flooding by 2140 and is composed of 96% people of color, 69% low-income, and 57% single parents. Reach 2 and 3 each have one designated highest priority community. Figure E.2-*4-19* shows exposed population counts for all three priority classes in each reach. Reach 3 faces the greatest exposure to these vulnerable communities with 3,530 people at risk of exposure with a 1-percent AEP flood event by 2140. Table E.2-4-20 presents the extent of flooding in the highest priority communities and the demographics in each community.

Table E.2-4-20. Highest Priority Community Exposure by 2140, USACE High Curve

Reach	Flood Exposure (acres)	Over 75	People of Color	Single Parent	Limited English Proficiency	Low Income	Disabled	Rent-Burdened	Zero Vehicle Household
2	22.3	14%	96%	7%	64%	72%	15%	27%	80%
3	20.2	37%	69%	0%	37%	49%	34%	4%	71%
4	104.8	3%	96%	57%	6%	69%	9%	16%	24%

E.2-4.5.1.2 American Community Survey 2019 Socioeconomic Indicators

ACS data is the common denominator across nearly all federal, state, and regional social vulnerability and environmental justice dashboards. This census data is available at the census block level for most of the eight social vulnerability characteristics analyzed in the OSE report: residents under 18, residents over 65, minority populations, people living in poverty, limited English-speaking households, households with disabilities, and single parent households. Note that when reviewing this data, one person can exhibit multiple vulnerability characteristics, and the percentage of exposed populations is therefore not additive.

Figure E.2-4-18 shows the percentage of vulnerable populations exposed to the 1-percent AEP event by 2140, under the USACE High Curve scenario. One can see that the distribution of exposed populations is nearly equivalent under all eight characteristics and ranges between 33 and 40 percent, with a trend towards minority populations. Minority populations experience the most exposure across the waterfront consistently across all time horizons, although at a lower exposure rate than shown in Figure E.2-4-18. The percentages compare exposed people with specific vulnerability characteristics to the total vulnerable population with that characteristic. For example, 40 percent of the total SFWCFS minority population is exposed to the 2140 1-percent AEP event and 39 percent of elderly populations are exposed to extreme storms.

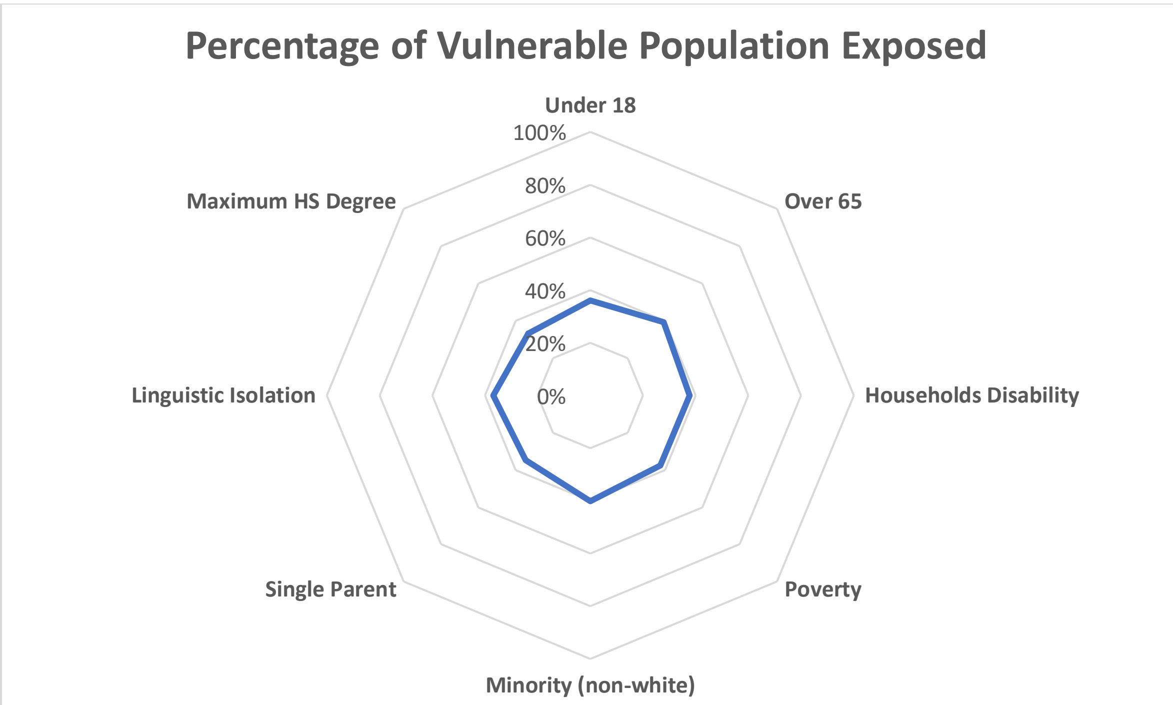


Figure E.2-4-18. Distribution of Vulnerable Population Exposure Expected by 2140, 1% AEP Event, USACE High Curve.

Note: first interior circle represents 10%.

Table E.2-4-21 shows the range in percentage of vulnerable populations exposed to the 1 percent AEP event under various time horizons expected with the USACE High Curve. The top two exposed social vulnerability characteristics under each time horizon consistently include minority populations, with the exception of 2040. The variation in characteristics can be explained by the progression of flood exposure to various neighborhoods. For example, the SoMa Pilipinas Cultural District begins to experience significant exposure to extreme flood events beginning in 2090, which may explain the increase in linguistic isolation characteristic.

Table E.2-4-21. USACE High Curve Range of Exposed Socially Vulnerable Population Percentages

Time Horizon, 1% AEP	Percentage Vulnerable Population Exposed	Top 2 Social Vulnerability Characteristics
2040	4 – 9 %	Single Parent, Under 18
2065	14 – 18%	Single Parent, Minority
2090	22 – 26%	Minority, Linguistic Isolation
2115	27 – 33%	Minority, Linguistic Isolation
2140	33 – 40%	Minority, Over 65

Figure E.2*-4-19* shows the distribution of exposure statistics for each social vulnerability characteristic across each of the four SFWCFS Reaches. Overall, the exposed vulnerable population estimates are somewhat consistent within a Reach once residents are exposed, with some outliers. For example, Reach 1 vulnerable population exposure rates for the 1% AEP by 2140 are between 15 and 40 percent, with trends toward single parent and disabled household characteristics. Reach 2 and 3 have similar vulnerable population exposure statistics ranging from 36 to 54 percent. Vulnerable characteristic exposure in Reach 2 trends towards single parent and elderly populations and Reach 3 exposure leans towards minority and linguistically isolated communities. Reach 4 residential population exposure is limited in general, with 8 to 22 percent of vulnerable populations exposed. Single parent exposure is the dominant social vulnerability characteristic exposed in Reach 4.

Figure E.2*-4-20* shows comparison maps for four social vulnerability exposure statistics at the block group level (top, left to right): under 18, minority, over 65, and poverty. The maps use a 5-class natural breaks classification scheme for each characteristic. While the breaks change under each vulnerability characteristic, the natural breaks uses a consistent method to minimize variance and maximize differences within the data at the block group level. Note that the remaining three social vulnerability characteristics reviewed (linguistic isolation, disability, and single parent households) are not shown in the figure but follow the same general patterns of concentrations. This is verified by Figure E.2*-4-19*.

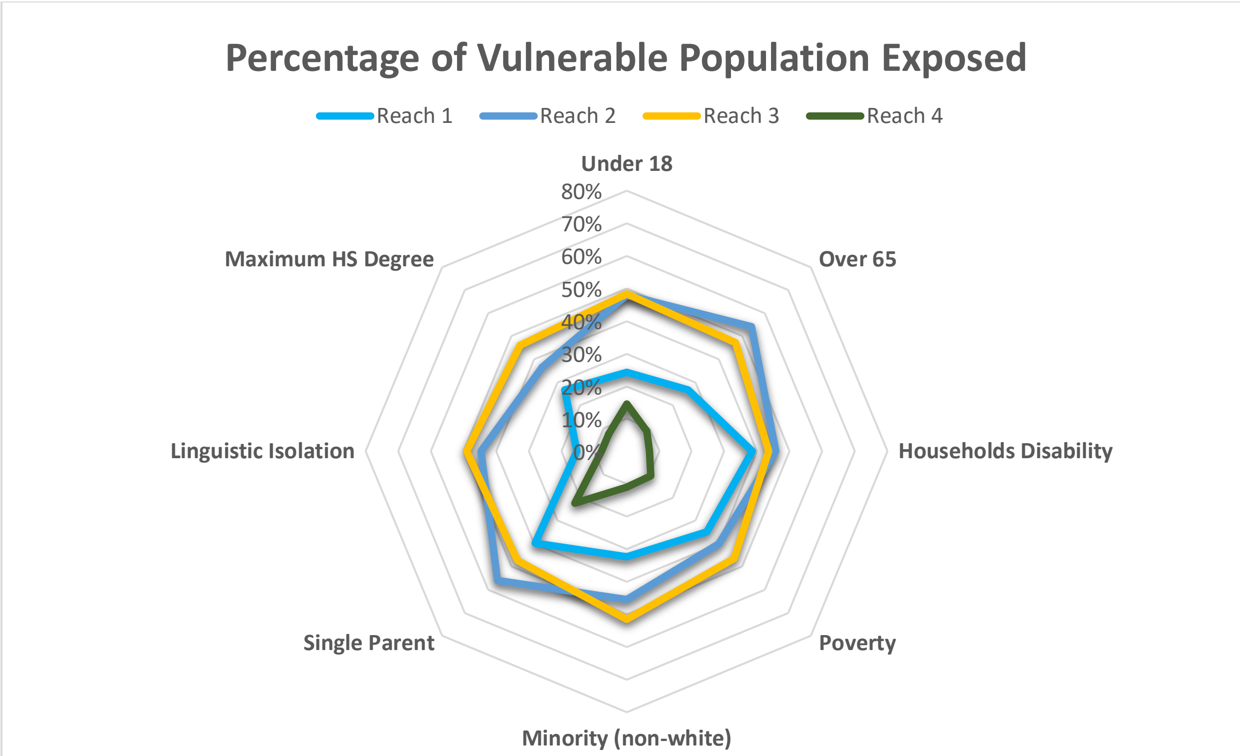
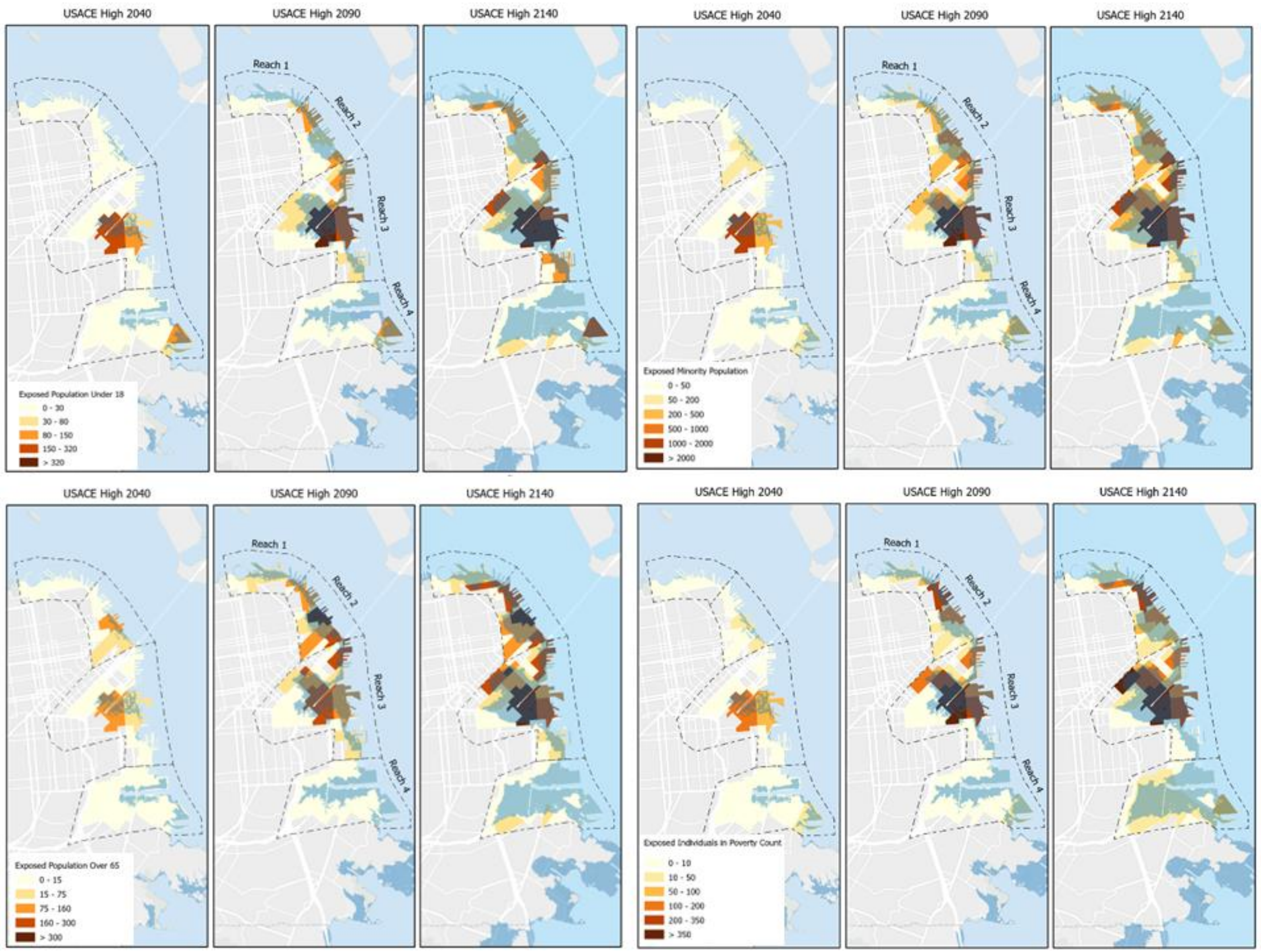


Figure E.2-*4-19*. Distribution of Vulnerable Population Exposure Expected by Reach by 2140, 1% AEP Event, USACE High Curve



From top left: Exposed Population Under 18; Exposed Minority Population. From bottom left: Exposed Population Over 65; Exposed Individuals in Poverty.

The MTC Equity Priority Communities data highlighted the following SFWCFS sub-areas: Fisherman's Wharf (Reach 1), portions of the NE Waterfront and Ferry Building (Reach 2), portions of Mission Creek (Reach 3), Pier 94 – 96, and Heron's Head in Reach 4.

The ACS data (see left) validates that in addition to Mission Creek (which contains the Pilipinas Cultural District and the Leather & LGBTQ Cultural District), Mission Rock, and Mission Bay also contain significant vulnerable populations, as all four characteristics show a concentration of vulnerable population exposure as early as 2040.

By 2090, The NE waterfront and Ferry Building sub-area in Reach 2 begins to demonstrate a slight concentration of exposed populations under 18, over 65, and in poverty. Additionally, South Beach (Reach 3) shows above-averaged concentrations of exposed populations across all four statistics.

Exposure to additional characteristics, linguistic isolation and disability, follow similar trends to minority and poverty characteristics shown in these maps. Single parent exposure throughout the period of analysis is concentrated in Mission Creek (Reach 3), Pier 94 – 96 and Heron's Head in Reach 4.

2140 exposure statistics begin to show the socioeconomic population trends explored to identify MTC Equity Priority Communities. These scenarios highlight Fisherman's Wharf, the NE Waterfront and Ferry Building, and Mission creek.

Figure E.2-*4-20*. Vulnerable Population Exposure Counts Expected by Reach by 2140, 1% AEP Event, USACE High Curve

E.2-4.5.2 Social Vulnerability Findings

Rufat et. al. (2015) conducted a meta-analysis of 67 flood disaster case studies to identify the leading demographic, health, and socioeconomic characteristics that exacerbate vulnerability to flooding. This comprehensive study determined that age, race, recent immigration status, and single parent families are among the leading demographic drivers of social vulnerability. It is critical to consider social vulnerability as part of plan formulation; any plan developed should account for ways to not only mitigate impacts to socially vulnerable communities, but also provide these communities with resources and community benefits. A number of residents living in the SFWCFS area are likely to bear multiple social and demographic characteristics that exacerbate vulnerability to flooding, such as the following:

Reach 3 and Reach 4 contain the highest concentration of residents that exhibit social vulnerability characteristics. Additionally, coastal flooding in Reach 3 will expose vulnerable populations earlier than in the other reaches. Reach 3 consistently has the highest exposed vulnerable populations across all indicators and time horizons. The 1-percent AEP event in 2140 could directly affect vulnerable populations in Mission Creek (Reach 3), particularly minority (51 percent) and linguistically isolated populations (49 percent). Over 42 percent of the minority population, 35 percent of residents in poverty, and 40 percent of linguistically isolated residents in Reach 3 could experience monthly flooding by 2140. Residents possessing these social vulnerability characteristics are less likely to be able to navigate and access emergency services due to potential language barriers, which would compound recovery and a return to normal for the communities residing in the area. Monthly or more frequent flooding will also result in profound consequences for residents that are reliant on the very limited affordable housing stock available in the SFWCFS area.

With a 1-percent AEP event in 2140, vulnerable populations in the Financial District, Chinatown, and North Beach neighborhoods (Reach 2) will also be directly exposed to coastal flooding. Reach 2 residents directly exposed to flooding will include the elderly (54 percent) and children (48 percent); the number of children exposed is particularly relevant, as the highest indicator exposed in Reach 2 is the single parent population (56 percent). These social vulnerability characteristics considered in tandem imply that mobility could be a significant challenge. Mobility is key during flood events, from evacuation to accessing services post-event.

The Bayview/Hunters Point neighborhood in Reach 4 contains some of the highest concentrations of vulnerable populations, although significant direct exposure of residential areas to coastal flooding is not expected by a 1-percent AEP event in 2140. However, indirect socioeconomic impacts to the Reach 4 community are also possible due to the exposure and potential disruption of important connecting transportation infrastructure for these vulnerable communities to the rest of the city.

Table E.2-4-22 provides social vulnerability findings and tipping points in the SFWCFS area for a future-without-project condition expected under the USACE High Curve.

Table E.2-4-22 Social Vulnerability Findings and Tipping Points, USACE High Curve

Time Horizon	2040	2065	2090	2115	2140
Reach 1	Limited vulnerable population exposure expected with 1% AEP and monthly flooding (less than 5% of vulnerable population exposed).	10% of households with disabilities, 10% of single parent households in the Reach exposed to the 1% AEP event. Limited monthly exposure of vulnerable populations (less than 5% of vulnerable population exposed).	16% of households with disabilities, 14% for residents in poverty, minorities, and single parents exposed to the 1% AEP event (based on total vulnerable populations in the Reach). Limited monthly exposure of vulnerable populations (less than 5% of vulnerable population exposed).	*2115 represents a tipping point for Reach 1, as monthly flooding begins to affect vulnerable populations. 25% of households with disabilities, 24% of single parents, 23% of residents in poverty, 22% of minorities exposed to the 1% AEP event. 14% of households with disabilities, 12% of residents in poverty, minorities, and single parents exposed to monthly flooding. Permanent relocation of these populations will likely cause severe distress.	40% of single parents and 39% of households with disabilities, 35% of people in poverty exposed to the 1% AEP event. 21% of households with disabilities, 19% of residents in poverty and single parents exposed to monthly flooding.

Time Horizon	2040	2065	2090	2115	2140
Reach 2	7% of elderly, 5% of linguistically isolated, 5% of minorities and households with disabilities exposed to the 1% AEP event. Limited monthly exposure of vulnerable populations (less than 5% of vulnerable population exposed).	30% of elderly, 23% of households with disabilities exposed to the 1% AEP event. Limited monthly exposure of vulnerable populations (less than 5% of vulnerable population exposed).	40% of elderly, 36% of single parents, 33% of households with disabilities exposed to the 1% AEP event. 5% of elderly exposed to monthly flooding.	*2115 represents a tipping point for Reach 2, as monthly flooding begins to affect vulnerable populations at a much higher rate. 48% of elderly and single parents, 42% of children exposed to the 1% AEP event. 36% of elderly, 30% of single parents, 27% of children exposed to monthly flooding.	56% of single parents, 54% of elderly and 48% of children exposed to the 1% AEP event. 47% of elderly and 46% of single parents exposed to monthly flooding.
Reach 3	11% of single parents and 10% of children exposed to the 1% AEP event. Limited monthly exposure of vulnerable populations (less than 5% of vulnerable population exposed).	26% of single parents, 24% of children, and 23% of minorities exposed to the 1% AEP event. Limited monthly exposure of vulnerable populations (less than 5% of vulnerable population exposed).	*2090 is the first time horizon in which over 5% of a vulnerable population is exposed to monthly flooding. 36% of single parents, 35% of minorities, and 34% of children exposed to the 1% AEP event. 9% of single parents and 8% of children exposed to monthly flooding.	44% of minorities, 43% of children and single parents, and 42% of linguistically isolated exposed to the 1% AEP event. 32% of single parents, 30% of minority and children exposed to monthly flooding.	51% of minorities, 49% linguistically isolated, 48% of children, 47% of elderly, residents in poverty, and single parents exposed to the 1% AEP event. 22% of minorities, 21% of linguistically isolated, 20% of children and residents in poverty exposed to monthly flooding.

Time Horizon	2040	2065	2090	2115	2140
Reach 4	10% of single parents exposed to the 1% AEP event. Limited monthly exposure of vulnerable populations (less than 5% of vulnerable population exposed).	12% of single parents exposed to the 1% AEP event. Limited monthly exposure of vulnerable populations (less than 5% of vulnerable population exposed).	*2090 is the first time horizon in which over 5% of a vulnerable population is exposed to monthly flooding. 16% of single parents exposed to the 1% AEP event. 9% of single parents and 5% of children exposed to monthly flooding	19% of single parents and 10% of children exposed to the 1% AEP event. 13% of single parents and 7% of children exposed to monthly flooding.	22% of single parents and 15% of children exposed to the 1% AEP event. 18% of single parents and 10% of children exposed to monthly flooding.

Section E.2-5. OSE FWOP Summary

Coastal flooding and sea level rise will affect the social conditions in the SFWCFS in a future without project condition. The following sections contain key take-aways for each OSE category explored for each SLC projection. The High SLC projection is explored in detail in the previous sections due to the amount of flooding expected over time, therefore the exposure analysis and potential impacts to socio economics is more complex. The OSE FWOP summary also includes findings for the Low and Intermediate SLC projections, which reflect similar findings that occur much later in the period of analysis due to the low rate of sea level rise.

E.2-5.1 USACE Low Curve

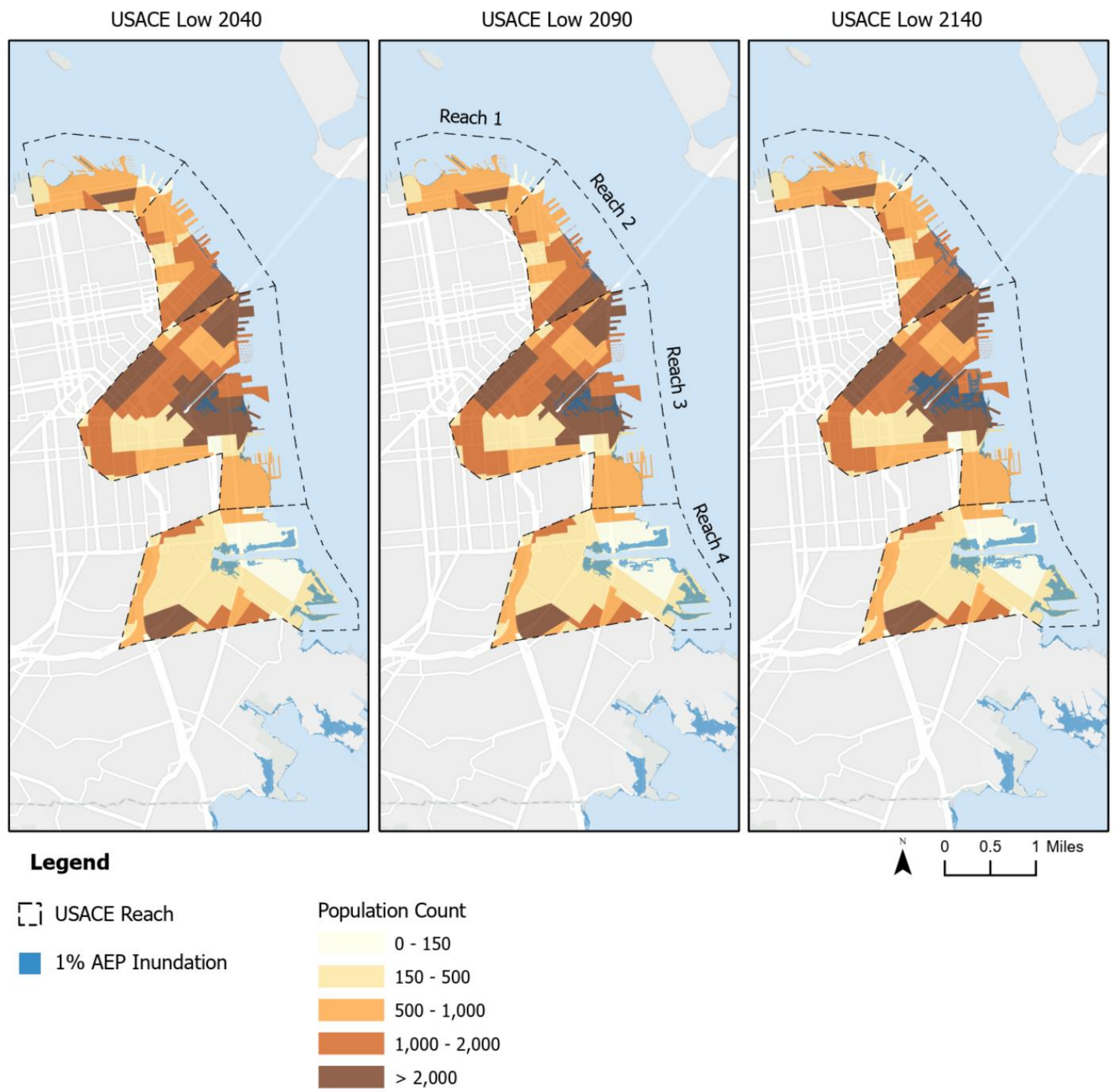


Figure E.2-*5-1*. Distribution of Population Exposure, USACE Low Curve

Figure E.2-*5-1* shows flooding during a 1% AEP event in Reach 1 is minimal under the low curve throughout the period of analysis. There is flooding along the shoreline in Reach 2, and more significant flooding is expected in Reaches 3 and 4 from both a depth and extent perspective. The extent of flooding in 2140 under the low curve matches the extent of flooding in 2040 under the high curve. Under the low curve, there is very minimal monthly flooding experienced in the SFWCFS study area.

- Health and Safety. Approximately 5 percent of the total population in the SFWCFS area will be exposed to flooding during a 1 percent AEP flood event by 2140. Reach 3 has the largest population and exposed counts; 7 percent of the population in this reach will be exposed by 2140, totaling over 3,200 people. Seven contaminated sites in Reaches 3 and 4 will be exposed to 1 percent AEP flooding by 2040, which could disturb contaminated soils and release hazardous substances with potential significant consequences on public health. A total of 11 contaminated sites will be exposed during a 1 percent AEP flooding by 2090, and 20 sites by 2140. Disaster response sites face early exposure due to their proximity to the shoreline; 50 percent of the sites in Reach 4 will be exposed by 2040. The majority exposed disaster response sites are located by Pier 92 and 94-96 by Islais Creek and Heron's Head Park.
- Economic Vitality. Seven disadvantaged businesses, specifically women-owned businesses, will be exposed in Reach 2 by 2040. Four additional disadvantaged, minority-owned, businesses will be exposed in Reaches 3 and 4 by 2115, totaling 11 exposed in the SFWCFS area. One legacy business will be exposed by 2090. Renter-occupied housing units are mainly concentrated in Reach 3 and are exposed in higher numbers during a 1% AEP event, relative to other reaches. Approximately 632 units will be exposed by 2090, increasing to 1,386 by 2140. Affordable housing sites are only exposed in Reaches 2 and 3, with a total of 4 exposed by 2040, increasing to 7 sites exposed by 2140. These seven sites contain 559 affordable housing units and are a part of the City's affordable housing pipeline projects and include projects in development. Four of the seven exposed sites are already built in Reach 3, containing a total of 524 affordable housing units.
- Social Connectedness. By 2140, flooding will impact mobility along the waterfront by exposing key transit and pedestrian corridors such as Third Street and the Bay Trail, which includes the Embarcadero in the northern waterfront and the Blue Greenway in the southern waterfront of the study area. Open spaces will also be exposed by a 1 percent AEP event by 2140, including approximately 1.9 acres of the Rowing Club, Embarcadero Plaza, and Ferry Park, all open space managed by San Francisco's Recreation and Parks department. Open space managed by the Port, which includes public piers, parks, and plazas, is significantly exposed by 2040; over 29 acres will be exposed by 2040, increasing to 39 acres by 2140. The greatest impact occurs in Reach 4 where 23 of the total

39 acres will be exposed. This exposure includes notable tourist attractions such as Pier 39 and Hyde Street Pier in the Fisherman's Wharf, as well as one of the largest parks in the southern waterfront, Heron's Head Park.

- Community Identity. Five community assets will be exposed to flooding by 2140 during a 1 percent AEP event, including the Fire Department's Bureau of Fire Investigation, Southern District Station, and Fire Station #4 and the Police Department's Public Safety Building, and the Child Advocacy Center, run by the city's Human Services Agency, in Reach 4. Four percent of places of worship will be exposed by 2140. Three of the eight total cultural districts in the city will be exposed by 2115: the SoMa Pilipinas/Filipino Cultural District, the Leather and LGBTQ Cultural District, and the African American Arts and Cultural District.
- Social Vulnerability. An average of 5 percent of the study area's socially vulnerable populations will be exposed to flooding during the 1 percent AEP event by 2140, exposing higher percentages of single parent households and children. In Reaches 1 and 4, two equity priority communities designated by the Metropolitan Transportation Commission, will be exposed by 2040. However, the flooding in Reach 1 is minimal, occurring mainly on the piers and the shoreline but may still impact the community's access and health and safety. In Reach 4, over 475 people in the equity priority community will be exposed.

E.2-5.2 USACE Intermediate Curve

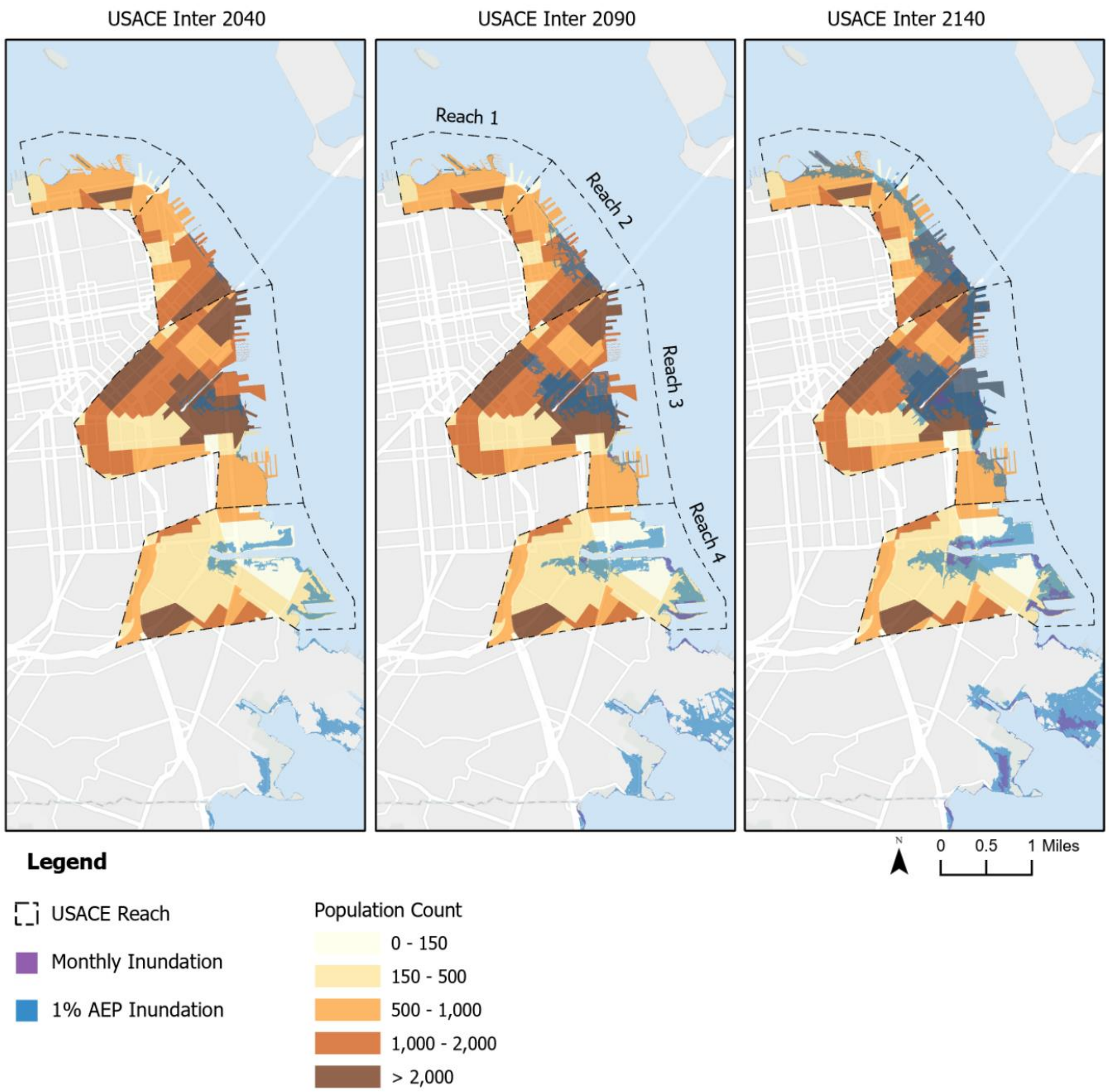


Figure E.2-*5-2*. Distribution of Population Exposure, USACE Intermediate Curve

Under the intermediate curve, there is significant flooding during a 1 percent AEP event across all reaches in the SFWCFS by 2140, as seen in Figure E.2-*5-2*. Reaches 3 and 4 face the earliest impacts with exposure by 2040. The extent of exposure by 2140 is similar to the extent of flooding by 2090 under the high curve. There is minimal monthly flooding by 2090, mainly occurring in Reach 4 by Islais Creek and Heron's Head. By 2140, there is additional monthly flooding in these areas and by Mission Creek.

- Health and Safety. Approximately 2 percent of the total study area population will be exposed to a 1 percent AEP event by 2040, 9 percent by 2090, and 21 percent by 2140. Over 12,900 people will be exposed in Reach 3 by 2140. Nine contaminated sites in Reaches 3 and 4 will be exposed to 1 percent AEP flooding by 2040, which could disturb contaminated soils and release hazardous substances with potential significant consequences on public health. A total of 46 contaminated sites will be exposed to 1 percent AEP flooding by 2090, and 90 by 2140. Five contaminated sites will be exposed to monthly flooding by 2140, 4 of which are in Reach 4 and 1 in Reach 3. Monthly flooding will also increase health and safety risks with the potential disturbance of hazardous substances, even if the surrounding area is relocated. Two disaster response sites will be exposed with monthly flooding by 2140, both located in Reach 4. These disaster response sites will likely require permanent relocation.

During a 1 percent AEP event, 11 disaster response sites will be exposed in the waterfront study area by 2090, with sites exposed mainly in Reaches 2 and 4. Approximately 55 percent of disaster response sites will be exposed by 2140, potentially impacting emergency resources and response in the waterfront area.

- Economic Vitality. There will be 39 disadvantaged and legacy businesses exposed in 2090, and 85 in 2140, which is 13% of these businesses in the total study area. Renter-occupied housing units are mainly concentrated in Reach 3 and are exposed in higher numbers during a 1% AEP event; there will be 3,939 units exposed by 2140. In the entire study area, approximately 2,460 units will be exposed by 2090, increasing to 6,187 units by 2140. Affordable housing sites are only exposed in Reaches 2 and 3, with 12 exposed by 2090 and 25 by 2140. The 25 exposed sites hold a total of 1,613 affordable housing units and 951 of these units are already built.

- <u>Social Connectedness</u>. By 2065, there will be significant impacts to the Third Street corridor in Reaches 3 and 4, and the Embarcadero in Reach 2. Most of the shoreline in the study area will experience landward flooding during extreme events by 2140. BART and SFMTA's light rail systems will likely be floodproofed by 2065 and reconfigured by 2140. Pedestrian access and walking trails such as the Bay Trail face exposure; approximately 2.7 miles of the Bay Trail will be exposed by 2090 and 5.9 miles in 2140. Over 8.6 acres of the Maritime Plaza, Rowing Club, Embarcadero Plaza, and Ferry Park, all open space managed by San Francisco's Recreation and Parks department, will be exposed by 2140 during a 1% AEP flood event. About 31 acres of open space managed by the Port of San Francisco along the waterfront in the SFWCFS will be exposed by 2040, increasing to a total of 79 acres exposed by 2140. The largest open space areas exposed include Crane Cove Park, Pier 92, Heron's Head Park in the southern waterfront and the Embarcadero, Shipway Park, Shoreline Park, Pier 39, and Ferry Plaza in the northern waterfront.
- <u>Community Identity</u>. Several community assets will be exposed by 2090 during a 1 percent AEP event including the Mission Bay Library, Bryant Navigation Center, and Five Key Charter School in Reach 3 and the Bayview Safe Navigation Center and Child Advocacy Center in Reach 4. Critical assets such as the Fire Department's Fire Station #4, 8, 25, Southern District Station and the Police Department's Public Safety Building will also be exposed by 2090. Eight percent of places of worship across the study area will be exposed by 2140. Three of the eight total cultural districts in the city are exposed by 2065: the SoMa Pilipinas/Filipino Cultural District, the Leather and LGBTQ Cultural District, and the African-American Arts and Cultural District. Most of the exposed historic assets are in Reach 2; 10 assets will be exposed by 2140. Fourteen percent of the total historic assets in the study area will be exposed by this time.
- <u>Social Vulnerability</u>. An average of 8 percent of the study area's socially vulnerable populations will be exposed during a 1 percent AEP event by 2090, increasing to 18 percent by 2140. Children, single parent households, and minority groups are exposed at higher percentages than the average, with 19 percent, 20 percent, and 21 percent exposed, respectively. The greatest increase of exposure for socially vulnerable populations in the period of analysis is between 2065 to 2090. A total of four equity priority communities in Reaches 1, 3, and 4 will be exposed by 2090. The communities in Reaches 1 and 3 have high rates of households without vehicles, increasing the health and safety risks during a flood event.

E.2-5.3 USACE High Curve

Key take-aways for each OSE category explored under the USACE High Curve include the following:

- Health and Safety. Approximately 6 percent of the total study area population will be exposed to the 1 percent AEP event by 2040, 26 percent by 2090, and 40 percent by 2140. Reach 3 contains the greatest risk to health and safety in the FWOP condition. Over 3,700 South Beach and Mission Bay (Reach 3) residents are exposed to the 1 percent AEP by 2040. These are the only areas with expected temporary displacement and emergency shelter needs in the study area until 2090, when flood exposure in the Financial District (Reach 2) increases significantly. Temporary displacement and shelter needs are not expected to be widespread across the study area until 2115. Half of the Reach 3 population will be exposed to the 1 percent AEP event by 2140.

  Monthly flooding presents additional health and safety challenges in the study area, starting in 2090. 20 contaminated sites in Reaches 3 and 4 will be exposed to repetitive flooding and groundwater rise, which could disturb contaminated soils and release hazardous substances with potential significant consequences on public health. A total of 170 contaminated sites could be exposed to repetitive flooding by 2140, with 115 exposed in Reach 3 and 55 in Reach 4. Approximately 134 contaminated sites may be exposed by 2090 in a 1 percent AEP event, and 234 sites may be exposed by 2140. By 2115, monthly flooding also exposes 70 percent of disaster response assets in the study area. If a non-flood related incident or emergency (such as spreading contaminants) were to occur during this time horizon, access to disaster response assets and resources would likely be limited due to repetitive flood conditions. People with health conditions such as asthma and cardiovascular disease (which comprise about 15 percent of the population) could be more vulnerable to medical complications associated with contamination exposure, either from disturbed sites or flood debris.

- Economic Vitality. Exposure of 73 disadvantaged and legacy businesses is expected by 2065 in a 1-percent AEP event. This increases to 147 by 2090 and 303 by 2140. These businesses are concentrated in Reach 2 near the Ferry Building, as well as Reach 3, and are likely at greater risk of closure or displacement due to limited resources. Given affordability challenges for real estate in San Francisco, these businesses may relocate out of the city or close permanently due to flooding.

  Housing affordability will also present economic vitality challenges in the face of coastal flooding and sea level rise. Approximately 70 percent of the study area's housing is renter-occupied, with median gross rent above $1,500 per month. Reach 3 exhibits the highest exposure of affordable housing sites in the FWOP condition. South Beach, Mission Rock, Mission Bay, Mission Creek, and Pier 70 have median rents greater than $3,000 per month. These neighborhoods also contain more affordable housing sites than other waterfront reaches, as 75 percent of study area affordable housing is in Reach 3. By 2090, 18 percent of affordable housing in the study area will be exposed to the 1 percent AEP. By 2140, 37 percent of affordable housing sites will be exposed to the 1 percent AEP and 25 percent of the sites will be exposed to monthly flooding. Due to high demand and limited availability for affordable housing units, residents who are affected by severe and repetitive flooding may not be able to find alternate affordable housing in the study area.

- Social Connectedness. Social connectedness covers multiple concepts: mental stress, lost productivity, and mobility. Because mental stress and lost productivity consequences are based on temporary displacement population estimates, trends mirror those expected in the health and safety OSE category.
  By 2040, $33.2M in mental health treatment costs and lost income to workers are expected. This rises to $152.9M by 2090, and $237M by 2140.

  One of the most consequential effects from coastal flooding and sea level rise in the SFWCFS is the disruption of mobility networks, including public transit and bike and pedestrian routes. Any component of the mobility network exposed to flooding will experience cascading impacts to operations and capacity. BART and SFMTA (Muni service) are the primary transit providers in the study area with 440,000 and 700,000 average daily ridership, respectively. Impacts in service to either agency impact the other, as public transit users will shift mobility modes quickly when one is down. Physical damage and transportation delay costs are covered in the NED account. SFMTA's light rail and bus routes will be the most exposed public transit route on the waterfront and will have significant impact on trip shifting from public transit to automobiles. This will indirectly impact travel time, miles traveled, congestion, and transportation experience that warrant OSE discussion.

  SFMTA completed a network analysis of their system to understand the city-wide impacts of exposed systems and assets, particularly to Environmental Justice Communities.[9] By 2040, system damage caused by a 1 percent AEP event (namely the Muni Metro Turnaround) will cause medium-to-high burdened communities throughout the City to have a very high likelihood of shifting to using cars instead of public transit, generally increasing household transportation costs. These communities will experience a 56 to 66 percent increase in their travel time, 29 to 37 percent increase in vehicle miles traveled due to re-routes, and a 40 to 71 percent increase in congestion. The congestion increase could lead to an increase in air particulates could exacerbate public health concerns in areas that already experience environmental justice challenges. BART and SFMTA's light rail systems will likely be floodproofed by 2065 and reconfigured by 2140 to reduce these projected impacts.

  Furthermore, disruption or delay of the transit network will impact residents with no vehicle access city-wide, potentially impacting residents' access to work. Residents with no vehicle access are concentrated in Reach 2 and 3 in the study

[9] Environmental Justice Communities are mapped by the San Francisco Planning Department and combine data from CalEnviroScreen, state housing income information, and air pollution exposure. These communities do not consider households dependent on public transit, or those with no vehicle access).

area. SFMTA has identified linchpin assets that are of highest priority to protect or maintain access: Muni Metro East (Reach 4), the T-Third line (Reach 3 and 4), Embarcadero Roadway and transit (Reach 2), and all four Mission Creek and Islais Creek bridges (Reach 3 and 4).

Repetitive monthly flooding will likely cause similar system-wide consequences to the mobility system to a higher degree if flood risk remains unaddressed. Repetitive flooding will also make pedestrian and cycling routes more difficult to navigate. The San Francisco Bay Trail and the Blue Greenway could have 7 to 8 miles exposed to repetitive flooding by 2140. Trail users would likely use other routes but would in turn lose shoreline access and recreation opportunities provided by the trail and greenway. Loss of these routes to accommodate trip-shifts from public transit could further increase automobile use and congestion issues in the study area.

- Community Identity. Community identity and cultural security are important factors in a social environment and can influence a community's willingness and ability to organize and recuperate from being impacted adversely. Community identity is represented in this report through exposure of community service facilities, places of worship, and cultural and historic assets. Approximately 122 community service assets (including schools, libraries, fire and police stations, hospitals, and community centers), 52 places of worship, and 131 historic places and landmarks exist in the study area. Community service assets are most exposed to coastal flooding and sea level rise: across the waterfront, 6 percent of the total community service assets are exposed to the 1 percent AEP event; 23 percent is exposed in 2090, and 40 percent is exposed in 2140. Four percent of the waterfront's historic assets are exposed to the 1 percent AEP by 2040, 17 percent by 2090, and 51 percent by 2140. Places of worship are least exposed relative to their prevalence, with 4 percent exposed to the 1 percent AEP event by 2040, 12 percent by 2090, and 35 percent by 2140. Reach 3 has the highest exposure of community services, while Reach 2 has the highest exposure of places of worship and historical assets. Exposure of these assets and areas to coastal flooding and sea level rise indicates the potential for future community disruption that could threaten an area's ability to organize and continue work supporting communities.

  San Francisco also has designated cultural heritage districts to represent institutions of cultural significance throughout the City. The program aims to preserve and strengthen cultural assets and diverse communities, while also combating gentrification and displacement. Three cultural districts are present in the SFWCFS study area: the Leather & LGBTQ Cultural District (Reach 3), the Filipino Cultural Heritage District (also known as SoMa Pilipinas, Reach 3), and the African-American Arts and Cultural District (Reach 4). Portions of the African American Arts and Cultural District will be exposed to the 1 percent AEP event in 2140 (308 acres). By 2090, all three cultural districts will be exposed to the 1 percent AEP event (864 total acres). By 2140, 1,524 acres of cultural districts will be exposed to extreme events. Monthly flooding will expose portions of all three cultural districts by 2115. Flooding of any kind is expected to disrupt critical infrastructure, impede access to emergency and community services, and potentially prompt permanent relocation of residents and businesses. Relocation and reduced access to community services are exactly the challenges that the districts are intended to address. Flood exposure would decrease the district's ability to protect its community and provide a safe place for celebrating its unique cultural heritage.

- <u>Social Vulnerability.</u> Understanding how coastal flooding and sea level rise may impact different communities, particularly those who exhibit social vulnerability characteristics, is a key component of an equitable and environmentally just planning process. Socially vulnerable populations often have the fewest resources to prepare for a flood, live in the highest-risk locations, occupy substandard housing or are homeless, and lack the knowledge or social and political connections necessary to access resources that would speed their recovery. Underserved and socially vulnerable populations live throughout the study area. However, six sub-areas meet the MTC Equity Priority Community criteria for exhibiting social, political, environmental, or economic inequalities: Fisherman's Wharf (Reach 1), portions of the NE Waterfront and Ferry Building sub-areas (Reach 2), portions of Mission Creek (Reach 3), and Pier 94-96 and Heron's Head in Reach 4.

  Four to nine percent of the study area's socially vulnerable populations will be exposed to the 1 percent AEP event by 2040, mostly affecting single parent households and children in Reach 3. By 2090, exposure has increased to 22 to 26 percent of the socially vulnerable population and now affects minorities and households with limited English that are potentially linguistically isolated. By 2140, 33 to 40 percent of the socially vulnerable population is exposed to the 1 percent AEP event, primarily affecting minorities and elderly over the age of 65. The variation in characteristics over the period of analysis can be somewhat explained by the progression of flood exposure to various neighborhoods. For example, the SoMa Pilipinas Cultural District begins to experience significant exposure to extreme flood events beginning in 2090, which may explain the increase in exposure to linguistically isolated households.

  Incorporating flood exposure with socially vulnerable population data highlights various areas of concern over time. In 2040, Mission Creek, Mission Rock, and Mission Bay have the highest concentrations of exposed socially vulnerable populations. By 2090, the NE waterfront, Ferry Building, and South Beach sub-areas in Reach 2 have an increase in vulnerable population exposure. And by 2140, exposure statistics begin to show the socioeconomic population trends identified in the MTC Equity Priority Communities. These scenarios highlight Fisherman's Wharf, the NE Waterfront and Ferry Building, and Mission Creek.

The consequences discussed for other OSE categories (health and safety, economic vitality, social connectedness, and community identity) will likely have disproportionate effects on socially vulnerable populations. Perhaps the most impactful of these consequences is potential permanent relocation of businesses, community services, and cultural assets due to repetitive flooding, as well as reduced access to mobility corridors and public transit to find these resources outside of the study area. Under the

USACE High Curve, 2090 represents the repetitive flooding threshold for many OSE categories. Reach 3 will likely be the first to experience these challenges, followed by Reach 2 and Reach 4.

Section E.2-6. Future With Project Analysis

The Future with Project (FWP) analysis offers data and social effects to support decision-making for the Project Delivery Team in selecting a final plan that reduces coastal flood risk in the SFW study area. The OSE FWP analysis assesses the potential effects of six proposed project alternatives (Alternatives B-G) on the social composition of the SFWCFS area. The FWP analysis examines project alternatives based on similar asset and population exposure methodologies, the same 5-time horizons, and three USACE SLC scenarios as the FWOP condition. Nevertheless, this section focuses on qualitative impacts identified through the lens of “key drivers.” These key drivers consolidate individual measures and metrics presented in the FWOP condition to assess trends in residual exposure for each proposed alternative, highlighting those with primary differences to support plan formulation and decision-making. Additionally, the FWP analysis brings forth qualitative analyses to support evaluation of maritime function, life safety, and historic district status impacts that were not fully explored in FWOP. These adjustments to the FWOP OSE approach were conducted to better assess the comparative performance of the alternatives.

The FWP Analysis section is structured as follows:

- **Section 6.1 Key Drivers Methodology**. Describes the approach to select key drivers, as well as a detailed description of each OSE key driver elevated for plan formulation. The detailed descriptions reference data leveraged from FWOP and define the scoring evaluation criteria for qualitative key drivers.
- **Section 6.2 FWP Findings for the USACE Low Curve**. Presents the level of protection offered by the various project alternatives compared to the USACE Low SLC projection, including exposure maps. Each project alternative is scored at the waterfront level with supplemental findings to highlight the primary differences between alternatives from an OSE perspective.
- **Section 6.3 FWP Findings for the USACE Intermediate Curve**. Presents exposure maps for each alternative compared to the USACE Intermediate SLC projection. Due to noticeable differences in flood risk throughout the SFW study area under the Intermediate curve, scores and findings per alternative are displayed at the reach level.
- **Section 6.4 FWP Findings for the USACE High Curve**. Presents exposure maps for each project alternative compared to the USACE High SLC projection. The High Curve maps demonstrate a significant increase in flood risk after 2090 and assume implementation of adaptive measures for each alternative needed to address coastal flood risk expected with high rates of sea level rise. Reach-level FWP findings are offered in this section.

- **Section 6.5 FWP Summaries**. Compiles OSE FWP findings for better comparison across various SLC projections.

The OSE FWP assessment continues to be based primarily on exposure to coastal flooding and sea level rise, consistent with the FWOP assessment. Therefore, findings are highly dependent on each alternative's linear extent, location relative to the shoreline, and design elevation. Table E.2-6-1 provides elevations for each alternative according to 2040 and 2090 designed performance. The alignments for each alternative are shown in Sections E.2-6.2, 6.3, and 6.4 below. Further description of the alternatives are available in the Engineering Appendix.

Table E.2-6-1 Alternative Design Performance and Elevations

Alternative	2040 Target Performance	2040 Finished Elevation	2090 Target Performance	2090 Finished Elevation
Alternative A	Alternative A is consistent with FWOP conditions.			
Alternative B	Floodproof areas at risk of 1% AEP coastal flooding; retreat areas at risk of monthly coastal flooding; add areas as risk increases over time.			
Alternative C	1.5 feet SLC	13.5 feet NAVD88	1.5 feet SLC	13.5 feet NAVD88
Alternative D	1.5 feet SLC	13.5 feet NAVD88	3.5 feet SLC	15.5 feet NAVD88
Alternative E	3.5 feet SLC	15.5 feet NAVD88	7.0 feet SLC	19.0 feet NAVD88
Alternative F	3.5 feet SLC	15.5 feet NAVD88	7.0 feet SLC	19.0 feet NAVD88
Alternative G	3.5 feet SLC	15.5 feet NAVD88	7.0 feet SLC	19.0 feet NAVD88

For all alternatives, assets on the bayside of the shoreline protection (e.g., on piers) are expected to be floodproofed. Alternative F and Alternative G includes a proactive (planned) retreat component. Illustrations showing the layout of the alignments and additional descriptions of the intent of each alignment are provided in the Engineering Appendix.

Alternative B represents the non-structural alternative considered in the SFWCFS. The non-structural alternative focuses on asset-level flood protection and does not include a shoreline protection component. Therefore, flood protection benefits for Alternative B can only be captured by an analysis that includes flood depth as a vulnerability component. The OSE exposure methodology is not able to capture the potential flood reduction benefits offered by Alternative B, as the study area will still experience inundation during extreme events and tidal flooding in the FWP condition. The OSE analyses assumes that some level of community disruption will occur under Alternative B due to reduced accessibility to jobs, residences, and community assets. Disruption that may be experienced under Alternative B conditions is not considered in this OSE analysis.

E.2-6.1 Key Drivers Selection and Scoring Methodology

The OSE FWP exposure analysis is presented through the lens of ten measures of social effects, each referred to as a 'key driver.' This section discusses how these key drivers were selected and describes the evaluation criteria and scoring definitions used for each to support plan formulation.

E.2-6.1.1 OSE Key Driver Selection Process

The OSE FWOP analysis contained a robust exposure assessment of assets and population criteria to represent five categories of social effects. In accordance with USACE study guidance, the PDT conducted the same exposure analysis for the FWP condition across the proposed alternatives and SLC projections. The FWP assessment revealed similar results for eighteen OSE metrics across the alternatives and time horizons, without much differentiation between metrics reviewed. To offer meaningful OSE effects for consideration in the plan formulation process, the PDT employed the approach delineated in Figure E.2-6-1 to consolidate over eighteen FWP exposure metrics into the eleven key drivers of social effects described in this document.

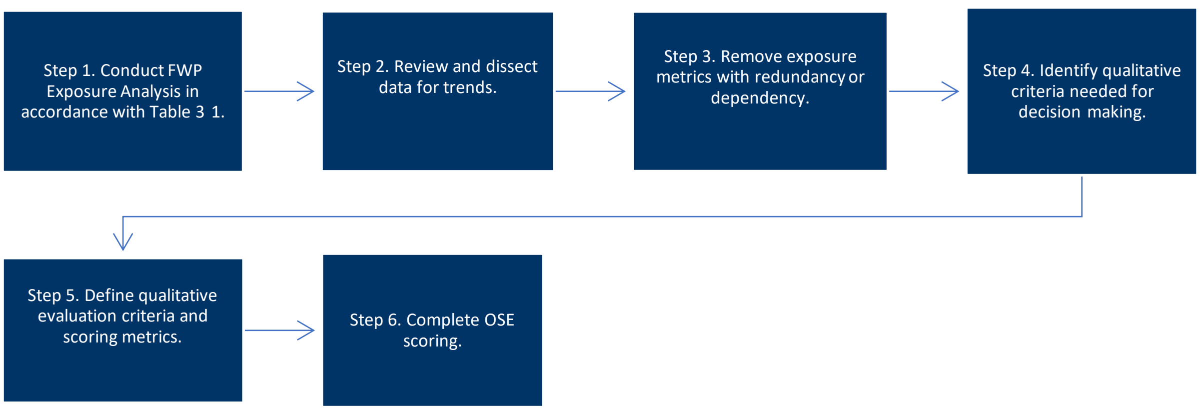
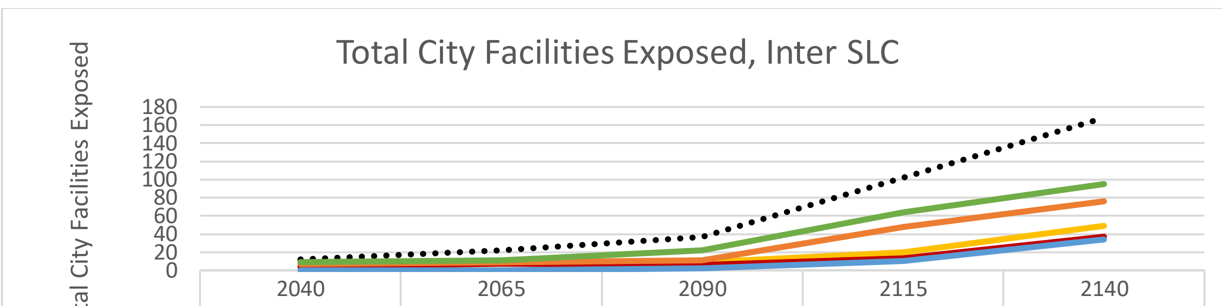


Figure E.2-6-1. OSE Key Driver Selection Process Overview

Steps 2 and 3 of the key driver selection process focused heavily on data processing to identify similarities or differences in FWP performance across alternatives and SLC projections. The PDT created visual and tabular exposure summaries (see Figure E.2-6-2 and Figure E.2-6-3 for example supporting outputs) to synthesize the OSE exposure results and understand the protective properties of each alternative, as well as how different OSE metrics potentially responded differently across reaches. This approach was sufficient to justify general findings; for example, Figure E.2-6-2 shows while all alternatives reduced exposure relative to FWOP conditions under the Intermediate SLC curve, Alternative D and Alternative E offered more protection for city and public facilities over the period of analysis. These same trends were seen for cultural and historical assets, disadvantaged and legacy businesses, and other structure-based exposure statistics. Figure E.2-6-3 presents an alternative method to review exposure results from the social vulnerability perspective. When evaluating residual exposure by reach for the Intermediate SLC curve, Figure E.2-6-3 demonstrates the general increase in exposed vulnerable populations over the period of analysis for each reach and alternative. However, Reach 3 and Reach 4 demonstrate vulnerable populations are potentially exposed to flooding much earlier under Alternatives F and G due to planned retreat for these alternatives. While these trends are useful to synthesize general conclusions on the other social effects of implementing any of the alternatives, they alone are not sufficient to support decision-making and tradeoff discussions.

Step 3 of the key driver selection process identified OSE exposure metrics that showed clear, differing trends to support decision-making. The PDT set aside metrics that were potentially redundant or dependent on each other. For example, the OSE FWOP analysis included several population factors, such as total population exposure, temporary displacement, mental health and lost productivity, and socially vulnerable population exposure. These metrics are dependent on the general population exposure; therefore, an individual alternative would reduce exposure to these populations to a similar degree. To simplify the data pushed forward for decision-making, the PDT selected vulnerable population exposure as a key driver. The PDT also recognized the importance of including distinct equity components in the selection process, such as housing, disaster response assets, and historic and cultural assets. These components were selected based on an equity outreach effort conducted by the Port of San Francisco in support of the SFW study.

Full exposure analyses for the FWP condition, using the original set of FWOP metrics are available in Appendix B and C and important for describing the total benefits of the final selected plan.



	2040	2065	2090	2115	2140
FWOP	12	22	37	102	168
Alt C	4	7	9	20	49
Alt D	4	7	6	13	37
Alt E	0	0	2	10	34
Alt F	7	9	11	48	76
Alt G	9	11	22	64	95

Figure E.2-6-2. Example OSE Exposure Data Processing Graphic, Total City Facilities Exposed for the FWP Condition, 1% AEP, Intermediate SLC Curve

	SV Indicator	2040					2065					2090					2115					2140				
		Alt C	Alt D	Alt E	Alt F	Alt G	Alt C	Alt D	Alt E	Alt F	Alt G	Alt C	Alt D	Alt E	Alt F	Alt G	Alt C	Alt D	Alt E	Alt F	Alt G	Alt C	Alt D	Alt E	Alt F	Alt G
Reach 1	Age over 65	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
	Age under 18	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
	Equivalent to High School Degree	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%	1%	0%	1%	1%	1%	1%	1%
	Households with Disability	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
	Poverty	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%	1%	0%	1%	1%	1%	1%	1%
	Linguistic Isolation	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	2%	1%	2%	2%	1%	2%	2%	3%	3%	2%
	Minority (non-white)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
	Single Parent	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	0%
Reach 2	Age over 65	1%	1%	0%	0%	0%	1%	1%	0%	0%	0%	1%	1%	0%	0%	0%	2%	1%	1%	1%	1%	4%	3%	2%	2%	2%
	Age under 18	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	1%	1%	0%	0%	0%	3%	1%	1%	1%	1%
	Equivalent to High School Degree	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	1%	1%	0%	1%	1%	3%	2%	2%	2%	2%
	Households with Disability	0%	0%	0%	0%	0%	1%	1%	0%	0%	0%	1%	0%	0%	0%	0%	2%	1%	1%	1%	1%	4%	3%	2%	2%	2%
	Poverty	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	3%	2%	1%	1%	1%
	Linguistic Isolation	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	1%	0%	0%	0%	0%	2%	1%	1%	1%	1%
	Minority (non-white)	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	1%	0%	0%	0%	0%	1%	1%	0%	1%	1%	3%	1%	1%	1%	1%
	Single Parent	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	3%	1%	1%	1%	1%
Reach 3	Age over 65	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	***4%***	0%	0%	0%	0%	***6%***	3%	3%	3%	3%	***9%***
	Age under 18	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	***8%***	1%	1%	1%	1%	***11%***	4%	3%	3%	3%	***16%***
	Equivalent to High School Degree	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	***6%***	0%	0%	0%	0%	***8%***	3%	3%	3%	3%	***12%***
	Households with Disability	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	***5%***	0%	0%	0%	0%	***7%***	3%	2%	3%	2%	***10%***
	Poverty	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	***5%***	0%	0%	0%	0%	***6%***	2%	2%	2%	2%	***10%***
	Linguistic Isolation	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	***6%***	1%	0%	1%	1%	***8%***	4%	3%	3%	4%	***14%***
	Minority (non-white)	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	***7%***	1%	0%	1%	0%	***10%***	4%	3%	3%	3%	***15%***
	Single Parent	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	1%	1%	1%	***9%***	1%	1%	1%	1%	***13%***	3%	3%	3%	3%	***18%***
Reach 4	Age over 65	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	***1%***	***1%***	0%	0%	0%	***1%***	***1%***	0%	0%	0%	***1%***	***1%***
	Age under 18	2%	2%	2%	4%	4%	2%	2%	2%	5%	5%	2%	2%	2%	***5%***	***5%***	2%	2%	2%	***6%***	***6%***	2%	2%	2%	***6%***	***7%***
	Equivalent to High School Degree	0%	0%	0%	1%	1%	0%	0%	0%	1%	1%	0%	0%	0%	***1%***	***1%***	0%	0%	0%	***1%***	***1%***	0%	0%	0%	***1%***	***1%***
	Households with Disability	0%	0%	0%	1%	1%	0%	0%	0%	1%	1%	0%	0%	0%	***1%***	***1%***	0%	0%	0%	***1%***	***1%***	1%	0%	1%	***2%***	***2%***
	Poverty	1%	1%	1%	2%	2%	1%	1%	1%	2%	2%	1%	1%	1%	***3%***	***3%***	1%	1%	1%	***3%***	***3%***	1%	1%	1%	***3%***	***3%***
	Linguistic Isolation	0%	0%	0%	1%	1%	0%	0%	0%	1%	1%	0%	0%	0%	***1%***	***1%***	0%	0%	0%	***1%***	***1%***	0%	0%	0%	***1%***	***1%***
	Minority (non-white)	1%	1%	1%	2%	2%	1%	1%	1%	2%	2%	1%	1%	1%	***3%***	***3%***	1%	1%	1%	***3%***	***3%***	1%	1%	1%	***3%***	***3%***
	Single Parent	3%	3%	3%	8%	8%	3%	3%	3%	9%	9%	4%	3%	3%	***10%***	***10%***	4%	3%	3%	***11%***	***11%***	4%	4%	4%	***12%***	***13%***

Note: Percent change values underlined in the table represent populations currently located Bayward of the alternative's shoreline protection and within the planned retreat area.

Figure E.2-6-3. Example OSE Exposure Data Processing Graphic, Socially Vulnerable Populations Exposed for the FWP Condition, 1% AEP, Intermediate SLC Curve

Error! Reference source not found. presents the eleven OSE Key Drivers selected for the SFW study area. These key drivers include factors related to life safety risk, disaster response exposure and capabilities, maritime functions, access to jobs, public transit disruption, community and cultural assets exposed, historic district designations, exposed and displaced socially vulnerable populations, disproportionate effects on underserved communities, and affordable housing. Step 4 and 5 of the key drivers selection process identified evaluation criteria and scoring definitions for each driver, so that each driver could be consistently compared across each alternative and each SLC projection.

The following sections offer detailed methodologies and considerations for the scoring of each OSE key driver.

Table E.2-6-2. OSE Key Drivers Selected

Category	Measures	Measure Type	Description
Health and Safety	Coastal Life Safety Risk	Qualitative Score	Qualitative measure of the relative performance of alternatives with respect to life-safety hazard caused by coastal water levels that can potentially expose populated areas to uninhibited flow of water due to overtopping or failure of the CSRM alternative. New key driver included in FWP for OSE.
	Seismic Life Safety Risk and Resilience	Qualitative Score	Qualitative measure of the effectiveness of the alternative in minimizing earthquake damage and disruption to waterfront disaster response and recovery functions. New key driver included in FWP for OSE.
	Compromised Disaster Response Assets	Exposure-Based	Semi-quantitative assessment of the count of disaster response assets exposed to a 1% AEP flood event.
Economic Vitality	Maritime Functions	Qualitative	Semi-quantitative assessment of the alternative’s impact on deep draft berthing and backland area to support maritime functions and jobs. New key driver included in FWP for OSE.
	Job Access	Qualitative	Qualitative measure of the effectiveness of the alternatives in protecting jobs that support low-income communities. New key driver included in FWP for OSE, relies on data from RED analysis.
Social Connectedness (or Mobility)	Public Transit Disruption	Qualitative	Qualitative assessment of the potential temporary and permanent disruption caused for SFMTA, the SFW study area’s primary public transit system.

Category	Measures	Measure Type	Description
Community Identity	Community and Cultural Assets	Exposure-Based	Semi-quantitative assessment of the count of community and cultural assets exposed to a 1% AEP flood event.
	Historic District Designations	Qualitative	Qualitative evaluation of historic asset loss and district designation impacts, based on improvements to wharf and pier structures for each alternative.
Social Vulnerability and Resiliency	Exposed and Displaced Populations	Exposure-Based	Semi-qualitative assessment of the percent reduction in exposure for socially vulnerable populations. Social vulnerability indices and statistical significance of children, elderly, minority populations, poverty status, disabilities, linguistic isolation, single parents. Additionally, permanently displaced population is included in the assessment.
	Disproportionate Effects on Underserved Communities	Qualitative and Exposure-Based	Semi-qualitative measure of the alternative's benefits to low-income communities of color considering historic lack of investment, high potential for community displacement, and high environmental contamination. Uses FWP exposure data to support scoring.
	Affordable Housing	Exposure-Based	Semi-quantitative assessment of the count of affordable housing sites exposed to 1% AEP and monthly flooding.

E.2-6.1.2 Health and Safety Key Drivers

Health and safety key drivers include coastal life safety risk, seismic life safety risk, and compromised disaster response assets.

E.2-6.1.2.1 Coastal Life Safety Risk

The Coastal Life Safety Risk key driver qualitatively measures the relative performance of the alternatives with respect to the life-safety hazard caused by coastal water levels that are unabated by the CSRM system, and/or exacerbated by the failure of the CSRM system when resisting coastal waters (i.e., fragility). The coastal storm life safety hazard incorporates the following conditions: The evaluation of the life-safety hazard is dependent on the costal water levels and frequency at which they are expected to be present. Safety is considered compromised when an unexpected failure of the CSRM system results in 2 feet or more of water suddenly entering urban areas of the city without warning.

The evaluation of the life-safety hazard is heavily linked to the coastal water levels and the frequency at which they are expected to be present. In the future without project condition, the life-safety hazard associated with coastal water is expected to be low, due to the nature of the coastal hazard and the opportunity to issue warnings and evacuate the waterfront's publicly accessible areas. Table E.2-6-3 presents the defined qualitative scoring scheme to assess coastal life safety risk across alternatives.

Table E.2-6-3. Coastal Life Safety Risk Scoring Definitions

Evaluation Criteria	Scoring Definitions		
	Red	**Yellow**	**Green**
Qualitative measure of the relative performance of alternatives with respect to coastal life safety hazards.	1 – Poor outcome indicating a higher probability that life safety hazard may exist due to uninhibited flow of costal water into populated area compared to FWOP. 2 – Moderately poor outcome when compared to FWOP, there is some probability that a costal life safety hazard exists.	3 – Neutral outcome, no significant change from FWOP	4 – Moderately positive outcome compared to FWOP, provides additional protection from wave action with a low probability of overtopping. 5 – Positive outcome indicated a lower probability that life safety hazard may exist due to uninhibited flow of coastal water into populated area compared to FWOP.

E.2-6.1.2.2 Seismic Life Safety Risk and Resilience

The Seismic Life Safety Risk and Resilience key driver qualitatively evaluates the alternatives based on their performance minimizing earthquake damage and disruption to waterfront disaster response and recovery functions. This evaluation recognizes that a project which replaces seismically vulnerable, aging waterfront structures with new, code compliant structures will inherently reduce the life-safety risk of waterfront assets. Additionally, the inclusion of substantial ground improvement in areas vulnerable to lateral spreading and liquefaction will reduce subsurface seismic hazards, thereby influencing the seismic performance of nearby structures.

Using information from the Multi-Hazard Risk Assessment and Initial Southern Waterfront Earthquake Assessment, the relative performance of the alternatives to minimize damage and disruption following an earthquake is a non-monetized benefit that is scored qualitatively using the definitions outlined in Table E.2-6-4 (Port of San Fransisco, 2020 and 2022). Alternatives that replace vulnerable structures with new facilities are expected to substantially reduce damage and disruption following an earthquake, thereby score higher from the lens of earthquake resilience.

Table E.2-6-4. Seismic Life Safety Risk Scoring Definitions

Evaluation Criteria	Scoring Definitions		
	Red	Yellow	Green
Qualitative measure of the effectiveness of the alternative in minimizing earthquake damage and disruption to waterfront disaster response and recovery functions. Considers physical damage to infrastructure and potential casualties expected due to the public nature of the waterfront.	1 – Poor outcome, no investment in vulnerable structures.	3 – Neutral outcome, reduces lateral spreading through ground improvement but does not invest in vulnerable structures.	5 – Positive outcome, reduces lateral spreading and replaces or improves vulnerable structures.

E.2-6.1.2.3 Compromised Disaster Response Assets

Disaster response sites are mainly located along the shoreline and were identified by the Port and the Department of Emergency Management through the Port's Multi-Hazard Risk Assessment. These sites are made up of staging areas, boat launches, mobile hospitals, fire truck connections and more disaster-related sites. Temporary and permanent inundation of these response sites can compromise accessibility, making it challenging for emergency personnel, supplies, and equipment to reach affected areas. It may strain already limited resources and complicate response efforts.

The disaster response key driver is dependent on the FWP exposure analysis and considers two variables: the number of assets exposed under FWP conditions, and the time horizon in which they are exposed. The exposure analysis was conducted in 25-year increments from 2040 to 2140, to align with the available FWOP and FWP inundation maps. To transform two variables in a consolidated score, analysis used a two-dimensional scoring approach shown in Table E.2-6-5 below.

Table E.2-6-5. Bivariate Scoring Scheme for Disaster Response Assets

Variable 1. Assets Exposed		Variable 2. Timing of Exposure	
Percentage of Assets Exposed	Score	Time Horizon	Score
0-20%	1	2040	5
20-40%	2	2065	4
40-60%	3	2090	3

Variable 1. Assets Exposed		Variable 2. Timing of Exposure	
Percentage of Assets Exposed	Score	Time Horizon	Score
60-80%	4	2115	2
80-100%	5	2140	1

Note: Equal breaks defined the exposure scores for percentage of assets exposed. These percentages represent residual exposure for each alternative compared to FWOP conditions.

The PDT averaged the two variable scores for a single combined score that indicates the timing and magnitude of exposure of disaster response assets. Table E.2-6-6 shows the combined scores and uses color-coding to indicate positive or poor outcomes for each alternative. These scores are further defined in **Error! Reference source not found.**, with green representing low exposure and scores of 1-2, yellow representing moderate exposure and a score of 3, and red representing high and early exposure and scores of 4-5.

Table E.2-6-6. Two-Dimensional Scoring Matrix

Scoring Matrix			
Early Exposure	3	4	5
	2	3	4
	1	2	3
	% of Assets Exposed		

Table E.2-6-7. Compromised Disaster Response Assets Scoring Definition

Evaluation Criteria	Scoring Definitions		
	Red	Yellow	Green
Semi-quantitative assessment of the count and time horizon of disaster response assets exposed to the 1% AEP flood event.	High exposure is represented by a 4-5 in the scoring matrix, which represents a higher percent of assets exposed (compared to FWOP) and asset exposure occurring early in the period of analysis.	Moderate exposure is represented by a 3 in scoring matrix. These scores represent a moderate number of assets exposed later in the period of analysis.	Low exposure is represented by a 1-2 in scoring matrix, which represents a lower percentage of assets exposed (compared to FWOP) and asset exposure occurring later in the period of analysis, or full protection provided.

E.2-6.1.3 Economic Vitality Drivers

Economic vitality drivers defined for the OSE account include the Port of San Francisco's maritime functionality, as well as access and protection of waterfront-dependent jobs that likely support low-income communities.

E.2-6.1.3.1 Maritime Functions

The Maritime Functions key driver comprises exposure to deep draft berthing and backland area, two critical components of an operable maritime port. The Port of San Francisco is home to several maritime business lines such as Cruise, Ro-Ro Cargo, Bulk Material Import, Lay Berthing, Excursion, Recreational and Fishing, which rely on several components of maritime infrastructure that are required to ensure the maritime industry remains viable.

To qualitatively assess the impact of the FWP conditions on the maritime viability of the Port, two quantitative statistics, 1) linear feet of deep draft berthing and 2) acres of backland space were computed to inform the qualitative ranking assigned for this metric. Based on these semi-quantitative metrics compiled to measure the effect of the FWOP and FWP alternatives on the maritime viability of the Port, a qualitative score was determined based on professional judgment and discussion with Port maritime experts.

Table E.2-6-8. Scoring Definitions for Maritime Functions

Evaluation Criteria	Scoring Definitions		
	Red	Yellow	Green
Semi-quantitative measure of the alternatives' impact on deep draft berthing and backland area. The composite score is based on the percentage of impacted of northern waterfront and southern waterfront berthing as well as SWF backland space. These activities are required to maintain business lines for the Port.	1 – Poor outcome, no berthing space is protected.	2 - Neutral outcome, some portion of backland space is viable with the alternative, even if berthing space is not protected.	3 – Moderately positive outcome, backland space is protected and less than 50% of berthing space is protected. 4 – Positive outcome, backland space is protected and between 50 and 75% of berthing space is protected. 5 – Very Positive outcome, backland space is protected and more than 90% of current berthing space is maintained.

E.2-6.1.3.2 Job Access

The SFW study area is a critical economic hub and provider of jobs in the San Francisco Bay Area. Jobs that are location-dependent are typically more vulnerable to the impacts of coastal flooding and sea level rise than those that can operate remotely or relocate quickly. The exposure analysis and economic vitality metrics explored in FWOP were not significant indicators to understand this challenge. Therefore, the Job Access Key Driver leverages RED analysis results to evaluate the social effects of coastal flood risk in the face of a location-dependent economy. The Job Access Key Driver provides a semi-qualitative measure of each alternative’s effectiveness in protecting jobs within each SFW reach. To assess how workers would be impacted by the various proposed alternatives, the PDT used the results of the direct, industry-specific job impact analyses conducted in the RED study. Table E.2-6-9 presents the evaluation criteria and scoring definitions for job access.

Table E.2-6-9. Evaluation Criteria and Scoring Definitions for Job Access

Evaluation Criteria	Scoring Definitions		
	Red	**Yellow**	**Green**
Measure of the effectiveness of the alternatives in protecting access to jobs in the study area. Scores notes the variance from FWOP.	1 or 2 – Poor protection benefits offered, job loss exceeds or has low variance from FWOP conditions	2 or 3 – Moderate protection benefits offered, medium variance from FWOP condition	4 or 5 – High protection benefits offered, high variance from FWOP condition

Note: Determination of scores under the same category is determined quantitatively by the number of jobs protected.

E.2-6.1.4 Social Connectedness Drivers

E.2-6.1.4.1 Public Transit Mobility

The availability of public transit plays a large role in the social fabric of the San Francisco Bay Area. As established in the FWOP condition for the OSE account, BART and SFMTA's light rail system are the two most prevalent public transit options in the SFW study area. Transit accessibility and potential impacts to mobility in the long-term are still likely with the consideration of the proposed alternatives due to necessary re-routing and relocation of assets. Based on conversations with SFMTA, these mobility impacts may occur under two conditions, and have a timing and a vulnerability threshold:

- Temporary disruption expected due to deployment of emergency protective measures to protect transit assets that are exposed to the 11.0-foot NAVD88 flood elevation and higher, including inflatables and temporary floodproofing.
- Long-term mobility disruption and system impacts due to build-out of the alternatives themselves, as studied by an internal SFMTA network analysis.

The Social Connectedness/Mobility Driver is a qualitative assessment of potential transit disruption in the FWP condition for each alternative, assuming that some alternatives will allow public transit systems to remain intact without major restructuring. Table E.2-6-10 below provides scoring details for this qualitative measure. Note that the aforementioned mobility impacts are not accounted for or duplicative with transit losses in the NED account analysis, which assumes that SFMTA and BART will adapt their system in the FWOP condition by 2070 under the High Curve.

Table E.2-6-10. Evaluation Criteria and Scoring Definitions for Social Connectedness/Mobility

Evaluation Criteria	Scoring Definitions		
	Red	**Yellow**	**Green**
Qualitative assessment of the potential temporary and permanent disruption caused for SFMTA, the SFW study area's primary public transit system.	1 – Long-term disruption is expected due to damage or network impacts from alternative build-out.	2 – Some temporary system disruption is expected due to floodproofing of assets. OR no change from FWOP conditions assuming permanent system adaptation.	3 – No temporary or long-term system disruption expected.

E.2-6.1.5 Community Identity Drivers

Community identity drivers defined for the OSE account include Community and Cultural Assets, and Historic District and Asset Designation.

E.2-6.1.5.1 Community and Cultural Assets

The key driver selection process identified community and cultural assets as important decision-making criteria due to the high number of assets present in the SFW study area. Community assets represent both critical service and city assets, made up of police, fire, libraries, schools, community centers, health centers, and shelter data from CCSF. Cultural assets represent places of worship, landmarks, and historic places. Community and cultural assets are consolidated into a combined FWP Key Driver.

The Community and Cultural Assets Key Driver uses the same exposure analysis and bivariate scoring method as the Disaster Response Key Driver. See Sections E.2-E.2-6.1.2.3. Table E.2-6-11 below displays the scoring criteria and definitions for the Community and Cultural Assets Key Driver.

Table E.2-6-11. Evaluation Criteria and Scoring Definitions for Community Services and Cultural Assets

Evaluation Criteria	Scoring Definitions		
	Red	**Yellow**	**Green**
Semi-quantitative assessment of the count and time horizon of community service and cultural assets exposed to the 1% AEP flood event.	High exposure is represented by a 4-5 in the scoring matrix, which represents a higher percent of assets exposed (compared to FWOP) and asset exposure occurring early in the period of analysis.	Moderate exposure is represented by a 3 in scoring matrix. These scores represent a moderate number of assets exposed later in the period of analysis.	Low exposure is represented by a 1-2 in scoring matrix, which represents a lower percentage of assets exposed (compared to FWOP) and asset exposure occurring later in the period of analysis, or full protection provided.

E.2-6.1.5.2 Historic District and Asset Designation

The Historic District and Asset Designation key driver qualitatively evaluates the SFW flood study alternatives based on their performance maintaining and preserving federally recognized historic districts from coastal storm flood risk. Preservation in the context of climate change is complex, as actions required to preserve historic resources likely require temporary or permanent modifications that could affect the resource’s historic designation. Substantial evaluation and design will be required in future study phases to ensure that such actions are executed in a mindful fashion that does not degrade the integrity and value of the historic resource. For the purpose of this qualitative evaluation, it is assumed that these modifications can be completed in a manner consistent with Secretary Standards (U.S. Department of the Interior, 2017).

The OSE key driver evaluation considers both contributing elements to a historic district and individually-recognized assets and recognizes that each alternative has the potential to elevate or move historic assets out of the floodplain, or substantially rehabilitate aging foundational components that supports the longevity of the historic assets. It is assumed that alternatives which replace aging substructures (such as wharves) and elevate assets are expected to substantially reduce the risk of loss. The qualitative scoring definitions and assumptions to identify the opportunities for each alternative to maintain and preserve historic districts, contributing elements, and individually-listed assets are outlined in Table E.2-6-12.

The FWP conditions for the historic district and asset designation are qualitatively determined using details from the Multi-Hazard Risk Assessment and data compiled for the FWOP Operation, Maintenance, Rehabilitation, Repair and Replacement calculation (See Economics Appendix).

Table E.2-6-12. Evaluation Criteria and Scoring Definitions for Historic Asset and District Designations

Evaluation Criteria	Scoring Definitions		
	Red	Yellow	Green
Qualitative measure of the effectiveness of the alternative in maintaining and preserving federally recognized historic districts, contributing elements, and individually listed assets. Considers physical damage to these assets from coastal flooding, earthquakes, and deterioration due to age of the asset.	1 – Poor outcome, substantial loss of historic assets by end of the study period.	3 – Neutral or Uncertain outcome, preservation characteristics are unclear due to variability in scope or timing of actions.	5 – Positive outcome, significant preservation of historic assets through the end of the study period.

E.2-6.1.6 Social Vulnerability and Resiliency Drivers

Social vulnerability and resiliency drivers for the SFW study area include exposed socially vulnerable populations; displaced total population; a qualitative analysis of the disproportionate effects of each alternative for underserved communities; and affordable housing exposure.

E.2-6.1.6.1 Exposed Vulnerable Population

The Exposed Vulnerable Population Key Driver mirrors the exposure analysis of vulnerable populations conducted in the FWOP conditions analysis. This includes the same social vulnerability indicators considered in FWOP: age under 18, age over 65, educational attainment, poverty, linguistic isolation, single parent, minority (non-white), and disabilities. Due to these overlapping indicator populations and similar percent reduction in exposure relative to FWOP conditions, the PDT calculated an average percentage reduction from FWOP exposure across the indicators for each alternative. The exposure results and reduction percentages can be found in *Sub-Appendix B FWOP Exposure Workbook*

The analysis used a semi-quantitative assessment to compare each alternative's performance in reducing exposure to vulnerable populations, with each alternative scored relative to one another. The scores are based on exposure with a 1% AEP flood event throughout all time horizons. The criteria and scoring definitions for the Exposed Vulnerable Population Key Driver are in Table E.2-6-13.

Table E.2-6-13. Evaluation Criteria and Scoring Definitions for Vulnerable Populations.

Evaluation Criteria	Scoring Definitions		
	Red	Yellow	Green
Semi-qualitative assessment of percent reduction for exposure in socially vulnerable populations with 1% AEP flooding.	Poor average reduction in exposed vulnerable population relative to exposure with FWOP. Scoring is relative to other alternative's performance.	Moderate average reduction in exposed vulnerable population relative to with exposure FWOP. Scoring is relative to other alternative's performance.	Good average reduction in exposed vulnerable population relative to exposure with FWOP. Scoring is relative to other alternative's performance.

E.2-6.1.6.2 Displaced Populations

The Displaced Population Key Driver refers to the population that remains exposed to recurrent flooding with alternatives in place, which could result in permanent displacement for impacted individuals. Permanent displacement in the FWP condition is associated with both exposure to monthly flooding and proactive retreat planned for Alternative F and G. Permanent residential displacement is a crucial component to consider when assessing alternative performance because of the complex social and economic consequences. For example, displacement can impact a person's sense of community and social networks, have psychological impacts, and even affect a person's employment.

The OSE analysis differentiates reactive and proactive retreat strategies by alternative and focuses on expected reactive retreat. Reactive retreat pertains to cases where monthly flooding exposes individuals in protected areas, proactive retreat pertains to cases where retreat is part of the alternative. For reactive retreat calculations, the team evaluated displaced population by calculating percentage reduction of the total population exposed by monthly flooding relative to exposure with FWOP conditions. Ranges in percent reduction thresholds for each alternative were defined as high, moderate, or low population exposure to monthly flooding. The criteria and scoring definitions for displaced population are in Table E.2-6-14.

Table E.2-6-14. Evaluation Criteria and Scoring Definitions for Displaced Population

Evaluation Criteria	Scoring Definitions		
	Red	**Yellow**	**Green**
Quantitative assessment of reduction in total population exposed to monthly flooding in 2140 as compared to FWOP. Scores determined using simple percent threshold (0-20, 20-60, 60-100%).	High exposure to monthly flooding by 2140. Reduction in total population exposed to monthly flooding in 2140 is 20% or less as compared to FWOP.	Moderate exposure to monthly flooding by 2140. Reduction in total population exposed to monthly flooding in 2140 is between 20% and 60% as compared to FWOP.	Low exposure to monthly flooding by 2140. Reduction in total population exposed to monthly flooding in 2140 is greater than 60% as compared to FWOP.

E.2-6.1.6.3 Disproportionate Effects on Vulnerable Communities

The OSE measure "disproportionate effects on vulnerable communities" was developed to assess whether an alternative has the potential to cause disproportionate harm to socially vulnerable, or disadvantaged, communities. This measure reflects the well-established understanding in environmental and climate justice literature that some communities bear a relatively greater burden than others from exposure to climate hazards. Socially vulnerable communities often have the fewest resources to prepare for a flood, live in the highest-risk locations, occupy substandard housing, and may also lack the social and political connections necessary to access information and resources that would help them to avoid exposure to hazards or to speed their recovery after a disaster (USACE IWR, 2016).

The PDT used a combination of OSE FWP exposure datasets and desktop research to develop and score the disproportionate effects key driver. The following five criteria are assumed to contribute to the unequal distribution and amplified impacts of climate-related hazards on communities in the SFW study area:

- **Historic policies and lack of investment:** Historic disinvestment is the long-standing practice of denying or withdrawing resources from marginalized communities, often due to their race, ethnicity, or socioeconomic status (Climate Justice Alliance, 2023). This disinvestment can take many forms, including inadequate funding for schools, hospitals, and other public services; lack of access to affordable housing and transportation; and exposure to environmental hazards. For example, redlining, a discriminatory practice that denied mortgages and other financial services to people of color in certain neighborhoods, led to the concentration of low-income Black people in the Bayview.

- **Environmental contamination:** Low-income communities and communities of color are often disproportionately burdened by environmental contamination. This is due to a number of factors, including historical patterns of discrimination, lack of political power, and economic vulnerability. The co-location of environmental contamination and low-income housing can have a number of negative health consequences, including increased risk of cancer, respiratory problems, and other health problems.
- **Risk of permanent displacement:** Distinct from proactive retreat, this criterion assesses if an alternative provides adequate protection outside of the line of defense in a given time horizon. The risk of permanent displacement is a major issue when thinking about social vulnerability in climate change in San Francisco (Urban Displacement Lab, 2023; Bayview Hunters Point Environmental Justice Network, 2023; San Francisco Department of Public Health, 2023). It can have a devastating impact on individuals and communities, leading to the loss of homes, businesses, and cultural heritage.
- **Critical transit corridor:** Communities that are more dependent on public transportation for their daily commute would be disproportionately impacted if an alternative does not provide adequate protection for a critical corridor to retain function. Any impairment of the public transit network could result in sustained disruptions in service, which ultimately could risk jobs, that frequently could be the sole source of income for families.
- **Impacts on broader underserved community:** Infrastructure investments can have a significant impact on the distribution of benefits and burdens in society, especially for marginalized communities. It is important to recognize that an alternative implemented at the scale intended for the San Francisco Waterfront and for the projected time horizon of protection will have a lasting impact on its residents. It can determine whose lives are made easier or more difficult, dictated by planning decisions such as access and proximity to critical infrastructure.

The potential for an alternative to cause disproportionate effects on vulnerable communities was assessed at the reach scale under the high and intermediate sea level rise curves. The evaluation for the low sea level rise curve was conducted at the waterfront wide scale. Five questions are used to evaluate whether an alternative may pose disproportionate effects on vulnerable communities based on the above criteria. A score is assigned from 1 to 3:

- ‘1’ indicates an alternative is likely to pose additional disproportionate effects beyond the already present disproportionate effects likely to be experienced within the community
- ‘2’ indicates either no positive effect or very low additional disproportionate effects as a result of the alternative

- ‘3’ indicates that an alternative has the potential to either mitigate the disproportionate effects present today, or actively render community benefits that can reverse these disproportionate effects.

The above considerations are consolidated into five ‘sub-driver metrics’ to evaluate whether an alternative may or may not pose disproportionate effects on vulnerable communities. Descriptions for each sub-driver metric and the associated scoring for 1, 2, and 3 are contained in the table below.

The definitions and approach to establish scoring definitions for the Disproportionate Effects on Vulnerable Communities Key Driver Metric is provided in Table E.2-6-15 below.

Table E.2-6-15. Evaluation Criteria and Scoring Definitions for Disproportionate Effects on Vulnerable Communities

Evaluation Criteria	**Scoring Definitions**		
	Red	**Yellow**	**Green**
Semi-qualitative measure of the alternatives’ benefits to low-income communities of color with historic lack of investment, high potential for community displacement and high environmental contamination	Composite score of 1- 5.	Composite Score of 6 - 10	Composite score of 11 - 15
Sub-Driver Metrics			
Definition	***Score of 1***	***Score of 2***	***Score of 3***
Does the strategy create, mitigate, or have no effect on the level of risk to the broader underserved community?	Directly or indirectly imposes risk to low-income, communities of color due to negative impact or lack of addressing climate risk	The strategy’s application would have no bearing on the greater community	Provides risk reduction to low-income, communities of color
Does this strategy actively consider and mitigate the historic (last ~70 years) lack of investment in the area?	Strategy exacerbates inequities	Strategy neither exacerbates nor address historical inequities (2)	Strategy has the potential to provide opportunities to address historic inequities because it maintains/protects workforce opportunities

Evaluation Criteria	Scoring Definitions		
	Red	**Yellow**	**Green**
Does the strategy directly or indirectly result in permanent displacement (as a consequence of monthly flooding), and/or result in disproportionate displacement of socially vulnerable groups?	Strategy causes high or moderate displacement (reactive or proactive) and/or disproportionately impacts socially vulnerable groups	Strategy causes low reactive displacement and/or does not disproportionately impact socially vulnerable groups	Strategy does not directly or indirectly result in displacement
Do the proposed measures in this strategy directly or indirectly worsen public health as a result of exposed contaminated sites, or negative effects on water quality?	Strategy may directly or indirectly result in significant water quality or other public health concerns in the immediate study area and/or larger community (1) >1 contaminated sites are exposed to coastal flooding	Strategy may directly or indirectly result in minimal water quality or other public health concerns for the study area and larger community (2) No contaminated sites are exposed to coastal flooding	No potential for direct or indirect impact on water quality or public health and/or may have potential community benefits (3) Strategy includes explicit measure(s) to remediate contaminated sites
Does the strategy directly or indirectly protect, negatively effect, or have no effect on critical transit routes in public transit dependent communities?	Strategy would remove or reduce a critical transit route for public transit-dependent community; or lack of action would mean the critical transit route will eventually be significantly/moderately impacted by flooding (1)	Strategy would create minor disruption to transit facilities or lack of action would allow minor flooding impacts (2)	Strategy proactively increases resilience of critical transit route (3)

E.2-6.1.6.4 Exposed Affordable Housing

Affordable housing locations include present and future housing locations from the Affordable Housing Pipeline provided by the Mayor's Office of Housing and Community Development and the Office of Community Investment and Infrastructure in 2022. Such projects usually provide affordable units for low-income, unhoused, and senior populations with a minority of the units offered at market price. Due to the lack of affordable housing in San Francisco, communities continue to be pushed out of job markets and displaced, which causes long and costly commutes for workers. With high costs of living and rental prices, there are likely significant losses in social cohesion and cultural identity due to displacement in the study area. Additionally, communities in affordable housing are less likely to be insured and typically have fewer resources to recover from flooding.

Exposed affordable housing follows the same evaluation criteria and scoring definitions described in Sections E.2-E.2-6.1.2.3, and are shown in Table E.2-6-16.

Table E.2-6-16. Evaluation Criteria and Scoring Definitions for Exposed Affordable Housing.

Evaluation Criteria	Scoring Definitions		
	Red	**Yellow**	**Green**
Semi-quantitative assessment of count of assets exposed with 1% AEP flooding. Scores were determined by a two-dimensional scoring matrix, based on time of exposure and number of assets. The number of assets exposed were based on percentages relative to total assets exposed with FWOP.	High exposure = 4-5 in scoring matrix, which represents a higher percent of assets exposed (compared to FWOP) and asset exposure occurring earlier in the period of analysis.	Moderate exposure = 3 in scoring matrix.	Low exposure = 1-2 in scoring matrix, which represents a lower percent of assets exposed (compared to FWOP) and asset exposure occurring later in the period of analysis.

E.2-6.2 Future With Project Findings for the Low SLC Curve

The following section includes the FWP findings for the Low SLC projection. The Low SLC projection results are presented at the waterfront level, as variations in OSE effects between reaches are minimal.

The OSE FWP analysis is primarily based on exposure analyses and qualitative assessments. Flood inundation maps were created for the SFW study to visualize areas of potential coastal flooding that may occur after an alternative has been constructed, including changes over time due to sea level change. The flood inundation maps are the underlying data that inform the OSE FWP exposure analyses and many of the qualitative key drivers. The FWP inundation maps were created by modifying the existing topographic ground elevations to reflect the elevation and extent (or alignment) of each alternative (see *Appendix B.1.2 SF Waterfront Inundation Maps* for additional details on the inundation mapping methodology). As shown in Figure E.2*-6-4*, the proposed alternatives mitigate nearly all flooding expected under the Low SLC projection. This is except for Alternative F and Alternative G, which have alignments farther back from the shoreline to plan for permanent retreat from areas in Reaches 3 and 4.

Table E.2-6-1 in Section E.2-6 shows adaptation planned for 2090, halfway through the study period of analysis, across all alternatives. These adaptive actions include both increases in design elevation of the solution, and slight changes in alignment. Due to the low rate of sea level rise expected for the Low SLC projection, that the adaptive action to increase the height or adjust the location of each alternative are likely not necessary under this scenario. The exposure analysis that was conducted assumes that the adaptive action is completed; however, this does not have meaningful impact on the FWP analysis for the USACE Low SLC projection.

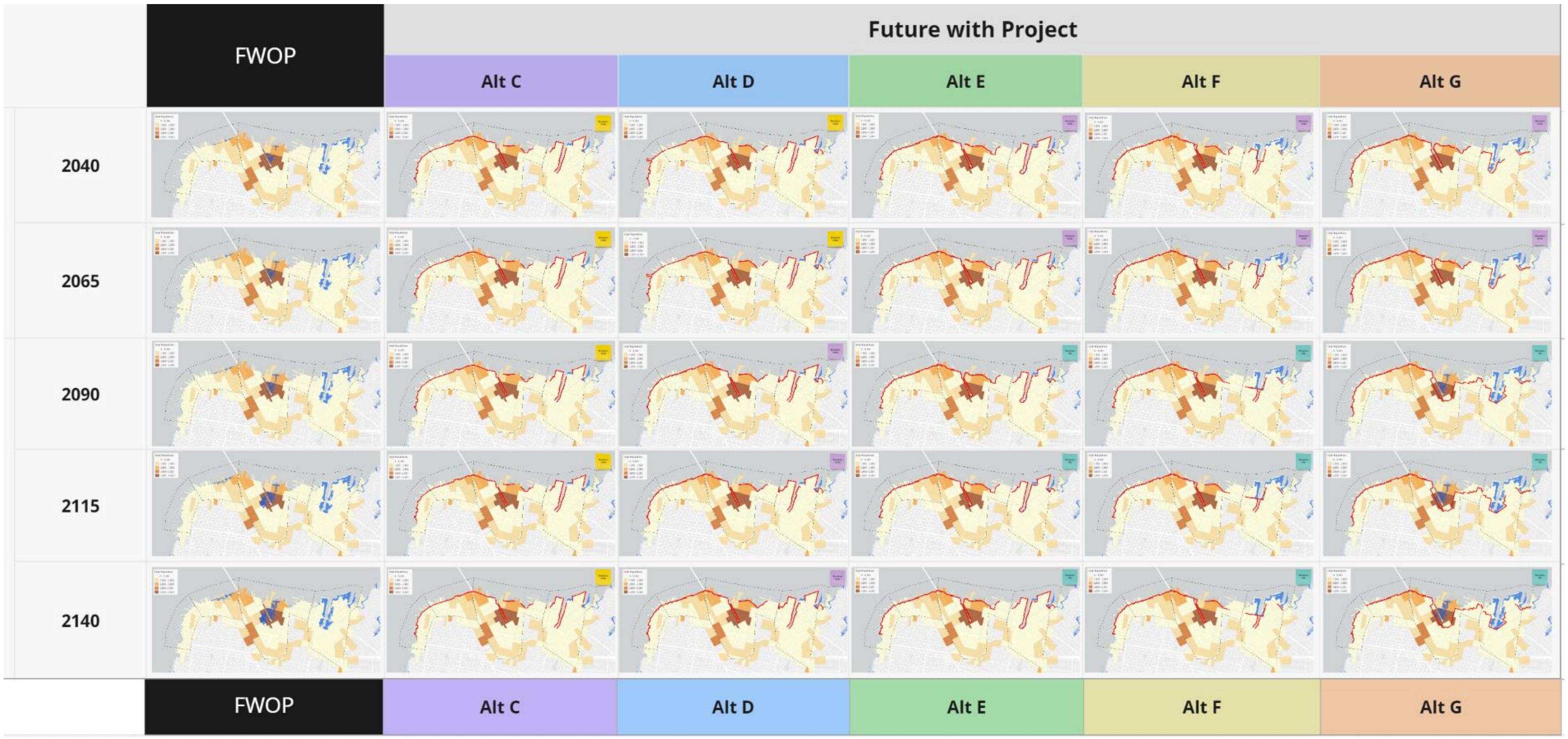


Figure E.2-*6-4*. Exposure Map Matrix for the USACE Low SLC projection, 1% AEP event shown

The OSE FWP findings for the Low SLC curve are presented in matrix format by OSE category, in accordance with the scoring definitions and schemes presented in Section E.2-6.1 above. Additional context is provided below the matrix to support and substantiate findings. This additional context is organized by key driver.

E.2-6.2.1 Health and Safety

The FWOP condition for health and safety key drivers under the Low SLC projection is most severe for seismic life safety risk and resilience. Significant damage and disruption for aged wharves and piers is currently expected at the waterfront in an earthquake, irrespective of flood risk or rate of sea level change. Life safety hazards associated with coastal flooding is likely low due to the nature of the coastal hazard and the ability to predict the timing of high-water levels. Additionally, exposed disaster response assets are minimal in the USACE Low curve FWOP condition: 5 sites are exposed by 2040,6 sites by 2090, and 7 sites by 2140 across the entire study area. Table E.2-6-17 presents the scoring outcomes for the health and safety key drivers under the Low SLC curve.

Table E.2-6-17. Health and Safety Key Driver Outcomes, USACE Low Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Coastal Life Safety Risk	5 – Positive Outcome					
Seismic Life Safety Risk & Resilience	1 – Poor Performance	3 – Neutral Performance		5 – Positive Performance		
Compromised Disaster Response Sites	High Exposure	Low Exposure			Moderate Exposure	

The PDT finds the following health and safety outcomes for the alternatives:

- **Coastal Life Safety Risk** is improved across all the alternatives under the Low SLC projection. Flooding expected within the 1-percent AEP event across the period of analysis does not extend significantly into the study area, and monthly high water is not expected to inundate the study area. Life loss associated with failure of any proposed measure with potentially retained water levels are judged to be extremely low in the Low SLC projection.

- **Seismic Life Safety Risk** is significantly reduced from the FWOP condition in Alternatives E, F, and G, with planned wharf replacement and ground improvements. Vulnerable wharves are replaced with either new structures or solid ground for each alternative, and ground improvement in Alternative E reduces lateral spread risk. Alternatives C and D reduce lateral spread risk with ground improvements, but leaves wharves vulnerable to seismic hazards, thereby earning a “neutral outcome” score. 2090 adaptations planned for Alternative D are expected to reduce seismic life safety risk, however this is not reflected in the scoring above. Alternative B does not change existing shoreline stability risk or wharf structure vulnerability.
- **Disaster Response Sites** have low to moderate exposure for each alternative under the Low SLC projection, with the exception of Alternative B. Alternative B still exposes disaster response sites to the 1% AEP event, even if floodproofing measures are deployed to reduce damage to structures. Alternatives C, D, and E result in minimal residual exposure of disaster response sites, with only 1 site exposed on Pier 52 (Reach 3) for the period of analysis. Alternative F exposes 6 sites in Reach 3 and 4, including Pier 52, Pier 80, and Pier 94-96. These sites could be affected by flooding by 2040. Alternative G exposes the same 6 sites on piers by 2040 due to planned retreat areas.

E.2-6.2.2 Economic Vitality

The economic vitality key drivers indicate how each alternative performs within the context of maritime function for the Port, and continued job access for those who work in the SFW study area. While scoring varies amongst the drivers, Alternative E indicates preferred outcomes for both maritime function and job access, as shown in Table E.2-6-18.

Table E.2-6-18. Economic Vitality Key Driver Outcomes, USACE Low Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Maritime Function	2 – Neutral Outcome	3 – Moderately Positive Outcome		5 – Positive Performance	4 – Moderately Positive Performance	
Job Access	5 - Low Exposure			4 – Moderately Low Exposure	3 - Moderate Exposure	

The PDT finds the following economic vitality outcomes for the alternatives:

- **Maritime function** is moderately affected under Alternatives B, C, and D, as most maritime berthing is lost due to age and condition of the wharf in these alternatives by 2090. Alternatives E, F, and G all preserve berthing in the northern waterfront wharves to 2090; however, Alternatives F and G lose function of the southern waterfront wharves by 2090. Ultimately, the Low and Intermediate SLR projections have substantially lower impact on backland space in the southern waterfront, even without shoreline protection. This is due to a reduced rate of sea level change that affects repetitively flooded areas.

- **Job access** is moderately to highly improved across all alternatives compared to the FWOP baseline. Alternative E offers the highest level of protection for waterfront-dependent jobs that serve potentially vulnerable communities. Alternatives F and G present the greatest threat to such jobs due to the proactive retreat planned for these alternatives. Nevertheless, both alternatives still protect jobs when compared to the FWOP scenario. Alternatives B, C, and D both preserve more job access than Alternatives F and G.

E.2-6.2.3 Social Connectedness

Mobility and public transit disruption is not likely to occur with the alternatives proposed under the USACE Low SLC projection. With a lower rate of sea level rise expected (less than 1 foot over the period of analysis), a 1 percent AEP flood event that exceeds 11 feet NAVD88 is not expected. In alignment with the assumed flood protection and relocation thresholds for public transit networks, no temporary floodproofing and subsequent disruption is expected, nor does SFMTA's network analysis anticipate transit degradation under this SLC scenario. As shown in Table E.2-6-19, all proposed alternatives likely have positive outcomes in terms of limiting mobility disruptions in the face of coastal flooding and sea level rise. Alternative B will likely require some adjustments to the public transit system and may cause temporary disruption.

Table E.2-6-19. Social Connectedness Key Driver Outcomes, USACE Low Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Public Transit Mobility	2 - Some temporary disruption	3 - No disruption				

E.2-6.2.4 Community Identity

Community identity key drivers identify alternatives E and F as having the most positive outcomes for protection of community and cultural assets under the Low SLC projection, as well as preservation of historic assets and districts.

Table E.2-6-20. Community Identity Key Driver Outcomes, USACE Low Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Community and Cultural Assets	No Change from FWOP	Moderate Exposure	Low Exposure			Moderate Exposure
Historic Asset and District Designation	1 – Poor outcome, no change from FWOP		3 – Neutral outcome	5 – Positive Outcome		

The PDT finds the following community identity outcomes for the alternatives:

- **Community and Cultural Assets** remain moderately exposed by Alternatives C and G relative to the FWOP condition. Alternative C has the highest and earliest residual exposure, with 3 cultural assets exposed by 2090. These three assets are designated historic places: the Central Embarcadero Piers and the Ferry Station Post Office. Alternative G exposes 5 community assets in the planned retreat area by 2140; Fire Station #4, Southern District Station, Bureau of Fire Investigation, SFPD’s Public Safety Building, and the Child Advocacy Center. Alternatives D, E, and F have similar levels of reduced exposure relative to FWOP conditions, with each leaving 1 to 2 cultural assets exposed for the entire period of analysis.
- The **Historic Asset and District Designation** evaluation favors Alternatives E, F, and G. These alternatives offer a significant change from FWOP with the replacement of wharf structures, which will elevate historic bulkhead buildings and enable continued access to historic pier sheds. The piers themselves would likely have floodwalls that reduce the risk of overtopping, but the useful life of these structures will deteriorate towards the end of the century without actions outside the study. Alternative D indicates replacement of wharves in 2090, which could maintain the historical setting of the historic districts. However, the age and condition of these assets may affect the historic district designation by this timeframe, and therefore the outcome is considered neutral or uncertain (yellow). Under Alternative C, the alignment does not protect marine structures from flooding due to the setback of the flood protection solution and is assume that historic assets and district designations will remain similar to FWOP. The non-structural plan (Alternative B) does not construct any physical infrastructure that will prolong the life of the Embarcadero Historic District, the Central Embarcadero Piers Historic District, or the Union Iron Works Historic District.

E.2-6.2.5 Social Vulnerability and Resiliency

The social vulnerability and resiliency key drivers appear to collectively favor Alternatives C, D, and E when considering the USACE Low SLC projection (Table E.2-6-21). No alternatives are expected to have “no disproportionate effects” on vulnerable communities because there are not yet specific plans to proactively address historic inequities in the study area.

Table E.2-6-21. Social Vulnerability and Resilience Key Driver Outcomes, USACE Low Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Vulnerable Populations	No Change from FWOP	Low Exposure			Moderate Exposure	
Disproportionate Effects on Vulnerable Communities	High Effects	Moderate Effects				High Effects
Permanently Displaced Population	No Change from FWOP	Low Exposure				
Affordable Housing	No Change from FWOP	Low Exposure				Moderate Exposure

The PDT finds the following social vulnerability and resiliency outcomes for the alternatives:

- **Vulnerable Populations** are highly protected by Alternatives C, D, and E. Additionally, no MTC priority equity communities experience residual exposure under these alternatives for the USACE Low SLC projection. Moderate exposure of vulnerable populations is expected under Alternatives F and G due to pro-active retreat areas. Alternative F primarily impacts Reach 4, while Alternative G impacts both Reaches 3 and 4. Nevertheless, both Alternatives F and G reduce FWOP exposure by 50%, even considering the retreat conditions. The non-structural alternative does not reduce flood exposure of vulnerable populations, as it assumes that assets will be floodproofed in place.

- No **permanent residential displacement** is expected for the structural alternatives due to a lack of repetitive flooding expected under the Low SLC projection.

- **Disproportionate Effects on Vulnerable Communities:** The disproportionate effects driver is related to the degree of flood exposure and location of critical city functions, the socioeconomic characteristics of the affected population, and the presence of nearby contaminated sites. Under the low SLC projection, the alternatives perform similarly in terms of flood protection. As a result, the alternatives also perform similarly in terms of their evaluation for disproportionate effects, with the exception of Alternative G in Reach 4. Due to the inward shift of the line of defense under this alternative, communities residing in and adjacent to the area would experience higher disproportionate exposure from the impacts of retreat.

- **Affordable Housing Sites** are not exposed with Alternatives C, D, E, and F. Alternative G exposes 3 sites by 2090 and 5 by 2140 in Reach 3.

E.2-6.3 Future with Project Findings for the Intermediate SLC Curve

Flood risk in the SFW study area increases approximately 2 feet between the USACE Low and Intermediate SLC curves. Projected sea level rise is expected to increase from approximately 1 foot by 2140 under the Low curve to nearly 3 feet under the Intermediate curve for the same time horizon (see Table E.2-3-2 above). As conceptualized, the proposed alternatives mitigate nearly all flooding expected under both the Intermediate and the Low SLC projections. As shown in Figure E.2-6-5, the primary difference in FWP conditions for the Intermediate SLC projection is the accelerated flood exposure of piers and other assets bayward of the proposed flood protection alignments.[10] This difference is significant enough that the OSE findings for the Intermediate SLC curve are presented at the reach level to support decision-making for the tentatively selected plan (TSP).

Similar to the Low SLC exposure analysis, the Intermediate SLC exposure analysis assumes that adaptive actions are taken in 2090 to increase the level of protection or adjust the alignment of the protective measure. Nevertheless, it is likely that the adaptive actions are not necessary under the Intermediate curve due to the relatively low rate of rise expected. This likely does not have meaningful impact on the FWP analysis.

[10] Piers can be protected by floodproofing but are still considered exposed under the OSE analysis.

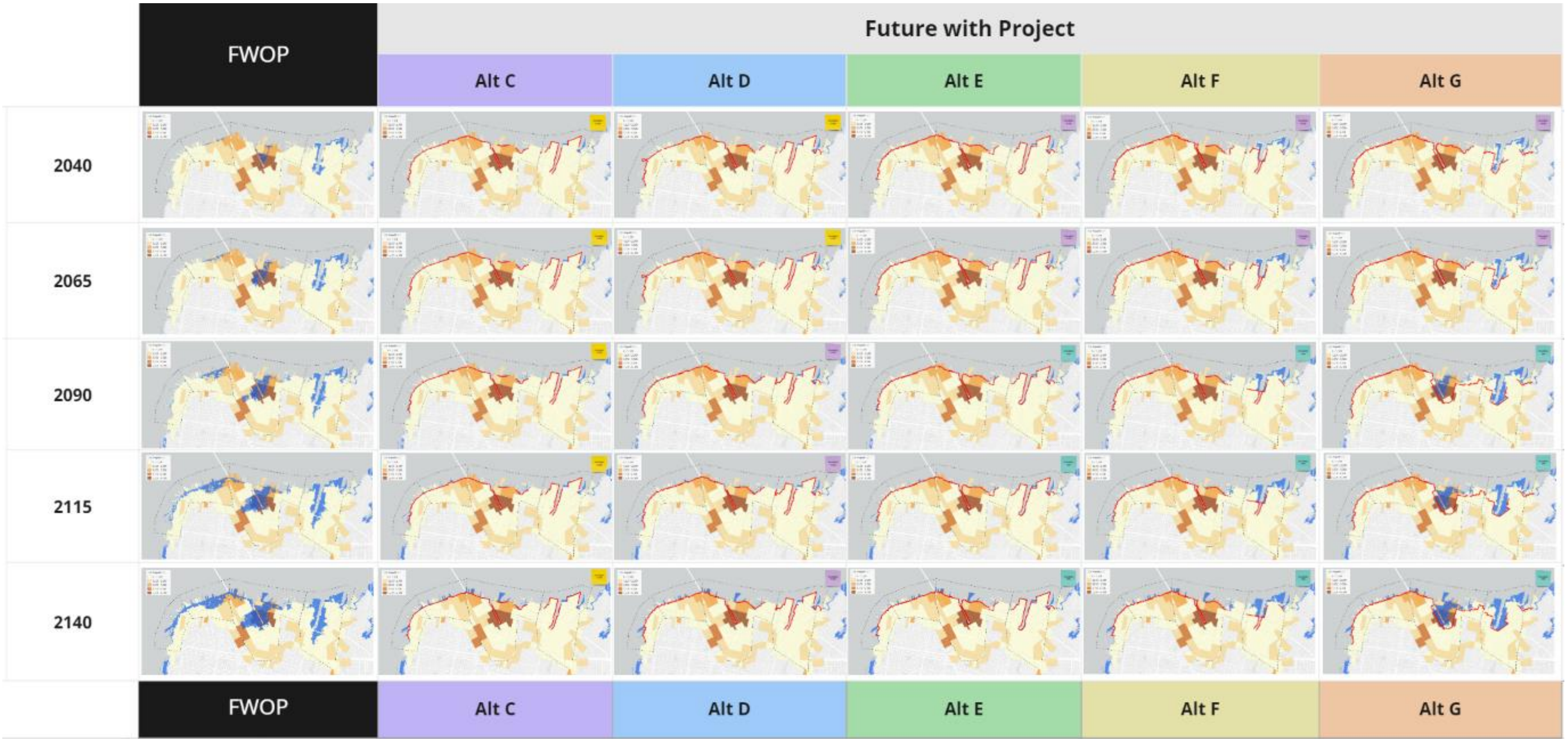


Figure E.2-6-5. Exposure Map Matrix for the USACE Intermediate SLC projection, 1% AEP event shown

E.2-6.3.1 Reach 1 OSE Key Driver Findings

Reach 1 has the lowest residential population throughout the SFW study area but has high public accessibility and visitor counts due to tourist attractions such as Fisherman's Wharf, views of the Golden Gate Bridge, and water recreation opportunities. It is estimated about 45,000 people visit attractions in Reach 1 daily. Several Muni and regional bus lines also operate in Reach 1 and serve roughly 23,500 riders, including Muni light rail. These public transit options are important for transporting workers and tourists alike.

In Reach 1, OSE key driver findings indicate moderate to positive effects for the structural alternatives with minor exceptions. Mostly poor or negative social effects are anticipated for non-structural Alternative B in Reach 1 due to the persistence of flood exposure from extreme events expected.

E.2-6.3.1.1 Health and Safety

Health and safety drivers do not vary significantly between reaches, as the coastal and seismic life safety risk evaluations are conducted at the waterfront scale. Table E.2-6-22 indicates that Alternatives D, E, F, and G have similar positive outcomes for both life safety drivers, while Alternatives B and C are not favorable from a health and safety perspective as modeled for the USACE Intermediate SLC curve.

Table E.2-6-22. Health and Safety Reach 1 Key Driver Outcomes, USACE Intermediate Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Coastal Life Safety Risk	3 – Neutral Performance	5 – Positive Performance				
Seismic Life Safety Risk & Resilience	1 – Poor Performance	3 – Neutral Performance	4 – Moderately Positive Performance	5 – Positive Performance		
Compromised Disaster Response Sites	No Change from FWOP	No Exposure				

The PDT finds the following health and safety outcomes for the alternatives:

- **Coastal Life Safety Risk** will likely be perceived under the FWOP condition for the Intermediate SLC projection, as flooding will be visible and apparent to the public. Alternative B could provide a sense of protection that pose life-safety hazards in a flood event. Flooding in neighborhoods will limit emergency response capabilities, and some residents may choose not to evacuate in an extreme storm event due to floodproofing measures implemented in the non-structural plan. If structural alternatives fail in a 1 percent AEP even by 2140, water depths of 2 feet or less could be expected across the study area. Due to this relatively low depth, life loss associated with failure of any measure under the Intermediate SLC projection are minimal.
- **Seismic Life Safety Risk** Alternative B has the highest potential for damage and disruption, offering no change to the existing shoreline stability risk or the wharf structure vulnerability expected in the FWOP condition. Alternative C has moderate potential for life safety improvements because ground improvements may stabilize shoreline and lifelines along the Embarcadero but does not replace vulnerable wharf structures. Therefore, a “neutral outcome” is expected. Alternative D performs better than C because it replaces vulnerable wharf structures in 2090. Alternatives E, F, and G replace wharves in 2040 and include ground improvements.
- **Disaster Response Sites** are not exposed in the FWOP condition for Reach 1 until 2115. These assets only remain exposed under Alternative B, which may impact Reach 1 disaster response capabilities during and immediately after a flood event. The non-structural alternatives protect all disaster response sites in Reach 1.

E.2-6.3.1.2 Economic Vitality

The economic vitality drivers indicate neutral to positive outcomes for most alternatives in Reach 1. Note that the maritime function driver does not vary between reaches, but rather identifies variations for the northern waterfront (Reach 1 and 2) and the southern waterfront (Reach 3 and 4). Scores in Table E.2-6-23 reflect a composite across the waterfront for simplicity. This is explained in further detail below.

Table E.2-6-23. Economic Vitality Reach 1 Key Driver Outcomes, USACE Intermediate Curve

<table>
<tr><th>OSE Driver</th><th>Alt B</th><th>Alt C</th><th>Alt D</th><th>Alt E</th><th>Alt F</th><th>Alt G</th></tr>
<tr><td>Maritime Function</td><td>2 – Neutral Outcome</td><td colspan="2">3 – Moderately positive outcome</td><td>5 – Very Positive Performance</td><td colspan="2">4 – Positive Outcome</td></tr>
<tr><td>Job Access</td><td>5 - Low Exposure</td><td colspan="5">4 - Moderately Low Exposure</td></tr>
</table>

The PDT finds the following economic vitality outcomes for the alternatives:

- The governing factor of **Maritime Function** scores for neutral or moderately positive scores for Alternatives B, C, and D is the age and condition of wharves in the northern waterfront that will limit future access to deep draft berthing. The wharves will not be replaced in these alternatives, which is the same outcome as stated in the Low SLC projection. Alternatives C and D provide better protection for maritime function than B, where most access is lost but floodproofing of piers provides marginal opportunity. Alternatives E, F, and G preserve berthing by replacing wharves. However, Alternatives F and G are scored as having "moderately positive" outcomes because they will likely result in a loss of deep draft berthing in the future due to planned retreat.
- Job Access in Reach 1 is important as employment opportunities are driven by the retail trade, accommodation, and food service, as well as professional, scientific, and technical services industries. Jobs in the retail and food service industries are generally not resilient to disruption because they rely on tourism, do not provide healthcare benefits, nor allow for telecommuting in most cases. Most Reach 1 jobs are protected across all alternatives (including non-structural) due to reduction of flood risk and reduced residual flood exposure.

E.2-6.3.1.3 Social Connectedness

Similar to the Low SLC projection, **mobility and public transit disruption** is expected to be minimal for most alternatives under the Intermediate SLC curve. A 1% AEP even that exceeds 11-feet NAVD88 in elevation is expected between 2090 and 2115 but is not expected to overtop the proposed solutions that are assumed to have 13.5 and 15.5-foot design elevations. The PDT did not analyze public transit mobility impacts by reach per alternative due to the networked status of the system.

As shown in Table E.2-6-24, the non-structural alternative has some temporary transit disruption expected due to floodproofing deployment measures. The table scores reflect findings for the waterfront. Alternative G may cause long-term disruption expected after build-out, although transit degradations are expected to be low (as opposed to none). Alternatives C, D, E, and F are not expected to cause transit system degradation according to SFMTA expert judgement.

Table E.2-6-24. Social Connectedness Reach 1 Key Driver Outcomes, USACE Intermediate Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Public Transit Mobility	2 - Some temporary disruption expected.	3 - No temporary or long-term system disruption expected.				1 - Long-term disruption is expected.

E.2-6.3.1.4 Community Identity

There is no exposure of community or cultural assets in Reach 1 in either FWOP or FWP conditions under the USACE Intermediate SLC projection. As discussed in Sections E.2-6.2.4, the key driver evaluation for Historic Asset and District Designation is completed at the waterfront scale and does not vary between reach. Nevertheless, Reach 1 contains portions of the Embarcadero Historic District, which is the last in-tact historic break-bulk cargo port in the United States. The FWOP condition assumes that all Embarcadero Historic District assets will be lost due to coastal flood inundation or the age and condition of the existing infrastructure.

Only alternatives E, F, and G are expected to have positive outcomes on historic asset and district designation due to the replacement of wharves that would prolong the life of the Embarcadero Historic District. See Table E.2-6-25 for reference.

Table E.2-6-25. Community Identity Reach 1 Key Driver Outcomes, USACE Intermediate Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Community and Cultural Assets	No Exposure					
Historic Asset and District Designation	1 – Poor outcome, no change from FWOP		3 – Neutral outcome	5 – Positive Outcome		

E.2-6.3.1.5 Social Vulnerability and Resiliency

Social vulnerability and resiliency key drivers have similar scoring results due to the limited residential population that lives in Reach 1 and are exposed to coastal flooding under the FWOP condition for the Intermediate SLC projection. Table E.2-6-26 displays these results.

Table E.2-6-26. Social Vulnerability and Resilience Reach 1 Key Driver Outcomes, USACE Intermediate Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Vulnerable Populations	No Change from FWOP	Low Exposure				
Disproportionate Effects on Vulnerable Communities	High Effects	Moderate Effects				
Permanently Displaced Population	No Exposure					
Affordable Housing	No exposure					

The PDT finds the following social vulnerability and resiliency OSE outcomes for the alternatives:

- **Vulnerable Populations.** Alternative B has the highest vulnerable population exposure, performing similarly to FWOP conditions because of the continued presence of flooding allowed by the nonstructural alternative. Alternatives C through G reduce the already limited vulnerable population exposure from FWOP by nearly 88% by 2140.
- **Disproportionate Effects on Vulnerable Communities.** In Reach 1, under the intermediate sea level rise curve, all structural alternatives provide adequate flood protection through 2140, thus preserving Reach 1's current land uses, critical transit, and jobs. However, the Alternatives do not proactively increase the resilience of these considerations. Reach 1 is also not considered a historically disinvested community, which is another significant factor in this metric. The combination of these two sub-metrics primarily drove the "moderate disproportionate effects" result, rather than a "no disproportionate effects" result. Alternative B has the potential to cause high disproportionate effects on vulnerable communities due to remaining flood exposure. Flooding in this area could have broader impacts on transit-dependent communities outside of Reach 1. These vulnerable populations include minimum wage workers and low-income people who depend on the land uses and functions in Reach 1 for their jobs and livelihoods.

Similar to vulnerable population exposure, there are no permanently displaced populations or exposure to affordable housing sites in the FWOP or FWP conditions under the Intermediate SLC projection.

E.2-6.3.2 Reach 2 OSE Key Driver Findings

Reach 2 represents the Bay Area's largest and densest job center, with moderate amounts of housing and considerable commercial space, including popular destinations such as the Exploratorium and the iconic Ferry Building. Between the waterfront attractions and the Financial District, approximately 200,000 jobs are available in this area. Additionally, Reach 2 contains significant city and regional transportation infrastructure and connection points, including the ferry terminals, two underground BART/Muni stations (e.g., Embarcadero and Montgomery Stations), multiple Muni bus lines, historic streetcars, cable cars, and ferry terminals.

In Reach 2, OSE key driver findings under the USACE Intermediate projection continue to indicate moderate to positive effects for the structural alternatives, with the exception of Alternative C due to the unprotected piers.

E.2-6.3.2.1 Health and Safety

Health and safety key driver outcomes in Reach 2 are similar to Reach 1 due to the waterfront scoring approach taken for the coastal and life safety risk drivers, as well as a high level of protection offered for the Intermediate SLC projection with limited residual flood exposure.

Table E.2-6-27 shows the results of the health and safety key driver outcomes for Reach 2 under the Intermediate curve. Like Reach 1, it is anticipated that coastal and seismic life safety could exist under Alternatives B and C due to a combination of perceived flood protection and limited shoreline stability or wharf vulnerability being addressed under the two alternatives.

Up to 8 disaster response sites are exposed to the 1 percent AEP event Reach 2 under the FWOP condition for the Intermediate SLC projection. Alternatives D, E, F, and G result in low residual exposure of disaster response assets, with 3 sites located on piers exposed by 2140. Alternative C has moderate residual exposure with 4 pier-based disaster response sites exposed by 2140.

Table E.2-6-27. Health and Safety Reach 2 Key Driver Outcomes, USACE Intermediate Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Coastal Life Safety Risk	2 – Neutral Performance	5 – Positive Performance				
Seismic Life Safety Risk & Resilience	1 – Poor Performance	3 – Neutral Performance	4 – Moderately Positive Performance	5 – Positive Performance		
Compromised Disaster Response Sites	No Change from FWOP	Moderate Exposure	Low Exposure			

E.2-6.3.2.2 Economic Vitality

As discussed above, the maritime function evaluation for Reach 1 and Reach 2 under the Intermediate SLC projection are similar. The neutral or moderately positive scores for maritime function for Alternatives B, C, and D are driven by the age and condition of wharves, which will not be replaced in these alternatives. Alternatives E, F, and G likely preserve berthing by replacing wharves. It is also noted that floodproofing of the piers is critical in Reach 2 given the location of the Port's Headquarters and Emergency Operating Center.

Job Access is important in Reach 2 given the magnitude of employment opportunities offered in the Financial District. The PDT assume that the majority of jobs protected by the proposed alternatives are moderately resilient, in that they are not location-dependent and present opportunities to work remotely even for a short period of time. Given the amount of flood protection offered by each alternative, it is expected that each has similar performance for jobs bayward of the line of protection. In Table E.2-6-28, jobs that might be affected reflects those supported by unprotected piers. Note that jobs protected by the structural alternatives are similar values, the scoring in Table E.2-6-28 is reflective of small variations.

Table E.2-6-28. Economic Vitality Reach 2 Key Driver Outcomes, USACE Intermediate Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Maritime Function	2 – Neutral Outcome	3 – Moderately Positive Outcome		5 – Very Positive Outcome	4 - Positive Outcome	
Job Access	5 - Low Exposure	3 - Moderate Exposure		4 - Moderately Low Exposure		

E.2-6.3.2.3 Social Connectedness

The social connectedness and public transit mobility driver results apply to all reaches across the waterfront, as it represents potential impact to the network. As shown in Table E.2-6-30, mobility and public transit disruption is expected to be minimal for most alternatives under the Intermediate SLC projection. Alternative B will likely result in temporary disruption of the transit network, while Alternative G is likely to result in long-term disruption due to the reconfiguration needed with the alternative in place. Note that transit degradations are still expected to be low, as opposed to none.

While the OSE analysis assumes a network-based approach to evaluation, Reach 2 contains several critical public transit assets, such as the BART and Muni Embarcadero Station and Muni Metro Turnaround. Impacts to these two assets have cascading effects across the entire public transit network in San Francisco. Both are protected across all alternatives presented.

Table E.2-6-29. Social Connectedness Reach 2 Key Driver Outcomes, USACE Intermediate Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Public Transit Mobility	2 - Some temporary disruption expected.	3 - No temporary or long-term system disruption expected.				1 - Long-term disruption is expected.

E.2-6.3.2.4 Community Identity

The community identity evaluation for Reach 2 identifies either neutral or positive outcomes for Alternatives D, E, F, and G. While the Historic Asset and District Designation key driver is evaluated at the waterfront-level (therefore does not change for the reach evaluations), Reach 2 comprises the Embarcadero Historic District, including the Central Embarcadero Piers Historic District. Table E.2-6-30 presents the following findings for community identity key drivers:

- Eighteen **community and cultural assets** are exposed in Reach 2 by 2140 under the FWOP condition for the Intermediate curve, including assets on piers. These assets have low residual exposure for Alternatives D, E, F, and G. Under Alternative D, 3 cultural assets are exposed by 2140 and Alternatives E, F, and G expose 2 cultural assets by 2140. Alternative C moderately exposes community and cultural assets, including 4 by 2090, increasing to 6 by 2140. All assets with residual exposure under the structural alternatives are located on piers.

- Similar to the Reach 1 **historic asset and district designation** evaluation results, only Alternatives E, F, and G are expected to prolong the life of the two historic districts due to wharf replacement plans. Additionally, these plans include elevating the historic bulkhead buildings to raise them above the future floodplain and stabilize the shoreline, thereby reducing the seismic risk to historic assets. Alternative D received a "neutral outcome" score because it does not initially construct replacement wharves that would affect the two historic districts in Reach 2, although the adaptable plan indicates the potential replacement of wharves in the future that would maintain the historical setting of the districts. Alternatives B does not construct any physical infrastructure that will prolong the life of the Reach 2 historic districts. Even though historical structures would be floodproofed, the historical setting would be lost without improvements to the piers and wharves. Alternative C also receives a "poor outcome" score because the line of protection is landward of most Reach 2 historic district assets and would require extensive floodproofing, nor are replacement wharves included in the plan.

Table E.2-6-30. Community Identity Reach 2 Key Driver Outcomes, USACE Intermediate Curve

<table>
<tr><th>OSE Driver</th><th>Alt B</th><th>Alt C</th><th>Alt D</th><th>Alt E</th><th>Alt F</th><th>Alt G</th></tr>
<tr><td>Community and Cultural Assets</td><td>No Change from FWOP</td><td>Moderate Exposure</td><td colspan="4">Low Exposure</td></tr>
<tr><td>Historic Asset and District Designation</td><td colspan="2">1 – Poor outcome, no change from FWOP</td><td>3 – Neutral outcome</td><td colspan="3">5 – Positive Outcome</td></tr>
</table>

E.2-6.3.2.5 Social Vulnerability and Resiliency

A maximum of 3,795 people are exposed to coastal flooding in Reach 2 under the FWOP condition for the Intermediate SLC projection. Due to the level of protection provided by the alternatives to residential land uses, residual exposure of residents and affordable housing units in the FWP conditions is limited. Table E.2-6-31 demonstrates that all structural alternatives have positive performance outcomes for social vulnerability and resiliency key drivers in Reach 2.

Table E.2-6-31. Social Vulnerability and Resiliency Reach 2 Key Driver Outcomes, USACE Intermediate Curve

<table>
<tr><th>OSE Driver</th><th>Alt B</th><th>Alt C</th><th>Alt D</th><th>Alt E</th><th>Alt F</th><th>Alt G</th></tr>
<tr><td>Vulnerable Populations</td><td>No Change from FWOP</td><td colspan="5">Low Exposure</td></tr>
</table>

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Disproportionate Effects on Vulnerable Communities	High Effects	Low to Moderate Effects				
Permanently Displaced Population	No Exposure					
Affordable Housing	No Change from FWOP	No Exposure				

The PDT finds the following social vulnerability and resiliency outcomes for the alternatives:

- Alternatives C, D, E, F, and G reduce flood risk exposure of **socially vulnerable populations** by 90% compared to FWOP conditions. This likely has the greatest effect on people over 65 and minorities, the most prevalent social vulnerability characteristics in Reach 2.
- **Disproportionate Effects on Vulnerable Communities.** In Reach 2, the non-structural alternatives provide adequate flood protection resulting in low to non-existent flood exposure through 2140. This is assumed to preserve Reach 2's current land uses, critical transit systems, and jobs landward of the alternatives. While Reach 2 is not a historically disinvested community, the alternatives do not proactively increase or improve disproportionate effects on vulnerable communities. Therefore, similar to Reach 1 findings, the alternatives are scored as having "low to moderate" disproportionate effects on vulnerable communities.
- **Affordable Housing** locations in Reach 2 are fully protected with Alternatives C, D, E, F and G in place. Alternative B provides no change from FWOP with displacement and affordable housing site exposure. As discussed in the health and safety section, the perception of flood risk protection in the non-structural alternative may present coastal life safety issues.

No permanent displacement is expected in Reach 2 for FWOP or FWP conditions due to the low elevations associated with monthly flooding.

E.2-6.3.3 Reach 3 OSE Key Driver Findings

Reach 3, also known as South of Market (SOMA) and Mission Creek / Mission Bay is the most densely populated residential area of the SFW study area, with high numbers of socially vulnerable populations. Among all the reaches, Reach 3 has the greatest concentration of children, elderly, low-income, linguistically isolated, and non-white populations. This area is an important transportation corridor that connects jobs and resources to northern parts of the city through the T-Third Muni Metro line and roadways. It is estimated that approximately 27,500 people travel through this area daily.

In Reach 3, OSE key driver findings are influenced by the flood protection approach in Mission Creek. Alternatives C, D, E, and F are designed to reduce flood exposure, while Alternative G is designed for adaptation and proactive retreat planned after 2090. The residual exposure associated with Alternative G, even for proactive retreat, results in poor or negative scoring evaluations for many OSE key drivers.

E.2-6.3.3.1 Health and Safety

Health and safety key driver outcomes in Reach 3 continue to favor Alternatives D, E, F, and G from a life safety risk and disaster response perspective (see Table E.2-6-32). In fact, the health and safety metrics are some of the only OSE evaluations for Reach 3 that result in positive outcomes for Alternative G. As discussed in Reach 1 and Reach 2, coastal and seismic life safety risk scores represent a waterfront approach. Residual exposure of disaster response sites in Reach 3 also continues to be low across all non-structural alternatives.

Table E.2-6-32. Health and Safety Reach 3 Key Driver Outcomes, Intermediate Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Coastal Life Safety Risk	3 – Neutral Performance	5 – Positive Performance				
Seismic Life Safety Risk & Resilience	1 – Poor Performance	3 – Neutral Performance	4 – Moderately Positive Performance	5 – Positive Performance		
Compromised Disaster Response Sites	No Change from FWOP	Low Exposure				

The PDT finds the following health and safety outcomes for the alternatives in Reach 3:

- Flooding will be visible and apparent to the public in Reach 3 in the FWOP condition, as this area will be one of the first to experience extensive monthly flooding. The high concentration of residences in Reach 3 highlight the importance of **coastal life safety risk**. Alternative B may result in life safety concerns due to the number of people living in the 1 percent AEP inundation area.
- **Seismic Life Safety Risk** continues to favor alternatives D, E, F, and G due to planned wharf replacements and ground improvements. Alternative B and C result in negative or neutral outcomes because there is no change to existing shoreline stability risk or vulnerable wharf structures proposed through these alternatives.
- Thirteen **disaster response sites** may be exposed to coastal flooding in Reach 3 by 2140 under the USACE Intermediate curve for the FWOP condition. Alternative B will not reduce this exposure, as flooding will continue to overtop the current shoreline. The non-structural alternatives will all result in low residual exposure of disaster response sites compared to the FWOP condition, with

7 disaster response sites experiencing residual exposure by 2140 with the alternatives in place. Sites that could experience residual exposure are bayward of the proposed line of defense.

E.2-6.3.3.2 Economic Vitality

The economic vitality key drivers evaluation point to Alternatives D, E, and F as those with positive or neutral outcomes in Reach 3. The maritime function scores presented in Table E.2-6-33 reflect the scores for both Reach 3 and 4 and consider that southern waterfront piers and wharves near the end of their useful life in 2090. It is assumed these assets will only remain operational in 2140 when replaced by a proposed alternative.

Table E.2-6-33. Economic Vitality Reach 3 Key Driver Outcomes, Intermediate Curve

<table>
<tr><th>OSE Driver</th><th>Alt B</th><th>Alt C</th><th>Alt D</th><th>Alt E</th><th>Alt F</th><th>Alt G</th></tr>
<tr><td>Maritime Function</td><td>2 – Neutral Outcome</td><td colspan="2">3 – Moderately Positive Outcome</td><td>5 – Very Positive Outcome</td><td colspan="2">4 - Moderately Positive Outcome</td></tr>
<tr><td>Job Access</td><td>5 - Low Exposure</td><td>3 - Moderate Exposure</td><td colspan="2">4 - Moderately Low Exposure</td><td>3 - Moderate Exposure</td><td>1 - High Exposure</td></tr>
</table>

The PDT finds the following economic vitality scores and outcomes for the alternatives in Reach 3:

- **Maritime Function** in Reach 3 is focused on retaining deep draft berthing opportunities. Alternative E retains 90% of deep draft berthing in the southern waterfront. Alternatives C, D, F, and G, while neutral to moderately positive outcomes are expected, only retain half of the southern waterfront's deep draft berthing. This allows maritime business lines to remain functional.
- **Job Access** is impacted greatest by Alternative G, with job losses closest to FWOP due to planned retreat. Alternative C and F have a moderate impact on Job Protection, with job losses not as great as Alternative G but closer to FWOP than other alternatives. Alternatives Dand E have lower levels of job loss, with the lowest impact seen with Alternative E.

E.2-6.3.3.3 Social Connectedness

The social connectedness and public transit mobility driver results for Reach 3 are the same as Reaches 1 and 2. As shown in Table E.2-6-34, mobility and public transit disruption is expected to be minimal for most alternatives under the Intermediate SLC projection. Alternative G is likely to result in long-term disruption due to the reconfiguration needed in the proactive retreat areas near Mission Creek. This disruption is likely due to several Reach 3 and 4 assets being affected by Alternative G's retreat solution, including the Mission 4th Street Bridge in Reach 3.

Table E.2-6-34. Social Connectedness Reach 3 Key Driver Outcomes, Intermediate Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Public Transit Mobility	2 - Some temporary disruption expected.	3 - No temporary or long-term system disruption expected.				1 - Long-term disruption is expected.

E.2-6.3.3.4 Community Identity

The community identity evaluation for Reach 3 identifies either neutral or positive outcomes for Alternatives D, E, and F. Community and cultural assets have no residual exposure to flooding under all non-structural alternatives except for Alternative G. The Union Iron Works Historic District, located near Crane Cove Park, is the primary historic district in Reach 3; some assets within this district will be lost in the FWOP condition due to inundation or age and condition of the existing infrastructure. Table E.2-6-35 presents the following findings for community identity key drivers:

- Seventeen **community and cultural assets** are exposed in Reach 3 by 2140 under the FWOP condition for the Intermediate curve. None of these assets will be exposed to coastal flooding under alternatives C, D, E, and F. Alternative G exposes 5 community assets to coastal flooding before 2090, when proactive retreat is expected. The nonstructural alternative will still expose community and cultural assets to flooding and will likely result in accessibility issues for the surrounding community.
- Alternatives E, F, and G are expected to prolong the life of the wharves that contribute to the Union Works Historic District – which is the first steel shipyard on the West Coast and made a significant contribution to World War II efforts. A "positive outcome" is assigned because Alternative G protects historic district assets through 2140 assuming local floodproofing of piers. Alternative B and C are assumed to perform similarly to the FWOP condition and result in loss of the Union Iron Works Historic District, while Alternative D is assigned a "neutral outcome" score. The neutral outcome is assigned to Alternative D because it is unclear if replacement of wharves will need to occur before or after the existing facilities reach the end of their useful life.

Table E.2-6-35. Community Identity Reach 3 Key Driver Outcomes, Intermediate Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Community and Cultural Assets	No Change from FWOP	No Exposure				High Exposure

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Historic Asset and District Designation	1 – Poor outcome, no change from FWOP		3 – Neutral outcome	5 – Positive Outcome		

E.2-6.3.3.5 Social Vulnerability and Resiliency

Over 12,900 residents may be exposed to coastal flooding in Reach 3 under the FWOP condition for the Intermediate SLC projection. Table E.2-6-36 shows that Alternatives C through F have neutral to positive outcomes for each of the four social vulnerability and resiliency key drivers. Alternative G has poor outcomes due to permanent displacement necessary for proactive retreat, including proactive retreat impacts on affordable housing, which is limited in San Francisco.

Table E.2-6-36. Social Vulnerability and Resilience Reach 3 Key Driver Outcomes, Intermediate Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Vulnerable Populations	No Change from FWOP	Low Exposure				Moderate Exposure
Disproportionate Effects on Vulnerable Communities	High Effects	Low to Moderate Effects				High Effects
Permanently Displaced Population	No Change from FWOP	No exposure				High Exposure
Affordable Housing	No Change from FWOP	No exposure				Moderate Exposure

The PDT finds the following social vulnerability and resiliency outcomes for the alternatives:

- **Vulnerable Populations** in Reach 3 are most protected under Alternatives C, D, E, and F, with a 90% reduction in exposure expected over the period of analysis. Alternative G results in moderate residual exposure relative to FWOP and Alternative B conditions, but still offers 50% reduction in exposure of vulnerable populations considering the proactive retreat planned. Vulnerable populations who may be affected the greatest include linguistically isolated residents, minorities, and residents living in poverty.
- There are two primary concerns as it relates to **disproportionate effects on vulnerable communities** in Reach 3: a history of disinvestment in the South Beach area, and the presence of contaminated sites near dense residential areas. Considering these factors, flood protection offered by Alternatives C through F are adequate to protect area residents and reduce flooding that may affect contaminated sites. However, similar to the evaluation in Reach 1 and 2, the proposed alternatives do not proactively increase the resilience of Reach 3

and therefore were scored as “low to moderate effects” on vulnerable communities relative to FWOP conditions. Alternative B and G are expected to result in “high” disproportionate effects relative to FWOP in Reach 3. Flooding under the intermediate curve in Reach 3 exposes nearly 40 contaminated sites by 2140, posing significant water quality and public health concerns. Alternative G reflects the same conditions as Alternative B through the planned proactive retreat, which still places vulnerable populations at risk of experiencing inequitable housing, waterfront access, and job security challenges that are not experienced in other reaches and alternatives. The unaddressed flood risks associated with Alternatives B and G are expected to further exacerbate historic and present-day inequities.

- **Permanent residential displacement** is only expected under Alternative G. Approximately 400 residents live in the proposed proactive retreat area, a portion of which exhibit social vulnerability characteristics.
- Approximately 21 **affordable housing sites** in Reach 3 may be exposed to flooding in the FWOP condition for the Intermediate curve. Alternative G’s proactive retreat approach may affect nearly half of the affordable housing locations in the Reach.

E.2-6.3.4 Reach 4 OSE Key Driver Findings

Reach 4 includes the industrial zone surrounding Islais Creek and the northern portion of the Bayview residential area, the Port’s marine cargo terminals and industrial operations within the Pier 80-96 Eco-Industrial Center, and Heron’s Head Park. The Bayview Islais Creek neighborhood is ethnically diverse with large Black, Asian, and Latino populations, and has a strong African American cultural legacy. The neighborhood has been subjected to significant historical and environmental injustices, and has high socially vulnerability, with high poverty, crime, unemployment, and hospitalization rates relative to San Francisco. The Islais Creek watershed also has environmental challenges due to the long-standing presence of industrial uses and freight transportation. The neighborhood contains areas identified by CalEnviroScreen as being in the top 10 percent in California for pollution burden from hazardous waste, solid waste, and impaired water.

The FWP condition in Reach 4 experiences the most residual flood exposure out of the four reaches in the study area due to planned retreat in Alternative F and G. There is no exposure with overtopping in Alternatives C, D, and E in this reach.

E.2-6.3.4.1 Health and Safety

Health and safety key driver outcomes in Reach 4 collectively favor Alternative D and E, shown in Table E.2-6-37. From a coastal and seismic life safety perspective, Alternatives F and G have “positive” outcomes, as the plans relocate residents and businesses from harm’s way in the long-term. Nevertheless, high exposure of disaster response sites due to proactive retreat is planned by Alternatives F and G. As discussed in previous reach analyses, coastal and seismic life safety risk scores represent a waterfront approach.

Table E.2-6-37. Health and Safety Reach 4 Key Driver Outcomes, USACE Intermediate Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Coastal Life Safety Risk	3 – Neutral Performance	5 – Positive Performance	5 – Positive Performance	5 – Positive Performance	5 – Positive Performance	5 – Positive Performance
Seismic Life Safety Risk & Resilience	1 – Poor Performance	3 – Neutral Performance	4 – Moderately Positive Performance	5 – Positive Performance	5 – Positive Performance	5 – Positive Performance
Compromised Disaster Response Sites	No Change from FWOP	Low Exposure	No Exposure	Low Exposure	High Exposure	High Exposure

The PDT finds the following health and safety outcomes for the alternatives:

- **Coastal Life Safety Risk** for Reach 4 assumes "positive" outcomes for the structural alternatives, including Alternatives F and G. As stated above, positive outcomes are assigned for Alternative F and G because proactive retreat will relocate residents and businesses from flood-prone areas that present several health and public safety challenges. Alternative B will have moderately poor outcomes in Reach 4 due to the potential for flooding to persist, even if physical damage is not incurred.
- **Seismic Life Safety Risk** Alternative B has the highest potential for damage and disruption, as it offers no change to the existing shoreline stability risk or wharf structure vulnerability. Alternative C has moderate potential because ground improvements may stabilize the shoreline but does not replace vulnerable wharf structures. Alternative D performs better than C because it replaces vulnerable wharf structures in 2090. Alternatives E, F, and G replace wharves in 2040 and include ground improvements. Additionally, retreat planned for Alternatives F and G will remove people from the seismically-vulnerable waterfront in Reach 4.
- Eight **Disaster Response Sites** will be exposed to coastal flooding by 2140 in Reach 4 in the FWOP condition. Alternatives C, D, and E have no to very low exposure to disaster response sites, with 1 site exposed by 2115. Alternatives F and G have high exposure disaster response sites with a total of 8 sites, mainly located on piers, exposed by 2115. These disaster response sites will likely require relocation under Alternatives F and G and finding a replacement staging area such as Pier 80 will be challenging in urban San Francisco.

E.2-6.3.4.2 Economic Vitality

The economic vitality key drivers evaluations do not point to a consistent high-performing alternative in Reach 4 (see Table E.2-6-38). This is potentially due to lack of maritime-specific job data, as the job access analysis considers mostly industrial and warehousing jobs to be affected and protected in Reach 4. Below are specifics related to the maritime function and job access key drivers.

Table E.2-6-38. Economic Vitality Reach 4 Key Driver Outcomes, USACE Intermediate Curve

<table>
<tr><th>OSE Driver</th><th>Alt B</th><th>Alt C</th><th>Alt D</th><th>Alt E</th><th>Alt F</th><th>Alt G</th></tr>
<tr><td>Maritime Function</td><td>2 – Neutral Outcome</td><td colspan="2">3 – Moderately Positive Outcome</td><td>5 - Positive Outcome</td><td colspan="2">4 - Moderately Positive Outcome</td></tr>
<tr><td>Job Access</td><td colspan="4">5 - Low Exposure</td><td>1 – Moderately High Exposure</td><td>2 - High Exposure</td></tr>
</table>

The analysis finds the following economic vitality outcomes for the alternatives:

- The **Maritime Function** in Reach 4 is mostly associated with backland space that is connected to maritime berths, railways, and roadways to support the maritime industry. The FWOP condition and some of the FWP alternatives will result in a loss of backland space throughout the period of analysis. All of the SFW study area's backland space is concentrated in Reach 4. This space will no longer be viable for maritime use when coastal flooding inundates a majority of the parcel or impedes access to rail, road, or maritime transportation. Implementation of Alternative F and G will reduce backland space due to planned proactive retreat. However, these alternatives still have "moderately positive" outcomes because the solutions will protect berthing sites and backland area in Reach 4 prior to planned retreat beginning in 2090.
- **Job Access** in Reach 4 is mostly protected under Alternatives C, D, and E. The proposed solutions offer sufficient flood protection that will not likely disrupt jobs. Alternative F and G will expose jobs to permanent relocation. Alternative B has positive job access benefits in Reach 4; nevertheless, it is expected that waterfront industrial areas exposed to flooding in Reach 4 may cause job disruption that is not accounted for in the analysis.

E.2-6.3.4.3 Social Connectedness

The social connectedness and public transit mobility driver results for Reach 4 do not deviate from the other reaches. As shown in Table E.2-6-39, mobility and public transit disruption is expected to be minimal for most alternatives under the Intermediate SLC projection. Alternative G is likely to result in long-term disruption due to the reconfiguration needed in the proactive retreat areas near Islais Creek. This disruption is likely due to several Reach 3 and 4 assets being affected by Alternative G's retreat solution, including the T-Third Light Rail Line and Third Street corridor, which are vital for connecting the southern and northern parts of the SFW study area.

Table E.2-6-39. Social Connectedness Reach 4 Key Driver Outcomes, USACE Intermediate Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Public Transit Mobility	2 - Some temporary disruption expected.	3 - No temporary or long-term system disruption expected.				1 - Long-term disruption is expected.

E.2-6.3.4.4 Community Identity

The community identity evaluation for Reach 4 identifies either neutral or positive outcomes for Alternatives D through G. Only 1 community asset, Fire Station #25, is exposed to flooding in Reach 4 under the FWOP condition for the Intermediate Curve, and there are no historic districts in Reach 4 that were included in the historic asset and district designation evaluation.

As shown in Table E.2-6-40, Alternatives C through F protect the one Reach 4 community asset exposed in the FWOP condition. This asset will need to be relocated permanently by 2090 under Alternative G.

Table E.2-6-40. Community Identity Reach 4 Key Driver Outcomes, USACE Intermediate Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Community and Cultural Assets	No Change from FWOP	No Exposure				Moderate Exposure
Historic Asset and District Designation	1 – Poor outcome, no change from FWOP		3 – Neutral outcome	5 – Positive Outcome		

E.2-6.3.4.5 Social Vulnerability and Resiliency

Reach 4's development history indicates that the Bayview community has serious concerns around equity and environmental justice, job loss, gentrification, and access to open space. Historic displacement has been fueled by gentrification and rising housing costs, pushing longtime residents out of the area. Notably, census data shows that the Black population in this neighborhood has declined from 65% in 1990 to 48% in 2000, to 28% currently. The Bayview Hunters Point neighborhood serves as a cultural asset for the entire City and was declared the African-American Arts and Cultural District in 2018.

The current and future floodplain in Reach 4 does not extend significantly into the Bayview community to expose residents directly. Over 160 residents may be exposed to coastal flooding in Reach 4 under the FWOP condition for the Intermediate SLC projection. Table E.2-6-41 shows that Alternatives C, D, and E have neutral to positive outcomes for each of the four social vulnerability and resiliency key drivers. Alternative F and G have poor outcomes due to permanent displacement necessary for proactive retreat.

Table E.2-6-41. Social Vulnerability and Resiliency Reach 4 Key Driver Outcomes, USACE Intermediate Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Vulnerable Populations	No Change from FWOP	Moderate Exposure			High Exposure	
Disproportionate Effects on Vulnerable Communities	High effects	Low to Moderate Effects			High Effects	
Permanently Displaced Population	No Change from FWOP	No Exposure			Moderate Exposure	
Affordable Housing	No Exposure					

The PDT finds the following social vulnerability and resiliency outcomes for the alternatives in Reach 4:

- **Vulnerable Populations** are moderately protected by Alternatives C, D, and E, with an expected 70% reduction in flood exposure by 2140. Alternatives F and G reduce exposure of vulnerable populations by only 6% until 2090, when planned retreat will likely occur.
- **Disproportionate Effects on Vulnerable Communities** are a vital consideration for alternatives analyzed in Reach 4 due to the history of disinvestment in the community. Alternatives C, D, and E provide adequate flood protection and present limited residual exposure of residents but are likely to result in "low to moderate" disproportionate effects because none of the alternatives result in proactive improvements in community resilience. Alternatives B, F, and G have the potential to cause high disproportionate effects on vulnerable communities in Reach 4. Alternative B will likely result in temporary transit disruptions that could reduce access to the T-Third Light Rail Line, Third Street corridor, Third and Illinois Street Bridges which are vital for connecting southern and northern parts of the waterfront. Additionally, Alternative B flooding exposes over 20 contaminated sites posing water quality and public health concerns in Reach 4.

  Proactive retreat planned for Alternatives F and G reflect displacement concerns for the Reach 4 community. The proposed solutions do not address the potential loss of land use and workforce that the Bayview community relies on, and may place vulnerable populations at risk of housing, waterfront access, and job security inequities. There is an immediate connection between Reach 4 and the Bayview Hunters Point neighborhood. Transit impacts in Reach 4 will have a direct effect on south bound traffic heading into the Bayview Hunters Point neighborhood. The Bayview Hunters Point neighborhood is a designated MTC Equity Priority Community and has a long history of disinvestment, and racial and environmental injustice. Therefore, Alternatives B, F, and G may limit access to jobs, health centers, the greater Bay Area, and cause longer commute times for vulnerable populations coming from the Bayview Hunters Point community.

- **Displaced Population** Alternatives F and G have moderate impacts in displacing populations, with about 150 people displaced due to proactive retreat. This planned displacement may have significant challenges in Reach 4, as the African-American Arts and Cultural District was created specifically to prevent gentrification and permanent displacement from the community.

No **affordable housing** sites in Reach 4 are expected to be impacted by flooding in the FWOP or FWP condition.

E.2-6.4 Future with Project Findings for the High SLC Curve

The USACE High SLC projection assumes approximately 4 feet of sea level rise by 2090, and 9 feet of sea level rise by 2140 for the SFW study area. This substantial acceleration in sea level rise greatly expands the inundation extents of extreme coastal storms and results in repetitive monthly flooding that could affect significant areas of the SFW study area. For context, the 1 percent AEP event in 2040 under the High SLC curve would result in the same Bay flood elevation as the 1 percent AEP event in 2065 under the Intermediate curve. Table E.2-3-2 shows that the sea level rise after 2115 under the High SLC curve is not expected until after 2140 under the Intermediate and Low SLC curve. This is a near 25-year acceleration of SLC reflected late in the period of analysis for the High curve.

Figure E.2-*6-6* demonstrates flood exposure expected for the 1 percent AEP event across five-time horizons for the FWOP and FWP conditions, considering USACE High curve projections. The adaptation actions planned for 2090 with each alternative are necessary to provide adequate flood protection for the USACE High curve. Alternative C and D have lower finished elevations in 2090 (Table E.2-6-42) and are expected to be inundated by the 1 percent AEP event in 2090 and 2115, respectively, in response to the accelerated sea level rise. The OSE key drivers analysis considers overall effectiveness over the period of analysis in the scoring criteria, with some exceptions to draw conclusions for an appropriate first action.

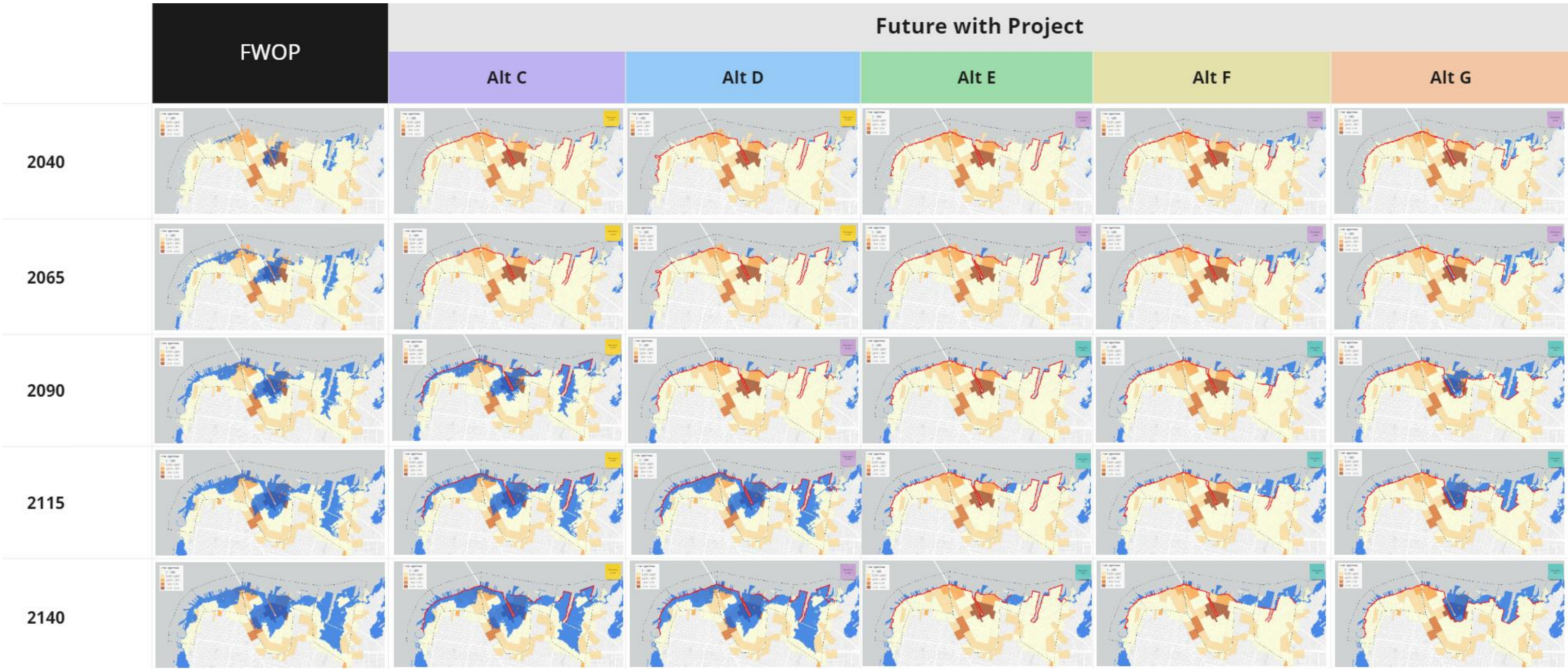


Figure E.2-*6-6*. Exposure Map Matrix for the USACE High SLC projection, 1% AEP event shown

E.2-6.4.1 Reach 1 OSE Key Driver Findings

As noted above, Reach 1 has the lowest residential population in the SFW study area but is important as a tourism destination. In Reach 1, Alternatives B, C, and D exhibit poor or neutral performance in reducing flood exposure, with Alternatives C and D overtopping in a 1% AEP flood event by 2090 and 2115, respectively. Alternatives E, F, and G protect the shoreline throughout all time horizons (including 2090 adaptive actions), causing the least residual impact for all key drivers and resulting in positive performance outcomes.

E.2-6.4.1.1 Health and Safety

Health and safety drivers do not vary significantly between reaches because the coastal and seismic life safety risk evaluations are conducted at the waterfront scale. Table E.2-6-42 indicates that Alternatives E, F, and G have consistent "positive" outcomes across the three health and safety key drivers for Reach 1 under the USACE High Curve.

Table E.2-6-42. Health and Safety Reach 1 Key Driver Outcomes, USACE High Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Coastal Life Safety Risk	2 - Moderately Poor Performance	3 – Neutral Performance				
Seismic Life Safety Risk & Resilience	1 – Poor Performance	3 – Neutral Performance	4 – Moderately Positive Performance	5 – Positive Performance		
Compromised Disaster Response Sites	No Change from FWOP	Moderate Exposure		Low Exposure		

The PDT finds the following health and safety outcomes for the alternatives:

- **Coastal Life Safety Risk** will be visible and apparent to the public under the High Curve FWOP condition. Similar to the Intermediate and Low curve scores, Alternative B is expected to have a “moderately poor” outcome as it pertains to life safety risk due to the potential false sense of protection created by the non-structural alternative. Flooding in neighborhoods will limit emergency response capabilities, and evacuation will still be necessary in advance of extreme events. Additionally, Alternative B will likely result in planned retreat over the period of analysis due to an increase in monthly flood inundation. Alternative C,D,E,F, and G all provide a “neutral” coastal life safety outcome under the High SLC projection. The nonstructural measures will reduce nearly all flooding before 2090. This is balance with the expectation that after 2090 there will be a significant amount of water retained by these measures that could result in widespread flooding and potentially significant life loss with minimal to no warning if the solutions fail.
- **Seismic Life Safety Risk** does not vary across sea level rise scenarios, nor by reach. Consistent with the findings under the Low and Intermediate curve, Alternatives E, F, and G offer the best seismic life safety risk reduction by replacing wharves in 2040 and providing ground improvements to stabilize the shoreline. Alternative C does not invest in vulnerable wharf structures, and Alternative B does not include earthquake resilience measures at all.
- Six Reach 1 **Disaster Response Sites** are exposed to the 1 percent AEP event by 2065 in the FWOP condition, increasing to 11 by 2090. Alternatives E, F, and G result in the lowest residual exposure of disaster response sites in Reach 1, with 2 sites on piers exposed to the 1 percent AEP event by 2090. Alternatives C and D have moderate residual exposure of disaster response sites. Each alternative exposes two to three pier sites by 2090 (bayward of the line of defense), and eight to nine sites after 2090 due to overtopping of the solution and flooding extending landward of the line of defense.

E.2-6.4.1.2 Economic Vitality

The economic vitality drivers consistently point to Alternatives E, F, and G as positive performers in Reach 1. The maritime function scores in Table E.2-6-43 reflect a composite waterfront score for the High Curve, and do not consider actions after 2090. Job access findings, however, accounts for the full period of analysis in the scoring.

Table E.2-6-43. Economic Vitality Reach 1 Key Driver Outcomes, USACE High Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Maritime Function	1 - Negative Performance	2 – Neutral Outcome		4 – Positive Outcome	3 – Moderately Positive Outcome	

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Job Access	5 - Low Exposure	1 - High Exposure	2 - Moderately High Exposure	4 - Moderately Low Exposure		

The PDT finds the following economic vitality outcomes for the alternatives:

- Governing scoring factors for the **Maritime Function** continue to focus on the age and condition of wharves that will limit future access to deep draft berthing, particularly in the northern waterfront. The maritime function evaluation for the High curve finds similar trends for the Low and Intermediate curve in terms of relative performance of the alternatives; however, the rate of sea level rise will likely expedite the deterioration of vulnerable wharves. Therefore, the High curve maritime function scores overall are lower. Alternative B does not propose any improvements that will support maritime function, and Alternatives C and D will provide "neutral" outcomes for maritime structures with floodproofing of piers. Alternatives E, F, and G preserve berthing by replacing wharves. However, Alternatives F and G have slightly lower maritime function scores than Alternative E due to retreat planned in the southern waterfront.
- **Job Access** exposure is greater than FWOP for Alternatives C and D, with the greatest job losses expected in Alternative C. Alternatives E, F, and G protect vulnerable populations and public transportation, resulting in low risk to job access.

E.2-6.4.1.3 Social Connectedness

Public transit mobility will be most impacted under the USACE High SLC projection, as more of the transit network could become inundated from extreme event and monthly flooding in the FWOP scenario. Table E.2-6-44 contains the public transit mobility scoring for the High projection, which reflects a waterfront wide analysis. The scores for the High projection are based on the following assumptions:

- Temporary disruption is expected before 2075 because of emergency protective measures that will be deployed to protect transit assets from the 1 percent AEP event. After 2075, SFMTA is likely to re-network their system due to flood risk expected under the High Curve. These system adjustments will likely cause mobility disruptions as well.
- Long-term mobility disruption may occur with the build-out of different alternatives, according to an internal SFMTA network analysis.

Based on these findings, Alternatives E and F have positive performance for public mobility. While early SFMTA analyses indicated that Alternative F may result in system disruption, future iterations of the Alternative F concept have addressed those issues. Alternatives C and D will likely result in long-term mobility disruptions due to damage incurred from overtopping of the alternatives, while Alternative G continues to expect long-term disruption due to necessary relocation of several Reach 3 and Reach 4 facilities, including those around Islais and Mission Creek.

Table E.2-6-44. Social Connectedness Reach 1 Key Driver Outcomes, USACE High Curve

<table>
<tr><th>OSE Driver</th><th>Alt B</th><th>Alt C</th><th>Alt D</th><th>Alt E</th><th>Alt F</th><th>Alt G</th></tr>
<tr><td>Public Transit Mobility</td><td>2 – Some temporary disruption expected</td><td colspan="2">1 – Long-term disruption is expected due to overtopping</td><td colspan="2">3 – No temporary or long-term system disruption expected</td><td>1 – Long-term disruption is expected</td></tr>
</table>

E.2-6.4.1.4 Community Identity

Community identity key drivers are likely to be affected in Reach 1 under USACE High Curve SLC projection, as shown in Table E.2-6-45. Two cultural assets, the Otis Elevator Company, and the Haslett Warehouse Building, are exposed to flooding in Reach 1 by 2140 in the FWOP condition, which are only protected by Alternatives E, F, and G. Alternatives C and D result in residual exposure of one cultural asset due to expected overtopping of the solutions. Alternative B does not change FWOP conditions for the community and cultural assets key driver, and in fact likely worsens conditions as monthly flooding could result in the need to relocate the exposed assets.

The historical asset and district designation scores remain similar to the Low and Intermediate Curve conditions, as the evaluation is primarily based on the replacement of wharf structures. Alternatives E, F, and G result in positive historic asset and district designation outcomes for the Embarcadero District in Reach 1 due to replacement of wharf structures that will elevate historic bulkhead buildings and prolong the useful life of the wharf substructures, enabling access to historic pier sheds. Alternatives B, C, and D will not significantly protect historical assets and district designations due to a lack of wharf structure improvements in the near-term.

Table E.2-6-45. Community Identity Reach 1 Key Driver Outcomes, USACE High Curve

<table>
<tr><th>OSE Driver</th><th>Alt B</th><th>Alt C</th><th>Alt D</th><th>Alt E</th><th>Alt F</th><th>Alt G</th></tr>
<tr><td>Community and Cultural Assets</td><td>No Change from FWOP</td><td colspan="2">Moderate Exposure</td><td colspan="3">No Exposure</td></tr>
<tr><td>Historical Asset and District Designation</td><td colspan="2">1 – Poor Outcome</td><td>3 – Neutral Outcome</td><td colspan="3">4 – Positive Outcome</td></tr>
</table>

E.2-6.4.1.5 Social Vulnerability and Resiliency

The outcomes for the social vulnerability and resiliency key drivers for Reach 1 continue to point to Alternatives E, F, and G as the higher performing solutions from an OSE perspective. As shown in Table E.2-6-46, Alternative B results in minimal social vulnerability improvements from the FWOP condition under the High SLC projection. Overtopping of Alternatives C and D in 2090 and 2115 may also result in severe social vulnerability effects.

Table E.2-6-46. Social Vulnerability and Resiliency Reach 1 Key Driver Outcomes, USACE High Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Vulnerable Populations	No Change from FWOP	High Exposure		Low Exposure		
Disproportionate Effects on Vulnerable Communities	No Change from FWOP	High effects		Moderate Effects		
Permanently Displaced Population	No Change from FWOP	High Exposure		Low Exposure		
Affordable Housing	No Change from FWOP	Moderate Exposure		No Exposure		

The PDT finds the following social vulnerability and resiliency outcomes for the alternatives:

- Approximately 450 residents with social vulnerability characteristics could be exposed to the 1 percent AEP event under the High Curve FWOP condition. Alternatives C and D reduce this flood exposure by 90 percent until overtopping occurs in 2090, which as stated above presents life safety issues. Alternatives E, F, and G reduces exposure of Reach 1 socially vulnerable populations by 85 to 90 percent across the period of analysis.

- **Disproportionate Effects on Vulnerable Communities.** As discussed in the Low and Intermediate SLC projection sections, Reach 1 does not represent a historically divested community and has limited site contamination. Alternatives E, F, and G provide adequate flood protection through 2140, thus preserving Reach 1's current land uses, critical transit, and jobs. However, the alternatives do not proactively increase the resilience of these considerations and are therefore scored as potentially having "moderate disproportionate effects" for disadvantaged communities. Alternatives B, C, and D have the potential to cause high disproportionate effects on vulnerable communities. Under the High SLC projection Alternatives B through D have significant overtopping in the area by 2090. Although Reach 1 is not considered a historically disinvested community, overtopping in this area would have broader impacts on transit-dependent communities outside of Reach 1.
- By 2140, approximately 1,600 Reach 1 residents may be **permanently displaced** in the FWOP condition due to monthly flooding expected under the High SLC projection. Alternatives B, C, and D will not offer a significant change to permanent residential displacement that could be required over the period of analysis and are therefore given a poor performance score. Monthly flooding is also likely to overtop the solutions designed for Alternatives C and D later in the period of analysis, resulting in potential retreat behind the line of defense. Alternatives E, F, and G significantly reduce the number of people exposed to monthly flooding in Reach 1.

There is limited **affordable housing** in Reach 1, with only two sites exposed to the 1 percent AEP event by 2140 under the FWOP condition. Both sites would be protected by Alternatives E, F, and G, and would continue to be exposed to coastal flooding for Alternatives B, C, and D.

E.2-6.4.2 Reach 2 OSE Key Driver Findings

The FWOP condition for Reach 2 identifies significant exposure and potential impacts for jobs, city and regional transportation infrastructure, and historic assets and districts. Similar to the USACE High OSE key driver findings for Reach 1, the Reach 2 key drivers analysis indicate more positive outcomes for Alternatives E, F, and G, with neutral or poor outcomes for Alternatives B, C, and D.

E.2-6.4.2.1 Health and Safety

The health and safety key driver outcomes presented in Table E.2-6-47 do not vary between Reach 1 and 2 under the USACE High Curve condition; Alternatives E, F, and G have neutral to positive life safety outcomes for both coastal and seismic life safety categories. However, there are more disaster response sites to consider in Reach 2 than in Reach 1. Fifteen disaster response sites are exposed by 2090 in the FWOP condition in Reach 2, many of which are on piers and are assumed unprotected without floodproofing interventions. Alternatives C and D expose 5 disaster response sites landward of the line of defense due to overtopping of the solutions. Piers also remain unprotected for Alternatives E, F, and G, but no sites are exposed landside of the proposed flood protection alignments.

Table E.2-6-47. Health and Safety Reach 2 Key Driver Outcomes, USACE High Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Coastal Life Safety Risk	2 – Moderately Poor Performance	3 – Neutral Performance				
Seismic Life Safety Risk & Resilience	1 – Poor Performance	3 – Neutral Performance	4 – Moderately Positive Performance	5 – Positive Performance		
Compromised Disaster Response Sites	No Change from FWOP	Moderate Exposure		Low Exposure		

E.2-6.4.2.2 Economic Vitality

The economic vitality driver outcomes also do not differ between Reach 1 and Reach 2 and consistently point to Alternatives E, F, and G as having positive outcomes. Alternatives E, F, and G maintain significantly more Port maritime functions compared to the other alternatives, retaining more than half of the berthing access at the northern wharves. Job access benefits are also higher amongst these alternatives in Reach 2. Job access protection is offered in Alternative B due to floodproofing measures, but it is noted that temporary disruption due to floodproofing measures and permanent relocation necessitated by monthly repetitive flooding could impact employment in the future. See Table E.2-6-48.

Table E.2-6-48. Economic Vitality Reach 2 Key Driver Outcomes, USACE High Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Maritime Function	1 – Poor Outcome	2 – Neutral Outcome		4 - Positive Outcome	3 – Moderately Positive Outcome	
Job Access	5 - Low Exposure	1 - High Exposure	2 - Moderately High Exposure	4 - Moderately Low Exposure		

E.2-6.4.2.3 Social Connectedness

Public transit mobility scores reflect a waterfront-wide assessment for the High SLC projection. As such, Table E.2-6-49 contains the same scores as Reach 1. Alternative B expects some temporary disruption as emergency protection measures are deployed to protect critical transit infrastructure in Reach 2 (such as the Embarcadero Station and Muni Metro Turnaround), while long-term disruption is expected in Alternatives C, D, and G due to overtopping or relocation of several Reach 3 and Reach 4 SFMTA assets.

Table E.2-6-49. Social Connectedness Reach 2 Key Driver Outcomes, USACE High Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Public Transit Mobility	2 – Some temporary disruption expected	1 – Long-term disruption is expected due to overtopping		3 – No temporary or long-term system disruption expected		1 – Long-term disruption is expected

E.2-6.4.2.4 Community Identity

The community identity evaluation for Reach 2 under the High SLC projection continues to identify Alternatives E, F, and G with the most positive outcomes. Interestingly, Alternative C and D have varying scores for exposed community and cultural assets (see Table E.2-6-50). Twenty-two community and cultural assets in Reach 2 are exposed to the 1 percent AEP event in 2090 under the FWOP condition. All of these assets are exposed by overtopping in 2090 for Alternative C and D, but the 2090 adaptation action for Alternative D affords some additional protection between 2090 and 2115 (see Figure E.2-*6-6*). This additional protection offered by Alternative D is the cause for the “moderate exposure” score for community and cultural assets rather than the “high exposure” score. Alternatives E, F, and G expose two cultural assets on piers in Reach 2.

Similar to the Reach 1 historic asset and district designation evaluation results, only Alternatives E, F, and G are expected to protect the Embarcadero Historic District and the Central Embarcadero Piers Historic District in Reach 2. Alternative D received a “neutral outcome” score because wharf replacement would not be considered until after 2090. Alternatives B and C do not construct physical infrastructure that would prolong the life of Reach 2 historic districts assets, including piers, wharves, and bulkhead buildings.

Table E.2-6-50. Community Identity Reach 2 Key Driver Outcomes, USACE High Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Community and Cultural Assets	No Change from FWOP	High Exposure	Moderate Exposure	Low Exposure		
Historical Asset and District Designation	1 – Poor Outcome		3 – Neutral Outcome	5 – Positive Outcome		

E.2-6.4.2.5 Social Vulnerability and Resiliency

Approximately 6,600 residents in Reach 2 are exposed to the 1 percent AEP flood event by 2140 in the FWOP condition under the High SLC projection, including over 5,610 people exposed to monthly flooding in the same time horizon. The social vulnerability and resiliency key drivers outcomes indicate similar results to Reach 1 with a slight change in affordable housing exposure. Table E.2-6-51 shows the social vulnerability and resiliency key drivers results for Reach 2 under the USACE High SLC projection.

Table E.2-6-51. Social Vulnerability and Resiliency Reach 2 Key Driver Outcomes, USACE High Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Vulnerable Populations	No Change from FWOP	High Exposure		Low Exposure		
Disproportionate Effects on Vulnerable Communities	No Change from FWOP	High Effects		Lower Effects		
Permanently Displaced Population	No Change from FWOP	High Exposure		Low Exposure		
Affordable Housing	No Change from FWOP	High Exposure	Moderate Exposure	Low Exposure		

The PDT finds the following social vulnerability and resiliency outcomes for the alternatives:

- **Vulnerable Populations** Of the 6,600 residents exposed to coastal flooding by 2140 for the FWOP condition, approximately 1,000 of those residents exhibit a social vulnerability characteristic. Alternatives B, C, and D result in high exposure of vulnerable populations relative to the FWOP condition by the end of the period of analysis. Until Alternatives C and D are overtopped by the 1 percent AEP event in 2090 and 2115, respectively, a 90 percent reduction in exposure of vulnerable populations could be expected. Alternatives E, F, and G offer at least a 90 percent reduction in exposure of vulnerable populations through 2140.

- **Disproportionate Effects on Vulnerable Communities** In Reach 2, flood protection and reduced residual exposure offered by Alternatives E, F, and G are likely to preserve land use, jobs, and transit opportunities that support vulnerable communities. However, these alternatives are scored as having a “moderate to low” disproportionate effect on vulnerable communities because the solutions do not proactively increase community resilience in Reach 2. Alternatives B, C, and D, however, have the potential to cause moderate to high disproportionate effects on vulnerable communities. Under the High SLC projection, Alternatives B through D have significant overtopping. Although Reach 2 is not considered a historically disinvested community, overtopping in this area would have broader impacts on transit-dependent communities outside of Reach 2.

- **Permanently Displaced Populations** are exposed to monthly flooding, even with alternatives in place. In Reach 2 under the FWOP condition, this could be 650 people by 2090 and 5,600 people by 2140. Because proactive retreat is not planned in Reach 2 as any of the alternatives, Alternatives B, C, and D are likely to have high permanently displaced populations due to monthly flooding expected later in the period of analysis. This is compared to Alternatives E, F, and G, which offer substantial flood protection benefits and reduce residual exposure to monthly flooding. Very little population displacement is expected in Reach 2 for these alternatives.
- **Affordable Housing Sites** in Reach 2 will likely experience exposure in the FWOP condition, including 6 sites by 2090 and 13 sites by 2140. Alternatives B and C are not expected to change from the FWOP condition. Alternative D exposes 10 sites in 2115, and then increases to FWOP-like conditions by 2140. Alternatives E, F, and G have minimal exposure of affordable housing locations in Reach 2.

E.2-6.4.3 Reach 3 OSE Key Driver Findings

Reach 3 represents the residential hub of the SFW study area. As discussed in the Key Driver Findings for the Intermediate SLC Curve section, Reach 3 findings are influenced by the flood protection approach for Mission Creek. Alternative G is designed for adaptation and proactive retreat to remove people, property, and infrastructure from the floodplain after 2090. The proactive retreat approach presented in Alternative G is intended to preserve life safety and naturally manage the future floodplain. Nevertheless, this challenge often results in poor or negative scoring evaluations for many OSE key drivers.

E.2-6.4.3.1 Health and Safety

Health and safety key driver outcomes in Reach 3 continue to indicate that Alternatives E, F, and G have more positive outcomes than Alternatives B, C, and D. The life safety risk metrics represent outcomes expected across the entire waterfront and are some of the only OSE evaluations that result in positive outcomes for Alternative G in both the Intermediate and High SLC projection findings.

As shown in Table E.2-6-52, disaster response sites continue to be at least moderately exposed to coastal flooding across all alternatives in Reach 3. Sixteen Reach 3 disaster response sites are exposed to the 1 percent AEP event by 2090 in the FWOP condition. Some of these sites are located on piers, but approximately 9 to 10 disaster response sites on either side of the line of defense for Alternatives C and D will remain exposed to flooding with the alternatives in place. Alternatives E and F are categorized as having “moderate” exposure of disaster response sites because pier protection is not included in the alternatives, while Alternative G is categorized as “moderate” exposure because of the 12 disaster response sites that are located in the proactive retreat area near Mission Creek. Finding alternative disaster response sites, including large staging areas, may be difficult in urbanized San Francisco.

Table E.2-6-52. Health and Safety Reach 3 Key Driver Outcomes, USACE High Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Coastal Life Safety Risk	2 – Moderately Negative Performance	3 – Neutral Performance				
Seismic Life Safety Risk & Resilience	1 – Poor Performance	3 – Neutral Performance		5 – Positive Performance		
Compromised Disaster Response Sites	No Change from FWOP	High Exposure		Moderate Exposure		

E.2-6.4.3.2 Economic Vitality

Economic vitality is not a strong measure for Reach 3 OSE key drivers, given the concentrated residential population in Mission Creek. Nevertheless, both the maritime function and job access key drivers results in Table E.2-6-53 point to Alternative G for positive economic vitality outcomes. The maritime function also identifies Alternatives E and F as having positive outcomes for maritime function, which is representative of the southern waterfront (including both Reach 3 and 4).

Table E.2-6-53. Economic Vitality Reach 3 Key Driver Outcomes, USACE High Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Maritime Function	1 – Poor Outcome	2 – Neutral Outcome		4 - Positive Outcome	3 – Moderately Positive Outcome	
Job Access	5 - Low Exposure	2 - Moderately High Exposure	1 - High Exposure	Moderate Exposure		4 - Moderately Low Exposure

The PDT finds the following economic vitality outcomes for the alternatives:

- **Maritime Function** is driven by berthing access in Reach 3. Alternative E retains 66 percent of existing deep draft berthing, followed by Alternatives C and D at 34 percent. Alternatives F and G actually do not protect many berthing assets, but maritime backland protected in Reach 4 increase the score to “moderately positive” for these alternatives.

- **Job Access** Alternatives E, F, and G protect vulnerable populations and public transportation, resulting in low risk to job access. The “moderately low” exposure score for Alternative G under job access reflects the relocation of existing jobs assumed to occur with the proactive retreat actions after 2090, thereby keeping overall job impacts for this alternative low. In reality, relocation of businesses and jobs may have a negative impact on employment access.

E.2-6.4.3.3 Social Connectedness

Public transit assets in Reach 3 have the potential to affect network mobility across the SFW study area, including assets such as the Mission 4th Street Bridge and special trackwork near 4th street that is necessary for light rail operations. Table E.2-6-54 presents the potential impacts to public transit mobility based on temporary or long-term disruption to SFMTA systems. As shown below, Alternative B is likely to cause temporary disruption due to floodproofing deployments, while Alternatives C, D, and G expect long-term disruption due to severe physical damage (C and D) and relocation of assets based on proactive retreat (G). Alternative E and F are assumed to have the least amount of temporary and long-term disruption to SFMTA’s public transit network, including critical assets in Reach 3.

Table E.2-6-54. Social Connectedness Reach 3 Key Driver Outcomes, USACE High Curve

<table>
<tr><th>OSE Driver</th><th>Alt B</th><th>Alt C</th><th>Alt D</th><th>Alt E</th><th>Alt F</th><th>Alt G</th></tr>
<tr><td>Public Transit Mobility</td><td>2 – Some temporary disruption expected</td><td colspan="2">1 – Long-term disruption is expected due to overtopping and damage</td><td colspan="2">3 – No temporary or long-term system disruption expected</td><td>1 – Long-term disruption is expected</td></tr>
</table>

E.2-6.4.3.4 Community Identity

The community identity key drivers evaluation for Reach 3 finds consistent outcomes for both community and cultural assets and historical asset and district designations. Table E.2-6-55 demonstrates that Alternatives B and C have “poor” outcomes, Alternative D has “moderate” outcomes, and Alternatives E, F and G have “positive” outcomes when it comes to protection of community identity assets.

- Eighteen Reach 3 community and cultural assets are exposed to the 1 percent AEP event in the FWOP condition. This increases to over 30 assets exposed by 2140. Alternative B leaves these assets exposed to monthly flooding and is assumed to affect asset functionality, potentially prompting relocation. Alternative C residual exposure matches FWOP conditions by 2090 due to solution overtopping, and Alternative D residual exposure matches FWOP by 2115 for the same reason. Alternatives E and F completely protect community and cultural assets through the period of analysis. Alternative G also protects all community and cultural assets through 2090 but identifies five locations that will require permanent relocation after 2090 due to planned retreat from Mission Creek and Mission Bay.

- The Union Works Historic District in Reach 3 is the primary historical district of concern in the southern waterfront. Alternatives B and C are expected to result in "poor outcomes," or loss of historic assets and district designation because no wharves will be replaced and increased sea level rise will likely deteriorate these assets more quickly. Alternative D has a neutral outcome, because it is unclear if the timing of wharf replacement will be sufficient before flood risk begins to significantly impact the wharf structures. Alternatives E, F, and G are adaptable plans that construct replacement wharves that would prolong the life of the life of historic districts through at least 2090, although the Union Iron Works Historic District may be partially lost to inundation or permanent retreat for these alternatives. Nevertheless, this is considered to be an overall positive change from the FWOP condition.

Table E.2-6-55. Community Identity Reach 3 Key Driver Outcomes, USACE High Curve

<table>
<tr><th>OSE Driver</th><th>Alt B</th><th>Alt C</th><th>Alt D</th><th>Alt E</th><th>Alt F</th><th>Alt G</th></tr>
<tr><td>Community and Cultural Assets</td><td>No Change from FWOP</td><td>High Exposure</td><td>Moderate Exposure</td><td colspan="2">No Exposure</td><td>Low Exposure</td></tr>
<tr><td>Historical Asset and District Designation</td><td colspan="2">1 – Poor Outcome</td><td>3 – Neutral Outcome</td><td colspan="3">5 – Positive Outcome</td></tr>
</table>

E.2-6.4.3.5 Social Vulnerability and Resiliency

Nearly 16,000 residents could be exposed to coastal flooding in Reach 3 by 2090 under the FWOP condition, with approximately 15 percent of the population exhibiting at least one social vulnerability characteristic. The social vulnerability and resiliency OSE drivers point to Alternatives E and F as neutral or positive outcomes across the four metrics, as shown in Table E.2-6-56 and discussed below.

Table E.2-6-56. Social Vulnerability and Resiliency Reach 3 Key Driver Outcomes, USACE High Curve

<table>
<tr><th>OSE Driver</th><th>Alt B</th><th>Alt C</th><th>Alt D</th><th>Alt E</th><th>Alt F</th><th>Alt G</th></tr>
<tr><td>Vulnerable Populations</td><td>No Change from FWOP</td><td colspan="2">High Exposure</td><td colspan="2">Low Exposure</td><td>Moderate Exposure</td></tr>
<tr><td>Disproportionate Effects on Vulnerable Communities</td><td>No Change from FWOP</td><td colspan="2">High effects</td><td colspan="2">Moderate effects</td><td>High effects</td></tr>
<tr><td>Permanently Displaced Population</td><td>No Change from FWOP</td><td colspan="2">High Exposure</td><td colspan="2">Low Exposure</td><td>Moderate Exposure</td></tr>
<tr><td>Affordable Housing</td><td>No Change from FWOP</td><td>High Exposure</td><td>Moderate Exposure</td><td colspan="2">Low Exposure</td><td>Moderate Exposure</td></tr>
</table>

The PDT finds the following social vulnerability and resiliency outcomes for the alternatives in Reach 3:

- **Vulnerable Populations** Alternatives B, C, and D have the highest residual exposure of vulnerable populations in Reach 3. Alternatives E and F have low exposure of vulnerable populations by providing nearly 95% reduction from FWOP. Alternative G has moderate exposure relative to FWOP; prior to proactive retreat planned in 2090, only 50 percent reduction in vulnerable population exposure is expected.
- **Disproportionate Effects on Vulnerable Communities** Reach 3 has some concerns with historical disinvestment in South Beach and a large residential population that co-exists with environmental contamination that may be exacerbated if flood risk is left unaddressed. Alternatives B, C, and D are likely to result in high disproportionate effects to vulnerable communities because Reach 3 contains over 60 contaminated sites could be disrupted by coastal flooding. This potentially increases the public health burden on traditionally low-income communities of color. Furthermore, overtopping under these alternatives in Reach 3 could reduce access to critical transit such as the T-Third Light Rail Line and Third Street corridor that are vital for connecting the southern and northern parts of the waterfront. Alternatives E and F provide adequate flood protection but do not proactively improve community resilience. As such, Alternatives E and F have a “moderate” disproportionate effects score. Alternative G will permanently displace vulnerable populations and disadvantaged communities. While this retreat is planned and a sound flood protection alternative, proactive retreat must address the loss of land use and workforce that the community is reliant on. Without proper planning, this retreat may place vulnerable populations at risk of losing housing, waterfront access, and job security. The unaddressed flood risks associated with this Alternative, including Alternatives B, C, and D, further exacerbate historic and present-day inequities.
- **Displaced Population** caused by reactive retreat and exposure to monthly flooding could be significant in Reach 3. The FWOP condition estimates 3,350 people in Reach 3 could be exposed to monthly flooding by 2090, increasing to upwards of 19,000 by 2140. This exposure to repetitive flooding will likely result in retreat and could have major impacts on community identity and resiliency. Alternatives B, C, and D are expected to have high amounts of retreat and relocation due to overtopping of the alternatives, even for residual exposure to monthly flooding. Alternatives E and F expect low reactive retreat, and Alternative G has planned proactive retreat, but results in permanently displaced populations, nonetheless.
- **Affordable Housing** is concentrated in Reach 3 compared to other reaches within the SFW study area. By 2090, 26 affordable housing sites may be exposed to the 1 percent AEP event in the FWOP condition. This increases to 50 sites by 2140. Alternatives E and F protect the most affordable housing locations

in Reach 3, only exposing one to two sites through the period of analysis. Alternatives B and C still expose FWOP locations due to overtopping, likely damaging structures and affecting access and functionality. Alternative D exposes FWOP locations but offers protection until 2115. Ten affordable housing sites are in the proactive retreat area for Alternative G. Affordable housing residents who are asked to relocate from their homes could have challenges finding comparable housing in San Francisco in the future and are at risk of relocating out of the city.

E.2-6.4.4 Reach 4 OSE Key Driver Findings

Reach 4 land use characteristics include a mix of industrial and maritime land uses, wetlands and public open space, and diverse residential areas. As discussed in the Community Profiles, the Bayview Islais Creek neighborhood has been subjected to significant historical and environmental injustices and has high social vulnerability including high poverty, crime, unemployment, and hospital rates relative to the rest of San Francisco.

The OSE key drivers analyses generally point to Alternative E as the highest performing alternative in Reach 4, considering residual flood exposure and improvements to wharf structures. Alternatives F and G propose proactive retreat in the reach, and as such are likely to have disproportionate effects on underserved communities.

E.2-6.4.4.1 Health and Safety

The health and safety key drivers for Reach 4 collectively favor Alternative E, F, and G apart from the compromised disaster response sites assessment. Alternative F and G are likely to require relocation for disaster response sites in Reach. Finding alternative space could be challenging, especially if waterfront proximity and large spaces (such as those offered on Pier 80) are required for disaster response purposes. Table E.2-6-57 presents the following health and safety outcomes for the Reach 4 alternatives:

- **Coastal Life Safety Risk** for Reach 4 assumes “neutral” outcomes for structural alternatives. This scoring accounts for flood risk reduction expected across all alternatives by 2090, balanced with the expectation that future failure of the measure could result in life safety issues with minimal to no flood warning. Additionally, Alternatives F and G reflect the opportunity to relocate people from the future floodplain and benefits coastal life safety impacts.
- **Seismic Life Safety Risk** is based on planned improvements to wharf structures. Alternatives E, F, and G offer the best seismic life safety risk reduction by replacing wharves in 2040 and providing ground improvement to stabilize the shoreline. Alternatives C and D have neutral performance because of either no or late investment in the vulnerable wharves. Alternative B is not designed to improve seismic life safety resilience.
- Nine **Disaster Response Sites** will be exposed to coastal flooding in the FWOP condition in Reach 4. Alternative E is the only alternative with a low residual exposure of disaster response assets, exposing just one site on Pier 92 that is

bayside of the line of protection. Alternatives B, C, and D result in high residual exposure of disaster response sites due to overtopping, and Alternatives F and G propose to relocate all nine Reach 4 disaster response sites.

Table E.2-6-57. Health and Safety Reach 4 Key Driver Outcomes, USACE High Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Coastal Life Safety Risk	2 – Moderately Poor Performance	3 – Neutral Performance				
Seismic Life Safety Risk & Resilience	1 – Poor Performance	3 – Neutral Performance		5 – Positive Performance		
Compromised Disaster Response Sites	No Change from FWOP	High Exposure		Low Exposure	High Exposure	

E.2-6.4.4.2 Economic Vitality

The economic viability and ability for the Port of San Francisco to remain a functional maritime operation is dependent on the protection of assets and jobs in Reach 4. The economic vitality OSE drivers point to Alternatives E, F, and G consistently as the solutions that will offer the best outcomes from this perspective. Table E.2-6-58 presents the following maritime function and job access findings for Reach 4 under the USACE High Curve:

- **Maritime Function** is best protected via Alternative E, which protects the highest amount of deep draft berthing across the alternatives and preserves 100 percent of backland area needed for maritime operations. Alternatives F and G protect some backland space before planned retreat in 2090 but do offer flood protection until that timeframe and therefore earn a “moderately positive” score. Alternatives C and D have neutral outcomes because prior to 2090, all backland area is protected and a third of berthing space is maintained.
- **Job Access** is preserved through Alternatives B, E, F, and G, but this finding requires caveats. Alternative B job access protection does not consider temporary disruption or accessibility challenges when floods do occur, even if buildings and assets are protected. Repetitive monthly flooding will also likely result in retreat and business relocation that will affect jobs. Alternative F and G have “moderately low” exposure but does not reflect the relocation of existing jobs in Reach 4 that may occur with the proactive retreat actions after 2090. The “high” exposure scores for Alternatives C and D reflect overtopping expected in 2090 and 2115, respectively.

Table E.2-6-58. Economic Vitality Reach 4 Key Driver Outcomes, USACE High Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Maritime Function	1 - Poor Outcome	2 - Neutral Outcome		4 - Positive Outcome	3 – Moderately Positive Outcome	
Job Access	5 - Low Exposure	1 - High Exposure	2 - Moderately High Exposure	4 - Moderately Low Exposure		

E.2-6.4.4.3 Social Connectedness

The social connectedness and public transit mobility driver results for Reach 4 do not deviate from the other reach results for the High SLC projection. As shown in Table E.2-6-59, Alternative E and F are the preferred alternative from a public mobility perspective. Alternative G is likely to result in long-term disruption due to the reconfiguration needed in the proactive retreat areas near Mission Creek and Islais Creek. This disruption is likely due to several Reach 3 and 4 assets being affected by Alternative G's retreat solution, including the T-Third Light Rail Line and Third Street corridor, which are vital for connecting the southern and northern parts of the SFW study area. Retreat planned for Alternative F in Reach 4 is likely to not result in system disruption based on expert judgement from the Port.

Table E.2-6-59. Social Connectedness Reach 4 Key Driver Outcomes, USACE High Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Public Transit Mobility	2 – Some temporary disruption expected	1 – Long-term disruption is expected due to overtopping		3 – No temporary or long-term system disruption expected		1 – Long-term disruption is expected

E.2-6.4.4.4 Community Identity

The primary key driver for community identity in Reach 4 is the protection of community and cultural assets. Reach 4 does not contain historic districts. According to FWOP conditions under the High SLC projection, 3 community and cultural assets are exposed to the 1 percent AEP event in 2090 in Reach 4. This increases to 15 assets by 2140. Since none of the community and cultural facilities are located on piers, all are protected by Alternative E and F. As shown in Table E.2-6-60, Alternative B and C result in high exposure of these assets compared to the FWOP condition due to overtopping, and Alternative D results in “moderate” exposure by protecting assets a little longer. Alternative G identifies two community assets, Fire Station #25, and the Child Advocacy Center, in the proactive retreat area, which would require permanent relocation.

Table E.2-6-60. Community Identity Reach 4 Key Driver Outcomes, USACE High Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Community and Cultural Assets	No Change from FWOP	High Exposure	Moderate Exposure	No Exposure		Moderate Exposure
Historic Asset and District Designation	1 – Poor Outcome		3 – Neutral Outcome	5 – Positive Outcome		

E.2-6.4.4.5 Social Vulnerability and Resiliency

Social vulnerability and resiliency is a vital decision-making factor in Reach 4. The area's history is laden with concerns around equity, environmental justice, job loss, gentrification, minority communities, and access to open space. The Bayview Hunters Point neighborhood identifies Reach 4 as the area where they live, work, and play. While coastal flooding and sea level rise does not directly expose residential areas in Bayview, flooding will likely affect community access and function. Table E.2-6-61 shows that Alternative E has consistent positive outcomes across the four social vulnerability and resiliency key drivers in Reach 4.

Table E.2-6-61. Social Vulnerability and Resiliency Reach 4 Key Driver Outcomes, USACE High Curve

OSE Driver	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Vulnerable Populations	No Change from FWOP	High Exposure		No Exposure	Moderate Exposure	
Disproportionate Effects on Vulnerable Communities	No Change from FWOP	High effects		Moderate effects	High effects	
Permanently Displaced Population	No Change from FWOP	High Exposure		Low Exposure	Moderate Exposure	
Affordable Housing	No Change from FWOP	Moderate Exposure		No Exposure		

The PDT finds the following social vulnerability and resiliency outcomes for the alternatives:

- **Vulnerable Populations** Approximately 300 people with social vulnerability characteristics may be exposed to coastal flooding in the FWOP condition by 2140. This is equivalent to roughly 20 percent of the total residential population exposed to flooding in Reach 4. Alternative E is the only alternative that will not expose vulnerable populations to coastal flooding over the study period of analysis. Alternatives F and G offer moderate exposure (35 percent reduction) until 2090, when proactive retreat is planned and residents may require permanent relocation. Alternatives B, C, and D will continue to expose vulnerable populations similar to the FWOP condition.

- **Disproportionate Effects on Vulnerable Communities** Reach 4 has the highest opportunity to address existing disproportionate effects on vulnerable communities through flood risk reduction efforts. Through the disproportionate effects qualitative evaluation, it was found that Alternative E has the potential for the lowest impact to disadvantaged communities due to the level of flood protection offered by the solution. All other Alternatives (B, C, D, F, and G) have the potential to cause high disproportionate effects on vulnerable communities in Reach 4. Under the High SLC projection, Alternatives B, C, and D have significant overtopping in the area by 2090. This overtopping reduces access to critical transit such as the T-Third Light Rail Line, Third Street corridor, and Third Street and Illinois Street Bridges which are vital for connecting the southern and northern parts of the waterfront. These alternatives also expose 90 contaminated sites by 2140 posing water quality and public health concerns. Alternatives F and G consider guaranteed displacement of vulnerable populations. Proactive retreat in this Reach does not address the loss of land use and workforce development that present and surrounding communities rely on and may place vulnerable populations at risk of housing challenges, reduced waterfront access, and job insecurity. The unaddressed flood risks associated with these Alternatives, including B, C, and D, further exacerbate historic and present-day inequities.

  Furthermore, there is an immediate connection between Reach 4 and the Bayview Hunters Point neighborhood. Transit impacts in Reach 4 will have a direct effect on south bound traffic heading into the Bayview Hunters Point neighborhood. The Bayview Hunters Point neighborhood is a designated MTC Equity Priority Community and has a long history of disinvestment, and racial and environmental injustice. Therefore, Alternatives B, C, D, F, and G may limit access to jobs, health centers, the greater Bay Area, and cause longer commute times for vulnerable populations coming from the Bayview Hunters Point community.

- **Displaced Population** counts could exceed 300 by 2090 in Reach 4 under the FWOP condition. Permanently displaced residents, even if planned through proactive retreat, will likely not be tolerated in Reach 4. The African-American Arts and Cultural District was created specifically to prevent gentrification and permanent displacement from the community. Alternative E is the only alternative in Reach 4 that has low permanent displacement estimates due to flood protection offered.

Two **Affordable Housing** locations may be exposed to flooding by 2140 in the FWOP condition. These sites will not likely be affected by planned retreat; therefore, Alternatives E, F, and G have a positive impact on affordable housing available in Reach 4.

E.2-6.5 OSE FWP Summary

Selecting a tentative plan that maximizes comprehensive benefits across the NED, RED, OSE, and EQ accounts require robust discussions of tradeoffs both within and between accounts. The summaries and accompanying maps below offer primary considerations from the key drivers analysis recommended for decision-making.

E.2-6.5.1.1 Low SLC Curve FWP Summary

The OSE key drivers analysis for the Low SLC projection offers general guidance on types of flood protection alternatives that would result in positive social effects in the SFW study area. This level of detail is expected for an exposure-based analysis that relies on the general location and elevation of flood protection solutions to determine benefits and tradeoffs. Moreover, considering that less than a foot of sea level rise is expected over a 100-year period of analysis, a waterfront-wide approach to evaluating OSE key drivers across alternatives is likely sufficient for the Low SLC scenario. The following findings should be considered when selecting a final plan for the SFW study area:

- Alternative C and D offer similar benefits and tradeoffs across OSE key drivers for the Low SLC projection. Both measures have positive coastal life safety outcomes, low to no disaster response site or vulnerable populations exposure, no affordable housing exposure, and preserve access to jobs. Additionally, both alternatives are expected to provide marginal maritime access and will likely not exacerbate disproportionate effects on vulnerable communities. Alternative C differs from Alternative D from the community and cultural assets perspective, where 4 cultural assets are exposed by 2090 to the 1-percent AEP flood event (as opposed to 2 in Alternative D). Alternative C and D also differ slightly in expected outcomes for historic assets and districts protection: Alternative C does not include replacement wharves that would maintain the Embarcadero Historic District, the Central Embarcadero Piers Historic District, or the Union Iron Works Historic District. Alternative D could include wharf replacement in the future, although the timing is unknown.
- Alternative E presents the most positive OSE outcomes under the Low SLC projection. The measure has top scores across the health and safety metrics, presents the greatest benefit to jobs, and significantly reduces FWOP exposure of cultural assets, disaster response sites, and vulnerable populations. This alternative offers the most opportunity to preserve maritime berthing across the waterfront by replacing wharves. Disproportionate effects to vulnerable communities are also not likely for Alternative E, and the solution would prolong the life of historic assets and districts along the waterfront.
- Alternatives F and G also offer similar benefits and tradeoffs under the Low SLC FWP condition. Positive outcomes for seismic and life safety are expected, and both alternatives preserve berthing space in Reach 1 and 2 (although Reach 3 and 4 wharves will likely be compromised due to age and condition). Moderate scores are assigned to both alternatives for disaster response asset exposure and exposure of vulnerable populations due to proactive retreat planned. Maintained access to location-dependent jobs is also moderate for these alternatives. While there is still some benefit for job accessibility, job impacts in the FWP condition are still highest amongst Alternatives F and G.

- Alternative G potentially presents more OSE challenges than the other structural alternatives when evaluating the Low SLC FWP condition. Moderate exposure of community and cultural assets are expected and the planned retreat component for Alternative G results in affordable housing exposure and relocation. Additionally, Alternative G has a high potential to pose disproportionate effects on disadvantaged communities due to the presence of exposed contaminated sites and potential impacts to the surrounding neighborhoods who are primarily low-income communities of color.
- Alternative B has limited OSE benefits as the non-structural solution. As discussed earlier in the report, the OSE analysis is primarily exposure-based and is not dependent on structure or asset vulnerability to coastal flooding and sea level rise. The solutions to floodproof buildings and assets do not reduce flood exposure nor do they offer seismic life safety improvements or protection of maritime assets. In most cases under the Low SLC projection, the OSE measures do not demonstrate in a change from FWOP conditions for Alternative B.

Table E.2-6-62 offers statistical references to reduced exposure benefits offered by each alternative. The reduced exposure benefits for the key drivers are based on 1-percent AEP events, with the exception of monthly flooding used for the Permanently Displaced Residents driver. The vulnerable population exposure count is the representative of a minimum total exposed population, made up of all eight social vulnerability indicators. The entire period of analysis was considered in protections offered by each alternative in the table below.

Table E.2-6-62. Exposure avoided by Alternative, USACE Low Curve

OSE Key Driver	FWOP Condition	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Disaster Response Sites	7 sites exposed by 2140	No change from FWOP	6 sites protected by 2140	6 sites protected by 2140	6 sites protected by 2140	2 sites are protected by 2140; Exposure occurs in 2090	1 site is protected by 2140; exposure occurs in 2040
Community and Cultural Assets	11 assets exposed by 2140	No change from FWOP	8 assets protected by 2140. Exposure begins in 2040	9 assets protected by 2140. Exposure begins in 2040	100 percent reduction in exposure	100 percent reduction in exposure	7 assets protected by 2140. Exposure begins in 2040.
Vulnerable Populations	2,400 people with social vulnerability characteristics exposed by 2140	No change from FWOP	100 percent reduction in exposure	100 percent reduction in exposure	100 percent reduction in exposure	50 percent reduction in exposure outside proactive retreat area	50 percent reduction in exposure outside proactive retreat area
Permanently Displaced Residents	100 people could be permanently displaced by 2140	No change from FWOP	100 percent reduction in displacement	100 percent reduction in displacement	100 percent reduction in displacement	100 percent reduction in displacement before 2090	100 percent reduction in displacement before 2090
Affordable Housing Locations	7 locations exposed by 2140	No change from FWOP	100 percent reduction in exposure	100 percent reduction in exposure	100 percent reduction in exposure	100 percent reduction in exposure	2 locations protected by 2140. Exposure begins in 2090

E.2-6.5.1.2 Intermediate SLC Curve FWP Summary

The OSE key drivers analysis for the Intermediate SLC projection requires an in-depth evaluation that reflects trade-offs at the reach level. This level of detail is necessary to understand the comprehensive benefits and risks associated with selecting an adaptable plan and supports assumptions regarding the timing of adaptive intervention. An expected 3 feet of sea level rise for the Intermediate Curve certainly impacts the magnitude of extreme events but does not result in significant monthly flood exposure that could result in permanent displacement of residents, jobs, and community assets. The OSE key drivers analysis is still exposure-based under this SLC scenario, and largely dependent on the location of the line of defense and elevation of flood protection solutions. The following findings should be considered when selecting a final plan for the SFW study area:

- The nonstructural Alternative B is expected to result in poor OSE outcomes across all reaches and nearly all key drivers. While physical damages are avoided by the nonstructural alternative, flooding will still occur and could affect resident safety as well as cause temporary disruptions before and after an extreme flood event. Furthermore, complex underground utilities may be affected by flooding in the nonstructural alternative that could still render structures unoccupiable until services could be restored. Additionally, operational procedures requiring the deployment of temporary flood protection measures may not always occur in time to prepare for a flood event. In 2022, winter storms experienced in San Francisco caused severe flash flooding that could not have been prevented by temporary or deployable measures.
- Alternative C has mixed positive and negative OSE outcomes across all four reaches. While it provides adequate flood protection, the alternative has poor historic asset and district designation benefits, as well as neutral OSE outcomes expected for seismic and coastal life safety and maritime benefits. It suffers from the missed opportunities to improve structural stability across the waterfront, offer life safety benefits, and protect the historic nature of the waterfront and maritime function.
- All structural alternatives provide flood risk reduction benefits and reduce exposure of residents and disadvantaged communities, jobs, community and cultural assets, and critical infrastructure in Reach 1 and 2. Approximately 88 – 90 percent of the exposed population is protected for Alternatives C through G. A handful of community and cultural assets that are located on pier structures may experience residual exposure in Reach 2. By 2090, Alternative C may expose 4 cultural assets, Alternative D may expose 3 cultural assets, and Alternatives E, F, and G will expose 2 cultural assets (the Embarcadero Piers). Floodproofing of the piers to protect these assets in extreme events may be considered.

- Alternatives D, E, F, and G have mostly positive OSE outcomes expected for Reach 1 and Reach 2. This is primarily due to the adequate flood protection offered and investments in ground improvements and wharf replacement that protects health and safety, maritime operations, and historic assets and districts. Nuances include:
  - Alternative D has lower performance expectations for coastal and seismic life safety risk than Alternatives E, F, and G, although the expectations are still positive. Alternative D's 2090 adaptive action replaces seismically vulnerable wharf structures but leaves some risk if a seismic event were to occur before then.
  - Alternatives E, F, and G provide sufficient protection and include robust structural elements that improve seismic life safety benefits. Additionally, these alternatives offer the highest economic vitality benefits in Reaches 1 and 2. The afore-mentioned wharf replacement offers the best opportunity to access deep draft berthing space in the northern waterfront, and also preserves the Embarcadero Historic District and Central Embarcadero Piers Historic District.

Consistency in OSE outcomes per alternative becomes less clear for Reaches 3 and 4 under the Intermediate SLC projection. Alternative G proposes proactive retreat in Reach 3 and 4 that will ultimately relocate residents, businesses, jobs, community assets, and disaster response sites that could significantly affect disadvantaged communities. Alternative F also proposes proactive retreat in Reach 4. While planned retreat is an excellent long-term community resilience option and does offer life safety benefits by relocating people and property from the future floodplain, the scale of permanent relocation proposed could present OSE challenges. These areas of San Francisco have seen waves of displacement in recent decades owing to historic disinvestment and gentrification. Due to the concentration of residential population, transit connections, and industrial-based jobs held in the southern waterfront, the planning decisions made in Reach 3 and 4 will have a direct impact on exacerbating existing pressures on the highly vulnerable and disproportionately impacted communities that live in the area, which includes the waning African-American community.

In Reach 3, Alternatives D, E, and F have positive outcomes across most key drivers. Reach 4 trends towards Alternative E as the most beneficial alternative, with Alternative D as the runner-up.

- Similar to the northern waterfront findings, Alternatives D, E, and F offer adequate flood risk reduction benefits that protect people and community assets. Each alternative is expected to gain a 90 percent reduction in population exposure in Reach 3. Alternative D has moderately positive seismic life safety effects, as well as maritime and historic asset and district benefits compared to positive effects for Alternatives E and F due to Alternative D's delayed 2090 investment in vulnerable wharf structures. All three alternatives result in residual exposure of 7 disaster response sites in Reach 3, all of which are located on piers and could be protected through floodproofing.

- Alternative E has slightly better outcomes than Alternative D in Reach 4. Both offer the same level of protection for public transit mobility and result in a 70 percent reduction in exposed population. There are no exposed community assets in Reach 4 to protect. Alternative E has more positive health and safety benefits for seismic life safety evaluations, and also preserves more maritime function due to protection of backland area necessary for maritime operations.

As discussed above, Alternatives C, D, and E are expected to have less expected effects on vulnerable populations and disadvantaged communities than Alternatives B, F, and G. It is expected that additional community resilience measures for the tentatively selected plan will be developed to fully assess disproportionate effects to disadvantaged communities. Table E.2-6-63 provides the exposure avoided by each alternative under the USACE Intermediate curve, summed across the waterfront.

Table E.2-6-63. Exposure avoided by Alternative, USACE Intermediate Curve

OSE Key Driver	FWOP Condition	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Disaster Response Sites	36 sites exposed by 2140	No change from FWOP	24 sites protected by 2140. Exposure begins in 2040	26 sites protected by 2140. Exposure begins in 2040	25 sites protected by 2140. Exposure begins in 2090	18 sites are protected by 2140; Exposure begins in 2040	18 sites are protected by 2140; Exposure begins in 2040
Community and Cultural Assets	36 assets exposed by 2140	No change from FWOP	29 assets protected by 2140. Exposure begins in 2040	33 assets protected by 2140. Exposure begins in 2040	34 assets protected by 2140	34 assets protected by 2140	29 assets protected by 2140. Exposure begins in 2065
Vulnerable Populations	9,700 people with social vulnerability characteristics exposed by 2140	No change from FWOP	80 percent reduction in exposure by 2140	70 percent reduction in exposure by 2090, 85 percent by 2140	65 percent reduction in exposure by 2090, 85 percent by 2140	55 percent reduction in exposure by 2090, 70 percent by 2140	40 percent reduction in exposure by 2090, 60 percent by 2140
Permanently Displaced Residents	700 people could be permanently displaced by 2140	No change from FWOP	100 percent reduction in displacement	100 percent reduction in displacement	100 percent reduction in displacement	100 percent reduction in displacement before 2090	100 percent reduction in displacement before 2090
Affordable Housing Locations	25 locations exposed by 2140	No change from FWOP	100 percent reduction in exposure	100 percent reduction in exposure	100 percent reduction in exposure	100 percent reduction in exposure	15 locations protected by 2140. Exposure begins in 2090

E.2-6.5.1.3 High SLC Curve FWP Summary

The USACE High SLC projection presents a complex flood risk profile in the SFW study area. Approximately 9 feet of sea level rise is expected by 2140, which increases the inundation extent and depth of flooding caused by extreme storms and results in repetitive flooding currently expected for king tides and other tidal-driven events. A significant amount of monthly flooding is expected to impact the project area by 2090. The adaptation actions planned for 2090 with each alternative are necessary to provide adequate flood protection for the High SLC projection. The OSE key drivers analysis considers overall effectiveness over the period of analysis in the scoring criteria, with some exceptions to draw conclusions for an appropriate first action. The following findings should be considered when selecting a final plan for the SFW study area:

- OSE challenges presented by Alternative B for the Intermediate curve are exacerbated by the High curve due to expected monthly flooding. The FWOP condition for monthly flooding assumes that people, businesses, and community assets will be strategically relocated over time to remove risk to monthly flood exposure. Alternative B actively acquires vulnerable structures exposed to repetitive flooding, accelerating displacement in these high-risk areas. Therefore, Alternative B results reflect poor or negative outcomes across all OSE key driver evaluations.
- Alternative C and D are not designed to offer a level of protection necessary to protect against extreme storm events later in the period of analysis. As shown in Figure E.2-*6-6* above, Alternative C could be overtopped by the 1 percent AEP event by 2090 and Alternative D could be overtopped by the 1 percent AEP event by 2115. This residual exposure causes much of the OSE key drivers analyses to result in negative or poor OSE outcomes and is particularly challenging from a disproportionate effects perspective. Nevertheless, both alternatives offer significant levels of protection prior to 2090 and may be considered as a first action for an adaptable tentatively selected plan.
- Alternatives E, F, and G have mostly positive OSE outcomes expected for Reach 1 and Reach 2. This is primarily due to the adequate flood protection offered through the 2090 adaptive action, as well as investments in ground improvements and wharf replacement that protects health and safety, maritime operations, and historic assets and districts. In the northern waterfront, these three alternatives have similar expected outcomes for residual exposure:
    - 10 disaster response sites on piers remain exposed by 2140, compared to 27 total in the FWOP condition.
    - 85-90 percent of Reach 1 and 2 residents will be protected from extreme storm events and monthly flooding, including socially vulnerable communities. All three alternatives earn a moderate to low disproportionate effects on disadvantaged communities score due to limited knowledge of proactive community resilience measures that will be included in future planning efforts.

    - Two community and cultural assets will remain exposed by 2065 under these three alternatives, both located on pier structures and could potentially be protected in the near-term via floodproofing measures.

- Alternative E and F continue to have mostly positive OSE outcomes expected for Reach 3 and 4, although Alternative F has more cases of neutral to negative OSE evaluations in Reach 4. As stated in the Intermediate Curve summary section, Alternative F and G propose proactive retreat in the southern waterfront that results in permanent relocation of all assets, residents, and infrastructure that presents significant OSE challenges. Alternative E is the only alternative proposed for the southern waterfront that does not have a “high” disproportionate effects score, due to residual risk presented with Alternatives B and C and the permanent displacement potential associated with Alternatives F and G. Additional expected outcomes include:
    - Alternatives E and F will reduce residential population exposure by 95 percent in Reach 3.
    - Alternatives E, F, and G all expose between 9 and 12 disaster response assets in Reach 3 due to pier locations. In Reach 4, 9 sites will be identified for relocation under Alternatives F and G.
    - Affordable housing and community and cultural assets in Reach 3 will be most protected by Alternatives E and F, with only 1 affordable housing location exposed to flooding with the flood protection solutions in place. Alternative G could require relocation of 10 affordable housing sites and five community assets in Reach 3, which will likely place a burden on residents to find alternate affordable housing in San Francisco.

Avoidance of permanent relocation that impacts OSE key drivers, whether retreat is planned or reactive, would likely be difficult under this sea level rise scenario. However, the OSE effects of permanent relocation can potentially be minimized based on the adaptive nature of the final project, inclusion of workforce development or relocation assistance, and consideration of other resiliency measures.

Table E.2-6-64 offers overall exposure statics for the FWOP and FWP conditions for select OSE key drivers.

Table E.2-6-64. Exposure avoided by Alternative, USACE High Curve

OSE Key Driver	FWOP Condition	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G
Disaster Response Sites	53 sites exposed by 2140	No change from FWOP	No Change from FWOP by 2115.	No Change from FWOP by 2140.	31 sites protected by 2140. Exposure begins in 2065	24 sites are protected by 2140; Exposure begins in 2040	22 sites are protected by 2140; Exposure begins in 2040
Community and Cultural Assets	114 assets exposed by 2140	No change from FWOP	No Change from FWOP by 2140.	No Change from FWOP by 2140.	112 assets protected by 2140. Exposure begins in 2065	112 assets protected by 2140. Exposure begins in 2065	112 assets protected by 2140. Exposure begins in 2065
Vulnerable Populations	18,800 people with social vulnerability characteristics exposed by 2140	No change from FWOP	No change from FWOP	No change from FWOP	100 percent reduction in exposure by 2140	100 percent reduction in exposure by 2140	40 percent reduction in exposure by 2090, 60 percent by 2140
Permanently Displaced Residents	27,200 people could be permanently displaced by 2140	No change from FWOP	No change from FWOP by 2140	No change from FWOP by 2140	100 percent reduction in displacement	100 percent reduction in displacement before 2090	16,200 people avoid displacement by 2140
Affordable Housing Locations	66 locations exposed by 2140	No change from FWOP	No change from FWOP by 2090	No change from FWOP by 2115	65 locations protected by 2140; Exposure begins in 2115	65 locations protected by 2140; Exposure begins in 2115	51 locations protected by 2140. Exposure begins in 2090

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Appendix A

To

E.2 OSE

This appendix provides detailed methodologies to execute select consequence loss estimates for shelter needs and stress factor losses.

Section X-1. Shelter Needs

One potential consequence of social vulnerability is the need for residents to seek emergency shelter for temporary housing, medical service, or essential lifelines services before or after a hazard event. Lowincome individuals, as well as young families and the elderly, are more likely to seek shelter according to FEMA (2015). While the population seeking shelter is not assigned a monetary value, evaluating the number of residents who may need shelter in San Francisco is an important indicator for emergency response planning. The shelter needs assessment is based on flood depths within residential buildings, as well as age and income population characteristics.

X-1.1 Data Sources

Key data sources for the shelter needs assessment include exposed and displaced population counts and the FEMA *Hazus-MH 2-1 Flood Technical Manual* (2015), which provides the shelter needs calculation and assumptions used for this assessment.

X-1.2 Analysis Steps

Shelter needs calculations were developed as follows:

1. **Identify displaced residential populations.** Shelter needs were calculated based on displaced populations, which are considered residents of buildings with more than 1 foot of flood depth expected.
2. **Determine sheltering needs.** The Hazus calculations for shelter needs depend on compounded estimates of income and age, and do not consider other potential factors, such as vehicle ownership. Income is the biggest driver in the shelter needs equation, as the ability to shelter in a hotel or with friends or family is largely dependent on income and social resources. Age is also a driver, as populations 65 or older as well as young families tend to seek public shelter for continuity of critical services, such as electricity or potable water. The following equation was used to calculate shelter needs:

   $\text{Shelter Needs} = \alpha_{km} * \text{Exposed Population}$

$$\alpha_{km} = \sum_{k=1}^{5} \sum_{m=1}^{3} \{[(IW * IM_k) + (AW * AM_m)] * HI_k * HA_m\}$$

Where:

$\alpha_{km}: Shelter\ coefficient\ for\ income\ class\ k\ and\ age\ class\ m$
$IW: Income\ weight =\ 0.8$

IM_k: $Modifier\ for\ income\ class\ k$
HI_k: $Percentage\ of\ population\ in\ income\ class\ k$
AW: $Age\ weight = 0.2$
AM_m: $Modifier\ for\ age\ class\ m$
HA_m: $Percentage\ of\ population\ in\ age\ class\ m$

This equation requires modifiers to estimate the percentage of each of five income and three population classes that will seek public shelter, as defined in Table E.A-1 and Table E.A-2. FEMA provides two options for the income modifier – one default, and one for more affluent areas, where more than 60 percent of people in the area are in the highest income bracket.

Age classes were not modified for this study; however, income classes in Hazus are sourced from a study produced by George Washington University in 1992 and are not specific to San Francisco (FEMA, 2015). To better pair these coefficients to the project area, income thresholds were scaled to account for both location and inflation. The federal poverty line according to the U.S. Census Bureau was $14,335 for a four-person family in 1992 (U.S. Census Bureau, 1992), and $24,563 in 2016 (U.S. Census Bureau, 2016b). Recognizing that the cost of living in San Francisco is much more than the national average, the City recognizes populations under 200 percent (MTC, ABAG, 2013) of the federal poverty line as vulnerable. Therefore, a scaling factor of 3.43 was used to translate the FEMA thresholds to values more appropriate for the project area. These values were then assigned to the closest available income thresholds in the ACS data set[7] (Table E.A-3).

Table E.A-1: Age Classes and Modifiers

Age Class	Description	Modifier
AM1	Under 16	0.05
AM2	Between 16 and 65	0.20
AM3	Over 65	0.50

Table E.A-2: Income Classes and Modifiers

Income Class	Description	Default Modifier	High Income Modifier
IM1	Under $35,000	0.40	0.46
IM2	Between $35,000 and $50,000	0.30	0.36
IM3	Between $50,000 and $100,000	0.15	0.12
IM4	Between $100,000 and $125,000	0.10	0.05
IM5	Over $125,000	0.05	0.01

Table E.A-3: Scaling Income Thresholds

FEMA's 1992 Thresholds ($)	Scaled 2016 Thresholds ($)	Available Census Thresholds ($)
10,000	34,270	35,000
15,000	51,405	50,000
25,000	85,675	100,000
35,000	119,945	125,000

Population data for the shelter analysis were pulled from the U.S. Census Bureau ACS at the block group level. Household income (ACS reference B19001) and age breakdowns (ACS reference B01001) were consolidated into the income and brackets defined herein and divided by population totals to determine the percent population in each class. The shelter coefficient calculated for each block group was applied to the exposed population for each building within that block group to determine the total shelter needs per building.

X-1.3 Assumptions

The following caveats apply to the shelter needs assessment:

- The Hazus national income and wage factors are applicable to the project area based on sensitivity tests to the modification factors. However, the thresholds for inclusion in each income bracket were scaled to San Francisco values.
- The entire residential population of a structure is displaced when there is 1 foot of flooding at the structure.
- Shelter needs only consider direct flood impact to a building, and do not represent displacement associated with pre-event evacuation or sheltering sought by individuals who lose access to utilities during a flood event.

Because no other social vulnerability factors besides income and age are considered in the shelter needs analysis, the calculated number of individuals who require shelter after a flood event is likely a conservatively low value.

Section X-2. Mental Stress and Lost Productivity

FEMA (2016) refers to mental stress and lost productivity as social sustainability factors. Mental stress and anxiety impacts evaluate expected psychological distress as a result of property damage or displacement based on the cost of treatment for post-disaster mental health impacts. Lost productivity reflects an estimate of lost workdays for people whose residences are impacted by flooding.

X-2.1 Data Sources

Resources used to complete the mental stress and lost productivity assessment include:

- Displaced population estimates
- FEMA Final Sustainability Benefits Methodology Report (Ideation, Inc. and Earth Economics, 2012). This report provides the method to calculate costs of avoided mental stress and anxiety treatment, and lost productivity impacts.
- FEMA Benefit-Cost Analysis Toolkit (2016). FEMA's BCA toolkit contains per capita standard values that represent treatment cost for mental stress, and lost productivity for workers. California-specific costs were extracted from the toolkit.

X-2.2 Analysis Steps

Mental stress and lost productivity impacts were estimated as follows:

1. Identify displaced population.
2. Estimate mental stress and anxiety costs. Mental health treatment costs can be based on three factors: cost, prevalence, and course. Cost is simply the cost of treatment for those who seek it. Prevalence is the percentage of people who experience mental health problems after a disaster event, and course is the rate at which mental health symptoms reduce or increase over time.
3. FEMA uses prevalence and mental health expenses to derive a standard per capita value for mental stress and anxiety costs. The standard per capita value assumes that mild to moderate impacts will reduce over time as treatment is provided, and severe mental health problems may persist longer. According to the FEMA *Benefit-Cost Analysis Toolkit,* Version 5.3 (FEMA, 2016), $2,443 is the standard per capita cost of mental stress treatment after a disaster in California, assuming only a limited number of people will seek treatment, and an even lesser amount will receive adequate care. This standard value is multiplied by the number of displaced residents for an estimate of the total cost of mental stress treatment after a flood event.
4. Estimate lost productivity costs. Work productivity can be lost because of mental illness as people take time off for treatment and recovery. FEMA research indicates that mental health issues will increase after a disaster. Paired with lost productivity due to mental illness, this implies that economic productivity can be impacted by an increase in mental health issues post-flood event. Another per capita standard value represents the lost productivity costs, which factor in prevalence rates used for mental stress. Coupled with local hourly wages and a monthly productivity loss share, the BCA toolkit (FEMA, 2016) assumes $8,736 per impacted worker is a fair representation of

productivity costs after a flood event. This standard value is multiplied by the number of displaced workers who reside in impacted residential structures.

X-2.3 Assumptions

The following assumptions apply to both mental stress and lost productivity metrics, unless otherwise noted:

- The standard values for mental stress and lost productivity costs assume that only 41 percent of the impacted population will seek help with mental health issues. This does not capture the social impact of mental health issues for those who do not seek help.
- Population growth is not considered in this assessment, nor are development plans for new residential uses in the Embarcadero Seawall Program area.
- FEMA uses mental stress and lost productivity as one-time losses in BCAs for mitigation projects as a conservative measure of social sustainability benefits provided by specific projects. The flood assessment includes the social sustainability losses for each flood event and does not limit them to one-time losses.

Standard values were extracted directly from the BCA toolkit under a California-based project (FEMA, 2016). These values are assumed to consider local wage conditions to some extent.

X-2.4 Methodology References

Ideation, Inc. and Earth Economics. 2012. *Sustainability Benefits Methodology Report*. Prepared for Federal Emergency Management Agency. Final. August.

Federal Emergency Management Agency (FEMA). 2015. *Hazus-MH 2.1 Flood Technical Manual*. Mitigation Division.

Federal Emergency Management Agency (FEMA). 2016. *Benefit-Cost-Analysis Toolkit*.

Federal Emergency Management Agency (FEMA). 2001. *What Is A Benefit: Guidance on Benefit-Cost Analysis*.

Appendix B

To

E.2 OSE

		MONTHLY															
Reach	**Variable**	**low_2040_monthly_**	**low_2065_monthly_**	**low_2090_monthly_**	**low_2115_monthly_**	**low_2140_monthly_**	**inter_2040_monthly_**	**inter_2065_monthly_**	**inter_2090_monthly_**	**inter_2115_monthly_**	**inter_2140_monthly_**	**high_2040_monthly_**	**high_2065_monthly_**	**high_2090_monthly_**	**high_2115_monthly_**	**high_2140_monthly_**	**opc_likely_2040_monthly_**
Reach 1	Total Population	7	8	9	9	10	8	10	13	16	32	11	20	50	1112	1608	10
	Age 65 and Older	2	2	2	2	2	2	2	3	4	6	3	4	9	221	320	2
	Age Under 18	1	1	1	1	1	1	1	1	2	2	1	2	3	99	146	1
	Households with Disability	1	1	1	1	1	1	1	1	1	3	1	1	4	152	229	1
	Individuals in Poverty	0	0	0	0	0	0	0	0	1	2	0	1	2	108	165	0
	Linguistic Isolation	2	2	2	3	3	2	3	4	5	8	3	6	12	148	195	3
	Minority (Non-White)	2	2	2	2	3	2	3	3	4	10	3	5	15	505	754	2
	Single Parent	0	0	0	0	0	0	0	0	0	0	0	0	0	25	39	0
Reach 2	Total Population	2	2	3	3	3	2	3	4	6	34	4	15	633	4120	5610	3
	Age 65 and Older	0	0	0	1	1	0	1	1	1	7	1	3	143	939	1231	1
	Age Under 18	0	0	0	0	0	0	0	0	0	2	0	1	41	302	433	0
	Households with Disability	0	0	0	0	0	0	0	0	0	2	0	1	44	322	436	0
	Individuals in Poverty	0	0	0	0	0	0	0	0	0	2	0	1	34	403	583	0
	Linguistic Isolation	1	1	1	1	1	1	1	1	2	10	1	5	102	680	948	1
	Minority (Non-White)	1	1	1	1	2	1	2	2	3	17	2	7	321	2070	2949	2
	Single Parent	0	0	0	0	0	0	0	0	0	0	0	0	0	25	39	0
Reach 3	Total Population	30	33	36	39	42	33	42	54	70	446	45	293	3343	13795	19263	39
	Age 65 and Older	2	2	2	3	3	2	3	4	5	30	3	20	223	1098	1737	3
	Age Under 18	4	4	5	5	6	4	5	7	9	54	6	36	398	1377	1893	5
	Households with Disability	2	2	2	2	2	2	2	3	4	26	3	17	197	799	1218	2
	Individuals in Poverty	2	3	3	3	3	3	3	4	5	38	3	25	297	1416	2043	3
	Linguistic Isolation	5	5	5	6	7	5	6	9	11	64	7	42	476	1977	2870	6
	Minority (Non-White)	16	18	19	20	22	18	22	28	37	247	24	162	1869	7445	10414	21
	Single Parent	1	1	1	1	1	1	1	2	2	14	2	9	102	320	423	1
Reach 4	Total Population	39	42	44	45	47	42	47	58	119	163	50	135	292	450	713	46
	Age 65 and Older	1	1	1	1	1	1	1	2	3	5	1	4	10	18	51	1
	Age Under 18	19	20	21	21	22	20	22	27	56	75	23	62	129	189	260	21
	Households with Disability	2	2	2	2	2	2	2	3	5	7	2	6	12	18	31	2
	Individuals in Poverty	7	7	7	7	8	7	8	10	20	27	8	22	48	73	109	8
	Linguistic Isolation	3	3	4	4	4	3	4	5	10	13	4	11	23	35	65	4
	Minority (Non-White)	36	38	40	41	43	38	43	53	108	145	46	122	252	371	565	42
	Single Parent	17	18	19	20	21	18	20	25	52	69	22	58	119	173	230	20

opc_likely_2065_ monthly_	opc_likely_2090_ monthly_	opc_likely_2115_ monthly_	opc_likely_2140_ monthly_	opc_1200_2040_ monthly_	opc_1200_2065_ monthly_	opc_1200_2090_ monthly_	opc_1200_2115_ monthly_	opc_1200_2140_ monthly_	low_2040_100y_	low_2065_100y_	low_2090_100y_	low_2115_100y_	low_2140_100y_	inter_2040_100y_	inter_2065_100y_	inter_2090_100y_	inter_2115_100y_	inter_2140_100y_
15	33	49	620	13	36	879	1494	2497	38	40	42	46	52	40	50	86	633	981
3	6	8	133	3	6	182	293	539	7	7	8	8	9	7	9	13	136	199
1	2	3	60	1	3	82	132	253	3	3	3	3	3	3	3	5	61	89
1	3	4	93	1	3	126	208	408	3	3	3	4	4	3	4	7	94	139
0	2	2	66	0	2	89	149	294	2	2	2	2	3	2	2	5	66	99
4	8	12	74	4	9	110	189	231	9	10	10	11	12	10	12	18	77	124
4	10	15	296	3	11	410	689	1280	11	12	13	14	16	12	16	29	299	455
0	0	0	17	0	0	22	34	76	0	0	0	0	0	0	0	0	17	24
5	37	619	2994	4	80	3557	5445	6495	180	251	341	492	631	286	605	1566	2975	3795
1	8	140	685	1	15	827	1199	1404	42	57	74	116	143	62	137	349	681	873
0	2	40	207	0	5	245	418	515	11	16	23	31	40	19	39	102	205	265
0	2	43	225	0	3	277	423	508	13	17	22	37	44	18	42	106	223	293
0	2	34	241	0	4	299	561	693	10	14	18	28	34	15	33	101	240	328
1	11	98	492	1	19	576	913	1118	29	39	53	75	100	43	96	291	488	617
3	19	313	1509	2	42	1785	2850	3497	90	127	176	246	319	147	306	792	1500	1908
0	0	0	12	0	0	15	37	47	0	0	0	0	0	0	0	3	12	18
61	473	3295	8705	52	694	11813	18470	22889	801	1009	1242	2896	3208	1052	3152	5301	8541	12906
4	32	220	643	4	47	912	1632	2279	54	68	84	194	214	71	211	377	633	1016
8	58	393	900	7	84	1207	1822	2194	97	122	150	346	382	127	376	590	882	1296
3	28	194	493	3	41	680	1149	1570	47	60	73	171	189	62	186	313	485	744
4	41	293	945	4	60	1235	1938	2613	70	89	109	257	285	92	280	569	930	1331
10	68	469	1220	8	100	1664	2754	3393	115	144	177	412	457	150	449	732	1195	1840
32	262	1842	4774	27	386	6428	9970	12492	446	563	693	1620	1794	587	1762	2974	4687	6980
2	15	101	222	2	22	289	410	474	25	31	39	89	98	33	96	149	217	305
66	170	290	378	56	191	409	676	1318	234	248	266	280	294	253	291	336	378	426
2	6	10	15	2	6	16	45	134	8	8	9	10	10	9	10	13	15	17
30	77	128	161	26	86	173	252	365	106	112	118	124	129	113	128	145	161	180
3	7	12	15	2	8	16	29	65	10	10	11	12	12	10	12	14	15	17
11	28	47	61	9	31	66	104	187	39	41	43	46	48	41	47	55	61	69
5	14	23	29	5	15	32	61	166	19	20	21	22	23	20	23	26	29	33
59	150	250	315	51	167	339	540	986	206	218	231	243	253	220	251	284	315	353
28	71	118	147	24	79	158	225	280	98	103	109	115	119	104	118	133	148	165

1% AEP EVENT																		
high_2040_100y_	high_2065_100y_	high_2090_100y_	high_2115_100y_	high_2140_100y_	opc_likely_2040_100y_	opc_likely_2065_100y_	opc_likely_2090_100y_	opc_likely_2115_100y_	opc_likely_2140_100y_	opc_1200_2040_100y_	opc_1200_2065_100y_	opc_1200_2090_100y_	opc_1200_2115_100y_	opc_1200_2140_100y_	low_2040_monthly_r_pct	low_2065_monthly_r_pct	low_2090_monthly_r_pct	low_2115_monthly_r_pct
63	786	1283	1864	2604	48	428	1040	1279	1484	77	1137	1616	2527	3058	0	0	0	0
10	165	250	383	565	8	95	206	250	291	12	225	322	546	666	0	0	0	0
4	74	112	177	266	3	44	92	112	131	5	101	147	257	329	0	0	0	0
5	114	174	282	429	4	71	145	173	206	6	156	231	414	509	0	0	0	0
3	80	124	202	309	2	50	103	124	147	4	110	166	298	373	0	0	0	0
14	98	170	204	236	11	41	133	170	189	17	151	195	233	280	0	0	0	0
20	367	581	907	1341	15	219	479	580	683	26	516	759	1297	1597	0	0	0	0
0	20	28	50	81	0	14	24	28	34	0	26	39	78	97	0	0	0	0
832	3362	4709	5900	6657	515	2411	3981	4697	5391	1363	4204	5607	6531	7348	0	0	0	0
190	782	1063	1281	1430	121	555	913	1061	1189	297	956	1231	1410	1530	0	0	0	0
54	231	351	460	529	32	164	291	350	413	90	308	433	518	588	0	0	0	0
59	261	369	452	516	38	181	313	369	419	88	328	436	510	547	0	0	0	0
51	278	469	611	707	29	190	389	468	555	87	412	583	697	774	0	0	0	0
141	543	783	1000	1147	81	409	651	781	901	259	696	947	1124	1285	0	0	0	0
418	1686	2408	3120	3593	257	1208	1999	2401	2817	694	2116	2946	3519	3989	0	0	0	0
1	14	30	41	48	0	8	24	30	37	3	26	39	47	53	0	0	0	0
3745	10624	15965	20212	23374	2976	7101	13139	15898	18251	5081	14107	19232	22984	27087	0	0	0	0
250	804	1328	1864	2359	199	517	1038	1318	1610	360	1128	1737	2300	2922	0	0	0	0
446	1101	1585	1975	2232	355	751	1316	1577	1799	566	1407	1887	2199	2586	0	0	0	0
221	610	947	1301	1622	176	407	758	941	1133	301	818	1218	1583	1993	0	0	0	0
334	1128	1636	2176	2693	264	761	1352	1632	1915	545	1449	2044	2633	3209	0	0	0	0
532	1489	2357	3004	3467	423	983	1876	2344	2718	702	2031	2862	3405	3945	0	0	0	0
2094	5815	8595	10946	12768	1664	3921	7098	8562	9853	2851	7613	10401	12550	14834	0	0	0	0
114	269	364	438	480	91	186	308	362	405	144	327	422	474	548	0	0	0	0
305	396	558	853	1435	283	358	432	556	667	331	467	714	1346	2478	0	0	0	0
11	16	29	67	154	10	14	17	28	44	12	19	51	139	296	0	0	0	0
134	168	226	278	388	125	153	182	225	251	143	196	260	370	560	0	0	0	0
12	16	23	37	74	12	14	17	23	29	13	19	31	67	140	0	0	0	0
50	64	89	120	205	46	58	70	89	103	54	75	109	192	317	0	0	0	0
24	31	47	82	191	22	28	34	46	60	26	37	66	172	409	0	0	0	0
262	329	458	647	1081	245	300	358	456	535	280	385	566	1009	1821	0	0	0	0
124	154	205	239	289	116	140	167	205	224	131	179	230	282	346	0	0	0	0

low_2140_monthly_r_pct	inter_2040_monthly_r_pct	inter_2065_monthly_r_pct	inter_2090_monthly_r_pct	inter_2115_monthly_r_pct	inter_2140_monthly_r_pct	high_2040_monthly_r_pct	high_2065_monthly_r_pct	high_2090_monthly_r_pct	high_2115_monthly_r_pct	high_2140_monthly_r_pct	opc_likely_2040_monthly_r_pct	opc_likely_2065_monthly_r_pct	opc_likely_2090_monthly_r_pct	opc_likely_2115_monthly_r_pct	opc_likely_2140_monthly_r_pct	opc_1200_2040_monthly_r_pct	opc_1200_2065_monthly_r_pct	opc_1200_2090_monthly_r_pct
0	0	0	0	0	0	0	0	1	10	15	0	0	0	1	6	0	0	8
0	0	0	0	0	0	0	0	0	2	3	0	0	0	0	1	0	0	2
0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1
0	0	0	0	0	0	0	0	0	3	4	0	0	0	0	2	0	0	2
0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	1	0	0	1
0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	1	0	0	1
0	0	0	0	0	0	0	0	0	5	7	0	0	0	0	3	0	0	4
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	4	28	38	0	0	0	4	20	0	1	24
0	0	0	0	0	0	0	0	1	6	8	0	0	0	1	5	0	0	6
0	0	0	0	0	0	0	0	0	2	3	0	0	0	0	1	0	0	2
0	0	0	0	0	0	0	0	1	4	5	0	0	0	1	3	0	0	3
0	0	0	0	0	0	0	0	0	3	4	0	0	0	0	2	0	0	2
0	0	0	0	0	0	0	0	1	4	5	0	0	0	1	3	0	0	3
0	0	0	0	0	0	0	0	2	14	20	0	0	0	2	10	0	0	12
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	1	7	30	41	0	0	1	7	19	0	2	25
0	0	0	0	0	0	0	0	1	2	4	0	0	0	1	1	0	0	2
0	0	0	0	0	0	0	0	1	3	4	0	0	0	1	2	0	0	3
0	0	0	0	0	0	0	0	1	4	6	0	0	0	1	2	0	0	3
0	0	0	0	0	0	0	0	1	3	4	0	0	0	1	2	0	0	3
0	0	0	0	0	0	0	0	1	4	6	0	0	0	1	3	0	0	4
0	0	0	0	0	1	0	0	4	16	22	0	0	1	4	10	0	1	14
0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1
0	0	0	0	1	1	0	1	2	3	5	0	1	1	2	3	0	1	3
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	1	1	1	2	0	0	1	1	1	0	1	1
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	1	0	1	2	3	4	0	0	1	2	2	0	1	3
0	0	0	0	0	1	0	0	1	1	2	0	0	1	1	1	0	1	1

% EXPOSED OUT OF REACH																		
opc_1200_2115_monthly_r_pct	opc_1200_2140_monthly_r_pct	low_2040_100y_r_pct	low_2065_100y_r_pct	low_2090_100y_r_pct	low_2115_100y_r_pct	low_2140_100y_r_pct	inter_2040_100y_r_pct	inter_2065_100y_r_pct	inter_2090_100y_r_pct	inter_2115_100y_r_pct	inter_2140_100y_r_pct	high_2040_100y_r_pct	high_2065_100y_r_pct	high_2090_100y_r_pct	high_2115_100y_r_pct	high_2140_100y_r_pct	opc_likely_2040_100y_r_pct	opc_likely_2065_100y_r_pct
14	23	0	0	0	0	1	0	1	1	6	9	1	7	12	17	24	0	4
3	5	0	0	0	0	0	0	0	0	1	2	0	2	2	4	5	0	1
1	2	0	0	0	0	0	0	0	0	1	1	0	1	1	2	3	0	0
4	7	0	0	0	0	0	0	0	0	2	2	0	2	3	5	7	0	1
1	3	0	0	0	0	0	0	0	0	1	1	0	1	1	2	3	0	1
2	2	0	0	0	0	0	0	0	0	1	1	0	1	2	2	2	0	0
6	12	0	0	0	0	0	0	0	0	3	4	0	3	5	8	12	0	2
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
37	44	1	2	2	3	4	2	4	11	20	26	6	23	32	40	45	4	16
8	9	0	0	1	1	1	0	1	2	5	6	1	5	7	9	10	1	4
3	4	0	0	0	0	0	0	0	1	1	2	0	2	2	3	4	0	1
5	6	0	0	0	1	1	0	1	1	3	4	1	3	5	6	6	1	2
4	5	0	0	0	0	0	0	0	1	2	2	0	2	3	4	5	0	1
5	6	0	0	0	0	1	0	1	2	3	3	1	3	4	5	6	0	2
19	24	1	1	1	2	2	1	2	5	10	13	3	11	16	21	24	2	8
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	49	2	2	3	6	7	2	7	11	18	28	8	23	34	43	50	6	15
4	5	0	0	0	0	1	0	1	1	1	2	1	2	3	4	5	0	1
4	5	0	0	0	1	1	0	1	1	2	3	1	2	3	4	5	1	2
5	7	0	0	0	1	1	0	1	1	2	3	1	3	4	6	7	1	2
4	6	0	0	0	1	1	0	1	1	2	3	1	2	4	5	6	1	2
6	7	0	0	0	1	1	0	1	2	3	4	1	3	5	7	8	1	2
21	27	1	1	2	4	4	1	4	6	10	15	5	12	18	23	27	4	8
1	1	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	0	0
5	10	2	2	2	2	2	2	2	3	3	3	2	3	4	6	11	2	3
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
2	3	1	1	1	1	1	1	1	1	1	1	1	1	2	2	3	1	1
1	2	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	0	0
1	1	0	0	0	0	0	0	0	0	1	1	0	1	1	1	2	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
4	7	2	2	2	2	2	2	2	2	2	3	2	3	4	5	8	2	2
2	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1

opc_likely_2090_100y_r_pct	opc_likely_2115_100y_r_pct	opc_likely_2140_100y_r_pct	opc_1200_2040_100y_r_pct	opc_1200_2065_100y_r_pct	opc_1200_2090_100y_r_pct	opc_1200_2115_100y_r_pct	opc_1200_2140_100y_r_pct	low_2040_monthly_r14_pct	low_2065_monthly_r14_pct	low_2090_monthly_r14_pct	low_2115_monthly_r14_pct	low_2140_monthly_r14_pct	inter_2040_monthly_r14_pct	inter_2065_monthly_r14_pct	inter_2090_monthly_r14_pct	inter_2115_monthly_r14_pct	inter_2140_monthly_r14_pct	inter_2065_monthly_r14_pct
10	12	14	1	11	15	23	28	0	0	0	0	0	0	0	0	0	0	0
2	2	3	0	2	3	5	6	0	0	0	0	0	0	0	0	0	0	0
1	1	1	0	1	1	2	3	0	0	0	0	0	0	0	0	0	0	0
3	3	4	0	3	4	7	9	0	0	0	0	0	0	0	0	0	0	0
1	1	1	0	1	2	3	3	0	0	0	0	0	0	0	0	0	0	0
1	2	2	0	1	2	2	3	0	0	0	0	0	0	0	0	0	0	0
4	5	6	0	5	7	12	15	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
27	32	36	9	28	38	44	49	0	0	0	0	0	0	0	0	0	0	0
6	7	8	2	6	8	10	10	0	0	0	0	0	0	0	0	0	0	0
2	2	3	1	2	3	4	4	0	0	0	0	0	0	0	0	0	0	0
4	5	5	1	4	5	6	7	0	0	0	0	0	0	0	0	0	0	0
3	3	4	1	3	4	5	5	0	0	0	0	0	0	0	0	0	0	0
3	4	5	1	4	5	6	7	0	0	0	0	0	0	0	0	0	0	0
13	16	19	5	14	20	24	27	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	34	39	11	30	41	49	58	0	0	0	0	0	0	0	0	0	1	0
2	3	3	1	2	4	5	6	0	0	0	0	0	0	0	0	0	0	0
3	3	4	1	3	4	5	6	0	0	0	0	0	0	0	0	0	0	0
3	4	5	1	4	6	7	9	0	0	0	0	0	0	0	0	0	0	0
3	4	4	1	3	4	6	7	0	0	0	0	0	0	0	0	0	0	0
4	5	6	2	4	6	7	9	0	0	0	0	0	0	0	0	0	0	0
15	18	21	6	16	22	27	32	0	0	0	0	0	0	0	0	0	0	0
1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
3	4	5	3	4	5	10	19	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0
1	2	2	1	2	2	3	4	0	0	0	0	0	0	0	0	0	0	0
0	1	1	0	0	1	2	3	0	0	0	0	0	0	0	0	0	0	0
1	1	1	0	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0
3	3	4	2	3	4	8	14	0	0	0	0	0	0	0	0	0	0	0
1	2	2	1	1	2	2	3	0	0	0	0	0	0	0	0	0	0	0

																% EXPOSED OUT OF WATERFRONT STUDY AREA		
inter_2090_monthly_r14_pct	inter_2115_monthly_r14_pct	inter_2140_monthly_r14_pct	high_2040_monthly_r14_pct	high_2065_monthly_r14_pct	high_2090_monthly_r14_pct	high_2115_monthly_r14_pct	high_2140_monthly_r14_pct	opc_likely_2040_monthly_r14_pct	opc_likely_2065_monthly_r14_pct	opc_likely_2090_monthly_r14_pct	opc_likely_2115_monthly_r14_pct	opc_likely_2140_monthly_r14_pct	opc_1200_2040_monthly_r14_pct	opc_1200_2065_monthly_r14_pct	opc_1200_2090_monthly_r14_pct	opc_1200_2115_monthly_r14_pct	opc_1200_2140_monthly_r14_pct	low_2040_100y_r14_pct
0	0	0	0	0	0	1	2	0	0	0	0	1	0	0	1	2	3	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	2	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	5	7	0	0	0	1	4	0	0	4	6	8	0
0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	1	2	0
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	0
0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	1	1	0
0	0	0	0	0	0	2	3	0	0	0	0	2	0	0	2	3	4	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	1	0	0	4	16	23	0	0	1	4	10	0	1	14	22	27	1
0	0	0	0	0	0	1	2	0	0	0	0	1	0	0	1	2	3	0
0	0	0	0	0	1	2	2	0	0	0	1	1	0	0	1	2	3	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	2	2	0	0	0	0	1	0	0	1	2	3	0
0	0	0	0	0	1	2	3	0	0	0	1	1	0	0	2	3	4	0
0	0	0	0	0	2	9	12	0	0	0	2	6	0	0	8	12	15	1
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0
0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	2	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

low_2065_100y_r14_pct	low_2090_100y_r14_pct	low_2115_100y_r14_pct	low_2140_100y_r14_pct	inter_2040_100y_r14_pct	inter_2065_100y_r14_pct	inter_2090_100y_r14_pct	inter_2115_100y_r14_pct	inter_2140_100y_r14_pct	high_2040_100y_r14_pct	high_2065_100y_r14_pct	high_2090_100y_r14_pct	high_2115_100y_r14_pct	high_2140_100y_r14_pct	opc_likely_2040_100y_r14_pct	opc_likely_2065_100y_r14_pct	opc_likely_2090_100y_r14_pct	opc_likely_2115_100y_r14_pct	opc_likely_2140_100y_r14_pct
0	0	0	0	0	0	0	1	1	0	1	2	2	3	0	1	1	2	2
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	0	0	1	1	2	0	0	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	1	1	0	1	2	4	4	1	4	6	7	8	1	3	5	6	6
0	0	0	0	0	0	0	1	1	0	1	1	2	2	0	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	1
0	0	0	0	0	0	0	1	1	0	1	1	1	1	0	1	1	1	1
0	0	0	0	0	0	1	2	2	1	2	3	4	4	0	1	2	3	3
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	3	4	1	4	6	10	15	4	12	19	24	27	4	8	15	19	21
0	0	0	0	0	0	0	1	1	0	1	2	2	3	0	1	1	2	2
0	0	0	0	0	0	1	1	2	1	1	2	2	3	0	1	2	2	2
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	1	2	0	1	2	3	3	0	1	2	2	2
0	0	1	1	0	1	1	1	2	1	2	3	4	4	1	1	2	3	3
1	1	2	2	1	2	4	6	8	2	7	10	13	15	2	5	8	10	12
0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1
0	0	0	0	0	0	0	0	1	0	1	1	1	2	0	0	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

opc_1200_2040_100y_r14_pct	opc_1200_2065_100y_r14_pct	opc_1200_2090_100y_r14_pct	opc_1200_2115_100y_r14_pct	opc_1200_2140_100y_r14_pct
0	1	2	3	4
0	0	0	1	1
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	1	1	2	2
0	0	0	0	0
2	5	7	8	9
0	1	1	2	2
0	0	1	1	1
0	0	0	0	0
0	1	1	1	1
0	1	1	1	2
1	3	3	4	5
0	0	0	0	0
6	17	22	27	32
0	1	2	3	3
1	2	2	3	3
0	0	0	0	0
1	2	2	3	4
1	2	3	4	5
3	9	12	15	17
0	0	1	1	1
0	1	1	2	3
0	0	0	0	0
0	0	0	0	1
0	0	0	0	0
0	0	0	0	0
0	0	0	0	1
0	0	1	1	2
0	0	0	0	0

USACE_Reach	Social Factor	Variable	Scenario	Units	USACE_Inter_2040	USACE_Inter_2065	USACE_Inter_2090	USACE_Inter_2115	USACE_Inter_2140	USACE_High_2040	USACE_High_2065	USACE_High_2090	USACE_High_2115	USACE_High_2140	USACE_Low_2040	USACE_Low_2065	USACE_Low_2090	USACE_Low_2115	USACE_Low_2140	OPC_Likely_2040	OPC_Likely_2065	OPC_Likely_2090	OPC_Likely_2115	OPC_Likely_2140	OPC_1200_2040	OPC_1200_2065	OPC_1200_2090	OPC_1200_2115	OPC_1200_2140
Reach 1	community identity	California Register H	1% AEP	acres	4.2	5.5	7.2	11.4	21.9	6.1	13.9	36.0	40.3	42.7	4.0	4.2	4.5	5.0	5.7	5.2	9.1	30.2	36.0	39.6	6.9	34.0	39.9	42.5	44.1
Reach 1	community identity	California Register H	1% AEP	acres	9.0	9.0	9.0	10.0	10.0	9.0	10.0	10.0	10.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0	10.0	10.0	10.0	10.0	9.0	10.0	10.0	10.0	10.0
Reach 1	community identity	City Facilities	1% AEP	count	1.0	1.0	3.0	8.0	27.0	1.0	12.0	50.0	53.0	53.0	1.0	1.0	1.0	1.0	1.0	1.0	6.0	33.0	50.0	53.0	1.0	48.0	53.0	53.0	54.0
Reach 1	community identity	City Facilities Buffer	1% AEP	count	70.0	70.0	70.0	71.0	71.0	70.0	71.0	77.0	77.0	77.0	70.0	70.0	70.0	70.0	70.0	70.0	71.0	71.0	77.0	77.0	70.0	71.0	77.0	77.0	77.0
Reach 1	community identity	Historic Places	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	1.0	2.0	3.0
Reach 1	community identity	Historic Places Buffe	1% AEP	count	5.0	5.0	5.0	5.0	6.0	5.0	6.0	6.0	6.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	6.0	6.0	6.0	5.0	6.0	6.0	6.0	6.0
Reach 1	community identity	Landmark	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0
Reach 1	community identity	Landmark Buffer	1% AEP	count	2.0	2.0	2.0	3.0	4.0	2.0	4.0	4.0	4.0	4.0	2.0	2.0	2.0	2.0	2.0	2.0	3.0	4.0	4.0	4.0	2.0	4.0	4.0	4.0	4.0
Reach 1	community identity	Legacy Businesses	1% AEP	count	0.0	0.0	2.0	2.0	4.0	1.0	2.0	5.0	6.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	4.0	5.0	6.0	1.0	4.0	6.0	7.0	7.0
Reach 1	community identity	Legacy Businesses B	1% AEP	count	8.0	8.0	8.0	10.0	10.0	8.0	10.0	12.0	12.0	12.0	8.0	8.0	8.0	8.0	8.0	8.0	10.0	10.0	12.0	12.0	8.0	10.0	12.0	12.0	12.0
Reach 1	community identity	Muni Stops	1% AEP	count	0.0	0.0	0.0	6.0	11.0	0.0	9.0	18.0	21.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	11.0	18.0	20.0	0.0	12.0	21.0	24.0	27.0
Reach 1	community identity	National Shelters	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
Reach 1	community identity	National Shelters Bu	1% AEP	count	1.0	1.0	1.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0
Reach 1	community identity	Schools	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Reach 1	community identity	Schools Buffer	1% AEP	count	3.0	3.0	3.0	4.0	5.0	3.0	4.0	6.0	6.0	6.0	3.0	3.0	3.0	3.0	3.0	3.0	4.0	6.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0
Reach 1	community identity	Schools (Polygon)	1% AEP	acres	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.9
Reach 1	community identity	Schools (Polygon) Bu	1% AEP	count	4.0	4.0	4.0	5.0	6.0	4.0	5.0	6.0	6.0	6.0	4.0	4.0	4.0	4.0	4.0	4.0	5.0	6.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0
Reach 1	community identity	Senior Housing Sites	1% AEP	count	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Reach 1	community identity	Senior Housing Sites	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
Reach 1	community identity	Places of Worship	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
Reach 1	community identity	Places of Worship B	1% AEP	count	0.0	0.0	0.0	4.0	4.0	0.0	4.0	4.0	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	4.0	4.0	4.0	0.0	4.0	4.0	4.0	4.0
Reach 1	economic vitality	LBE Businesses	1% AEP	count	0.0	0.0	0.0	1.0	1.0	0.0	1.0	2.0	4.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	4.0	0.0	1.0	4.0	7.0	8.0
Reach 1	economic vitality	LBE Minority-Ownec	1% AEP	count	0.0	0.0	0.0	1.0	1.0	0.0	1.0	1.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	1.0	1.0	1.0	2.0
Reach 1	economic vitality	LBE Women-Owned	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0	3.0	3.0
Reach 1	economic vitality	Affordable Housing	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0
Reach 1	health and safety	Disaster Response S	1% AEP	count	0.0	0.0	0.0	4.0	7.0	0.0	6.0	11.0	11.0	11.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	9.0	11.0	11.0	0.0	10.0	11.0	11.0	11.0
Reach 1	health and safety	HazMat RCRA Sites	1% AEP	count	0.0	0.0	1.0	7.0	9.0	0.0	8.0	10.0	16.0	17.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	9.0	10.0	11.0	0.0	9.0	16.0	16.0	19.0
Reach 1	health and safety	Manholes	1% AEP	count	0.0	0.0	10.0	122.0	179.0	0.0	150.0	220.0	255.0	279.0	0.0	0.0	0.0	0.0	0.0	0.0	37.0	186.0	219.0	236.0	6.0	189.0	248.0	277.0	302.0
Reach 1	health and safety	North Point Wet-We	1% AEP	acres	0.0	0.0	0.0	0.1	0.2	0.0	0.1	0.6	1.3	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.6	1.1	0.0	0.3	1.2	2.2	3.4
Reach 1	health and safety	Pump Stations	1% AEP	acres	0.0	0.0	0.0	0.0	1.0	0.0	0.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	2.0	0.0	1.0	2.0	2.0	2.0
Reach 1	leisure and recreation	Bay Trail	1% AEP	feet	83.7	539.4	1928.7	5469.8	7294.5	861.1	6948.0	7411.7	7715.6	7913.3	25.8	80.8	131.1	315.8	561.6	349.3	3382.3	7309.2	7410.5	7564.0	1749.6	7327.4	7646.5	7885.2	8000.5
Reach 1	leisure and recreation	Land Use Open Spac	1% AEP	acres	1.2	1.3	1.5	2.7	3.7	1.4	3.1	6.8	7.8	8.6	1.1	1.2	1.2	1.3	1.3	1.3	2.0	3.8	6.8	7.3	1.5	6.0	7.6	8.5	9.3
Reach 1	leisure and recreation	Recreation and Park	1% AEP	acres	0.3	0.3	0.4	0.5	0.7	0.3	0.6	1.0	1.0	1.0	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.8	1.0	1.0	0.4	0.8	1.0	1.0	1.0
Reach 1	leisure and recreation	Port Open Space	1% AEP	acres	0.4	1.2	2.2	3.9	6.9	1.6	4.6	9.2	10.1	10.3	0.3	0.4	0.6	0.9	1.3	1.0	3.0	7.1	9.2	10.0	2.0	7.7	10.1	10.3	10.3
Reach 1	leisure and recreation	Swimming and Fishi	1% AEP	count	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	3.0	3.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0	3.0	1.0	2.0	3.0	3.0	3.0
Reach 1	social	Bike Routes	1% AEP	feet	0.0	0.0	0.0	1809.3	3501.4	0.0	2531.2	4022.4	5017.6	5466.8	0.0	0.0	0.0	0.0	0.0	0.0	663.0	3593.0	4017.9	4431.8	0.0	3789.5	4700.6	5436.7	5572.5
Reach 1	social	Golden Gate Bus Ro	1% AEP	feet	0.0	0.0	0.0	44106.2	60018.0	0.0	52085.7	82204.6	86354.2	90146.3	0.0	0.0	0.0	0.0	0.0	0.0	18651.1	60413.1	82161.8	84243.2	0.0	62091.2	85269.3	89732.8	92984.0
Reach 1	social	Regional Bus Stops	1% AEP	count	0.0	0.0	0.0	3.0	4.0	0.0	4.0	5.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	4.0	5.0	5.0	0.0	5.0	5.0	5.0	6.0
Reach 1	social	Ferry Stations	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 1	social	Muni Pattern Stops	1% AEP	count	0.0	0.0	0.0	24.0	47.0	0.0	36.0	61.0	66.0	75.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	47.0	61.0	63.0	0.0	49.0	66.0	75.0	79.0
Reach 1	social	Muni Route	1% AEP	feet	0.0	0.0	724.8	7875.5	12764.3	0.0	10292.5	16633.6	17893.4	19148.4	0.0	0.0	0.0	0.0	0.0	0.0	2280.8	12911.8	16622.0	17250.4	453.9	13555.3	17511.7	18996.7	20218.4
Reach 1	social	Streets	1% AEP	feet	0.0	308.1	1551.8	11777.1	14936.7	520.7	13524.6	18844.7	23801.2	27888.3	0.0	0.0	6.4	128.1	351.6	177.4	4622.1	15099.1	18818.9	20738.4	1278.6	15655.7	22283.3	27488.8	31185.5
Reach 2	community identity	California Register H	1% AEP	acres	2.5	3.6	8.3	16.9	31.8	5.5	23.9	58.3	68.4	82.8	1.7	2.4	2.9	3.3	3.7	3.4	14.3	46.5	58.2	63.3	7.4	52.8	65.8	82.0	88.7
Reach 2	community identity	California Register H	1% AEP	acres	8.0	9.0	19.0	22.0	24.0	14.0	22.0	30.0	30.0	30.0	8.0	8.0	8.0	9.0	9.0	9.0	22.0	24.0	30.0	30.0	18.0	27.0	30.0	30.0	30.0
Reach 2	community identity	Cultural Districts	1% AEP	acres	0.0	0.0	21.0	42.8	56.0	0.1	48.7	77.5	119.6	182.8	0.0	0.0	0.0	0.0	0.1	0.0	31.3	57.0	77.2	99.5	19.8	62.8	109.1	173.9	239.7
Reach 2	community identity	Cultural Districts	1% AEP	count	0.0	1.0	2.0	3.0	3.0	1.0	3.0	3.0	3.0	3.0	0.0	0.0	0.0	1.0	1.0	1.0	2.0	3.0	3.0	3.0	2.0	3.0	3.0	3.0	4.0
Reach 2	community identity	cd_bus	1% AEP	count	2.0	3.0	7.0	8.0	8.0	3.0	8.0	8.0	9.0	9.0	2.0	2.0	2.0	3.0	3.0	3.0	7.0	8.0	8.0	8.0	7.0	8.0	9.0	9.0	9.0
Reach 2	community identity	City Facilities	1% AEP	count	2.0	3.0	9.0	26.0	33.0	4.0	30.0	42.0	47.0	48.0	1.0	2.0	3.0	3.0	3.0	3.0	22.0	40.0	42.0	46.0	8.0	41.0	46.0	48.0	48.0
Reach 2	community identity	City Facilities Buffer	1% AEP	count	49.0	49.0	53.0	55.0	57.0	50.0	56.0	59.0	63.0	65.0	49.0	49.0	49.0	49.0	49.0	49.0	55.0	57.0	59.0	61.0	53.0	57.0	62.0	65.0	65.0
Reach 2	community identity	Historic Places	1% AEP	count	2.0	4.0	5.0	6.0	10.0	4.0	10.0	11.0	17.0	20.0	1.0	2.0	3.0	3.0	4.0	3.0	6.0	10.0	11.0	16.0	4.0	10.0	16.0	20.0	21.0
Reach 2	community identity	Historic Places Buffe	1% AEP	count	15.0	16.0	27.0	28.0	29.0	21.0	28.0	31.0	31.0	31.0	15.0	15.0	15.0	15.0	16.0	15.0	28.0	29.0	31.0	31.0	26.0	29.0	31.0	31.0	31.0
Reach 2	community identity	Healthcare Facilities	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	community identity	Healthcare Facilities	1% AEP	count	0.0	0.0	0.0	1.0	1.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	1.0	1.0	1.0	1.0
Reach 2	community identity	Landmarks	1% AEP	count	0.0	1.0	3.0	4.0	4.0	1.0	4.0	5.0	11.0	34.0	0.0	0.0	0.0	0.0	1.0	0.0	3.0	4.0	5.0	8.0	3.0	4.0	9.0	30.0	39.0
Reach 2	community identity	Landmarks Buffer	1% AEP	count	11.0	13.0	44.0	47.0	49.0	15.0	47.0	52.0	56.0	57.0	11.0	11.0	11.0	12.0	13.0	12.0	46.0	49.0	52.0	54.0	26.0	49.0	54.0	56.0	57.0
Reach 2	community identity	Legacy Businesses	1% AEP	count	0.0	0.0	2.0	2.0	5.0	0.0	3.0	5.0	5.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	5.0	5.0	5.0	2.0	5.0	5.0	6.0	6.0
Reach 2	community identity	Legacy Businesses B	1% AEP	count	4.0	5.0	7.0	7.0	7.0	5.0	7.0	12.0	14.0	14.0	4.0	4.0	4.0	5.0	5.0	5.0	7.0	7.0	12.0	13.0	5.0	9.0	14.0	14.0	14.0
Reach 2	community identity	Muni Stops	1% AEP	count	2.0	10.0	35.0	57.0	63.0	17.0	59.0	74.0	90.0	96.0	2.0	2.0	5.0	7.0	11.0	8.0	44.0	64.0	74.0	79.0	33.0	64.0	84.0	95.0	102.0
Reach 2	community identity	National Shelters	1% AEP	count	0.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Reach 2	community identity	National Shelters Bu	1% AEP	count	1.0	1.0	2.0	2.0	2.0	1.0	2.0	3.0	4.0	4.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0	3.0	4.0	2.0	2.0	4.0	4.0	4.0
Reach 2	community identity	Schools	1% AEP	count	0.0	0.0	1.0	1.0	3.0	1.0	2.0	5.0	6.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0	5.0	5.0	1.0	3.0	5.0	6.0	6.0
Reach 2	community identity	Schools Buffer	1% AEP	count	7.0	7.0	10.0	12.0	15.0	8.0	12.0	15.0	15.0	15.0	6.0	7.0	7.0	7.0	7.0	7.0	12.0	15.0	15.0	15.0	8.0	15.0	15.0	15.0	15.0
Reach 2	community identity	Schools (Polygon)	1% AEP	acres	0.0	0.0	0.5	0.8	1.2	0.1	0.9	2.5	5.3	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.3	2.4	3.3	0.4	1.5	3.6	5.4	5.5
Reach 2	community identity	Schools (Polygon) Bu	1% AEP	count	7.0	7.0	10.0	17.0	18.0	8.0	17.0	18.0	18.0	18.0	7.0	7.0	7.0	7.0	7.0	7.0	14.0	18.0	18.0	18.0	8.0	18.0	18.0	18.0	18.0
Reach 2	community identity	Senior Housing Sites	1% AEP	count	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Reach 2	community identity	Senior Housing Sites	1% AEP	count	0.0	0.0	0.0	1.0	1.0	0.0	1.0	1.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	1.0	1.0	1.0	2.0
Reach 2	community identity	Places of Worship	1% AEP	count	0.0	2.0	2.0	2.0	3.0	2.0	2.0	5.0	5.0	9.0	0.0	0.0	0.0	0.0	2.0	0.0	2.0	3.0	5.0	5.0	2.0	4.0	5.0	9.0	9.0
Reach 2	community identity	Places of Worship B	1% AEP	count	3.0	7.0	9.0	11.0	11.0	7.0	11.0	14.0	14.0	15.0	3.0	3.0	4.0	6.0	7.0	6.0	10.0	11.0	14.0	14.0	8.0	11.0	14.0	15.0	15.0
Reach 2	economic vitality	LBE Businesses	1% AEP	count	13.0	13.0	24.0	41.0	48.0	18.0	45.0	98.0	123.0	143.0	13.0	13.0	13.0	13.0	13.0	13.0	31.0	48.0	98.0	103.0	24.0	60.0	120.0	140.0	148.0
Reach 2	economic vitality	LBE Minority-Ownec	1% AEP	count	0.0	0.0	8.0	18.0	22.0	5.0	22.0	35.0	44.0	57.0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	22.0	35.0	40.0	8.0	23.0	44.0	54.0	62.0
Reach 2	economic vitality	LBE Women-Owned	1% AEP	count	7.0	7.0	7.0	13.0	15.0	7.0	13.0	48.0	61.0	66.0	7.0	7.0	7.0	7.0	7.0	7.0	8.0	15.0	48.0	48.0	7.0	23.0	58.0	66.0	66.0
Reach 2	economic vitality	Affordable Housing	1% AEP	count	2.0	2.0	2.0	4.0	4.0	2.0	4.0	6.0	10.0	13.0	2.0	2.0	2.0	2.0	2.0	2.0	3.0	4.0	6.0	10.0	2.0	4.0	10.0	12.0	13.0
Reach 2	health and safety	Contaminated Sites	1% AEP	count	0.0	0.0	0.0	1.0	1.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	1.0	1.0	1.0	1.0
Reach 2	health and safety	Disaster Response S	1% AEP	count	1.0	1.0	5.0	6.0	8.0	2.0	8.0	15.0	15.0	16.0	0.0	1.0	1.0	1.0	1.0	1.0	6.0	13.0	14.0	15.0	3.0	13.0	15.0	16.0	16.0
Reach 2	health and safety	HazMat RCRA Sites	1% AEP	count	1.0	4.0	16.0	27.0	32.0	8.0	27.0	41.0	61.0	73.0	0.0	1.0	1.0	3.0	4.0	3.0	23.0	34.0	41.0	52.0	13.0	35.0	54.0	71.0	78.0
Reach 2	health and safety	Manholes	1% AEP	count	30.0	71.0	185.0	301.0	334.0	97.0	316.0	408.0	512.0	586.0	25.0	29.0	35.0	60.0	73.0	62.0	264.0	338.0	408.0	463.0	167.0	348.0	485.0	580.0	629.0
Reach 2	leisure and recreation	Bay Trail	1% AEP	feet	3125.7	4464.6	6194.7	7281.1	7674.9	4534.2	7482.9	7720.1	7725.3	7723.8	2397.4	2990.6	3672.4	4109.6	4492.9	4122.0	6967.6	7695.8	7720.1	7725.8	6081.4	7721.4	7724.6	7725.1	7724.6
Reach 2	leisure and recreation	Land Use Open Spac	1% AEP	acres	0.2	1.0	2.9	4.6	6.7	1.1	5.6	9.4	11.8	13.4	0.0	0.1	0.3	0.9	1.0	0.9	3.8	6.9	9.4	10.9	1.6	7.8	11.4	13.1	14.1
Reach 2	leisure and recreation	Recreation and Park	1% AEP	acres	0.0	1.5	3.7	6.2	7.9	1.8	7.0	9.4	9.9	10.1	0.0	0.0	0.0	1.3	1.6	1.4	5.4	8.0	9.3	9.7	2.3	8.5	9.8	10.1	10.2
Reach 2	leisure and recreation	Port Open Space	1% AEP	acres	2.8	5.4	8.9	13.1	15.3	6.3	15.0	16.0	17.5	18.3	2.2	2.6	3.2	4.5	5.5	4.6	12.1	15.4	15.9	16.9	8.1	15.5	17.1	18.3	18.3
Reach 2	leisure and recreation	Swimming and Fishi	1% AEP	count	0.0	1.0	1.0	2.0	2.0	1.0	2.0	2.0	3.0	3.0	0.0	0.0	0.0	0.0	1.0	0.0	2.0	2.0	2.0	3.0	1.0	2.0	3.0	3.0	3.0
Reach 2	social	AC Transit Route	1% AEP	feet	0.0	0.0	0.0	34.1	1588.3	0.0	340.9	3130.3	4898.1	6096.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1686.4	3108.5	4329.0	0.0	2217.9	4597.7	6019.4	6575.8
Reach 2	social	Amtrak Route	1% AEP	feet	0.0	0.0	0.0	0.0	20.8	0.0	0.0	20.8	20.8	20.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.8	20.8	20.8	0.0	20.8	20.8	20.8	20.8
Reach 2	social	Bart Route	1% AEP	feet	44.4	790.0	1300.6	2026.3	2237.5	962.3	2100.1	2631.5	2917.9	3081.0	23.8	43.8	58.0	578.6	802.2	685.4	1933.7	2251.4	2628.8	2788.9	1230.9	2370.0	2833.8	3050.5	3233.9
Reach 2	social	Bart Stations	1% AEP	count	0.0	0.0	2.0	3.0	5.0	0.0	5.0	7.0	7.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	5.0	7.0	7.0	1.0	7.0	7.0	7.0	7.0

Reach 2	social	Bike Routes	1% AEP	feet	4249.9	6737.0	12070.2	17145.3	19036.3	8467.2	17987.0	21459.5	25316.2	27662.9	3464.7	3880.1	5055.8	6120.6	6952.1	6289.3	15126.7	19086.5	21424.7	23442.4	11704.8	19420.7	24386.0	27492.5	29023.0
Reach 2	social	Golden Gate Bus Ro	1% AEP	feet	0.0	0.0	1787.8	19492.6	23957.6	0.0	20924.4	53214.0	117925.8	141696.7	0.0	0.0	0.0	0.0	0.0	0.0	15337.1	24401.9	52520.2	88362.3	1611.4	27906.9	99444.0	139448.1	157292.2
Reach 2	social	Regional Bus Stops	1% AEP	count	0.0	0.0	0.0	1.0	5.0	0.0	4.0	14.0	45.0	52.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	13.0	28.0	0.0	9.0	37.0	51.0	55.0
Reach 2	social	Ferry Stations	1% AEP	count	0.0	0.0	0.0	1.0	1.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	1.0	1.0	1.0	1.0
Reach 2	social	MTA Light Rail	1% AEP	count	0.0	0.0	1.0	1.0	1.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Reach 2	social	Muni Pattern Stops	1% AEP	count	3.0	86.0	247.0	348.0	396.0	127.0	380.0	436.0	570.0	589.0	3.0	3.0	27.0	52.0	96.0	58.0	286.0	401.0	436.0	475.0	242.0	401.0	493.0	588.0	592.0
Reach 2	social	Muni Route	1% AEP	feet	1495.2	9214.5	19205.5	30854.3	36856.3	10984.9	33020.4	43241.5	50145.5	55253.1	440.4	814.8	3684.5	7710.2	9554.2	8308.3	26377.2	37470.2	43164.5	46181.9	17611.1	38958.0	48115.8	54814.8	58364.5
Reach 2	social	Samtrans Route	1% AEP	feet	0.0	0.0	426.1	918.7	1452.6	0.0	953.0	2280.0	3354.8	4228.4	0.0	0.0	0.0	0.0	0.0	0.0	640.6	1488.6	2266.2	2761.6	393.2	1736.7	3040.2	4123.5	4936.6
Reach 2	social	Samtrans Stations	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	2.0	2.0	3.0
Reach 2	social	Streets	1% AEP	feet	3606.7	6566.0	18045.1	30112.4	34489.6	9102.3	31806.5	44337.6	57556.0	69277.9	3037.5	3571.6	4207.0	5379.5	6705.8	5850.8	26007.6	35087.9	44228.8	50835.6	15745.0	36999.0	54022.7	67758.1	76984.6
Reach 3	community identity	California Register H	1% AEP	acres	3.1	8.6	17.1	29.0	69.0	9.2	42.4	97.8	117.7	139.3	2.9	3.1	3.2	8.1	8.7	8.6	20.6	71.9	94.9	107.6	16.6	79.7	110.9	132.8	166.4
Reach 3	community identity	California Register H	1% AEP	acres	16.0	18.0	26.0	26.0	26.0	18.0	26.0	27.0	27.0	27.0	16.0	16.0	17.0	18.0	18.0	18.0	26.0	26.0	27.0	27.0	25.0	27.0	27.0	27.0	29.0
Reach 3	community identity	Cultural Districts	1% AEP	acres	0.0	0.0	9.6	11.5	12.5	0.0	11.9	13.2	17.1	37.5	0.0	0.0	0.0	0.0	0.0	0.0	10.7	12.6	13.2	14.0	9.3	12.9	15.4	34.2	93.7
Reach 3	community identity	Cultural Districts	1% AEP	count	0.0	0.0	1.0	1.0	1.0	0.0	1.0	1.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	2.0	1.0	1.0	2.0	2.0	6.0
Reach 3	community identity	cd_bus	1% AEP	count	0.0	2.0	4.0	4.0	4.0	2.0	4.0	4.0	5.0	5.0	0.0	0.0	0.0	1.0	2.0	1.0	4.0	4.0	4.0	4.0	4.0	4.0	5.0	5.0	11.0
Reach 3	community identity	City Facilities	1% AEP	count	1.0	9.0	11.0	52.0	83.0	10.0	65.0	115.0	126.0	131.0	1.0	1.0	3.0	9.0	9.0	9.0	47.0	84.0	115.0	121.0	10.0	92.0	123.0	131.0	142.0
Reach 3	community identity	City Facilities Buffer	1% AEP	count	113.0	132.0	150.0	156.0	158.0	132.0	157.0	163.0	165.0	171.0	114.0	113.0	114.0	132.0	132.0	132.0	151.0	158.0	163.0	164.0	150.0	161.0	165.0	170.0	180.0
Reach 3	community identity	Historic Places	1% AEP	count	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0	3.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	1.0	3.0	3.0	4.0
Reach 3	community identity	Historic Places Buffe	1% AEP	count	1.0	4.0	4.0	4.0	5.0	4.0	4.0	6.0	6.0	13.0	1.0	1.0	1.0	4.0	4.0	4.0	4.0	5.0	6.0	6.0	4.0	5.0	6.0	12.0	17.0
Reach 3	community identity	Healthcare Facilities	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0
Reach 3	community identity	Healthcare Facilities	1% AEP	count	0.0	0.0	3.0	3.0	3.0	0.0	3.0	3.0	3.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	4.0
Reach 3	community identity	Landmarks	1% AEP	count	0.0	0.0	0.0	0.0	3.0	0.0	2.0	4.0	5.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	4.0	4.0	0.0	3.0	5.0	6.0	8.0
Reach 3	community identity	Landmarks Buffer	1% AEP	count	5.0	6.0	6.0	8.0	9.0	6.0	8.0	9.0	9.0	10.0	5.0	5.0	5.0	6.0	6.0	6.0	6.0	9.0	9.0	9.0	6.0	9.0	9.0	10.0	14.0
Reach 3	community identity	Legacy Businesses	1% AEP	count	0.0	1.0	2.0	2.0	3.0	1.0	2.0	6.0	6.0	8.0	0.0	0.0	1.0	1.0	1.0	1.0	2.0	3.0	6.0	6.0	2.0	4.0	6.0	7.0	11.0
Reach 3	community identity	Legacy Businesses B	1% AEP	count	5.0	9.0	10.0	15.0	15.0	9.0	15.0	16.0	19.0	23.0	5.0	5.0	5.0	8.0	9.0	8.0	12.0	15.0	16.0	19.0	10.0	15.0	19.0	23.0	32.0
Reach 3	community identity	Muni Stops	1% AEP	count	0.0	6.0	14.0	35.0	39.0	8.0	37.0	54.0	71.0	84.0	0.0	0.0	0.0	5.0	6.0	5.0	29.0	39.0	52.0	66.0	13.0	41.0	68.0	83.0	106.0
Reach 3	community identity	National Shelters	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0	3.0
Reach 3	community identity	National Shelters Bu	1% AEP	count	1.0	1.0	4.0	4.0	4.0	1.0	4.0	5.0	5.0	5.0	1.0	1.0	1.0	1.0	1.0	1.0	4.0	5.0	5.0	5.0	4.0	5.0	5.0	5.0	5.0
Reach 3	community identity	Schools	1% AEP	count	0.0	0.0	1.0	1.0	2.0	0.0	2.0	3.0	4.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	3.0	4.0	1.0	2.0	4.0	7.0	9.0
Reach 3	community identity	Schools Buffer	1% AEP	count	5.0	7.0	10.0	12.0	13.0	7.0	12.0	14.0	14.0	17.0	5.0	5.0	5.0	6.0	7.0	6.0	10.0	13.0	14.0	14.0	10.0	13.0	14.0	16.0	23.0
Reach 3	community identity	Schools (Polygon)	1% AEP	acres	0.0	0.3	1.2	2.2	3.5	0.7	2.8	5.8	12.1	13.2	0.0	0.0	0.2	0.3	0.4	0.3	1.4	3.6	5.8	10.1	1.1	4.0	11.9	13.0	15.0
Reach 3	community identity	Schools (Polygon) Bu	1% AEP	count	5.0	7.0	11.0	14.0	14.0	7.0	14.0	15.0	17.0	20.0	5.0	5.0	5.0	7.0	7.0	7.0	12.0	14.0	15.0	16.0	11.0	14.0	16.0	18.0	28.0
Reach 3	community identity	Senior Housing Sites	1% AEP	count	0.0	0.0	1.0	1.0	1.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Reach 3	community identity	Senior Housing Sites	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	community identity	Places of Worship	1% AEP	count	0.0	0.0	0.0	1.0	1.0	0.0	1.0	1.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	1.0	1.0	2.0	7.0
Reach 3	community identity	Places of Worship B	1% AEP	count	4.0	4.0	10.0	10.0	10.0	4.0	10.0	11.0	15.0	15.0	4.0	4.0	4.0	4.0	4.0	4.0	10.0	10.0	11.0	14.0	10.0	10.0	15.0	15.0	17.0
Reach 3	economic vitality	LBE Businesses	1% AEP	count	0.0	2.0	10.0	21.0	30.0	8.0	24.0	37.0	46.0	97.0	0.0	0.0	1.0	2.0	2.0	2.0	19.0	33.0	37.0	40.0	10.0	33.0	46.0	95.0	155.0
Reach 3	economic vitality	LBE Minority-Ownec	1% AEP	count	0.0	2.0	2.0	11.0	15.0	2.0	11.0	19.0	26.0	57.0	0.0	0.0	1.0	2.0	2.0	2.0	9.0	15.0	19.0	20.0	2.0	15.0	26.0	55.0	85.0
Reach 3	economic vitality	LBE Women-Owned	1% AEP	count	0.0	0.0	2.0	2.0	5.0	2.0	5.0	5.0	5.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	5.0	5.0	5.0	2.0	5.0	5.0	20.0	34.0
Reach 3	economic vitality	Affordable Housing	1% AEP	count	2.0	5.0	10.0	17.0	21.0	6.0	20.0	26.0	37.0	49.0	2.0	2.0	3.0	5.0	5.0	5.0	15.0	22.0	26.0	32.0	9.0	24.0	34.0	48.0	69.0
Reach 3	health and safety	Contaminated Sites	1% AEP	count	0.0	0.0	0.0	2.0	2.0	0.0	2.0	4.0	4.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	4.0	4.0	0.0	2.0	4.0	4.0	6.0
Reach 3	health and safety	Disaster Response S	1% AEP	count	0.0	1.0	1.0	3.0	13.0	1.0	8.0	16.0	17.0	17.0	0.0	0.0	0.0	1.0	1.0	1.0	3.0	14.0	16.0	17.0	1.0	15.0	17.0	17.0	17.0
Reach 3	health and safety	HazMat RCRA Sites	1% AEP	count	3.0	8.0	18.0	34.0	48.0	9.0	40.0	60.0	78.0	104.0	3.0	3.0	3.0	8.0	9.0	8.0	28.0	48.0	60.0	67.0	17.0	54.0	73.0	100.0	133.0
Reach 3	health and safety	Manholes	1% AEP	count	29.0	110.0	194.0	439.0	546.0	118.0	503.0	715.0	915.0	1074.0	23.0	29.0	30.0	101.0	111.0	105.0	342.0	556.0	711.0	823.0	190.0	592.0	859.0	1050.0	1357.0
Reach 3	health and safety	Pump Stations	1% AEP	acres	1.0	2.0	4.0	5.0	6.0	2.0	5.0	6.0	6.0	6.0	1.0	1.0	1.0	2.0	2.0	2.0	5.0	6.0	6.0	6.0	4.0	6.0	6.0	6.0	8.0
Reach 3	leisure and recreation	Blue Greenway	1% AEP	feet	428.9	1436.5	2147.5	4941.3	5490.7	1685.9	5229.2	5745.4	6070.6	6340.8	356.5	408.7	530.5	1292.0	1478.3	1352.5	3998.5	5508.8	5740.8	5912.0	1946.8	5591.9	5997.6	6298.8	6501.4
Reach 3	leisure and recreation	Bay Trail	1% AEP	feet	710.9	1803.9	2540.7	7203.5	10117.9	2009.4	8740.9	11037.4	11353.8	11540.4	643.6	705.9	752.9	1569.4	1851.3	1623.5	5120.3	10190.9	11038.3	11192.2	2362.0	10392.4	11276.4	11510.3	11738.2
Reach 3	leisure and recreation	Land Use Open Spac	1% AEP	acres	0.0	0.2	1.2	1.8	3.0	0.2	2.6	4.6	6.7	9.2	0.0	0.0	0.0	0.0	0.2	0.1	1.4	3.1	4.5	5.3	1.1	3.2	5.8	8.9	15.1
Reach 3	leisure and recreation	Recreation and Park	1% AEP	acres	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.8	3.4	3.5
Reach 3	leisure and recreation	Port Open Space	1% AEP	acres	6.6	8.8	13.4	20.3	29.1	10.1	24.3	35.0	38.5	38.6	5.9	6.5	7.2	8.2	8.9	8.3	16.9	29.6	34.8	38.0	12.6	31.2	38.4	38.6	38.6
Reach 3	leisure and recreation	Swimming and Fishi	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	2.0	0.0	2.0	2.0	2.0	2.0
Reach 3	social	AC Transit Route	1% AEP	feet	0.0	0.0	809.9	1231.1	2205.5	0.0	1472.0	3397.0	5448.8	7810.1	0.0	0.0	0.0	0.0	0.0	0.0	1025.1	2245.9	3384.6	4576.7	789.3	2424.5	4952.8	7579.6	11017.4
Reach 3	social	Amtrak Route	1% AEP	feet	0.0	0.0	1513.2	1971.1	2403.8	0.0	2079.0	4194.0	5843.3	7576.2	0.0	0.0	0.0	0.0	0.0	0.0	1733.0	2439.6	4154.3	5355.8	1438.4	2760.4	5531.7	7347.3	8368.1
Reach 3	social	Bike Routes	1% AEP	feet	659.3	3415.8	5627.4	17028.1	23574.5	4116.7	21048.1	29588.5	39370.8	45413.0	604.6	644.1	771.1	3123.1	3500.6	3189.6	12368.8	23770.7	29366.3	35237.2	5208.8	25077.7	37665.0	44757.8	59888.6
Reach 3	social	Golden Gate Bus Ro	1% AEP	feet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.3	3586.7	7922.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.9	1443.1	0.0	0.0	2454.3	7654.6	8894.2
Reach 3	social	Regional Bus Stops	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0	3.0	4.0
Reach 3	social	Ferry Stations	1% AEP	count	0.0	0.0	0.0	0.0	1.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	1.0	1.0	1.0	1.0
Reach 3	social	Muni Pattern Stops	1% AEP	count	0.0	13.0	36.0	147.0	154.0	14.0	150.0	205.0	257.0	287.0	0.0	0.0	0.0	12.0	13.0	12.0	113.0	154.0	193.0	240.0	32.0	161.0	251.0	285.0	350.0
Reach 3	social	Muni Route	1% AEP	feet	453.0	6060.5	10465.3	27583.6	37076.2	7157.3	33011.7	48615.8	69098.9	81147.7	162.1	420.3	684.0	5523.6	6217.5	5636.8	20558.3	37637.7	47727.8	59269.2	9816.6	40225.9	64428.6	79781.7	95213.2
Reach 3	social	Caltrain Line	1% AEP	feet	0.0	21388.6	25064.5	29403.0	31998.5	23071.7	30247.9	33545.3	36758.0	36880.7	0.0	0.0	0.0	20027.7	21770.2	20399.0	26176.3	32217.7	33461.1	35807.3	24718.9	32687.7	36627.6	36878.6	36904.1
Reach 3	social	Samtrans Route	1% AEP	feet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	62.2	3331.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3150.3	5071.5
Reach 3	social	Samtrans Stations	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
Reach 3	social	Streets	1% AEP	feet	10325.4	25693.8	43998.4	70211.6	89490.2	29321.6	78397.3	117183.2	158208.2	192835.8	8150.7	9969.2	12221.8	23403.6	26246.4	24153.0	58306.6	90671.5	116388.1	140299.5	42117.1	97788.9	149829.6	188638.3	245405.4
Reach 4	community identity	California Register H	1% AEP	acres	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4
Reach 4	community identity	California Register H	1% AEP	acres	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Reach 4	community identity	Cultural Districts	1% AEP	acres	215.6	275.2	401.4	511.3	609.4	308.2	550.8	773.3	1032.8	1303.8	186.0	201.5	233.8	253.8	279.8	258.5	460.9	618.4	771.0	907.1	385.5	669.0	959.8	1276.9	1450.1
Reach 4	community identity	Cultural Districts	1% AEP	count	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Reach 4	community identity	cd_bus	1% AEP	count	5.0	5.0	5.0	5.0	5.0	5.0	5.0	7.0	7.0	7.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	7.0	7.0	5.0	7.0	7.0	7.0	7.0
Reach 4	community identity	City Facilities	1% AEP	count	8.0	9.0	14.0	16.0	25.0	10.0	17.0	30.0	63.0	75.0	8.0	8.0	8.0	8.0	9.0	8.0	16.0	26.0	30.0	44.0	12.0	28.0	53.0	74.0	78.0
Reach 4	community identity	City Facilities Buffer	1% AEP	count	74.0	75.0	106.0	107.0	112.0	75.0	111.0	124.0	130.0	134.0	73.0	74.0	75.0	75.0	75.0	75.0	106.0	112.0	124.0	126.0	106.0	117.0	127.0	134.0	134.0
Reach 4	community identity	Landmarks	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0	1.0	1.0
Reach 4	community identity	Landmarks Buffer	1% AEP	count	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Reach 4	community identity	Legacy Businesses	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	9.0	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	7.0	0.0	3.0	7.0	11.0	11.0
Reach 4	community identity	Legacy Businesses B	1% AEP	count	6.0	7.0	14.0	14.0	14.0	7.0	14.0	15.0	16.0	16.0	6.0	6.0	6.0	7.0	7.0	7.0	14.0	14.0	15.0	15.0	14.0	15.0	15.0	16.0	16.0
Reach 4	community identity	Muni Stops	1% AEP	count	0.0	1.0	6.0	9.0	10.0	2.0	10.0	20.0	42.0	55.0	0.0	0.0	0.0	0.0	1.0	0.0	8.0	10.0	20.0	33.0	6.0	13.0	36.0	52.0	68.0
Reach 4	community identity	National Shelters	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	community identity	National Shelters Bu	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	1.0	2.0	2.0
Reach 4	community identity	Schools	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0
Reach 4	community identity	Schools Buffer	1% AEP	count	2.0	2.0	2.0	2.0	2.0	2.0	2.0	6.0	10.0	10.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	6.0	6.0	2.0	3.0	7.0	10.0	10.0
Reach 4	community identity	Schools (Polygon)	1% AEP	acres	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.9	3.6
Reach 4	community identity	Schools (Polygon) Bu	1% AEP	count	2.0	2.0	2.0	3.0	4.0	2.0	3.0	6.0	10.0	10.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	4.0	6.0	8.0	2.0	5.0	8.0	10.0	10.0
Reach 4	community identity	Places of Worship	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	7.0
Reach 4	community identity	Places of Worship B	1% AEP	count	5.0	6.0	6.0	7.0	8.0	6.0	7.0	15.0	16.0	16.0	5.0	5.0	6.0	6.0	6.0	6.0	6.0	8.0	15.0	16.0	6.0	9.0	16.0	16.0	16.0
Reach 4	economic vitality	LBE Businesses	1% AEP	count	3.0	12.0	27.0	27.0	34.0	12.0	29.0	37.0	85.0	145.0	0.0	0.0	3.0	12.0	12.0	12.0	27.0	34.0	37.0	63.0	27.0	36.0	66.0	129.0	169.0
Reach 4	economic vitality	LBE Minority-Ownec	1% AEP	count	2.0	2.0	11.0	11.0	12.0	2.0	11.0	13.0	26.0	48.0	0.0	0.0	2.0	2.0	2.0	2.0	11.0	12.0	13.0	18.0	11.0	12.0	18.0	33.0	61.0
Reach 4	economic vitality	LBE Women-Owned	1% AEP	count	0.0	0.0	3.0	3.0	3.0	0.0	3.0	5.0	13.0	18.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	3.0	5.0	11.0	3.0	5.0	12.0	18.0	25.0
Reach 4	economic vitality	Affordable Housing	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0

Reach 4	health and safety	Contaminated Sites	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Reach 4	health and safety	Disaster Response S	1% AEP	count	5.0	5.0	5.0	8.0	8.0	5.0	8.0	9.0	9.0	9.0	5.0	5.0	5.0	5.0	5.0	5.0	7.0	8.0	9.0	9.0	5.0	8.0	9.0	9.0	10.0
Reach 4	health and safety	HazMat RCRA Sites	1% AEP	count	7.0	11.0	17.0	17.0	20.0	14.0	17.0	31.0	50.0	62.0	5.0	5.0	7.0	8.0	11.0	9.0	17.0	20.0	31.0	40.0	17.0	24.0	43.0	61.0	74.0
Reach 4	health and safety	Manholes	1% AEP	count	142.0	161.0	211.0	277.0	340.0	170.0	301.0	447.0	685.0	818.0	124.0	132.0	150.0	154.0	164.0	155.0	241.0	347.0	447.0	555.0	207.0	374.0	601.0	804.0	983.0
Reach 4	health and safety	Pump Stations	1% AEP	acres	5.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	4.0	4.0	5.0	5.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Reach 4	health and safety	Southeast Treatmen	1% AEP	acres	0.0	0.0	0.1	0.9	2.8	0.0	1.4	10.0	25.9	30.7	0.0	0.0	0.0	0.0	0.0	0.0	0.6	3.3	9.8	18.5	0.0	5.5	23.1	30.0	33.6
Reach 4	leisure and recreation	Blue Greenway	1% AEP	feet	537.4	880.4	1409.9	1693.5	2003.0	1150.8	1845.3	3520.0	6896.3	7660.2	529.7	534.2	556.5	768.6	926.7	786.7	1533.8	2148.4	3505.0	5336.7	1363.3	3005.3	6377.9	7565.0	8135.0
Reach 4	leisure and recreation	Bay Trail	1% AEP	feet	2153.5	2694.3	3811.0	5407.4	6167.2	3045.6	5620.3	8141.9	11509.8	13364.1	2066.8	2119.4	2244.5	2317.7	2744.2	2328.1	5060.6	6267.0	8107.2	9688.1	3615.5	6691.6	11057.9	13176.1	14630.6
Reach 4	leisure and recreation	Land Use Open Spac	1% AEP	acres	10.1	10.2	10.4	10.6	10.9	10.3	10.7	11.4	12.0	12.3	10.0	10.1	10.2	10.2	10.3	10.2	10.5	10.9	11.4	11.7	10.4	11.0	11.8	12.3	12.4
Reach 4	leisure and recreation	Recreation and Park	1% AEP	acres	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Reach 4	leisure and recreation	Port Open Space	1% AEP	acres	21.2	23.3	24.9	26.6	28.2	23.9	27.2	31.1	35.4	38.2	20.7	21.1	21.6	22.0	23.4	22.1	25.9	28.4	31.0	33.7	24.7	29.3	34.5	37.9	39.5
Reach 4	social	Bike Routes	1% AEP	feet	1090.4	1969.7	3826.7	6493.6	7628.4	2273.8	7028.0	10250.9	19067.9	24546.6	954.0	1052.2	1380.4	1600.2	2002.2	1628.9	5452.0	7700.4	10190.6	13322.7	3659.5	8144.0	14945.1	24048.5	31659.2
Reach 4	social	Regional Bus Stops	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
Reach 4	social	Muni Pattern Stops	1% AEP	count	0.0	2.0	7.0	10.0	11.0	3.0	11.0	40.0	94.0	142.0	0.0	0.0	0.0	0.0	2.0	0.0	9.0	11.0	40.0	65.0	7.0	21.0	80.0	131.0	202.0
Reach 4	social	Muni Route	1% AEP	feet	550.9	722.0	2541.0	4704.6	5543.2	774.7	5019.3	7221.3	17029.1	25019.9	472.2	520.5	636.2	691.2	724.8	694.8	4020.2	5655.0	7185.2	12328.3	2354.1	6077.6	14215.4	23598.2	36416.0
Reach 4	social	Caltrain Line	1% AEP	feet	0.0	0.0	78.6	146.4	202.4	0.0	153.5	700.0	1263.8	1589.5	0.0	0.0	0.0	0.0	0.0	0.0	126.7	207.9	698.9	1080.7	59.4	401.7	1167.9	1565.7	1723.4
Reach 4	social	Samtrans Route	1% AEP	feet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1043.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	618.5	5563.7
Reach 4	social	Samtrans Stations	1% AEP	count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
Reach 4	social	Streets	1% AEP	feet	11170.9	13953.3	20975.3	25899.2	31001.3	14805.1	27859.6	42194.7	80761.6	110044.7	9251.4	9904.0	12060.9	13120.7	14085.2	13305.0	23819.4	31494.7	42024.4	61446.0	19970.5	33788.0	68799.7	106856.3	140026.0

USACE_Reach	Social Factor	Variable	Scenario	Units	USACE_Inter_2040	USACE_Inter_2065
Reach 1	community identity	California Register Historic I	monthly	acres	0.6	0.7
Reach 1	community identity	California Register Historic I	monthly	acres	9.0	9.0
Reach 1	community identity	City Facilities	monthly	count	0.0	0.0
Reach 1	community identity	City Facilities Buffer	monthly	count	70.0	70.0
Reach 1	community identity	Historic Places	monthly	count	5.0	5.0
Reach 1	community identity	Historic Places Buffer	monthly	count	0.0	0.0
Reach 1	community identity	Landmark	monthly	count	0.0	0.0
Reach 1	community identity	Landmark Buffer	monthly	count	2.0	2.0
Reach 1	community identity	Legacy Businesses	monthly	count	0.0	0.0
Reach 1	community identity	Legacy Businesses Buffer	monthly	count	8.0	8.0
Reach 1	community identity	Muni Stops	monthly	count	0.0	0.0
Reach 1	community identity	National Shelters	monthly	count	0.0	0.0
Reach 1	community identity	National Shelters Buffer	monthly	count	1.0	1.0
Reach 1	community identity	Schools	monthly	count	0.0	0.0
Reach 1	community identity	Schools Buffer	monthly	count	3.0	3.0
Reach 1	community identity	Schools (Polygon)	monthly	acres	0.0	0.0
Reach 1	community identity	Schools (Polygon) Buffer	monthly	count	4.0	4.0
Reach 1	community identity	Senior Housing Sites Buffer	monthly	count	1.0	1.0
Reach 1	community identity	Senior Housing Sites	monthly	count	0.0	0.0
Reach 1	community identity	Places of Worship	monthly	count	0.0	0.0
Reach 1	community identity	Places of Worship Buffer	monthly	count	0.0	0.0
Reach 1	economic vitality	LBE Businesses	monthly	count	0.0	0.0
Reach 1	economic vitality	LBE Minority-Owned Busine	monthly	count	0.0	0.0
Reach 1	economic vitality	LBE Women-Owned Busines	monthly	count	0.0	0.0
Reach 1	economic vitality	Affordable Housing Sites	monthly	count	0.0	0.0
Reach 1	health and safety	Disaster Response Sites	monthly	count	0.0	0.0
Reach 1	health and safety	HazMat RCRA Sites	monthly	count	0.0	0.0
Reach 1	health and safety	Manholes	monthly	count	0.0	0.0
Reach 1	health and safety	North Point Wet-Weather F	monthly	acres	0.0	0.0
Reach 1	health and safety	Pump Stations	monthly	acres	0.0	0.0
Reach 1	leisure and recreatio	Bay Trail	monthly	feet	0.0	0.0
Reach 1	leisure and recreatio	Land Use Open Space	monthly	acres	0.3	0.5
Reach 1	leisure and recreatio	Recreation and Parks Open	monthly	acres	0.1	0.1
Reach 1	leisure and recreatio	Port Open Space	monthly	acres	0.1	0.1
Reach 1	leisure and recreatio	Swimming and Fishing Acce	monthly	count	0.0	0.0
Reach 1	social	Bike Routes	monthly	feet	0.0	0.0
Reach 1	social	Golden Gate Bus Route	monthly	feet	0.0	0.0
Reach 1	social	Regional Bus Stops	monthly	count	0.0	0.0
Reach 1	social	Ferry Stations	monthly	count	0.0	0.0
Reach 1	social	Muni Pattern Stops	monthly	count	0.0	0.0
Reach 1	social	Muni Route	monthly	feet	0.0	0.0
Reach 1	social	Streets	monthly	feet	0.0	0.0
Reach 2	community identity	California Register Historic I	monthly	acres	0.1	0.1
Reach 2	community identity	California Register Historic I	monthly	acres	7.0	7.0

Reach 2	community identity	Cultural Districts	monthly	acres	0.0	0.0
Reach 2	community identity	Cultural Districts	monthly	count	0.0	0.0
Reach 2	community identity	cd_bus	monthly	count	1.0	1.0
Reach 2	community identity	City Facilities	monthly	count	0.0	0.0
Reach 2	community identity	City Facilities Buffer	monthly	count	48.0	48.0
Reach 2	community identity	Historic Places	monthly	count	12.0	12.0
Reach 2	community identity	Historic Places Buffer	monthly	count	0.0	0.0
Reach 2	community identity	Healthcare Facilities	monthly	count	0.0	0.0
Reach 2	community identity	Healthcare Facilities Buffer	monthly	count	0.0	0.0
Reach 2	community identity	Landmarks	monthly	count	0.0	0.0
Reach 2	community identity	Landmarks Buffer	monthly	count	11.0	11.0
Reach 2	community identity	Legacy Businesses	monthly	count	0.0	0.0
Reach 2	community identity	Legacy Businesses Buffer	monthly	count	4.0	4.0
Reach 2	community identity	Muni Stops	monthly	count	0.0	0.0
Reach 2	community identity	National Shelters	monthly	count	0.0	0.0
Reach 2	community identity	National Shelters Buffer	monthly	count	1.0	1.0
Reach 2	community identity	Schools	monthly	count	0.0	0.0
Reach 2	community identity	Schools Buffer	monthly	count	6.0	6.0
Reach 2	community identity	Schools (Polygon)	monthly	acres	0.0	0.0
Reach 2	community identity	Schools (Polygon) Buffer	monthly	count	6.0	6.0
Reach 2	community identity	Senior Housing Sites Buffer	monthly	count	2.0	2.0
Reach 2	community identity	Senior Housing Sites	monthly	count	0.0	0.0
Reach 2	community identity	Places of Worship	monthly	count	0.0	0.0
Reach 2	community identity	Places of Worship Buffer	monthly	count	3.0	3.0
Reach 2	economic vitality	LBE Businesses	monthly	count	0.0	0.0
Reach 2	economic vitality	LBE Minority-Owned Busine	monthly	count	0.0	0.0
Reach 2	economic vitality	LBE Women-Owned Busine:	monthly	count	0.0	0.0
Reach 2	economic vitality	Affordable Housing Sites	monthly	count	0.0	0.0
Reach 2	health and safety	Contaminated Sites	monthly	count	0.0	0.0
Reach 2	health and safety	Disaster Response Sites	monthly	count	0.0	0.0
Reach 2	health and safety	HazMat RCRA Sites	monthly	count	0.0	0.0
Reach 2	health and safety	Manholes	monthly	count	1.0	1.0
Reach 2	leisure and recreatio	Bay Trail	monthly	feet	19.8	19.1
Reach 2	leisure and recreatio	Land Use Open Space	monthly	acres	0.0	0.0
Reach 2	leisure and recreatio	Recreation and Parks Open	monthly	acres	0.0	0.0
Reach 2	leisure and recreatio	Port Open Space	monthly	acres	0.1	0.1
Reach 2	leisure and recreatio	Swimming and Fishing Acce	monthly	count	0.0	0.0
Reach 2	social	AC Transit Route	monthly	feet	0.0	0.0
Reach 2	social	Amtrak Route	monthly	feet	0.0	0.0
Reach 2	social	Bart Route	monthly	feet	0.0	0.0
Reach 2	social	Bart Stations	monthly	count	0.0	0.0
Reach 2	social	Bike Routes	monthly	feet	0.0	0.0
Reach 2	social	Golden Gate Bus Route	monthly	feet	0.0	0.0
Reach 2	social	Regional Bus Stops	monthly	count	0.0	0.0
Reach 2	social	Ferry Stations	monthly	count	0.0	0.0
Reach 2	social	MTA Light Rail	monthly	count	0.0	0.0
Reach 2	social	Muni Pattern Stops	monthly	count	0.0	0.0

Reach 2	social	Muni Route	monthly	feet	0.0	0.0
Reach 2	social	Samtrans Route	monthly	feet	0.0	0.0
Reach 2	social	Samtrans Stations	monthly	count	0.0	0.0
Reach 2	social	Streets	monthly	feet	0.0	0.0
Reach 3	community identity	California Register Historic I	monthly	acres	0.6	0.7
Reach 3	community identity	California Register Historic I	monthly	acres	14.0	14.0
Reach 3	community identity	Cultural Districts	monthly	acres	0.0	0.0
Reach 3	community identity	Cultural Districts	monthly	count	0.0	0.0
Reach 3	community identity	cd_buf	monthly	count	0.0	0.0
Reach 3	community identity	City Facilities	monthly	count	1.0	1.0
Reach 3	community identity	City Facilities Buffer	monthly	count	109.0	109.0
Reach 3	community identity	Historic Places	monthly	count	1.0	1.0
Reach 3	community identity	Historic Places Buffer	monthly	count	0.0	0.0
Reach 3	community identity	Healthcare Facilities	monthly	count	0.0	0.0
Reach 3	community identity	Healthcare Facilities Buffer	monthly	count	0.0	0.0
Reach 3	community identity	Landmarks	monthly	count	0.0	0.0
Reach 3	community identity	Landmarks Buffer	monthly	count	5.0	5.0
Reach 3	community identity	Legacy Businesses	monthly	count	0.0	0.0
Reach 3	community identity	Legacy Businesses Buffer	monthly	count	5.0	5.0
Reach 3	community identity	Muni Stops	monthly	count	0.0	0.0
Reach 3	community identity	National Shelters	monthly	count	0.0	0.0
Reach 3	community identity	National Shelters Buffer	monthly	count	1.0	1.0
Reach 3	community identity	Schools	monthly	count	0.0	0.0
Reach 3	community identity	Schools Buffer	monthly	count	5.0	5.0
Reach 3	community identity	Schools (Polygon)	monthly	acres	0.0	0.0
Reach 3	community identity	Schools (Polygon) Buffer	monthly	count	5.0	5.0
Reach 3	community identity	Senior Housing Sites Buffer	monthly	count	0.0	0.0
Reach 3	community identity	Senior Housing Sites	monthly	count	0.0	0.0
Reach 3	community identity	Places of Worship	monthly	count	0.0	0.0
Reach 3	community identity	Places of Worship Buffer	monthly	count	4.0	4.0
Reach 3	economic vitality	LBE Businesses	monthly	count	0.0	0.0
Reach 3	economic vitality	LBE Minority-Owned Busine	monthly	count	0.0	0.0
Reach 3	economic vitality	LBE Women-Owned Busine:	monthly	count	0.0	0.0
Reach 3	economic vitality	Affordable Housing Sites	monthly	count	0.0	0.0
Reach 3	health and safety	Contaminated Sites	monthly	count	0.0	0.0
Reach 3	health and safety	Disaster Response Sites	monthly	count	0.0	0.0
Reach 3	health and safety	HazMat RCRA Sites	monthly	count	0.0	0.0
Reach 3	health and safety	Manholes	monthly	count	7.0	7.0
Reach 3	health and safety	Pump Stations	monthly	acres	0.0	0.0
Reach 3	leisure and recreatio	Blue Greenway	monthly	feet	0.0	0.0
Reach 3	leisure and recreatio	Bay Trail	monthly	feet	15.1	21.0
Reach 3	leisure and recreatio	Land Use Open Space	monthly	acres	0.0	0.0
Reach 3	leisure and recreatio	Recreation and Parks Open	monthly	acres	0.0	0.0
Reach 3	leisure and recreatio	Port Open Space	monthly	acres	1.1	1.6
Reach 3	leisure and recreatio	Swimming and Fishing Acce	monthly	count	0.0	0.0
Reach 3	social	AC Transit Route	monthly	feet	0.0	0.0
Reach 3	social	Amtrak Route	monthly	feet	0.0	0.0

Reach 3	social	Bike Routes	monthly	feet	14.0	18.6
Reach 3	social	Golden Gate Bus Route	monthly	feet	0.0	0.0
Reach 3	social	Regional Bus Stops	monthly	count	0.0	0.0
Reach 3	social	Ferry Stations	monthly	count	0.0	0.0
Reach 3	social	Muni Pattern Stops	monthly	count	0.0	0.0
Reach 3	social	Muni Route	monthly	feet	19.2	32.8
Reach 3	social	Caltrain Line	monthly	feet	0.0	0.0
Reach 3	social	Samtrans Route	monthly	feet	0.0	0.0
Reach 3	social	Samtrans Stations	monthly	count	0.0	0.0
Reach 3	social	Streets	monthly	feet	60.7	79.6
Reach 4	community identity	California Register Historic I	monthly	acres	0.0	0.0
Reach 4	community identity	California Register Historic I	monthly	acres	2.0	2.0
Reach 4	community identity	Cultural Districts	monthly	acres	27.1	30.2
Reach 4	community identity	Cultural Districts	monthly	count	5.0	5.0
Reach 4	community identity	cd_buf	monthly	count	5.0	5.0
Reach 4	community identity	City Facilities	monthly	count	0.0	0.0
Reach 4	community identity	City Facilities Buffer	monthly	count	51.0	51.0
Reach 4	community identity	Landmarks	monthly	count	0.0	0.0
Reach 4	community identity	Landmarks Buffer	monthly	count	0.0	0.0
Reach 4	community identity	Legacy Businesses	monthly	count	0.0	0.0
Reach 4	community identity	Legacy Businesses Buffer	monthly	count	2.0	2.0
Reach 4	community identity	Muni Stops	monthly	count	0.0	0.0
Reach 4	community identity	National Shelters	monthly	count	0.0	0.0
Reach 4	community identity	National Shelters Buffer	monthly	count	0.0	0.0
Reach 4	community identity	Schools	monthly	count	0.0	0.0
Reach 4	community identity	Schools Buffer	monthly	count	1.0	1.0
Reach 4	community identity	Schools (Polygon)	monthly	acres	0.0	0.0
Reach 4	community identity	Schools (Polygon) Buffer	monthly	count	1.0	1.0
Reach 4	community identity	Places of Worship	monthly	count	0.0	0.0
Reach 4	community identity	Places of Worship Buffer	monthly	count	0.0	0.0
Reach 4	economic vitality	LBE Businesses	monthly	count	0.0	0.0
Reach 4	economic vitality	LBE Minority-Owned Busine	monthly	count	0.0	0.0
Reach 4	economic vitality	LBE Women-Owned Busine:	monthly	count	0.0	0.0
Reach 4	economic vitality	Affordable Housing Sites	monthly	count	0.0	0.0
Reach 4	health and safety	Contaminated Sites	monthly	count	0.0	0.0
Reach 4	health and safety	Disaster Response Sites	monthly	count	0.0	0.0
Reach 4	health and safety	HazMat RCRA Sites	monthly	count	0.0	0.0
Reach 4	health and safety	Manholes	monthly	count	9.0	10.0
Reach 4	health and safety	Pump Stations	monthly	acres	1.0	1.0
Reach 4	health and safety	Southeast Treatment Plant	monthly	acres	0.0	0.0
Reach 4	leisure and recreatio	Blue Greenway	monthly	feet	27.2	34.7
Reach 4	leisure and recreatio	Bay Trail	monthly	feet	91.6	233.2
Reach 4	leisure and recreatio	Land Use Open Space	monthly	acres	7.1	7.7
Reach 4	leisure and recreatio	Recreation and Parks Open	monthly	acres	0.0	0.0
Reach 4	leisure and recreatio	Port Open Space	monthly	acres	13.4	14.6
Reach 4	social	Bike Routes	monthly	feet	5.2	13.9
Reach 4	social	Regional Bus Stops	monthly	count	0.0	0.0

Reach 4	social	Muni Pattern Stops	monthly	count	0.0	0.0
Reach 4	social	Muni Route	monthly	feet	11.2	17.6
Reach 4	social	Caltrain Line	monthly	feet	0.0	0.0
Reach 4	social	Samtrans Route	monthly	feet	0.0	0.0
Reach 4	social	Samtrans Stations	monthly	count	0.0	0.0
Reach 4	social	Streets	monthly	feet	110.6	160.0

USACE_Inter_2090	USACE_Inter_2115	USACE_Inter_2140	USACE_High_2040	USACE_High_2065	USACE_High_2090	USACE_High_2115	USACE_High_2140	USACE_Low_2040
0.9	1.1	3.5	0.7	1.6	5.5	33.6	39.9	0.5
9.0	9.0	9.0	9.0	9.0	9.0	10.0	10.0	9.0
0.0	0.0	1.0	0.0	0.0	1.0	47.0	53.0	0.0
70.0	70.0	70.0	70.0	70.0	70.0	71.0	77.0	70.0
5.0	5.0	5.0	5.0	5.0	5.0	6.0	6.0	5.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0
0.0	0.0	0.0	0.0	0.0	0.0	4.0	6.0	0.0
8.0	8.0	8.0	8.0	8.0	8.0	10.0	12.0	8.0
0.0	0.0	0.0	0.0	0.0	0.0	11.0	21.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.0	3.0	3.0	3.0	3.0	3.0	6.0	6.0	3.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.0	4.0	4.0	4.0	4.0	4.0	6.0	6.0	4.0
1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	4.0	4.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	1.0	4.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	9.0	11.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	9.0	14.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	189.0	247.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.2	0.0
0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	0.0
0.0	0.0	0.0	0.0	0.0	374.7	7316.9	7639.8	0.0
0.6	0.8	1.0	0.5	0.8	1.3	5.8	7.5	0.3
0.1	0.1	0.2	0.1	0.1	0.3	0.8	1.0	0.0
0.1	0.2	0.2	0.1	0.2	1.2	7.4	10.1	0.1
0.0	0.0	1.0	0.0	0.0	1.0	2.0	3.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	3728.0	4662.4	0.0
0.0	0.0	0.0	0.0	0.0	0.0	61226.6	85104.5	0.0
0.0	0.0	0.0	0.0	0.0	0.0	4.0	5.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	47.0	66.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	13287.6	17502.7	0.0
0.0	0.0	0.0	0.0	0.0	210.8	15369.5	22120.2	0.0
0.2	0.2	0.8	0.1	0.4	3.7	50.8	65.9	0.1
7.0	7.0	7.0	7.0	7.0	9.0	27.0	30.0	7.0

0.0	0.0	0.0	0.0	0.0	0.1	60.7	109.2	0.0
0.0	0.0	0.0	0.0	0.0	1.0	3.0	3.0	0.0
1.0	1.0	2.0	1.0	1.0	3.0	8.0	9.0	1.0
0.0	0.0	0.0	0.0	0.0	3.0	41.0	46.0	0.0
48.0	48.0	48.0	48.0	48.0	49.0	57.0	62.0	48.0
12.0	12.0	13.0	12.0	13.0	16.0	29.0	31.0	12.0
0.0	0.0	0.0	0.0	0.0	4.0	10.0	16.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0	4.0	9.0	0.0
11.0	11.0	11.0	11.0	11.0	13.0	49.0	54.0	11.0
0.0	0.0	0.0	0.0	0.0	0.0	5.0	5.0	0.0
4.0	4.0	4.0	4.0	4.0	5.0	7.0	14.0	4.0
0.0	0.0	0.0	0.0	0.0	11.0	64.0	84.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0
1.0	1.0	1.0	1.0	1.0	1.0	2.0	4.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	3.0	5.0	0.0
6.0	6.0	6.0	6.0	6.0	7.0	15.0	15.0	6.0
0.0	0.0	0.0	0.0	0.0	0.0	1.4	3.6	0.0
6.0	6.0	6.0	6.0	6.0	7.0	18.0	18.0	6.0
2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	2.0	4.0	5.0	0.0
3.0	3.0	3.0	3.0	3.0	7.0	11.0	14.0	3.0
0.0	0.0	6.0	0.0	6.0	13.0	55.0	120.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	22.0	44.0	0.0
0.0	0.0	0.0	0.0	0.0	7.0	19.0	58.0	0.0
0.0	0.0	0.0	0.0	0.0	2.0	4.0	10.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0	13.0	15.0	0.0
0.0	0.0	0.0	0.0	0.0	4.0	35.0	54.0	0.0
1.0	1.0	8.0	1.0	5.0	74.0	342.0	486.0	1.0
31.8	99.8	985.4	23.8	675.1	4492.6	7720.8	7724.6	3.6
0.0	0.0	0.0	0.0	0.0	1.0	7.5	11.4	0.0
0.0	0.0	0.0	0.0	0.0	1.6	8.3	9.8	0.0
0.1	0.2	0.8	0.1	0.5	5.5	15.5	17.1	0.1
0.0	0.0	0.0	0.0	0.0	1.0	2.0	3.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	1971.1	4592.2	0.0
0.0	0.0	0.0	0.0	0.0	0.0	20.8	20.8	0.0
0.0	0.0	0.0	0.0	0.0	808.8	2337.1	2833.8	0.0
0.0	0.0	0.0	0.0	0.0	0.0	6.0	7.0	0.0
0.0	0.0	637.5	0.0	355.3	6957.0	19318.6	24398.4	0.0
0.0	0.0	0.0	0.0	0.0	0.0	26164.1	99691.1	0.0
0.0	0.0	0.0	0.0	0.0	0.0	9.0	37.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	96.0	401.0	493.0	0.0

0.0	0.0	0.0	0.0	0.0	9554.2	38492.3	48146.7	0.0
0.0	0.0	0.0	0.0	0.0	0.0	1672.1	3048.7	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0
0.0	0.0	394.1	0.0	125.0	6725.1	36322.7	54082.3	0.0
1.2	1.5	2.2	0.8	1.8	8.8	77.1	113.5	0.5
14.0	14.0	16.0	14.0	16.0	18.0	27.0	27.0	14.0
0.0	0.0	0.0	0.0	0.0	0.0	12.8	15.5	0.0
0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	0.0
0.0	0.0	0.0	0.0	0.0	2.0	4.0	5.0	0.0
1.0	1.0	1.0	1.0	1.0	10.0	90.0	123.0	1.0
110.0	111.0	111.0	109.0	111.0	132.0	159.0	165.0	109.0
1.0	1.0	1.0	1.0	1.0	4.0	5.0	6.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	3.0	3.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	3.0	5.0	0.0
5.0	5.0	5.0	5.0	5.0	6.0	9.0	9.0	5.0
0.0	0.0	0.0	0.0	0.0	1.0	4.0	6.0	0.0
5.0	5.0	5.0	5.0	5.0	9.0	15.0	19.0	5.0
0.0	0.0	0.0	0.0	0.0	7.0	41.0	68.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
1.0	1.0	1.0	1.0	1.0	1.0	5.0	5.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	2.0	4.0	0.0
5.0	5.0	5.0	5.0	5.0	7.0	13.0	14.0	5.0
0.0	0.0	0.0	0.0	0.0	0.4	3.9	11.9	0.0
5.0	5.0	5.0	5.0	5.0	7.0	14.0	16.0	5.0
0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0
4.0	4.0	4.0	4.0	4.0	4.0	10.0	15.0	4.0
0.0	0.0	0.0	0.0	0.0	2.0	33.0	46.0	0.0
0.0	0.0	0.0	0.0	0.0	2.0	15.0	26.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	5.0	5.0	0.0
0.0	0.0	0.0	0.0	0.0	5.0	24.0	34.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	2.0	4.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0	15.0	17.0	0.0
0.0	0.0	0.0	0.0	0.0	9.0	53.0	73.0	0.0
10.0	12.0	17.0	8.0	14.0	112.0	576.0	860.0	7.0
0.0	1.0	1.0	0.0	1.0	2.0	6.0	6.0	0.0
0.0	0.0	204.9	0.0	0.0	1565.8	5558.5	6002.8	0.0
39.8	83.9	344.4	24.8	95.7	1931.7	10346.5	11281.3	15.1
0.0	0.0	0.0	0.0	0.0	0.2	3.2	5.8	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0
2.3	3.0	4.3	1.8	3.4	9.1	30.8	38.4	1.0
0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	2353.4	4980.8	0.0
0.0	0.0	0.0	0.0	0.0	0.0	2595.2	5534.3	0.0

21.9	27.6	203.5	20.0	28.9	3781.8	24787.6	37719.6	13.5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	2390.3	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	14.0	160.0	251.0	0.0
41.9	53.0	65.3	37.2	56.7	6571.6	39486.9	64624.9	15.1
0.0	0.0	0.0	0.0	0.0	22521.9	32657.0	36650.6	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
118.6	162.4	4259.0	85.2	2311.7	27527.8	94869.1	150017.0	57.4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
35.6	57.9	138.2	31.5	86.6	283.4	653.4	965.0	25.6
5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
5.0	5.0	5.0	5.0	5.0	5.0	7.0	7.0	5.0
0.0	1.0	5.0	0.0	1.0	9.0	28.0	53.0	0.0
63.0	67.0	70.0	51.0	68.0	75.0	114.0	127.0	51.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	2.0	7.0	0.0
4.0	5.0	6.0	2.0	5.0	7.0	15.0	15.0	2.0
0.0	0.0	0.0	0.0	0.0	1.0	12.0	36.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	1.0	1.0	1.0	1.0	2.0	3.0	6.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
1.0	1.0	1.0	1.0	1.0	2.0	5.0	8.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	5.0	5.0	0.0	5.0	6.0	8.0	16.0	0.0
0.0	0.0	0.0	0.0	0.0	12.0	36.0	66.0	0.0
0.0	0.0	0.0	0.0	0.0	2.0	12.0	18.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	5.0	12.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	1.0	2.0	0.0	1.0	5.0	8.0	9.0	0.0
0.0	3.0	4.0	0.0	4.0	11.0	22.0	44.0	0.0
19.0	49.0	91.0	11.0	60.0	159.0	368.0	600.0	10.0
2.0	3.0	3.0	1.0	3.0	6.0	6.0	6.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	4.5	23.0	0.0
48.4	355.0	429.8	37.0	354.7	899.8	2516.6	6331.7	24.5
305.9	626.9	1686.2	244.5	976.6	2718.3	6518.9	11052.6	41.3
8.3	8.8	9.6	7.9	9.0	10.2	11.0	11.8	6.7
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15.9	17.4	19.5	15.1	18.3	23.4	28.9	34.5	12.7
15.2	23.3	621.7	14.4	277.9	1978.6	7989.1	14888.6	4.8
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

0.0	0.0	0.0	0.0	0.0	2.0	19.0	80.0	0.0
30.1	41.1	254.7	17.8	93.4	717.2	5878.5	14101.1	11.0
0.0	0.0	0.0	0.0	0.0	0.0	219.3	1168.4	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
407.7	3158.3	6658.4	217.7	4767.9	13969.6	32544.3	68761.7	102.5

USACE_Low_2065	USACE_Low_2090	USACE_Low_2115	USACE_Low_2140	OPC_Likely_2040	OPC_Likely_2065	OPC_Likely_2090	OPC_Likely_2115	OPC_Likely_2140
0.5	0.6	0.7	0.7	0.7	0.9	3.6	5.4	11.2
9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	10.0
0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	8.0
70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	71.0
5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	10.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	4.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	5.0
1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	119.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	363.9	5347.6
0.3	0.4	0.4	0.5	0.4	0.7	1.0	1.3	2.7
0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.5
0.1	0.1	0.1	0.1	0.1	0.2	0.2	1.1	3.9
0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1795.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43767.5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7806.4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	202.3	11597.3
0.1	0.1	0.1	0.1	0.1	0.2	0.9	3.6	17.0
7.0	7.0	7.0	7.0	7.0	7.0	7.0	9.0	22.0

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	43.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0
1.0	1.0	1.0	1.0	1.0	1.0	2.0	3.0	8.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	26.0
48.0	48.0	48.0	48.0	48.0	48.0	48.0	49.0	55.0
12.0	12.0	12.0	12.0	12.0	12.0	13.0	16.0	28.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	6.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	4.0
11.0	11.0	11.0	11.0	11.0	11.0	11.0	13.0	47.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
4.0	4.0	4.0	4.0	4.0	4.0	4.0	5.0	7.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0	57.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
6.0	6.0	6.0	6.0	6.0	6.0	6.0	7.0	12.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
6.0	6.0	6.0	6.0	6.0	6.0	6.0	7.0	17.0
2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0
3.0	3.0	3.0	3.0	3.0	3.0	3.0	7.0	11.0
0.0	0.0	0.0	0.0	0.0	0.0	6.0	13.0	41.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	13.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	4.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	6.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	27.0
1.0	1.0	1.0	1.0	1.0	1.0	9.0	74.0	301.0
15.8	16.1	17.9	20.0	15.5	54.6	1002.9	4476.4	7300.9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	4.7
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	6.3
0.1	0.1	0.1	0.1	0.1	0.2	0.9	5.4	13.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	790.6	2029.9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
0.0	0.0	0.0	0.0	0.0	0.0	652.5	6837.4	17178.3
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19592.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	96.0	348.0

0.0	0.0	0.0	0.0	0.0	0.0	0.0	9431.6	31076.4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	923.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	446.2	6645.0	30261.0
0.6	0.6	0.7	0.7	0.7	1.4	2.3	8.8	29.7
14.0	14.0	14.0	14.0	14.0	14.0	16.0	18.0	26.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	4.0
1.0	1.0	1.0	1.0	1.0	1.0	1.0	9.0	54.0
109.0	109.0	109.0	109.0	109.0	110.0	111.0	132.0	156.0
1.0	1.0	1.0	1.0	1.0	1.0	1.0	4.0	4.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.0	5.0	5.0	5.0	5.0	5.0	5.0	6.0	8.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0
5.0	5.0	5.0	5.0	5.0	5.0	5.0	9.0	15.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	35.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	4.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
5.0	5.0	5.0	5.0	5.0	5.0	5.0	7.0	12.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	2.4
5.0	5.0	5.0	5.0	5.0	5.0	5.0	7.0	14.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	10.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	21.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	11.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	17.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0
0.0	0.0	0.0	0.0	0.0	0.0	1.0	9.0	36.0
7.0	7.0	7.0	7.0	7.0	11.0	17.0	112.0	451.0
0.0	0.0	0.0	0.0	0.0	1.0	1.0	2.0	5.0
0.0	0.0	0.0	0.0	0.0	0.0	224.8	1539.9	4977.4
15.1	19.4	21.2	21.3	20.7	58.5	381.4	1901.5	7319.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.8
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.1	1.2	1.4	1.6	1.4	2.7	4.5	9.0	20.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1244.9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1975.7

13.7	13.9	17.3	19.3	17.9	26.1	255.9	3715.2	18118.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.0	147.0
18.9	18.7	31.9	33.8	31.9	48.9	66.1	6431.2	28694.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	22316.9	29822.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
59.6	64.2	72.9	81.2	74.6	139.7	4579.2	27152.5	71964.5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
26.9	28.1	29.2	30.4	29.5	39.8	142.1	280.0	518.9
5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
0.0	0.0	0.0	0.0	0.0	0.0	5.0	9.0	16.0
51.0	51.0	51.0	51.0	51.0	63.0	70.0	75.0	107.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.0	2.0	2.0	2.0	2.0	4.0	6.0	7.0	14.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	9.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	3.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	5.0	6.0	7.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	27.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	11.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	3.0	5.0	8.0
0.0	0.0	0.0	0.0	0.0	0.0	4.0	9.0	17.0
9.0	10.0	9.0	10.0	9.0	31.0	107.0	158.0	279.0
1.0	1.0	1.0	1.0	1.0	3.0	3.0	6.0	6.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
27.2	28.3	32.9	34.5	34.2	51.6	449.7	867.1	1710.8
67.4	124.8	231.3	235.7	232.4	399.2	1724.9	2700.5	5391.7
7.0	7.3	7.5	7.7	7.6	8.5	9.6	10.2	10.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13.3	13.8	14.3	14.7	14.4	16.7	19.6	23.3	26.6
5.2	8.6	11.4	12.8	13.0	19.3	667.2	1956.7	6463.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	10.0
11.2	12.4	16.5	19.1	16.8	33.1	298.0	714.1	4674.3
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	146.7
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
111.4	121.9	133.0	170.6	137.6	788.1	6901.6	13886.9	25919.7

OPC_1200_2040	OPC_1200_2065	OPC_1200_2090	OPC_1200_2115	OPC_1200_2140
0.8	3.8	17.0	39.6	42.4
9.0	9.0	10.0	10.0	10.0
0.0	1.0	17.0	53.0	53.0
70.0	70.0	71.0	77.0	77.0
5.0	5.0	6.0	6.0	6.0
0.0	0.0	0.0	1.0	2.0
0.0	0.0	0.0	0.0	1.0
2.0	2.0	4.0	4.0	4.0
0.0	0.0	3.0	6.0	7.0
8.0	8.0	10.0	12.0	12.0
0.0	0.0	10.0	20.0	24.0
0.0	0.0	0.0	0.0	1.0
1.0	1.0	2.0	2.0	2.0
0.0	0.0	0.0	0.0	0.0
3.0	3.0	4.0	6.0	6.0
0.0	0.0	0.0	0.0	0.1
4.0	4.0	5.0	6.0	6.0
1.0	1.0	1.0	1.0	1.0
0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	4.0	4.0	4.0
0.0	0.0	1.0	4.0	7.0
0.0	0.0	1.0	1.0	1.0
0.0	0.0	0.0	1.0	3.0
0.0	0.0	0.0	0.0	2.0
0.0	0.0	6.0	11.0	11.0
0.0	0.0	9.0	11.0	16.0
0.0	0.0	167.0	236.0	277.0
0.0	0.0	0.2	1.1	2.0
0.0	0.0	0.0	2.0	2.0
0.0	0.0	7248.5	7564.0	7872.6
0.6	1.0	3.3	7.4	8.5
0.1	0.2	0.7	1.0	1.0
0.1	0.3	5.6	10.0	10.3
0.0	1.0	1.0	3.0	3.0
0.0	0.0	3043.2	4454.1	5430.7
0.0	0.0	56010.4	84324.4	89543.6
0.0	0.0	4.0	5.0	5.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	41.0	63.0	75.0
0.0	0.0	11634.0	17258.6	18937.0
0.0	0.0	14293.6	20801.8	27328.8
0.2	1.2	25.9	63.8	81.6
7.0	7.0	23.0	30.0	30.0

0.0	0.0	52.3	101.2	171.9
0.0	0.0	3.0	3.0	3.0
1.0	2.0	8.0	8.0	9.0
0.0	1.0	31.0	46.0	48.0
48.0	49.0	57.0	61.0	65.0
12.0	14.0	29.0	31.0	31.0
0.0	1.0	10.0	16.0	20.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	1.0	1.0
0.0	0.0	4.0	8.0	30.0
11.0	11.0	47.0	54.0	56.0
0.0	0.0	4.0	5.0	6.0
4.0	4.0	7.0	14.0	14.0
0.0	0.0	62.0	81.0	95.0
0.0	0.0	1.0	1.0	1.0
1.0	1.0	2.0	4.0	4.0
0.0	0.0	3.0	5.0	6.0
6.0	6.0	13.0	15.0	15.0
0.0	0.0	1.1	3.4	5.4
6.0	7.0	17.0	18.0	18.0
2.0	2.0	2.0	2.0	2.0
0.0	0.0	1.0	1.0	1.0
0.0	0.0	3.0	5.0	9.0
3.0	3.0	11.0	14.0	15.0
0.0	6.0	47.0	118.0	137.0
0.0	0.0	22.0	44.0	54.0
0.0	0.0	15.0	56.0	63.0
0.0	0.0	4.0	10.0	11.0
0.0	0.0	1.0	1.0	1.0
0.0	0.0	8.0	15.0	16.0
0.0	0.0	29.0	54.0	71.0
1.0	16.0	322.0	468.0	578.0
29.2	1180.9	7549.6	7725.6	7725.3
0.0	0.0	6.3	11.0	12.9
0.0	0.0	7.5	9.7	10.1
0.1	1.1	15.2	16.9	18.3
0.0	0.0	2.0	3.0	3.0
0.0	0.0	869.4	4390.0	5998.0
0.0	0.0	0.0	20.8	20.8
0.0	0.0	2151.8	2798.3	3045.4
0.0	0.0	5.0	7.0	7.0
0.0	1149.8	18591.0	23641.4	27438.5
0.0	0.0	21914.9	91038.9	138820.5
0.0	0.0	4.0	31.0	51.0
0.0	0.0	1.0	1.0	1.0
0.0	0.0	1.0	1.0	1.0
0.0	0.0	392.0	483.0	588.0

0.0	321.8	35048.8	46734.8	54633.0
0.0	0.0	1035.1	2811.7	4093.4
0.0	0.0	0.0	2.0	2.0
0.0	1094.9	32973.5	51865.2	67191.6
1.1	2.7	53.8	110.8	134.3
14.0	16.0	26.0	27.0	27.0
0.0	0.0	12.2	14.2	33.6
0.0	0.0	1.0	2.0	2.0
0.0	0.0	4.0	4.0	5.0
1.0	1.0	74.0	122.0	131.0
110.0	111.0	157.0	164.0	170.0
1.0	1.0	5.0	6.0	12.0
0.0	0.0	0.0	2.0	3.0
0.0	0.0	0.0	0.0	1.0
0.0	0.0	3.0	3.0	3.0
0.0	0.0	2.0	4.0	6.0
5.0	5.0	9.0	9.0	10.0
0.0	0.0	3.0	6.0	7.0
5.0	5.0	15.0	19.0	23.0
0.0	0.0	38.0	67.0	82.0
0.0	0.0	0.0	1.0	3.0
1.0	1.0	4.0	5.0	5.0
0.0	0.0	2.0	4.0	7.0
5.0	5.0	13.0	14.0	16.0
0.0	0.0	3.2	10.8	13.0
5.0	5.0	14.0	16.0	18.0
0.0	0.0	1.0	1.0	1.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	1.0	2.0
4.0	4.0	10.0	14.0	15.0
0.0	0.0	24.0	40.0	95.0
0.0	0.0	11.0	20.0	55.0
0.0	0.0	5.0	5.0	20.0
0.0	2.0	20.0	33.0	48.0
0.0	0.0	2.0	4.0	4.0
0.0	0.0	11.0	17.0	17.0
0.0	3.0	44.0	67.0	98.0
10.0	17.0	527.0	828.0	1045.0
0.0	1.0	6.0	6.0	6.0
0.0	319.3	5360.8	5928.1	6287.7
41.1	523.6	9449.6	11218.7	11500.6
0.0	0.0	2.9	5.4	8.9
0.0	0.0	0.0	0.3	3.4
2.2	5.4	26.9	38.2	38.6
0.0	0.0	0.0	2.0	2.0
0.0	0.0	1649.3	4675.6	7545.4
0.0	0.0	2186.6	5397.8	7262.6

20.1	450.8	22526.6	35901.0	44583.9
0.0	0.0	0.0	1519.4	7520.7
0.0	0.0	0.0	1.0	3.0
0.0	0.0	1.0	1.0	1.0
0.0	0.0	152.0	241.0	282.0
42.3	76.4	35317.2	60677.1	79403.5
0.0	0.0	30940.2	36052.4	36878.0
0.0	0.0	0.0	0.0	3029.6
0.0	0.0	0.0	0.0	1.0
105.8	6948.1	83782.8	142693.8	187395.4
0.0	0.0	0.0	0.0	0.0
2.0	2.0	2.0	2.0	2.0
34.8	162.9	583.4	921.0	1271.3
5.0	5.0	5.0	5.0	5.0
5.0	5.0	5.0	7.0	7.0
0.0	8.0	18.0	45.0	74.0
62.0	71.0	112.0	126.0	134.0
0.0	0.0	0.0	1.0	1.0
0.0	1.0	1.0	1.0	1.0
0.0	0.0	0.0	7.0	11.0
4.0	6.0	14.0	15.0	16.0
0.0	0.0	10.0	33.0	52.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	1.0	2.0
0.0	0.0	0.0	0.0	1.0
1.0	2.0	2.0	6.0	10.0
0.0	0.0	0.0	0.0	1.8
1.0	2.0	3.0	8.0	10.0
0.0	0.0	0.0	0.0	7.0
0.0	5.0	8.0	16.0	16.0
0.0	0.0	29.0	63.0	129.0
0.0	0.0	11.0	18.0	33.0
0.0	0.0	3.0	11.0	18.0
0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0
0.0	3.0	8.0	9.0	9.0
0.0	5.0	17.0	40.0	61.0
18.0	115.0	319.0	566.0	798.0
2.0	3.0	6.0	6.0	6.0
0.0	0.0	1.8	19.3	29.6
43.4	508.9	1953.2	5484.2	7497.5
269.1	2018.0	5826.1	9825.3	13093.9
8.2	9.9	10.8	11.8	12.3
0.0	0.0	0.0	0.0	0.0
15.7	20.3	27.6	33.9	37.8
14.7	842.6	7236.3	13680.8	23879.6
0.0	0.0	0.0	0.0	0.0

0.0	0.0	11.0	65.0	131.0
29.4	400.0	5184.4	12644.5	23191.8
0.0	0.0	187.7	1106.1	1556.1
0.0	0.0	0.0	0.0	578.6
0.0	0.0	0.0	0.0	0.0
325.1	8307.9	29345.5	63058.8	105948.5

USACE Reach	Facility Common Name	Address	City	Department
Reach 1	Fire Station #28	1814 Stockton St	San Francisco	Fire Department
Reach 1	Galileo High	1150 Francisco St	San Francisco	School District (Sfus
Reach 1	Francisco Middle	2190 Powell St	San Francisco	School District (Sfus
Reach 2	Fire Station #35 - Fi	Pier 22 1/2	San Francisco	Fire Department
Reach 2	Stanford Hotel - 25(	250 Kearny St	San Francisco	Non-City
Reach 2	Chinese Education (	657 Merchant St	San Francisco	School District (Sfus
Reach 2	Fire Station #13	530 Sansome St	San Francisco	Fire Department
Reach 2	John Yehall Chin Ele	350 Broadway	San Francisco	School District (Sfus
Reach 2	Garfield Elementary	420 Filbert St	San Francisco	School District (Sfus
Reach 3	SFUSD -- Irving M S	1060 Tennessee St	San Francisco	School District (Sfus
Reach 3	Old Potrero Police S	2300 03rd St	San Francisco	Police Department
Reach 3	SFPD Tactical Head	1740 17th St	San Francisco	Non-City
Reach 3	295 San Bruno Ave	295 San Bruno Ave	San Francisco	Non-City
Reach 3	Fire Station #29	299 Vermont St	San Francisco	Fire Department
Reach 3	Marshall Elementar	1575 15th St	San Francisco	School District (Sfus
Reach 3	Sheriff Training Faci	120 14th St	San Francisco	Non-City
Reach 3	Division Navigation	246 South Van Ness	San Francisco	Non-City
Reach 3	333 12th St	333 12th St	San Francisco	Homelessness And S
Reach 3	580 King Street Poli	580 King St	San Francisco	Non-City
Reach 3	Bureau of Fire Inves	1275 3rd St	San Francisco	Fire Department
Reach 3	Southern District St	1251 03rd St	San Francisco	Fire Department
Reach 3	Public Safety Buildin	1245 03rd St	San Francisco	Police Department
Reach 3	Fire Station #4	449 Mission Rock St	San Francisco	Fire Department
Reach 3	750 Brannan St	750 Brannan St	San Francisco	Non-City
Reach 3	Women's Resource	930 Bryant St	San Francisco	Sheriff
Reach 3	798 Brannan St	798 Brannan St	San Francisco	Non-City
Reach 3	833 Bryant St - Park	833 Bryant St	San Francisco	Non-City
Reach 3	County Jail	425 07th St	San Francisco	Sheriff
Reach 3	Mission Bay Library	960 04th St	San Francisco	Public Library
Reach 3	650 5th St	650 5th St	San Francisco	Non-City
Reach 3	San Francisco City C	356 07th St	San Francisco	Public Health
Reach 3	Bessie Carmichael E	375 07th St	San Francisco	School District (Sfus
Reach 3	The Episcopal Sanct	201 08th St	San Francisco	Non-City
Reach 3	Parking Lot - 6th/Ha	1 Ahern Way	San Francisco	Non-City
Reach 3	Parking Lot F	45 Morris St	San Francisco	Non-City
Reach 3	Five Keys Charter S	70 Oak Grove St	San Francisco	Non-City
Reach 3	Fire Station #8	36 Bluxome St	San Francisco	Fire Department
Reach 3	Fifth St Homeless C	695 Bryant St	San Francisco	Police Department
Reach 3	5th and Bryant Navi	5th St & Bryant St	San Francisco	Non-City
Reach 3	Fire Station #1	935 Folsom St	San Francisco	Fire Department
Reach 3	Fire Headquarters	698 02nd St	San Francisco	Fire Department
Reach 3	Bessie Carmichael /	824 Harrison St	San Francisco	School District (Sfus

Reach 3	South of Market Me	760 Harrison St	San Francisco	Non-City
Reach 3	SFHA -- Clementina	320-330 Clementina	San Francisco	Non-City
Reach 4	Thurgood Marshall	45 Conkling St	San Francisco	School District (Sfus
Reach 4	Willie L. Brown Jr. M	2055 Silver Ave	San Francisco	School District (Sfus
Reach 4	Bureau of Equipmer	1415 Evans Ave	San Francisco	Fire Department
Reach 4	SFUSD -- Warehous	801 Toland St	San Francisco	School District (Sfus
Reach 4	SFUSD -- Buildings a	834 Toland St	San Francisco	School District (Sfus
Reach 4	Station 49, Ambular	2241 JERROLD AVE	San Francisco	Fire Department
Reach 4	Fire Station #9	2245 Jerrold Ave	San Francisco	Fire Department
Reach 4	125 Bay Shore Blvd	125 Bay Shore Blvd	San Francisco	Non-City
Reach 4	Fire Station #25	3305 3rd St	San Francisco	Fire Department
Reach 4	Ground Lease - 110	1101 Connecticut St	San Francisco	School District (Sfus

City Tenant	Name	OPC_1200_2040_MonthlyInundated	OPC_1200_2065_MonthlyInundated	OPC_1200_2090_MonthlyInundated	OPC_1200_2115_MonthlyInundated
	Fisherman's Wharf	<Null>	<Null>	<Null>	<Null>
d)	Aquatic Park	<Null>	<Null>	<Null>	<Null>
d)	Fisherman's Wharf	<Null>	<Null>	<Null>	<Null>
	Ferry Building	<Null>	<Null>	Yes	Yes
Homelessness And :	Ferry Building	<Null>	<Null>	<Null>	<Null>
d)	Ferry Building	<Null>	<Null>	<Null>	<Null>
	Ferry Building	<Null>	<Null>	<Null>	Yes
d)	NE Waterfront	<Null>	<Null>	<Null>	<Null>
d)	NE Waterfront	<Null>	<Null>	<Null>	<Null>
d)	Pier 70	<Null>	<Null>	<Null>	<Null>
	Pier 70	<Null>	<Null>	<Null>	<Null>
Police Department	Mission Creek	<Null>	<Null>	<Null>	<Null>
Public Health	Mission Creek	<Null>	<Null>	<Null>	<Null>
	Mission Creek	<Null>	<Null>	<Null>	<Null>
d)	Mission Creek	<Null>	<Null>	<Null>	<Null>
Sheriff	Mission Creek	<Null>	<Null>	<Null>	<Null>
Homelessness And :	Mission Creek	<Null>	<Null>	<Null>	<Null>
Supportive Housing	Mission Creek	<Null>	<Null>	<Null>	<Null>
Police Department	Mission Creek	<Null>	<Null>	<Null>	Yes
	Mission Bay	<Null>	<Null>	Yes	Yes
	Mission Bay	<Null>	<Null>	Yes	Yes
	Mission Bay	<Null>	<Null>	Yes	Yes
	Mission Bay	<Null>	<Null>	Yes	Yes
Public Library	Mission Creek	<Null>	<Null>	<Null>	<Null>
	Mission Creek	<Null>	<Null>	<Null>	<Null>
Public Health	Mission Creek	<Null>	<Null>	<Null>	Yes
Police Department	Mission Creek	<Null>	<Null>	<Null>	<Null>
	Mission Creek	<Null>	<Null>	<Null>	<Null>
	Mission Creek	<Null>	<Null>	Yes	Yes
Public Health	Mission Creek	<Null>	<Null>	Yes	Yes
	Mission Creek	<Null>	<Null>	<Null>	<Null>
d)	Mission Creek	<Null>	<Null>	<Null>	<Null>
Homelessness And :	Mission Creek	<Null>	<Null>	<Null>	<Null>
Police Department	Mission Creek	<Null>	<Null>	<Null>	Yes
Sheriff	Mission Creek	<Null>	<Null>	Yes	Yes
Sheriff	Mission Creek	<Null>	<Null>	Yes	Yes
	Mission Creek	<Null>	<Null>	Yes	Yes
	Mission Creek	<Null>	<Null>	Yes	Yes
Homelessness And :	Mission Creek	<Null>	<Null>	Yes	Yes
	Mission Creek	<Null>	<Null>	<Null>	<Null>
	South Beach	<Null>	<Null>	<Null>	<Null>
d)	Mission Creek	<Null>	<Null>	<Null>	Yes

Public Health	South Beach	<Null>	<Null>	<Null>	<Null>
San Francisco Housi	Mission Creek	<Null>	<Null>	<Null>	<Null>
d)	Islais Creek	<Null>	<Null>	<Null>	<Null>
d)	Islais Creek	<Null>	<Null>	<Null>	<Null>
	Islais Creek	<Null>	<Null>	<Null>	<Null>
d)	Islais Creek	<Null>	<Null>	<Null>	<Null>
d)	Islais Creek	<Null>	<Null>	<Null>	<Null>
	Islais Creek	<Null>	<Null>	<Null>	Yes
	Islais Creek	<Null>	<Null>	<Null>	Yes
Homelessness And :	Islais Creek	<Null>	<Null>	<Null>	<Null>
	Cargo Way	<Null>	<Null>	Yes	Yes
d)	Islais Creek	<Null>	<Null>	<Null>	<Null>

OPC_1200_2140_MonthlyInundated	OPC_Likely_2040_MonthlyInundated	OPC_Likely_2065_MonthlyInundated	OPC_Likely_2090_MonthlyInundated	OPC_Likely_2115_MonthlyInundated	OPC_Likely_2140_MonthlyInundated	USACE_High_2040_MonthlyInundated
<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
Yes	<Null>	<Null>	<Null>	<Null>	Yes	<Null>
<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
Yes	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
<Null>	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
Yes	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
Yes	<Null>	<Null>	<Null>	Yes	Yes	<Null>
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		Yes	Yes
		Yes	Yes
		Yes	Yes

FWOP Southern Waterfront Contaminated Sites

		REACH 3	REACH 4	WFW
USACE HIGH				
	2040	13	10	23
	2065	55	24	79
	2090	93	41	134
	2115	119	65	184
	2140	144	90	234
USACE INTER				
	2040	3	6	9
	2065	10	10	20
	2090	27	19	46
	2115	50	22	72
	2140	64	26	90
USACE LOW				
	2040	3	4	7
	2065	3	6	9
	2090	4	7	11
	2115	10	9	19
	2140	10	10	20

		LOW CURVE					
	USACE Reach	**Reach 1**	**Reach 2**			**Reach 3**	
	Equity Priority Community Class	**Higher**	**High**	**Higher**	**Highest**	**High**	**Higher**
	Total Population	3,714	882	2,189	3,198	72	7,000
2040	**FWOP**	60	0	0	0	0	0
2065	**FWOP**	63	0	0	0	0	0
2090	**FWOP**	69	0	0	0	0	0
2115	**FWOP**	82	0	0	0	0	0
2140	**FWOP**	99	0	0	0	0	0

						1% AEP			
								INTER CURVE	
	Reach 4			Reach 1	Reach 2			Reach 3	
Highest	High	Higher	Highest	Higher	High	Higher	Highest	High	Higher
3,448	5,809	138	2,225	3714	882	2189	3198	72	7000
0	0	0	395	64	0	0	0	0	0
0	0	0	415	94	0	0	0	0	0
0	0	0	439	201	28	0	0	0	227
0	0	0	459	724	83	8	0	0	294
0	0	0	478	1341	133	34	0	0	364

										HIGH CURVE
	Reach 4				Reach 1	Reach 2			Reach 3	
Highest	High	Higher	Highest		Higher	High	Higher	Highest	High	Higher
3448	5809	138	2225		3714	882	2189	3198	72	7000
0	0	0	419		134	1	0	0	0	0
0	0	0	474		959	102	10	0	0	321
48	0	0	528		1906	222	162	301	0	572
107	0	0	583		2404	338	178	1026	0	1278
183	0	0	648		2805	443	178	1762	0	2135

	Reach 4		
Highest	High	Higher	Highest
3448	5809	138	2225
0	0	0	494
131	0	0	608
362	40	0	796
805	204	0	871
1396	727	0	902

Appendix C
To
E.2 OSE

SHEET DIRECTORY

ACS Sheets - Population

Note:

******** COUNT FOR DISPLACED PEOPLE IN RETREAT AREAS FOR ALT F AND G highlighted in sheets***

Low Exposure Count	Contains the raw counts of exposure for each alternative for 1% AEP events and Monthly flooding with the Low USACE Curve for entire period of analysis.
Inter Exposure Count	Contains the raw counts of exposure for each alternative for 1% AEP events and Monthly flooding with the Inter USACE Curve for entire period of analysis.
High Exposure Count	Contains the raw counts of exposure for each alternative for 1% AEP events and Monthly flooding with the High USACE Curve for entire period of analysis.
Low % Reduction	Contains the percent reduction exposure from FWOP exposure for each alternative for 1% AEP events and Monthly flooding with the Low USACE Curve for entire period of analysis.
Inter % Reduction	Contains the percent reduction exposure from FWOP exposure for each alternative for 1% AEP events and Monthly flooding with the Inter USACE Curve for entire period of analysis.
High % Reduction	Contains the percent reduction exposure from FWOP exposure for each alternative for 1% AEP events and Monthly flooding with the High USACE Curve for entire period of analysis.
Low SV Count	Contains the raw counts of exposure (social vulnerability indicators only) for each alternative for 1% AEP events and Monthly flooding with the Low USACE Curve for entire period of analysis.
Inter SV Count	Contains the raw counts of exposure (social vulnerability indicators only) for each alternative for 1% AEP events and Monthly flooding with the Inter USACE Curve for entire period of analysis.
High SV Count	Contains the raw counts of exposure (social vulnerability indicators only) for each alternative for 1% AEP events and Monthly flooding with the High USACE Curve for entire period of analysis.
Low SV Baseline %	Contains the percent FWP exposure (social vulnerability indicators only) for each alternative for 1% AEP events and Monthly flooding with the Low USACE Curve for entire period of analysis.
Inter SV Baseline %	Contains the percent FWP exposure (social vulnerability indicators only) for each alternative for 1% AEP events and Monthly flooding with the Inter USACE Curve for entire period of analysis.
High SV Baseline %	Contains the percent FWP exposure (social vulnerability indicators only) for each alternative for 1% AEP events and Monthly flooding with the High USACE Curve for entire period of analysis.
MTC Equity Priority Communities	Contains exposed counts of population in MTC Equity Priority Communities for each alternative and FWOP for entire period of analysis.

Physical Asset Sheets

Physical Asset Exposure	Contains raw counts of exposure for physical assets for 1% AEP events and Monthly flooding with all curves for entire period of analysis.
City Facilities Exposure Alt C	Contains community/city facility exposure for Alt C for 1% AEP events and Monthly flooding with all curves for entire period of analysis. "Yes" if facility is exposed, "-" if not.
City Facilities Exposure Alt D	Contains community/city facility exposure for Alt D for 1% AEP events and Monthly flooding with all curves for entire period of analysis. "Yes" if facility is exposed, "-" if not.
City Facilities Exposure Alt E	Contains community/city facility exposure for Alt E for 1% AEP events and Monthly flooding with all curves for entire period of analysis. "Yes" if facility is exposed, "-" if not.
City Facilities Exposure Alt F	Contains community/city facility exposure for Alt F for 1% AEP events and Monthly flooding with all curves for entire period of analysis. "Yes" if facility is exposed, "-" if not.
City Facilities Exposure Alt G	Contains community/city facility exposure for Alt G for 1% AEP events and Monthly flooding with all curvesfor entire period of analysis. "Yes" if facility is exposed, "-" if not.

***** COUNT FOR DISPLACED PEOPLE IN RETREAT AREAS FOR ALT F AND G*****

	Base			100y														
				2040					2065					2090				
	Reach	Social Factor Category	Variable	c_low_2040_100y_	d_low_2040_100y_	e_low_2040_100y_	f_low_2040_100y_	g_low_2040_100y_	c_low_2065_100y_	d_low_2065_100y_	e_low_2065_100y_	f_low_2065_100y_	g_low_2065_100y_	c_low_2090_100y_	d_low_2090_100y_	e_low_2090_100y_	f_low_2090_100y_	g_low_2090_100y_
0	Reach 1	economic vitality	Businesses	16	16	14	13	13	17	17	14	14	14	18	15	15	17	15
1	Reach 1	economic vitality	Employed	27	27	25	23	23	28	28	26	24	24	29	25	26	28	26
4	Reach 1	economic vitality	Unemployed	9	9	9	8	8	9	9	9	8	8	10	8	9	10	9
5	Reach 1	economic vitality	Owner Occupied Units	4	4	4	4	4	4	4	5	4	4	4	4	5	5	5
7	Reach 1	economic vitality	Total Jobs	141	140	114	110	110	148	145	119	116	116	160	125	126	135	126
8	Reach 1	economic vitality	Total Households	22	22	21	20	20	23	23	22	20	20	25	21	22	24	22
9	Reach 1	economic vitality	Total Housing Units	24	24	22	21	21	25	25	23	22	22	26	22	23	26	23
10	Reach 1	health and safety	Asthma	6	6	5	5	5	6	6	6	5	5	6	5	6	6	6
11	Reach 1	health and safety	Cardiovascular Disease	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
12	Reach 1	health and safety	Covid Count	17	17	15	14	14	18	18	16	15	15	19	16	16	18	16
13	Reach 1	health and safety	Covid Deaths	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	Reach 1	health and safety	Total Population	38	38	35	34	33	40	39	37	35	35	42	35	37	40	37
15	Reach 1	social connectedness	Public Transit User with No Vehicle	7	7	6	6	6	7	7	6	6	6	7	6	6	7	6
16	Reach 1	social connectedness	Commutes over 30 mins a day	13	13	12	11	11	13	13	12	12	12	14	12	12	13	12
17	Reach 1	social connectedness	Commutes under 30 mins a day	11	11	10	10	10	11	11	11	10	10	12	10	11	12	11
18	Reach 1	social connectedness	Commutes with Car, Truck, or Van	6	6	6	6	6	7	7	6	6	6	7	6	6	7	6
19	Reach 1	social connectedness	Commutes with Public Transit	7	7	6	6	6	7	7	7	6	6	7	6	7	7	7
20	Reach 1	social vulnerability and resiliency	Age older than 65	7	7	7	6	6	7	7	7	7	7	7	6	7	8	7
21	Reach 1	social vulnerability and resiliency	Age under 18	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
22	Reach 1	social vulnerability and resiliency	Education 12th Grade with No Diploma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	Reach 1	social vulnerability and resiliency	Education GED or Alternate Degree	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	Reach 1	social vulnerability and resiliency	Education Equivalent to High School Degree	2	2	1	1	1	2	2	1	1	1	2	1	1	2	1
25	Reach 1	social vulnerability and resiliency	Education High School Diploma	2	2	1	1	1	2	2	1	1	1	2	1	1	1	1
26	Reach 1	social vulnerability and resiliency	Households in Poverty	1	1	0	0	0	1	1	1	0	0	1	1	1	1	1
27	Reach 1	social vulnerability and resiliency	Households without Disability	20	19	18	17	17	20	20	19	18	18	21	18	19	21	19
28	Reach 1	social vulnerability and resiliency	Households with Disability	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
29	Reach 1	social vulnerability and resiliency	Poverty		2	2	1	1	2	2	2	2	2	2	2	2	2	2
30	Reach 1	social vulnerability and resiliency	Linguistic Isolation	9	9	9	9	9	10	10	10	9	9	10	9	9	11	9
31	Reach 1	social vulnerability and resiliency	Low Birth Weight	3	3	3	2	2	3	3	3	2	2	3	2	3	3	3
32	Reach 1	social vulnerability and resiliency	Minority (Non-White)	12	11	10	10	10	12	12	11	10	10	13	11	11	12	11
33	Reach 1	social vulnerability and resiliency	White	27	27	25	24	24	28	27	26	25	25	29	25	26	29	26
34	Reach 1	social vulnerability and resiliency	Renter Occupied Units	18	18	16	15	15	19	19	17	16	16	20	17	17	19	17
35	Reach 1	social vulnerability and resiliency	Single Parent	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	Reach 2	economic vitality	Businesses	19	19	4	6	6	25	25	4	6	6	31	16	2	11	6
37	Reach 2	economic vitality	Employed	22	22	1	6	6	32	32	1	7	8	42	19	1	8	7
40	Reach 2	economic vitality	Unemployed	9	9	0	2	2	14	14	0	2	2	18	7	0	3	2
41	Reach 2	economic vitality	Owner Occupied Units	5	5	0	2	2	6	6	0	3	3	8	4	0	3	2
43	Reach 2	economic vitality	Total Jobs	468	460	10	133	139	580	573	10	140	147	688	417	7	139	128
44	Reach 2	economic vitality	Total Households	20	20	1	5	5	29	30	1	5	6	38	17	1	7	5
45	Reach 2	economic vitality	Total Housing Units	23	24	1	6	6	34	34	1	7	7	44	19	1	8	7
46	Reach 2	health and safety	Asthma	5	5	1	2	2	6	6	1	2	2	8	5	1	3	2
47	Reach 2	health and safety	Cardiovascular Disease	2	2	0	1	1	2	2	0	1	1	3	2	0	1	1
48	Reach 2	health and safety	Covid Count	8	8	1	3	3	10	10	1	3	3	12	7	1	4	3
49	Reach 2	health and safety	Covid Deaths	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	Reach 2	health and safety	Total Population	33	33	1	8	9	48	49	1	10	11	63	27	1	12	10
51	Reach 2	social connectedness	Public Transit User with No Vehicle	3	3	0	1	1	3	3	0	1	1	4	2	0	1	1
52	Reach 2	social connectedness	Commutes over 30 mins a day	6	6	0	2	2	9	9	0	2	2	11	5	0	3	2
53	Reach 2	social connectedness	Commutes under 30 mins a day	12	12	0	3	3	18	18	0	3	4	23	10	0	4	3
54	Reach 2	social connectedness	Commutes with Car, Truck, or Van	4	4	0	1	1	6	6	0	1	2	8	3	0	2	1
55	Reach 2	social connectedness	Commutes with Public Transit	4	4	0	1	1	6	6	0	1	1	8	4	0	1	1
56	Reach 2	social vulnerability and resiliency	Age older than 65	8	8	0	1	1	13	13	0	2	2	17	7	0	2	2
57	Reach 2	social vulnerability and resiliency	Age under 18	2	2	0	1	1	3	3	0	1	1	4	2	0	1	1
58	Reach 2	social vulnerability and resiliency	Education 12th Grade with No Diploma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	Reach 2	social vulnerability and resiliency	Education GED or Alternate Degree	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	Reach 2	social vulnerability and resiliency	Education Equivalent to High School Degree	1	1	0	0	0	2	2	0	0	0	2	1	0	0	0
61	Reach 2	social vulnerability and resiliency	Education High School Diploma	1	1	0	0	0	2	2	0	0	0	2	1	0	0	0
62	Reach 2	social vulnerability and resiliency	Households in Poverty	1	1	0	0	0	1	1	0	0	0	2	1	0	0	0
63	Reach 2	social vulnerability and resiliency	Households without Disability	17	17	1	4	5	25	25	1	5	6	32	14	0	6	5
64	Reach 2	social vulnerability and resiliency	Households with Disability	3	3	0	0	0	4	5	0	0	0	6	2	0	1	0
65	Reach 2	social vulnerability and resiliency	Poverty	2	2	0	0	0	3	3	0	0	0	4	2	0	1	0
66	Reach 2	social vulnerability and resiliency	Linguistic Isolation	6	6	1	2	2	7	7	1	2	3	8	5	0	3	2
67	Reach 2	social vulnerability and resiliency	Low Birth Weight		2	1	1	1	3	3	1	1	1	4	2	0	2	1
68	Reach 2	social vulnerability and resiliency	Minority (Non-White)	16	16	1	5	5	23	24	1	6	6	30	13	0	7	6
69	Reach 2	social vulnerability and resiliency	White	17	17	1	4	4	25	26	1	4	5	33	14	0	6	4
70	Reach 2	social vulnerability and resiliency	Renter Occupied Units	16	16	1	3	3	23	23	1	3	3	31	13	0	4	3
71	Reach 2	social vulnerability and resiliency	Single Parent	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	Reach 3	economic vitality	Businesses	13	13	13	6	*14*	14	13	13	7	*16*	15	14	13	10	*116*

73	Reach 3	economic vitality	Employed	51	49	52	29	61	55	53	55	32	69	60	56	56	37	807
76	Reach 3	economic vitality	Unemployed	16	15	17	9	19	17	16	18	9	22	19	17	18	11	269
77	Reach 3	economic vitality	Owner Occupied Units	12	12	13	7	15	13	13	13	8	17	14	14	14	9	200
79	Reach 3	economic vitality	Total Jobs	79	76	80	47	95	86	82	85	52	108	94	88	86	59	1218
80	Reach 3	economic vitality	Total Households	36	34	37	20	43	39	37	39	22	49	42	39	39	26	575
81	Reach 3	economic vitality	Total Housing Units	41	39	42	23	49	44	42	45	26	56	48	45	45	30	661
82	Reach 3	health and safety	Asthma	11	11	12	6	13	12	12	12	7	15	13	12	12	8	179
83	Reach 3	health and safety	Cardiovascular Disease	4	4	4	2	4	4	4	4	2	5	4	4	4	3	60
84	Reach 3	health and safety	Covid Count	29	28	29	13	33	31	30	30	14	36	33	31	30	17	273
85	Reach 3	health and safety	Covid Deaths	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
86	Reach 3	health and safety	Total Population	75	72	77	42	90	81	77	81	47	102	88	82	82	54	1196
87	Reach 3	social connectedness	Public Transit User with No Vehicle	5	5	6	3	7	6	6	6	4	8	7	6	6	5	87
88	Reach 3	social connectedness	Commutes over 30 mins a day	25	25	26	15	31	28	26	28	16	35	30	28	28	18	408
89	Reach 3	social connectedness	Commutes under 30 mins a day	21	20	21	12	25	22	21	22	13	28	24	23	22	15	323
90	Reach 3	social connectedness	Commutes with Car, Truck, or Van	12	12	13	7	15	13	13	13	8	17	15	14	13	9	192
91	Reach 3	social connectedness	Commutes with Public Transit	17	16	17	10	20	18	17	18	11	23	20	19	18	12	258
92	Reach 3	social vulnerability and resiliency	Age older than 65	5	5	5	3	6	5	5	6	3	7	6	6	6	4	80
93	Reach 3	social vulnerability and resiliency	Age under 18	9	9	10	6	11	10	10	10	6	13	11	10	10	7	143
94	Reach 3	social vulnerability and resiliency	Education 12th Grade with No Diploma	1	1	2	1	2	2	2	2	1	2	2	2	2	1	25
95	Reach 3	social vulnerability and resiliency	Education GED or Alternate Degree	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18
96	Reach 3	social vulnerability and resiliency	Education Equivalent to High School Degree	5	5	5	3	6	5	5	6	3	7	6	5	6	3	87
97	Reach 3	social vulnerability and resiliency	Education High School Diploma	4	4	4	2	5	4	4	4	2	5	5	4	4	3	68
98	Reach 3	social vulnerability and resiliency	Households in Poverty	4	4	4	2	5	4	4	4	2	5	4	4	4	2	65
99	Reach 3	social vulnerability and resiliency	Households without Disability	31	30	32	18	38	34	33	34	20	43	37	35	35	23	504
100	Reach 3	social vulnerability and resiliency	Households with Disability	4	4	5	2	5	5	4	5	3	6	5	5	5	3	71
101	Reach 3	social vulnerability and resiliency	Poverty	6	6	6	3	7	7	6	7	3	8	7	7	7	4	107
102	Reach 3	social vulnerability and resiliency	Linguistic Isolation	11	11	12	7	13	12	12	12	8	15	13	12	12	10	168
103	Reach 3	social vulnerability and resiliency	Low Birth Weight	5	5	5	3	6	6	5	6	3	7	6	6	6	4	85
104	Reach 3	social vulnerability and resiliency	Minority (Non-White)	40	39	42	22	49	44	42	45	25	56	48	45	45	28	672
105	Reach 3	social vulnerability and resiliency	White		33	35	20	41	37	35	37	22	46	40	38	37	26	525
106	Reach 3	social vulnerability and resiliency	Renter Occupied Units	24	23	24	13	28	25	24	26	15	32	28	26	26	17	376
107	Reach 3	social vulnerability and resiliency	Single Parent	2	2	2	2	3	3	3	3	2	3	3	3	3	2	37
108	Reach 4	economic vitality	Businesses	26	25	32	76	107	27	26	33	85	115	29	27	34	101	167
109	Reach 4	economic vitality	Employed	30	30	31	74	78	31	31	32	79	83	34	32	34	85	96
112	Reach 4	economic vitality	Unemployed	23	23	23	59	60	23	23	24	62	63	25	24	24	66	68
113	Reach 4	economic vitality	Owner Occupied Units	3	3	3	7	7	3	3	3	7	7	4	3	4	8	9
115	Reach 4	economic vitality	Total Jobs	141	131	199	479	798	153	140	213	555	871	162	146	225	712	1391
116	Reach 4	economic vitality	Total Households	29	29	30	74	77	30	30	31	78	82	33	31	32	84	92
117	Reach 4	economic vitality	Total Housing Units	33	33	35	85	90	34	34	36	91	96	37	35	37	98	109
118	Reach 4	health and safety	Asthma	13	13	13	33	34	13	13	14	35	36	14	14	14	37	40
119	Reach 4	health and safety	Cardiovascular Disease	4	4	4	11	11	4	4	5	12	12	5	5	5	12	13
120	Reach 4	health and safety	Covid Count	82	82	83	210	210	83	83	83	221	221	90	84	84	232	234
121	Reach 4	health and safety	Covid Deaths	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
122	Reach 4	health and safety	Total Population	87	87	89	220	227	89	89	91	234	240	96	90	93	249	264
123	Reach 4	social connectedness	Public Transit User with No Vehicle	5	5	5	12	12	5	5	5	12	13	5	5	5	13	13
124	Reach 4	social connectedness	Commutes over 30 mins a day	18	18	19	45	47	19	19	20	48	50	21	20	21	52	56
125	Reach 4	social connectedness	Commutes under 30 mins a day	7	7	7	16	17	7	7	7	17	19	8	7	8	19	22
126	Reach 4	social connectedness	Commutes with Car, Truck, or Van	13	13	13	33	34	13	13	14	35	36	15	14	14	37	39
127	Reach 4	social connectedness	Commutes with Public Transit	11	11	11	26	27	11	11	11	28	29	12	11	12	30	33
128	Reach 4	social vulnerability and resiliency	Age older than 65	3	2	3	6	7	3	3	3	7	8	3	3	3	8	9
129	Reach 4	social vulnerability and resiliency	Age under 18	40	41	41	104	105	41	41	41	109	110	44	41	42	115	118
130	Reach 4	social vulnerability and resiliency	Education 12th Grade with No Diploma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
131	Reach 4	social vulnerability and resiliency	Education GED or Alternate Degree	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
132	Reach 4	social vulnerability and resiliency	Education Equivalent to High School Degree	4	4	4	11	11	4	4	4	12	12	5	4	5	12	13
133	Reach 4	social vulnerability and resiliency	Education High School Diploma	4	4	4	11	11	4	4	4	12	12	5	4	4	12	13
134	Reach 4	social vulnerability and resiliency	Households in Poverty	8	8	8	21	22	8	8	8	22	23	9	8	9	24	25
135	Reach 4	social vulnerability and resiliency	Households without Disability	25	26	26	64	68	26	26	27	69	72	28	27	28	74	82
136	Reach 4	social vulnerability and resiliency	Households with Disability	4	4	4	9	10	4	4	4	10	10	4	4	4	11	11
137	Reach 4	social vulnerability and resiliency	Poverty	14	14	14	36	37	14	14	15	38	39	15	14	15	41	43
138	Reach 4	social vulnerability and resiliency	Linguistic Isolation	7	7	7	18	18	7	7	8	19	19	8	8	8	20	21
139	Reach 4	social vulnerability and resiliency	Low Birth Weight	6	6	6	16	16	6	6	6	17	17	7	6	7	18	19
140	Reach 4	social vulnerability and resiliency	Minority (Non-White)	79	79	80	201	203	80	80	81	213	215	87	81	82	225	230
141	Reach 4	social vulnerability and resiliency	White	8	8	9	19	24	9	9	10	22	26	10	9	11	25	34
142	Reach 4	social vulnerability and resiliency	Renter Occupied Units	26	26	27	67	70	27	27	28	71	75	29	27	28	76	84
143	Reach 4	social vulnerability and resiliency	Single Parent		38	38	97	97	38	38	38	102	102	41	38	38	107	109

																						Monthly
2115					2140					2040					2065					2090		
c_low_2115_100y_	d_low_2115_100y_	e_low_2115_100y_	f_low_2115_100y_	g_low_2115_100y_	c_low_2140_100y_	d_low_2140_100y_	e_low_2140_100y_	f_low_2140_100y_	g_low_2140_100y_	c_low_2040_monthly_	d_low_2040_monthly_	e_low_2040_monthly_	f_low_2040_monthly_	g_low_2040_monthly_	c_low_2065_monthly_	d_low_2065_monthly_	e_low_2065_monthly_	f_low_2065_monthly_	g_low_2065_monthly_	c_low_2090_monthly_	d_low_2090_monthly_	e_low_2090_monthly_
20	17	17	19	17	23	19	20	21	20	2	2	3	2	2	2	2	3	2	2	3	2	2
32	27	29	31	29	35	30	32	34	32	6	6	6	5	5	6	6	7	6	6	7	6	6
11	9	10	11	10	11	10	11	11	11	2	2	2	2	2	2	2	3	2	2	3	2	2
5	4	5	5	5	5	4	5	5	5	1	1	2	1	1	2	2	2	1	1	2	2	2
183	147	147	156	148	210	172	173	181	173	13	12	13	10	10	14	13	14	11	11	15	12	11
27	23	24	26	24	29	25	26	28	26	5	5	5	5	5	6	6	6	5	5	6	5	5
29	24	26	28	26	31	27	28	30	28	6	6	6	5	5	6	6	7	6	6	7	6	6
7	6	6	7	6	7	6	7	7	7	1	1	1	1	1	1	1	2	1	1	2	1	1
2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	1	0	0	1	0	0
21	18	18	20	18	24	20	21	23	21	3	3	3	2	3	3	3	3	3	3	3	3	3
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	39	41	44	41	49	42	45	48	45	9	9	9	8	8	10	10	10	9	9	10	9	9
8	7	7	8	7	9	7	8	9	8	1	1	1	1	1	1	1	1	1	1	2	1	1
16	13	14	15	14	17	15	15	16	15	3	3	3	2	2	3	3	3	2	2	3	3	3
13	11	12	13	12	14	12	13	14	13	3	3	3	2	2	3	3	3	3	3	3	3	3
8	7	7	7	7	8	7	8	8	8	2	2	2	2	2	2	2	2	2	2	2	2	2
8	7	7	8	7	8	7	8	8	8	2	2	2	2	2	2	2	2	2	2	2	2	2
8	7	7	8	7	8	7	8	9	8	2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
23	20	21	23	21	25	22	23	25	23	4	4	5	4	4	5	5	5	4	4	5	5	5
4	3	3	3	3	4	3	3	4	3	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
11	9	10	11	10	12	10	11	12	11	2	2	3	2	2	3	3	3	2	2	3	3	3
3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1
14	12	12	13	12	16	13	14	15	14	2	2	2	2	2	2	2	3	2	2	3	2	2
31	27	29	31	29	34	29	31	34	31	7	7	7	6	6	7	7	8	6	6	8	7	7
22	19	19	21	19	25	21	22	23	22	4	4	4	3	3	4	4	4	4	4	4	4	4
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	18	2	11	6	40	18	3	11	7	3	3	4	3	3	3	3	4	3	3	3	3	2
46	21	1	9	8	54	22	1	9	8	2	2	1	1	1	2	2	1	1	1	2	2	0
20	9	0	3	2	24	9	1	3	3	1	1	0	0	0	1	1	0	0	0	1	1	0
9	4	0	3	3	10	4	0	3	3	1	1	0	0	0	1	1	0	0	0	1	0	0
739	445	9	144	133	832	456	14	148	139	40	39	9	35	35	42	41	9	37	37	45	42	4
43	19	1	7	6	51	20	1	8	7	1	1	1	1	1	2	2	1	1	1	2	1	0
49	22	1	9	7	58	23	1	9	8	2	2	1	1	1	2	2	1	1	1	2	2	0
8	5	1	4	2	9	5	1	4	3	1	1	1	1	1	1	1	1	1	1	1	1	1
3	2	0	1	1	3	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
13	7	1	4	3	15	8	1	5	3	1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	31	1	13	11	84	32	2	14	12	2	2	1	2	2	3	3	1	2	2	3	2	0
5	2	0	2	1	5	3	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
13	6	0	3	2	15	6	0	3	3	1	1	0	0	0	1	1	0	0	0	1	0	0
26	12	0	4	4	30	12	1	5	4	1	1	0	1	1	1	1	0	1	1	1	1	0
9	4	0	2	2	10	4	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
9	4	0	1	1	10	4	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
19	8	0	2	2	22	8	1	3	2	0	0	0	0	0	1	0	0	0	0	1	0	0
4	2	0	1	1	5	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	1	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	16	1	7	6	43	17	1	7	6	1	1	1	1	1	1	1	1	1	1	2	1	0
7	3	0	1	0	8	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	2	0	1	0	5	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
9	5	0	3	2	10	6	1	3	3	1	1	1	1	1	1	1	1	1	1	1	1	0
4	2	0	2	1	4	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	0
34	15	1	7	6	40	16	1	7	7	1	1	1	1	1	1	1	1	1	1	2	1	0
37	16	1	6	5	44	17	1	6	5	1	1	1	1	1	1	1	1	1	1	1	1	0
34	15	1	4	3	40	15	1	5	4	1	1	1	1	1	1	1	1	1	1	1	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	17	15	13	***145***	19	18	16	14	***188***	6	6	7	2	***6***	6	6	7	2	***6***	6	6	6

78	72	72	55	*1023*	83	76	78	59	*1334*	16	16	19	7	*17*	18	17	20	7	*18*	19	18	17
25	23	23	17	*342*	26	24	25	18	*446*	5	5	6	2	*5*	6	6	7	2	*6*	6	6	6
19	18	18	13	*253*	20	18	19	14	*331*	4	4	5	2	*4*	4	4	5	2	*4*	5	5	4
122	113	110	87	*1545*	129	119	120	94	*2014*	25	25	29	11	*25*	27	27	31	11	*27*	29	28	27
55	51	51	38	*730*	58	54	56	42	*952*	12	12	13	5	*12*	12	12	14	5	*13*	13	13	12
63	58	59	44	*838*	67	62	64	48	*1093*	14	13	15	6	*14*	14	14	16	6	*15*	15	15	14
17	16	16	12	*228*	18	17	17	13	*297*	4	4	4	1	*4*	4	4	4	2	*4*	4	4	4
6	5	5	4	*76*	6	6	6	4	*99*	1	1	1	0	*1*	1	1	1	1	*1*	1	1	1
39	37	36	23	*343*	41	39	38	25	*444*	14	14	15	3	*14*	15	15	16	3	*15*	15	15	15
0	0	0	0	*0*	0	0	0	0	*0*	0	0	0	0	*0*	0	0	0	0	*0*	0	0	0
115	107	106	80	*1518*	122	112	116	87	*1979*	24	24	28	10	*25*	26	26	30	10	*26*	28	27	26
9	8	8	7	*111*	9	8	8	7	*145*	2	2	2	1	*2*	2	2	2	1	*2*	2	2	2
39	36	36	27	*517*	42	38	40	30	*675*	8	8	9	3	*8*	9	9	10	4	*9*	9	9	9
32	29	29	23	*410*	33	31	32	24	*534*	7	7	8	3	*7*	7	7	8	3	*7*	8	7	7
19	18	17	13	*244*	20	19	19	15	*318*	4	4	5	2	*4*	4	4	5	2	*4*	5	4	4
26	24	23	18	*328*	27	25	25	20	*427*	5	5	6	2	*5*	6	6	6	2	*6*	6	6	6
8	7	7	5	*102*	8	8	8	6	*133*	2	2	2	1	*2*	2	2	2	1	*2*	2	2	2
14	13	13	10	*181*	15	14	14	11	*236*	3	3	3	1	*3*	3	3	4	1	*3*	3	3	3
2	2	2	2	*31*	2	2	2	2	*41*	1	1	1	0	*1*	1	1	1	0	*1*	1	1	1
2	2	2	1	*23*	2	2	2	1	*31*	0	0	0	0	*0*	0	0	0	0	*0*	0	0	0
8	7	7	5	*110*	8	7	8	5	*144*	2	2	2	1	*2*	2	2	2	1	*2*	2	2	2
6	6	6	4	*87*	6	6	6	4	*113*	1	1	2	1	*1*	1	1	2	1	*1*	2	2	1
6	5	6	4	*83*	6	6	6	4	*108*	1	1	1	1	*1*	1	1	2	1	*1*	1	1	1
49	45	45	34	*640*	51	47	49	37	*834*	10	10	12	4	*10*	11	11	12	4	*11*	12	11	11
7	6	6	5	*90*	7	7	7	5	*118*	1	1	2	1	*1*	2	2	2	1	*2*	2	2	2
9	9	9	6	*136*	10	9	10	7	*178*	2	2	2	1	*2*	2	2	3	1	*2*	2	2	2
17	16	15	14	*213*	18	17	17	15	*277*	4	4	5	2	*4*	4	4	5	2	*4*	4	4	4
8	8	8	6	*108*	9	8	8	6	*140*	2	2	2	1	*2*	2	2	2	1	*2*	2	2	2
63	58	59	43	*852*	66	61	64	46	*1112*	13	13	15	5	*14*	14	14	16	6	*15*	15	15	14
53	49	48	38	*665*	56	51	52	41	*867*	11	11	13	5	*11*	12	12	13	5	*12*	12	12	12
36	34	33	25	*476*	38	35	36	27	*621*	8	8	9	3	*8*	8	8	9	3	*8*	9	9	8
4	4	3	3	*47*	4	4	4	3	*61*	1	1	1	0	*1*	1	1	1	0	*1*	1	1	1
30	27	35	*108*	*180*	31	28	36	*114*	*195*	13	13	14	*13*	*13*	14	14	14	*14*	*14*	14	14	15
35	32	35	*90*	*102*	36	33	36	*94*	*107*	13	13	13	*13*	*13*	14	14	14	*14*	*14*	14	14	14
26	24	24	*69*	*71*	26	24	25	*72*	*75*	11	11	11	*11*	*11*	11	11	11	*11*	*11*	12	12	12
4	3	4	*8*	*9*	4	4	4	*9*	*10*	1	1	1	*1*	*1*	1	1	1	*1*	*1*	1	1	1
170	153	236	*763*	*1512*	180	163	247	*817*	*1655*	68	68	72	*66*	*70*	71	71	75	*68*	*74*	74	74	76
33	31	33	*89*	*98*	34	32	34	*93*	*103*	13	13	13	*13*	*13*	14	14	14	*14*	*14*	14	14	14
38	36	38	*103*	*115*	39	36	39	*107*	*121*	15	15	15	*15*	*15*	16	16	16	*16*	*16*	16	16	16
15	14	14	*39*	*42*	15	14	15	*41*	*44*	6	6	6	*6*	*6*	6	6	6	*6*	*6*	6	6	6
5	5	5	*13*	*14*	5	5	5	*14*	*15*	2	2	2	*2*	*2*	2	2	2	*2*	*2*	2	2	2
92	85	86	*243*	*245*	93	86	87	*253*	*255*	37	37	37	*37*	*37*	39	39	39	*39*	*39*	41	41	41
0	0	0	*0*	*0*	0	0	0	*0*	*0*	0	0	0	*0*	*0*	0	0	0	*0*	*0*	0	0	0
99	92	95	*262*	*278*	101	93	97	*273*	*292*	39	39	39	*39*	*39*	41	41	41	*41*	*41*	43	43	43
5	5	5	*14*	*14*	5	5	5	*14*	*15*	2	2	2	*2*	*2*	2	2	2	*2*	*2*	2	2	2
21	20	21	*55*	*60*	22	20	22	*57*	*63*	8	8	8	*8*	*8*	8	8	9	*8*	*8*	9	9	9
8	7	8	*20*	*23*	8	8	8	*21*	*25*	3	3	3	*3*	*3*	3	3	3	*3*	*3*	3	3	3
15	14	14	*39*	*41*	15	14	15	*41*	*43*	6	6	6	*6*	*6*	6	6	6	*6*	*6*	6	6	6
12	12	12	*31*	*34*	13	12	13	*33*	*36*	5	5	5	*5*	*5*	5	5	5	*5*	*5*	5	5	5
3	3	3	*8*	*10*	3	3	3	*8*	*10*	1	1	1	*1*	*1*	1	1	1	*1*	*1*	1	1	1
45	42	42	*121*	*124*	46	42	43	*126*	*129*	18	18	18	*18*	*18*	19	19	19	*19*	*19*	20	20	20
0	0	0	*0*	*0*	0	0	0	*0*	*0*	0	0	0	*0*	*0*	0	0	0	*0*	*0*	0	0	0
0	0	0	*0*	*0*	0	0	0	*0*	*0*	0	0	0	*0*	*0*	0	0	0	*0*	*0*	0	0	0
5	4	5	*13*	*14*	5	5	5	*14*	*15*	2	2	2	*2*	*2*	2	2	2	*2*	*2*	2	2	2
5	4	5	*13*	*14*	5	4	5	*14*	*15*	2	2	2	*2*	*2*	2	2	2	*2*	*2*	2	2	2
9	9	9	*25*	*26*	9	9	9	*26*	*27*	4	4	4	*4*	*4*	4	4	4	*4*	*4*	4	4	4
29	27	29	*78*	*86*	30	28	30	*81*	*91*	11	11	11	*11*	*11*	12	12	12	*12*	*12*	12	12	12
4	4	4	*11*	*11*	4	4	4	*12*	*12*	2	2	2	*2*	*2*	2	2	2	*2*	*2*	2	2	2
16	15	15	*43*	*45*	16	15	15	*45*	*48*	6	6	7	*6*	*6*	7	7	7	*7*	*7*	7	7	7
8	8	8	*21*	*22*	8	8	8	*22*	*23*	3	3	3	*3*	*3*	3	3	3	*3*	*3*	4	4	4
7	7	7	*19*	*20*	7	7	7	*19*	*21*	3	3	3	*3*	*3*	3	3	3	*3*	*3*	3	3	3
89	82	84	*235*	*242*	91	83	85	*245*	*252*	36	36	36	*36*	*36*	38	38	38	*38*	*38*	39	39	39
10	10	11	*26*	*37*	11	10	12	*28*	*40*	3	3	3	*3*	*3*	3	3	4	*3*	*3*	4	4	4
30	28	29	*80*	*89*	30	28	30	*84*	*93*	12	12	12	*12*	*12*	12	12	13	*12*	*12*	13	13	13
42	39	39	*112*	*114*	43	39	39	*117*	*119*	17	17	17	*17*	*17*	18	18	18	*18*	*18*	19	19	19

		2115					2140				
f_low_2090_monthly_	g_low_2090_monthly_	c_low_2115_monthly_	d_low_2115_monthly_	e_low_2115_monthly_	f_low_2115_monthly_	g_low_2115_monthly_	c_low_2140_monthly_	d_low_2140_monthly_	e_low_2140_monthly_	f_low_2140_monthly_	g_low_2140_monthly_
4	2	3	2	2	4	2	3	3	3	5	3
8	6	8	7	7	8	7	8	7	7	9	7
3	2	3	3	3	3	3	3	3	3	3	3
2	2	2	2	2	2	2	2	2	2	2	2
19	11	16	12	12	20	12	17	13	13	21	13
7	5	6	6	6	7	6	7	6	6	8	6
8	6	7	6	6	8	6	8	7	7	9	7
2	1	2	2	1	2	2	2	2	2	2	2
1	0	1	1	0	1	1	1	1	1	1	1
5	3	4	3	3	5	3	4	3	3	5	3
0	0	0	0	0	0	0	0	0	0	0	0
12	9	11	10	10	13	10	12	11	11	13	11
2	1	2	1	1	2	1	2	2	2	2	2
4	3	3	3	3	4	3	4	3	3	4	3
4	3	3	3	3	4	3	4	3	3	4	3
2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	3	2	3	2	2	3	2
3	2	3	2	2	3	2	3	3	3	3	3
1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	1	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
6	5	6	5	5	6	5	6	5	5	7	5
1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0
4	3	3	3	3	4	3	4	3	3	4	3
1	1	1	1	1	1	1	1	1	1	1	1
3	2	3	3	2	3	3	3	3	3	3	3
9	7	8	8	7	9	8	9	8	8	10	8
5	4	5	4	4	5	4	5	4	4	6	4
0	0	0	0	0	0	0	0	0	0	0	0
8	3	3	3	2	8	3	4	3	2	8	3
3	1	2	2	0	3	1	2	2	0	3	2
1	0	1	1	0	1	0	1	1	0	1	0
1	0	1	0	0	1	0	1	1	0	1	0
54	38	48	45	4	55	39	52	49	4	57	42
3	1	2	1	0	3	1	2	1	0	3	1
3	1	2	2	0	3	1	2	2	0	3	2
2	1	1	1	1	2	1	1	1	1	2	1
1	0	0	0	0	1	0	0	0	0	1	0
3	1	1	1	1	3	1	1	1	1	3	1
0	0	0	0	0	0	0	0	0	0	0	0
5	2	3	2	0	5	2	3	2	0	5	2
1	0	0	0	0	1	0	1	0	0	1	0
1	0	1	1	0	1	0	1	1	0	1	1
2	1	1	1	0	2	1	1	1	0	2	1
1	0	0	0	0	1	0	1	0	0	1	0
1	0	0	0	0	1	0	0	0	0	1	0
1	0	1	0	0	1	0	1	1	0	1	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
2	1	2	1	0	2	1	2	1	0	2	1
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	1	0	0	0	0	1	0
2	1	1	1	0	2	1	1	1	0	2	1
1	1	1	1	0	1	1	1	1	0	1	1
2	1	2	1	0	2	1	2	1	0	2	1
2	1	1	1	0	2	1	2	1	0	2	1
2	1	1	1	0	2	1	1	1	0	2	1
0	0	0	0	0	0	0	0	0	0	0	0
4	*6*	7	6	6	4	*7*	7	7	7	4	***7***

9	19	20	19	18	10	20	21	21	20	10	22
3	6	6	6	6	3	7	7	7	6	3	7
2	5	5	5	5	2	5	5	5	5	2	5
15	29	30	30	28	15	31	32	32	30	16	33
7	13	14	14	13	7	14	15	15	14	7	15
8	15	16	16	15	8	16	17	17	16	8	18
2	4	4	4	4	2	4	5	5	4	2	5
1	1	1	1	1	1	1	2	2	1	1	2
6	15	16	16	15	6	16	16	16	16	6	17
0	0	0	0	0	0	0	0	0	0	0	0
14	28	29	29	27	14	30	31	31	29	15	32
2	2	2	2	2	2	2	2	2	2	2	2
5	10	10	10	9	5	10	11	10	10	5	11
4	8	8	8	7	4	8	9	8	8	4	9
2	5	5	5	4	2	5	5	5	5	2	5
3	6	6	6	6	3	7	7	7	6	3	7
1	2	2	2	2	1	2	2	2	2	1	2
2	3	4	4	3	2	4	4	4	4	2	4
0	1	1	1	1	0	1	1	1	1	0	1
0	0	0	0	0	0	0	0	0	0	0	1
1	2	2	2	2	1	2	2	2	2	1	2
1	2	2	2	2	1	2	2	2	2	1	2
1	1	2	2	1	1	2	2	2	2	1	2
6	12	12	12	11	6	13	13	13	12	6	14
1	2	2	2	2	1	2	2	2	2	1	2
1	2	2	2	2	1	3	3	3	2	1	3
3	4	4	4	4	4	5	5	5	4	4	5
1	2	2	2	2	1	2	2	2	2	1	2
7	16	16	16	15	7	16	17	17	16	8	18
7	13	13	13	12	7	13	14	14	13	7	14
4	9	9	9	9	4	9	10	10	9	5	10
0	1	1	1	1	0	1	1	1	1	0	1
14	15	15	15	15	14	15	15	15	16	15	16
14	14	15	15	15	15	15	15	15	15	15	16
11	12	12	12	12	12	12	12	12	12	12	12
1	1	1	1	1	1	1	1	1	1	1	1
71	78	77	77	79	73	82	79	79	82	75	86
14	14	15	15	15	15	15	15	15	15	15	16
16	16	17	17	17	17	17	18	18	18	17	18
6	6	7	7	7	7	7	7	7	7	7	7
2	2	2	2	2	2	2	2	2	2	2	2
40	41	42	42	42	42	42	44	44	44	43	44
0	0	0	0	0	0	0	0	0	0	0	0
42	43	44	44	45	44	45	46	46	46	45	46
2	2	2	2	2	2	2	3	3	3	2	3
9	9	9	9	9	9	9	10	10	10	9	10
3	3	3	3	3	3	3	3	3	3	3	3
6	6	7	7	7	7	7	7	7	7	7	7
5	5	5	5	5	5	5	5	5	5	5	6
1	1	1	1	1	1	1	1	1	1	1	1
20	20	21	21	21	21	21	22	22	22	21	22
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
2	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2
4	4	4	4	4	4	4	4	4	4	4	4
12	12	13	13	13	13	13	13	13	13	13	14
2	2	2	2	2	2	2	2	2	2	2	2
7	7	7	7	7	7	7	8	8	8	8	8
3	4	4	4	4	4	4	4	4	4	4	4
3	3	3	3	3	3	3	3	3	3	3	3
39	39	41	41	41	40	41	42	42	42	42	42
4	4	4	4	4	4	4	4	4	4	4	4
13	13	13	13	13	13	14	14	14	14	14	14
19	19	19	19	20	19	20	20	20	20	20	20

***** COUNT FOR DISPLACED PEOPLE IN RETREAT AREAS FOR ALT F AND G*****

	Base			100y															
				2040					2065					2090					
	Reach	Social Factor Category	Variable	Alt C Inter 2040 1% AEP	Alt D Inter 2040 1% AEP	Alt E Inter 2040 1% AEP	Alt F Inter 2040 1% AEP	Alt G Inter 2040 1% AEP	c_inter_2065_ 100y_	d_inter_2065_ 100y_	e_inter_2065_ 100y_	f_inter_2065_ 100y_	g_inter_2065_ 100y_	c_inter_2090_ 100y_	d_inter_2090_ 100y_	e_inter_2090_ 100y_	f_inter_2090_ 100y_	g_inter_2090_1 00y_	c_inter_2115_ 100y_
0	Reach 1	economic vitality	Businesses	17	17	14	14	14	22	19	19	19	19	37	30	30	32	31	55
1	Reach 1	economic vitality	Employed	28	28	26	25	25	34	30	32	31	30	51	43	45	47	45	84
4	Reach 1	economic vitality	Unemployed	9	9	9	9	9	11	10	11	10	10	16	13	14	15	14	28
5	Reach 1	economic vitality	Owner Occupied Units	4	4	5	4	4	5	5	5	5	5	5	5	6	6	5	11
7	Reach 1	economic vitality	Total Jobs	150	146	121	117	117	200	166	168	164	164	352	282	282	288	284	511
8	Reach 1	economic vitality	Total Households	23	23	22	21	21	28	26	27	26	25	43	36	37	39	37	70
9	Reach 1	economic vitality	Total Housing Units	25	25	24	22	22	30	27	29	28	27	45	37	40	41	39	74
10	Reach 1	health and safety	Asthma	6	6	6	5	5	7	6	7	7	6	11	9	9	10	9	18
11	Reach 1	health and safety	Cardiovascular Disease	2	2	2	2	2	2	2	2	2	2	4	3	3	3	3	6
12	Reach 1	health and safety	Covid Count	18	18	16	15	15	23	20	20	20	20	37	31	31	33	31	57
13	Reach 1	health and safety	Covid Deaths	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	Reach 1	health and safety	Total Population	40	39	37	35	35	48	43	46	44	43	71	59	63	66	62	118
15	Reach 1	social connectedness	Public Transit User with No Vehicle	7	7	6	6	6	9	8	8	8	8	13	11	11	12	11	21
16	Reach 1	social connectedness	Commutes over 30 mins a day	14	13	12	12	12	17	15	15	15	15	26	21	22	23	22	41
17	Reach 1	social connectedness	Commutes under 30 mins a day	12	11	11	10	10	14	12	13	13	12	21	17	18	19	18	34
18	Reach 1	social connectedness	Commutes with Car, Truck, or Van	7	7	6	6	6	8	7	8	7	7	12	10	10	11	10	19
19	Reach 1	social connectedness	Commutes with Public Transit	7	7	7	6	6	8	7	8	8	7	11	10	10	11	10	20
20	Reach 1	social vulnerability and resiliency	Age older than 65	7	7	7	7	7	8	8	8	8	8	11	9	10	11	10	20
21	Reach 1	social vulnerability and resiliency	Age under 18	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	8
22	Reach 1	social vulnerability and resiliency	Education 12th Grade with No Diploma	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
23	Reach 1	social vulnerability and resiliency	Education GED or Alternate Degree	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	Reach 1	social vulnerability and resiliency	Education Equivalent to High School Degree	2	2	1	1	1	2	2	2	2	2	3	3	3	3	3	5
25	Reach 1	social vulnerability and resiliency	Education High School Diploma	2	2	1	1	1	2	2	2	2	2	3	3	3	3	3	5
26	Reach 1	social vulnerability and resiliency	Households in Poverty	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	2
27	Reach 1	social vulnerability and resiliency	Households without Disability	20	20	19	18	18	25	22	23	22	22	37	31	33	34	32	61
28	Reach 1	social vulnerability and resiliency	Households with Disability	3	3	3	3	3	4	3	4	3	3	6	5	5	5	5	9
29	Reach 1	social vulnerability and resiliency	Poverty	2	2	2	2	2	2	2	2	2	2	4	3	3	3	3	6
30	Reach 1	social vulnerability and resiliency	Linguistic Isolation	10	10	10	9	9	11	11	11	11	11	15	13	14	15	14	27
31	Reach 1	social vulnerability and resiliency	Low Birth Weight	3	3	3	3	2	3	3	3	3	3	5	4	4	5	4	8
32	Reach 1	social vulnerability and resiliency	Minority (Non-White)	12	12	11	10	10	15	13	14	13	13	24	19	20	21	20	37
33	Reach 1	social vulnerability and resiliency	White	28	28	26	25	25	33	30	32	30	30	47	40	43	45	42	81
34	Reach 1	social vulnerability and resiliency	Renter Occupied Units	19	19	17	16	16	24	21	22	21	21	37	31	32	33	32	58
35	Reach 1	social vulnerability and resiliency	Single Parent	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
36	Reach 2	economic vitality	Businesses	26	26	4	6	6	39	39	4	7	8	56	28	12	20	16	102
37	Reach 2	economic vitality	Employed	34	34	1	8	8	54	54	1	10	11	79	34	13	20	20	133
40	Reach 2	economic vitality	Unemployed	14	15	0	2	2	24	24	1	3	3	36	15	7	9	9	65
41	Reach 2	economic vitality	Owner Occupied Units	7	7	0	3	3	10	11	0	3	4	15	6	1	4	4	25
43	Reach 2	economic vitality	Total Jobs	596	589	10	142	149	823	812	20	161	171	1111	619	175	300	300	1830
44	Reach 2	economic vitality	Total Households	31	31	1	6	6	50	50	2	8	8	74	32	13	19	19	128
45	Reach 2	economic vitality	Total Housing Units	35	36	1	7	7	57	57	2	9	10	84	37	15	22	21	147
46	Reach 2	health and safety	Asthma	8	7	1	2	3	9	9	2	3	3	12	6	2	5	4	20
47	Reach 2	health and safety	Cardiovascular Disease	3	2	0	1	1	3	3	1	1	1	4	2	1	2	1	7
48	Reach 2	health and safety	Covid Count	10	10	1	3	3	15	14	1	4	4	20	10	3	7	6	35
49	Reach 2	health and safety	Covid Deaths	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	Reach 2	health and safety	Total Population	51	52	1	11	11	82	83	2	14	15	122	52	21	32	31	211
51	Reach 2	social connectedness	Public Transit User with No Vehicle	4	4	0	1	1	5	5	1	1	1	7	4	1	3	2	13
52	Reach 2	social connectedness	Commutes over 30 mins a day	9	9	0	2	3	15	15	0	3	3	22	9	3	6	6	37
53	Reach 2	social connectedness	Commutes under 30 mins a day	19	19	0	3	4	30	30	1	5	5	44	19	8	11	11	74
54	Reach 2	social connectedness	Commutes with Car, Truck, or Van	6	6	0	2	2	10	10	0	2	2	15	6	2	4	4	25
55	Reach 2	social connectedness	Commutes with Public Transit	6	6	0	1	1	10	10	0	1	2	15	7	3	4	4	25
56	Reach 2	social vulnerability and resiliency	Age older than 65	13	13	0	2	2	22	22	1	2	2	33	15	7	8	8	58
57	Reach 2	social vulnerability and resiliency	Age under 18	3	3	0	1	1	5	5	0	1	1	7	3	1	2	2	13
58	Reach 2	social vulnerability and resiliency	Education 12th Grade with No Diploma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
59	Reach 2	social vulnerability and resiliency	Education GED or Alternate Degree	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	Reach 2	social vulnerability and resiliency	Education Equivalent to High School Degree	2	2	0	0	0	3	3	0	0	0	5	2	1	1	1	10
61	Reach 2	social vulnerability and resiliency	Education High School Diploma	2	2	0	0	0	3	3	0	0	0	5	2	1	1	1	9
62	Reach 2	social vulnerability and resiliency	Households in Poverty	2	2	0	0	0	3	3	0	0	0	4	2	1	1	1	8
63	Reach 2	social vulnerability and resiliency	Households without Disability	26	26	1	6	6	42	42	1	7	8	62	27	10	16	16	106
64	Reach 2	social vulnerability and resiliency	Households with Disability	5	5	0	0	0	8	8	0	0	0	12	5	3	3	3	22
65	Reach 2	social vulnerability and resiliency	Poverty	3	3	0	0	0	5	5	0	1	1	8	4	2	2	2	18
66	Reach 2	social vulnerability and resiliency	Linguistic Isolation	7	7	1	3	3	10	10	1	3	3	14	7	2	5	4	23
67	Reach 2	social vulnerability and resiliency	Low Birth Weight	4	3	1	1	1	4	4	1	1	1	6	3	1	2	2	10
68	Reach 2	social vulnerability and resiliency	Minority (Non-White)	24	25	1	6	6	39	40	1	8	9	58	24	9	15	15	99
69	Reach 2	social vulnerability and resiliency	White	27	27	1	5	5	43	43	1	6	7	64	28	12	17	16	112
70	Reach 2	social vulnerability and resiliency	Renter Occupied Units	24	24	1	3	3	40	39	1	4	5	59	27	12	15	15	103
71	Reach 2	social vulnerability and resiliency	Single Parent	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
72	Reach 3	economic vitality	Businesses	14	14	14	7	*16*	19	18	17	12	*28*	30	27	27	29	*293*	42

73	Reach 3	economic vitality	Employed	56	53	56	33	70	82	78	78	58	153	112	100	119	95	2032	168
76	Reach 3	economic vitality	Unemployed	17	17	18	10	22	26	24	25	18	50	32	29	36	24	674	50
77	Reach 3	economic vitality	Owner Occupied Units	13	13	14	8	17	20	19	19	14	38	26	23	29	21	502	40
79	Reach 3	economic vitality	Total Jobs	87	83	86	52	109	128	121	120	92	236	182	162	189	162	3079	269
80	Reach 3	economic vitality	Total Households	39	38	39	23	50	58	55	55	41	109	78	69	84	65	1448	117
81	Reach 3	economic vitality	Total Housing Units	45	43	45	26	57	66	63	64	47	125	89	79	96	74	1662	136
82	Reach 3	health and safety	Asthma	12	12	12	7	16	18	17	17	13	34	24	22	26	21	452	37
83	Reach 3	health and safety	Cardiovascular Disease	4	4	4	2	5	6	6	6	4	11	8	7	9	7	151	12
84	Reach 3	health and safety	Covid Count	31	30	31	14	36	41	39	38	23	64	59	54	58	49	682	80
85	Reach 3	health and safety	Covid Deaths	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
86	Reach 3	health and safety	Total Population	82	78	82	48	104	120	114	115	85	227	163	145	175	138	3012	246
87	Reach 3	social connectedness	Public Transit User with No Vehicle	6	6	6	4	8	9	9	9	7	17	13	12	13	12	221	19
88	Reach 3	social connectedness	Commutes over 30 mins a day	28	27	28	16	36	41	39	39	29	77	56	50	60	47	1027	83
89	Reach 3	social connectedness	Commutes under 30 mins a day	23	22	22	13	28	33	31	31	24	62	46	41	48	40	814	70
90	Reach 3	social connectedness	Commutes with Car, Truck, or Van	14	13	13	8	17	20	19	19	14	37	28	25	29	24	486	41
91	Reach 3	social connectedness	Commutes with Public Transit	18	18	18	11	23	27	26	25	19	50	38	34	40	34	653	56
92	Reach 3	social vulnerability and resiliency	Age older than 65	6	5	6	3	7	8	8	8	6	15	11	10	12	9	202	17
93	Reach 3	social vulnerability and resiliency	Age under 18	10	10	10	6	13	15	14	14	11	28	22	20	23	20	361	32
94	Reach 3	social vulnerability and resiliency	Education 12th Grade with No Diploma	2	2	2	1	2	2	2	2	2	5	3	3	3	2	62	4
95	Reach 3	social vulnerability and resiliency	Education GED or Alternate Degree	1	1	1	1	2	2	2	2	1	3	2	2	2	1	46	3
96	Reach 3	social vulnerability and resiliency	Education Equivalent to High School Degree	5	5	6	3	7	8	8	8	5	16	9	8	11	6	217	15
97	Reach 3	social vulnerability and resiliency	Education High School Diploma	4	4	4	2	6	6	6	6	4	12	7	7	9	5	171	12
98	Reach 3	social vulnerability and resiliency	Households in Poverty	4	4	4	2	5	6	6	6	4	12	7	6	8	4	163	11
99	Reach 3	social vulnerability and resiliency	Households without Disability	35	33	35	20	44	51	48	49	36	96	69	61	74	58	1269	103
100	Reach 3	social vulnerability and resiliency	Households with Disability	5	5	5	3	6	7	7	7	5	13	9	8	10	7	178	14
101	Reach 3	social vulnerability and resiliency	Poverty	7	6	7	3	9	10	9	10	7	19	11	10	14	7	268	18
102	Reach 3	social vulnerability and resiliency	Linguistic Isolation	12	12	12	8	15	18	17	17	14	33	28	25	28	28	427	40
103	Reach 3	social vulnerability and resiliency	Low Birth Weight	6	6	6	3	7	9	8	8	6	16	12	10	12	10	214	17
104	Reach 3	social vulnerability and resiliency	Minority (Non-White)	44	42	45	25	57	65	62	64	46	125	85	76	94	68	1686	129
105	Reach 3	social vulnerability and resiliency	White	38	36	37	23	47	55	52	52	40	101	78	70	81	70	1326	117
106	Reach 3	social vulnerability and resiliency	Renter Occupied Units	26	25	26	15	33	38	36	36	27	71	52	46	55	44	946	78
107	Reach 3	social vulnerability and resiliency	Single Parent	3	3	3	2	3	4	4	4	3	7	6	5	6	5	93	8
108	Reach 4	economic vitality	Businesses	28	26	33	86	117	31	28	36	103	152	37	32	43	136	236	41
109	Reach 4	economic vitality	Employed	33	31	33	80	85	35	33	36	93	100	40	35	39	107	122	44
112	Reach 4	economic vitality	Unemployed	25	23	24	63	64	26	24	25	71	73	29	25	26	80	83	31
113	Reach 4	economic vitality	Owner Occupied Units	3	3	3	7	8	4	4	4	9	9	4	4	5	10	11	5
115	Reach 4	economic vitality	Total Jobs	156	141	215	562	883	178	162	246	706	1214	229	193	315	1013	2041	265
116	Reach 4	economic vitality	Total Households	32	30	31	79	83	34	32	33	91	97	38	34	36	104	116	42
117	Reach 4	economic vitality	Total Housing Units	36	34	36	92	97	39	36	38	105	114	43	38	42	121	138	48
118	Reach 4	health and safety	Asthma	14	13	14	35	36	15	14	15	41	42	17	15	16	46	49	18
119	Reach 4	health and safety	Cardiovascular Disease	5	4	5	12	12	5	5	5	14	14	6	5	5	15	16	6
120	Reach 4	health and safety	Covid Count	88	83	84	223	223	93	86	87	252	252	102	90	91	281	282	111
121	Reach 4	health and safety	Covid Deaths	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
122	Reach 4	health and safety	Total Population	94	89	92	236	243	101	93	97	270	281	111	98	104	305	328	122
123	Reach 4	social connectedness	Public Transit User with No Vehicle	5	5	5	13	13	5	5	5	14	14	6	5	5	16	16	7
124	Reach 4	social connectedness	Commutes over 30 mins a day	20	19	20	49	51	22	20	22	57	60	24	22	24	65	71	27
125	Reach 4	social connectedness	Commutes under 30 mins a day	7	7	8	18	19	8	8	8	21	23	9	8	10	24	29	10
126	Reach 4	social connectedness	Commutes with Car, Truck, or Van	14	13	14	35	36	15	14	15	40	42	17	15	16	45	48	18
127	Reach 4	social connectedness	Commutes with Public Transit	12	11	12	28	29	13	12	13	32	34	14	13	14	37	41	16
128	Reach 4	social vulnerability and resiliency	Age older than 65	3	3	3	7	8	3	3	3	8	9	3	3	3	9	12	4
129	Reach 4	social vulnerability and resiliency	Age under 18	43	41	41	110	111	46	42	43	125	126	50	44	45	140	143	55
130	Reach 4	social vulnerability and resiliency	Education 12th Grade with No Diploma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
131	Reach 4	social vulnerability and resiliency	Education GED or Alternate Degree	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
132	Reach 4	social vulnerability and resiliency	Education Equivalent to High School Degree	5	4	4	12	12	5	5	5	13	14	5	5	5	15	17	6
133	Reach 4	social vulnerability and resiliency	Education High School Diploma	5	4	4	12	12	5	4	5	13	14	5	5	5	15	17	6
134	Reach 4	social vulnerability and resiliency	Households in Poverty	9	8	8	23	23	9	9	9	26	27	10	9	9	29	31	11
135	Reach 4	social vulnerability and resiliency	Households without Disability	28	26	27	69	73	30	28	29	80	85	33	29	32	91	103	37
136	Reach 4	social vulnerability and resiliency	Households with Disability	4	4	4	10	10	4	4	4	11	12	5	4	4	13	13	5
137	Reach 4	social vulnerability and resiliency	Poverty	15	14	15	39	40	16	15	15	44	46	18	15	16	50	53	19
138	Reach 4	social vulnerability and resiliency	Linguistic Isolation	8	7	8	19	19	8	8	8	22	22	9	8	9	25	26	10
139	Reach 4	social vulnerability and resiliency	Low Birth Weight	7	6	6	17	17	7	7	7	19	20	8	7	7	22	23	9
140	Reach 4	social vulnerability and resiliency	Minority (Non-White)	85	80	81	215	217	90	83	85	244	247	99	87	90	273	280	108
141	Reach 4	social vulnerability and resiliency	White	9	9	10	22	26	10	10	12	26	33	12	11	14	33	47	14
142	Reach 4	social vulnerability and resiliency	Renter Occupied Units	28	27	28	72	75	30	28	29	83	88	34	30	32	94	105	37
143	Reach 4	social vulnerability and resiliency	Single Parent	40	38	38	103	103	42	39	39	116	117	46	41	42	130	132	50

																					Monthly
2115				2140					2040					2065					2090		
d_inter_2115_100y_	e_inter_2115_100y_	f_inter_2115_100y_	g_inter_2115_100y_	c_inter_2140_100y_	d_inter_2140_100y_	e_inter_2140_100y_	f_inter_2140_100y_	g_inter_2140_100y_	c_inter_2040_monthly_	d_inter_2040_monthly_	e_inter_2040_monthly_	f_inter_2040_monthly_	g_inter_2040_monthly_	c_inter_2065_monthly_	d_inter_2065_monthly_	e_inter_2065_monthly_	f_inter_2065_monthly_	g_inter_2065_monthly_	c_inter_2090_monthly_	d_inter_2090_monthly_	e_inter_2090_monthly_
41	44	45	41	97	74	79	79	74	3	2	3	2	2	3	3	3	3	3	4	3	3
67	79	80	66	130	103	125	126	105	7	7	7	6	6	8	8	8	7	7	10	9	9
23	28	28	22	40	32	42	42	33	2	2	3	2	2	3	3	3	3	3	4	4	4
11	15	15	10	12	11	19	19	12	2	2	2	1	1	2	2	2	2	2	3	2	2
367	376	381	365	936	705	719	720	701	14	14	14	11	11	17	16	16	13	13	20	16	16
56	66	67	55	108	86	104	105	87	6	6	6	5	5	7	7	7	6	6	9	8	8
60	71	72	59	113	90	111	112	91	6	6	7	6	6	8	8	8	7	7	10	9	9
14	17	17	14	27	21	27	27	22	1	1	2	1	1	2	2	2	2	2	2	2	2
5	6	6	5	9	7	9	9	7	0	0	1	0	0	1	1	1	1	1	1	1	1
43	47	48	43	96	74	82	82	74	3	3	3	3	3	4	4	4	3	3	5	4	4
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	114	116	94	179	143	177	178	146	10	10	10	9	9	12	12	12	11	11	15	14	13
17	19	20	16	33	26	31	31	26	1	1	1	1	1	2	2	2	2	2	2	2	2
33	38	38	32	66	52	61	61	52	3	3	3	3	3	4	4	4	3	3	4	4	4
27	32	33	27	52	41	50	51	42	3	3	3	3	3	4	4	4	3	3	4	4	4
16	18	19	15	29	23	29	29	24	2	2	2	2	2	2	2	2	2	2	3	2	2
17	21	21	16	27	23	30	31	23	2	2	2	2	2	2	2	3	2	2	3	3	3
17	22	23	17	26	22	31	32	23	2	2	2	2	2	3	3	3	2	2	4	3	3
7	8	9	6	10	9	12	12	9	1	1	1	1	1	1	1	1	1	1	1	1	1
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4	4	4	4	9	7	7	7	7	0	0	0	0	0	0	0	0	0	0	1	0	0
4	4	4	4	9	7	7	7	7	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	1	1	3	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
49	58	58	48	94	75	91	91	76	5	5	5	4	4	6	6	6	5	5	8	7	7
7	8	9	7	14	11	14	14	11	1	1	1	1	1	1	1	1	1	1	1	1	1
4	5	5	4	10	8	8	8	8	0	0	0	0	0	0	0	0	0	0	0	0	0
23	29	30	23	38	31	42	42	32	3	3	3	2	2	3	3	4	3	3	4	4	4
7	8	8	7	13	10	13	13	10	1	1	1	1	1	1	1	1	1	1	1	1	1
29	33	33	28	61	47	54	55	48	2	2	3	2	2	3	3	3	3	3	4	3	3
66	81	82	65	119	96	123	124	98	7	7	8	6	6	9	9	9	8	8	11	10	10
45	51	52	45	96	75	85	86	75	4	4	4	4	4	5	5	5	4	4	6	5	5
1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
59	43	50	47	232	138	122	127	126	3	3	4	3	3	3	3	4	3	3	4	4	2
76	55	62	63	268	157	136	142	143	2	2	1	1	1	2	2	1	2	2	3	2	0
37	29	31	31	138	82	74	76	76	1	1	0	0	0	1	1	0	0	1	1	1	0
11	7	10	10	56	25	20	23	23	1	1	0	0	0	1	1	0	1	1	1	1	0
1157	713	835	840	3621	2275	1832	1946	1959	42	41	9	37	37	51	49	9	43	43	67	63	4
74	56	61	61	261	156	137	142	143	2	2	1	1	1	2	2	1	1	1	2	2	0
84	62	69	69	310	182	161	166	167	2	2	1	1	1	2	2	1	2	2	3	2	0
12	8	10	9	45	26	22	24	24	1	1	1	1	1	1	1	1	1	1	2	1	1
4	3	3	3	15	9	7	8	8	0	0	0	0	0	0	0	0	0	0	1	0	0
20	13	16	15	80	46	39	42	42	1	1	1	1	1	1	1	1	1	1	2	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
119	88	98	99	437	254	223	231	233	3	3	1	2	2	3	3	1	2	2	4	3	0
7	5	6	6	30	18	16	17	16	0	0	0	0	0	1	0	0	0	0	1	1	0
20	14	16	16	77	43	38	40	40	1	1	0	0	0	1	1	0	1	1	1	1	0
44	33	36	36	145	90	79	81	82	1	1	0	1	1	1	1	0	1	1	2	1	0
14	10	12	12	52	29	25	27	27	0	0	0	0	0	1	0	0	0	0	1	0	0
15	11	12	12	51	32	28	29	29	0	0	0	0	0	0	0	0	0	0	1	0	0
35	27	29	29	113	72	64	65	66	1	1	0	0	0	1	1	0	0	0	1	1	0
6	4	5	5	31	15	13	14	14	0	0	0	0	0	0	0	0	0	0	0	0	0
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5	4	4	4	23	14	13	13	13	0	0	0	0	0	0	0	0	0	0	0	0	0
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4	3	4	3	22	12	11	11	11	0	0	0	0	0	0	0	0	0	0	0	0	0
61	45	50	50	216	126	110	114	115	1	1	1	1	1	2	2	1	1	1	2	2	0
14	11	11	11	46	30	27	28	28	0	0	0	0	0	0	0	0	0	0	0	0	0
9	7	7	7	50	27	25	25	25	0	0	0	0	0	0	0	0	0	0	0	0	0
13	8	10	10	50	28	23	25	25	1	1	1	1	1	1	1	1	1	1	1	1	0
5	4	5	4	21	12	10	11	11	1	1	1	1	1	1	1	1	1	1	1	1	0
54	39	45	45	206	113	98	103	104	1	1	1	1	1	2	2	1	1	1	2	2	0
65	49	54	53	231	140	124	128	129	1	1	1	1	1	2	2	1	1	1	2	2	0
63	48	51	51	205	132	117	119	120	1	1	1	1	1	1	1	1	1	1	2	1	0
0	0	0	0	3	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
33	36	43	*411*	365	292	297	308	*795*	6	6	7	2	*6*	7	7	8	2	*7*	8	8	7

140	179	143	2843	1246	1062	1111	1077	4488	18	18	20	7	18	21	21	23	8	21	25	25	24
41	56	36	942	450	380	398	375	1512	6	6	7	2	6	7	7	8	2	7	8	8	8
33	43	32	702	306	260	273	261	1103	4	4	5	2	4	5	5	6	2	5	6	6	6
224	278	245	4310	1911	1600	1668	1646	7113	27	27	31	11	28	32	32	36	13	33	39	38	36
98	126	98	2024	864	739	774	745	3177	13	13	14	5	13	15	15	16	6	15	18	18	17
111	144	111	2324	1141	960	1001	966	3761	15	14	17	6	15	17	17	19	6	18	20	20	19
31	39	31	632	276	235	246	238	996	4	4	4	2	4	5	5	5	2	5	6	5	5
10	13	10	211	92	78	82	79	332	1	1	1	1	1	2	2	2	1	2	2	2	2
68	78	73	952	404	348	362	363	1515	15	15	16	4	15	16	16	17	4	17	18	18	18
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205	263	208	4212	1837	1567	1640	1584	6637	26	26	30	11	27	31	31	34	12	32	37	37	35
16	20	18	310	117	102	106	106	487	2	2	2	1	2	2	2	3	1	2	3	3	3
70	90	71	1437	535	466	491	473	2197	9	9	10	4	9	10	10	12	4	11	13	12	12
57	72	60	1139	604	504	524	512	1876	7	7	8	3	7	9	8	9	3	9	10	10	10
34	43	37	679	281	241	252	247	1056	4	4	5	2	4	5	5	6	2	5	6	6	6
47	59	51	914	346	302	316	311	1407	6	6	7	2	6	7	7	8	3	7	8	8	8
14	18	14	283	154	128	133	129	468	2	2	2	1	2	2	2	2	1	2	3	2	2
27	33	30	506	168	149	156	155	755	3	3	4	1	3	4	4	4	2	4	5	5	4
4	5	3	86	21	20	21	19	123	1	1	1	0	1	1	1	1	0	1	1	1	1
3	4	2	64	15	14	16	14	91	0	0	0	0	0	0	0	1	0	1	1	1	1
12	18	10	302	117	102	108	99	466	2	2	2	1	2	2	2	2	1	2	3	3	2
10	14	8	238	102	88	93	85	374	1	1	2	1	2	2	2	2	1	2	2	2	2
9	13	7	227	59	54	59	51	328	1	1	2	1	1	2	2	2	1	2	2	2	2
86	111	87	1775	760	649	679	656	2788	11	11	13	4	11	13	13	14	5	13	16	15	15
12	15	11	249	104	90	94	89	389	2	2	2	1	2	2	2	2	1	2	2	2	2
15	21	11	374	144	125	133	120	575	2	2	3	1	2	3	3	3	1	3	3	3	3
33	40	41	598	279	236	245	249	979	4	4	5	2	4	5	5	6	2	5	6	5	5
15	19	15	299	130	111	116	112	471	2	2	2	1	2	2	2	2	1	2	3	3	2
109	144	102	2357	934	806	848	803	3642	14	14	16	6	15	17	17	19	6	18	20	20	19
96	120	105	1856	903	762	791	781	2995	12	12	13	5	12	14	14	15	6	14	17	16	16
65	83	66	1323	558	478	501	484	2074	8	8	9	3	8	10	10	11	4	10	12	12	11
7	9	8	130	32	30	32	32	186	1	1	1	0	1	1	1	1	0	1	1	1	1
34	52	161	275	46	37	61	187	311	14	14	14	14	14	15	15	16	15	16	17	17	18
38	44	120	138	50	42	50	136	155	14	14	14	14	14	15	15	16	15	15	17	17	18
27	28	89	92	36	30	32	99	103	11	11	11	11	11	12	12	12	12	12	14	14	14
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210	398	1222	2410	293	228	467	1443	2721	72	72	76	68	75	79	79	84	74	86	88	88	96
36	40	117	130	47	40	46	132	146	14	14	14	14	14	15	15	15	15	15	17	17	17
41	47	136	155	54	45	53	153	174	16	16	16	16	16	17	18	18	18	18	20	20	20
16	17	51	55	21	17	19	57	61	6	6	6	6	6	7	7	7	7	7	8	8	8
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95	99	311	312	126	106	111	347	348	40	40	40	40	40	44	44	44	44	44	49	49	49
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105	114	340	365	138	116	129	382	408	41	41	42	41	41	46	46	46	46	46	51	52	52
6	6	18	18	8	6	7	20	21	2	2	2	2	2	2	2	3	3	3	3	3	3
23	26	72	80	30	26	30	81	89	9	9	9	8	9	9	9	10	9	10	11	11	11
9	11	27	32	12	10	13	31	37	3	3	3	3	3	3	3	3	3	3	4	4	4
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14	15	42	46	18	15	18	47	52	5	5	5	5	5	5	5	6	5	5	6	6	6
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47	49	155	159	62	52	55	173	177	20	20	20	20	20	22	22	22	22	22	24	24	24
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10	10	32	34	13	11	11	36	38	4	4	4	4	4	4	4	4	4	4	5	5	5
32	36	102	116	42	35	41	116	130	12	12	12	12	12	13	13	13	13	13	15	15	15
4	5	14	15	6	5	5	16	17	2	2	2	2	2	2	2	2	2	2	2	2	2
16	17	55	59	22	18	19	62	66	7	7	7	7	7	8	8	8	8	8	8	8	9
9	10	28	29	12	10	11	31	32	3	3	3	3	3	4	4	4	4	4	4	4	4
7	8	24	26	10	8	9	27	29	3	3	3	3	3	3	3	3	3	3	4	4	4
93	98	302	311	122	102	109	337	346	38	38	38	38	38	42	42	42	42	42	47	47	47
12	17	38	55	16	14	20	45	62	3	3	4	3	4	4	4	4	4	4	5	5	5
32	35	106	118	42	35	40	119	132	13	13	13	13	13	14	14	14	14	14	16	16	16
43	45	143	146	57	48	50	160	163	18	18	18	18	18	20	20	20	20	20	22	22	23

		2115					2140				
f_inter_2090_ monthly_	g_inter_2090_ monthly_	c_inter_2115_ monthly_	d_inter_2115_ monthly_	e_inter_2115_ monthly_	f_inter_2115_ monthly_	g_inter_2115_ monthly_	c_inter_2140_ monthly_	d_inter_2140_ monthly_	e_inter_2140_ monthly_	f_inter_2140_ monthly_	g_inter_2140_ monthly_
5	3	5	4	4	6	4	14	12	12	14	12
11	9	12	11	11	13	11	24	20	20	22	20
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3	2	3	3	3	3	3	4	3	4	4	4
24	16	27	22	21	29	22	124	98	98	106	98
9	8	10	9	9	11	9	20	17	17	19	17
10	9	12	10	10	12	10	21	18	18	20	19
2	2	3	2	2	3	2	5	4	4	5	4
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6	4	6	5	5	7	5	15	13	12	15	13
0	0	0	0	0	0	0	0	0	0	0	0
16	14	18	16	16	19	16	34	29	29	32	29
3	2	3	2	2	3	2	6	5	5	6	5
5	4	5	5	5	6	5	11	10	10	11	10
5	4	5	5	5	5	5	10	8	8	9	8
3	2	3	3	3	3	3	6	5	5	6	5
3	3	4	3	3	4	3	6	5	5	6	5
4	3	4	4	4	4	4	6	5	5	6	6
1	1	2	2	2	2	2	2	2	2	2	2
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	1	0	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0
8	7	9	8	8	10	8	17	15	15	16	15
1	1	1	1	1	1	1	3	2	2	2	2
1	0	1	1	1	1	1	2	1	1	1	1
5	4	5	5	5	6	5	8	7	7	9	7
1	1	1	1	1	1	1	2	2	2	2	2
4	3	5	4	4	5	4	10	9	9	9	9
12	10	14	12	12	14	12	24	21	21	23	21
6	5	7	6	6	8	6	16	14	14	15	14
0	0	0	0	0	0	0	0	0	0	0	0
8	3	5	5	2	8	4	12	10	2	9	4
3	2	5	3	0	3	2	12	9	0	5	3
1	1	1	1	0	2	1	4	3	0	2	1
1	1	1	1	0	1	1	3	2	0	1	1
64	50	124	118	4	78	63	336	305	4	108	97
3	1	3	3	0	3	2	10	8	0	4	3
4	2	4	3	0	4	2	12	10	0	5	3
2	1	2	2	1	3	1	4	3	1	3	2
1	0	1	1	0	1	0	1	1	0	1	1
3	1	2	2	1	3	2	5	5	1	3	2
0	0	0	0	0	0	0	0	0	0	0	0
5	3	6	5	0	5	3	17	13	0	7	5
1	0	1	1	0	1	1	2	1	0	1	1
1	1	1	1	0	1	1	3	3	0	1	1
2	1	2	2	0	2	1	6	5	0	2	2
1	0	1	1	0	1	0	2	2	0	1	1
1	0	1	1	0	1	0	2	2	0	1	1
1	0	1	1	0	1	1	4	3	0	1	1
0	0	0	0	0	0	0	1	1	0	1	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
2	1	3	3	0	3	2	9	7	0	3	3
0	0	0	0	0	0	0	1	1	0	0	0
1	0	0	0	0	1	0	1	1	0	1	0
2	1	2	2	0	2	1	4	4	0	2	2
1	1	1	1	0	1	1	2	2	0	1	1
2	1	3	2	0	3	2	8	6	0	3	3
3	1	3	2	0	3	1	9	7	0	3	2
2	1	2	2	0	2	1	7	6	0	3	2
0	0	0	0	0	0	0	0	0	0	0	0
4	***8***	9	9	9	5	***9***	11	10	11	6	***43***

11	26	31	30	30	12	34	40	39	40	21	282
3	8	10	10	10	4	11	13	12	13	6	94
3	6	7	7	7	3	8	10	10	10	5	70
17	40	47	47	47	20	52	63	60	63	33	426
8	18	22	21	22	9	24	29	28	29	14	201
9	21	25	25	25	10	28	33	32	33	17	231
2	6	7	7	7	3	8	9	9	9	5	63
1	2	2	2	2	1	3	3	3	3	2	21
7	19	21	21	21	7	22	25	24	25	10	102
0	0	0	0	0	0	0	0	0	0	0	0
16	38	45	45	45	18	50	60	58	60	30	418
2	3	3	3	3	2	4	4	4	4	3	31
5	13	15	15	15	6	17	20	20	20	10	143
5	11	12	12	12	5	14	16	16	16	9	113
3	6	7	7	7	3	8	10	9	10	5	67
4	9	10	10	10	4	11	13	13	13	7	90
1	3	3	3	3	1	3	4	4	4	2	28
2	5	6	6	6	2	6	7	7	7	4	50
0	1	1	1	1	0	1	1	1	1	1	9
0	1	1	1	1	0	1	1	1	1	0	6
1	3	3	3	3	1	3	4	4	4	2	30
1	2	2	2	2	1	3	3	3	3	2	24
1	2	2	2	2	1	3	3	3	3	1	23
7	16	19	19	19	8	21	25	24	25	13	176
1	2	3	3	3	1	3	3	3	4	2	25
1	3	4	4	4	1	4	5	5	5	2	37
4	6	7	7	7	4	7	9	8	9	6	59
1	3	3	3	3	1	4	4	4	4	2	30
8	21	25	25	25	9	28	33	32	33	16	235
8	17	20	20	20	9	22	27	26	27	14	184
5	12	14	14	14	6	16	19	18	19	10	131
1	1	1	1	1	1	2	2	2	2	1	13
17	21	22	22	24	29	43	24	24	29	45	79
19	20	25	26	26	37	40	28	28	29	50	56
15	15	21	21	21	31	32	22	22	22	41	43
2	2	2	2	2	3	4	3	3	3	5	5
87	124	104	103	125	127	269	124	118	172	236	588
19	19	25	25	26	37	39	28	28	28	51	55
21	22	29	29	30	43	45	32	32	33	58	64
8	9	11	12	12	17	18	12	12	13	23	24
3	3	4	4	4	6	6	4	4	4	8	8
53	54	73	74	74	111	112	78	79	79	148	149
0	0	0	0	0	0	0	0	0	0	0	0
56	58	76	77	77	114	118	83	83	84	153	162
3	3	4	4	4	6	6	4	5	5	8	8
12	12	16	16	16	23	24	17	17	18	31	34
4	4	6	6	6	8	9	6	6	6	11	13
8	9	11	12	12	17	18	12	12	13	23	24
7	7	9	9	9	13	14	10	10	10	18	19
2	2	2	2	2	3	3	2	2	2	4	5
26	27	36	36	36	54	55	39	39	39	73	74
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
3	3	4	4	4	6	6	4	4	4	8	8
3	3	4	4	4	6	6	4	4	4	8	8
5	6	7	7	7	11	11	8	8	8	15	16
16	17	22	22	22	32	34	24	24	25	44	48
2	3	3	3	3	5	5	4	4	4	7	7
9	9	13	13	13	19	19	13	14	14	25	27
5	5	6	6	6	9	10	7	7	7	12	13
4	4	5	5	5	8	8	6	6	6	11	11
51	52	70	70	71	105	107	75	76	76	141	144
5	5	6	6	7	8	11	7	7	8	12	17
17	18	23	23	23	34	36	25	25	26	46	50
24	25	34	34	34	51	51	36	36	36	68	69

***** COUNT FOR DISPLACED PEOPLE IN RETREAT AREAS FOR ALT F AND G*****

	Base			100y														
				2040					2065					2090				
	Reach	Social Factor Category	Variable	c_high_2040_100y_	d_high_2040_100y_	e_high_2040_100y_	f_high_2040_100y_	g_high_2040_100y_	c_high_2065_100y_	d_high_2065_100y_	e_high_2065_100y_	f_high_2065_100y_	g_high_2065_100y_	c_high_2090_100y_	d_high_2090_100y_	e_high_2090_100y_	f_high_2090_100y_	g_high_2090_100y_
0	Reach 1	economic vitality	Businesses	29	25	26	26	26	65	59	54	53	49	434	116	120	120	114
1	Reach 1	economic vitality	Employed	42	38	40	39	38	95	88	94	93	76	799	167	194	194	168
4	Reach 1	economic vitality	Unemployed	13	12	13	13	12	31	28	33	33	25	390	53	65	65	54
5	Reach 1	economic vitality	Owner Occupied Units	5	5	5	5	5	12	11	17	16	11	89	19	29	29	20
7	Reach 1	economic vitality	Total Jobs	274	234	239	235	235	607	556	469	467	449	4228	1106	1092	1092	1069
8	Reach 1	economic vitality	Total Households	35	32	33	32	32	79	73	79	78	63	717	139	162	162	140
9	Reach 1	economic vitality	Total Housing Units	37	33	35	34	34	83	77	85	83	67	779	147	173	173	148
10	Reach 1	health and safety	Asthma	9	8	8	8	8	20	18	20	20	16	193	35	41	41	35
11	Reach 1	health and safety	Cardiovascular Disease	3	3	3	3	3	7	6	7	7	5	64	12	14	14	12
12	Reach 1	health and safety	Covid Count	30	26	27	26	26	66	60	57	57	50	428	118	125	125	116
13	Reach 1	health and safety	Covid Deaths	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	Reach 1	health and safety	Total Population	58	53	56	54	53	133	123	136	133	107	1288	232	275	276	235
15	Reach 1	social connectedness	Public Transit User with No Vehicle	11	9	10	10	10	24	22	23	23	19	149	42	47	47	42
16	Reach 1	social connectedness	Commutes over 30 mins a day	21	19	19	19	19	47	43	45	45	37	387	83	94	94	83
17	Reach 1	social connectedness	Commutes under 30 mins a day	17	15	16	16	15	38	35	38	38	31	333	68	79	79	68
18	Reach 1	social connectedness	Commutes with Car, Truck, or Van	10	9	9	9	9	22	20	22	22	17	179	39	45	45	39
19	Reach 1	social connectedness	Commutes with Public Transit	9	9	9	9	9	22	20	25	24	18	201	37	47	47	38
20	Reach 1	social vulnerability and resiliency	Age older than 65	9	9	9	9	9	22	20	26	26	18	251	36	49	49	38
21	Reach 1	social vulnerability and resiliency	Age under 18	4	3	4	4	3	8	8	10	10	7	113	14	19	19	15
22	Reach 1	social vulnerability and resiliency	Education 12th Grade with No Diploma	1	1	1	1	1	1	1	1	1	1	24	2	2	2	2
23	Reach 1	social vulnerability and resiliency	Education GED or Alternate Degree	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0
24	Reach 1	social vulnerability and resiliency	Education Equivalent to High School Degree	3	2	2	2	2	6	5	5	5	4	87	11	11	11	11
25	Reach 1	social vulnerability and resiliency	Education High School Diploma	3	2	2	2	2	6	5	5	5	4	70	11	11	11	10
26	Reach 1	social vulnerability and resiliency	Households in Poverty	1	1	1	1	1	2	2	2	2	2	56	4	4	4	3
27	Reach 1	social vulnerability and resiliency	Households without Disability	30	27	29	28	28	69	64	69	68	55	543	121	141	141	122
28	Reach 1	social vulnerability and resiliency	Households with Disability	5	4	4	4	4	10	10	10	10	8	174	18	21	21	18
29	Reach 1	social vulnerability and resiliency	Poverty	3	3	3	3	3	7	6	6	6	5	124	12	13	13	12
30	Reach 1	social vulnerability and resiliency	Linguistic Isolation	13	12	13	13	12	30	28	34	33	25	171	51	65	65	52
31	Reach 1	social vulnerability and resiliency	Low Birth Weight	4	4	4	4	4	9	9	10	9	8	91	17	20	20	17
32	Reach 1	social vulnerability and resiliency	Minority (Non-White)	19	17	18	17	17	43	39	40	39	33	583	76	84	84	76
33	Reach 1	social vulnerability and resiliency	White	39	36	38	37	36	90	84	96	95	74	705	156	191	192	159
34	Reach 1	social vulnerability and resiliency	Renter Occupied Units	30	27	28	27	27	67	62	62	61	53	628	121	133	133	120
35	Reach 1	social vulnerability and resiliency	Single Parent	0	0	0	0	0	1	1	1	1	1	29	1	2	2	2
36	Reach 2	economic vitality	Businesses	43	42	4	7	8	168	166	87	92	92	3763	315	299	301	303
37	Reach 2	economic vitality	Employed	60	60	2	10	11	207	205	111	121	122	3047	244	223	228	230
40	Reach 2	economic vitality	Unemployed	27	27	1	3	4	106	105	59	62	62	1315	145	137	138	139
41	Reach 2	economic vitality	Owner Occupied Units	12	12	0	3	4	35	35	13	16	17	748	54	50	52	53
43	Reach 2	economic vitality	Total Jobs	887	869	21	163	173	2901	2860	1476	1632	1648	75524	4238	3795	3888	3920
44	Reach 2	economic vitality	Total Households	56	55	2	8	8	205	203	113	121	122	2755	258	240	243	245
45	Reach 2	economic vitality	Total Housing Units	64	63	2	10	10	235	233	126	135	136	3325	323	301	305	308
46	Reach 2	health and safety	Asthma	14	10	2	3	3	30	30	14	16	16	654	61	57	58	58
47	Reach 2	health and safety	Cardiovascular Disease	5	3	1	1	1	10	10	5	5	5	218	20	19	19	19
48	Reach 2	health and safety	Covid Count	16	16	1	4	4	54	53	25	28	28	1161	112	105	107	108
49	Reach 2	health and safety	Covid Deaths	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
50	Reach 2	health and safety	Total Population	92	92	3	15	16	333	330	178	192	194	4711	428	397	404	407
51	Reach 2	social connectedness	Public Transit User with No Vehicle	6	6	1	1	1	21	21	11	11	11	385	43	41	41	42
52	Reach 2	social connectedness	Commutes over 30 mins a day	16	16	0	3	3	56	55	28	31	31	890	79	73	75	75
53	Reach 2	social connectedness	Commutes under 30 mins a day	33	33	1	5	5	118	116	67	71	72	1580	125	113	116	117
54	Reach 2	social connectedness	Commutes with Car, Truck, or Van	11	11	0	2	2	39	38	20	22	22	587	48	44	45	45
55	Reach 2	social connectedness	Commutes with Public Transit	11	11	0	1	2	41	41	23	25	25	537	49	45	46	46
56	Reach 2	social vulnerability and resiliency	Age older than 65	24	24	1	2	3	96	95	57	59	59	1063	106	98	99	100
57	Reach 2	social vulnerability and resiliency	Age under 18	5	5	0	1	1	20	20	8	10	10	351	39	37	37	38
58	Reach 2	social vulnerability and resiliency	Education 12th Grade with No Diploma	0	0	0	0	0	1	1	1	1	1	12	1	1	1	1
59	Reach 2	social vulnerability and resiliency	Education GED or Alternate Degree	0	0	0	0	0	0	0	0	0	0	11	3	3	3	3
60	Reach 2	social vulnerability and resiliency	Education Equivalent to High School Degree	4	4	0	0	0	16	16	9	9	9	205	34	33	33	33
61	Reach 2	social vulnerability and resiliency	Education High School Diploma	4	3	0	0	0	16	16	9	9	9	194	31	30	30	30
62	Reach 2	social vulnerability and resiliency	Households in Poverty	3	3	0	0	0	15	14	7	7	7	210	37	36	36	36
63	Reach 2	social vulnerability and resiliency	Households without Disability	47	47	1	7	8	167	166	90	97	98	2386	208	192	196	197
64	Reach 2	social vulnerability and resiliency	Households with Disability	9	9	0	0	1	38	38	23	23	24	369	50	48	48	48
65	Reach 2	social vulnerability and resiliency	Poverty	6	6	0	1	1	31	31	14	14	14	469	85	83	83	83
66	Reach 2	social vulnerability and resiliency	Linguistic Isolation	11	11	1	3	3	34	33	15	17	18	784	58	53	55	55
67	Reach 2	social vulnerability and resiliency	Low Birth Weight	7	5	1	1	1	14	14	7	8	8	310	29	27	27	28
68	Reach 2	social vulnerability and resiliency	Minority (Non-White)	44	44	1	8	9	152	151	78	86	87	2409	193	178	182	184
69	Reach 2	social vulnerability and resiliency	White	48	48	1	6	7	180	178	100	106	107	2302	234	218	221	223
70	Reach 2	social vulnerability and resiliency	Renter Occupied Units	44	43	1	5	5	171	169	100	104	105	2007	204	190	191	193
71	Reach 2	social vulnerability and resiliency	Single Parent	0	0	0	0	0	1	1	0	0	0	30	7	7	7	7
72	Reach 3	economic vitality	Businesses	20	19	18	13	*33*	99	97	93	84	*132*	2657	344	367	384	*986*

73	Reach 3	economic vitality	Employed	86	82	88	62	*182*	580	575	591	523	*850*	10138	1200	1291	1265	*5342*
76	Reach 3	economic vitality	Unemployed	27	26	29	19	*59*	188	187	194	168	*279*	3602	429	454	431	*1782*
77	Reach 3	economic vitality	Owner Occupied Units	21	20	22	15	*45*	142	141	145	128	*209*	2501	293	314	303	*1305*
79	Reach 3	economic vitality	Total Jobs	135	128	135	99	*280*	891	880	900	805	*1296*	27390	1812	1962	1960	*8877*
80	Reach 3	economic vitality	Total Households	61	58	63	44	*129*	411	407	420	371	*604*	7073	832	895	871	*3775*
81	Reach 3	economic vitality	Total Housing Units	70	66	72	50	*148*	474	470	482	425	*693*	8560	1089	1162	1131	*4469*
82	Reach 3	health and safety	Asthma	19	18	20	14	*40*	129	127	131	116	*189*	2250	265	285	279	*1183*
83	Reach 3	health and safety	Cardiovascular Disease	6	6	7	5	*13*	43	42	44	39	*63*	750	88	95	93	*394*
84	Reach 3	health and safety	Covid Count	43	41	42	25	*74*	214	211	213	185	*301*	3389	396	439	448	*1870*
85	Reach 3	health and safety	Covid Deaths	0	0	0	0	*0*	0	0	0	0	*0*	2	0	0	0	*0*
86	Reach 3	health and safety	Total Population	127	121	131	91	*270*	858	849	875	773	*1258*	15003	1768	1901	1857	*7887*
87	Reach 3	social connectedness	Public Transit User with No Vehicle	10	9	10	7	*20*	64	63	65	58	*93*	1038	114	125	126	*596*
88	Reach 3	social connectedness	Commutes over 30 mins a day	43	41	45	31	*92*	291	288	299	264	*429*	4526	522	567	553	*2613*
89	Reach 3	social connectedness	Commutes under 30 mins a day	35	33	36	25	*73*	235	233	237	210	*341*	4499	575	613	605	*2235*
90	Reach 3	social connectedness	Commutes with Car, Truck, or Van	21	20	21	15	*44*	139	138	142	126	*204*	2151	272	295	292	*1256*
91	Reach 3	social connectedness	Commutes with Public Transit	29	27	29	21	*59*	188	186	191	171	*275*	2957	339	370	370	*1685*
92	Reach 3	social vulnerability and resiliency	Age older than 65	9	8	9	6	*18*	58	57	59	52	*84*	1263	146	155	151	*554*
93	Reach 3	social vulnerability and resiliency	Age under 18	16	15	16	12	*33*	104	103	106	95	*153*	1460	166	184	186	*901*
94	Reach 3	social vulnerability and resiliency	Education 12th Grade with No Diploma	2	2	3	2	*5*	17	17	18	15	*25*	224	21	23	21	*145*
95	Reach 3	social vulnerability and resiliency	Education GED or Alternate Degree	2	2	2	1	*4*	12	12	13	11	*19*	188	15	17	14	*107*
96	Reach 3	social vulnerability and resiliency	Education Equivalent to High School Degree	8	8	9	6	*19*	59	59	62	53	*89*	1106	113	121	111	*547*
97	Reach 3	social vulnerability and resiliency	Education High School Diploma	7	6	7	5	*15*	47	47	49	42	*70*	918	98	104	96	*440*
98	Reach 3	social vulnerability and resiliency	Households in Poverty	6	6	7	4	*14*	44	44	47	40	*67*	669	58	63	55	*383*
99	Reach 3	social vulnerability and resiliency	Households without Disability	54	51	55	39	*114*	361	358	369	326	*530*	6181	731	787	768	*3315*
100	Reach 3	social vulnerability and resiliency	Households with Disability	7	7	8	5	*16*	50	50	52	45	*74*	892	101	108	103	*460*
101	Reach 3	social vulnerability and resiliency	Poverty	10	10	11	7	*23*	73	73	77	65	*110*	1562	139	147	134	*673*
102	Reach 3	social vulnerability and resiliency	Linguistic Isolation	19	18	19	15	*39*	126	124	126	115	*181*	2202	270	293	302	*1204*
103	Reach 3	social vulnerability and resiliency	Low Birth Weight	9	9	9	6	*19*	61	60	62	55	*89*	1065	126	135	132	*560*
104	Reach 3	social vulnerability and resiliency	Minority (Non-White)	69	65	72	49	*149*	473	469	488	426	*700*	8080	901	969	926	*4310*
105	Reach 3	social vulnerability and resiliency	White	58	55	58	43	*121*	385	381	388	346	*558*	6923	867	932	930	*3577*
106	Reach 3	social vulnerability and resiliency	Renter Occupied Units	40	38	41	29	*85*	269	267	275	243	*395*	4573	539	581	568	*2470*
107	Reach 3	social vulnerability and resiliency	Single Parent	4	4	4	3	*9*	27	26	27	25	*39*	331	33	38	39	*223*
108	Reach 4	economic vitality	Businesses	32	29	38	*110*	*163*	43	39	56	*149*	*226*	504	41	69	*220*	*352*
109	Reach 4	economic vitality	Employed	36	34	37	*97*	*105*	46	40	46	*122*	*134*	224	46	59	*166*	*185*
112	Reach 4	economic vitality	Unemployed	27	25	25	*75*	*76*	33	28	30	*92*	*94*	140	33	36	*121*	*125*
113	Reach 4	economic vitality	Owner Occupied Units	4	4	4	*9*	*10*	5	5	5	*12*	*12*	23	5	7	*16*	*17*
115	Reach 4	economic vitality	Total Jobs	191	175	266	*765*	*1318*	277	255	427	*1082*	*1882*	4599	258	523	*1666*	*3039*
116	Reach 4	economic vitality	Total Households	35	32	34	*95*	*102*	44	38	42	*120*	*129*	203	44	53	*160*	*176*
117	Reach 4	economic vitality	Total Housing Units	40	37	39	*110*	*119*	50	43	49	*139*	*152*	243	50	61	*186*	*208*
118	Reach 4	health and safety	Asthma	15	14	15	*42*	*44*	19	16	18	*53*	*55*	84	19	22	*70*	*74*
119	Reach 4	health and safety	Cardiovascular Disease	5	5	5	*14*	*15*	6	5	6	*18*	*18*	28	6	7	*23*	*25*
120	Reach 4	health and safety	Covid Count	95	87	88	*263*	*263*	117	99	103	*325*	*325*	445	116	128	*424*	*426*
121	Reach 4	health and safety	Covid Deaths	0	0	0	*0*	*0*	0	0	0	*0*	*0*	0	0	0	*0*	*0*
122	Reach 4	health and safety	Total Population	103	94	99	*282*	*294*	128	110	120	*352*	*368*	557	127	149	*466*	*494*
123	Reach 4	social connectedness	Public Transit User with No Vehicle	6	5	5	*15*	*15*	7	6	6	*19*	*19*	27	7	8	*25*	*25*
124	Reach 4	social connectedness	Commutes over 30 mins a day	22	21	22	*59*	*63*	28	24	28	*74*	*79*	125	28	35	*99*	*107*
125	Reach 4	social connectedness	Commutes under 30 mins a day	8	8	9	*22*	*24*	11	10	12	*28*	*31*	56	11	15	*38*	*44*
126	Reach 4	social connectedness	Commutes with Car, Truck, or Van	16	14	15	*42*	*44*	19	17	18	*52*	*55*	88	19	23	*70*	*73*
127	Reach 4	social connectedness	Commutes with Public Transit	13	12	13	*34*	*36*	16	14	16	*43*	*46*	71	16	21	*58*	*63*
128	Reach 4	social vulnerability and resiliency	Age older than 65	3	3	3	*8*	*10*	4	3	4	*11*	*13*	29	4	5	*15*	*18*
129	Reach 4	social vulnerability and resiliency	Age under 18	47	43	43	*130*	*132*	57	49	51	*161*	*164*	225	57	63	*211*	*216*
130	Reach 4	social vulnerability and resiliency	Education 12th Grade with No Diploma	0	0	0	*0*	*0*	0	0	0	*0*	*0*	1	0	0	*0*	*0*
131	Reach 4	social vulnerability and resiliency	Education GED or Alternate Degree	0	0	0	*0*	*0*	0	0	0	*0*	*0*	1	0	0	*0*	*0*
132	Reach 4	social vulnerability and resiliency	Education Equivalent to High School Degree	5	5	5	*14*	*15*	6	5	6	*17*	*19*	32	6	7	*23*	*25*
133	Reach 4	social vulnerability and resiliency	Education High School Diploma	5	5	5	*14*	*15*	6	5	6	*17*	*18*	31	6	7	*23*	*25*
134	Reach 4	social vulnerability and resiliency	Households in Poverty	10	9	9	*27*	*28*	12	10	10	*33*	*35*	50	12	13	*44*	*46*
135	Reach 4	social vulnerability and resiliency	Households without Disability	31	28	30	*84*	*90*	38	33	38	*105*	*114*	180	38	47	*141*	*156*
136	Reach 4	social vulnerability and resiliency	Households with Disability	4	4	4	*12*	*12*	5	5	5	*15*	*15*	23	5	6	*20*	*20*
137	Reach 4	social vulnerability and resiliency	Poverty	16	15	15	*46*	*48*	20	17	18	*57*	*60*	89	20	22	*75*	*80*
138	Reach 4	social vulnerability and resiliency	Linguistic Isolation	9	8	8	*23*	*23*	11	10	10	*29*	*29*	46	11	14	*39*	*40*
139	Reach 4	social vulnerability and resiliency	Low Birth Weight	7	7	7	*20*	*21*	9	8	9	*25*	*26*	40	9	11	*33*	*35*
140	Reach 4	social vulnerability and resiliency	Minority (Non-White)	92	84	86	*254*	*258*	113	96	102	*314*	*320*	458	112	125	*411*	*422*
141	Reach 4	social vulnerability and resiliency	White	11	10	13	*28*	*36*	15	14	18	*37*	*48*	99	15	24	*54*	*73*
142	Reach 4	social vulnerability and resiliency	Renter Occupied Units	31	28	30	*86*	*92*	39	33	37	*108*	*117*	181	39	46	*144*	*159*
143	Reach 4	social vulnerability and resiliency	Single Parent	43	39	40	*121*	*122*	53	45	47	*149*	*151*	205	52	57	*195*	*198*

2115					2140					2040					2065					
c_high_2115_100y_	d_high_2115_100y_	e_high_2115_100y_	f_high_2115_100y_	g_high_2115_100y_	c_high_2140_100y_	d_high_2140_100y_	e_high_2140_100y_	f_high_2140_100y_	g_high_2140_100y_	c_high_2040_monthly_	d_high_2040_monthly_	e_high_2040_monthly_	f_high_2040_monthly_	g_high_2040_monthly_	c_high_2065_monthly_	d_high_2065_monthly_	e_high_2065_monthly_	f_high_2065_monthly_	g_high_2065_monthly_	c_high_2090_monthly_
543	544	134	134	126	638	638	141	141	130	3	3	3	3	3	7	6	6	6	6	22
1109	1112	219	220	186	1484	1484	240	240	198	9	9	9	8	8	15	15	15	13	13	34
604	605	74	74	60	894	894	82	82	64	3	3	3	3	3	6	5	5	5	5	11
122	123	34	34	23	169	169	39	40	25	2	2	2	2	2	3	3	3	3	3	5
5328	5331	1213	1215	1182	6261	6262	1266	1266	1225	18	18	18	14	14	46	45	44	40	41	200
1020	1022	184	184	156	1398	1398	201	202	166	8	8	8	7	7	12	12	12	11	11	28
1120	1122	197	197	165	1551	1552	217	218	177	9	9	9	8	8	14	14	14	13	13	30
280	281	47	47	39	392	392	51	51	41	2	2	2	2	2	3	3	3	3	3	7
93	94	16	16	13	131	131	17	17	14	1	1	1	1	1	1	1	1	1	1	2
532	533	140	140	128	620	620	149	149	134	4	4	4	4	4	8	8	8	7	7	23
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1869	1872	311	312	260	2610	2612	342	343	277	13	13	13	12	12	22	22	21	20	20	48
183	183	53	53	46	212	212	57	57	48	2	2	2	2	2	3	3	3	3	3	8
531	532	106	107	92	701	701	115	116	97	4	4	4	3	3	7	7	7	6	6	17
470	470	89	89	76	637	638	98	98	81	4	4	4	3	3	6	6	6	6	6	14
248	249	52	52	44	333	333	57	57	47	2	2	2	2	2	4	4	4	3	3	8
290	290	54	54	42	406	406	60	60	45	3	3	3	2	2	4	4	4	4	4	8
384	385	56	56	42	566	567	63	63	45	3	3	3	3	3	5	5	5	4	4	8
177	178	21	21	16	266	267	24	24	17	1	1	1	1	1	2	2	2	2	2	3
39	39	2	2	2	60	60	2	2	2	0	0	0	0	0	0	0	0	0	0	0
32	32	1	1	1	53	53	1	1	1	0	0	0	0	0	0	0	0	0	0	0
138	138	13	13	12	206	206	14	14	13	0	0	0	0	0	1	1	1	1	1	2
106	106	12	12	12	153	153	13	13	12	0	0	0	0	0	1	1	1	1	1	2
96	96	4	4	4	152	152	5	5	4	0	0	0	0	0	0	0	0	0	0	1
738	740	160	160	135	968	968	175	176	144	7	7	7	6	6	11	11	11	10	10	25
282	283	24	24	21	430	430	26	26	22	1	1	1	1	1	2	2	2	1	1	4
203	203	14	14	13	310	310	15	15	14	0	0	0	0	0	1	1	1	1	1	2
205	206	73	74	57	237	237	81	82	61	4	4	4	3	3	6	6	6	6	6	11
133	133	22	22	18	185	185	24	24	20	1	1	1	1	1	2	2	2	1	1	3
910	910	94	95	84	1344	1344	102	102	88	3	3	3	3	3	6	6	6	5	5	15
960	962	217	218	177	1266	1267	240	241	189	10	10	10	9	9	16	16	16	15	15	33
898	899	150	150	133	1229	1229	162	162	141	5	5	5	5	5	9	9	9	8	8	24
50	50	2	2	2	81	81	3	3	2	0	0	0	0	0	0	0	0	0	0	0
5192	5193	326	331	330	6362	6362	327	331	331	4	4	4	3	3	7	7	4	4	4	40
3813	3814	236	244	243	4291	4291	237	244	244	3	3	1	2	2	7	6	1	3	3	54
1634	1634	147	149	149	1845	1845	147	149	149	1	1	0	1	1	2	2	0	1	1	24
960	961	55	57	57	1084	1084	55	57	57	1	1	0	1	1	2	2	0	1	1	10
100227	100240	4096	4229	4220	119829	119829	4101	4234	4225	56	54	10	47	47	207	190	10	78	78	832
3398	3399	255	261	261	3810	3810	256	261	261	2	2	1	1	1	5	5	1	2	2	51
4114	4115	323	330	329	4620	4620	323	330	330	3	3	1	2	2	7	6	1	3	3	58
914	915	63	65	65	1122	1122	63	65	65	1	1	1	1	1	3	3	1	2	2	9
305	305	21	22	22	374	374	21	22	22	1	0	0	0	0	1	1	0	1	1	3
1566	1566	115	118	117	1877	1877	115	118	117	2	2	1	1	1	4	3	1	2	2	15
3	3	0	0	0	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5903	5904	423	434	433	6660	6660	424	435	434	4	4	1	3	3	9	9	1	4	4	84
516	516	45	46	45	617	617	45	46	46	1	1	0	0	0	1	1	0	1	1	5
1145	1145	78	81	81	1309	1309	79	81	81	1	1	0	1	1	2	2	0	1	1	15
1940	1940	119	122	122	2163	2163	119	123	122	1	1	0	1	1	3	3	0	1	1	30
737	738	47	48	48	830	830	47	48	48	1	1	0	0	0	1	1	0	1	1	10
684	684	47	48	48	783	783	47	48	48	0	0	0	0	0	1	1	0	0	0	10
1281	1281	103	105	105	1430	1430	103	105	105	1	1	0	0	0	2	2	0	1	1	22
460	460	41	42	41	529	529	41	42	41	0	0	0	0	0	1	1	0	0	0	5
21	21	1	1	1	30	30	1	1	1	0	0	0	0	0	0	0	0	0	0	0
17	17	3	3	3	20	20	3	3	3	0	0	0	0	0	0	0	0	0	0	0
266	266	36	36	36	307	307	36	36	36	0	0	0	0	0	0	0	0	0	0	3
249	249	33	33	33	287	287	33	33	33	0	0	0	0	0	0	0	0	0	0	3
282	282	40	40	40	335	335	40	40	40	0	0	0	0	0	0	0	0	0	0	3
2946	2947	205	210	210	3295	3295	205	210	210	2	2	1	1	1	5	5	1	2	2	43
452	452	51	51	51	515	515	51	51	51	0	0	0	0	0	0	0	0	0	0	8
611	612	92	92	92	707	707	92	93	92	0	0	0	0	0	0	0	0	0	0	5
1001	1001	58	60	60	1148	1148	58	60	60	1	1	1	1	1	3	3	1	1	1	10
433	433	30	31	31	531	531	30	31	31	1	1	1	1	1	1	1	1	1	1	4
3121	3121	191	197	196	3594	3594	191	197	197	2	2	1	1	1	5	5	1	2	2	40
2782	2783	233	237	237	3066	3066	233	238	237	2	2	1	1	1	5	4	1	2	2	44
2438	2438	201	204	204	2726	2726	201	204	204	1	1	1	1	1	4	3	1	1	1	40
41	41	8	8	8	48	48	8	8	8	0	0	0	0	0	0	0	0	0	0	0
3604	3604	505	490	***1266***	4375	4375	570	555	***1308***	7	7	8	2	***7***	10	9	10	3	***10***	19

13603	13603	1719	1611	*6825*	15651	15651	1852	1743	*6998*	22	22	25	8	*23*	34	34	37	12	*38*	84
4957	4957	539	501	*2243*	5960	5960	558	519	*2292*	7	7	8	3	*7*	11	11	12	4	*12*	26
3341	3341	408	381	*1658*	3834	3834	434	406	*1698*	5	5	6	2	*6*	8	8	9	3	*9*	20
40416	40416	2917	2760	*11712*	51254	51254	3185	3024	*12066*	34	34	38	13	*35*	52	52	57	20	*59*	131
9583	9583	1177	1099	*4818*	11176	11176	1262	1183	*4939*	16	16	17	6	*16*	24	24	26	9	*27*	59
11465	11465	1477	1387	*5668*	13306	13306	1571	1480	*5805*	18	18	20	7	*19*	27	27	30	10	*31*	68
3044	3044	375	351	*1509*	3541	3541	403	378	*1547*	5	5	5	2	*5*	7	7	8	3	*8*	18
1015	1015	125	117	*503*	1180	1180	134	126	*516*	2	2	2	1	*2*	2	2	3	1	*3*	6
4719	4719	660	616	*2469*	5584	5584	759	715	*2550*	17	17	18	4	*17*	22	22	24	6	*24*	42
3	3	0	0	*0*	6	6	0	0	*0*	0	0	0	0	*0*	0	0	0	0	*0*	0
20291	20291	2498	2337	*10063*	23608	23607	2685	2522	*10315*	33	33	36	12	*34*	50	49	55	18	*56*	123
1455	1455	175	164	*782*	1725	1725	195	184	*806*	2	2	3	1	*3*	4	4	4	1	*4*	9
6076	6076	787	733	*3359*	6879	6879	853	797	*3446*	11	11	12	4	*12*	17	17	19	6	*19*	42
6022	6022	785	743	*2833*	7003	7003	843	800	*2904*	9	9	10	3	*9*	14	14	15	5	*15*	34
2844	2844	403	377	*1609*	3208	3208	440	414	*1651*	5	5	6	2	*6*	8	8	9	3	*9*	20
4015	4015	530	497	*2180*	4573	4573	585	552	*2241*	7	7	8	3	*7*	11	11	12	4	*13*	28
1865	1865	191	180	*698*	2370	2370	202	191	*715*	2	2	2	1	*2*	3	3	4	1	*4*	8
1982	1982	272	254	*1170*	2268	2268	307	289	*1203*	4	4	4	2	*4*	6	6	7	2	*7*	16
297	297	29	26	*186*	342	342	31	27	*191*	1	1	1	0	*1*	1	1	1	0	*1*	2
264	264	21	18	*137*	304	304	21	18	*140*	1	1	1	0	*1*	1	1	1	0	*1*	2
1514	1514	141	128	*690*	1784	1784	142	129	*705*	2	2	3	1	*2*	3	3	4	1	*4*	8
1250	1250	120	110	*553*	1480	1480	122	111	*565*	2	2	2	1	*2*	3	3	3	1	*3*	6
961	961	75	65	*490*	1206	1206	75	65	*501*	2	2	2	1	*2*	3	3	3	1	*3*	6
8282	8282	1043	975	*4235*	9548	9548	1121	1052	*4341*	14	14	15	5	*14*	21	21	23	8	*24*	52
1301	1301	134	124	*584*	1628	1628	141	131	*598*	2	2	2	1	*2*	3	3	3	1	*3*	7
2178	2178	169	153	*849*	2694	2694	169	153	*867*	3	3	3	1	*3*	4	4	5	1	*5*	10
3010	3010	412	393	*1574*	3516	3516	463	444	*1622*	5	5	6	2	*5*	7	7	9	3	*8*	19
1441	1441	177	166	*714*	1676	1676	191	179	*732*	2	2	3	1	*2*	4	4	4	1	*4*	9
10983	10983	1243	1149	*5495*	12865	12865	1316	1221	*5627*	18	18	20	7	*19*	27	27	30	9	*31*	67
9308	9308	1255	1188	*4568*	10743	10743	1368	1300	*4688*	15	15	16	6	*15*	23	22	25	9	*25*	56
6242	6242	768	718	*3160*	7342	7342	829	778	*3241*	10	10	11	4	*11*	16	16	17	6	*18*	39
439	439	61	56	*292*	489	489	70	66	*301*	1	1	1	0	*1*	2	2	2	1	*2*	4
766	767	76	*277*	*418*	1031	1032	81	*307*	*443*	16	16	16	*16*	*17*	23	22	26	*31*	*42*	31
402	404	79	*257*	*277*	732	733	91	*344*	*334*	16	16	16	*16*	*17*	26	27	27	*42*	*43*	36
208	208	40	*141*	*145*	370	370	43	*154*	*155*	13	13	13	*13*	*13*	21	21	21	*35*	*35*	26
61	61	11	*36*	*37*	151	152	14	*57*	*50*	2	2	2	*2*	*2*	3	3	3	*4*	*4*	4
7387	7395	613	*2364*	*3820*	10214	10216	659	*2828*	*4172*	82	82	87	*77*	*91*	112	109	147	*128*	*241*	180
323	325	66	*222*	*238*	522	523	74	*277*	*275*	16	16	16	*16*	*16*	26	26	27	*42*	*44*	34
381	383	76	*255*	*278*	599	599	85	*316*	*319*	18	18	18	*19*	*19*	30	30	31	*48*	*50*	39
127	127	27	*90*	*95*	214	215	30	*108*	*107*	7	7	7	*7*	*7*	12	12	12	*19*	*20*	15
42	42	9	*30*	*32*	71	72	10	*36*	*36*	2	2	2	*2*	*2*	4	4	4	*6*	*7*	5
567	568	139	*481*	*483*	792	792	149	*515*	*508*	45	45	45	*47*	*47*	75	76	76	*125*	*125*	93
1	1	0	*0*	*0*	2	2	0	*0*	*0*	0	0	0	*0*	*0*	0	0	0	*0*	*0*	0
846	849	178	*602*	*632*	1429	1430	197	*719*	*710*	48	48	48	*49*	*49*	79	79	80	*129*	*131*	101
39	39	10	*31*	*31*	58	58	11	*36*	*35*	3	3	3	*3*	*3*	4	4	4	*7*	*7*	5
222	223	46	*153*	*162*	399	400	54	*206*	*196*	10	10	10	*10*	*10*	16	16	17	*26*	*27*	22
113	114	22	*66*	*72*	218	218	26	*94*	*90*	4	4	4	*4*	*4*	6	6	6	*9*	*9*	8
157	157	28	*92*	*96*	302	303	31	*111*	*109*	7	7	7	*7*	*7*	12	12	12	*19*	*20*	15
119	120	28	*90*	*95*	205	206	33	*121*	*115*	6	6	6	*6*	*6*	9	9	10	*15*	*15*	13
67	67	6	*21*	*24*	153	153	7	*26*	*27*	1	1	1	*1*	*1*	2	2	2	*3*	*4*	3
277	277	68	*239*	*244*	386	386	73	*256*	*257*	22	22	22	*23*	*23*	37	37	37	*61*	*62*	46
5	5	0	*0*	*0*	23	23	0	*0*	*0*	0	0	0	*0*	*0*	0	0	0	*0*	*0*	0
6	6	0	*1*	*1*	14	14	0	*2*	*1*	0	0	0	*0*	*0*	0	0	0	*0*	*0*	0
57	57	8	*28*	*30*	144	144	8	*32*	*33*	2	2	2	*2*	*2*	4	4	4	*6*	*6*	5
51	51	8	*27*	*29*	130	130	8	*30*	*32*	2	2	2	*2*	*2*	4	4	4	*6*	*6*	5
63	63	13	*48*	*51*	90	90	14	*51*	*53*	5	5	5	*5*	*5*	8	8	8	*12*	*13*	9
287	289	59	*198*	*214*	449	449	67	*251*	*249*	14	14	14	*14*	*14*	23	23	23	*37*	*38*	30
36	37	7	*23*	*24*	74	74	8	*26*	*26*	2	2	2	*2*	*2*	3	3	3	*6*	*6*	4
120	120	24	*85*	*90*	204	204	25	*91*	*95*	8	8	8	*8*	*8*	13	13	13	*21*	*22*	16
81	82	17	*52*	*53*	191	192	20	*65*	*62*	4	4	4	*4*	*4*	7	7	7	*11*	*11*	8
60	60	13	*43*	*45*	101	102	14	*51*	*50*	3	3	3	*3*	*4*	6	6	6	*9*	*9*	7
644	645	141	*490*	*502*	1079	1080	152	*549*	*542*	44	44	44	*45*	*45*	72	73	73	*119*	*120*	90
202	204	37	*112*	*131*	350	351	45	*170*	*168*	4	4	4	*4*	*4*	7	7	7	*10*	*11*	11
263	264	55	*186*	*201*	371	371	60	*220*	*224*	14	14	15	*15*	*15*	24	24	24	*38*	*40*	30
238	238	60	*214*	*218*	288	288	63	*221*	*225*	21	21	21	*22*	*22*	34	35	35	*57*	*58*	42

Monthly													
2090				2115					2140				
d_high_2090_monthly_	**e_high_2090_monthly_**	**f_high_2090_monthly_**	**g_high_2090_monthly_**	**c_high_2115_monthly_**	**d_high_2115_monthly_**	**e_high_2115_monthly_**	**f_high_2115_monthly_**	**g_high_2115_monthly_**	**c_high_2140_monthly_**	**d_high_2140_monthly_**	**e_high_2140_monthly_**	**f_high_2140_monthly_**	**g_high_2140_monthly_**
18	19	21	19	141	111	116	116	110	512	487	133	133	125
29	30	33	30	194	159	182	182	161	981	940	215	216	185
10	10	11	10	60	50	60	61	51	503	489	72	73	59
4	5	5	5	19	18	26	26	19	108	101	33	33	22
162	163	171	164	1356	1048	1060	1060	1041	5012	4782	1208	1207	1179
24	26	27	25	161	132	152	152	134	890	856	180	181	154
26	27	29	27	169	139	161	162	141	972	935	193	194	163
6	6	7	6	40	33	39	39	34	242	233	46	46	39
2	2	2	2	13	11	13	13	11	81	78	15	15	13
19	20	22	20	141	112	120	120	112	503	476	138	138	127
0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	43	47	43	268	221	257	258	224	1613	1554	306	306	258
7	8	8	8	49	40	45	45	40	173	163	52	52	45
14	15	16	15	97	79	89	89	79	473	452	105	105	91
12	12	13	12	78	64	74	74	65	412	396	88	88	75
7	7	8	7	44	37	42	42	37	220	210	51	51	43
7	8	8	8	41	35	44	44	36	250	239	52	53	41
7	8	8	8	40	34	44	45	35	321	310	54	54	41
3	3	3	3	16	13	17	17	14	146	142	21	21	16
0	0	0	0	3	2	2	2	2	32	31	2	2	2
0	0	0	0	0	0	0	0	0	24	24	1	1	1
2	2	2	2	13	10	11	11	10	114	112	13	13	12
2	2	2	2	13	10	10	10	10	90	88	12	12	12
1	1	1	1	4	3	4	4	3	77	76	4	4	4
21	22	24	22	140	115	132	132	116	660	630	157	157	134
3	3	4	3	21	17	20	20	18	230	226	23	23	20
2	2	2	2	15	12	12	12	12	165	163	14	14	13
10	11	12	11	57	48	60	60	50	196	182	72	72	57
3	3	3	3	19	16	18	18	16	115	110	22	22	18
13	13	14	13	90	72	80	80	73	757	739	93	93	83
28	30	33	30	178	149	177	178	151	856	815	213	213	175
20	21	22	21	142	114	126	126	115	783	755	148	148	132
0	0	0	0	1	1	2	2	1	39	39	2	2	2
18	3	11	7	410	291	275	278	279	4903	4818	322	325	326
22	1	9	8	349	226	205	211	212	3623	3510	234	240	242
9	1	3	3	202	138	129	131	131	1560	1510	145	146	147
4	0	3	3	88	52	48	50	50	901	868	54	56	56
456	14	148	139	5598	3973	3533	3633	3658	95099	93592	4052	4145	4175
20	1	8	7	360	241	222	226	228	3243	3142	253	257	258
23	1	9	8	450	303	281	286	288	3923	3802	320	324	326
5	1	4	3	75	53	49	50	50	859	840	63	64	64
2	0	1	1	25	18	16	17	17	287	280	21	21	21
8	1	5	3	138	97	90	92	92	1478	1445	114	115	116
0	0	0	0	0	0	0	0	0	3	3	0	0	0
33	2	14	12	607	399	368	376	379	5613	5436	420	426	430
3	0	2	1	54	38	36	37	37	488	477	44	45	45
6	0	3	3	108	70	64	66	67	1082	1048	78	79	80
12	1	5	4	178	118	106	109	110	1852	1798	118	120	121
4	0	2	2	69	44	40	41	41	699	677	46	47	48
4	0	1	1	66	46	42	43	43	652	634	47	48	48
8	1	3	2	148	102	94	95	96	1231	1194	103	103	104
2	0	1	1	56	36	35	35	35	433	418	40	41	41
0	0	0	0	1	1	1	1	1	19	19	1	1	1
0	0	0	0	3	2	2	2	2	15	15	3	3	3
1	0	0	0	43	31	30	30	30	254	246	35	35	35
1	0	0	0	40	29	28	28	28	238	231	32	32	32
1	0	0	0	49	34	34	34	34	267	259	39	39	39
17	1	7	6	295	194	178	182	183	2807	2719	203	206	208
3	0	1	0	66	47	45	45	45	436	423	50	50	50
2	0	1	1	111	79	78	78	78	583	565	91	91	91
6	1	3	3	80	54	49	50	51	948	924	57	59	59
2	1	2	1	36	25	23	24	24	407	398	30	30	30
16	1	7	7	285	181	166	171	172	2950	2858	189	193	195
17	1	6	5	322	218	202	205	207	2663	2578	231	233	235
15	1	5	4	272	189	175	177	178	2341	2274	199	201	202
0	0	0	0	9	7	7	7	7	39	38	8	8	8
18	17	14	***195***	422	330	336	349	***862***	3426	3414	504	488	***1246***

77	81	60	*1385*	1383	1157	1208	1178	*4754*	13000	12974	1716	1608	*6703*
24	26	18	*463*	504	417	436	413	*1604*	4688	4678	539	500	*2203*
19	20	14	*343*	340	283	296	285	*1167*	3195	3189	408	380	*1629*
121	124	96	*2090*	2119	1739	1812	1798	*7566*	37952	37912	2913	2755	*11479*
55	58	42	*988*	957	803	840	813	*3362*	9135	9118	1175	1097	*4732*
62	66	49	*1135*	1280	1056	1099	1066	*3995*	10939	10912	1475	1385	*5568*
17	18	13	*308*	306	256	267	260	*1054*	2902	2896	374	350	*1482*
6	6	4	*103*	102	85	89	87	*351*	967	965	125	117	*494*
39	39	26	*460*	443	374	390	394	*1608*	4499	4492	659	615	*2423*
0	0	0	*0*	0	0	0	0	*0*	3	3	0	0	*0*
114	120	88	*2054*	2039	1706	1782	1732	*7029*	19345	19307	2495	2333	*9883*
9	9	7	*150*	127	109	114	114	*515*	1383	1381	175	164	*767*
39	41	30	*700*	584	501	526	510	*2318*	5825	5817	786	731	*3297*
31	33	25	*554*	681	557	578	567	*1998*	5742	5727	784	741	*2785*
19	20	15	*330*	310	261	273	269	*1117*	2733	2728	402	377	*1580*
26	26	20	*443*	378	324	339	336	*1485*	3843	3838	529	496	*2141*
8	8	6	*138*	175	142	147	143	*498*	1739	1735	191	180	*686*
14	15	11	*245*	180	157	165	166	*795*	1900	1898	272	254	*1148*
2	2	2	*42*	21	20	22	20	*129*	285	285	29	26	*183*
2	2	1	*32*	16	15	16	14	*96*	251	251	21	18	*134*
8	8	6	*149*	129	110	117	107	*491*	1435	1433	141	128	*677*
6	7	4	*118*	114	96	101	93	*396*	1184	1182	120	110	*543*
6	6	4	*112*	61	56	61	53	*343*	902	902	75	65	*480*
48	51	37	*866*	842	705	737	716	*2951*	7917	7901	1041	973	*4158*
7	7	5	*122*	115	97	102	97	*412*	1219	1217	134	124	*573*
9	10	7	*185*	158	135	143	130	*606*	2045	2042	169	153	*834*
17	17	15	*288*	310	258	267	273	*1042*	2877	2871	411	392	*1545*
8	9	6	*146*	145	121	127	123	*499*	1374	1371	177	166	*702*
62	66	47	*1154*	1028	871	915	871	*3846*	10452	10435	1242	1148	*5395*
52	54	41	*900*	1011	836	867	861	*3182*	8893	8872	1253	1185	*4488*
36	38	28	*645*	617	519	543	528	*2195*	5940	5929	767	717	*3103*
4	4	3	*63*	33	31	33	34	*195*	425	425	61	56	*287*
28	36	*114*	*194*	49	38	174	*196*	*322*	678	679	238	*259*	*398*
33	36	*94*	*107*	54	43	70	*142*	*161*	307	311	97	*195*	*216*
24	25	*72*	*74*	38	31	37	*104*	*107*	180	181	44	*132*	*137*
4	4	*9*	*10*	6	5	7	*13*	*15*	38	39	12	*20*	*22*
163	248	*816*	*1643*	302	234	1635	*1505*	*2812*	6351	6363	2280	*2043*	*3488*
32	34	*92*	*102*	51	41	61	*138*	*153*	263	265	81	*183*	*200*
36	39	*107*	*121*	58	47	74	*160*	*181*	313	316	98	*213*	*236*
14	15	*41*	*44*	22	18	24	*60*	*64*	106	107	31	*79*	*83*
5	5	*14*	*15*	7	6	8	*20*	*21*	35	36	10	*26*	*28*
86	87	*252*	*253*	136	110	117	*363*	*364*	521	523	137	*462*	*463*
0	0	*0*	*0*	0	0	0	*0*	*0*	1	1	0	*0*	*0*
93	97	*272*	*290*	149	120	159	*400*	*427*	707	712	204	*524*	*553*
5	5	*14*	*15*	8	7	8	*21*	*22*	34	34	10	*28*	*28*
20	22	*57*	*62*	33	27	38	*85*	*93*	168	170	53	*116*	*125*
8	8	*21*	*25*	13	10	18	*33*	*38*	82	84	27	*47*	*53*
14	15	*40*	*43*	23	18	24	*60*	*63*	125	126	31	*79*	*82*
12	13	*33*	*36*	19	15	23	*49*	*54*	91	93	32	*68*	*73*
3	3	*8*	*10*	5	4	7	*13*	*16*	50	51	10	*17*	*20*
42	43	*125*	*128*	67	54	61	*181*	*185*	258	259	72	*230*	*235*
0	0	*0*	*0*	0	0	0	*0*	*0*	4	4	0	*0*	*0*
0	0	*0*	*0*	0	0	0	*0*	*0*	4	4	0	*0*	*0*
5	5	*14*	*15*	7	6	8	*20*	*22*	46	47	10	*25*	*28*
4	5	*13*	*15*	7	6	8	*20*	*22*	43	43	10	*25*	*27*
9	9	*26*	*27*	13	11	14	*38*	*40*	59	59	16	*47*	*50*
28	30	*81*	*90*	45	36	55	*121*	*135*	232	234	74	*162*	*177*
4	4	*12*	*12*	6	5	6	*17*	*17*	31	31	7	*22*	*22*
15	15	*44*	*47*	23	19	24	*64*	*69*	108	108	29	*82*	*87*
8	8	*22*	*23*	13	10	13	*33*	*34*	65	65	18	*44*	*45*
7	7	*19*	*21*	11	9	11	*28*	*30*	50	51	14	*37*	*39*
83	85	*244*	*251*	131	106	122	*353*	*362*	563	565	147	*452*	*463*
10	12	*28*	*39*	17	14	37	*47*	*65*	145	147	56	*71*	*90*
28	30	*84*	*93*	45	36	54	*124*	*138*	225	226	70	*163*	*178*
39	39	*116*	*118*	61	50	55	*167*	*170*	229	230	63	*211*	*215*

***** COUNT FOR DISPLACED PEOPLE IN RETREAT AREAS FOR ALT F AND G*****

	Base			100y																					
				2040						2065						2090						2115			
	Reach	Social Factor Category	Variable	FWOP	c_low_2040_100y_	d_low_2040_100y_	e_low_2040_100y_	f_low_2040_100y_	g_low_2040_100y_	FWOP	c_low_2065_100y_	d_low_2065_100y_	e_low_2065_100y_	f_low_2065_100y_	g_low_2065_100y_	FWOP	c_low_2090_100y_	d_low_2090_100y_	e_low_2090_100y_	f_low_2090_100y_	g_low_2090_100y_	FWOP	c_low_2115_100y_	d_low_2115_100y_	e_low_2115_100y_
1	Reach 1	economic vitality	In Labor Force	27	1%	0%	-8%	-12%	-12%	27.8	0%	-1%	-8%	-13%	-13%	29.5	-1%	-17%	-13%	-5%	-13%	32.8	-3%	-17%	-13%
2	Reach 1	economic vitality	Median Income per Household	14,237	-4%	-4%	-22%	-28%	-28%	14758.7	-4%	-4%	-23%	-28%	-28%	15921.7	-8%	-34%	-31%	5%	-31%	16918.9	-9%	-34%	-31%
4	Reach 1	economic vitality	Not in Labor Force	9	0%	0%	-4%	-10%	-10%	9.4	0%	-1%	-5%	-11%	-11%	9.9	-1%	-15%	-10%	-2%	-10%	10.9	-4%	-17%	-11%
5	Reach 1	economic vitality	Owner Occupied Units	4	-2%	-2%	2%	-5%	-5%	4.4	-2%	-2%	5%	-2%	-2%	4.6	-4%	-13%	-2%	7%	-2%	4.8	-4%	-15%	-4%
6	Reach 1	economic vitality	Median Gross Rent	275	-3%	-3%	-25%	-31%	-31%	285.6	-2%	-3%	-26%	-30%	-30%	306.2	-6%	-36%	-33%	-4%	-33%	327.7	-7%	-36%	-33%
7	Reach 1	economic vitality	Total Jobs	139	1%	1%	-18%	-21%	-21%	146.4	1%	-1%	-18%	-21%	-21%	158.6	1%	-21%	-21%	-15%	-20%	185.6	-1%	-21%	-21%
8	Reach 1	economic vitality	Total Households	22	1%	0%	-7%	-12%	-12%	23.2	0%	-1%	-7%	-12%	-12%	24.7	-1%	-16%	-13%	-4%	-12%	27.4	-3%	-17%	-13%
9	Reach 1	economic vitality	Total Housing Units	24	1%	0%	-7%	-11%	-11%	25	0%	-1%	-7%	-12%	-12%	26.4	-1%	-16%	-11%	-3%	-11%	29.2	-2%	-17%	-12%
14	Reach 1	health and safety	Total Population	38	1%	1%	-7%	-11%	-12%	39.6	0%	-1%	-7%	-12%	-12%	41.9	-1%	-16%	-12%	-4%	-11%	46.4	-3%	-17%	-12%
15	Reach 1	social connectedness	Public Transit User with No Vehicle	6	2%	2%	-8%	-13%	-13%	6.7	1%	0%	-7%	-12%	-12%	7.2	0%	-17%	-13%	-1%	-13%	8.1	-2%	-17%	-14%
16	Reach 1	social connectedness	Commutes over 30 mins a day	13	1%	1%	-9%	-13%	-13%	13.4	0%	-1%	-10%	-14%	-14%	14.2	-1%	-17%	-13%	-6%	-13%	15.9	-3%	-18%	-14%
17	Reach 1	social connectedness	Commutes under 30 mins a day	11	1%	0%	-7%	-12%	-12%	11.3	1%	-1%	-6%	-12%	-12%	12	0%	-16%	-12%	-3%	-12%	13.3	-2%	-17%	-12%
18	Reach 1	social connectedness	Commutes with Car, Truck, or Van	6	2%	2%	-6%	-11%	-11%	6.6	0%	-2%	-6%	-11%	-11%	7	-1%	-16%	-11%	-3%	-11%	7.7	-3%	-16%	-12%
19	Reach 1	social connectedness	Commutes with Public Transit	7	0%	0%	-3%	-9%	-9%	6.9	-1%	-1%	-3%	-9%	-9%	7.3	-3%	-15%	-10%	-1%	-10%	7.9	-4%	-16%	-10%
21	Reach 1	social vulnerability and resiliency	Age older than 65	7	0%	-1%	-1%	-7%	-9%	7.2	-1%	-3%	-3%	-8%	-8%	7.5	-3%	-15%	-8%	1%	-8%	8.1	-5%	-16%	-9%
22	Reach 1	social vulnerability and resiliency	Age under 18	3	0%	0%	-4%	-7%	-7%	2.8	-4%	-4%	-4%	-7%	-7%	2.9	-3%	-14%	-7%	3%	-7%	3.1	-3%	-16%	-6%
23	Reach 1	social vulnerability and resiliency	Education 12th Grade with No Diploma	0	0%	0%	-33%	-33%	-33%	0.3	0%	0%	-33%	-33%	-33%	0.3	0%	-33%	-33%	-33%	-33%	0.4	-25%	-25%	-25%
24	Reach 1	social vulnerability and resiliency	Education GED or Alternate Degree	0	0%	0%	0%	0%	0%	0.1	0%	0%	0%	0%	0%	0.1	0%	0%	0%	0%	0%	0.1	0%	0%	0%
25	Reach 1	social vulnerability and resiliency	Education Equivalent to High School Degree	2	7%	0%	-13%	-13%	-13%	1.6	0%	0%	-13%	-19%	-19%	1.7	0%	-18%	-18%	-6%	-18%	1.9	0%	-16%	-16%
26	Reach 1	social vulnerability and resiliency	Education High School Diploma	1	7%	7%	-14%	-14%	-14%	1.5	0%	0%	-13%	-20%	-20%	1.6	0%	-19%	-19%	-13%	-19%	1.8	0%	-17%	-17%
27	Reach 1	social vulnerability and resiliency	Households in Poverty	1	0%	0%	-20%	-20%	-20%	0.5	0%	0%	0%	-20%	-20%	0.6	0%	-17%	-17%	-17%	-17%	0.6	0%	-17%	-17%
28	Reach 1	social vulnerability and resiliency	Households without Disability	19	1%	0%	-7%	-12%	-12%	20.2	0%	-1%	-7%	-12%	-12%	21.5	-1%	-16%	-12%	-5%	-12%	23.8	-3%	-17%	-13%
29	Reach 1	social vulnerability and resiliency	Households with Disability	3	0%	0%	-10%	-14%	-14%	3	0%	0%	-7%	-13%	-13%	3.2	0%	-16%	-13%	-6%	-13%	3.6	-3%	-19%	-14%
30	Reach 1	social vulnerability and resiliency	Poverty	2	0%	0%	-12%	-18%	-18%	1.8	0%	0%	-17%	-17%	-17%	1.9	0%	-16%	-16%	-11%	-16%	2.2	-5%	-18%	-18%
31	Reach 1	social vulnerability and resiliency	Linguistic Isolation	9	2%	1%	-1%	-8%	-8%	9.7	0%	-1%	-2%	-8%	-8%	10.2	-1%	-14%	-8%	3%	-8%	11.1	-3%	-15%	-9%
33	Reach 1	social vulnerability and resiliency	Minority (Non-White)	11	2%	1%	-10%	-14%	-14%	11.9	0%	-1%	-10%	-14%	-14%	12.7	-1%	-17%	-14%	-7%	-14%	14.3	-2%	-18%	-15%
34	Reach 1	social vulnerability and resiliency	White	27	0%	0%	-5%	-11%	-11%	27.7	0%	-1%	-5%	-10%	-11%	29.3	-1%	-16%	-11%	-2%	-11%	32.1	-3%	-17%	-11%
35	Reach 1	social vulnerability and resiliency	Renter Occupied Units	18	1%	1%	-10%	-14%	-14%	18.8	1%	-1%	-10%	-14%	-14%	20	0%	-17%	-14%	-7%	-14%	22.6	-2%	-18%	-15%
36	Reach 1	social vulnerability and resiliency	Single Parent	0	0%	0%	0%	0%	0%	0.3	0%	0%	33%	0%	0%	0.3	0%	0%	0%	33%	0%	0.4	-25%	-25%	0%
38	Reach 2	economic vitality	In Labor Force	122	-82%	-82%	-99%	-95%	-95%	169.3	-81%	-81%	-100%	-96%	-96%	231	-82%	-92%	-100%	-96%	-97%	330	-86%	-94%	-100%
39	Reach 2	economic vitality	Median Income per Household	18,527	-83%	-83%	-84%	-95%	-95%	25714.3	-83%	-83%	-88%	-96%	-95%	35550.4	-84%	-93%	-99%	-60%	-97%	50174.8	-88%	-94%	-99%
41	Reach 2	economic vitality	Not in Labor Force	48	-81%	-81%	-99%	-96%	-96%	65.5	-79%	-79%	-99%	-97%	-97%	87.6	-79%	-92%	-100%	-97%	-98%	131.1	-84%	-94%	-100%
42	Reach 2	economic vitality	Owner Occupied Units	28	-84%	-84%	-99%	-93%	-93%	41.5	-85%	-85%	-100%	-94%	-94%	59.4	-87%	-93%	-100%	-96%	-96%	76.5	-89%	-95%	-100%
43	Reach 2	economic vitality	Median Gross Rent	296	-84%	-83%	-88%	-95%	-95%	409.5	-83%	-83%	-92%	-96%	-96%	563.3	-84%	-93%	-99%	-73%	-97%	804.7	-87%	-94%	-99%
44	Reach 2	economic vitality	Total Jobs	2,268	-79%	-80%	-100%	-94%	-94%	2957.8	-80%	-81%	-100%	-95%	-95%	3917.7	-82%	-89%	-100%	-96%	-97%	5895.5	-87%	-92%	-100%
45	Reach 2	economic vitality	Total Households	106	-81%	-81%	-99%	-96%	-96%	146.2	-80%	-80%	-100%	-96%	-96%	196.8	-80%	-92%	-100%	-97%	-97%	289.6	-85%	-93%	-100%
46	Reach 2	economic vitality	Total Housing Units	124	-81%	-81%	-99%	-96%	-95%	171	-80%	-80%	-99%	-96%	-96%	230.8	-81%	-92%	-100%	-96%	-97%	337.6	-86%	-93%	-100%
51	Reach 2	health and safety	Total Population	180	-82%	-81%	-99%	-95%	-95%	251	-81%	-80%	-99%	-96%	-96%	341.3	-81%	-92%	-100%	-96%	-97%	491.7	-86%	-94%	-100%
52	Reach 2	social connectedness	Public Transit User with No Vehicle	12	-79%	-79%	-97%	-93%	-93%	16	-79%	-79%	-98%	-94%	-94%	21.4	-81%	-90%	-99%	-93%	-96%	31.8	-86%	-92%	-99%
53	Reach 2	social connectedness	Commutes over 30 mins a day	34	-82%	-82%	-99%	-95%	-94%	48.2	-82%	-82%	-100%	-95%	-95%	66.6	-83%	-92%	-100%	-96%	-97%	92.8	-87%	-94%	-100%
54	Reach 2	social connectedness	Commutes under 30 mins a day	64	-81%	-81%	-99%	-96%	-95%	88	-80%	-80%	-100%	-96%	-96%	118.3	-81%	-91%	-100%	-97%	-97%	174.5	-85%	-93%	-100%
55	Reach 2	social connectedness	Commutes with Car, Truck, or Van	23	-82%	-82%	-100%	-95%	-95%	32.4	-82%	-81%	-100%	-96%	-95%	44.6	-83%	-92%	-100%	-96%	-97%	62.5	-86%	-94%	-100%
56	Reach 2	social connectedness	Commutes with Public Transit	21	-81%	-80%	-100%	-96%	-96%	28.5	-79%	-79%	-100%	-96%	-96%	37.9	-79%	-91%	-100%	-97%	-97%	57.3	-85%	-93%	-100%
58	Reach 2	social vulnerability and resiliency	Age older than 65	42	-80%	-80%	-99%	-97%	-97%	56.6	-78%	-77%	-99%	-97%	-97%	74.1	-77%	-91%	-100%	-97%	-98%	115.5	-84%	-93%	-100%
59	Reach 2	social vulnerability and resiliency	Age under 18	11	-83%	-83%	-99%	-95%	-94%	16.2	-83%	-83%	-99%	-95%	-94%	22.7	-84%	-93%	-100%	-96%	-96%	30.6	-87%	-94%	-100%
60	Reach 2	social vulnerability and resiliency	Education 12th Grade with No Diploma	0	-67%	-67%	-100%	-100%	-100%	0.4	-75%	-75%	-100%	-100%	-100%	0.5	-80%	-80%	-100%	-100%	-100%	0.8	-75%	-88%	-100%
62	Reach 2	social vulnerability and resiliency	Education Equivalent to High School Degree	6	-80%	-80%	-98%	-98%	-98%	7.4	-76%	-76%	-99%	-99%	-97%	9.6	-75%	-91%	-100%	-96%	-98%	15.3	-82%	-93%	-99%
63	Reach 2	social vulnerability and resiliency	Education High School Diploma	6	-80%	-80%	-98%	-98%	-98%	7.4	-76%	-76%	-99%	-99%	-97%	9.5	-75%	-91%	-100%	-96%	-98%	15.3	-83%	-93%	-99%
64	Reach 2	social vulnerability and resiliency	Households in Poverty	5	-80%	-80%	-98%	-98%	-98%	6.3	-78%	-78%	-98%	-97%	-97%	8.3	-77%	-92%	-100%	-95%	-98%	12.8	-84%	-93%	-99%
65	Reach 2	social vulnerability and resiliency	Households without Disability	93	-82%	-81%	-99%	-95%	-95%	128.9	-81%	-80%	-100%	-96%	-96%	175	-81%	-92%	-100%	-97%	-97%	252.8	-86%	-94%	-100%
66	Reach 2	social vulnerability and resiliency	Households with Disability	13	-79%	-79%	-99%	-98%	-98%	17.3	-75%	-74%	-99%	-99%	-99%	21.8	-72%	-90%	-100%	-97%	-99%	36.8	-82%	-93%	-100%
67	Reach 2	social vulnerability and resiliency	Poverty	10	-80%	-80%	-98%	-97%	-97%	13.6	-78%	-78%	-99%	-97%	-97%	17.8	-78%	-91%	-99%	-95%	-98%	27.6	-84%	-93%	-100%
68	Reach 2	social vulnerability and resiliency	Linguistic Isolation	29	-80%	-80%	-98%	-92%	-92%	39.1	-82%	-82%	-98%	-94%	-94%	53.4	-84%	-90%	-99%	-94%	-96%	75.3	-88%	-93%	-99%
70	Reach 2	social vulnerability and resiliency	Minority (Non-White)	90	-82%	-82%	-99%	-95%	-95%	127.3	-82%	-81%	-100%	-96%	-95%	175.6	-83%	-92%	-100%	-96%	-97%	245.5	-86%	-94%	-100%
71	Reach 2	social vulnerability and resiliency	White	90	-81%	-81%	-99%	-96%	-96%	123.6	-80%	-79%	-99%	-96%	-96%	165.8	-80%	-91%	-100%	-97%	-97%	246.1	-85%	-93%	-100%
72	Reach 2	social vulnerability and resiliency	Renter Occupied Units	78	-80%	-80%	-99%	-97%	-97%	104.7	-78%	-78%	-99%	-97%	-97%	137.4	-78%	-91%	-100%	-97%	-98%	213.1	-84%	-93%	-100%
75	Reach 3	economic vitality	In Labor Force	541	-91%	-91%	-90%	-95%	*-89%*	681.6	-92%	-92%	-92%	-95%	*-90%*	838.8	-93%	-93%	-93%	-96%	*-4%*	1952.1	-96%	-96%	-96%
76	Reach 3	economic vitality	Median Income per Household	37,694	-81%	-81%	-88%	-84%	*-80%*	46964.8	-83%	-83%	-90%	-85%	*-82%*	56144.1	-83%	-84%	-91%	-86%	*-16%*	135864.3	-91%	-92%	-96%
78	Reach 3	economic vitality	Not in Labor Force	178	-91%	-91%	-91%	-95%	*-89%*	224.3	-92%	-93%	-92%	-96%	*-90%*	276.8	-93%	-94%	-94%	-96%	*-3%*	651.8	-96%	-97%	-96%
79	Reach 3	economic vitality	Owner Occupied Units	133	-91%	-91%	-90%	-95%	*-89%*	167.8	-92%	-92%	-92%	-95%	*-90%*	206.7	-93%	-93%	-93%	-96%	*-3%*	483.6	-96%	-96%	-96%
80	Reach 3	economic vitality	Median Gross Rent	708	-82%	-82%	-88%	-85%	*-81%*	887.7	-84%	-84%	-90%	-86%	*-83%*	1064.3	-84%	-85%	-92%	-87%	*-15%*	2570	-92%	-92%	-96%
81	Reach 3	economic vitality	Total Jobs	825	-90%	-91%	-90%	-94%	*-89%*	1037.3	-92%	-92%	-92%	-95%	*-90%*	1274.9	-93%	-93%	-93%	-95%	*-4%*	3350.8	-96%	-97%	-97%
82	Reach 3	economic vitality	Total Households	385	-91%	-91%	-90%	-95%	*-89%*	484.8	-92%	-92%	-92%	-95%	*-90%*	596.9	-93%	-93%	-93%	-96%	*-4%*	1389.1	-96%	-96%	-96%
83	Reach 3	economic vitality	Total Housing Units	442	-91%	-91%	-90%	-95%	*-89%*	556.5	-92%	-92%	-92%	-95%	*-90%*	685.2	-93%	-93%	-93%	-96%	*-4%*	1596.2	-96%	-96%	-96%
88	Reach 3	health and safety	Total Population	801	-91%	-91%	-90%	-95%	*-89%*	1009.3	-92%	-92%	-92%	-95%	*-90%*	1242.4	-93%	-93%	-93%	-96%	*-4%*	2895.9	-96%	-96%	-96%
89	Reach 3	social connectedness	Public Transit User with No Vehicle	59	-91%	-91%	-90%	-94%	*-89%*	74.2	-92%	-92%	-92%	-95%	*-90%*	91.3	-93%	-93%	-94%	-95%	*-4%*	212.5	-96%	-96%	-96%
90	Reach 3	social connectedness	Commutes over 30 mins a day	273	-91%	-91%	-90%	-95%	*-89%*	344.2	-92%	-92%	-92%	-95%	*-90%*	423.7	-93%	-93%	-93%	-96%	*-4%*	982.5	-96%	-96%	-96%

91	Reach 3	social connectedness	Commutes under 30 mins a day	217	-91%	-91%	-90%	-95%	-89%	273.5	-92%	-92%	-92%	-95%	-90%	336.4	-93%	-93%	-93%	-95%	-4%	785.8	-96%	-96%	-96%
92	Reach 3	social connectedness	Commutes with Car, Truck, or Van	130	-91%	-91%	-90%	-95%	-89%	163.2	-92%	-92%	-92%	-95%	-90%	200.7	-93%	-93%	-93%	-96%	-4%	464.2	-96%	-96%	-96%
93	Reach 3	social connectedness	Commutes with Public Transit	175	-90%	-91%	-90%	-94%	-89%	219.8	-92%	-92%	-92%	-95%	-90%	270.2	-93%	-93%	-93%	-95%	-4%	623.1	-96%	-96%	-96%
95	Reach 3	social vulnerability and resiliency	Age older than 65	54	-91%	-91%	-90%	-95%	-89%	67.8	-92%	-92%	-92%	-95%	-90%	83.5	-93%	-93%	-93%	-96%	-4%	193.6	-96%	-96%	-96%
96	Reach 3	social vulnerability and resiliency	Age under 18	97	-90%	-91%	-90%	-94%	-88%	121.9	-92%	-92%	-92%	-95%	-90%	149.8	-93%	-93%	-93%	-95%	-5%	345.5	-96%	-96%	-96%
97	Reach 3	social vulnerability and resiliency	Education 12th Grade with No Diploma	16	-91%	-91%	-91%	-95%	-90%	20.5	-93%	-93%	-92%	-96%	-90%	25.3	-93%	-94%	-94%	-96%	-3%	59.5	-96%	-96%	-96%
98	Reach 3	social vulnerability and resiliency	Education GED or Alternate Degree	12	-92%	-92%	-91%	-96%	-89%	15.2	-93%	-93%	-92%	-96%	-91%	18.7	-94%	-94%	-94%	-97%	-2%	44.3	-96%	-97%	-97%
99	Reach 3	social vulnerability and resiliency	Education Equivalent to High School Degree	57	-91%	-92%	-91%	-96%	-89%	71.7	-93%	-93%	-92%	-96%	-91%	88.6	-94%	-94%	-94%	-96%	-2%	210.4	-96%	-97%	-96%
100	Reach 3	social vulnerability and resiliency	Education High School Diploma	45	-91%	-92%	-91%	-96%	-89%	56.5	-93%	-93%	-92%	-96%	-90%	69.8	-94%	-94%	-94%	-96%	-2%	166.1	-96%	-97%	-97%
101	Reach 3	social vulnerability and resiliency	Households in Poverty	42	-92%	-92%	-91%	-96%	-89%	53.8	-93%	-93%	-92%	-96%	-91%	66.5	-94%	-94%	-94%	-97%	-2%	155.6	-96%	-97%	-96%
102	Reach 3	social vulnerability and resiliency	Households without Disability	338	-91%	-91%	-90%	-95%	-89%	425.3	-92%	-92%	-92%	-95%	-90%	523.5	-93%	-93%	-93%	-96%	-4%	1218.1	-96%	-96%	-96%
103	Reach 3	social vulnerability and resiliency	Households with Disability	47	-91%	-91%	-90%	-95%	-89%	59.5	-92%	-93%	-92%	-96%	-90%	73.4	-93%	-94%	-93%	-96%	-3%	171	-96%	-96%	-96%
104	Reach 3	social vulnerability and resiliency	Poverty	70	-91%	-92%	-91%	-96%	-89%	88.5	-93%	-93%	-92%	-96%	-91%	109.4	-94%	-94%	-94%	-97%	-2%	257.1	-96%	-97%	-96%
105	Reach 3	social vulnerability and resiliency	Linguistic Isolation	115	-90%	-91%	-90%	-94%	-89%	144.1	-92%	-92%	-92%	-95%	-90%	176.9	-92%	-93%	-93%	-94%	-5%	411.8	-96%	-96%	-96%
107	Reach 3	social vulnerability and resiliency	Minority (Non-White)	446	-91%	-91%	-91%	-95%	-89%	562.6	-92%	-93%	-92%	-96%	-90%	693.4	-93%	-94%	-93%	-96%	-3%	1619.5	-96%	-96%	-96%
108	Reach 3	social vulnerability and resiliency	White	355	-90%	-91%	-90%	-94%	-89%	446.7	-92%	-92%	-92%	-95%	-90%	549	-93%	-93%	-93%	-95%	-4%	1276.4	-96%	-96%	-96%
109	Reach 3	social vulnerability and resiliency	Renter Occupied Units	252	-91%	-91%	-90%	-95%	-89%	317	-92%	-92%	-92%	-95%	-90%	390.2	-93%	-93%	-93%	-96%	-4%	905.5	-96%	-96%	-96%
110	Reach 3	social vulnerability and resiliency	Single Parent	25	-90%	-91%	-90%	-94%	-88%	31.4	-92%	-92%	-92%	-95%	-89%	38.5	-92%	-93%	-93%	-95%	-5%	88.5	-96%	-96%	-96%
112	Reach 4	economic vitality	In Labor Force	83	-64%	-64%	-63%	-12%	-6%	89	-65%	-65%	-64%	-11%	-6%	97	-65%	-68%	-65%	-12%	-1%	102.8	-66%	-69%	-66%
113	Reach 4	economic vitality	Median Income per Household	114,477	-13%	-13%	-12%	-1%	-1%	116183.8	-14%	-14%	-13%	-1%	-1%	118179	-15%	-15%	-15%	-1%	-1%	119816.8	-15%	-16%	-15%
115	Reach 4	economic vitality	Not in Labor Force	61	-62%	-62%	-62%	-3%	-2%	64.2	-64%	-64%	-63%	-3%	-2%	68.3	-63%	-65%	-65%	-4%	0%	71.7	-64%	-67%	-66%
116	Reach 4	economic vitality	Owner Occupied Units	7	-58%	-58%	-57%	-8%	-6%	7.8	-59%	-59%	-58%	-8%	-5%	8.7	-60%	-62%	-59%	-10%	-2%	9.2	-61%	-63%	-58%
117	Reach 4	economic vitality	Median Gross Rent	5,221	-26%	-26%	-25%	-9%	-3%	5371.9	-28%	-28%	-27%	-8%	-3%	5755.5	-32%	-32%	-32%	-9%	-1%	5969.2	-34%	-34%	-34%
118	Reach 4	economic vitality	Total Jobs	1,112	-87%	-88%	-82%	-57%	-28%	1215.3	-87%	-88%	-82%	-54%	-28%	1430	-89%	-90%	-84%	-50%	-3%	1554.4	-89%	-90%	-85%
119	Reach 4	economic vitality	Total Households	81	-64%	-64%	-63%	-9%	-5%	86.2	-65%	-65%	-64%	-9%	-5%	93.2	-65%	-67%	-66%	-10%	-1%	98.5	-66%	-68%	-67%
120	Reach 4	economic vitality	Total Housing Units	95	-65%	-65%	-64%	-11%	-6%	101.4	-66%	-66%	-65%	-11%	-6%	110	-66%	-68%	-67%	-11%	-1%	116.3	-67%	-69%	-68%
125	Reach 4	health and safety	Total Population	234	-63%	-63%	-62%	-6%	-3%	248.2	-64%	-64%	-63%	-6%	-3%	266.2	-64%	-66%	-65%	-6%	-1%	280.3	-65%	-67%	-66%
126	Reach 4	social connectedness	Public Transit User with No Vehicle	12	-61%	-61%	-61%	-3%	-2%	12.7	-63%	-62%	-62%	-2%	-2%	13.5	-62%	-64%	-64%	-3%	-1%	14.2	-63%	-65%	-65%
127	Reach 4	social connectedness	Commutes over 30 mins a day	49	-63%	-63%	-62%	-8%	-4%	52.6	-64%	-64%	-63%	-8%	-5%	56.9	-64%	-66%	-64%	-9%	-1%	60.2	-65%	-67%	-65%
128	Reach 4	social connectedness	Commutes under 30 mins a day	19	-65%	-65%	-63%	-15%	-8%	20.3	-66%	-66%	-64%	-15%	-8%	22.3	-66%	-68%	-65%	-15%	-1%	23.8	-67%	-69%	-66%
129	Reach 4	social connectedness	Commutes with Car, Truck, or Van	35	-62%	-62%	-62%	-5%	-3%	36.7	-64%	-64%	-63%	-5%	-3%	39.4	-63%	-65%	-64%	-6%	-1%	41.4	-64%	-67%	-65%
130	Reach 4	social connectedness	Commutes with Public Transit	28	-63%	-63%	-62%	-9%	-5%	30.3	-64%	-64%	-62%	-9%	-5%	32.9	-64%	-66%	-64%	-10%	-1%	34.8	-65%	-67%	-65%
132	Reach 4	social vulnerability and resiliency	Age older than 65	8	-68%	-69%	-67%	-19%	-10%	8.3	-70%	-70%	-67%	-18%	-10%	9.2	-70%	-72%	-70%	-18%	-2%	9.7	-71%	-73%	-70%
133	Reach 4	social vulnerability and resiliency	Age under 18	106	-62%	-62%	-61%	-2%	-1%	111.5	-63%	-63%	-63%	-2%	-1%	118.3	-63%	-65%	-65%	-3%	0%	124	-64%	-66%	-66%
136	Reach 4	social vulnerability and resiliency	Education Equivalent to High School Degree	12	-64%	-64%	-64%	-8%	-4%	12.5	-66%	-66%	-65%	-8%	-4%	13.5	-65%	-68%	-67%	-9%	-1%	14.2	-66%	-69%	-68%
137	Reach 4	social vulnerability and resiliency	Education High School Diploma	12	-64%	-64%	-64%	-8%	-4%	12.5	-66%	-66%	-65%	-8%	-4%	13.4	-66%	-68%	-67%	-8%	-1%	14.1	-67%	-69%	-68%
138	Reach 4	social vulnerability and resiliency	Households in Poverty	22	-63%	-63%	-63%	-5%	-2%	23.5	-65%	-65%	-64%	-5%	-3%	25.1	-64%	-67%	-66%	-5%	0%	26.3	-65%	-68%	-67%
139	Reach 4	social vulnerability and resiliency	Households without Disability	71	-64%	-64%	-63%	-10%	-5%	75.9	-65%	-66%	-64%	-10%	-5%	82.3	-65%	-68%	-66%	-10%	-1%	87	-66%	-69%	-67%
140	Reach 4	social vulnerability and resiliency	Households with Disability	10	-62%	-62%	-61%	-3%	-1%	10.3	-63%	-63%	-63%	-3%	-2%	10.9	-62%	-65%	-64%	-3%	0%	11.5	-63%	-66%	-65%
141	Reach 4	social vulnerability and resiliency	Poverty	39	-64%	-63%	-63%	-6%	-3%	40.6	-65%	-65%	-64%	-5%	-3%	43.4	-65%	-67%	-66%	-6%	0%	45.7	-66%	-68%	-67%
142	Reach 4	social vulnerability and resiliency	Linguistic Isolation	19	-61%	-61%	-61%	-4%	-3%	19.6	-62%	-62%	-62%	-4%	-3%	20.9	-62%	-64%	-63%	-5%	-1%	22	-63%	-65%	-64%
144	Reach 4	social vulnerability and resiliency	Minority (Non-White)	206	-62%	-62%	-61%	-2%	-1%	217.5	-63%	-63%	-63%	-2%	-1%	231.2	-62%	-65%	-64%	-3%	0%	242.5	-63%	-66%	-65%
145	Reach 4	social vulnerability and resiliency	White	28	-71%	-71%	-68%	-32%	-16%	30.7	-71%	-72%	-68%	-30%	-16%	35	-72%	-74%	-69%	-30%	-3%	37.7	-73%	-75%	-70%
146	Reach 4	social vulnerability and resiliency	Renter Occupied Units	74	-64%	-64%	-63%	-9%	-5%	78.4	-66%	-66%	-65%	-9%	-5%	84.6	-66%	-68%	-67%	-10%	-1%	89.3	-67%	-69%	-68%
147	Reach 4	social vulnerability and resiliency	Single Parent	98	-62%	-62%	-61%	-2%	-1%	103.3	-64%	-63%	-63%	-2%	-1%	109.4	-63%	-65%	-65%	-2%	0%	114.6	-64%	-66%	-66%

								Monthly																								
		2140						2040						2065						2090						2115						
f_low_2115_100y_	g_low_2115_100y_	FWOP	c_low_2140_100y_	d_low_2140_100y_	e_low_2140_100y_	f_low_2140_100y_	g_low_2140_100y_	FWOP	c_low_2040_monthly_	d_low_2040_monthly_	e_low_2040_monthly_	f_low_2040_monthly_	g_low_2040_monthly_	FWOP	c_low_2065_monthly_	d_low_2065_monthly_	e_low_2065_monthly_	f_low_2065_monthly_	g_low_2065_monthly_	FWOP	c_low_2090_monthly_	d_low_2090_monthly_	e_low_2090_monthly_	f_low_2090_monthly_	g_low_2090_monthly_	FWOP	c_low_2115_monthly_	d_low_2115_monthly_	e_low_2115_monthly_	f_low_2115_monthly_	g_low_2115_monthly_	FWOP
-6%	-13%	36.9	-5%	-19%	-14%	-8%	-14%	4.8	-78%	-78%	-77%	-80%	-80%	5.2	-77%	-77%	-76%	-79%	-79%	5.8	-77%	-79%	-79%	-73%	-79%	6.3	-77%	-80%	-80%	-74%	-80%	6.9
3%	-31%	18123.7	-10%	-35%	-31%	1%	-31%	2560.4	-70%	-70%	-68%	-72%	-72%	2737.7	-70%	-70%	-68%	-72%	-72%	2973.3	-71%	-72%	-72%	-53%	-72%	3174.5	-71%	-73%	-73%	-55%	-73%	3883
-4%	-11%	12.1	-6%	-19%	-12%	-6%	-12%	1.8	-76%	-76%	-74%	-78%	-78%	2	-74%	-74%	-73%	-78%	-78%	2.2	-74%	-77%	-77%	-71%	-77%	2.4	-73%	-77%	-77%	-72%	-77%	2.7
6%	-4%	5	-6%	-16%	-4%	6%	-4%	1.2	-67%	-67%	-65%	-70%	-70%	1.3	-64%	-64%	-61%	-68%	-68%	1.5	-63%	-65%	-65%	-59%	-65%	1.6	-60%	-65%	-65%	-58%	-65%	1.8
-6%	-33%	353.7	-8%	-36%	-33%	-8%	-33%	46.7	-73%	-73%	-71%	-75%	-75%	50.1	-73%	-73%	-71%	-75%	-75%	54.5	-73%	-75%	-75%	-59%	-75%	58.3	-74%	-76%	-76%	-61%	-76%	69.5
-16%	-20%	220.1	-5%	-22%	-22%	-18%	-21%	9.5	-91%	-91%	-90%	-93%	-93%	10.4	-91%	-91%	-90%	-93%	-93%	11.5	-91%	-93%	-93%	-88%	-93%	12.5	-92%	-93%	-94%	-89%	-93%	13.7
-6%	-13%	30.8	-5%	-19%	-14%	-8%	-14%	4.1	-77%	-77%	-76%	-80%	-80%	4.5	-76%	-76%	-75%	-79%	-79%	5	-76%	-79%	-79%	-72%	-79%	5.4	-77%	-79%	-79%	-74%	-79%	5.9
-5%	-12%	32.7	-5%	-19%	-13%	-7%	-13%	4.7	-76%	-76%	-74%	-79%	-79%	5.1	-75%	-75%	-74%	-78%	-78%	5.6	-75%	-77%	-78%	-71%	-77%	6.1	-75%	-78%	-78%	-72%	-78%	6.7
-5%	-12%	52	-6%	-19%	-14%	-7%	-14%	7.1	-77%	-77%	-75%	-79%	-79%	7.8	-76%	-76%	-75%	-79%	-79%	8.6	-75%	-78%	-78%	-72%	-78%	9.4	-76%	-78%	-79%	-73%	-78%	10.4
-4%	-14%	9.2	-5%	-20%	-15%	-7%	-15%	0.9	-81%	-81%	-80%	-83%	-83%	1	-79%	-79%	-79%	-82%	-82%	1.1	-79%	-82%	-82%	-72%	-82%	1.3	-80%	-83%	-83%	-74%	-83%	1.4
-8%	-14%	18	-5%	-19%	-15%	-9%	-15%	2.1	-80%	-80%	-79%	-83%	-83%	2.3	-79%	-79%	-78%	-82%	-82%	2.5	-79%	-81%	-82%	-75%	-81%	2.7	-79%	-82%	-82%	-77%	-82%	3
-5%	-12%	15	-5%	-19%	-14%	-8%	-14%	2.1	-76%	-76%	-74%	-79%	-79%	2.3	-75%	-75%	-74%	-78%	-78%	2.5	-75%	-78%	-78%	-71%	-78%	2.7	-75%	-78%	-78%	-72%	-78%	3
-4%	-12%	8.6	-5%	-17%	-13%	-7%	-13%	1.4	-75%	-75%	-73%	-76%	-76%	1.5	-73%	-73%	-71%	-76%	-76%	1.6	-73%	-76%	-76%	-69%	-76%	1.7	-74%	-77%	-77%	-70%	-77%	1.9
-1%	-10%	8.7	-7%	-18%	-11%	-3%	-11%	1.4	-74%	-74%	-73%	-77%	-77%	1.6	-72%	-72%	-71%	-75%	-75%	1.7	-71%	-75%	-75%	-68%	-75%	1.9	-71%	-75%	-75%	-68%	-75%	2.1
0%	-9%	8.8	-7%	-18%	-9%	-2%	-10%	1.5	-72%	-72%	-71%	-75%	-75%	1.7	-71%	-71%	-69%	-74%	-74%	1.9	-69%	-73%	-73%	-67%	-73%	2.1	-69%	-73%	-73%	-67%	-73%	2.4
0%	-6%	3.4	-6%	-18%	-9%	-3%	-9%	0.6	-70%	-70%	-70%	-74%	-74%	0.7	-68%	-68%	-68%	-71%	-71%	0.8	-69%	-72%	-72%	-66%	-72%	0.8	-68%	-71%	-71%	-65%	-71%	0.9
-25%	-25%	0.4	0%	-25%	-25%	-25%	-25%	0	-100%	-100%	-100%	-100%	-100%	0	-100%	-100%	-100%	-100%	-100%	0	-100%	-100%	-100%	-100%	-100%	0	-100%	-100%	-100%	-100%	-100%	0
0%	0%	0.1	0%	0%	0%	0%	0%	0.1	0%	0%	0%	0%	0%	0.1	0%	0%	0%	0%	0%	0.1	0%	0%	0%	0%	0%	0.1	0%	0%	0%	0%	0%	0.1
-11%	-16%	2.2	0%	-18%	-14%	-9%	-14%	0.3	-80%	-80%	-73%	-80%	-80%	0.3	-81%	-81%	-75%	-81%	-81%	0.3	-76%	-82%	-82%	-76%	-82%	0.3	-79%	-84%	-84%	-79%	-84%	0.3
-11%	-17%	2.1	0%	-19%	-14%	-10%	-14%	0.2	-79%	-79%	-79%	-86%	-86%	0.2	-80%	-80%	-80%	-87%	-87%	0.2	-81%	-81%	-81%	-81%	-81%	0.3	-83%	-83%	-83%	-78%	-83%	0.3
0%	-17%	0.7	0%	-14%	-14%	-14%	-14%	0.1	-80%	-80%	-80%	-80%	-80%	0.1	-80%	-80%	-80%	-80%	-80%	0.1	-83%	-83%	-83%	-83%	-83%	0.1	-83%	-83%	-83%	-83%	-83%	0.1
-5%	-13%	26.8	-5%	-19%	-14%	-8%	-14%	3.6	-77%	-77%	-76%	-80%	-79%	3.9	-76%	-76%	-75%	-79%	-79%	4.3	-76%	-79%	-79%	-73%	-79%	4.7	-76%	-79%	-79%	-74%	-79%	5.2
-8%	-14%	4	-5%	-20%	-15%	-8%	-15%	0.5	-79%	-79%	-76%	-79%	-79%	0.6	-77%	-77%	-77%	-80%	-80%	0.6	-78%	-78%	-78%	-72%	-78%	0.7	-78%	-81%	-81%	-75%	-81%	0.7
-14%	-18%	2.5	-4%	-20%	-16%	-12%	-16%	0.2	-82%	-82%	-82%	-82%	-82%	0.3	-83%	-83%	-83%	-83%	-83%	0.3	-84%	-84%	-84%	-79%	-84%	0.3	-86%	-86%	-86%	-82%	-86%	0.3
1%	-9%	12.1	-5%	-17%	-10%	-1%	-10%	1.9	-74%	-74%	-72%	-76%	-76%	2.1	-72%	-72%	-71%	-75%	-75%	2.3	-72%	-75%	-75%	-66%	-75%	2.6	-71%	-75%	-75%	-66%	-75%	2.9
-8%	-15%	16.3	-5%	-20%	-16%	-10%	-16%	1.8	-81%	-81%	-79%	-82%	-82%	2	-80%	-80%	-79%	-82%	-82%	2.2	-80%	-82%	-82%	-76%	-82%	2.3	-80%	-83%	-83%	-78%	-83%	2.6
-4%	-11%	35.7	-6%	-18%	-13%	-6%	-13%	5.3	-75%	-75%	-74%	-78%	-78%	5.9	-74%	-74%	-73%	-77%	-77%	6.5	-74%	-76%	-77%	-70%	-76%	7	-74%	-77%	-77%	-71%	-77%	7.8
-8%	-15%	25.8	-5%	-19%	-16%	-11%	-16%	2.9	-80%	-80%	-78%	-82%	-82%	3.2	-79%	-79%	-78%	-81%	-81%	3.5	-79%	-82%	-82%	-76%	-82%	3.8	-80%	-82%	-83%	-77%	-82%	4.1
0%	0%	0.4	0%	-25%	0%	0%	0%	0.1	-67%	-67%	-67%	-67%	-67%	0.1	-67%	-67%	-33%	-67%	-67%	0.1	-33%	-67%	-67%	-33%	-67%	0.1	-50%	-50%	-50%	-50%	-50%	0.2
-97%	-98%	426	-87%	-95%	-100%	-98%	-98%	1.5	-99%	-99%	-99%	-99%	-99%	1.6	-99%	-99%	-100%	-99%	-99%	1.8	-99%	-99%	-100%	-99%	-99%	1.9	-99%	-100%	-100%	-99%	-100%	2.2
-71%	-98%	64537.5	-84%	-95%	-99%	-77%	-98%	501.1	-98%	-98%	-84%	-98%	-98%	517.3	-98%	-98%	-88%	-98%	-98%	534.7	-99%	-99%	-99%	-62%	-99%	554.7	-99%	-99%	-99%	-73%	-99%	589.2
-98%	-98%	164.2	-85%	-95%	-100%	-98%	-98%	0.5	-99%	-99%	-99%	-99%	-99%	0.5	-99%	-99%	-99%	-99%	-99%	0.6	-99%	-99%	-100%	-98%	-100%	0.6	-99%	-100%	-100%	-99%	-100%	0.7
-96%	-97%	103.8	-90%	-96%	-100%	-97%	-97%	0.4	-98%	-98%	-99%	-99%	-99%	0.4	-99%	-99%	-100%	-99%	-99%	0.5	-99%	-99%	-100%	-99%	-99%	0.6	-99%	-99%	-100%	-99%	-99%	0.6
-81%	-98%	1022.2	-82%	-95%	-99%	-84%	-98%	9.4	-98%	-98%	-88%	-98%	-98%	9.7	-98%	-98%	-92%	-98%	-98%	9.9	-99%	-99%	-99%	-74%	-99%	10.2	-99%	-99%	-99%	-82%	-99%	10.6
-98%	-98%	7682.7	-89%	-94%	-100%	-98%	-98%	37.6	-98%	-98%	-100%	-98%	-98%	39.9	-99%	-99%	-100%	-99%	-99%	42.5	-99%	-99%	-100%	-99%	-99%	45.3	-99%	-99%	-100%	-99%	-99%	49.9
-98%	-98%	368	-86%	-95%	-100%	-98%	-98%	1.2	-99%	-99%	-99%	-99%	-99%	1.3	-99%	-99%	-100%	-99%	-99%	1.4	-99%	-99%	-100%	-99%	-99%	1.6	-99%	-100%	-100%	-99%	-100%	1.8
-97%	-98%	430.9	-87%	-95%	-100%	-98%	-98%	1.5	-99%	-99%	-99%	-99%	-99%	1.6	-99%	-99%	-99%	-99%	-99%	1.7	-99%	-99%	-100%	-99%	-99%	1.9	-99%	-100%	-100%	-99%	-100%	2.1
-97%	-98%	630.5	-87%	-95%	-100%	-98%	-98%	2.1	-99%	-99%	-99%	-99%	-99%	2.3	-99%	-99%	-100%	-99%	-99%	2.5	-99%	-99%	-100%	-99%	-99%	2.7	-99%	-100%	-100%	-99%	-100%	3.1
-95%	-97%	40.9	-87%	-94%	-99%	-96%	-98%	0.2	-97%	-97%	-97%	-97%	-97%	0.2	-98%	-98%	-98%	-98%	-98%	0.2	-98%	-98%	-99%	-95%	-98%	0.2	-99%	-99%	-99%	-97%	-99%	0.3
-97%	-97%	121	-88%	-95%	-100%	-98%	-98%	0.5	-99%	-99%	-99%	-99%	-99%	0.5	-99%	-99%	-100%	-99%	-99%	0.5	-99%	-99%	-100%	-99%	-99%	0.6	-99%	-99%	-100%	-99%	-100%	0.7
-98%	-98%	222.1	-86%	-95%	-100%	-98%	-98%	0.7	-99%	-99%	-99%	-99%	-99%	0.8	-99%	-99%	-100%	-99%	-99%	0.9	-99%	-99%	-100%	-99%	-99%	0.9	-99%	-100%	-100%	-99%	-100%	1.1
-97%	-97%	81.2	-87%	-95%	-100%	-98%	-98%	0.3	-99%	-99%	-100%	-99%	-99%	0.3	-99%	-99%	-100%	-99%	-99%	0.3	-99%	-99%	-100%	-99%	-100%	0.4	-99%	-100%	-100%	-99%	-100%	0.4
-98%	-98%	72.2	-86%	-94%	-100%	-98%	-98%	0.2	-99%	-99%	-100%	-99%	-99%	0.3	-99%	-99%	-100%	-99%	-99%	0.3	-99%	-99%	-100%	-98%	-99%	0.3	-99%	-99%	-100%	-99%	-100%	0.3
-98%	-99%	142.5	-84%	-94%	-100%	-98%	-99%	0.4	-99%	-99%	-99%	-99%	-99%	0.4	-99%	-99%	-99%	-99%	-99%	0.4	-99%	-99%	-100%	-99%	-100%	0.5	-100%	-100%	-100%	-99%	-100%	0.5
-96%	-97%	40.3	-88%	-96%	-100%	-97%	-98%	0.2	-98%	-98%	-99%	-99%	-99%	0.2	-99%	-99%	-99%	-99%	-99%	0.2	-99%	-100%	-100%	-99%	-100%	0.2	-99%	-100%	-100%	-99%	-100%	0.2
-100%	-100%	0.9	-78%	-89%	-100%	-100%	-100%	0	-100%	-100%	-100%	-100%	-100%	0	-100%	-100%	-100%	-100%	-100%	0	-100%	-100%	-100%	-100%	-100%	0	-100%	-100%	-100%	-100%	-100%	0
-97%	-99%	18.6	-83%	-94%	-99%	-98%	-99%	0.1	-98%	-98%	-98%	-100%	-100%	0.1	-99%	-99%	-99%	-100%	-100%	0.1	-99%	-99%	-100%	-97%	-100%	0.1	-99%	-99%	-100%	-98%	-100%	0.1
-97%	-99%	18.5	-83%	-94%	-99%	-98%	-99%	0.1	-98%	-98%	-98%	-100%	-100%	0.1	-99%	-99%	-99%	-100%	-100%	0.1	-99%	-99%	-100%	-98%	-100%	0.1	-99%	-99%	-100%	-98%	-100%	0.1
-97%	-98%	15.7	-83%	-94%	-99%	-97%	-99%	0.1	-98%	-98%	-98%	-100%	-100%	0.1	-98%	-98%	-98%	-100%	-100%	0.1	-99%	-99%	-100%	-96%	-100%	0.1	-99%	-99%	-100%	-98%	-100%	0.1
-97%	-98%	324.4	-87%	-95%	-100%	-98%	-98%	1.1	-99%	-99%	-99%	-99%	-99%	1.2	-99%	-99%	-100%	-99%	-99%	1.3	-99%	-99%	-100%	-99%	-99%	1.4	-99%	-100%	-100%	-99%	-100%	1.6
-98%	-99%	43.6	-82%	-94%	-100%	-98%	-99%	0.1	-99%	-99%	-99%	-99%	-99%	0.1	-99%	-99%	-99%	-99%	-99%	0.1	-100%	-100%	-100%	-98%	-100%	0.1	-100%	-100%	-100%	-99%	-100%	0.1
-97%	-99%	34.1	-84%	-94%	-99%	-97%	-99%	0.1	-99%	-99%	-98%	-99%	-99%	0.1	-99%	-99%	-99%	-99%	-99%	0.2	-99%	-99%	-99%	-97%	-99%	0.2	-99%	-100%	-100%	-98%	-100%	0.2
-96%	-97%	100.4	-90%	-95%	-100%	-97%	-98%	0.5	-97%	-97%	-98%	-97%	-97%	0.5	-98%	-98%	-98%	-98%	-98%	0.5	-98%	-99%	-99%	-97%	-99%	0.6	-99%	-99%	-99%	-98%	-99%	0.7
-97%	-97%	319.2	-88%	-95%	-100%	-98%	-98%	1.1	-99%	-99%	-99%	-99%	-99%	1.2	-99%	-99%	-100%	-99%	-99%	1.3	-99%	-99%	-100%	-99%	-99%	1.4	-99%	-100%	-100%	-99%	-100%	1.7
-98%	-98%	311.3	-86%	-95%	-100%	-98%	-98%	1	-99%	-99%	-99%	-99%	-99%	1.1	-99%	-99%	-99%	-99%	-99%	1.2	-99%	-99%	-100%	-99%	-100%	1.3	-99%	-100%	-100%	-99%	-100%	1.5
-98%	-98%	264.2	-85%	-94%	-100%	-98%	-99%	0.8	-99%	-99%	-99%	-99%	-99%	0.9	-99%	-99%	-99%	-99%	-99%	0.9	-99%	-99%	-100%	-99%	-99%	1	-99%	-100%	-100%	-99%	-100%	1.1
-97%	-48%	2162.5	-96%	-96%	-96%	-97%	-38%	20.7	-97%	-97%	-97%	-99%	-97%	22.4	-97%	-97%	-97%	-99%	-97%	24.3	-98%	-98%	-98%	-99%	-98%	26.2	-99%	-99%	-99%	-100%	-99%	28.8
-92%	-57%	152403.3	-91%	-92%	-96%	-92%	-46%	2853.3	-96%	-96%	-96%	-97%	-96%	3122.9	-97%	-97%	-96%	-98%	-97%	3521.6	-97%	-97%	-97%	-98%	-97%	3954.9	-99%	-99%	-99%	-99%	-99%	4526.4
-97%	-48%	722.3	-96%	-97%	-96%	-98%	-38%	6.4	-97%	-97%	-97%	-99%	-97%	6.9	-97%	-97%	-97%	-99%	-97%	7.4	-98%	-98%	-98%	-99%	-98%	7.9	-99%	-99%	-99%	-100%	-99%	8.6
-97%	-48%	535.8	-96%	-97%	-96%	-97%	-38%	4.9	-97%	-97%	-97%	-99%	-97%	5.3	-97%	-97%	-97%	-99%	-97%	5.8	-98%	-98%	-98%	-99%	-98%	6.2	-99%	-99%	-99%	-100%	-99%	6.8
-93%	-56%	2877.1	-92%	-92%	-96%	-93%	-44%	50.8	-96%	-96%	-96%	-98%	-96%	55.5	-97%	-97%	-96%	-98%	-97%	62.4	-97%	-97%	-97%	-98%	-97%	69.9	-99%	-99%	-99%	-99%	-99%	79.8
-97%	-54%	3757.1	-97%	-97%	-97%	-97%	-46%	32.8	-97%	-97%	-96%	-99%	-97%	35.5	-97%	-97%	-97%	-99%	-97%	38.6	-98%	-98%	-98%	-99%	-98%	41.8	-99%	-99%	-99%	-100%	-99%	46.1
-97%	-47%	1538.4	-96%	-97%	-96%	-97%	-38%	14.5	-97%	-97%	-97%	-99%	-97%	15.7	-97%	-97%	-97%	-99%	-97%	17	-98%	-98%	-98%	-99%	-98%	18.3	-99%	-99%	-99%	-100%	-99%	20.1
-97%	-47%	1767.8	-96%	-97%	-96%	-97%	-38%	16.8	-97%	-97%	-97%	-99%	-97%	18.1	-97%	-97%	-97%	-99%	-97%	19.6	-98%	-98%	-98%	-99%	-98%	21.1	-99%	-99%	-99%	-99%	-99%	23.1
-97%	-48%	3208	-96%	-96%	-96%	-97%	-38%	30.4	-97%	-97%	-97%	-99%	-97%	32.9	-97%	-97%	-97%	-99%	-97%	35.7	-98%	-98%	-98%	-99%	-98%	38.5	-99%	-99%	-99%	-100%	-99%	42.2
-97%	-48%	235.4	-96%	-96%	-96%	-97%	-39%	2.1	-97%	-97%	-96%	-99%	-97%	2.3	-97%	-97%	-97%	-99%	-97%	2.6	-98%	-98%	-98%	-98%	-98%	2.8	-99%	-99%	-99%	-99%	-99%	3.1
-97%	-47%	1087.8	-96%	-96%	-96%	-97%	-38%	10.3	-97%	-97%	-97%	-99%	-97%	11.1	-97%	-97%	-97%	-99%	-97%	12.1	-98%	-98%	-98%	-99%	-98%	13.1	-99%	-99%	-99%	-100%	-99%	14.3

-97%	-48%	871	-96%	-96%	-96%	-97%	-39%	8.5	-97%	-97%	-96%	-99%	-97%	9.2	-97%	-97%	-97%	-99%	-97%	10	-98%	-98%	-98%	-99%	-98%	10.8	-99%	-99%	-99%	-99%	-99%	11.9
-97%	-47%	513.8	-96%	-96%	-96%	-97%	-38%	5	-97%	-97%	-97%	-99%	-97%	5.5	-97%	-97%	-97%	-99%	-97%	5.9	-98%	-98%	-98%	-99%	-98%	6.4	-99%	-99%	-99%	-100%	-99%	7.1
-97%	-47%	689.9	-96%	-96%	-96%	-97%	-38%	6.9	-97%	-97%	-97%	-99%	-97%	7.4	-97%	-97%	-97%	-99%	-97%	8.1	-98%	-98%	-98%	-99%	-98%	8.8	-99%	-99%	-99%	-100%	-99%	9.7
-97%	-47%	214.4	-96%	-97%	-96%	-97%	-38%	2.1	-97%	-97%	-96%	-99%	-97%	2.2	-97%	-97%	-97%	-99%	-97%	2.4	-98%	-98%	-98%	-99%	-98%	2.6	-99%	-99%	-99%	-99%	-99%	2.8
-97%	-48%	382.4	-96%	-96%	-96%	-97%	-38%	3.8	-97%	-97%	-96%	-99%	-97%	4.2	-97%	-97%	-97%	-99%	-97%	4.5	-98%	-98%	-98%	-99%	-98%	4.9	-99%	-99%	-99%	-100%	-99%	5.5
-97%	-47%	65.9	-97%	-97%	-97%	-98%	-38%	0.5	-97%	-97%	-97%	-99%	-97%	0.6	-98%	-98%	-97%	-99%	-98%	0.6	-98%	-98%	-98%	-99%	-98%	0.7	-99%	-99%	-99%	-100%	-99%	0.7
-98%	-47%	49.1	-97%	-97%	-97%	-98%	-38%	0.4	-98%	-98%	-97%	-99%	-97%	0.4	-97%	-97%	-97%	-99%	-97%	0.4	-98%	-98%	-98%	-99%	-98%	0.5	-99%	-99%	-99%	-100%	-99%	0.5
-98%	-48%	233.3	-97%	-97%	-97%	-98%	-38%	1.9	-97%	-97%	-97%	-99%	-97%	2	-97%	-97%	-97%	-99%	-97%	2.2	-98%	-98%	-98%	-99%	-98%	2.4	-99%	-99%	-99%	-100%	-99%	2.5
-98%	-48%	184.2	-97%	-97%	-97%	-98%	-38%	1.5	-97%	-97%	-97%	-99%	-97%	1.6	-98%	-98%	-97%	-99%	-98%	1.8	-98%	-98%	-98%	-99%	-98%	1.9	-99%	-99%	-99%	-100%	-99%	2
-98%	-47%	172.1	-97%	-97%	-97%	-98%	-37%	1.4	-97%	-97%	-97%	-99%	-97%	1.5	-98%	-98%	-97%	-99%	-97%	1.6	-98%	-98%	-98%	-99%	-98%	1.7	-99%	-99%	-99%	-100%	-99%	1.8
-97%	-47%	1349.1	-96%	-96%	-96%	-97%	-38%	12.8	-97%	-97%	-97%	-99%	-97%	13.8	-97%	-97%	-97%	-99%	-97%	15	-98%	-98%	-98%	-99%	-98%	16.2	-99%	-99%	-99%	-100%	-99%	17.7
-97%	-47%	189.3	-96%	-97%	-96%	-97%	-38%	1.7	-97%	-97%	-97%	-99%	-97%	1.9	-97%	-97%	-97%	-99%	-97%	2	-98%	-98%	-98%	-99%	-98%	2.2	-99%	-99%	-99%	-100%	-99%	2.4
-98%	-47%	285	-97%	-97%	-97%	-98%	-38%	2.3	-97%	-97%	-97%	-99%	-97%	2.5	-98%	-98%	-97%	-99%	-97%	2.7	-98%	-98%	-98%	-99%	-98%	2.8	-99%	-99%	-99%	-100%	-99%	3.1
-97%	-48%	456.5	-96%	-96%	-96%	-97%	-39%	4.5	-97%	-97%	-96%	-99%	-97%	4.9	-97%	-97%	-97%	-99%	-97%	5.4	-98%	-98%	-98%	-98%	-98%	5.9	-99%	-99%	-99%	-99%	-99%	6.5
-97%	-47%	1793.7	-96%	-97%	-96%	-97%	-38%	16.2	-97%	-97%	-97%	-99%	-97%	17.5	-97%	-97%	-97%	-99%	-97%	18.9	-98%	-98%	-98%	-99%	-98%	20.4	-99%	-99%	-99%	-100%	-99%	22.3
-97%	-48%	1414.3	-96%	-96%	-96%	-97%	-39%	14.2	-97%	-97%	-96%	-99%	-97%	15.4	-97%	-97%	-97%	-99%	-97%	16.7	-98%	-98%	-98%	-99%	-98%	18.1	-99%	-99%	-99%	-99%	-99%	20
-97%	-47%	1002.6	-96%	-96%	-96%	-97%	-38%	9.6	-97%	-97%	-97%	-99%	-97%	10.4	-97%	-97%	-97%	-99%	-97%	11.2	-98%	-98%	-98%	-99%	-98%	12.1	-99%	-99%	-99%	-100%	-99%	13.3
-97%	-47%	97.9	-96%	-96%	-96%	-97%	-38%	1	-97%	-97%	-96%	-99%	-97%	1.1	-97%	-97%	-97%	-99%	-97%	1.2	-98%	-98%	-98%	-99%	-98%	1.3	-99%	-99%	-99%	-100%	-99%	1.4
-12%	-1%	108.5	-67%	-70%	-67%	-13%	-1%	13.1	-85%	-85%	-84%	-85%	-85%	13.8	-85%	-85%	-84%	-85%	-85%	14.6	-85%	-85%	-85%	-86%	-85%	15.2	-86%	-86%	-86%	-86%	-86%	15.9
-1%	-1%	121306.3	-16%	-17%	-16%	-1%	-1%	39727.1	-66%	-66%	-66%	-66%	-66%	40140.4	-66%	-66%	-65%	-66%	-66%	40228.4	-66%	-66%	-66%	-66%	-66%	48167.8	-63%	-63%	-63%	-66%	-63%	60158
-4%	0%	74.8	-65%	-68%	-67%	-4%	0%	10.6	-83%	-83%	-83%	-83%	-83%	11.2	-83%	-83%	-83%	-83%	-83%	11.7	-83%	-83%	-83%	-83%	-83%	12.1	-83%	-83%	-83%	-84%	-83%	12.6
-10%	-1%	9.8	-61%	-64%	-59%	-11%	-2%	1.2	-85%	-85%	-83%	-85%	-85%	1.3	-85%	-85%	-83%	-85%	-85%	1.3	-85%	-85%	-85%	-85%	-85%	1.4	-85%	-85%	-85%	-86%	-85%	1.5
-11%	-1%	6206.8	-36%	-37%	-36%	-12%	-1%	1533.1	-71%	-71%	-71%	-71%	-71%	1550.1	-72%	-72%	-71%	-72%	-72%	1555.1	-73%	-73%	-73%	-73%	-73%	1864.5	-71%	-71%	-71%	-74%	-71%	2330
-51%	-3%	1702.1	-89%	-90%	-85%	-52%	-3%	69.7	-94%	-94%	-94%	-94%	-94%	73.7	-94%	-94%	-94%	-94%	-94%	77.9	-95%	-95%	-95%	-95%	-95%	82.3	-95%	-95%	-95%	-95%	-95%	86.6
-10%	-1%	103.6	-67%	-69%	-68%	-11%	-1%	13.1	-84%	-84%	-84%	-84%	-84%	13.8	-84%	-84%	-84%	-84%	-84%	14.5	-85%	-85%	-85%	-85%	-85%	15.1	-85%	-85%	-85%	-85%	-85%	15.7
-12%	-1%	122.5	-68%	-71%	-69%	-12%	-1%	15	-84%	-84%	-84%	-84%	-84%	15.9	-85%	-85%	-84%	-85%	-85%	16.7	-85%	-85%	-85%	-85%	-85%	17.3	-85%	-85%	-85%	-86%	-85%	18.1
-7%	-1%	293.6	-66%	-68%	-67%	-7%	-1%	39.4	-83%	-83%	-83%	-83%	-83%	41.6	-83%	-83%	-83%	-84%	-83%	43.6	-84%	-84%	-84%	-84%	-84%	45.3	-84%	-84%	-84%	-84%	-84%	47.1
-4%	-1%	14.8	-64%	-66%	-66%	-3%	-1%	2.1	-83%	-83%	-83%	-83%	-83%	2.2	-83%	-83%	-83%	-83%	-83%	2.3	-83%	-83%	-83%	-83%	-83%	2.4	-83%	-83%	-83%	-84%	-83%	2.5
-9%	-1%	63.3	-65%	-68%	-66%	-9%	-1%	8.1	-84%	-84%	-84%	-84%	-84%	8.5	-84%	-84%	-84%	-84%	-84%	9	-85%	-85%	-85%	-85%	-85%	9.4	-85%	-85%	-85%	-85%	-85%	9.8
-16%	-2%	25.2	-68%	-70%	-67%	-17%	-2%	2.9	-85%	-85%	-85%	-85%	-85%	3	-86%	-86%	-85%	-86%	-85%	3.2	-86%	-86%	-86%	-86%	-86%	3.4	-87%	-87%	-87%	-87%	-86%	3.5
-6%	-1%	43.4	-65%	-68%	-66%	-6%	-1%	5.9	-83%	-83%	-83%	-83%	-83%	6.2	-83%	-83%	-83%	-83%	-83%	6.5	-84%	-84%	-84%	-84%	-84%	6.8	-84%	-84%	-84%	-84%	-84%	7
-10%	-1%	36.6	-66%	-68%	-66%	-10%	-1%	4.6	-84%	-84%	-84%	-84%	-84%	4.9	-84%	-84%	-84%	-84%	-84%	5.2	-85%	-85%	-85%	-85%	-85%	5.4	-85%	-85%	-85%	-85%	-85%	5.6
-19%	-1%	10.3	-72%	-74%	-72%	-19%	-1%	1.1	-86%	-86%	-86%	-86%	-86%	1.2	-87%	-87%	-86%	-87%	-86%	1.2	-87%	-87%	-87%	-87%	-87%	1.3	-88%	-88%	-87%	-88%	-87%	1.3
-3%	0%	129.3	-64%	-67%	-67%	-3%	0%	18.6	-83%	-83%	-83%	-83%	-83%	19.6	-83%	-83%	-83%	-83%	-83%	20.5	-83%	-83%	-83%	-83%	-83%	21.2	-83%	-83%	-83%	-83%	-83%	22
-8%	-1%	14.9	-67%	-70%	-68%	-9%	-1%	1.9	-84%	-84%	-84%	-84%	-84%	2	-84%	-84%	-84%	-84%	-84%	2.1	-84%	-84%	-84%	-84%	-84%	2.2	-85%	-85%	-85%	-85%	-85%	2.3
-9%	-1%	14.8	-68%	-70%	-69%	-9%	-1%	1.9	-84%	-84%	-84%	-84%	-84%	2	-84%	-84%	-84%	-84%	-84%	2.1	-84%	-84%	-84%	-84%	-84%	2.2	-84%	-84%	-84%	-85%	-84%	2.3
-5%	0%	27.5	-66%	-69%	-68%	-5%	0%	3.8	-83%	-83%	-83%	-83%	-83%	4	-83%	-83%	-83%	-83%	-83%	4.2	-84%	-84%	-84%	-84%	-84%	4.3	-84%	-84%	-84%	-84%	-84%	4.5
-11%	-1%	91.6	-67%	-70%	-68%	-11%	-1%	11.4	-84%	-84%	-84%	-84%	-84%	12	-84%	-84%	-84%	-84%	-84%	12.6	-85%	-85%	-85%	-85%	-85%	13.1	-85%	-85%	-85%	-86%	-85%	13.7
-3%	-1%	12	-64%	-68%	-67%	-4%	-1%	1.7	-82%	-82%	-82%	-82%	-82%	1.8	-83%	-83%	-83%	-83%	-83%	1.9	-83%	-83%	-83%	-83%	-83%	1.9	-83%	-83%	-83%	-83%	-83%	2
-7%	-1%	47.8	-67%	-69%	-68%	-7%	-1%	6.5	-83%	-83%	-83%	-83%	-83%	6.8	-83%	-83%	-83%	-83%	-83%	7.1	-84%	-84%	-84%	-84%	-84%	7.4	-84%	-84%	-84%	-84%	-84%	7.7
-5%	-1%	23	-63%	-66%	-65%	-5%	-1%	3.2	-83%	-83%	-83%	-83%	-83%	3.4	-83%	-83%	-83%	-83%	-83%	3.6	-83%	-83%	-83%	-84%	-83%	3.7	-84%	-84%	-84%	-84%	-84%	3.9
-3%	0%	253	-64%	-67%	-66%	-3%	0%	36.1	-83%	-83%	-83%	-83%	-83%	38.1	-83%	-83%	-83%	-83%	-83%	39.8	-83%	-83%	-83%	-83%	-83%	41.2	-83%	-83%	-83%	-84%	-83%	42.9
-30%	-2%	40.6	-74%	-76%	-70%	-32%	-2%	3.3	-89%	-89%	-88%	-89%	-89%	3.6	-89%	-89%	-88%	-89%	-89%	3.8	-90%	-90%	-90%	-90%	-90%	4	-90%	-90%	-90%	-90%	-90%	4.3
-10%	-1%	93.8	-68%	-70%	-69%	-11%	-1%	11.9	-84%	-84%	-84%	-84%	-84%	12.6	-84%	-84%	-84%	-84%	-84%	13.2	-85%	-85%	-85%	-85%	-85%	13.7	-85%	-85%	-85%	-85%	-85%	14.2
-2%	0%	119.4	-64%	-67%	-67%	-2%	0%	17.3	-82%	-82%	-82%	-82%	-82%	18.2	-82%	-82%	-82%	-83%	-82%	19.1	-83%	-83%	-83%	-83%	-83%	19.7	-83%	-83%	-83%	-83%	-83%	20.5

2140				
c_low_2140_monthly_	d_low_2140_monthly_	e_low_2140_monthly_	f_low_2140_monthly_	g_low_2140_monthly_
-78%	-80%	-80%	-76%	-80%
-70%	-72%	-72%	-56%	-72%
-74%	-77%	-77%	-72%	-77%
-58%	-62%	-62%	-56%	-62%
-74%	-75%	-75%	-62%	-75%
-92%	-94%	-94%	-91%	-94%
-77%	-80%	-80%	-75%	-80%
-76%	-79%	-79%	-74%	-79%
-77%	-79%	-79%	-74%	-79%
-80%	-83%	-84%	-75%	-83%
-80%	-83%	-83%	-78%	-83%
-77%	-79%	-79%	-74%	-79%
-74%	-77%	-77%	-72%	-77%
-71%	-75%	-75%	-69%	-75%
-68%	-72%	-72%	-67%	-72%
-68%	-71%	-71%	-65%	-71%
-100%	-100%	-100%	-100%	-100%
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-82%	-82%	-82%	-77%	-82%
-86%	-86%	-86%	-81%	-86%
-86%	-86%	-86%	-86%	-86%
-77%	-80%	-80%	-75%	-80%
-78%	-80%	-80%	-75%	-80%
-84%	-88%	-88%	-84%	-88%
-71%	-74%	-74%	-67%	-74%
-82%	-83%	-83%	-79%	-83%
-74%	-77%	-77%	-72%	-77%
-81%	-83%	-83%	-79%	-83%
-50%	-50%	-50%	-50%	-50%
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-99%	-99%	-99%	-100%	*-99%*
-86%	-86%	-86%	*-86%*	*-86%*
-51%	-51%	-51%	*-45%*	*-51%*
-84%	-84%	-84%	*-84%*	*-83%*
-86%	-86%	-86%	*-86%*	*-86%*
-63%	-63%	-63%	*-58%*	*-63%*
-95%	-95%	-95%	*-96%*	*-95%*
-85%	-85%	-85%	*-85%*	*-85%*
-86%	-86%	-86%	*-86%*	*-85%*
-84%	-84%	-84%	*-85%*	*-84%*
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-83%	-83%	-83%	*-84%*	*-83%*
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-85%	-85%	-85%	*-86%*	*-85%*
-83%	-83%	-83%	*-83%*	*-83%*
-84%	-84%	-84%	*-84%*	*-84%*
-84%	-84%	-84%	*-84%*	*-83%*
-83%	-83%	-83%	*-84%*	*-83%*
-90%	-90%	-90%	*-90%*	*-90%*
-85%	-85%	-85%	*-85%*	*-85%*
-83%	-83%	-83%	*-83%*	*-83%*

***** COUNT FOR DISPLACED PEOPLE IN RETREAT AREAS FOR ALT F AND G*****

	Base			100y																					
				2040						2065						2090						2115			
	Reach	Social Factor Category	Variable	FWOP	c_inter_2 040_100y –	d_inter_2 040_100y –	e_inter_2 040_100y –	f_inter_2 040_100y –	g_inter_2 040_100y –	FWOP	c_inter_2 065_100y –	d_inter_2 065_100y –	e_inter_2 065_100y –	f_inter_2 065_100y –	g_inter_2 065_100y –	FWOP	c_inter_2 090_100y –	d_inter_2 090_100y –	e_inter_2 090_100y –	f_inter_2 090_100y –	g_inter_2 090_100y –	FWOP	c_inter_2 115_100y –	d_inter_2 115_100y –	e_inter_2 115_100y –
1	Reach 1	economic vitality	In Labor Force	28	0%	-1%	-8%	-13%	-13%	35.7	-5%	-15%	-11%	-14%	-15%	62.2	-18%	-32%	-28%	-25%	-28%	373.5	-78%	-82%	-79%
2	Reach 1	economic vitality	Median Income per Household	14,856	-4%	-4%	-23%	-28%	-28%	17815.6	-10%	-14%	-24%	-31%	-32%	24806.1	-17%	-40%	-36%	-13%	-36%	128281.9	-72%	-81%	-77%
4	Reach 1	economic vitality	Not in Labor Force	10	-1%	-2%	-5%	-11%	-11%	11.8	-6%	-14%	-8%	-13%	-14%	19.2	-17%	-30%	-25%	-21%	-26%	205.8	-87%	-89%	-86%
5	Reach 1	economic vitality	Owner Occupied Units	5	-2%	-2%	2%	-4%	-4%	5	-8%	-8%	2%	-4%	-6%	6.2	-15%	-23%	-10%	-3%	-13%	48.1	-77%	-78%	-69%
6	Reach 1	economic vitality	Median Gross Rent	288	-2%	-3%	-26%	-30%	-30%	346.9	-8%	-13%	-27%	-33%	-33%	499	-16%	-41%	-38%	-20%	-38%	2507.9	-71%	-81%	-78%
7	Reach 1	economic vitality	Total Jobs	148	1%	-1%	-18%	-21%	-21%	209.6	-4%	-21%	-20%	-22%	-22%	437.1	-19%	-36%	-36%	-34%	-35%	1641.9	-69%	-78%	-77%
8	Reach 1	economic vitality	Total Households	24	0%	-2%	-8%	-12%	-12%	29.8	-5%	-14%	-10%	-14%	-15%	51.6	-18%	-31%	-28%	-24%	-28%	343.2	-80%	-84%	-81%
9	Reach 1	economic vitality	Total Housing Units	25	0%	-2%	-7%	-12%	-12%	31.7	-5%	-14%	-9%	-13%	-14%	54	-18%	-31%	-27%	-24%	-27%	378.5	-80%	-84%	-81%
14	Reach 1	health and safety	Total Population	40	-1%	-2%	-7%	-12%	-12%	50.4	-5%	-14%	-10%	-13%	-14%	85.9	-18%	-31%	-27%	-24%	-27%	632.5	-81%	-85%	-82%
15	Reach 1	social connectedness	Public Transit User with No Vehicle	7	1%	-1%	-9%	-13%	-13%	8.8	-3%	-15%	-11%	-15%	-15%	15.8	-18%	-32%	-28%	-25%	-29%	62.1	-66%	-73%	-69%
16	Reach 1	social connectedness	Commutes over 30 mins a day	14	0%	-1%	-10%	-13%	-14%	17.4	-5%	-16%	-12%	-16%	-16%	31.1	-18%	-32%	-29%	-26%	-29%	177.7	-77%	-82%	-79%
17	Reach 1	social connectedness	Commutes under 30 mins a day	12	0%	-2%	-7%	-12%	-12%	14.5	-5%	-14%	-10%	-14%	-14%	24.9	-18%	-31%	-27%	-24%	-28%	158	-79%	-83%	-80%
18	Reach 1	social connectedness	Commutes with Car, Truck, or Van	7	2%	0%	-6%	-11%	-11%	8.3	-5%	-13%	-8%	-12%	-13%	14	-16%	-30%	-26%	-23%	-26%	83.7	-77%	-81%	-78%
19	Reach 1	social connectedness	Commutes with Public Transit	7	-1%	-3%	-4%	-10%	-10%	8.5	-6%	-13%	-7%	-11%	-13%	13.2	-17%	-29%	-23%	-18%	-23%	102.2	-81%	-84%	-79%
21	Reach 1	social vulnerability and resiliency	Age older than 65	7	-1%	-1%	-1%	-7%	-8%	8.6	-6%	-10%	-5%	-9%	-10%	12.7	-17%	-28%	-20%	-15%	-21%	135.5	-85%	-87%	-83%
22	Reach 1	social vulnerability and resiliency	Age under 18	3	0%	-4%	0%	-7%	-7%	3.3	-6%	-9%	-3%	-9%	-9%	5	-18%	-28%	-20%	-16%	-22%	61.2	-88%	-89%	-86%
23	Reach 1	social vulnerability and resiliency	Education 12th Grade with No Diploma	0	0%	0%	-33%	-33%	-33%	0.4	0%	-25%	-25%	-25%	-25%	0.9	-22%	-33%	-44%	-33%	-33%	12.5	-92%	-94%	-94%
24	Reach 1	social vulnerability and resiliency	Education GED or Alternate Degree	0	0%	0%	0%	0%	0%	0.1	0%	0%	0%	0%	0%	0.1	0%	0%	0%	0%	0%	10.3	-99%	-99%	-99%
25	Reach 1	social vulnerability and resiliency	Education Equivalent to High School Degree	2	0%	0%	-13%	-13%	-13%	2.1	0%	-14%	-14%	-14%	-14%	4.1	-17%	-32%	-32%	-29%	-32%	44.3	-89%	-92%	-91%
26	Reach 1	social vulnerability and resiliency	Education High School Diploma	2	0%	0%	-13%	-13%	-13%	2.1	-5%	-19%	-19%	-19%	-19%	4	-18%	-33%	-33%	-30%	-33%	34	-86%	-89%	-89%
27	Reach 1	social vulnerability and resiliency	Households in Poverty	1	0%	0%	0%	-20%	-20%	0.7	0%	-14%	-14%	-14%	-14%	1.3	-15%	-31%	-31%	-31%	-31%	31.6	-95%	-96%	-96%
28	Reach 1	social vulnerability and resiliency	Households without Disability	20	0%	-1%	-7%	-12%	-12%	26	-5%	-15%	-10%	-14%	-15%	44.8	-18%	-31%	-27%	-24%	-28%	249.6	-76%	-81%	-77%
29	Reach 1	social vulnerability and resiliency	Households with Disability	3	0%	0%	-7%	-13%	-13%	3.9	-5%	-15%	-10%	-15%	-15%	6.8	-18%	-31%	-28%	-25%	-28%	93.7	-90%	-92%	-91%
30	Reach 1	social vulnerability and resiliency	Poverty	2	0%	0%	-17%	-17%	-17%	2.4	-4%	-17%	-17%	-17%	-17%	4.7	-19%	-34%	-32%	-30%	-32%	65.9	-91%	-93%	-93%
31	Reach 1	social vulnerability and resiliency	Linguistic Isolation	10	0%	-1%	-3%	-8%	-8%	11.9	-5%	-12%	-6%	-10%	-12%	18.4	-16%	-28%	-22%	-17%	-23%	76.8	-65%	-70%	-62%
33	Reach 1	social vulnerability and resiliency	Minority (Non-White)	12	0%	-2%	-10%	-14%	-14%	15.7	-4%	-16%	-13%	-16%	-17%	28.7	-18%	-32%	-30%	-28%	-30%	299.1	-88%	-90%	-89%
34	Reach 1	social vulnerability and resiliency	White	28	-1%	-2%	-6%	-11%	-11%	34.7	-5%	-13%	-8%	-12%	-13%	57.1	-17%	-30%	-25%	-22%	-26%	333.4	-76%	-80%	-76%
35	Reach 1	social vulnerability and resiliency	Renter Occupied Units	19	1%	-1%	-10%	-14%	-14%	24.8	-4%	-16%	-13%	-16%	-17%	45.5	-18%	-33%	-30%	-28%	-30%	295.2	-80%	-85%	-83%
36	Reach 1	social vulnerability and resiliency	Single Parent	0	0%	0%	33%	0%	0%	0.4	0%	0%	0%	0%	0%	0.4	0%	0%	0%	0%	0%	17	-95%	-96%	-94%
38	Reach 2	economic vitality	In Labor Force	193	-83%	-82%	-100%	-96%	-96%	408.3	-87%	-87%	-100%	-98%	-97%	1063.6	-93%	-97%	-99%	-98%	-98%	1962.2	-93%	-96%	-97%
39	Reach 2	economic vitality	Median Income per Household	28,800	-84%	-84%	-90%	-96%	-96%	61927.2	-84%	-83%	-95%	-97%	-97%	174226.9	-91%	-97%	-99%	-91%	-98%	419295.1	-94%	-97%	-98%
41	Reach 2	economic vitality	Not in Labor Force	74	-80%	-80%	-99%	-97%	-97%	157.9	-85%	-85%	-99%	-98%	-98%	401.3	-91%	-96%	-98%	-98%	-98%	808.1	-92%	-95%	-96%
42	Reach 2	economic vitality	Owner Occupied Units	50	-87%	-87%	-100%	-95%	-95%	98.8	-90%	-89%	-100%	-97%	-96%	257.9	-94%	-98%	-99%	-98%	-98%	474.3	-95%	-98%	-99%
43	Reach 2	economic vitality	Median Gross Rent	457	-84%	-84%	-92%	-96%	-96%	982.2	-82%	-82%	-96%	-97%	-97%	2631.2	-90%	-97%	-99%	-93%	-98%	6811.5	-93%	-97%	-98%
44	Reach 2	economic vitality	Total Jobs	3,133	-81%	-81%	-100%	-95%	-95%	7378.4	-89%	-89%	-100%	-98%	-98%	25308.9	-96%	-98%	-99%	-99%	-99%	43512.4	-96%	-97%	-98%
45	Reach 2	economic vitality	Total Households	165	-81%	-81%	-100%	-97%	-96%	353.4	-86%	-86%	-100%	-98%	-98%	920.7	-92%	-97%	-99%	-98%	-98%	1747.1	-93%	-96%	-97%
46	Reach 2	economic vitality	Total Housing Units	193	-82%	-81%	-100%	-96%	-96%	413.7	-86%	-86%	-100%	-98%	-98%	1097.4	-92%	-97%	-99%	-98%	-98%	2083.1	-93%	-96%	-97%
51	Reach 2	health and safety	Total Population	286	-82%	-82%	-100%	-96%	-96%	604.7	-86%	-86%	-100%	-98%	-97%	1566.2	-92%	-97%	-99%	-98%	-98%	2975.1	-93%	-96%	-97%
52	Reach 2	social connectedness	Public Transit User with No Vehicle	18	-80%	-80%	-98%	-95%	-95%	39.3	-87%	-87%	-99%	-97%	-97%	118.3	-94%	-97%	-99%	-98%	-98%	217.2	-94%	-97%	-98%
53	Reach 2	social connectedness	Commutes over 30 mins a day	56	-84%	-83%	-100%	-96%	-96%	115.8	-87%	-87%	-100%	-97%	-97%	300.3	-93%	-97%	-99%	-98%	-98%	557.5	-93%	-96%	-97%
54	Reach 2	social connectedness	Commutes under 30 mins a day	99	-81%	-81%	-100%	-97%	-96%	213.3	-86%	-86%	-100%	-98%	-98%	558.5	-92%	-97%	-99%	-98%	-98%	1030.3	-93%	-96%	-97%
55	Reach 2	social connectedness	Commutes with Car, Truck, or Van	37	-83%	-83%	-100%	-96%	-96%	77.7	-87%	-87%	-100%	-97%	-97%	199.4	-93%	-97%	-99%	-98%	-98%	374.3	-93%	-96%	-97%
56	Reach 2	social connectedness	Commutes with Public Transit	32	-80%	-80%	-100%	-97%	-97%	69.5	-86%	-86%	-100%	-98%	-98%	185	-92%	-96%	-99%	-98%	-98%	341.3	-93%	-96%	-97%
58	Reach 2	social vulnerability and resiliency	Age older than 65	62	-79%	-78%	-100%	-98%	-97%	137.3	-84%	-84%	-99%	-98%	-98%	349	-91%	-96%	-98%	-98%	-98%	680.8	-92%	-95%	-96%
59	Reach 2	social vulnerability and resiliency	Age under 18	19	-85%	-85%	-99%	-95%	-95%	38.5	-88%	-88%	-99%	-97%	-97%	101.5	-93%	-97%	-99%	-98%	-98%	205.4	-94%	-97%	-98%
60	Reach 2	social vulnerability and resiliency	Education 12th Grade with No Diploma	0	-75%	-75%	-100%	-100%	-100%	0.9	-78%	-78%	-100%	-100%	-100%	2.4	-88%	-96%	-96%	-96%	-96%	5.1	-90%	-94%	-94%
62	Reach 2	social vulnerability and resiliency	Education Equivalent to High School Degree	8	-78%	-77%	-99%	-98%	-98%	17.9	-83%	-83%	-99%	-98%	-98%	49.3	-90%	-96%	-98%	-97%	-98%	111.9	-92%	-95%	-96%
63	Reach 2	social vulnerability and resiliency	Education High School Diploma	8	-78%	-76%	-99%	-98%	-98%	17.9	-83%	-83%	-99%	-98%	-98%	48.2	-90%	-96%	-98%	-97%	-98%	107.6	-91%	-95%	-96%
64	Reach 2	social vulnerability and resiliency	Households in Poverty	7	-79%	-79%	-99%	-97%	-97%	15.2	-84%	-84%	-99%	-98%	-98%	44.3	-91%	-96%	-98%	-98%	-98%	106.1	-92%	-96%	-97%
65	Reach 2	social vulnerability and resiliency	Households without Disability	146	-82%	-82%	-100%	-96%	-96%	311.2	-87%	-87%	-100%	-98%	-97%	814.8	-92%	-97%	-99%	-98%	-98%	1523.8	-93%	-96%	-97%
66	Reach 2	social vulnerability and resiliency	Households with Disability	18	-75%	-74%	-99%	-99%	-99%	42.2	-81%	-82%	-99%	-99%	-99%	105.9	-89%	-95%	-97%	-97%	-97%	223.2	-90%	-94%	-95%
67	Reach 2	social vulnerability and resiliency	Poverty	15	-79%	-79%	-99%	-97%	-97%	32.9	-84%	-84%	-99%	-98%	-98%	101.1	-92%	-97%	-98%	-98%	-98%	239.5	-93%	-96%	-97%
68	Reach 2	social vulnerability and resiliency	Linguistic Isolation	43	-83%	-83%	-98%	-94%	-94%	96	-89%	-89%	-99%	-97%	-97%	291.2	-95%	-98%	-99%	-98%	-99%	488.4	-95%	-97%	-98%
70	Reach 2	social vulnerability and resiliency	Minority (Non-White)	147	-83%	-83%	-100%	-96%	-96%	305.5	-87%	-87%	-100%	-97%	-97%	791.7	-93%	-97%	-99%	-98%	-98%	1499.5	-93%	-96%	-97%
71	Reach 2	social vulnerability and resiliency	White	139	-81%	-81%	-99%	-97%	-97%	299.2	-86%	-86%	-100%	-98%	-98%	774.5	-92%	-96%	-98%	-98%	-98%	1475.6	-92%	-96%	-97%
72	Reach 2	social vulnerability and resiliency	Renter Occupied Units	115	-79%	-79%	-99%	-97%	-97%	254.6	-84%	-85%	-100%	-98%	-98%	662.9	-91%	-96%	-98%	-98%	-98%	1272.8	-92%	-95%	-96%
75	Reach 3	economic vitality	In Labor Force	711	-92%	-93%	-92%	-95%	*-90%*	2124.4	-96%	-96%	-96%	-97%	*-93%*	3563	-97%	-97%	-97%	-97%	*-43%*	5783.7	-97%	-98%	-97%
76	Reach 3	economic vitality	Median Income per Household	48,548	-83%	-83%	-90%	-85%	*-82%*	149425.3	-91%	-92%	-96%	-92%	*-90%*	303853.5	-93%	-93%	-96%	-92%	*-52%*	568262	-94%	-95%	-97%
78	Reach 3	economic vitality	Not in Labor Force	234	-93%	-93%	-92%	-96%	*-90%*	709.6	-96%	-97%	-96%	-98%	*-93%*	1236.5	-97%	-98%	-97%	-98%	*-45%*	2002	-97%	-98%	-97%
79	Reach 3	economic vitality	Owner Occupied Units	175	-92%	-93%	-92%	-96%	*-90%*	526.4	-96%	-96%	-96%	-97%	*-93%*	866.4	-97%	-97%	-97%	-98%	*-42%*	1412.2	-97%	-98%	-97%
80	Reach 3	economic vitality	Median Gross Rent	918	-84%	-84%	-90%	-86%	*-83%*	2821	-92%	-92%	-96%	-93%	*-90%*	5497.9	-93%	-94%	-96%	-92%	*-48%*	9681.8	-94%	-95%	-97%
81	Reach 3	economic vitality	Total Jobs	1,081	-92%	-92%	-92%	-95%	*-90%*	3690.1	-97%	-97%	-97%	-98%	*-94%*	7487	-98%	-98%	-97%	-98%	*-59%*	13364	-98%	-98%	-98%
82	Reach 3	economic vitality	Total Households	505	-92%	-93%	-92%	-95%	*-90%*	1511.4	-96%	-96%	-96%	-97%	*-93%*	2508.8	-97%	-97%	-97%	-97%	*-42%*	4024.7	-97%	-98%	-97%
83	Reach 3	economic vitality	Total Housing Units	580	-92%	-93%	-92%	-96%	*-90%*	1736.8	-96%	-96%	-96%	-97%	*-93%*	2877.6	-97%	-97%	-97%	-97%	*-42%*	4748.9	-97%	-98%	-97%
88	Reach 3	health and safety	Total Population	1,052	-92%	-93%	-92%	-95%	*-90%*	3151.6	-96%	-96%	-96%	-97%	*-93%*	5300.9	-97%	-97%	-97%	-97%	*-43%*	8540.9	-97%	-98%	-97%
89	Reach 3	social connectedness	Public Transit User with No Vehicle	77	-92%	-93%	-92%	-95%	*-90%*	231.3	-96%	-96%	-96%	-97%	*-93%*	384.2	-97%	-97%	-97%	-97%	*-42%*	587.2	-97%	-97%	-97%
90	Reach 3	social connectedness	Commutes over 30 mins a day	359	-92%	-93%	-92%	-95%	*-90%*	1068.7	-96%	-96%	-96%	-97%	*-93%*	1726.8	-97%	-97%	-97%	-97%	*-41%*	2678.4	-97%	-97%	-97%

91	Reach 3	social connectedness	Commutes under 30 mins a day	285	-92%	-92%	-92%	-95%	-90%	855.6	-96%	-96%	-96%	-97%	-93%	1472.2	-97%	-97%	-97%	-97%	-45%	2479.9	-97%	-98%	-97%
92	Reach 3	social connectedness	Commutes with Car, Truck, or Van	170	-92%	-92%	-92%	-95%	-90%	504.8	-96%	-96%	-96%	-97%	-93%	802.5	-97%	-97%	-96%	-97%	-40%	1260.6	-97%	-97%	-97%
93	Reach 3	social connectedness	Commutes with Public Transit	229	-92%	-92%	-92%	-95%	-90%	677.8	-96%	-96%	-96%	-97%	-93%	1110.1	-97%	-97%	-96%	-97%	-41%	1733.1	-97%	-97%	-97%
95	Reach 3	social vulnerability and resiliency	Age older than 65	71	-92%	-93%	-92%	-95%	-90%	210.6	-96%	-96%	-96%	-97%	-93%	376.7	-97%	-97%	-97%	-98%	-46%	632.6	-97%	-98%	-97%
96	Reach 3	social vulnerability and resiliency	Age under 18	127	-92%	-92%	-92%	-95%	-90%	375.8	-96%	-96%	-96%	-97%	-93%	589.5	-96%	-97%	-96%	-97%	-39%	881.8	-96%	-97%	-96%
97	Reach 3	social vulnerability and resiliency	Education 12th Grade with No Diploma	21	-93%	-93%	-93%	-96%	-91%	64.8	-96%	-97%	-96%	-98%	-93%	104.3	-97%	-98%	-97%	-98%	-41%	149	-97%	-98%	-97%
98	Reach 3	social vulnerability and resiliency	Education GED or Alternate Degree	16	-93%	-93%	-92%	-96%	-91%	48.2	-96%	-97%	-96%	-98%	-93%	78.3	-98%	-98%	-97%	-98%	-41%	113.9	-97%	-98%	-97%
99	Reach 3	social vulnerability and resiliency	Education Equivalent to High School Degree	75	-93%	-93%	-93%	-96%	-91%	229.2	-97%	-97%	-97%	-98%	-93%	409	-98%	-98%	-97%	-98%	-47%	645.6	-98%	-98%	-97%
100	Reach 3	social vulnerability and resiliency	Education High School Diploma	59	-93%	-93%	-93%	-96%	-91%	181	-97%	-97%	-97%	-98%	-93%	330.7	-98%	-98%	-97%	-98%	-48%	531.7	-98%	-98%	-97%
101	Reach 3	social vulnerability and resiliency	Households in Poverty	56	-93%	-93%	-93%	-96%	-91%	169.1	-97%	-97%	-97%	-98%	-93%	282.4	-98%	-98%	-97%	-98%	-42%	409.1	-97%	-98%	-97%
102	Reach 3	social vulnerability and resiliency	Households without Disability	443	-92%	-93%	-92%	-95%	-90%	1325.4	-96%	-96%	-96%	-97%	-93%	2195.9	-97%	-97%	-97%	-97%	-42%	3540	-97%	-98%	-97%
103	Reach 3	social vulnerability and resiliency	Households with Disability	62	-92%	-93%	-92%	-96%	-90%	186	-96%	-96%	-96%	-97%	-93%	312.9	-97%	-97%	-97%	-98%	-43%	484.7	-97%	-98%	-97%
104	Reach 3	social vulnerability and resiliency	Poverty	92	-93%	-93%	-93%	-96%	-91%	279.9	-97%	-97%	-96%	-98%	-93%	569.3	-98%	-98%	-98%	-99%	-53%	930.3	-98%	-98%	-98%
105	Reach 3	social vulnerability and resiliency	Linguistic Isolation	150	-92%	-92%	-92%	-95%	-90%	448.5	-96%	-96%	-96%	-97%	-93%	732.4	-96%	-97%	-96%	-96%	-42%	1194.5	-97%	-97%	-97%
107	Reach 3	social vulnerability and resiliency	Minority (Non-White)	587	-92%	-93%	-92%	-96%	-90%	1762.2	-96%	-96%	-96%	-97%	-93%	2973.6	-97%	-97%	-97%	-98%	-43%	4686.6	-97%	-98%	-97%
108	Reach 3	social vulnerability and resiliency	White	466	-92%	-92%	-92%	-95%	-90%	1389.5	-96%	-96%	-96%	-97%	-93%	2327.3	-97%	-97%	-97%	-97%	-43%	3854.3	-97%	-98%	-97%
109	Reach 3	social vulnerability and resiliency	Renter Occupied Units	331	-92%	-93%	-92%	-95%	-90%	985.1	-96%	-96%	-96%	-97%	-93%	1642.4	-97%	-97%	-97%	-97%	-42%	2612.5	-97%	-98%	-97%
110	Reach 3	social vulnerability and resiliency	Single Parent	33	-92%	-92%	-92%	-95%	-90%	96.2	-96%	-96%	-96%	-97%	-93%	149.2	-96%	-97%	-96%	-96%	-38%	217	-96%	-97%	-96%
112	Reach 4	economic vitality	In Labor Force	92	-64%	-66%	-64%	-13%	-8%	107.4	-67%	-69%	-67%	-14%	-7%	128.3	-69%	-73%	-69%	-17%	-5%	146.7	-70%	-74%	-70%
113	Reach 4	economic vitality	Median Income per Household	116,561	-14%	-14%	-13%	-1%	-1%	121017.9	-16%	-16%	-15%	-1%	-1%	125381.2	-17%	-18%	-17%	-1%	-1%	131460.5	-18%	-20%	-18%
115	Reach 4	economic vitality	Not in Labor Force	65	-62%	-64%	-64%	-3%	-2%	74.2	-65%	-67%	-67%	-4%	-2%	84.2	-66%	-70%	-69%	-5%	-1%	93.8	-67%	-71%	-70%
116	Reach 4	economic vitality	Owner Occupied Units	8	-58%	-60%	-58%	-10%	-6%	9.7	-62%	-64%	-59%	-10%	-6%	11.5	-63%	-66%	-61%	-14%	-4%	13	-64%	-68%	-61%
117	Reach 4	economic vitality	Median Gross Rent	5,596	-30%	-31%	-29%	-12%	-7%	6169.6	-35%	-36%	-35%	-14%	-4%	6925.7	-41%	-42%	-41%	-15%	-3%	7615	-44%	-46%	-44%
118	Reach 4	economic vitality	Total Jobs	1,334	-88%	-89%	-84%	-58%	-34%	1678.2	-89%	-90%	-85%	-58%	-28%	2411.7	-91%	-92%	-87%	-58%	-15%	2960.7	-91%	-93%	-87%
119	Reach 4	economic vitality	Total Households	88	-64%	-66%	-65%	-10%	-6%	102.7	-67%	-69%	-67%	-11%	-6%	120.9	-69%	-72%	-70%	-14%	-4%	137.3	-70%	-74%	-71%
120	Reach 4	economic vitality	Total Housing Units	104	-65%	-67%	-66%	-12%	-7%	121.4	-68%	-70%	-68%	-13%	-7%	144.3	-70%	-73%	-71%	-16%	-4%	164.5	-71%	-75%	-72%
125	Reach 4	health and safety	Total Population	253	-63%	-65%	-64%	-7%	-4%	291.1	-65%	-68%	-67%	-7%	-4%	336.2	-67%	-71%	-69%	-9%	-3%	378.1	-68%	-72%	-70%
126	Reach 4	social connectedness	Public Transit User with No Vehicle	13	-61%	-63%	-63%	-3%	-2%	14.7	-63%	-67%	-65%	-3%	-2%	16.7	-65%	-69%	-68%	-5%	-2%	18.7	-65%	-70%	-68%
127	Reach 4	social connectedness	Commutes over 30 mins a day	54	-63%	-64%	-63%	-9%	-5%	62.8	-65%	-68%	-65%	-10%	-5%	73.6	-67%	-71%	-68%	-12%	-4%	83.3	-68%	-72%	-68%
128	Reach 4	social connectedness	Commutes under 30 mins a day	21	-65%	-67%	-64%	-16%	-10%	24.9	-67%	-70%	-66%	-18%	-9%	30.4	-70%	-73%	-69%	-21%	-6%	35.1	-71%	-74%	-69%
129	Reach 4	social connectedness	Commutes with Car, Truck, or Van	37	-62%	-64%	-63%	-6%	-4%	43	-65%	-68%	-66%	-7%	-3%	49.5	-66%	-70%	-68%	-8%	-2%	55.7	-67%	-72%	-69%
130	Reach 4	social connectedness	Commutes with Public Transit	31	-63%	-65%	-63%	-10%	-6%	36.3	-66%	-68%	-66%	-11%	-6%	42.8	-67%	-71%	-68%	-14%	-4%	48.7	-68%	-72%	-68%
132	Reach 4	social vulnerability and resiliency	Age older than 65	9	-69%	-71%	-69%	-20%	-12%	10.2	-72%	-74%	-72%	-22%	-11%	12.6	-74%	-77%	-74%	-25%	-6%	14.7	-76%	-79%	-75%
133	Reach 4	social vulnerability and resiliency	Age under 18	113	-62%	-64%	-63%	-2%	-2%	128.2	-64%	-67%	-67%	-3%	-1%	144.6	-65%	-69%	-69%	-4%	-1%	160.7	-66%	-71%	-70%
136	Reach 4	social vulnerability and resiliency	Education Equivalent to High School Degree	13	-65%	-66%	-66%	-9%	-5%	14.7	-67%	-69%	-68%	-10%	-4%	17.2	-69%	-73%	-71%	-12%	-3%	19.4	-70%	-74%	-72%
137	Reach 4	social vulnerability and resiliency	Education High School Diploma	13	-65%	-66%	-65%	-9%	-5%	14.7	-67%	-70%	-69%	-10%	-5%	17.1	-69%	-73%	-71%	-12%	-3%	19.4	-70%	-75%	-72%
138	Reach 4	social vulnerability and resiliency	Households in Poverty	24	-63%	-65%	-65%	-5%	-3%	27.3	-66%	-69%	-68%	-6%	-3%	31.3	-67%	-72%	-71%	-8%	-2%	35	-68%	-73%	-71%
139	Reach 4	social vulnerability and resiliency	Households without Disability	78	-64%	-66%	-65%	-11%	-7%	90.8	-67%	-70%	-68%	-12%	-6%	107.4	-69%	-73%	-70%	-15%	-4%	122.2	-70%	-74%	-71%
140	Reach 4	social vulnerability and resiliency	Households with Disability	10	-62%	-63%	-63%	-3%	-2%	11.9	-65%	-67%	-66%	-4%	-2%	13.5	-65%	-70%	-68%	-5%	-1%	15.1	-66%	-71%	-69%
141	Reach 4	social vulnerability and resiliency	Poverty	41	-64%	-66%	-65%	-7%	-4%	47.4	-66%	-69%	-68%	-7%	-4%	54.6	-68%	-72%	-71%	-9%	-2%	61.2	-69%	-73%	-72%
142	Reach 4	social vulnerability and resiliency	Linguistic Isolation	20	-61%	-63%	-62%	-5%	-3%	22.8	-64%	-66%	-65%	-5%	-3%	26.1	-64%	-68%	-67%	-6%	-2%	29.4	-65%	-69%	-67%
144	Reach 4	social vulnerability and resiliency	Minority (Non-White)	220	-61%	-64%	-63%	-3%	-2%	250.9	-64%	-67%	-66%	-3%	-2%	283.6	-65%	-69%	-68%	-4%	-1%	315.3	-66%	-71%	-69%
145	Reach 4	social vulnerability and resiliency	White	33	-71%	-73%	-69%	-33%	-20%	40.1	-74%	-76%	-70%	-34%	-17%	52.6	-77%	-79%	-73%	-38%	-10%	62.8	-78%	-80%	-73%
146	Reach 4	social vulnerability and resiliency	Renter Occupied Units	80	-65%	-67%	-65%	-10%	-6%	93	-67%	-70%	-68%	-11%	-6%	109.5	-69%	-73%	-71%	-14%	-4%	124.3	-70%	-74%	-72%
147	Reach 4	social vulnerability and resiliency	Single Parent	104	-62%	-64%	-64%	-2%	-1%	118.4	-64%	-67%	-67%	-2%	-1%	133.1	-65%	-69%	-69%	-3%	-1%	147.5	-66%	-71%	-70%

								Monthly																							
		2140						2040						2065						2090						2115					
f_inter_2115_100y_	g_inter_2115_100y_	FWOP	c_inter_2140_100y_	d_inter_2140_100y_	e_inter_2140_100y_	f_inter_2140_100y_	g_inter_2140_100y_	FWOP	c_inter_2040_monthly_	d_inter_2040_monthly_	e_inter_2040_monthly_	f_inter_2040_monthly_	g_inter_2040_monthly_	FWOP	c_inter_2065_monthly_	d_inter_2065_monthly_	e_inter_2065_monthly_	f_inter_2065_monthly_	g_inter_2065_monthly_	FWOP	c_inter_2090_monthly_	d_inter_2090_monthly_	e_inter_2090_monthly_	f_inter_2090_monthly_	g_inter_2090_monthly_	FWOP	c_inter_2115_monthly_	d_inter_2115_monthly_	e_inter_2115_monthly_	f_inter_2115_monthly_	g_inter_2115_monthly_
-79%	-82%	595.9	-78%	-83%	-79%	-79%	-82%	5.3	-77%	-77%	-76%	-80%	-80%	6.8	-78%	-78%	-77%	-80%	-80%	8.8	-84%	-86%	-86%	-83%	-86%	10.9	-97%	-97%	-97%	-97%	-97%
-74%	-81%	204451	-71%	-81%	-77%	-75%	-81%	2772.1	-70%	-70%	-68%	-72%	-72%	3841.2	-70%	-70%	-68%	-72%	-72%	4663.6	-76%	-77%	-77%	-63%	-77%	5941.4	-95%	-95%	-95%	-92%	-95%
-86%	-89%	307.1	-87%	-89%	-86%	-86%	-89%	2	-75%	-75%	-74%	-77%	-77%	2.6	-74%	-74%	-74%	-77%	-77%	3.4	-80%	-82%	-82%	-79%	-82%	4.2	-98%	-98%	-98%	-98%	-98%
-69%	-79%	68.6	-82%	-84%	-73%	-73%	-83%	1.3	-64%	-64%	-62%	-69%	-69%	1.8	-58%	-58%	-58%	-62%	-62%	2.4	-58%	-61%	-61%	-56%	-61%	2.9	-94%	-94%	-94%	-93%	-94%
-75%	-82%	4083.3	-69%	-81%	-77%	-76%	-81%	50.7	-73%	-73%	-71%	-75%	-75%	68.7	-73%	-73%	-72%	-75%	-75%	84.2	-79%	-80%	-80%	-69%	-80%	106.3	-95%	-96%	-96%	-93%	-96%
-77%	-78%	2983.1	-69%	-76%	-76%	-76%	-77%	10.6	-91%	-91%	-90%	-93%	-93%	13.5	-92%	-92%	-92%	-94%	-94%	17.2	-95%	-96%	-96%	-95%	-96%	23.9	-98%	-99%	-99%	-98%	-99%
-81%	-84%	540.2	-80%	-84%	-81%	-81%	-84%	4.6	-76%	-76%	-75%	-79%	-79%	5.8	-77%	-77%	-77%	-80%	-80%	7.5	-84%	-85%	-85%	-82%	-85%	9.3	-97%	-97%	-97%	-97%	-97%
-81%	-84%	589.9	-81%	-85%	-81%	-81%	-85%	5.2	-75%	-75%	-74%	-78%	-78%	6.6	-76%	-76%	-75%	-78%	-78%	8.5	-82%	-84%	-84%	-81%	-84%	10.4	-97%	-97%	-97%	-97%	-97%
-82%	-85%	981	-82%	-85%	-82%	-82%	-85%	8	-76%	-76%	-75%	-79%	-79%	10.2	-76%	-76%	-76%	-79%	-79%	13.3	-83%	-84%	-84%	-81%	-84%	16.4	-97%	-97%	-97%	-97%	-97%
-69%	-74%	106.4	-69%	-75%	-71%	-71%	-75%	1	-79%	-79%	-79%	-82%	-82%	1.4	-81%	-81%	-80%	-83%	-83%	1.9	-86%	-88%	-88%	-83%	-88%	2.4	-96%	-96%	-96%	-95%	-96%
-78%	-82%	287.1	-77%	-82%	-79%	-79%	-82%	2.3	-79%	-79%	-79%	-81%	-81%	3	-80%	-80%	-79%	-82%	-82%	3.9	-86%	-87%	-87%	-85%	-87%	4.8	-97%	-97%	-97%	-97%	-97%
-79%	-83%	249.5	-79%	-83%	-80%	-80%	-83%	2.3	-76%	-76%	-74%	-78%	-78%	3	-76%	-76%	-75%	-79%	-79%	3.8	-83%	-84%	-85%	-82%	-84%	4.6	-97%	-97%	-97%	-97%	-97%
-78%	-82%	132.7	-78%	-82%	-78%	-78%	-82%	1.5	-73%	-73%	-71%	-76%	-76%	1.9	-73%	-73%	-73%	-77%	-77%	2.3	-81%	-83%	-83%	-79%	-83%	2.8	-96%	-97%	-97%	-96%	-97%
-79%	-84%	154.8	-82%	-85%	-80%	-80%	-85%	1.6	-73%	-73%	-71%	-76%	-76%	2.1	-72%	-72%	-71%	-74%	-74%	2.7	-77%	-79%	-79%	-75%	-79%	3.4	-96%	-97%	-97%	-96%	-97%
-83%	-88%	199	-87%	-89%	-84%	-84%	-89%	1.7	-71%	-71%	-69%	-74%	-74%	2.3	-69%	-69%	-69%	-72%	-72%	3.1	-72%	-76%	-76%	-72%	-76%	3.8	-97%	-97%	-97%	-97%	-97%
-86%	-90%	89.4	-89%	-90%	-87%	-87%	-90%	0.7	-68%	-68%	-68%	-71%	-71%	0.9	-67%	-67%	-67%	-70%	-70%	1.2	-72%	-76%	-76%	-72%	-76%	1.5	-97%	-98%	-98%	-97%	-98%
-94%	-94%	18.9	-90%	-93%	-93%	-93%	-93%	0	-100%	-100%	-100%	-100%	-100%	0	-100%	-100%	-100%	-100%	-100%	0	-100%	-100%	-100%	-100%	-100%	0	-100%	-100%	-100%	-100%	-100%
-99%	-99%	14.4	-99%	-99%	-99%	-99%	-99%	0.1	0%	0%	0%	0%	0%	0.1	0%	0%	0%	0%	0%	0.1	0%	0%	0%	0%	0%	0.1	-99%	-99%	-99%	-99%	-99%
-91%	-92%	67.7	-87%	-90%	-90%	-90%	-90%	0.3	-81%	-81%	-75%	-81%	-81%	0.3	-81%	-81%	-81%	-81%	-81%	0.4	-88%	-90%	-90%	-88%	-90%	0.5	-99%	-99%	-99%	-99%	-99%
-89%	-89%	53.3	-84%	-88%	-87%	-87%	-88%	0.2	-80%	-80%	-80%	-87%	-87%	0.3	-86%	-86%	-86%	-86%	-86%	0.3	-90%	-93%	-93%	-90%	-93%	0.4	-99%	-99%	-99%	-99%	-99%
-96%	-96%	45.9	-94%	-95%	-95%	-95%	-95%	0.1	-80%	-80%	-80%	-80%	-80%	0.1	-86%	-86%	-86%	-86%	-86%	0.1	-92%	-92%	-92%	-92%	-92%	0.2	-99%	-100%	-100%	-99%	-100%
-77%	-81%	401.3	-77%	-81%	-77%	-77%	-81%	4	-76%	-76%	-75%	-79%	-79%	5.1	-77%	-77%	-77%	-80%	-80%	6.6	-83%	-85%	-85%	-82%	-85%	8.1	-96%	-97%	-97%	-96%	-97%
-91%	-92%	138.9	-90%	-92%	-90%	-90%	-92%	0.6	-77%	-77%	-77%	-80%	-80%	0.7	-77%	-77%	-77%	-79%	-79%	0.9	-84%	-85%	-87%	-84%	-85%	1.2	-99%	-99%	-99%	-99%	-99%
-93%	-94%	98.8	-90%	-92%	-92%	-92%	-92%	0.3	-83%	-83%	-83%	-83%	-83%	0.3	-83%	-83%	-83%	-88%	-88%	0.4	-91%	-91%	-91%	-89%	-91%	0.5	-99%	-99%	-99%	-99%	-99%
-62%	-71%	123.7	-70%	-75%	-66%	-66%	-74%	2.1	-72%	-72%	-71%	-76%	-76%	2.8	-71%	-71%	-71%	-74%	-74%	3.8	-77%	-79%	-79%	-73%	-79%	4.7	-93%	-94%	-94%	-92%	-94%
-89%	-91%	455.1	-87%	-90%	-88%	-88%	-90%	2	-80%	-80%	-78%	-83%	-82%	2.5	-81%	-81%	-81%	-83%	-83%	3.2	-87%	-89%	-89%	-86%	-89%	4	-98%	-99%	-99%	-98%	-99%
-75%	-80%	526	-77%	-82%	-77%	-77%	-81%	6	-74%	-74%	-73%	-77%	-77%	7.7	-74%	-74%	-73%	-77%	-77%	10	-80%	-82%	-82%	-79%	-82%	12.3	-96%	-96%	-96%	-96%	-96%
-82%	-85%	471.6	-80%	-84%	-82%	-82%	-84%	3.3	-79%	-79%	-78%	-82%	-82%	4.1	-81%	-81%	-80%	-83%	-83%	5.2	-87%	-89%	-89%	-86%	-89%	6.4	-98%	-98%	-98%	-97%	-98%
-94%	-96%	23.7	-96%	-97%	-95%	-95%	-97%	0.1	-67%	-67%	-33%	-67%	-67%	0.2	-50%	-50%	-50%	-50%	-50%	0.2	-50%	-50%	-50%	-50%	-50%	0.2	-98%	-99%	-99%	-98%	-99%
-97%	-97%	2486.2	-89%	-94%	-95%	-94%	-94%	1.6	-99%	-99%	-100%	-99%	-99%	2.1	-99%	-99%	-100%	-100%	-100%	2.9	-100%	-100%	-100%	-100%	-100%	4.3	-100%	-100%	-100%	-100%	-100%
-95%	-98%	839703.3	-65%	-68%	-69%	-68%	-68%	518.5	-98%	-98%	-90%	-99%	-99%	579.6	-99%	-99%	-95%	-99%	-99%	673.7	-100%	-100%	-100%	-92%	-100%	854.7	-100%	-100%	-100%	-97%	-100%
-96%	-96%	1044.6	-87%	-92%	-93%	-93%	-93%	0.5	-99%	-99%	-99%	-99%	-99%	0.7	-100%	-100%	-100%	-100%	-100%	0.9	-100%	-100%	-100%	-100%	-100%	1.2	-100%	-100%	-100%	-100%	-100%
-98%	-98%	594.7	-91%	-96%	-97%	-96%	-96%	0.5	-99%	-99%	-100%	-99%	-99%	0.6	-99%	-99%	-100%	-99%	-99%	0.9	-100%	-100%	-100%	-100%	-100%	1.3	-100%	-100%	-100%	-100%	-100%
-96%	-98%	11502	-70%	-73%	-74%	-73%	-74%	9.7	-98%	-98%	-92%	-99%	-99%	10.5	-99%	-99%	-96%	-99%	-99%	11.8	-100%	-100%	-100%	-94%	-100%	13.8	-100%	-100%	-100%	-98%	-100%
-98%	-98%	56686.9	-94%	-96%	-97%	-97%	-97%	40	-99%	-99%	-100%	-99%	-99%	48.8	-99%	-99%	-100%	-99%	-99%	64.9	-100%	-100%	-100%	-100%	-100%	121.2	-100%	-100%	-100%	-100%	-100%
-97%	-97%	2230.8	-88%	-93%	-94%	-94%	-94%	1.3	-99%	-99%	-100%	-99%	-99%	1.7	-99%	-99%	-100%	-100%	-100%	2.3	-100%	-100%	-100%	-100%	-100%	3.3	-100%	-100%	-100%	-100%	-100%
-97%	-97%	2667.8	-88%	-93%	-94%	-94%	-94%	1.6	-99%	-99%	-100%	-99%	-99%	2.1	-99%	-99%	-100%	-100%	-100%	2.8	-100%	-100%	-100%	-100%	-100%	4.1	-100%	-100%	-100%	-100%	-100%
-97%	-97%	3794.9	-88%	-93%	-94%	-94%	-94%	2.3	-99%	-99%	-100%	-99%	-99%	3	-99%	-99%	-100%	-100%	-100%	4.1	-100%	-100%	-100%	-100%	-100%	5.9	-100%	-100%	-100%	-100%	-100%
-97%	-97%	281.9	-89%	-94%	-94%	-94%	-94%	0.2	-98%	-98%	-98%	-98%	-98%	0.2	-99%	-99%	-99%	-99%	-99%	0.3	-100%	-100%	-100%	-99%	-100%	0.5	-100%	-100%	-100%	-99%	-100%
-97%	-97%	707.3	-89%	-94%	-95%	-94%	-94%	0.5	-99%	-99%	-100%	-99%	-99%	0.7	-99%	-99%	-100%	-100%	-100%	0.9	-100%	-100%	-100%	-100%	-100%	1.3	-100%	-100%	-100%	-100%	-100%
-97%	-96%	1309.7	-89%	-93%	-94%	-94%	-94%	0.8	-99%	-99%	-100%	-99%	-99%	1	-99%	-99%	-100%	-100%	-100%	1.4	-100%	-100%	-100%	-100%	-100%	2.1	-100%	-100%	-100%	-100%	-100%
-97%	-97%	475.2	-89%	-94%	-95%	-94%	-94%	0.3	-99%	-99%	-100%	-99%	-99%	0.4	-99%	-99%	-100%	-100%	-100%	0.6	-100%	-100%	-100%	-100%	-100%	0.8	-100%	-100%	-100%	-100%	-100%
-96%	-96%	435.5	-88%	-93%	-93%	-93%	-93%	0.3	-99%	-99%	-100%	-99%	-99%	0.3	-100%	-100%	-100%	-100%	-100%	0.4	-100%	-100%	-100%	-100%	-100%	0.7	-100%	-100%	-100%	-100%	-100%
-96%	-96%	872.7	-87%	-92%	-93%	-93%	-92%	0.4	-99%	-99%	-100%	-100%	-100%	0.5	-100%	-100%	-100%	-100%	-100%	0.7	-100%	-100%	-100%	-100%	-100%	1	-100%	-100%	-100%	-100%	-100%
-97%	-97%	265.2	-88%	-94%	-95%	-95%	-95%	0.2	-99%	-99%	-99%	-99%	-99%	0.2	-99%	-99%	-100%	-99%	-99%	0.3	-100%	-100%	-100%	-100%	-100%	0.4	-100%	-100%	-100%	-100%	-100%
-94%	-94%	6.9	-86%	-90%	-91%	-91%	-91%	0	-100%	-100%	-100%	-100%	-100%	0	-100%	-100%	-100%	-100%	-100%	0	-100%	-100%	-100%	-100%	-100%	0	-100%	-100%	-100%	-100%	-100%
-96%	-96%	150.9	-84%	-91%	-91%	-91%	-91%	0.1	-99%	-99%	-99%	-100%	-100%	0.1	-99%	-99%	-99%	-100%	-100%	0.1	-100%	-100%	-100%	-99%	-100%	0.1	-100%	-100%	-100%	-100%	-100%
-96%	-96%	144.3	-84%	-91%	-91%	-91%	-91%	0.1	-99%	-99%	-99%	-100%	-100%	0.1	-99%	-99%	-99%	-100%	-100%	0.1	-100%	-100%	-100%	-99%	-100%	0.1	-100%	-100%	-100%	-100%	-100%
-97%	-97%	144.1	-84%	-92%	-92%	-92%	-92%	0.1	-99%	-99%	-99%	-100%	-100%	0.1	-99%	-99%	-99%	-100%	-100%	0.1	-100%	-100%	-100%	-99%	-100%	0.1	-100%	-100%	-100%	-100%	-100%
-97%	-97%	1938.2	-89%	-93%	-94%	-94%	-94%	1.2	-99%	-99%	-100%	-99%	-99%	1.6	-99%	-99%	-100%	-100%	-100%	2.1	-100%	-100%	-100%	-100%	-100%	3.1	-100%	-100%	-100%	-100%	-100%
-95%	-95%	292.6	-84%	-90%	-91%	-91%	-91%	0.1	-99%	-99%	-99%	-99%	-99%	0.1	-100%	-100%	-100%	-100%	-100%	0.1	-100%	-100%	-100%	-100%	-100%	0.2	-100%	-100%	-100%	-100%	-100%
-97%	-97%	327.5	-85%	-92%	-92%	-92%	-92%	0.1	-99%	-99%	-99%	-99%	-99%	0.2	-99%	-99%	-99%	-100%	-100%	0.2	-100%	-100%	-100%	-99%	-100%	0.3	-100%	-100%	-100%	-100%	-100%
-98%	-98%	616.9	-92%	-95%	-96%	-96%	-96%	0.5	-98%	-98%	-98%	-98%	-98%	0.6	-99%	-99%	-99%	-99%	-99%	0.9	-100%	-100%	-100%	-100%	-100%	1.5	-100%	-100%	-100%	-100%	-100%
-97%	-97%	1908.2	-89%	-94%	-95%	-95%	-95%	1.2	-99%	-99%	-100%	-99%	-99%	1.6	-99%	-99%	-100%	-100%	-100%	2.2	-100%	-100%	-100%	-100%	-100%	3.1	-100%	-100%	-100%	-100%	-100%
-96%	-96%	1886.7	-88%	-93%	-93%	-93%	-93%	1.1	-99%	-99%	-99%	-99%	-99%	1.4	-99%	-99%	-100%	-100%	-100%	1.9	-100%	-100%	-100%	-100%	-100%	2.7	-100%	-100%	-100%	-100%	-100%
-96%	-96%	1636.1	-87%	-92%	-93%	-93%	-93%	0.9	-99%	-99%	-99%	-99%	-99%	1.1	-100%	-100%	-100%	-100%	-100%	1.4	-100%	-100%	-100%	-100%	-100%	2	-100%	-100%	-100%	-100%	-100%
-98%	*-51%*	8741.7	-86%	-88%	-87%	-88%	*-49%*	22.7	-97%	-98%	-97%	-99%	*-97%*	28.3	-99%	-99%	-99%	-100%	*-99%*	36.7	-99%	-99%	-99%	-100%	*-99%*	47.8	-99%	-99%	-99%	-100%	*-99%*
-94%	*-62%*	967046.8	-84%	-86%	-88%	-85%	*-58%*	3177.2	-97%	-97%	-96%	-98%	*-97%*	4422.8	-99%	-99%	-99%	-99%	*-99%*	6056.2	-99%	-99%	-99%	-99%	*-99%*	7789.8	-99%	-99%	-100%	-100%	*-99%*
-98%	*-53%*	3052.3	-85%	-88%	-87%	-88%	*-50%*	6.9	-98%	-98%	-97%	-99%	*-97%*	8.5	-99%	-99%	-99%	-100%	*-99%*	10.7	-99%	-99%	-99%	-100%	*-99%*	13.9	-100%	-100%	-100%	-100%	*-99%*
-98%	*-50%*	2147.4	-86%	-88%	-87%	-88%	*-49%*	5.4	-98%	-98%	-97%	-99%	*-97%*	6.7	-99%	-99%	-99%	-100%	*-99%*	8.6	-99%	-99%	-99%	-100%	*-99%*	11.2	-99%	-99%	-99%	-100%	*-99%*
-93%	*-57%*	15931.2	-84%	-86%	-87%	-85%	*-54%*	56.5	-97%	-97%	-96%	-98%	*-97%*	78	-99%	-99%	-99%	-99%	*-99%*	106.3	-99%	-99%	-99%	-99%	*-99%*	136.9	-99%	-99%	-99%	-100%	*-99%*
-98%	*-68%*	20227	-91%	-92%	-92%	-92%	*-65%*	36	-97%	-97%	-97%	-99%	*-97%*	45.2	-99%	-99%	-99%	-100%	*-99%*	59.3	-99%	-99%	-100%	-100%	*-99%*	77.3	-100%	-100%	-100%	-100%	*-100%*
-98%	*-50%*	6086.1	-86%	-88%	-87%	-88%	*-48%*	15.9	-98%	-98%	-97%	-99%	*-97%*	19.7	-99%	-99%	-99%	-100%	*-99%*	25.5	-99%	-99%	-99%	-100%	*-99%*	33.3	-99%	-99%	-99%	-100%	*-99%*
-98%	*-51%*	7330.7	-84%	-87%	-86%	-87%	*-49%*	18.4	-97%	-98%	-97%	-99%	*-97%*	22.7	-99%	-99%	-99%	-100%	*-99%*	29.3	-99%	-99%	-99%	-100%	*-99%*	38.1	-99%	-99%	-99%	-100%	*-99%*
-98%	*-51%*	12905.6	-86%	-88%	-87%	-88%	*-49%*	33.3	-98%	-98%	-97%	-99%	*-97%*	41.5	-99%	-99%	-99%	-100%	*-99%*	53.6	-99%	-99%	-99%	-100%	*-99%*	69.9	-99%	-99%	-99%	-100%	*-99%*
-97%	*-47%*	875	-87%	-88%	-88%	-88%	*-44%*	2.4	-97%	-97%	-97%	-99%	*-97%*	3	-99%	-99%	-99%	-100%	*-99%*	4	-99%	-99%	-99%	-100%	*-99%*	5.2	-99%	-99%	-99%	-100%	*-99%*
-97%	*-46%*	3981.2	-87%	-88%	-88%	-88%	*-45%*	11.3	-98%	-98%	-97%	-99%	*-97%*	14.1	-99%	-99%	-99%	-100%	*-99%*	18.3	-99%	-99%	-99%	-100%	*-99%*	23.9	-99%	-99%	-99%	-100%	*-99%*

-98%	-54%	3828.3	-84%	-87%	-86%	-87%	-51%	9.4	-97%	-97%	-97%	-99%	-97%	11.6	-99%	-99%	-99%	-100%	-99%	15.1	-99%	-99%	-99%	-100%	-99%	19.6	-99%	-100%	-100%	-100%	-99%
-97%	-46%	1900.6	-85%	-87%	-87%	-87%	-44%	5.5	-97%	-98%	-97%	-99%	-97%	6.9	-99%	-99%	-99%	-100%	-99%	9	-99%	-99%	-99%	-100%	-99%	11.8	-99%	-99%	-99%	-100%	-99%
-97%	-47%	2582.7	-87%	-88%	-88%	-88%	-46%	7.5	-98%	-98%	-97%	-99%	-97%	9.5	-99%	-99%	-99%	-100%	-99%	12.5	-99%	-99%	-99%	-100%	-99%	16.2	-99%	-99%	-99%	-100%	-99%
-98%	-55%	1015.6	-85%	-87%	-87%	-87%	-54%	2.3	-97%	-97%	-97%	-99%	-97%	2.8	-99%	-99%	-99%	-100%	-99%	3.6	-99%	-99%	-99%	-100%	-99%	4.7	-100%	-100%	-100%	-100%	-99%
-97%	-43%	1295.9	-87%	-89%	-88%	-88%	-42%	4.2	-97%	-97%	-97%	-99%	-97%	5.4	-99%	-99%	-99%	-100%	-99%	7.1	-99%	-99%	-99%	-100%	-99%	9.3	-99%	-99%	-99%	-100%	-99%
-98%	-42%	205.5	-90%	-91%	-90%	-91%	-40%	0.6	-98%	-98%	-97%	-99%	-98%	0.7	-99%	-99%	-99%	-100%	-99%	0.9	-99%	-99%	-99%	-100%	-99%	1.2	-99%	-99%	-99%	-100%	-99%
-98%	-44%	163.3	-91%	-91%	-90%	-92%	-44%	0.4	-97%	-97%	-97%	-99%	-97%	0.5	-99%	-99%	-99%	-100%	-99%	0.6	-99%	-99%	-99%	-100%	-99%	0.8	-99%	-99%	-99%	-100%	-99%
-98%	-53%	949.4	-88%	-89%	-89%	-90%	-51%	2.1	-98%	-98%	-97%	-99%	-97%	2.5	-99%	-99%	-99%	-100%	-99%	3.1	-99%	-99%	-99%	-100%	-99%	4.1	-100%	-100%	-100%	-100%	-99%
-99%	-55%	786.1	-87%	-89%	-88%	-89%	-52%	1.7	-98%	-98%	-97%	-99%	-97%	2	-99%	-99%	-99%	-100%	-99%	2.5	-99%	-99%	-99%	-100%	-99%	3.3	-100%	-100%	-100%	-100%	-99%
-98%	-44%	581.1	-90%	-91%	-90%	-91%	-44%	1.5	-98%	-98%	-97%	-99%	-98%	1.8	-99%	-99%	-99%	-100%	-99%	2.2	-99%	-99%	-99%	-100%	-99%	2.9	-99%	-99%	-99%	-100%	-99%
-98%	-50%	5342.2	-86%	-88%	-87%	-88%	-48%	14	-97%	-98%	-97%	-99%	-97%	17.4	-99%	-99%	-99%	-100%	-99%	22.6	-99%	-99%	-99%	-100%	-99%	29.4	-99%	-99%	-99%	-100%	-99%
-98%	-49%	743.9	-86%	-88%	-87%	-88%	-48%	1.9	-98%	-98%	-97%	-99%	-97%	2.3	-99%	-99%	-99%	-100%	-99%	3	-99%	-99%	-99%	-100%	-99%	3.9	-99%	-99%	-99%	-100%	-99%
-99%	-60%	1330.7	-89%	-91%	-90%	-91%	-57%	2.5	-98%	-98%	-97%	-99%	-98%	3	-99%	-99%	-99%	-100%	-99%	3.8	-99%	-99%	-99%	-100%	-99%	4.9	-100%	-100%	-100%	-100%	-100%
-97%	-50%	1840.4	-85%	-87%	-87%	-86%	-47%	5	-97%	-97%	-97%	-99%	-97%	6.4	-99%	-99%	-99%	-100%	-99%	8.5	-99%	-99%	-99%	-99%	-99%	11.1	-99%	-99%	-99%	-100%	-99%
-98%	-50%	6980.2	-87%	-88%	-88%	-88%	-48%	17.7	-98%	-98%	-97%	-99%	-97%	21.9	-99%	-99%	-99%	-100%	-99%	28	-99%	-99%	-99%	-100%	-99%	36.6	-99%	-99%	-99%	-100%	-99%
-97%	-52%	5925.4	-85%	-87%	-87%	-87%	-49%	15.6	-97%	-97%	-97%	-99%	-97%	19.6	-99%	-99%	-99%	-100%	-99%	25.6	-99%	-99%	-99%	-100%	-99%	33.4	-99%	-99%	-99%	-100%	-99%
-97%	-49%	3938.8	-86%	-88%	-87%	-88%	-47%	10.5	-98%	-98%	-97%	-99%	-97%	13.1	-99%	-99%	-99%	-100%	-99%	16.9	-99%	-99%	-99%	-100%	-99%	22.1	-99%	-99%	-99%	-100%	-99%
-96%	-40%	304.8	-89%	-90%	-89%	-89%	-39%	1.1	-98%	-98%	-97%	-99%	-98%	1.4	-99%	-99%	-99%	-100%	-99%	1.8	-99%	-99%	-99%	-100%	-99%	2.4	-99%	-99%	-99%	-100%	-99%
-18%	-6%	167.3	-70%	-75%	-70%	-19%	-8%	14	-85%	-85%	-85%	-85%	-85%	15.7	-86%	-86%	-86%	-86%	-86%	19.9	-87%	-86%	-86%	-86%	-85%	40	-83%	-83%	-82%	-75%	-73%
-1%	-1%	139878.6	-20%	-23%	-19%	-1%	-2%	39856.7	-66%	-66%	-66%	-66%	-66%	57813.7	-53%	-53%	-54%	-53%	-53%	94204.6	-26%	-26%	-26%	-25%	-25%	102470.3	-26%	-26%	-26%	-23%	-23%
-5%	-2%	105.1	-66%	-72%	-70%	-6%	-2%	11.2	-83%	-83%	-83%	-83%	-83%	12.5	-83%	-83%	-83%	-83%	-83%	15.5	-84%	-84%	-84%	-82%	-82%	31.7	-78%	-78%	-78%	-67%	-66%
-14%	-5%	14.9	-64%	-69%	-60%	-14%	-7%	1.3	-85%	-85%	-84%	-85%	-85%	1.5	-86%	-86%	-86%	-86%	-86%	1.9	-86%	-86%	-86%	-85%	-84%	3.6	-82%	-82%	-82%	-75%	-73%
-16%	-3%	8326.5	-48%	-50%	-46%	-17%	-5%	1540.4	-73%	-73%	-72%	-73%	-73%	2239.1	-64%	-64%	-65%	-64%	-64%	3656.6	-48%	-48%	-48%	-48%	-47%	4031.6	-51%	-51%	-50%	-48%	-47%
-59%	-19%	3498.5	-92%	-93%	-87%	-59%	-22%	74.5	-95%	-95%	-94%	-95%	-94%	85.6	-95%	-95%	-95%	-96%	-95%	124.9	-96%	-96%	-96%	-96%	-95%	270.1	-96%	-97%	-96%	-96%	-91%
-15%	-5%	155.7	-70%	-75%	-71%	-16%	-6%	14	-85%	-85%	-84%	-85%	-85%	15.6	-85%	-85%	-85%	-85%	-85%	19.6	-86%	-86%	-86%	-85%	-84%	39.8	-82%	-82%	-81%	-73%	-71%
-17%	-6%	187	-71%	-76%	-72%	-18%	-7%	16	-85%	-85%	-85%	-85%	-85%	17.9	-86%	-86%	-86%	-86%	-86%	22.6	-86%	-86%	-86%	-85%	-85%	45.9	-82%	-82%	-82%	-74%	-72%
-10%	-3%	426.4	-68%	-73%	-70%	-10%	-4%	42	-84%	-84%	-84%	-84%	-84%	46.8	-84%	-84%	-84%	-84%	-84%	58.4	-85%	-85%	-85%	-83%	-83%	118.8	-80%	-80%	-80%	-70%	-69%
-5%	-2%	21	-64%	-70%	-67%	-5%	-2%	2.2	-83%	-83%	-83%	-83%	-83%	2.5	-84%	-84%	-83%	-83%	-83%	3.1	-84%	-83%	-83%	-82%	-81%	6.3	-78%	-78%	-78%	-67%	-67%
-13%	-5%	94.4	-68%	-73%	-68%	-14%	-6%	8.6	-84%	-84%	-84%	-84%	-84%	9.7	-85%	-85%	-85%	-85%	-85%	12.2	-85%	-85%	-85%	-84%	-84%	24.5	-81%	-81%	-81%	-72%	-71%
-22%	-8%	40.5	-71%	-76%	-69%	-23%	-10%	3.1	-86%	-86%	-86%	-86%	-86%	3.5	-87%	-87%	-86%	-87%	-86%	4.5	-88%	-88%	-87%	-87%	-86%	8.8	-84%	-84%	-84%	-77%	-75%
-9%	-3%	62.9	-67%	-72%	-69%	-10%	-4%	6.3	-83%	-83%	-83%	-83%	-83%	7	-84%	-84%	-84%	-84%	-84%	8.7	-84%	-84%	-84%	-83%	-83%	17.7	-80%	-79%	-79%	-69%	-69%
-15%	-5%	55.3	-68%	-73%	-68%	-15%	-6%	4.9	-85%	-85%	-84%	-85%	-85%	5.6	-85%	-85%	-85%	-85%	-85%	7	-86%	-86%	-86%	-85%	-84%	14	-82%	-81%	-81%	-73%	-71%
-27%	-9%	17	-75%	-80%	-75%	-28%	-12%	1.2	-86%	-86%	-86%	-86%	-86%	1.3	-87%	-87%	-87%	-87%	-87%	1.7	-89%	-88%	-88%	-87%	-87%	3.4	-86%	-86%	-85%	-79%	-77%
-4%	-1%	179.7	-66%	-71%	-70%	-4%	-2%	19.7	-83%	-83%	-83%	-83%	-83%	21.9	-83%	-83%	-83%	-83%	-83%	27.1	-83%	-83%	-83%	-82%	-81%	55.5	-78%	-78%	-77%	-66%	-66%
-13%	-4%	22	-70%	-75%	-72%	-14%	-5%	2.1	-84%	-84%	-84%	-84%	-84%	2.3	-85%	-85%	-84%	-85%	-84%	2.9	-85%	-85%	-85%	-84%	-84%	5.8	-81%	-81%	-80%	-71%	-70%
-13%	-5%	21.9	-70%	-75%	-73%	-14%	-5%	2	-84%	-84%	-84%	-84%	-84%	2.3	-85%	-85%	-85%	-85%	-84%	2.8	-85%	-85%	-85%	-84%	-84%	5.8	-81%	-81%	-80%	-72%	-70%
-8%	-3%	39.2	-68%	-73%	-72%	-9%	-3%	4	-83%	-83%	-83%	-83%	-83%	4.5	-84%	-84%	-84%	-84%	-84%	5.5	-84%	-84%	-84%	-83%	-82%	11.4	-79%	-79%	-79%	-69%	-68%
-16%	-5%	138.8	-70%	-75%	-71%	-17%	-7%	12.1	-85%	-85%	-84%	-85%	-85%	13.6	-85%	-85%	-85%	-85%	-85%	17.1	-86%	-86%	-86%	-85%	-84%	34.7	-82%	-82%	-82%	-73%	-72%
-5%	-2%	16.9	-66%	-71%	-69%	-5%	-2%	1.8	-83%	-83%	-83%	-83%	-83%	2	-83%	-83%	-83%	-83%	-83%	2.5	-84%	-84%	-84%	-82%	-81%	5.1	-78%	-78%	-78%	-68%	-67%
-10%	-3%	68.8	-69%	-74%	-72%	-10%	-4%	6.9	-84%	-84%	-83%	-84%	-84%	7.6	-84%	-84%	-84%	-84%	-84%	9.5	-85%	-85%	-84%	-83%	-83%	19.5	-80%	-79%	-79%	-69%	-68%
-6%	-3%	33.4	-64%	-70%	-66%	-7%	-4%	3.4	-83%	-83%	-83%	-83%	-83%	3.8	-84%	-84%	-84%	-84%	-84%	4.8	-84%	-84%	-84%	-83%	-82%	9.6	-79%	-79%	-79%	-69%	-68%
-4%	-1%	352.7	-65%	-71%	-69%	-4%	-2%	38.4	-83%	-83%	-83%	-83%	-83%	42.6	-83%	-83%	-83%	-83%	-83%	52.8	-83%	-83%	-83%	-82%	-82%	107.9	-78%	-78%	-78%	-67%	-66%
-39%	-13%	73.6	-78%	-82%	-73%	-39%	-16%	3.6	-90%	-90%	-89%	-90%	-89%	4.2	-90%	-90%	-90%	-90%	-90%	5.6	-91%	-91%	-91%	-91%	-90%	10.8	-90%	-90%	-89%	-87%	-83%
-15%	-5%	140.8	-70%	-75%	-72%	-16%	-6%	12.7	-84%	-84%	-84%	-84%	-84%	14.1	-85%	-85%	-85%	-85%	-85%	17.7	-86%	-86%	-86%	-85%	-84%	36.1	-82%	-81%	-81%	-73%	-71%
-3%	-1%	164.6	-65%	-71%	-70%	-3%	-1%	18.4	-83%	-83%	-83%	-83%	-83%	20.3	-83%	-83%	-83%	-83%	-83%	25.1	-83%	-83%	-83%	-82%	-81%	51.7	-77%	-77%	-77%	-66%	-65%

2140					
FWOP	**c_inter_2140_monthly_**	**d_inter_2140_monthly_**	**e_inter_2140_monthly_**	**f_inter_2140_monthly_**	**g_inter_2140_monthly_**
22.7	-96%	-97%	-97%	-96%	-97%
10822.1	-94%	-96%	-96%	-93%	-96%
7.6	-97%	-98%	-98%	-97%	-98%
3.5	-94%	-95%	-95%	-94%	-95%
214.8	-94%	-96%	-96%	-94%	-96%
121	-96%	-97%	-97%	-96%	-97%
19	-96%	-97%	-97%	-97%	-97%
20.4	-96%	-97%	-97%	-97%	-97%
32.2	-97%	-97%	-97%	-97%	-97%
5.5	-95%	-95%	-95%	-95%	-95%
10.9	-96%	-97%	-97%	-96%	-97%
9.3	-96%	-97%	-97%	-96%	-97%
5.4	-96%	-96%	-96%	-96%	-96%
5.6	-96%	-97%	-97%	-96%	-97%
5.8	-97%	-97%	-97%	-97%	-97%
2.2	-97%	-98%	-98%	-97%	-98%
0.2	-99%	-99%	-99%	-99%	-99%
0.1	-99%	-99%	-99%	-99%	-99%
1.3	-98%	-98%	-98%	-98%	-98%
1.3	-98%	-98%	-98%	-98%	-98%
0.4	-99%	-99%	-99%	-99%	-99%
16.5	-96%	-96%	-96%	-96%	-96%
2.5	-98%	-98%	-98%	-98%	-98%
1.5	-98%	-99%	-99%	-99%	-99%
7.8	-93%	-94%	-94%	-93%	-94%
9.8	-98%	-98%	-98%	-98%	-98%
22.5	-95%	-96%	-96%	-96%	-96%
15.5	-97%	-97%	-97%	-97%	-97%
0.3	-99%	-99%	-99%	-99%	-99%
24.7	-100%	-100%	-100%	-100%	-100%
3549.1	-100%	-100%	-100%	-98%	-100%
7.1	-100%	-100%	-100%	-100%	-100%
6.1	-100%	-100%	-100%	-100%	-100%
48.9	-100%	-100%	-100%	-99%	-100%
863	-99%	-99%	-100%	-100%	-100%
20.1	-100%	-100%	-100%	-100%	-100%
24.7	-100%	-100%	-100%	-100%	-100%
33.6	-100%	-100%	-100%	-100%	-100%
3.4	-99%	-100%	-100%	-100%	-100%
6.9	-100%	-100%	-100%	-100%	-100%
13	-100%	-100%	-100%	-100%	-100%
4.3	-100%	-100%	-100%	-100%	-100%
4.5	-100%	-100%	-100%	-100%	-100%
6.8	-100%	-100%	-100%	-100%	-100%
1.9	-100%	-100%	-100%	-100%	-100%
0	-100%	-100%	-100%	-100%	-100%
0.7	-100%	-100%	-100%	-100%	-100%
0.7	-100%	-100%	-100%	-100%	-100%
0.6	-100%	-100%	-100%	-100%	-100%
18.5	-100%	-100%	-100%	-100%	-100%
1.6	-100%	-100%	-100%	-100%	-100%
1.5	-100%	-100%	-100%	-100%	-100%
9.8	-99%	-99%	-100%	-100%	-100%
16.9	-100%	-100%	-100%	-100%	-100%
16.7	-100%	-100%	-100%	-100%	-100%
14	-100%	-100%	-100%	-100%	-100%
301.6	-100%	-100%	-100%	-100%	*-97%*
21486.3	-100%	-100%	-100%	-100%	*-98%*
98.2	-100%	-100%	-100%	-100%	*-97%*
73.9	-100%	-100%	-100%	-100%	*-97%*
399.9	-99%	-100%	-100%	-100%	*-98%*
461.6	-100%	-100%	-100%	-100%	*-98%*
214.1	-100%	-100%	-100%	-100%	*-97%*
245.7	-100%	-100%	-100%	-100%	*-97%*
446.1	-100%	-100%	-100%	-100%	*-97%*
32.8	-100%	-100%	-100%	-100%	*-97%*
152.1	-99%	-100%	-99%	-100%	*-96%*

121.2	-100%	-100%	-100%	-100%	-97%
72.4	-99%	-100%	-99%	-100%	-96%
97.7	-99%	-100%	-99%	-100%	-96%
29.9	-100%	-100%	-100%	-100%	-97%
54.3	-99%	-99%	-99%	-100%	-96%
8.9	-99%	-99%	-99%	-100%	-96%
6.6	-100%	-100%	-99%	-100%	-96%
31.2	-100%	-100%	-100%	-100%	-97%
24.6	-100%	-100%	-100%	-100%	-97%
23.3	-99%	-100%	-99%	-100%	-96%
187.9	-100%	-100%	-100%	-100%	-97%
26.2	-100%	-100%	-100%	-100%	-97%
38.4	-100%	-100%	-100%	-100%	-97%
64.3	-100%	-100%	-100%	-100%	-97%
247.3	-100%	-100%	-100%	-100%	-97%
198.8	-100%	-100%	-100%	-100%	-97%
140.2	-100%	-100%	-100%	-100%	-97%
14	-99%	-99%	-99%	-100%	-96%
56.5	-83%	-83%	-83%	-70%	-67%
106992.1	-29%	-29%	-29%	-24%	-24%
42.7	-79%	-79%	-79%	-61%	-60%
5	-82%	-82%	-82%	-70%	-67%
4424.7	-54%	-54%	-54%	-49%	-47%
596.9	-96%	-97%	-95%	-93%	-83%
55.5	-82%	-82%	-82%	-68%	-65%
64.7	-83%	-83%	-83%	-69%	-66%
162.7	-81%	-81%	-80%	-64%	-62%
8.5	-79%	-79%	-79%	-61%	-60%
34	-82%	-82%	-81%	-67%	-64%
12.7	-85%	-85%	-84%	-73%	-69%
24.2	-80%	-80%	-80%	-64%	-62%
19.6	-82%	-82%	-82%	-68%	-65%
5.1	-86%	-86%	-86%	-75%	-70%
74.6	-79%	-78%	-78%	-60%	-59%
8.1	-82%	-82%	-81%	-66%	-63%
8.1	-82%	-82%	-81%	-66%	-63%
15.5	-80%	-80%	-80%	-62%	-60%
48.7	-83%	-83%	-82%	-68%	-65%
6.9	-79%	-79%	-79%	-61%	-60%
26.7	-81%	-80%	-80%	-63%	-61%
13	-80%	-80%	-79%	-63%	-62%
145.2	-79%	-78%	-78%	-60%	-59%
17.6	-90%	-90%	-89%	-84%	-77%
50.5	-82%	-82%	-82%	-67%	-64%
69.3	-78%	-78%	-78%	-59%	-58%

***** COUNT FOR DISPLACED PEOPLE IN RETREAT AREAS FOR ALT F AND G*****

	Base			100y																				
				2040						2065						2090						2115		
	Reach	Social Factor Category	Variable	FWOP	c_high_2040_100y_	d_high_2040_100y_	e_high_2040_100y_	f_high_2040_100y_	g_high_2040_100y_	FWOP	c_high_2065_100y_	d_high_2065_100y_	e_high_2065_100y_	f_high_2065_100y_	g_high_2065_100y_	FWOP	c_high_2090_100y_	d_high_2090_100y_	e_high_2090_100y_	f_high_2090_100y_	g_high_2090_100y_	FWOP	c_high_2115_100y_	d_high_2115_100y_
1	Reach 1	economic vitality	In Labor Force	45	-7%	-16%	-12%	-14%	-15%	469.7	-80%	-81%	-80%	-80%	-84%	795.6	0%	-79%	-76%	-76%	-79%	1106.4	0%	0%
2	Reach 1	economic vitality	Median Income per Household	20,078	-10%	-15%	-23%	-30%	-30%	160538.9	-75%	-76%	-78%	-79%	-83%	400383.9	1%	-52%	-49%	-49%	-52%	468832	0%	0%
4	Reach 1	economic vitality	Not in Labor Force	14	-8%	-15%	-9%	-13%	-14%	251.5	-88%	-89%	-87%	-87%	-90%	388.5	0%	-86%	-83%	-83%	-86%	602.4	0%	0%
5	Reach 1	economic vitality	Owner Occupied Units	5	-8%	-8%	2%	-4%	-6%	59	-80%	-81%	-72%	-72%	-82%	87.9	1%	-79%	-67%	-67%	-77%	121.8	0%	1%
6	Reach 1	economic vitality	Median Gross Rent	398	-8%	-14%	-26%	-31%	-32%	3130.7	-74%	-75%	-79%	-79%	-83%	7543.8	0%	-56%	-53%	-53%	-56%	8723.5	0%	0%
7	Reach 1	economic vitality	Total Jobs	294	-7%	-20%	-19%	-20%	-20%	2164.1	-72%	-74%	-78%	-78%	-79%	4212.1	0%	-74%	-74%	-74%	-75%	5321.3	0%	0%
8	Reach 1	economic vitality	Total Households	37	-7%	-16%	-11%	-14%	-15%	428.9	-82%	-83%	-82%	-82%	-85%	713.7	0%	-80%	-77%	-77%	-80%	1017.4	0%	0%
9	Reach 1	economic vitality	Total Housing Units	39	-7%	-15%	-10%	-14%	-14%	471.3	-82%	-84%	-82%	-82%	-86%	775.4	0%	-81%	-78%	-78%	-81%	1116.9	0%	0%
14	Reach 1	health and safety	Total Population	63	-7%	-16%	-11%	-14%	-15%	785.8	-83%	-84%	-83%	-83%	-86%	1282.5	0%	-82%	-79%	-79%	-82%	1863.8	0%	0%
15	Reach 1	social connectedness	Public Transit User with No Vehicle	11	-6%	-17%	-12%	-15%	-16%	80.7	-71%	-73%	-72%	-72%	-77%	148.1	1%	-72%	-68%	-68%	-72%	182.2	0%	0%
16	Reach 1	social connectedness	Commutes over 30 mins a day	22	-7%	-17%	-13%	-16%	-16%	224.5	-79%	-81%	-80%	-80%	-83%	384.8	0%	-78%	-75%	-75%	-79%	529.6	0%	0%
17	Reach 1	social connectedness	Commutes under 30 mins a day	18	-7%	-15%	-11%	-14%	-15%	197.8	-81%	-82%	-81%	-81%	-85%	331.8	0%	-80%	-76%	-76%	-80%	468.3	0%	0%
18	Reach 1	social connectedness	Commutes with Car, Truck, or Van	10	-7%	-15%	-10%	-14%	-14%	105	-79%	-81%	-79%	-80%	-83%	177.8	0%	-78%	-75%	-75%	-78%	247.5	0%	1%
19	Reach 1	social connectedness	Commutes with Public Transit	10	-7%	-14%	-7%	-11%	-13%	126.4	-83%	-84%	-81%	-81%	-86%	199.6	1%	-82%	-76%	-76%	-81%	288.6	0%	1%
21	Reach 1	social vulnerability and resiliency	Age older than 65	10	-8%	-13%	-6%	-10%	-12%	165.3	-87%	-88%	-84%	-85%	-89%	250.2	0%	-86%	-81%	-80%	-85%	383.1	0%	1%
22	Reach 1	social vulnerability and resiliency	Age under 18	4	-5%	-11%	-5%	-8%	-11%	74.3	-89%	-90%	-87%	-87%	-91%	112.1	0%	-88%	-83%	-83%	-87%	176.6	0%	1%
23	Reach 1	social vulnerability and resiliency	Education 12th Grade with No Diploma	1	-17%	-17%	-17%	-17%	-17%	15.2	-92%	-93%	-94%	-94%	-94%	23.8	0%	-91%	-91%	-91%	-91%	39	0%	0%
24	Reach 1	social vulnerability and resiliency	Education GED or Alternate Degree	0	0%	0%	0%	0%	0%	12.2	-99%	-99%	-99%	-99%	-99%	17.3	0%	-98%	-98%	-98%	-98%	31.7	0%	0%
25	Reach 1	social vulnerability and resiliency	Education Equivalent to High School Degre	3	-7%	-17%	-17%	-17%	-17%	54.3	-89%	-90%	-91%	-91%	-92%	86.8	0%	-87%	-87%	-87%	-88%	137.7	0%	0%
26	Reach 1	social vulnerability and resiliency	Education High School Diploma	3	-7%	-18%	-18%	-18%	-18%	42.1	-86%	-88%	-89%	-89%	-90%	69.5	0%	-85%	-85%	-85%	-85%	106	0%	0%
27	Reach 1	social vulnerability and resiliency	Households in Poverty	1	0%	-11%	-11%	-11%	-11%	37.9	-95%	-95%	-96%	-96%	-96%	56.2	0%	-94%	-93%	-93%	-94%	96	0%	0%
28	Reach 1	social vulnerability and resiliency	Households without Disability	33	-7%	-16%	-11%	-14%	-15%	315.2	-78%	-80%	-78%	-79%	-83%	539.8	1%	-78%	-74%	-74%	-77%	735.9	0%	0%
29	Reach 1	social vulnerability and resiliency	Households with Disability	5	-6%	-16%	-12%	-14%	-14%	113.6	-91%	-92%	-91%	-91%	-93%	173.9	0%	-89%	-88%	-88%	-89%	281.5	0%	0%
30	Reach 1	social vulnerability and resiliency	Poverty	3	-6%	-16%	-16%	-16%	-16%	80.1	-92%	-92%	-93%	-93%	-94%	124	0%	-90%	-90%	-90%	-90%	202.3	0%	0%
31	Reach 1	social vulnerability and resiliency	Linguistic Isolation	14	-6%	-13%	-6%	-11%	-12%	98.4	-70%	-72%	-66%	-66%	-75%	169.9	1%	-70%	-62%	-62%	-69%	204.2	0%	1%
33	Reach 1	social vulnerability and resiliency	Minority (Non-White)	20	-6%	-17%	-13%	-16%	-16%	366.6	-88%	-89%	-89%	-89%	-91%	581.3	0%	-87%	-86%	-86%	-87%	907.2	0%	0%
34	Reach 1	social vulnerability and resiliency	White	42	-7%	-15%	-9%	-13%	-14%	419.2	-78%	-80%	-77%	-77%	-82%	701.2	1%	-78%	-73%	-73%	-77%	956.6	0%	1%
35	Reach 1	social vulnerability and resiliency	Renter Occupied Units	32	-7%	-17%	-13%	-16%	-16%	369.8	-82%	-83%	-83%	-83%	-86%	625.8	0%	-81%	-79%	-79%	-81%	895.6	0%	0%
36	Reach 1	social vulnerability and resiliency	Single Parent	0	0%	0%	0%	0%	0%	20.1	-96%	-96%	-95%	-95%	-97%	28.4	0%	-95%	-93%	-93%	-95%	49.8	0%	0%
38	Reach 2	economic vitality	In Labor Force	561	-89%	-89%	-100%	-98%	-98%	2207.8	-91%	-91%	-95%	-95%	-94%	3044.9	0%	-92%	-93%	-93%	-92%	3810.9	0%	0%
39	Reach 2	economic vitality	Median Income per Household	92,229	-87%	-87%	-96%	-98%	-98%	496731.1	-92%	-92%	-96%	-97%	-97%	1033446.6	0%	-66%	-66%	-66%	-66%	1384222.9	0%	0%
41	Reach 2	economic vitality	Not in Labor Force	218	-88%	-88%	-100%	-99%	-98%	924.5	-89%	-89%	-94%	-93%	-93%	1314.6	0%	-89%	-90%	-90%	-89%	1633.4	0%	0%
42	Reach 2	economic vitality	Owner Occupied Units	135	-91%	-91%	-100%	-98%	-97%	522.2	-93%	-93%	-98%	-97%	-97%	747.3	0%	-93%	-93%	-93%	-93%	959.7	0%	0%
43	Reach 2	economic vitality	Median Gross Rent	1,435	-86%	-86%	-97%	-98%	-98%	7771.5	-92%	-92%	-96%	-96%	-96%	14525	0%	-67%	-68%	-68%	-68%	19520.1	0%	0%
44	Reach 2	economic vitality	Total Jobs	11,221	-92%	-92%	-100%	-99%	-98%	49289	-94%	-94%	-97%	-97%	-97%	75517.6	0%	-94%	-95%	-95%	-95%	100227.6	0%	0%
45	Reach 2	economic vitality	Total Households	489	-89%	-89%	-100%	-98%	-98%	1981.8	-90%	-90%	-94%	-94%	-94%	2753.7	0%	-91%	-91%	-91%	-91%	3396.8	0%	0%
46	Reach 2	economic vitality	Total Housing Units	577	-89%	-89%	-100%	-98%	-98%	2360.1	-90%	-90%	-95%	-94%	-94%	3323.7	0%	-90%	-91%	-91%	-91%	4112.8	0%	0%
51	Reach 2	health and safety	Total Population	832	-89%	-89%	-100%	-98%	-98%	3362.2	-90%	-90%	-95%	-94%	-94%	4708.5	0%	-91%	-92%	-91%	-91%	5900.2	0%	0%
52	Reach 2	social connectedness	Public Transit User with No Vehicle	58	-90%	-90%	-99%	-98%	-98%	246	-91%	-92%	-96%	-95%	-95%	385	0%	-89%	-89%	-89%	-89%	515.7	0%	0%
53	Reach 2	social connectedness	Commutes over 30 mins a day	159	-90%	-90%	-100%	-98%	-98%	624.7	-91%	-91%	-96%	-95%	-95%	889.6	0%	-91%	-92%	-92%	-92%	1144	0%	0%
54	Reach 2	social connectedness	Commutes under 30 mins a day	294	-89%	-89%	-100%	-98%	-98%	1166.7	-90%	-90%	-94%	-94%	-94%	1579.5	0%	-92%	-93%	-93%	-93%	1938.4	0%	0%
55	Reach 2	social connectedness	Commutes with Car, Truck, or Van	106	-89%	-89%	-100%	-98%	-98%	420.5	-91%	-91%	-95%	-95%	-95%	586.9	0%	-92%	-93%	-92%	-92%	737	0%	0%
56	Reach 2	social connectedness	Commutes with Public Transit	97	-89%	-89%	-100%	-99%	-98%	388	-89%	-90%	-94%	-94%	-94%	537.2	0%	-91%	-92%	-92%	-91%	683.2	0%	0%
58	Reach 2	social vulnerability and resiliency	Age older than 65	190	-87%	-87%	-100%	-99%	-99%	782.2	-88%	-88%	-93%	-92%	-92%	1063	0%	-90%	-91%	-91%	-91%	1280.7	0%	0%
59	Reach 2	social vulnerability and resiliency	Age under 18	54	-90%	-90%	-100%	-98%	-98%	230.7	-91%	-92%	-96%	-96%	-96%	350.8	0%	-89%	-89%	-89%	-89%	459.7	0%	0%
60	Reach 2	social vulnerability and resiliency	Education 12th Grade with No Diploma	1	-83%	-83%	-100%	-100%	-100%	6.1	-85%	-87%	-90%	-90%	-90%	12	0%	-90%	-90%	-90%	-90%	21.1	0%	0%
62	Reach 2	social vulnerability and resiliency	Education Equivalent to High School Degre	26	-87%	-87%	-99%	-99%	-99%	130.5	-87%	-88%	-93%	-93%	-93%	204.9	0%	-84%	-84%	-84%	-84%	265.5	0%	0%
63	Reach 2	social vulnerability and resiliency	Education High School Diploma	26	-86%	-87%	-100%	-99%	-99%	125.3	-87%	-87%	-93%	-93%	-93%	193.6	0%	-84%	-85%	-85%	-84%	249.1	0%	0%
64	Reach 2	social vulnerability and resiliency	Households in Poverty	23	-88%	-88%	-100%	-99%	-99%	123.4	-88%	-88%	-95%	-94%	-94%	209.9	0%	-83%	-83%	-83%	-83%	281.6	0%	0%
65	Reach 2	social vulnerability and resiliency	Households without Disability	430	-89%	-89%	-100%	-98%	-98%	1720.5	-90%	-90%	-95%	-94%	-94%	2384.3	0%	-91%	-92%	-92%	-92%	2945	0%	0%
66	Reach 2	social vulnerability and resiliency	Households with Disability	59	-85%	-86%	-99%	-99%	-99%	261.4	-85%	-86%	-91%	-91%	-91%	369.4	0%	-86%	-87%	-87%	-87%	451.8	0%	0%
67	Reach 2	social vulnerability and resiliency	Poverty	51	-88%	-88%	-99%	-99%	-99%	278.3	-89%	-89%	-95%	-95%	-95%	469	0%	-82%	-82%	-82%	-82%	611.4	0%	0%
68	Reach 2	social vulnerability and resiliency	Linguistic Isolation	141	-92%	-92%	-99%	-98%	-98%	542.5	-94%	-94%	-97%	-97%	-97%	783.4	0%	-93%	-93%	-93%	-93%	1000.3	0%	0%
70	Reach 2	social vulnerability and resiliency	Minority (Non-White)	418	-89%	-89%	-100%	-98%	-98%	1685.7	-91%	-91%	-95%	-95%	-95%	2408.1	0%	-92%	-93%	-92%	-92%	3119.6	0%	0%
71	Reach 2	social vulnerability and resiliency	White	414	-88%	-89%	-100%	-98%	-98%	1676.5	-89%	-89%	-94%	-94%	-94%	2300.4	0%	-90%	-91%	-90%	-90%	2780.6	0%	0%
72	Reach 2	social vulnerability and resiliency	Renter Occupied Units	354	-88%	-88%	-100%	-99%	-99%	1459.6	-88%	-88%	-93%	-93%	-93%	2006.4	0%	-90%	-91%	-90%	-90%	2437.1	0%	0%
75	Reach 3	economic vitality	In Labor Force	2524.3	-97%	-97%	-97%	-98%	*-93%*	7193	-92%	-92%	-92%	-93%	*-88%*	10793	-6%	-89%	-88%	-88%	*-51%*	13536.2	0%	0%
76	Reach 3	economic vitality	Median Income per Household	186758.4	-92%	-93%	-96%	-93%	*-90%*	768160	-89%	-89%	-91%	-90%	*-88%*	1341209	-8%	-89%	-89%	-86%	*-61%*	1842367.1	1%	1%
78	Reach 3	economic vitality	Not in Labor Force	843.4	-97%	-97%	-97%	-98%	*-93%*	2487.6	-92%	-92%	-92%	-93%	*-89%*	3800.3	-5%	-89%	-88%	-89%	*-53%*	4951.4	0%	0%
79	Reach 3	economic vitality	Owner Occupied Units	625.3	-97%	-97%	-97%	-98%	*-93%*	1761.5	-92%	-92%	-92%	-93%	*-88%*	2656.7	-6%	-89%	-88%	-89%	*-51%*	3323.7	1%	1%
80	Reach 3	economic vitality	Median Gross Rent	3540.1	-93%	-93%	-96%	-93%	*-91%*	13018.6	-88%	-88%	-90%	-88%	*-86%*	21236.9	-9%	-88%	-88%	-86%	*-56%*	28088.2	1%	1%
81	Reach 3	economic vitality	Total Jobs	4353.8	-97%	-97%	-97%	-98%	*-94%*	16581.8	-95%	-95%	-95%	-95%	*-92%*	28455.6	-4%	-94%	-93%	-93%	*-69%*	40140.7	1%	1%
82	Reach 3	economic vitality	Total Households	1795.8	-97%	-97%	-97%	-98%	*-93%*	5011.2	-92%	-92%	-92%	-93%	*-88%*	7532.9	-6%	-89%	-88%	-88%	*-50%*	9543.7	0%	0%
83	Reach 3	economic vitality	Total Housing Units	2063.6	-97%	-97%	-97%	-98%	*-93%*	5925.3	-92%	-92%	-92%	-93%	*-88%*	9084.4	-6%	-88%	-87%	-88%	*-51%*	11423	0%	0%
88	Reach 3	health and safety	Total Population	3744.5	-97%	-97%	-97%	-98%	*-93%*	10623.7	-92%	-92%	-92%	-93%	*-88%*	15965.1	-6%	-89%	-88%	-88%	*-51%*	20211.9	0%	0%
89	Reach 3	social connectedness	Public Transit User with No Vehicle	274.6	-97%	-97%	-97%	-97%	*-93%*	728.5	-91%	-91%	-91%	-92%	*-87%*	1113	-7%	-90%	-89%	-89%	*-46%*	1453	0%	0%
90	Reach 3	social connectedness	Commutes over 30 mins a day	1270	-97%	-97%	-96%	-98%	*-93%*	3341.5	-91%	-91%	-91%	-92%	*-87%*	4854.3	-7%	-89%	-88%	-89%	*-46%*	6032.1	1%	1%

91	Reach 3	social connectedness	Commutes under 30 mins a day	1016.3	-97%	-97%	-97%	-98%	*-93%*	3078.5	-92%	-92%	-92%	-93%	*-89%*	4764.6	-6%	-88%	-87%	-87%	*-53%*	6002.7	0%	0%
92	Reach 3	social connectedness	Commutes with Car, Truck, or Van	599.6	-96%	-97%	-96%	-97%	*-93%*	1573.1	-91%	-91%	-91%	-92%	*-87%*	2310.9	-7%	-88%	-87%	-87%	*-46%*	2830.1	0%	0%
93	Reach 3	social connectedness	Commutes with Public Transit	805.3	-96%	-97%	-96%	-97%	*-93%*	2164.3	-91%	-91%	-91%	-92%	*-87%*	3176.2	-7%	-89%	-88%	-88%	*-47%*	3991.2	1%	1%
95	Reach 3	social vulnerability and resiliency	Age older than 65	250.3	-97%	-97%	-97%	-98%	*-93%*	803.7	-93%	-93%	-93%	-94%	*-89%*	1327.5	-5%	-89%	-88%	-89%	*-58%*	1864	0%	0%
96	Reach 3	social vulnerability and resiliency	Age under 18	446.1	-96%	-97%	-96%	-97%	*-93%*	1100.5	-91%	-91%	-90%	-91%	*-86%*	1584.6	-8%	-90%	-88%	-88%	*-43%*	1974.7	0%	0%
97	Reach 3	social vulnerability and resiliency	Education 12th Grade with No Diploma	77	-97%	-97%	-97%	-98%	*-93%*	182.7	-91%	-91%	-90%	-92%	*-86%*	242.1	-7%	-91%	-90%	-91%	*-40%*	297	0%	0%
98	Reach 3	social vulnerability and resiliency	Education GED or Alternate Degree	57.4	-97%	-97%	-97%	-98%	*-93%*	143.4	-91%	-91%	-91%	-92%	*-87%*	200.7	-6%	-92%	-92%	-93%	*-47%*	263.6	0%	0%
99	Reach 3	social vulnerability and resiliency	Education Equivalent to High School Degre	272.6	-97%	-97%	-97%	-98%	*-93%*	799.6	-93%	-93%	-92%	-93%	*-89%*	1166.5	-5%	-90%	-90%	-91%	*-53%*	1511.8	0%	0%
100	Reach 3	social vulnerability and resiliency	Education High School Diploma	215.2	-97%	-97%	-97%	-98%	*-93%*	656.2	-93%	-93%	-93%	-94%	*-89%*	965.8	-5%	-90%	-89%	-90%	*-54%*	1248.2	0%	0%
101	Reach 3	social vulnerability and resiliency	Households in Poverty	201.2	-97%	-97%	-97%	-98%	*-93%*	505.2	-91%	-91%	-91%	-92%	*-87%*	713.2	-6%	-92%	-91%	-92%	*-46%*	960.8	0%	0%
102	Reach 3	social vulnerability and resiliency	Households without Disability	1574.8	-97%	-97%	-97%	-98%	*-93%*	4401.2	-92%	-92%	-92%	-93%	*-88%*	6585.9	-6%	-89%	-88%	-88%	*-50%*	8242.9	0%	0%
103	Reach 3	social vulnerability and resiliency	Households with Disability	221	-97%	-97%	-97%	-98%	*-93%*	610	-92%	-92%	-92%	-93%	*-88%*	947	-6%	-89%	-89%	-89%	*-51%*	1300.8	0%	0%
104	Reach 3	social vulnerability and resiliency	Poverty	333.5	-97%	-97%	-97%	-98%	*-93%*	1128.1	-94%	-94%	-93%	-94%	*-90%*	1635.7	-4%	-92%	-91%	-92%	*-59%*	2176.3	0%	0%
105	Reach 3	social vulnerability and resiliency	Linguistic Isolation	532.1	-96%	-97%	-96%	-97%	*-93%*	1489.2	-92%	-92%	-92%	-92%	*-88%*	2356.5	-7%	-89%	-88%	-87%	*-49%*	3004	0%	0%
107	Reach 3	social vulnerability and resiliency	Minority (Non-White)	2094.4	-97%	-97%	-97%	-98%	*-93%*	5814.5	-92%	-92%	-92%	-93%	*-88%*	8594.6	-6%	-90%	-89%	-89%	*-50%*	10946.2	0%	0%
108	Reach 3	social vulnerability and resiliency	White	1650.1	-96%	-97%	-96%	-97%	*-93%*	4809.2	-92%	-92%	-92%	-93%	*-88%*	7370.5	-6%	-88%	-87%	-87%	*-51%*	9265.6	0%	0%
109	Reach 3	social vulnerability and resiliency	Renter Occupied Units	1170.5	-97%	-97%	-96%	-98%	*-93%*	3249.7	-92%	-92%	-92%	-93%	*-88%*	4876.2	-6%	-89%	-88%	-88%	*-49%*	6220	0%	0%
110	Reach 3	social vulnerability and resiliency	Single Parent	114.2	-96%	-97%	-96%	-97%	*-93%*	268.5	-90%	-90%	-90%	-91%	*-85%*	363.5	-9%	-91%	-90%	-89%	*-39%*	438	0%	0%
112	Reach 4	economic vitality	In Labor Force	113.5	-68%	-70%	-68%	*-15%*	*-7%*	154.5	-70%	-74%	-70%	*-21%*	*-13%*	224.8	0%	-79%	-74%	*-26%*	*-18%*	406.4	-1%	-1%
113	Reach 4	economic vitality	Median Income per Household	122604.6	-16%	-17%	-16%	*-1%*	*-1%*	134783.8	-20%	-21%	-18%	*-3%*	*-2%*	158716.7	0%	-31%	-23%	*-2%*	*-3%*	214222.1	-2%	0%
115	Reach 4	economic vitality	Not in Labor Force	77.6	-65%	-68%	-68%	*-4%*	*-2%*	98	-66%	-71%	-70%	*-6%*	*-4%*	140.1	0%	-77%	-74%	*-14%*	*-11%*	208.6	0%	0%
116	Reach 4	economic vitality	Owner Occupied Units	10.2	-62%	-65%	-59%	*-11%*	*-5%*	13.7	-64%	-67%	-61%	*-16%*	*-10%*	22.7	0%	-78%	-69%	*-31%*	*-26%*	61.2	-1%	0%
117	Reach 4	economic vitality	Median Gross Rent	6392.1	-37%	-38%	-37%	*-15%*	*-5%*	7900.4	-46%	-47%	-44%	*-21%*	*-8%*	11003.7	-1%	-61%	-57%	*-30%*	*-19%*	14917.8	-5%	-5%
118	Reach 4	economic vitality	Total Jobs	1833.4	-90%	-90%	-85%	*-58%*	*-28%*	3172.6	-91%	-92%	-87%	*-66%*	*-41%*	4650.1	-1%	-94%	-89%	*-64%*	*-35%*	7573.1	-2%	-2%
119	Reach 4	economic vitality	Total Households	108.1	-68%	-70%	-68%	*-12%*	*-6%*	144.3	-70%	-74%	-71%	*-17%*	*-11%*	204	0%	-79%	-74%	*-22%*	*-14%*	326.9	-1%	-1%
120	Reach 4	economic vitality	Total Housing Units	128	-69%	-71%	-69%	*-14%*	*-7%*	173.1	-71%	-75%	-72%	*-20%*	*-12%*	244.4	0%	-80%	-75%	*-24%*	*-15%*	385.8	-1%	-1%
125	Reach 4	health and safety	Total Population	305.3	-66%	-69%	-68%	*-8%*	*-4%*	396.3	-68%	-72%	-70%	*-11%*	*-7%*	557.9	0%	-77%	-73%	*-17%*	*-11%*	852.6	-1%	0%
126	Reach 4	social connectedness	Public Transit User with No Vehicle	15.4	-64%	-68%	-66%	*-4%*	*-2%*	19.5	-65%	-70%	-67%	*-5%*	*-4%*	27.3	0%	-75%	-70%	*-10%*	*-8%*	39.3	-1%	0%
127	Reach 4	social connectedness	Commutes over 30 mins a day	66.1	-66%	-69%	-66%	*-10%*	*-5%*	87.5	-68%	-72%	-68%	*-15%*	*-10%*	125.4	0%	-78%	-72%	*-21%*	*-15%*	223.9	-1%	0%
128	Reach 4	social connectedness	Commutes under 30 mins a day	26.4	-68%	-70%	-67%	*-18%*	*-9%*	37.1	-71%	-74%	-69%	*-26%*	*-16%*	56.5	-1%	-81%	-73%	*-32%*	*-22%*	114.6	-1%	-1%
129	Reach 4	social connectedness	Commutes with Car, Truck, or Van	45.1	-66%	-69%	-67%	*-7%*	*-4%*	58.4	-67%	-72%	-69%	*-10%*	*-7%*	88.2	0%	-78%	-74%	*-21%*	*-17%*	157.5	-1%	0%
130	Reach 4	social connectedness	Commutes with Public Transit	38.3	-66%	-69%	-66%	*-11%*	*-6%*	51.2	-68%	-72%	-68%	*-17%*	*-11%*	71.5	0%	-77%	-71%	*-19%*	*-12%*	120.4	-1%	0%
132	Reach 4	social vulnerability and resiliency	Age older than 65	10.8	-72%	-75%	-72%	*-22%*	*-10%*	15.5	-75%	-79%	-74%	*-30%*	*-19%*	28.5	0%	-87%	-82%	*-48%*	*-38%*	67.4	-1%	0%
133	Reach 4	social vulnerability and resiliency	Age under 18	133.9	-65%	-68%	-68%	*-3%*	*-1%*	167.9	-66%	-71%	-69%	*-4%*	*-3%*	225.6	0%	-75%	-72%	*-7%*	*-4%*	278.1	-1%	0%
136	Reach 4	social vulnerability and resiliency	Education Equivalent to High School Degre	15.5	-68%	-71%	-69%	*-10%*	*-5%*	20.4	-70%	-75%	-72%	*-15%*	*-9%*	31.7	0%	-81%	-78%	*-28%*	*-21%*	57.4	-1%	0%
137	Reach 4	social vulnerability and resiliency	Education High School Diploma	15.4	-68%	-71%	-69%	*-10%*	*-5%*	20.3	-70%	-74%	-72%	*-15%*	*-9%*	30.6	0%	-80%	-78%	*-25%*	*-19%*	51.7	-1%	-1%
138	Reach 4	social vulnerability and resiliency	Households in Poverty	28.6	-67%	-70%	-69%	*-6%*	*-3%*	36.6	-68%	-73%	-72%	*-9%*	*-6%*	49.9	0%	-77%	-75%	*-13%*	*-8%*	63.6	-1%	-1%
139	Reach 4	social vulnerability and resiliency	Households without Disability	95.7	-68%	-71%	-68%	*-13%*	*-6%*	128.5	-70%	-74%	-71%	*-18%*	*-12%*	181	0%	-79%	-74%	*-22%*	*-14%*	290.3	-1%	-1%
140	Reach 4	social vulnerability and resiliency	Households with Disability	12.4	-65%	-68%	-67%	*-4%*	*-2%*	15.7	-66%	-71%	-69%	*-6%*	*-3%*	23.1	0%	-77%	-74%	*-16%*	*-13%*	36.6	-1%	0%
141	Reach 4	social vulnerability and resiliency	Poverty	49.6	-67%	-70%	-69%	*-7%*	*-4%*	64.1	-69%	-73%	-72%	*-11%*	*-7%*	88.7	0%	-78%	-75%	*-16%*	*-10%*	120.3	-1%	-1%
142	Reach 4	social vulnerability and resiliency	Linguistic Isolation	23.9	-64%	-67%	-66%	*-5%*	*-3%*	30.9	-64%	-69%	-66%	*-8%*	*-5%*	46.6	0%	-76%	-70%	*-17%*	*-15%*	82.1	-1%	0%
144	Reach 4	social vulnerability and resiliency	Minority (Non-White)	262.2	-65%	-68%	-67%	*-3%*	*-2%*	329.3	-66%	-71%	-69%	*-5%*	*-3%*	457.8	0%	-75%	-73%	*-10%*	*-8%*	646.7	0%	0%
145	Reach 4	social vulnerability and resiliency	White	43.2	-75%	-76%	-71%	*-35%*	*-17%*	67	-78%	-80%	-73%	*-44%*	*-28%*	100.1	-1%	-85%	-76%	*-46%*	*-28%*	205.9	-2%	-1%
146	Reach 4	social vulnerability and resiliency	Renter Occupied Units	97.8	-68%	-71%	-69%	*-12%*	*-6%*	130.6	-70%	-74%	-72%	*-17%*	*-11%*	181.4	0%	-79%	-75%	*-20%*	*-12%*	265.7	-1%	-1%
147	Reach 4	social vulnerability and resiliency	Single Parent	123.5	-65%	-68%	-68%	*-2%*	*-1%*	154	-66%	-71%	-70%	*-3%*	*-2%*	204.9	0%	-74%	-72%	*-5%*	*-3%*	239.2	0%	0%

									Monthly																				
			2140						2040						2065						2090						2115		
e_high_2115_100y_	f_high_2115_100y_	g_high_2115_100y_	FWOP	c_high_2140_100y_	d_high_2140_100y_	e_high_2140_100y_	f_high_2140_100y_	g_high_2140_100y_	FWOP	c_high_2040_monthly_	d_high_2040_monthly_	e_high_2040_monthly_	f_high_2040_monthly_	g_high_2040_monthly_	FWOP	c_high_2065_monthly_	d_high_2065_monthly_	e_high_2065_monthly_	f_high_2065_monthly_	g_high_2065_monthly_	FWOP	c_high_2090_monthly_	d_high_2090_monthly_	e_high_2090_monthly_	f_high_2090_monthly_	g_high_2090_monthly_	FWOP	c_high_2115_monthly_	d_high_2115_monthly_
-80%	-80%	-83%	1480.1	0%	0%	-84%	-84%	-87%	7.6	-80%	-80%	-80%	-83%	-83%	13.5	-97%	-97%	-97%	-97%	-97%	35.1	-96%	-96%	-96%	-96%	-96%	685.2	-82%	-86%
-55%	-55%	-58%	550422	0%	0%	-60%	-60%	-63%	4149.3	-77%	-77%	-76%	-79%	-79%	6681.3	-95%	-95%	-95%	-96%	-96%	17672.8	-96%	-97%	-97%	-96%	-97%	369206.9	-54%	-60%
-88%	-88%	-90%	891.4	0%	0%	-91%	-91%	-93%	2.9	-76%	-76%	-76%	-79%	-79%	5	-98%	-98%	-98%	-98%	-98%	11.6	-97%	-98%	-97%	-97%	-97%	340.5	-90%	-92%
-72%	-72%	-81%	168.1	0%	1%	-77%	-76%	-85%	2	-56%	-56%	-56%	-60%	-60%	3.1	-94%	-94%	-94%	-95%	-95%	5	-95%	-95%	-95%	-94%	-95%	77.9	-84%	-85%
-58%	-57%	-60%	9980.6	0%	0%	-62%	-61%	-65%	74.5	-79%	-79%	-78%	-80%	-80%	121.7	-96%	-96%	-95%	-96%	-96%	344	-96%	-97%	-97%	-96%	-97%	6919.9	-55%	-63%
-77%	-77%	-78%	6254.7	0%	0%	-80%	-80%	-80%	14.9	-94%	-94%	-94%	-95%	-95%	42.6	-98%	-98%	-98%	-98%	-98%	205.1	-95%	-96%	-96%	-96%	-96%	3538.1	-75%	-80%
-82%	-82%	-85%	1394.3	0%	0%	-86%	-86%	-88%	6.5	-80%	-80%	-80%	-82%	-82%	11.4	-97%	-97%	-97%	-97%	-97%	29.3	-96%	-97%	-97%	-96%	-96%	616.7	-84%	-87%
-82%	-82%	-85%	1547.3	0%	0%	-86%	-86%	-89%	7.3	-78%	-78%	-78%	-81%	-81%	12.6	-97%	-97%	-97%	-97%	-97%	31.2	-96%	-97%	-96%	-96%	-96%	671.4	-85%	-88%
-83%	-83%	-86%	2604.1	0%	0%	-87%	-87%	-89%	11.4	-79%	-79%	-79%	-81%	-81%	19.9	-97%	-97%	-97%	-98%	-97%	49.6	-96%	-97%	-97%	-96%	-97%	1112	-86%	-88%
-71%	-71%	-75%	211.8	0%	0%	-73%	-73%	-77%	1.6	-83%	-83%	-83%	-85%	-85%	3	-96%	-96%	-96%	-96%	-96%	8.7	-94%	-95%	-95%	-94%	-95%	126.6	-73%	-78%
-80%	-80%	-83%	699.5	0%	0%	-84%	-83%	-86%	3.3	-83%	-83%	-83%	-85%	-85%	6.1	-97%	-97%	-97%	-97%	-97%	17.1	-96%	-96%	-96%	-96%	-96%	330.9	-82%	-85%
-81%	-81%	-84%	635.8	0%	0%	-85%	-85%	-87%	3.3	-79%	-79%	-79%	-81%	-81%	5.7	-97%	-97%	-97%	-97%	-97%	14.3	-96%	-96%	-96%	-96%	-96%	286.1	-83%	-86%
-79%	-79%	-82%	331.9	0%	0%	-83%	-83%	-86%	2	-77%	-78%	-77%	-80%	-80%	3.4	-96%	-96%	-96%	-97%	-97%	8.2	-96%	-96%	-96%	-96%	-96%	153.2	-82%	-85%
-81%	-81%	-86%	404.6	0%	0%	-85%	-85%	-89%	2.3	-73%	-73%	-73%	-76%	-76%	3.9	-97%	-97%	-97%	-97%	-97%	8.3	-96%	-97%	-96%	-96%	-96%	175.1	-86%	-88%
-86%	-85%	-89%	564.7	0%	0%	-89%	-89%	-92%	2.6	-70%	-70%	-70%	-73%	-73%	4.3	-97%	-97%	-97%	-97%	-97%	8.5	-97%	-97%	-97%	-97%	-97%	220.9	-90%	-91%
-88%	-88%	-91%	265.7	0%	0%	-91%	-91%	-94%	1	-68%	-68%	-68%	-71%	-71%	1.7	-98%	-98%	-98%	-98%	-98%	3.3	-97%	-98%	-97%	-97%	-97%	98.6	-91%	-92%
-94%	-94%	-94%	59.6	0%	0%	-96%	-96%	-96%	0	-100%	-100%	-100%	-100%	-100%	0.1	-99%	-99%	-99%	-99%	-99%	0.4	-98%	-99%	-99%	-99%	-99%	20.6	-93%	-95%
-98%	-98%	-98%	52.4	0%	0%	-99%	-99%	-99%	0.1	0%	0%	0%	0%	0%	0.1	-99%	-99%	-99%	-99%	-99%	0.1	-99%	-99%	-99%	-99%	-99%	15.3	-99%	-99%
-91%	-91%	-91%	205.3	0%	0%	-93%	-93%	-94%	0.4	-86%	-86%	-86%	-86%	-86%	0.6	-99%	-99%	-99%	-99%	-99%	2.1	-98%	-98%	-98%	-98%	-98%	75.2	-91%	-93%
-88%	-88%	-89%	152.8	0%	0%	-91%	-91%	-92%	0.3	-89%	-89%	-89%	-89%	-89%	0.6	-99%	-99%	-99%	-99%	-99%	2	-97%	-98%	-98%	-97%	-98%	59.9	-88%	-91%
-96%	-96%	-96%	151.7	0%	0%	-97%	-97%	-97%	0.1	-89%	-89%	-89%	-89%	-89%	0.2	-99%	-99%	-99%	-99%	-99%	0.7	-99%	-99%	-99%	-99%	-99%	49.4	-96%	-97%
-78%	-78%	-82%	965.3	0%	0%	-82%	-82%	-85%	5.7	-80%	-80%	-80%	-82%	-82%	10	-97%	-97%	-97%	-97%	-97%	25.5	-95%	-96%	-96%	-96%	-96%	464.4	-81%	-84%
-92%	-92%	-93%	428.9	0%	0%	-94%	-94%	-95%	0.8	-82%	-82%	-80%	-84%	-84%	1.4	-99%	-99%	-99%	-99%	-99%	3.8	-98%	-98%	-98%	-98%	-98%	152.3	-92%	-94%
-93%	-93%	-93%	308.9	0%	0%	-95%	-95%	-95%	0.3	-88%	-88%	-88%	-91%	-91%	0.7	-99%	-99%	-99%	-99%	-99%	2.4	-98%	-98%	-98%	-98%	-98%	108.1	-93%	-94%
-64%	-64%	-72%	236.4	0%	0%	-66%	-65%	-74%	3.2	-73%	-73%	-73%	-76%	-76%	5.5	-94%	-94%	-94%	-94%	-94%	11.7	-93%	-94%	-94%	-93%	-94%	147.5	-72%	-76%
-90%	-90%	-91%	1340.9	0%	0%	-92%	-92%	-93%	2.8	-84%	-84%	-84%	-86%	-86%	5.2	-98%	-98%	-98%	-99%	-99%	15.4	-97%	-98%	-98%	-98%	-98%	505	-90%	-92%
-77%	-77%	-82%	1263.1	0%	0%	-81%	-81%	-85%	8.6	-77%	-77%	-76%	-79%	-79%	14.7	-96%	-96%	-96%	-97%	-97%	34.2	-95%	-96%	-96%	-95%	-96%	607	-81%	-84%
-83%	-83%	-85%	1226.2	0%	0%	-87%	-87%	-89%	4.5	-84%	-84%	-84%	-86%	-86%	8.3	-98%	-98%	-98%	-98%	-98%	24.4	-96%	-97%	-97%	-96%	-97%	538.8	-84%	-87%
-95%	-95%	-97%	80.5	0%	0%	-97%	-97%	-98%	0.2	-50%	-50%	-50%	-50%	-50%	0.2	-99%	-99%	-99%	-99%	-99%	0.4	-99%	-99%	-99%	-99%	-99%	25.4	-97%	-97%
-94%	-94%	-94%	4288.3	0%	0%	-94%	-94%	-94%	2.4	-100%	-100%	-100%	-100%	-100%	11.2	-100%	-100%	-100%	-100%	-100%	428.2	-98%	-99%	-100%	-100%	-100%	2671.6	-91%	-94%
-74%	-73%	-73%	1460584.4	0%	0%	-75%	-75%	-75%	616.5	-99%	-99%	-97%	-100%	-100%	1800	-100%	-100%	-99%	-100%	-100%	64842.8	-99%	-100%	-100%	-99%	-100%	928293.9	-75%	-77%
-91%	-91%	-91%	1845.1	0%	0%	-92%	-92%	-92%	0.8	-100%	-100%	-100%	-100%	-100%	2.8	-100%	-100%	-100%	-100%	-100%	164.6	-98%	-99%	-100%	-100%	-100%	1148.2	-88%	-92%
-94%	-94%	-94%	1083.6	0%	0%	-95%	-95%	-95%	0.7	-99%	-99%	-100%	-100%	-100%	2.8	-100%	-100%	-100%	-100%	-100%	104.4	-99%	-99%	-100%	-100%	-100%	653.7	-91%	-95%
-75%	-75%	-75%	20513.6	0%	0%	-76%	-76%	-76%	11	-99%	-99%	-98%	-100%	-100%	24.9	-100%	-100%	-100%	-100%	-100%	1025.6	-99%	-100%	-100%	-99%	-100%	12734.4	-77%	-80%
-96%	-96%	-96%	119828.5	0%	0%	-97%	-96%	-96%	54.1	-100%	-100%	-100%	-100%	-100%	460.7	-100%	-100%	-100%	-100%	-100%	7785.7	-99%	-99%	-100%	-100%	-100%	62454.4	-94%	-96%
-92%	-92%	-92%	3808.9	0%	0%	-93%	-93%	-93%	1.9	-100%	-100%	-100%	-100%	-100%	8.9	-100%	-100%	-100%	-100%	-100%	369.7	-98%	-99%	-100%	-100%	-100%	2419.7	-89%	-93%
-92%	-92%	-92%	4618.7	0%	0%	-93%	-93%	-93%	2.3	-100%	-100%	-100%	-100%	-100%	11.2	-100%	-100%	-100%	-100%	-100%	433.1	-98%	-99%	-100%	-100%	-100%	2919	-89%	-93%
-93%	-93%	-93%	6657.4	0%	0%	-94%	-93%	-93%	3.5	-100%	-100%	-100%	-100%	-100%	14.8	-100%	-100%	-100%	-100%	-100%	633.3	-98%	-99%	-100%	-100%	-100%	4120.2	-90%	-93%
-91%	-91%	-91%	617.2	0%	0%	-93%	-93%	-93%	0.3	-99%	-99%	-99%	-99%	-99%	1.7	-100%	-100%	-100%	-100%	-100%	41.3	-99%	-99%	-100%	-100%	-100%	319.5	-90%	-93%
-93%	-93%	-93%	1307.9	0%	0%	-94%	-94%	-94%	0.8	-99%	-99%	-100%	-100%	-100%	3.1	-100%	-100%	-100%	-100%	-100%	121.7	-98%	-99%	-100%	-100%	-100%	768.5	-91%	-94%
-94%	-94%	-94%	2161.8	0%	0%	-94%	-94%	-94%	1.2	-100%	-100%	-100%	-100%	-100%	5.9	-100%	-100%	-100%	-100%	-100%	223.2	-98%	-99%	-100%	-100%	-100%	1396.8	-91%	-94%
-94%	-93%	-93%	829.7	0%	0%	-94%	-94%	-94%	0.5	-100%	-100%	-100%	-100%	-100%	1.9	-100%	-100%	-100%	-100%	-100%	81.5	-98%	-99%	-100%	-100%	-100%	512.2	-91%	-94%
-93%	-93%	-93%	783	0%	0%	-94%	-94%	-94%	0.4	-100%	-100%	-100%	-100%	-100%	2.1	-100%	-100%	-100%	-100%	-100%	72.6	-98%	-99%	-100%	-100%	-100%	468.7	-90%	-93%
-92%	-92%	-92%	1429.6	0%	0%	-93%	-93%	-93%	0.6	-100%	-100%	-100%	-100%	-100%	2.8	-100%	-100%	-100%	-100%	-100%	143	-98%	-99%	-100%	-100%	-100%	938.8	-88%	-92%
-91%	-91%	-91%	529.1	0%	0%	-92%	-92%	-92%	0.3	-99%	-99%	-100%	-100%	-100%	0.8	-100%	-100%	-100%	-100%	-100%	40.5	-99%	-99%	-100%	-100%	-100%	301.7	-88%	-92%
-94%	-94%	-94%	30.1	0%	0%	-96%	-96%	-96%	0	-100%	-100%	-100%	-100%	-100%	0	-100%	-100%	-100%	-100%	-100%	0.9	-98%	-99%	-100%	-100%	-100%	7.5	-94%	-95%
-87%	-87%	-87%	307	0%	0%	-88%	-88%	-88%	0.1	-100%	-100%	-100%	-100%	-100%	0.2	-100%	-100%	-100%	-100%	-100%	18.6	-98%	-99%	-100%	-100%	-100%	176.7	-84%	-88%
-87%	-87%	-87%	286.7	0%	0%	-89%	-89%	-89%	0.1	-100%	-100%	-100%	-100%	-100%	0.2	-100%	-100%	-100%	-100%	-100%	18.5	-98%	-99%	-100%	-100%	-100%	167.4	-84%	-88%
-86%	-86%	-86%	335.2	0%	0%	-88%	-88%	-88%	0.1	-100%	-100%	-100%	-100%	-100%	0.2	-100%	-100%	-100%	-100%	-100%	15.8	-99%	-100%	-100%	-100%	-100%	176.1	-83%	-88%
-93%	-93%	-93%	3293.4	0%	0%	-94%	-94%	-94%	1.8	-100%	-100%	-100%	-100%	-100%	8.4	-100%	-100%	-100%	-100%	-100%	326.1	-98%	-99%	-100%	-100%	-100%	2097.9	-90%	-93%
-89%	-89%	-89%	515.5	0%	0%	-90%	-90%	-90%	0.1	-100%	-100%	-100%	-100%	-100%	0.5	-100%	-100%	-100%	-100%	-100%	43.6	-98%	-99%	-100%	-100%	-100%	321.8	-85%	-90%
-85%	-85%	-85%	707	0%	0%	-87%	-87%	-87%	0.2	-100%	-100%	-100%	-100%	-100%	0.7	-100%	-100%	-100%	-100%	-100%	34.2	-99%	-100%	-100%	-100%	-100%	403.1	-82%	-87%
-94%	-94%	-94%	1147.3	0%	0%	-95%	-95%	-95%	0.7	-99%	-99%	-100%	-99%	-99%	5.1	-99%	-100%	-100%	-100%	-100%	101.5	-99%	-99%	-100%	-100%	-100%	680	-92%	-95%
-94%	-94%	-94%	3592.5	0%	0%	-95%	-95%	-95%	1.9	-100%	-100%	-100%	-100%	-100%	7.4	-100%	-100%	-100%	-100%	-100%	320.6	-98%	-99%	-100%	-100%	-100%	2070.1	-91%	-94%
-92%	-91%	-91%	3064.9	0%	0%	-92%	-92%	-92%	1.6	-100%	-100%	-100%	-100%	-100%	7.4	-100%	-100%	-100%	-100%	-100%	312.7	-98%	-99%	-100%	-100%	-100%	2050	-88%	-92%
-92%	-92%	-92%	2725.3	0%	0%	-93%	-93%	-93%	1.2	-100%	-100%	-100%	-100%	-100%	6.1	-100%	-100%	-100%	-100%	-100%	265.3	-98%	-99%	-100%	-100%	-100%	1766	-89%	-92%
-87%	-88%	*-50%*	15472.3	1%	1%	-88%	-89%	*-55%*	31	-99%	-99%	-99%	-100%	*-99%*	197.9	-100%	-100%	-99%	-100%	*-99%*	2253.3	-99%	-99%	-99%	-99%	*-87%*	9337	-90%	-91%
-86%	-86%	*-61%*	2178030.4	2%	2%	-86%	-86%	*-66%*	4978.5	-99%	-99%	-99%	-99%	*-99%*	14407.5	-100%	-100%	-100%	-100%	*-100%*	158691.8	-99%	-99%	-100%	-99%	*-94%*	1048638.9	-91%	-92%
-89%	-90%	*-55%*	5939.9	0%	0%	-91%	-91%	*-61%*	9.2	-99%	-99%	-99%	-100%	*-99%*	64	-100%	-100%	-100%	-100%	*-100%*	752.9	-99%	-99%	-99%	-100%	*-88%*	3275.2	-90%	-92%
-88%	-89%	*-50%*	3795.2	1%	1%	-89%	-89%	*-55%*	7.3	-99%	-99%	-99%	-100%	*-99%*	48.4	-100%	-100%	-99%	-100%	*-99%*	558.3	-99%	-99%	-99%	-99%	*-87%*	2295.6	-90%	-91%
-85%	-85%	*-54%*	32532.2	3%	3%	-85%	-85%	*-59%*	87.6	-99%	-99%	-99%	-99%	*-99%*	265.1	-100%	-100%	-100%	-100%	*-99%*	2996	-99%	-99%	-99%	-99%	*-92%*	17065	-90%	-92%
-93%	-93%	*-71%*	50759.9	1%	1%	-94%	-94%	*-76%*	49.8	-99%	-99%	-99%	-100%	*-99%*	304	-100%	-100%	-100%	-100%	*-100%*	3923.5	-100%	-100%	-100%	-100%	*-93%*	22334.3	-95%	-96%
-88%	-88%	*-50%*	11065.3	1%	1%	-89%	-89%	*-55%*	21.6	-99%	-99%	-99%	-100%	*-99%*	140.3	-100%	-100%	-99%	-100%	*-99%*	1602.9	-99%	-99%	-99%	-99%	*-87%*	6500.1	-90%	-92%
-87%	-88%	*-50%*	13186.8	1%	1%	-88%	-89%	*-56%*	24.9	-99%	-99%	-99%	-100%	*-99%*	161	-100%	-100%	-99%	-100%	*-99%*	1842	-99%	-99%	-99%	-99%	*-88%*	7850.6	-89%	-91%
-88%	-88%	*-50%*	23373.5	1%	1%	-89%	-89%	*-56%*	45.4	-99%	-99%	-99%	-100%	*-99%*	292.5	-100%	-100%	-99%	-100%	*-99%*	3342.8	-99%	-99%	-99%	-99%	*-87%*	13795.3	-90%	-92%
-88%	-89%	*-46%*	1706.6	1%	1%	-89%	-89%	*-53%*	3.3	-99%	-99%	-99%	-100%	*-99%*	21.5	-100%	-100%	-99%	-100%	*-99%*	245.2	-99%	-99%	-99%	-99%	*-87%*	936.4	-91%	-92%
-87%	-88%	*-44%*	6780.7	1%	1%	-87%	-88%	*-49%*	15.4	-99%	-99%	-99%	-100%	*-99%*	99.8	-99%	-99%	-99%	-100%	*-99%*	1133.3	-99%	-99%	-99%	-99%	*-86%*	4229.7	-90%	-92%

-87%	-88%	-53%	6936.3	1%	1%	-88%	-88%	-58%	12.8	-99%	-99%	-99%	-100%	-99%	79.7	-100%	-100%	-100%	-100%	-99%	907.6	-99%	-99%	-99%	-99%	-88%	4111.6	-89%	-91%
-86%	-87%	-43%	3163.2	1%	1%	-86%	-87%	-48%	7.6	-99%	-99%	-99%	-100%	-99%	47.6	-99%	-99%	-99%	-100%	-99%	535.2	-99%	-99%	-99%	-99%	-86%	2023.2	-89%	-91%
-87%	-88%	-45%	4502.8	2%	2%	-87%	-88%	-50%	10.4	-99%	-99%	-99%	-100%	-99%	64.3	-99%	-99%	-99%	-100%	-99%	718.7	-99%	-99%	-99%	-99%	-86%	2746.1	-91%	-92%
-90%	-90%	-63%	2359.3	0%	0%	-91%	-92%	-70%	3	-99%	-99%	-99%	-100%	-99%	19.6	-100%	-100%	-100%	-100%	-100%	223.3	-99%	-99%	-99%	-100%	-90%	1098	-91%	-92%
-86%	-87%	-41%	2231.6	2%	2%	-86%	-87%	-46%	5.9	-99%	-99%	-99%	-100%	-99%	35.8	-99%	-99%	-99%	-100%	-99%	398.3	-99%	-99%	-99%	-99%	-85%	1376.8	-91%	-92%
-90%	-91%	-37%	340.5	0%	0%	-91%	-92%	-44%	0.8	-99%	-99%	-99%	-100%	-99%	5.8	-99%	-99%	-99%	-100%	-99%	68.7	-99%	-99%	-99%	-99%	-82%	216.2	-93%	-93%
-92%	-93%	-48%	302.8	0%	0%	-93%	-94%	-54%	0.5	-99%	-99%	-99%	-100%	-99%	4.3	-100%	-100%	-99%	-100%	-99%	51.2	-99%	-99%	-99%	-99%	-84%	172.8	-94%	-94%
-91%	-92%	-54%	1780.5	0%	0%	-92%	-93%	-60%	2.7	-99%	-99%	-99%	-100%	-99%	20.2	-100%	-100%	-100%	-100%	-100%	243.3	-99%	-99%	-99%	-100%	-87%	1013.7	-91%	-93%
-90%	-91%	-56%	1477.6	0%	0%	-92%	-92%	-62%	2.2	-99%	-99%	-99%	-100%	-99%	16	-100%	-100%	-100%	-100%	-100%	192.2	-99%	-99%	-99%	-100%	-88%	840.9	-91%	-92%
-92%	-93%	-49%	1206.6	0%	0%	-94%	-95%	-59%	1.9	-99%	-99%	-99%	-100%	-99%	15.1	-100%	-100%	-99%	-100%	-99%	179.4	-99%	-99%	-99%	-99%	-84%	614.7	-94%	-94%
-87%	-88%	-49%	9443.7	1%	1%	-88%	-89%	-54%	19.1	-99%	-99%	-99%	-100%	-99%	123.2	-100%	-100%	-99%	-100%	-99%	1405.7	-99%	-99%	-99%	-99%	-87%	5701.6	-90%	-91%
-90%	-90%	-55%	1621.6	0%	0%	-91%	-92%	-63%	2.5	-99%	-99%	-99%	-100%	-99%	17.1	-100%	-100%	-99%	-100%	-99%	197.2	-99%	-99%	-99%	-99%	-87%	798.5	-91%	-93%
-92%	-93%	-61%	2693	0%	0%	-94%	-94%	-68%	3.3	-99%	-99%	-99%	-100%	-99%	24.9	-100%	-100%	-100%	-100%	-100%	297.3	-99%	-99%	-99%	-100%	-89%	1416.4	-93%	-94%
-86%	-87%	-48%	3467.3	1%	1%	-87%	-87%	-53%	7.1	-99%	-99%	-99%	-100%	-99%	42.4	-100%	-100%	-99%	-100%	-99%	475.5	-99%	-99%	-99%	-99%	-88%	1977.4	-90%	-91%
-89%	-89%	-50%	12767.8	1%	1%	-90%	-90%	-56%	23.9	-99%	-99%	-99%	-100%	-99%	161.5	-100%	-100%	-99%	-100%	-99%	1869.1	-99%	-99%	-99%	-99%	-87%	7444.8	-91%	-92%
-86%	-87%	-51%	10605.7	1%	1%	-87%	-88%	-56%	21.5	-99%	-99%	-99%	-100%	-99%	131	-100%	-100%	-99%	-100%	-99%	1473.6	-99%	-99%	-99%	-99%	-88%	6350.5	-89%	-91%
-88%	-88%	-49%	7270	1%	1%	-89%	-89%	-55%	14.3	-99%	-99%	-99%	-100%	-99%	91.9	-100%	-100%	-99%	-100%	-99%	1044.6	-99%	-99%	-99%	-99%	-87%	4204.5	-90%	-92%
-86%	-87%	-33%	479.9	2%	2%	-85%	-86%	-37%	1.5	-99%	-99%	-99%	-100%	-99%	9.2	-99%	-99%	-99%	-100%	-99%	102	-99%	-99%	-99%	-99%	-83%	320.3	-92%	-93%
-81%	-37%	-32%	735.8	-1%	0%	-88%	-53%	-55%	16.9	-86%	-86%	-86%	-86%	-85%	46	-83%	-83%	-82%	-73%	-72%	107.9	-84%	-85%	-84%	-58%	-53%	177.7	-87%	-89%
-36%	-6%	-8%	283040.3	0%	0%	-48%	-12%	-19%	73432.5	-40%	-40%	-37%	-40%	-40%	104194	-27%	-27%	-27%	-24%	-24%	121195.8	-36%	-36%	-36%	-25%	-25%	143325.5	-47%	-50%
-81%	-32%	-30%	370.7	0%	0%	-88%	-58%	-58%	13.3	-84%	-84%	-84%	-83%	-83%	35.7	-79%	-78%	-78%	-64%	-64%	74.4	-81%	-83%	-82%	-49%	-47%	110.7	-82%	-85%
-81%	-42%	-40%	151.4	0%	0%	-91%	-62%	-67%	1.6	-85%	-85%	-85%	-85%	-85%	4.1	-82%	-82%	-81%	-72%	-72%	9.7	-83%	-85%	-82%	-62%	-58%	15.9	-91%	-92%
-66%	-38%	-30%	17807.5	-6%	-6%	-70%	-42%	-37%	2844.2	-56%	-55%	-53%	-56%	-55%	4151.1	-52%	-52%	-52%	-49%	-48%	6187.6	-64%	-64%	-64%	-50%	-44%	8625	-70%	-72%
-92%	-69%	-50%	10490.1	-3%	-3%	-94%	-73%	-60%	91.4	-96%	-96%	-95%	-96%	-95%	388	-96%	-97%	-95%	-96%	-92%	1688.3	-96%	-96%	-95%	-82%	-65%	3805.4	-96%	-97%
-80%	-32%	-27%	525.7	-1%	-1%	-86%	-47%	-48%	16.7	-85%	-85%	-85%	-85%	-85%	45.5	-82%	-82%	-81%	-71%	-70%	103.1	-83%	-85%	-84%	-55%	-50%	165	-84%	-87%
-80%	-34%	-28%	603.4	-1%	-1%	-86%	-48%	-47%	19.2	-86%	-86%	-86%	-85%	-85%	52.7	-83%	-83%	-82%	-72%	-71%	121.9	-84%	-85%	-84%	-56%	-51%	198.4	-85%	-88%
-79%	-29%	-26%	1434.7	0%	0%	-86%	-50%	-50%	50.1	-84%	-84%	-84%	-84%	-84%	134.7	-80%	-80%	-80%	-68%	-67%	292.1	-82%	-83%	-83%	-51%	-48%	450.2	-83%	-86%
-75%	-21%	-20%	58.4	0%	0%	-82%	-38%	-40%	2.7	-84%	-84%	-83%	-83%	-83%	7.1	-78%	-78%	-78%	-65%	-64%	14.7	-80%	-82%	-81%	-48%	-47%	22.1	-79%	-83%
-79%	-32%	-28%	400.8	0%	0%	-87%	-49%	-51%	10.4	-85%	-85%	-85%	-85%	-85%	28	-81%	-81%	-81%	-70%	-69%	63	-83%	-84%	-83%	-54%	-50%	99.9	-85%	-88%
-81%	-42%	-37%	218.8	-1%	0%	-88%	-57%	-59%	3.8	-87%	-87%	-86%	-86%	-86%	10.2	-84%	-84%	-84%	-76%	-75%	25.1	-86%	-87%	-85%	-63%	-56%	43.2	-89%	-91%
-82%	-42%	-39%	302.7	0%	0%	-90%	-63%	-64%	7.5	-84%	-84%	-84%	-84%	-84%	20	-80%	-80%	-79%	-67%	-67%	43.2	-83%	-84%	-83%	-54%	-51%	66.6	-86%	-89%
-77%	-26%	-21%	206.5	-1%	0%	-84%	-41%	-44%	6	-85%	-85%	-85%	-85%	-85%	16.1	-82%	-82%	-81%	-71%	-70%	36.5	-82%	-84%	-82%	-54%	-50%	58.6	-84%	-87%
-91%	-69%	-65%	153.5	0%	0%	-95%	-83%	-82%	1.4	-88%	-88%	-87%	-87%	-87%	4.1	-86%	-86%	-85%	-78%	-76%	10.3	-90%	-91%	-90%	-71%	-65%	18.3	-93%	-95%
-75%	-14%	-12%	387.5	0%	0%	-81%	-34%	-34%	23.4	-83%	-83%	-83%	-83%	-83%	62.4	-78%	-78%	-78%	-63%	-63%	128.6	-80%	-81%	-81%	-45%	-43%	188.7	-76%	-81%
-86%	-51%	-47%	144.2	0%	0%	-94%	-78%	-77%	2.4	-85%	-85%	-85%	-85%	-85%	6.7	-81%	-81%	-81%	-69%	-69%	14.8	-85%	-86%	-85%	-57%	-54%	23.3	-88%	-90%
-85%	-47%	-43%	129.9	0%	0%	-94%	-77%	-76%	2.4	-85%	-85%	-85%	-84%	-84%	6.6	-81%	-81%	-81%	-69%	-68%	14.7	-84%	-86%	-85%	-56%	-52%	23.2	-86%	-89%
-79%	-24%	-20%	90.8	-1%	-1%	-85%	-44%	-42%	4.8	-84%	-84%	-84%	-84%	-84%	12.9	-80%	-80%	-79%	-66%	-66%	27.4	-81%	-83%	-83%	-48%	-45%	41.3	-79%	-83%
-80%	-32%	-26%	451.9	-1%	-1%	-85%	-45%	-45%	14.6	-86%	-86%	-85%	-85%	-85%	39.8	-82%	-82%	-82%	-72%	-71%	91.1	-83%	-85%	-84%	-55%	-50%	147.1	-85%	-88%
-81%	-36%	-34%	73.8	0%	0%	-90%	-64%	-65%	2.1	-84%	-84%	-83%	-83%	-83%	5.7	-78%	-78%	-78%	-64%	-64%	11.9	-81%	-83%	-83%	-50%	-48%	17.8	-83%	-86%
-80%	-29%	-25%	205.1	0%	0%	-88%	-56%	-54%	8.2	-84%	-84%	-84%	-84%	-84%	22.1	-80%	-80%	-80%	-67%	-66%	47.5	-82%	-83%	-83%	-50%	-47%	72.5	-81%	-84%
-79%	-36%	-35%	191.1	0%	0%	-89%	-66%	-68%	4.1	-84%	-84%	-84%	-83%	-83%	10.9	-79%	-79%	-79%	-66%	-66%	22.9	-82%	-83%	-83%	-53%	-52%	35.4	-84%	-87%
-78%	-24%	-22%	1081	0%	0%	-86%	-49%	-50%	45.5	-83%	-83%	-83%	-83%	-83%	121.5	-78%	-78%	-78%	-64%	-64%	251.7	-80%	-82%	-81%	-47%	-45%	370.9	-80%	-84%
-82%	-46%	-36%	353.8	-1%	-1%	-87%	-52%	-52%	4.6	-90%	-90%	-90%	-90%	-90%	13.3	-90%	-90%	-89%	-86%	-84%	40.4	-90%	-90%	-88%	-72%	-61%	79.3	-92%	-93%
-79%	-30%	-24%	374.2	-1%	-1%	-84%	-41%	-40%	15.1	-85%	-85%	-85%	-85%	-85%	41.4	-82%	-82%	-81%	-71%	-70%	93.3	-83%	-85%	-84%	-54%	-49%	149.1	-83%	-86%
-75%	-11%	-9%	289.2	0%	0%	-78%	-23%	-22%	21.7	-83%	-83%	-83%	-83%	-83%	58	-78%	-78%	-77%	-63%	-63%	118.7	-79%	-81%	-81%	-43%	-42%	172.6	-74%	-79%

			2140					
e_high_2115_monthly_	f_high_2115_monthly_	g_high_2115_monthly_	FWOP	c_high_2140_monthly_	d_high_2140_monthly_	e_high_2140_monthly_	f_high_2140_monthly_	g_high_2140_monthly_
-84%	-84%	-85%	978.5	-34%	-36%	-85%	-85%	-88%
-58%	-58%	-60%	445963.3	-19%	-22%	-62%	-62%	-64%
-90%	-90%	-92%	501.3	-44%	-45%	-92%	-92%	-93%
-79%	-78%	-85%	106.9	-36%	-40%	-80%	-80%	-87%
-61%	-60%	-63%	8344	-16%	-20%	-63%	-63%	-65%
-80%	-80%	-80%	5005.1	-20%	-24%	-81%	-81%	-81%
-85%	-85%	-87%	887.6	-36%	-39%	-87%	-87%	-89%
-86%	-86%	-87%	968.8	-37%	-40%	-88%	-87%	-89%
-86%	-86%	-88%	1607.7	-38%	-40%	-88%	-88%	-90%
-75%	-75%	-78%	172.7	-18%	-23%	-75%	-75%	-79%
-83%	-83%	-85%	471.2	-32%	-35%	-85%	-85%	-87%
-84%	-84%	-86%	410.9	-35%	-38%	-86%	-86%	-88%
-83%	-83%	-85%	218.9	-34%	-37%	-85%	-85%	-87%
-85%	-85%	-88%	248.7	-38%	-41%	-87%	-87%	-90%
-88%	-88%	-91%	320	-43%	-45%	-90%	-90%	-93%
-90%	-90%	-92%	145.6	-45%	-47%	-92%	-92%	-94%
-95%	-95%	-95%	31.6	-47%	-47%	-96%	-96%	-96%
-99%	-99%	-99%	24.3	-53%	-53%	-99%	-99%	-99%
-92%	-92%	-93%	113.8	-44%	-45%	-94%	-94%	-94%
-90%	-90%	-91%	89.5	-41%	-43%	-92%	-92%	-92%
-96%	-96%	-97%	76.2	-50%	-50%	-97%	-97%	-97%
-82%	-82%	-84%	658.2	-32%	-35%	-84%	-84%	-86%
-93%	-93%	-94%	229.4	-46%	-47%	-95%	-95%	-95%
-94%	-94%	-94%	164.7	-47%	-47%	-95%	-95%	-96%
-71%	-71%	-76%	194.9	-17%	-23%	-70%	-70%	-76%
-91%	-91%	-92%	754.4	-44%	-45%	-93%	-93%	-94%
-81%	-81%	-84%	853.3	-32%	-35%	-83%	-83%	-86%
-86%	-86%	-87%	780.7	-36%	-38%	-88%	-88%	-89%
-96%	-96%	-97%	38.9	-52%	-52%	-97%	-97%	-98%
-95%	-94%	-94%	3620.8	-16%	-18%	-95%	-94%	-94%
-77%	-77%	-77%	1354418.6	-7%	-9%	-75%	-75%	-75%
-92%	-92%	-92%	1559.9	-15%	-18%	-92%	-92%	-92%
-95%	-95%	-95%	900.6	-17%	-20%	-95%	-95%	-95%
-80%	-80%	-80%	19123.3	-7%	-8%	-76%	-76%	-76%
-96%	-96%	-96%	95097.6	-21%	-22%	-97%	-97%	-97%
-93%	-93%	-93%	3241.3	-15%	-18%	-93%	-93%	-93%
-93%	-93%	-93%	3921.6	-15%	-18%	-93%	-93%	-93%
-94%	-94%	-94%	5610.3	-16%	-18%	-94%	-94%	-94%
-93%	-93%	-93%	488.1	-21%	-23%	-93%	-93%	-93%
-94%	-94%	-94%	1081.4	-17%	-20%	-94%	-94%	-94%
-95%	-94%	-94%	1851.4	-14%	-17%	-95%	-94%	-94%
-95%	-94%	-94%	698.7	-16%	-18%	-94%	-94%	-94%
-94%	-94%	-94%	651.5	-17%	-19%	-94%	-94%	-94%
-93%	-93%	-93%	1231.4	-14%	-16%	-93%	-93%	-93%
-92%	-92%	-92%	433.1	-18%	-21%	-92%	-92%	-92%
-96%	-96%	-96%	19.5	-36%	-36%	-96%	-96%	-96%
-89%	-89%	-89%	253.7	-17%	-20%	-89%	-89%	-89%
-89%	-89%	-89%	238.3	-17%	-19%	-89%	-89%	-89%
-88%	-88%	-88%	267.3	-20%	-23%	-88%	-88%	-88%
-94%	-94%	-94%	2805.4	-15%	-17%	-94%	-94%	-94%
-90%	-90%	-90%	435.9	-15%	-18%	-90%	-90%	-90%
-87%	-87%	-87%	582.9	-18%	-20%	-87%	-87%	-87%
-95%	-95%	-95%	947.7	-17%	-19%	-95%	-95%	-95%
-95%	-95%	-94%	2948.5	-18%	-20%	-95%	-95%	-95%
-93%	-93%	-93%	2661.9	-13%	-16%	-92%	-92%	-92%
-93%	-93%	-93%	2340.7	-14%	-17%	-93%	-93%	-93%
-91%	-91%	***-65%***	12930.8	-16%	-16%	-89%	-90%	***-57%***
-93%	-91%	***-76%***	1741128.2	-19%	-19%	-88%	-88%	***-68%***
-91%	-92%	***-68%***	4682.1	-21%	-21%	-91%	-92%	***-63%***
-91%	-91%	***-65%***	3177	-16%	-16%	-89%	-90%	***-57%***
-92%	-91%	***-72%***	26728.9	-17%	-17%	-87%	-87%	***-61%***
-95%	-96%	***-81%***	37670.9	-25%	-25%	-94%	-95%	***-77%***
-91%	-91%	***-65%***	9094.5	-17%	-18%	-89%	-90%	***-57%***
-90%	-91%	***-65%***	10896.1	-17%	-17%	-89%	-89%	***-58%***
-91%	-91%	***-65%***	19263	-17%	-17%	-89%	-90%	***-58%***
-92%	-92%	***-65%***	1380.1	-19%	-19%	-90%	-90%	***-55%***
-91%	-92%	***-62%***	5780.8	-14%	-14%	-88%	-89%	***-51%***

-90%	-91%	-67%	5722.3	-17%	-17%	-89%	-89%	-60%
-90%	-91%	-61%	2718.6	-14%	-14%	-87%	-88%	-50%
-92%	-92%	-63%	3818.5	-15%	-15%	-88%	-89%	-52%
-92%	-92%	-73%	1737.2	-26%	-26%	-92%	-92%	-71%
-92%	-92%	-60%	1892.6	-15%	-15%	-88%	-89%	-49%
-93%	-93%	-57%	285.2	-16%	-16%	-91%	-92%	-46%
-94%	-95%	-64%	250.4	-17%	-17%	-93%	-94%	-56%
-92%	-93%	-67%	1433	-19%	-20%	-92%	-93%	-62%
-92%	-93%	-68%	1182.6	-20%	-20%	-92%	-93%	-63%
-94%	-94%	-64%	901.9	-25%	-25%	-94%	-95%	-60%
-91%	-91%	-64%	7876.4	-16%	-16%	-89%	-90%	-56%
-92%	-93%	-68%	1218.1	-25%	-25%	-92%	-92%	-65%
-93%	-94%	-72%	2042.7	-24%	-24%	-94%	-94%	-69%
-91%	-91%	-65%	2870	-17%	-17%	-88%	-89%	-55%
-92%	-92%	-65%	10413.8	-18%	-18%	-90%	-91%	-58%
-91%	-91%	-66%	8849.1	-16%	-16%	-88%	-89%	-58%
-91%	-92%	-65%	5917.5	-18%	-18%	-89%	-90%	-57%
-92%	-92%	-55%	423.3	-12%	-12%	-87%	-88%	-40%
-83%	-65%	-60%	310.7	-58%	-58%	-87%	-73%	-71%
-46%	-34%	-35%	182489.4	-37%	-35%	-53%	-39%	-40%
-83%	-50%	-49%	180.8	-51%	-51%	-88%	-64%	-63%
-88%	-78%	-76%	38.6	-75%	-74%	-92%	-87%	-86%
-61%	-52%	-45%	13722.9	-26%	-26%	-61%	-51%	-45%
-78%	-80%	-63%	6497.9	-39%	-39%	-78%	-81%	-67%
-81%	-58%	-53%	265.6	-50%	-50%	-85%	-65%	-62%
-81%	-58%	-53%	317.1	-48%	-48%	-84%	-65%	-61%
-81%	-53%	-50%	713	-51%	-50%	-86%	-64%	-61%
-80%	-47%	-45%	33.8	-43%	-42%	-83%	-53%	-52%
-83%	-62%	-58%	169.8	-58%	-58%	-87%	-71%	-69%
-84%	-71%	-67%	83.7	-62%	-62%	-88%	-79%	-76%
-85%	-62%	-60%	125.6	-59%	-59%	-90%	-74%	-73%
-81%	-59%	-55%	92.6	-56%	-55%	-84%	-67%	-65%
-89%	-81%	-77%	50.8	-67%	-67%	-94%	-89%	-87%
-78%	-35%	-33%	259.5	-33%	-33%	-81%	-41%	-39%
-86%	-66%	-62%	46.6	-68%	-68%	-93%	-82%	-81%
-85%	-62%	-58%	43	-67%	-67%	-92%	-81%	-79%
-79%	-41%	-38%	59.2	-35%	-35%	-82%	-48%	-45%
-81%	-58%	-53%	234.7	-49%	-48%	-84%	-64%	-61%
-84%	-54%	-53%	30.9	-58%	-58%	-90%	-71%	-70%
-80%	-46%	-43%	108.8	-47%	-47%	-86%	-60%	-58%
-84%	-60%	-59%	65.3	-66%	-66%	-91%	-77%	-76%
-81%	-45%	-44%	565.1	-48%	-48%	-86%	-58%	-57%
-82%	-77%	-69%	147.9	-59%	-58%	-84%	-80%	-75%
-80%	-53%	-48%	227	-40%	-40%	-81%	-56%	-52%
-77%	-30%	-29%	230.2	-21%	-21%	-78%	-27%	-26%

	Base					100y																						
					*FWOP ba	2040						2065						2090						2115				
	Reach	Social Factor Category	Variable	Baseline	FWOP	C	D	E	F	G	FWOP	C	D	E	F	G	FWOP	C	D	E	F	G	FWOP	C	D	E	F	G
10	Reach 1	health and safety	Asthma	1623.8	#N/A	6	6	5	5	5	#N/A	6	6	6	5	5	#N/A	6	5	6	6	6	#N/A	7	6	6	7	6
11	Reach 1	health and safety	Cardiovascular	541.3	#N/A	2	2	2	2	2	#N/A	2	2	2	2	2	#N/A	2	2	2	2	2	#N/A	2	2	2	2	2
14	Reach 1	health and safety	Total Population	10826	#N/A	38	38	35	34	33	#N/A	40	39	37	35	35	#N/A	42	35	37	40	37	#N/A	45	39	41	44	41
20	Reach 1	social vulnerability and res	Age over 65	2123	#N/A	7	7	7	6	6	#N/A	7	7	7	7	7	#N/A	7	6	7	8	7	#N/A	8	7	7	8	7
21	Reach 1	social vulnerability and res	Age under 18	1094	#N/A	3	3	3	3	3	#N/A	3	3	3	3	3	#N/A	3	3	3	3	3	#N/A	3	3	3	3	3
	Reach 1	social vulnerability and res	Age under 18 AND Age over 65	3216.609	#N/A	10	10	9	9	9	#N/A	10	10	10	9	9	#N/A	10	9	10	11	10	#N/A	11	9	10	11	10
24	Reach 1	social vulnerability and res	Equivalent to High School Degre	765	#N/A	2	2	1	1	1	#N/A	2	2	1	1	1	#N/A	2	1	1	2	1	#N/A	2	2	2	2	2
28	Reach 1	social vulnerability and res	Households with Disability	1,112	#N/A	3	3	3	3	3	#N/A	3	3	3	3	3	#N/A	3	3	3	3	3	#N/A	4	3	3	3	3
29	Reach 1	social vulnerability and res	Poverty	886	#N/A	2	2	2	1	1	#N/A	2	2	2	2	2	#N/A	2	2	2	2	2	#N/A	2	2	2	2	2
30	Reach 1	social vulnerability and res	Linguistic Isolation	1549	#N/A	9	9	9	9	9	#N/A	10	10	10	9	9	#N/A	10	9	9	11	9	#N/A	11	9	10	11	10
31	Reach 1	social vulnerability and res	Low Birth Weight	768.6	#N/A	3	3	3	2	2	#N/A	3	3	3	2	2	#N/A	3	2	3	3	3	#N/A	3	3	3	3	3
32	Reach 1	social vulnerability and res	Minority (non-white)	4151	#N/A	12	11	10	10	10	#N/A	12	12	11	10	10	#N/A	13	11	11	12	11	#N/A	14	12	12	13	12
35	Reach 1	social vulnerability and res	Single Parent	203	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0
46	Reach 2	health and safety	Asthma	2234.4	#N/A	5	5	0	1	1	#N/A	7	7	0	2	2	#N/A	9	4	0	2	2	#N/A	11	5	0	2	2
47	Reach 2	health and safety	Cardiovascular	744.8	#N/A	2	2	0	0	0	#N/A	2	2	0	1	1	#N/A	3	1	0	1	1	#N/A	4	2	0	1	1
50	Reach 2	health and safety	Total Population	14896	#N/A	33	33	1	8	9	#N/A	48	49	1	10	11	#N/A	63	27	1	12	10	#N/A	70	31	1	13	11
56	Reach 2	social vulnerability and res	Age over 65	2644	#N/A	8	8	0	1	1	#N/A	13	13	0	2	2	#N/A	17	7	0	2	2	#N/A	19	8	0	2	2
57	Reach 2	social vulnerability and res	Age under 18	1103	#N/A	2	2	0	1	1	#N/A	3	3	0	1	1	#N/A	4	2	0	1	1	#N/A	4	2	0	1	1
	Reach 2	social vulnerability and res	Age under 18 AND Age over 65	3746.628	#N/A	10	10	0	2	2	#N/A	15	16	0	2	2	#N/A	20	8	0	3	2	#N/A	23	10	0	3	3
60	Reach 2	social vulnerability and res	Equivalent to High School Degre	841	6	1	1	0	0	0	7	2	2	0	0	0	10	2	1	0	0	0	15	3	1	0	0	0
64	Reach 2	social vulnerability and res	Households with Disability	1,127	#N/A	3	3	0	0	0	#N/A	4	5	0	0	0	#N/A	6	2	0	1	0	#N/A	7	3	0	1	0
65	Reach 2	social vulnerability and res	Poverty	1766	#N/A	2	2	0	0	0	#N/A	3	3	0	0	0	#N/A	4	2	0	1	0	#N/A	5	2	0	1	0
66	Reach 2	social vulnerability and res	Linguistic Isolation	2571	#N/A	6	6	1	2	2	#N/A	7	7	1	2	3	#N/A	8	5	0	3	2	#N/A	9	5	0	3	2
67	Reach 2	social vulnerability and res	Low Birth Weight	1057.6	#N/A	2	2	0	1	1	#N/A	3	3	0	1	1	#N/A	4	2	0	1	1	#N/A	5	2	0	1	1
68	Reach 2	social vulnerability and res	Minority (non-white)	7911	#N/A	16	16	1	5	5	#N/A	23	24	1	6	6	#N/A	30	13	0	7	6	#N/A	34	15	1	7	6
71	Reach 2	social vulnerability and res	Single Parent	85	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0
82	Reach 3	health and safety	Asthma	7015.5	120	11	11	12	6	13	151	12	12	12	7	15	186	13	12	12	8	179	434	17	16	16	12	228
83	Reach 3	health and safety	Cardiovascular	2338.5	40	4	4	4	2	4	50	4	4	4	2	5	62	4	4	4	3	60	145	6	5	5	4	76
86	Reach 3	health and safety	Total Population	46770	801	75	72	77	42	90	1009	81	77	81	47	102	1242	88	82	82	54	1196	2896	115	107	106	80	1518
92	Reach 3	social vulnerability and res	Age over 65	4984	#N/A	5	5	5	3	6	#N/A	5	5	6	3	7	#N/A	6	6	6	4	80	#N/A	8	7	7	5	102
93	Reach 3	social vulnerability and res	Age under 18	4615	#N/A	9	9	10	6	11	#N/A	10	10	10	6	13	#N/A	11	10	10	7	143	#N/A	14	13	13	10	181
	Reach 3	social vulnerability and res	Age under 18 AND Age over 65	9598.957	#N/A	14	14	15	8	17	#N/A	16	15	16	9	20	#N/A	17	16	16	11	223	#N/A	22	21	20	16	283
96	Reach 3	social vulnerability and res	Equivalent to High School Degre	3858	57	5	5	5	3	6	72	5	5	6	3	7	89	6	5	6	3	87	210	8	7	7	5	110
100	Reach 3	social vulnerability and res	Households with Disability	3,721	#N/A	4	4	5	2	5	#N/A	5	4	5	3	6	#N/A	5	5	5	3	71	#N/A	7	6	6	5	90
101	Reach 3	social vulnerability and res	Poverty	5789	#N/A	6	6	6	3	7	#N/A	7	6	7	3	8	#N/A	7	7	7	4	107	#N/A	9	9	9	6	136
102	Reach 3	social vulnerability and res	Linguistic Isolation	7071	#N/A	11	11	12	7	13	#N/A	12	12	12	8	15	#N/A	13	12	12	10	168	#N/A	17	16	15	14	213
103	Reach 3	social vulnerability and res	Low Birth Weight	3320.7	57	5	5	5	3	6	72	6	5	6	3	7	88	6	6	6	4	85	206	8	8	8	6	108
104	Reach 3	social vulnerability and res	Minority (non-white)	24794	#N/A	40	39	42	22	49	#N/A	44	42	45	25	56	#N/A	48	45	45	28	672	#N/A	63	58	59	43	852
107	Reach 3	social vulnerability and res	Single Parent	1016	#N/A	2	2	2	2	3	#N/A	3	3	3	2	3	#N/A	3	3	3	2	37	#N/A	4	4	3	3	47
118	Reach 4	health and safety	Asthma	1988.1	35	13	13	13	33	34	37	13	13	14	35	36	40	14	14	14	37	40	42	15	14	14	39	42
119	Reach 4	health and safety	Cardiovascular	662.7	12	4	4	4	11	11	12	4	4	5	12	12	13	5	5	5	12	13	14	5	5	5	13	14
122	Reach 4	health and safety	Total Population	13254	234	87	87	89	220	227	248	89	89	91	234	240	266	96	90	93	249	264	280	99	92	95	262	278
128	Reach 4	social vulnerability and res	Age over 65	1720	#N/A	3	2	3	6	7	#N/A	3	3	3	7	8	#N/A	3	3	3	8	9	#N/A	3	3	3	8	10
129	Reach 4	social vulnerability and res	Age under 18	2660	#N/A	40	41	41	104	105	#N/A	41	41	41	109	110	#N/A	44	41	42	115	118	#N/A	45	42	42	121	124
	Reach 4	social vulnerability and res	Age under 18 AND Age over 65	4380.155	#N/A	43	43	43	110	112	#N/A	43	43	44	116	118	#N/A	47	44	44	123	127	#N/A	48	45	45	129	133
132	Reach 4	social vulnerability and res	Equivalent to High School Degre	1872	12	4	4	4	11	11	13	4	4	4	12	12	14	5	4	5	12	13	14	5	4	5	13	14
136	Reach 4	social vulnerability and res	Households with Disability	1,045	#N/A	4	4	4	9	10	#N/A	4	4	4	10	10	#N/A	4	4	4	11	11	#N/A	4	4	4	11	11
137	Reach 4	social vulnerability and res	Poverty	1951	#N/A	14	14	14	36	37	#N/A	14	14	15	38	39	#N/A	15	14	15	41	43	#N/A	16	15	15	43	45
138	Reach 4	social vulnerability and res	Linguistic Isolation	2497	#N/A	7	7	7	18	18	#N/A	7	7	8	19	19	#N/A	8	8	8	20	21	#N/A	8	8	8	21	22
139	Reach 4	social vulnerability and res	Low Birth Weight	941.0	17	6	6	6	16	16	18	6	6	6	17	17	19	7	6	7	18	19	20	7	7	7	19	20
140	Reach 4	social vulnerability and res	Minority (non-white)	9923	#N/A	79	79	80	201	203	#N/A	80	80	81	213	215	#N/A	87	81	82	225	230	#N/A	89	82	84	235	242
143	Reach 4	social vulnerability and res	Single Parent	1289	#N/A	37	38	38	97	97	#N/A	38	38	38	102	102	#N/A	41	38	38	107	109	#N/A	42	39	39	112	114

						Monthly																										
	2140						2040						2065						2090						2115							
FWOP	C	D	E	F	G	FWOP	C	D	E	F	G	FWOP	C	D	E	F	G	FWOP	C	D	E	F	G	FWOP	C	D	E	F	G	FWOP	C	D
#N/A	7	6	7	7	7	#N/A	1	1	1	1	1	#N/A	1	1	2	1	1	#N/A	2	1	1	2	1	#N/A	2	2	1	2	2	#N/A	2	2
#N/A	2	2	2	2	2	#N/A	0	0	0	0	0	#N/A	0	0	1	0	0	#N/A	1	0	0	1	0	#N/A	1	1	0	1	1	#N/A	1	1
#N/A	49	42	45	48	45	#N/A	9	9	9	8	8	#N/A	10	10	10	9	9	#N/A	10	9	9	12	9	#N/A	11	10	10	13	10	#N/A	12	11
#N/A	8	7	8	9	8	#N/A	2	2	2	2	2	#N/A	2	2	2	2	2	#N/A	2	2	2	3	2	#N/A	3	2	2	3	2	#N/A	3	3
#N/A	3	3	3	3	3	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	1
#N/A	11	10	11	12	11	#N/A	3	3	3	2	2	#N/A	3	3	3	3	3	#N/A	3	3	3	4	3	#N/A	4	3	3	4	3	#N/A	4	4
#N/A	2	2	2	2	2	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0
#N/A	4	3	3	4	3	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	1
#N/A	2	2	2	2	2	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0
#N/A	12	10	11	12	11	#N/A	2	2	3	2	2	#N/A	3	3	3	2	2	#N/A	3	3	3	4	3	#N/A	3	3	3	4	3	#N/A	4	3
#N/A	3	3	3	3	3	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	1
#N/A	16	13	14	15	14	#N/A	2	2	2	2	2	#N/A	2	2	3	2	2	#N/A	3	2	2	3	2	#N/A	3	3	2	3	3	#N/A	3	3
#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0
#N/A	13	5	0	2	2	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	1	0	#N/A	0	0	0	1	0	#N/A	1	0
#N/A	4	2	0	1	1	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0
#N/A	84	32	2	14	12	#N/A	2	2	1	2	2	#N/A	3	3	1	2	2	#N/A	3	2	0	5	2	#N/A	3	2	0	5	2	#N/A	3	2
#N/A	22	8	1	3	2	#N/A	0	0	0	0	0	#N/A	1	0	0	0	0	#N/A	1	0	0	1	0	#N/A	1	0	0	1	0	#N/A	1	1
#N/A	5	2	0	1	1	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0
#N/A	27	10	1	4	3	#N/A	1	1	0	0	0	#N/A	1	1	0	0	0	#N/A	1	1	0	1	0	#N/A	1	1	0	1	0	#N/A	1	1
19	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
#N/A	8	3	0	1	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0
#N/A	5	2	0	1	1	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	1	0	#N/A	0	0	0	1	0	#N/A	0	0
#N/A	10	6	1	3	3	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	1	0	2	1	#N/A	1	1	0	2	1	#N/A	1	1
#N/A	6	2	0	1	1	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0
#N/A	40	16	1	7	7	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	2	1	0	2	1	#N/A	2	1	0	2	1	#N/A	2	1
#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0
481	18	17	17	13	297	5	4	4	4	1	4	5	4	4	4	2	4	5	4	4	4	2	4	6	4	4	4	2	4	6	5	5
160	6	6	6	4	99	2	1	1	1	0	1	2	1	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	2	2	2
3208	122	112	116	87	1979	30	24	24	28	10	25	33	26	26	30	10	26	36	28	27	26	14	28	39	29	29	27	14	30	42	31	31
#N/A	8	8	8	6	133	#N/A	2	2	2	1	2	#N/A	2	2	2	1	2	#N/A	2	2	2	1	2	#N/A	2	2	2	1	2	#N/A	2	2
#N/A	15	14	14	11	236	#N/A	3	3	3	1	3	#N/A	3	3	4	1	3	#N/A	3	3	3	2	3	#N/A	4	4	3	2	4	#N/A	4	4
#N/A	23	22	22	17	369	#N/A	5	5	5	2	5	#N/A	5	5	6	2	5	#N/A	5	5	5	3	5	#N/A	6	5	5	3	6	#N/A	6	6
233	8	7	8	5	144	2	2	2	2	1	2	2	2	2	2	1	2	2	2	2	2	1	2	2	2	2	2	1	2	3	2	2
#N/A	7	7	7	5	118	#N/A	1	1	2	1	1	#N/A	2	2	2	1	2	#N/A	2	2	2	1	2	#N/A	2	2	2	1	2	#N/A	2	2
#N/A	10	9	10	7	178	#N/A	2	2	2	1	2	#N/A	2	2	3	1	2	#N/A	2	2	2	1	2	#N/A	2	2	2	1	3	#N/A	3	3
#N/A	18	17	17	15	277	#N/A	4	4	5	2	4	#N/A	4	4	5	2	4	#N/A	4	4	4	3	4	#N/A	4	4	4	4	5	#N/A	5	5
228	9	8	8	6	140	2	2	2	2	1	2	2	2	2	2	1	2	3	2	2	2	1	2	3	2	2	2	1	2	3	2	2
#N/A	66	61	64	46	1112	#N/A	13	13	15	5	14	#N/A	14	14	16	6	15	#N/A	15	15	14	7	16	#N/A	16	16	15	7	16	#N/A	17	17
#N/A	4	4	4	3	61	#N/A	1	1	1	0	1	#N/A	1	1	1	0	1	#N/A	1	1	1	0	1	#N/A	1	1	1	0	1	#N/A	1	1
44	15	14	15	41	44	6	6	6	6	6	6	6	6	6	6	6	6	7	6	6	6	6	6	7	7	7	7	7	7	7	7	7
15	5	5	5	14	15	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
294	101	93	97	273	292	39	39	39	39	39	39	42	41	41	41	41	41	44	43	43	43	42	43	45	44	44	45	44	45	47	46	46
#N/A	3	3	3	8	10	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	1
#N/A	46	42	43	126	129	#N/A	18	18	18	18	18	#N/A	19	19	19	19	19	#N/A	20	20	20	20	20	#N/A	21	21	21	21	21	#N/A	22	22
#N/A	49	45	46	134	139	#N/A	20	20	20	20	20	#N/A	21	21	21	20	21	#N/A	21	21	21	21	21	#N/A	22	22	22	22	22	#N/A	23	23
15	5	5	5	14	15	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
#N/A	4	4	4	12	12	#N/A	2	2	2	2	2	#N/A	2	2	2	2	2	#N/A	2	2	2	2	2	#N/A	2	2	2	2	2	#N/A	2	2
#N/A	16	15	15	45	48	#N/A	6	6	7	6	6	#N/A	7	7	7	7	7	#N/A	7	7	7	7	7	#N/A	7	7	7	7	7	#N/A	8	8
#N/A	8	8	8	22	23	#N/A	3	3	3	3	3	#N/A	3	3	3	3	3	#N/A	4	4	4	3	4	#N/A	4	4	4	4	4	#N/A	4	4
21	7	7	7	19	21	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
#N/A	91	83	85	245	252	#N/A	36	36	36	36	36	#N/A	38	38	38	38	38	#N/A	39	39	39	39	39	#N/A	41	41	41	40	41	#N/A	42	42
#N/A	43	39	39	117	119	#N/A	17	17	17	17	17	#N/A	18	18	18	18	18	#N/A	19	19	19	19	19	#N/A	19	19	20	19	20	#N/A	20	20

2140		
E	F	G
2	2	2
1	1	1
11	13	11
3	3	3
1	1	1
4	4	4
0	1	0
1	1	1
0	0	0
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1	1	1
3	3	3
0	0	0
0	1	0
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0	1	0
0	0	0
0	1	1
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0	2	1
0	0	0
0	2	1
0	0	0
4	2	**5**
1	1	**2**
29	15	**32**
2	1	**2**
4	2	**4**
6	3	**6**
2	1	**2**
2	1	**2**
2	1	**3**
4	4	**5**
2	1	**2**
16	8	**18**
1	0	**1**
7	**7**	**7**
2	**2**	**2**
46	**45**	**46**
1	**1**	**1**
22	**21**	**22**
23	**23**	**23**
2	**2**	**2**
2	**2**	**2**
8	**8**	**8**
4	**4**	**4**
3	**3**	**3**
42	**42**	**42**
20	**20**	**20**

	Base					100y																						
					*FWOP ba	2040						2065						2090						2115				
	Reach	Social Factor Category	Variable	Baseline	FWOP	C	D	E	F	G	FWOP	C	D	E	F	G	FWOP	C	D	E	F	G	FWOP	C	D	E	F	G
10	Reach 1	health and safety	Asthma	1624	#N/A	6	6	6	5	5	#N/A	7	6	7	7	6	#N/A	11	9	9	10	9	#N/A	18	14	17	17	14
11	Reach 1	health and safety	Cardiovascular	541	#N/A	2	2	2	2	2	#N/A	2	2	2	2	2	#N/A	4	3	3	3	3	#N/A	6	5	6	6	5
14	Reach 1	health and safety	Total Population	10826	#N/A	40	39	37	35	35	#N/A	48	43	46	44	43	#N/A	71	59	63	66	62	#N/A	118	95	114	116	94
20	Reach 1	social vulnerability and re	Age over 65	2123	#N/A	7	7	7	7	7	#N/A	8	8	8	8	8	#N/A	11	9	10	11	10	#N/A	20	17	22	23	17
21	Reach 1	social vulnerability and re	Age under 18	1094	#N/A	3	3	3	3	3	#N/A	3	3	3	3	3	#N/A	4	4	4	4	4	#N/A	8	7	8	9	6
	Reach 1	social vulnerability and re	Age under 18 AND Age over 65	3217	#N/A	10	10	10	9	9	#N/A	11	11	11	11	11	#N/A	15	13	14	15	14	#N/A	28	24	31	31	23
24	Reach 1	social vulnerability and re	Equivalent to High School Degree	765	#N/A	2	2	1	1	1	#N/A	2	2	2	2	2	#N/A	3	3	3	3	3	#N/A	5	4	4	4	4
28	Reach 1	social vulnerability and re	Households with Disability	1112	#N/A	3	3	3	3	3	#N/A	4	3	4	3	3	#N/A	6	5	5	5	5	#N/A	9	7	8	9	7
29	Reach 1	social vulnerability and re	Poverty	886	#N/A	2	2	2	2	2	#N/A	2	2	2	2	2	#N/A	4	3	3	3	3	#N/A	6	4	5	5	4
30	Reach 1	social vulnerability and re	Linguistic Isolation	1549	#N/A	10	10	10	9	9	#N/A	11	11	11	11	11	#N/A	15	13	14	15	14	#N/A	27	23	29	30	23
31	Reach 1	social vulnerability and re	Low Birth Weight	769	#N/A	3	3	3	3	2	#N/A	3	3	3	3	3	#N/A	5	4	4	5	4	#N/A	8	7	8	8	7
32	Reach 1	social vulnerability and re	Minority (non-white)	4151	#N/A	12	12	11	10	10	#N/A	15	13	14	13	13	#N/A	24	19	20	21	20	#N/A	37	29	33	33	28
35	Reach 1	social vulnerability and re	Single Parent	203	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	1	1	1	1	1
46	Reach 2	health and safety	Asthma	2234	#N/A	8	8	0	2	2	#N/A	12	12	0	2	2	#N/A	18	8	3	5	5	#N/A	32	18	13	15	15
47	Reach 2	health and safety	Cardiovascular	745	#N/A	3	3	0	1	1	#N/A	4	4	0	1	1	#N/A	6	3	1	2	2	#N/A	11	6	4	5	5
50	Reach 2	health and safety	Total Population	14896	#N/A	51	52	1	11	11	#N/A	82	83	2	14	15	#N/A	122	52	21	32	31	#N/A	211	119	88	98	99
56	Reach 2	social vulnerability and re	Age over 65	2644	#N/A	13	13	0	2	2	#N/A	22	22	1	2	2	#N/A	33	15	7	8	8	#N/A	58	35	27	29	29
57	Reach 2	social vulnerability and re	Age under 18	1103	#N/A	3	3	0	1	1	#N/A	5	5	0	1	1	#N/A	7	3	1	2	2	#N/A	13	6	4	5	5
	Reach 2	social vulnerability and re	Age under 18 AND Age over 65	3747	#N/A	16	16	0	2	3	#N/A	27	27	1	3	4	#N/A	40	17	8	10	10	#N/A	71	41	32	34	34
60	Reach 2	social vulnerability and re	Equivalent to High School Degree	841	8	2	2	0	0	0	18	3	3	0	0	0	49	5	2	1	1	1	112	10	5	4	4	4
64	Reach 2	social vulnerability and re	Households with Disability	1127	#N/A	5	5	0	0	0	#N/A	8	8	0	0	0	#N/A	12	5	3	3	3	#N/A	22	14	11	11	11
65	Reach 2	social vulnerability and re	Poverty	1766	#N/A	3	3	0	0	0	#N/A	5	5	0	1	1	#N/A	8	4	2	2	2	#N/A	18	9	7	7	7
66	Reach 2	social vulnerability and re	Linguistic Isolation	2571	#N/A	7	7	1	3	3	#N/A	10	10	1	3	3	#N/A	14	7	2	5	4	#N/A	23	13	8	10	10
67	Reach 2	social vulnerability and re	Low Birth Weight	1058	#N/A	4	4	0	1	1	#N/A	6	6	0	1	1	#N/A	9	4	1	2	2	#N/A	15	8	6	7	7
68	Reach 2	social vulnerability and re	Minority (non-white)	7911	#N/A	24	25	1	6	6	#N/A	39	40	1	8	9	#N/A	58	24	9	15	15	#N/A	99	54	39	45	45
71	Reach 2	social vulnerability and re	Single Parent	85	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	1	0	0	0	0
82	Reach 3	health and safety	Asthma	7016	158	12	12	12	7	16	473	18	17	17	13	34	795	24	22	26	21	452	1281	37	31	39	31	632
83	Reach 3	health and safety	Cardiovascular	2339	53	4	4	4	2	5	158	6	6	6	4	11	265	8	7	9	7	151	427	12	10	13	10	211
86	Reach 3	health and safety	Total Population	46770	1052	82	78	82	48	104	3152	120	114	115	85	227	5301	163	145	175	138	3012	8541	246	205	263	208	4212
92	Reach 3	social vulnerability and re	Age over 65	4984	#N/A	6	5	6	3	7	#N/A	8	8	8	6	15	#N/A	11	10	12	9	202	#N/A	17	14	18	14	283
93	Reach 3	social vulnerability and re	Age under 18	4615	#N/A	10	10	10	6	13	#N/A	15	14	14	11	28	#N/A	22	20	23	20	361	#N/A	32	27	33	30	506
	Reach 3	social vulnerability and re	Age under 18 AND Age over 65	9599	#N/A	16	15	16	10	20	#N/A	23	22	22	17	43	#N/A	33	29	34	29	564	#N/A	48	41	51	44	789
96	Reach 3	social vulnerability and re	Equivalent to High School Degree	3858	75	5	5	6	3	7	229	8	8	8	5	16	409	9	8	11	6	217	646	15	12	18	10	302
100	Reach 3	social vulnerability and re	Households with Disability	3721	#N/A	5	5	5	3	6	#N/A	7	7	7	5	13	#N/A	9	8	10	7	178	#N/A	14	12	15	11	249
101	Reach 3	social vulnerability and re	Poverty	5789	#N/A	7	6	7	3	9	#N/A	10	9	10	7	19	#N/A	11	10	14	7	268	#N/A	18	15	21	11	374
102	Reach 3	social vulnerability and re	Linguistic Isolation	7071	#N/A	12	12	12	8	15	#N/A	18	17	17	14	33	#N/A	28	25	28	28	427	#N/A	40	33	40	41	598
103	Reach 3	social vulnerability and re	Low Birth Weight	3321	75	6	6	6	3	7	224	9	8	8	6	16	376	12	10	12	10	214	606	17	15	19	15	299
104	Reach 3	social vulnerability and re	Minority (non-white)	24794	#N/A	44	42	45	25	57	#N/A	65	62	64	46	125	#N/A	85	76	94	68	1686	#N/A	129	109	144	102	2357
107	Reach 3	social vulnerability and re	Single Parent	1016	#N/A	3	3	3	2	3	#N/A	4	4	4	3	7	#N/A	6	5	6	5	93	#N/A	8	7	9	8	130
118	Reach 4	health and safety	Asthma	1988	38	14	13	14	35	36	44	15	14	15	41	42	50	17	15	16	46	49	57	18	16	17	51	55
119	Reach 4	health and safety	Cardiovascular	663	13	5	4	5	12	12	15	5	5	5	14	14	17	6	5	5	15	16	19	6	5	6	17	18
122	Reach 4	health and safety	Total Population	13254	253	94	89	92	236	243	291	101	93	97	270	281	336	111	98	104	305	328	378	122	105	114	340	365
128	Reach 4	social vulnerability and re	Age over 65	1720	#N/A	3	3	3	7	8	#N/A	3	3	3	8	9	#N/A	3	3	3	9	12	#N/A	4	3	4	11	13
129	Reach 4	social vulnerability and re	Age under 18	2660	#N/A	43	41	41	110	111	#N/A	46	42	43	125	126	#N/A	50	44	45	140	143	#N/A	55	47	49	155	159
	Reach 4	social vulnerability and re	Age under 18 AND Age over 65	4380	#N/A	46	43	44	117	119	#N/A	49	45	46	133	136	#N/A	54	47	49	149	155	#N/A	58	50	53	165	172
132	Reach 4	social vulnerability and re	Equivalent to High School Degree	1872	13	5	4	4	12	12	15	5	5	5	13	14	17	5	5	5	15	17	19	6	5	6	17	19
136	Reach 4	social vulnerability and re	Households with Disability	1045	#N/A	4	4	4	10	10	#N/A	4	4	4	11	12	#N/A	5	4	4	13	13	#N/A	5	4	5	14	15
137	Reach 4	social vulnerability and re	Poverty	1951	#N/A	15	14	15	39	40	#N/A	16	15	15	44	46	#N/A	18	15	16	50	53	#N/A	19	16	17	55	59
138	Reach 4	social vulnerability and re	Linguistic Isolation	2497	#N/A	8	7	8	19	19	#N/A	8	8	8	22	22	#N/A	9	8	9	25	26	#N/A	10	9	10	28	29
139	Reach 4	social vulnerability and re	Low Birth Weight	941	18	7	6	6	17	17	21	7	7	7	19	20	24	8	7	7	22	23	27	9	7	8	24	26
140	Reach 4	social vulnerability and re	Minority (non-white)	9923	#N/A	85	80	81	215	217	#N/A	90	83	85	244	247	#N/A	99	87	90	273	280	#N/A	108	93	98	302	311
143	Reach 4	social vulnerability and re	Single Parent	1289	#N/A	40	38	38	103	103	#N/A	42	39	39	116	117	#N/A	46	41	42	130	132	#N/A	50	43	45	143	146

						Monthly																										
	2140						2040						2065						2090						2115							
FWOP	C	D	E	F	G	FWOP	C	D	E	F	G	FWOP	C	D	E	F	G	FWOP	C	D	E	F	G	FWOP	C	D	E	F	G	FWOP	C	D
#N/A	27	21	27	27	22	#N/A	1	1	2	1	1	#N/A	2	2	2	2	2	#N/A	2	2	2	2	2	#N/A	3	2	2	3	2	#N/A	5	4
#N/A	9	7	9	9	7	#N/A	0	0	1	0	0	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	2	1
#N/A	179	143	177	178	146	#N/A	10	10	10	9	9	#N/A	12	12	12	11	11	#N/A	15	14	13	16	14	#N/A	18	16	16	19	16	#N/A	34	29
#N/A	26	22	31	32	23	#N/A	2	2	2	2	2	#N/A	3	3	3	2	2	#N/A	4	3	3	4	3	#N/A	4	4	4	4	4	#N/A	6	5
#N/A	10	9	12	12	9	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	2	2	2	2	2	#N/A	2	2
#N/A	36	30	43	44	32	#N/A	3	3	3	3	3	#N/A	4	4	4	3	3	#N/A	5	4	4	5	4	#N/A	6	5	5	6	5	#N/A	9	8
#N/A	9	7	7	7	7	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	1	0	0	1	0	#N/A	1	1	1	1	1	#N/A	1	1
#N/A	14	11	14	14	11	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	3	2
#N/A	10	8	8	8	8	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	1	0	#N/A	1	1	1	1	1	#N/A	2	1
#N/A	38	31	42	42	32	#N/A	3	3	3	2	2	#N/A	3	3	4	3	3	#N/A	4	4	4	5	4	#N/A	5	5	5	6	5	#N/A	8	7
#N/A	13	10	13	13	10	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	2	2
#N/A	61	47	54	55	48	#N/A	2	2	3	2	2	#N/A	3	3	3	3	3	#N/A	4	3	3	4	3	#N/A	5	4	4	5	4	#N/A	10	9
#N/A	1	1	1	1	1	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0
#N/A	66	38	33	35	35	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	1	0	0	1	0	#N/A	1	1	0	1	0	#N/A	3	2
#N/A	22	13	11	12	12	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	1	1
#N/A	437	254	223	231	233	#N/A	3	3	1	2	2	#N/A	3	3	1	2	2	#N/A	4	3	0	5	3	#N/A	6	5	0	5	3	#N/A	17	13
#N/A	113	72	64	65	66	#N/A	1	1	0	0	0	#N/A	1	1	0	0	0	#N/A	1	1	0	1	0	#N/A	1	1	0	1	1	#N/A	4	3
#N/A	31	15	13	14	14	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	1	1
#N/A	144	87	77	79	80	#N/A	1	1	0	0	0	#N/A	1	1	0	1	1	#N/A	1	1	0	1	1	#N/A	1	1	0	2	1	#N/A	5	4
151	23	14	13	13	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
#N/A	46	30	27	28	28	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	1	1
#N/A	50	27	25	25	25	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	1	0	#N/A	0	0	0	1	0	#N/A	1	1
#N/A	50	28	23	25	25	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	1	0	2	1	#N/A	2	2	0	2	1	#N/A	4	4
#N/A	31	18	16	16	17	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	1	1
#N/A	206	113	98	103	104	#N/A	1	1	1	1	1	#N/A	2	2	1	1	1	#N/A	2	2	0	2	1	#N/A	3	2	0	3	2	#N/A	8	6
#N/A	3	1	1	1	1	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0
1936	276	235	246	238	996	5	4	4	4	2	4	6	5	5	5	2	5	8	6	5	5	2	6	10	7	7	7	3	8	67	9	9
645	92	78	82	79	332	2	1	1	1	1	1	2	2	2	2	1	2	3	2	2	2	1	2	3	2	2	2	1	3	22	3	3
12906	1837	1567	1640	1584	6637	33	26	26	30	11	27	42	31	31	34	12	32	54	37	37	35	16	38	70	45	45	45	18	50	446	60	58
#N/A	154	128	133	129	468	#N/A	2	2	2	1	2	#N/A	2	2	2	1	2	#N/A	3	2	2	1	3	#N/A	3	3	3	1	3	#N/A	4	4
#N/A	168	149	156	155	755	#N/A	3	3	4	1	3	#N/A	4	4	4	2	4	#N/A	5	5	4	2	5	#N/A	6	6	6	2	6	#N/A	7	7
#N/A	322	277	289	284	1223	#N/A	5	5	6	2	5	#N/A	6	6	6	2	6	#N/A	7	7	7	3	7	#N/A	9	9	9	4	9	#N/A	11	11
949	117	102	108	99	466	2	2	2	2	1	2	3	2	2	2	1	2	3	3	3	2	1	3	4	3	3	3	1	3	31	4	4
#N/A	104	90	94	89	389	#N/A	2	2	2	1	2	#N/A	2	2	2	1	2	#N/A	2	2	2	1	2	#N/A	3	3	3	1	3	#N/A	3	3
#N/A	144	125	133	120	575	#N/A	2	2	3	1	2	#N/A	3	3	3	1	3	#N/A	3	3	3	1	3	#N/A	4	4	4	1	4	#N/A	5	5
#N/A	279	236	245	249	979	#N/A	4	4	5	2	4	#N/A	5	5	6	2	5	#N/A	6	5	5	4	6	#N/A	7	7	7	4	7	#N/A	9	8
916	130	111	116	112	471	2	2	2	2	1	2	3	2	2	2	1	2	4	3	3	2	1	3	5	3	3	3	1	4	32	4	4
#N/A	934	806	848	803	3642	#N/A	14	14	16	6	15	#N/A	17	17	19	6	18	#N/A	20	20	19	8	21	#N/A	25	25	25	9	28	#N/A	33	32
#N/A	32	30	32	32	186	#N/A	1	1	1	0	1	#N/A	1	1	1	0	1	#N/A	1	1	1	1	1	#N/A	1	1	1	1	2	#N/A	2	2
64	21	17	19	57	61	6	6	6	6	6	6	7	7	7	7	7	7	9	8	8	8	8	9	18	11	12	12	17	18	24	12	12
21	7	6	6	19	20	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	6	4	4	4	6	6	8	4	4
426	138	116	129	382	408	42	41	41	42	41	41	47	46	46	46	46	46	58	51	52	52	56	58	119	76	77	77	114	118	163	83	83
#N/A	4	3	4	12	15	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	1	2	2	2	2	#N/A	2	2	2	3	3	#N/A	2	2
#N/A	62	52	55	173	177	#N/A	20	20	20	20	20	#N/A	22	22	22	22	22	#N/A	24	24	24	26	27	#N/A	36	36	36	54	55	#N/A	39	39
#N/A	66	55	59	185	192	#N/A	21	21	21	21	21	#N/A	23	23	23	23	23	#N/A	25	26	26	28	29	#N/A	38	38	39	57	59	#N/A	41	41
22	7	6	6	19	21	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	6	4	4	4	6	6	8	4	4
#N/A	6	5	5	16	17	#N/A	2	2	2	2	2	#N/A	2	2	2	2	2	#N/A	2	2	2	2	3	#N/A	3	3	3	5	5	#N/A	4	4
#N/A	22	18	19	62	66	#N/A	7	7	7	7	7	#N/A	8	8	8	8	8	#N/A	8	8	9	9	9	#N/A	13	13	13	19	19	#N/A	13	14
#N/A	12	10	11	31	32	#N/A	3	3	3	3	3	#N/A	4	4	4	4	4	#N/A	4	4	4	5	5	#N/A	6	6	6	9	10	#N/A	7	7
30	10	8	9	27	29	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	8	5	5	5	8	8	12	6	6
#N/A	122	102	109	337	346	#N/A	38	38	38	38	38	#N/A	42	42	42	42	42	#N/A	47	47	47	51	52	#N/A	70	70	71	105	107	#N/A	75	76
#N/A	57	48	50	160	163	#N/A	18	18	18	18	18	#N/A	20	20	20	20	20	#N/A	22	22	23	24	25	#N/A	34	34	34	51	51	#N/A	36	36

2140		
E	F	G
4	5	4
1	2	1
29	32	29
5	6	6
2	2	2
8	9	8
1	1	1
2	2	2
1	1	1
7	9	7
2	2	2
9	9	9
0	0	0
0	1	1
0	0	0
0	7	5
0	1	1
0	1	0
0	2	1
0	0	0
0	0	0
0	1	0
0	2	2
0	0	0
0	3	3
0	0	0
9	5	**63**
3	2	**21**
60	30	**418**
4	2	**28**
7	4	**50**
11	6	**78**
4	2	**30**
4	2	**25**
5	2	**37**
9	6	**59**
4	2	**30**
33	16	**235**
2	1	**13**
13	**23**	**24**
4	**8**	**8**
84	**153**	**162**
2	**4**	**5**
39	**73**	**74**
41	**77**	**79**
4	**8**	**8**
4	**7**	**7**
14	**25**	**27**
7	**12**	**13**
6	**11**	**11**
76	**141**	**144**
36	**68**	**69**

	Base					100y																							
					*FWOP ba	2040						2065						2090						2115					
	Reach	Social Factor Category	Variable	Baseline	FWOP	C	D	E	F	G	FWOP	C	D	E	F	G	FWOP	C	D	E	F	G	FWOP	C	D	E	F	G	FWOP
10	Reach 1	health and safety	Asthma	1624	#N/A	9	8	8	8	8	#N/A	20	18	20	20	16	#N/A	193	35	41	41	35	#N/A	280	281	47	47	39	#N/A
11	Reach 1	health and safety	Cardiovascular	541	#N/A	3	3	3	3	3	#N/A	7	6	7	7	5	#N/A	64	12	14	14	12	#N/A	93	94	16	16	13	#N/A
14	Reach 1	health and safety	Total Population	10826	#N/A	58	53	56	54	53	#N/A	133	123	136	133	107	#N/A	1288	232	275	276	235	#N/A	1869	1872	311	312	260	#N/A
20	Reach 1	social vulnerability a	Age over 65	2123	#N/A	9	9	9	9	9	#N/A	22	20	26	26	18	#N/A	251	36	49	49	38	#N/A	384	385	56	56	42	#N/A
21	Reach 1	social vulnerability a	Age under 18	1094	#N/A	4	3	4	4	3	#N/A	8	8	10	10	7	#N/A	113	14	19	19	15	#N/A	177	178	21	21	16	#N/A
	Reach 1	social vulnerability a	Age under 18 AND Age over 65	3217	#N/A	13	12	13	12	12	#N/A	30	28	36	35	25	#N/A	364	50	67	67	52	#N/A	562	563	77	77	58	#N/A
24	Reach 1	social vulnerability a	Equivalent to High School Degree	765	#N/A	3	2	2	2	2	#N/A	6	5	5	5	4	#N/A	87	11	11	11	11	#N/A	138	138	13	13	12	#N/A
28	Reach 1	social vulnerability a	Households with Disability	1112	#N/A	5	4	4	4	4	#N/A	10	10	10	10	8	#N/A	174	18	21	21	18	#N/A	282	283	24	24	21	#N/A
29	Reach 1	social vulnerability a	Poverty	886	#N/A	3	3	3	3	3	#N/A	7	6	6	6	5	#N/A	124	12	13	13	12	#N/A	203	203	14	14	13	#N/A
30	Reach 1	social vulnerability a	Linguistic Isolation	1549	#N/A	13	12	13	13	12	#N/A	30	28	34	33	25	#N/A	171	51	65	65	52	#N/A	205	206	73	74	57	#N/A
31	Reach 1	social vulnerability a	Low Birth Weight	769	#N/A	4	4	4	4	4	#N/A	9	9	10	9	8	#N/A	91	17	20	20	17	#N/A	133	133	22	22	18	#N/A
32	Reach 1	social vulnerability a	Minority (non-white)	4151	#N/A	19	17	18	17	17	#N/A	43	39	40	39	33	#N/A	583	76	84	84	76	#N/A	910	910	94	95	84	#N/A
35	Reach 1	social vulnerability a	Single Parent	203	#N/A	0	0	0	0	0	#N/A	1	1	1	1	1	#N/A	29	1	2	2	2	#N/A	50	50	2	2	2	#N/A
46	Reach 2	health and safety	Asthma	2234	#N/A	14	14	0	2	2	#N/A	50	49	27	29	29	#N/A	707	64	59	61	61	#N/A	885	886	63	65	65	#N/A
47	Reach 2	health and safety	Cardiovascular	745	#N/A	5	5	0	1	1	#N/A	17	16	9	10	10	#N/A	236	21	20	20	20	#N/A	295	295	21	22	22	#N/A
50	Reach 2	health and safety	Total Population	14896	#N/A	92	92	3	15	16	#N/A	333	330	178	192	194	#N/A	4711	428	397	404	407	#N/A	5903	5904	423	434	433	#N/A
56	Reach 2	social vulnerability a	Age over 65	2644	#N/A	24	24	1	2	3	#N/A	96	95	57	59	59	#N/A	1063	106	98	99	100	#N/A	1281	1281	103	105	105	#N/A
57	Reach 2	social vulnerability a	Age under 18	1103	#N/A	5	5	0	1	1	#N/A	20	20	8	10	10	#N/A	351	39	37	37	38	#N/A	460	460	41	42	41	#N/A
	Reach 2	social vulnerability a	Age under 18 AND Age over 65	3747	#N/A	30	29	1	4	4	#N/A	116	115	65	69	69	#N/A	1414	145	135	136	137	#N/A	1741	1741	144	146	146	#N/A
60	Reach 2	social vulnerability a	Equivalent to High School Degree	841	26	4	4	0	0	0	131	16	16	9	9	9	205	205	34	33	33	33	266	266	266	36	36	36	307
64	Reach 2	social vulnerability a	Households with Disability	1127	#N/A	9	9	0	0	1	#N/A	38	38	23	23	24	#N/A	369	50	48	48	48	#N/A	452	452	51	51	51	#N/A
65	Reach 2	social vulnerability a	Poverty	1766	#N/A	6	6	0	1	1	#N/A	31	31	14	14	14	#N/A	469	85	83	83	83	#N/A	611	612	92	92	92	#N/A
66	Reach 2	social vulnerability a	Linguistic Isolation	2571	#N/A	11	11	1	3	3	#N/A	34	33	15	17	18	#N/A	784	58	53	55	55	#N/A	1001	1001	58	60	60	#N/A
67	Reach 2	social vulnerability a	Low Birth Weight	1058	#N/A	7	7	0	1	1	#N/A	24	23	13	14	14	#N/A	334	30	28	29	29	#N/A	419	419	30	31	31	#N/A
68	Reach 2	social vulnerability a	Minority (non-white)	7911	#N/A	44	44	1	8	9	#N/A	152	151	78	86	87	#N/A	2409	193	178	182	184	#N/A	3121	3121	191	197	196	#N/A
71	Reach 2	social vulnerability a	Single Parent	85	#N/A	0	0	0	0	0	#N/A	1	1	0	0	0	#N/A	30	7	7	7	7	#N/A	41	41	8	8	8	#N/A
82	Reach 3	health and safety	Asthma	7016	562	19	18	20	14	40	1594	129	127	131	116	189	2395	2250	265	285	279	1183	3032	3044	3044	375	351	1509	3506
83	Reach 3	health and safety	Cardiovascular	2339	187	6	6	7	5	13	531	43	42	44	39	63	798	750	88	95	93	394	1011	1015	1015	125	117	503	1169
86	Reach 3	health and safety	Total Population	46770	3745	127	121	131	91	270	10624	858	849	875	773	1258	15965	15003	1768	1901	1857	7887	20212	20291	20291	2498	2337	10063	23374
92	Reach 3	social vulnerability a	Age over 65	4984	#N/A	9	8	9	6	18	#N/A	58	57	59	52	84	#N/A	1263	146	155	151	554	#N/A	1865	1865	191	180	698	#N/A
93	Reach 3	social vulnerability a	Age under 18	4615	#N/A	16	15	16	12	33	#N/A	104	103	106	95	153	#N/A	1460	166	184	186	901	#N/A	1982	1982	272	254	1170	#N/A
	Reach 3	social vulnerability a	Age under 18 AND Age over 65	9599	#N/A	25	23	25	18	51	#N/A	162	160	165	147	237	#N/A	2723	312	339	337	1455	#N/A	3847	3847	463	434	1868	#N/A
96	Reach 3	social vulnerability a	Equivalent to High School Degree	3858	273	8	8	9	6	19	800	59	59	62	53	89	1167	1106	113	121	111	547	1512	1514	1514	141	128	690	1781
100	Reach 3	social vulnerability a	Households with Disability	3721	#N/A	7	7	8	5	16	#N/A	50	50	52	45	74	#N/A	892	101	108	103	460	#N/A	1301	1301	134	124	584	#N/A
101	Reach 3	social vulnerability a	Poverty	5789	#N/A	10	10	11	7	23	#N/A	73	73	77	65	110	#N/A	1562	139	147	134	673	#N/A	2178	2178	169	153	849	#N/A
102	Reach 3	social vulnerability a	Linguistic Isolation	7071	#N/A	19	18	19	15	39	#N/A	126	124	126	115	181	#N/A	2202	270	293	302	1204	#N/A	3010	3010	412	393	1574	#N/A
103	Reach 3	social vulnerability a	Low Birth Weight	3321	266	9	9	9	6	19	754	61	60	62	55	89	1134	1065	126	135	132	560	1435	1441	1441	177	166	714	1660
104	Reach 3	social vulnerability a	Minority (non-white)	24794	#N/A	69	65	72	49	149	#N/A	473	469	488	426	700	#N/A	8080	901	969	926	4310	#N/A	10983	10983	1243	1149	5495	#N/A
107	Reach 3	social vulnerability a	Single Parent	1016	#N/A	4	4	4	3	9	#N/A	27	26	27	25	39	#N/A	331	33	38	39	223	#N/A	439	439	61	56	292	#N/A
118	Reach 4	health and safety	Asthma	1988	46	15	14	15	42	44	59	19	16	18	53	55	84	84	19	22	70	74	128	127	127	27	90	95	215
119	Reach 4	health and safety	Cardiovascular	663	15	5	5	5	14	15	20	6	5	6	18	18	28	28	6	7	23	25	43	42	42	9	30	32	72
122	Reach 4	health and safety	Total Population	13254	305	103	94	99	282	294	396	128	110	120	352	368	558	557	127	149	466	494	853	846	849	178	602	632	1435
128	Reach 4	social vulnerability a	Age over 65	1720	#N/A	3	3	3	8	10	#N/A	4	3	4	11	13	#N/A	29	4	5	15	18	#N/A	67	67	6	21	24	#N/A
129	Reach 4	social vulnerability a	Age under 18	2660	#N/A	47	43	43	130	132	#N/A	57	49	51	161	164	#N/A	225	57	63	211	216	#N/A	277	277	68	239	244	#N/A
	Reach 4	social vulnerability a	Age under 18 AND Age over 65	4380	#N/A	50	45	46	139	142	#N/A	61	52	55	172	176	#N/A	254	61	68	225	233	#N/A	343	344	75	260	268	#N/A
132	Reach 4	social vulnerability a	Equivalent to High School Degree	1872	16	5	5	5	14	15	20	6	5	6	17	19	32	32	6	7	23	25	57	57	57	8	28	30	144
136	Reach 4	social vulnerability a	Households with Disability	1045	#N/A	4	4	4	12	12	#N/A	5	5	5	15	15	#N/A	23	5	6	20	20	#N/A	36	37	7	23	24	#N/A
137	Reach 4	social vulnerability a	Poverty	1951	#N/A	16	15	15	46	48	#N/A	20	17	18	57	60	#N/A	89	20	22	75	80	#N/A	120	120	24	85	90	#N/A
138	Reach 4	social vulnerability a	Linguistic Isolation	2497	#N/A	9	8	8	23	23	#N/A	11	10	10	29	29	#N/A	46	11	14	39	40	#N/A	81	82	17	52	53	#N/A
139	Reach 4	social vulnerability a	Low Birth Weight	941	22	7	7	7	20	21	28	9	8	9	25	26	40	40	9	11	33	35	61	60	60	13	43	45	102
140	Reach 4	social vulnerability a	Minority (non-white)	9923	#N/A	92	84	86	254	258	#N/A	113	96	102	314	320	#N/A	458	112	125	411	422	#N/A	644	645	141	490	502	#N/A
143	Reach 4	social vulnerability a	Single Parent	1289	#N/A	43	39	40	121	122	#N/A	53	45	47	149	151	#N/A	205	52	57	195	198	#N/A	238	238	60	214	218	#N/A

					Monthly																											
2140						2040						2065						2090						2115						2140		
C	D	E	F	G	FWOP	C	D	E	F	G	FWOP	C	D	E	F	G	FWOP	C	D	E	F	G	FWOP	C	D	E	F	G	FWOP	C	D	E
392	392	51	51	41	#N/A	2	2	2	2	2	#N/A	3	3	3	3	3	#N/A	7	6	6	7	6	#N/A	40	33	39	39	34	#N/A	242	233	46
131	131	17	17	14	#N/A	1	1	1	1	1	#N/A	1	1	1	1	1	#N/A	2	2	2	2	2	#N/A	13	11	13	13	11	#N/A	81	78	15
2610	2612	342	343	277	#N/A	13	13	13	12	12	#N/A	22	22	21	20	20	#N/A	48	41	43	47	43	#N/A	268	221	257	258	224	#N/A	1613	1554	306
566	567	63	63	45	#N/A	3	3	3	3	3	#N/A	5	5	5	4	4	#N/A	8	7	8	8	8	#N/A	40	34	44	45	35	#N/A	321	310	54
266	267	24	24	17	#N/A	1	1	1	1	1	#N/A	2	2	2	2	2	#N/A	3	3	3	3	3	#N/A	16	13	17	17	14	#N/A	146	142	21
833	833	86	86	62	#N/A	4	4	4	4	4	#N/A	7	6	6	6	6	#N/A	11	10	11	12	11	#N/A	55	48	61	62	49	#N/A	467	452	75
206	206	14	14	13	#N/A	0	0	0	0	0	#N/A	1	1	1	1	1	#N/A	2	2	2	2	2	#N/A	13	10	11	11	10	#N/A	114	112	13
430	430	26	26	22	#N/A	1	1	1	1	1	#N/A	2	2	2	1	1	#N/A	4	3	3	4	3	#N/A	21	17	20	20	18	#N/A	230	226	23
310	310	15	15	14	#N/A	0	0	0	0	0	#N/A	1	1	1	1	1	#N/A	2	2	2	2	2	#N/A	15	12	12	12	12	#N/A	165	163	14
237	237	81	82	61	#N/A	4	4	4	3	3	#N/A	6	6	6	6	6	#N/A	11	10	11	12	11	#N/A	57	48	60	60	50	#N/A	196	182	72
185	185	24	24	20	#N/A	1	1	1	1	1	#N/A	2	2	2	1	1	#N/A	3	3	3	3	3	#N/A	19	16	18	18	16	#N/A	115	110	22
1344	1344	102	102	88	#N/A	3	3	3	3	3	#N/A	6	6	6	5	5	#N/A	15	13	13	14	13	#N/A	90	72	80	80	73	#N/A	757	739	93
81	81	3	3	2	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	1	1	2	2	1	#N/A	39	39	2
999	999	64	65	65	#N/A	1	1	0	0	0	#N/A	1	1	0	1	1	#N/A	13	5	0	2	2	#N/A	91	60	55	56	57	#N/A	842	815	63
333	333	21	22	22	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	4	2	0	1	1	#N/A	30	20	18	19	19	#N/A	281	272	21
6660	6660	424	435	434	#N/A	4	4	1	3	3	#N/A	9	9	1	4	4	#N/A	84	33	2	14	12	#N/A	607	399	368	376	379	#N/A	5613	5436	420
1430	1430	103	105	105	#N/A	1	1	0	0	0	#N/A	2	2	0	1	1	#N/A	22	8	1	3	2	#N/A	148	102	94	95	96	#N/A	1231	1194	103
529	529	41	42	41	#N/A	0	0	0	0	0	#N/A	1	1	0	0	0	#N/A	5	2	0	1	1	#N/A	56	36	35	35	35	#N/A	433	418	40
1959	1959	144	147	146	#N/A	1	1	0	1	1	#N/A	2	2	0	1	1	#N/A	27	10	1	4	3	#N/A	204	138	129	130	131	#N/A	1665	1612	143
307	307	36	36	36	0	0	0	0	0	0	0	0	0	0	0	0	19	3	1	0	0	0	177	43	31	30	30	30	254	254	246	35
515	515	51	51	51	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	8	3	0	1	0	#N/A	66	47	45	45	45	#N/A	436	423	50
707	707	92	93	92	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	5	2	0	1	1	#N/A	111	79	78	78	78	#N/A	583	565	91
1148	1148	58	60	60	#N/A	1	1	1	1	1	#N/A	3	3	1	1	1	#N/A	10	6	1	3	3	#N/A	80	54	49	50	51	#N/A	948	924	57
473	473	30	31	31	#N/A	0	0	0	0	0	#N/A	1	1	0	0	0	#N/A	6	2	0	1	1	#N/A	43	28	26	27	27	#N/A	399	386	30
3594	3594	191	197	197	#N/A	2	2	1	1	1	#N/A	5	5	1	2	2	#N/A	40	16	1	7	7	#N/A	285	181	166	171	172	#N/A	2950	2858	189
48	48	8	8	8	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	0	0	0	0	0	#N/A	9	7	7	7	7	#N/A	39	38	8
3541	3541	403	378	1547	7	5	5	5	2	5	44	7	7	8	3	8	501	18	17	18	13	308	2069	306	256	267	260	1054	2889	2902	2896	374
1180	1180	134	126	516	2	2	2	2	1	2	15	2	2	3	1	3	167	6	6	6	4	103	690	102	85	89	87	351	963	967	965	125
23608	23607	2685	2522	10315	45	33	33	36	12	34	293	50	49	55	18	56	3343	123	114	120	88	2054	13795	2039	1706	1782	1732	7029	19263	19345	19307	2495
2370	2370	202	191	715	#N/A	2	2	2	1	2	#N/A	3	3	4	1	4	#N/A	8	8	8	6	138	#N/A	175	142	147	143	498	#N/A	1739	1735	191
2268	2268	307	289	1203	#N/A	4	4	4	2	4	#N/A	6	6	7	2	7	#N/A	16	14	15	11	245	#N/A	180	157	165	166	795	#N/A	1900	1898	272
4637	4637	509	480	1918	#N/A	6	6	7	2	6	#N/A	10	9	10	4	11	#N/A	24	22	23	17	383	#N/A	355	299	312	309	1293	#N/A	3639	3633	462
1784	1784	142	129	705	3	2	2	3	1	2	20	3	3	4	1	4	243	8	8	8	6	149	1014	129	110	117	107	491	1433	1435	1433	141
1628	1628	141	131	598	#N/A	2	2	2	1	2	#N/A	3	3	3	1	3	#N/A	7	7	7	5	122	#N/A	115	97	102	97	412	#N/A	1219	1217	134
2694	2694	169	153	867	#N/A	3	3	3	1	3	#N/A	4	4	5	1	5	#N/A	10	9	10	7	185	#N/A	158	135	143	130	606	#N/A	2045	2042	169
3516	3516	463	444	1622	#N/A	5	5	6	2	5	#N/A	7	7	9	3	8	#N/A	19	17	17	15	288	#N/A	310	258	267	273	1042	#N/A	2877	2871	411
1676	1676	191	179	732	3	2	2	3	1	2	21	4	4	4	1	4	237	9	8	9	6	146	979	145	121	127	123	499	1368	1374	1371	177
12865	12865	1316	1221	5627	#N/A	18	18	20	7	19	#N/A	27	27	30	9	31	#N/A	67	62	66	47	1154	#N/A	1028	871	915	871	3846	#N/A	10452	10435	1242
489	489	70	66	301	#N/A	1	1	1	0	1	#N/A	2	2	2	1	2	#N/A	4	4	4	3	63	#N/A	33	31	33	34	195	#N/A	425	425	61
214	215	30	108	107	8	7	7	7	7	7	20	12	12	12	19	20	44	15	14	15	41	44	68	22	18	24	60	64	107	106	107	31
71	72	10	36	36	3	2	2	2	2	2	7	4	4	4	6	7	15	5	5	5	14	15	23	7	6	8	20	21	36	35	36	10
1429	1430	197	719	710	50	48	48	48	49	49	135	79	79	80	129	131	292	101	93	97	272	290	450	149	120	159	400	427	713	707	712	204
153	153	7	26	27	#N/A	1	1	1	1	1	#N/A	2	2	2	3	4	#N/A	3	3	3	8	10	#N/A	5	4	7	13	16	#N/A	50	51	10
386	386	73	256	257	#N/A	22	22	22	23	23	#N/A	37	37	37	61	62	#N/A	46	42	43	125	128	#N/A	67	54	61	181	185	#N/A	258	259	72
540	540	80	281	284	#N/A	24	24	24	25	25	#N/A	39	39	40	65	65	#N/A	49	45	46	133	138	#N/A	71	58	68	193	201	#N/A	309	310	82
144	144	8	32	33	2	2	2	2	2	2	7	4	4	4	6	6	15	5	5	5	14	15	23	7	6	8	20	22	47	46	47	10
74	74	8	26	26	#N/A	2	2	2	2	2	#N/A	3	3	3	6	6	#N/A	4	4	4	12	12	#N/A	6	5	6	17	17	#N/A	31	31	7
204	204	25	91	95	#N/A	8	8	8	8	8	#N/A	13	13	13	21	22	#N/A	16	15	15	44	47	#N/A	23	19	24	64	69	#N/A	108	108	29
191	192	20	65	62	#N/A	4	4	4	4	4	#N/A	7	7	7	11	11	#N/A	8	8	8	22	23	#N/A	13	10	13	33	34	#N/A	65	65	18
101	102	14	51	50	4	3	3	3	3	4	10	6	6	6	9	9	21	7	7	7	19	21	32	11	9	11	28	30	51	50	51	14
1079	1080	152	549	542	#N/A	44	44	44	45	45	#N/A	72	73	73	119	120	#N/A	90	83	85	244	251	#N/A	131	106	122	353	362	#N/A	563	565	147
288	288	63	221	225	#N/A	21	21	21	22	22	#N/A	34	35	35	57	58	#N/A	42	39	39	116	118	#N/A	61	50	55	167	170	#N/A	229	230	63

F	G
46	39
15	13
306	258
54	41
21	16
75	57
13	12
23	20
14	13
72	57
22	18
93	83
2	2
64	64
21	21
426	430
103	104
41	41
144	145
35	35
50	50
91	91
59	59
30	30
193	195
8	8
350	**1482**
117	**494**
2333	**9883**
180	**686**
254	**1148**
434	**1835**
128	**677**
124	**573**
153	**834**
392	**1545**
166	**702**
1148	**5395**
56	**287**
79	**83**
26	**28**
524	**553**
17	**20**
230	**235**
247	**255**
25	**28**
22	**22**
82	**87**
44	**45**
37	**39**
452	**463**
211	**215**

	Base				100y																						
					2040					2065					2090					2115					2140		
	Reach	Social Factor Category	Variable	Baseline	c_low_2040_100y_	d_low_2040_100y_	e_low_2040_100y_	f_low_2040_100y_	g_low_2040_100y_	c_low_2065_100y_	d_low_2065_100y_	e_low_2065_100y_	f_low_2065_100y_	g_low_2065_100y_	c_low_2090_100y_	d_low_2090_100y_	e_low_2090_100y_	f_low_2090_100y_	g_low_2090_100y_	c_low_2115_100y_	d_low_2115_100y_	e_low_2115_100y_	f_low_2115_100y_	g_low_2115_100y_	c_low_2140_100y_	d_low_2140_100y_	e_low_2140_100y_
10	Reach 1	health and safety	Asthma	1766	0.4%	0.4%	0.3%	0.3%	0.3%	0.4%	0.4%	0.3%	0.3%	0.3%	0.4%	0.3%	0.3%	0.4%	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%	0.5%	0.4%	0.4%
14	Reach 1	health and safety	Total Population	10826	0.4%	0.4%	0.3%	0.3%	0.3%	0.4%	0.4%	0.3%	0.3%	0.3%	0.4%	0.3%	0.3%	0.4%	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%	0.5%	0.4%	0.4%
20	Reach 1	social vulnerability and resiliency	Age over 65	2123	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.4%	0.3%	0.4%	0.3%	0.3%	0.4%	0.3%	0.4%	0.3%	0.4%
21	Reach 1	social vulnerability and resiliency	Age under 18	1094	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.2%	0.2%	0.3%	0.2%	0.3%	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
	Reach 1	social vulnerability and resiliency	Age under 18 AND Age over 65	3216.609	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.4%	0.3%	0.3%
24	Reach 1	social vulnerability and resiliency	Equivalent to High School Degree	765	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.2%	0.2%
28	Reach 1	social vulnerability and resiliency	Households with Disability	1,112	0.3%	0.3%	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%	0.2%	0.2%	0.3%	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
29	Reach 1	social vulnerability and resiliency	Poverty	886	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.2%	0.2%
30	Reach 1	social vulnerability and resiliency	Linguistic Isolation	1549	0.6%	0.6%	0.6%	0.5%	0.5%	0.6%	0.6%	0.6%	0.6%	0.6%	0.7%	0.6%	0.6%	0.7%	0.6%	0.7%	0.6%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%
32	Reach 1	social vulnerability and resiliency	Minority (non-white)	4151	0.3%	0.3%	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.4%	0.3%	0.3%
35	Reach 1	social vulnerability and resiliency	Single Parent	203	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.1%	0.2%
46	Reach 2	health and safety	Asthma	2921	0.2%	0.2%	0.0%	0.1%	0.1%	0.3%	0.3%	0.0%	0.1%	0.1%	0.4%	0.2%	0.0%	0.1%	0.1%	0.5%	0.2%	0.0%	0.1%	0.1%	0.6%	0.2%	0.0%
50	Reach 2	health and safety	Total Population	14896	0.2%	0.2%	0.0%	0.1%	0.1%	0.3%	0.3%	0.0%	0.1%	0.1%	0.4%	0.2%	0.0%	0.1%	0.1%	0.5%	0.2%	0.0%	0.1%	0.1%	0.6%	0.2%	0.0%
56	Reach 2	social vulnerability and resiliency	Age over 65	2644	0.3%	0.3%	0.0%	0.0%	0.0%	0.5%	0.5%	0.0%	0.1%	0.1%	0.6%	0.3%	0.0%	0.1%	0.1%	0.7%	0.3%	0.0%	0.1%	0.1%	0.8%	0.3%	0.0%
57	Reach 2	social vulnerability and resiliency	Age under 18	1103	0.2%	0.2%	0.0%	0.1%	0.1%	0.2%	0.3%	0.0%	0.1%	0.1%	0.3%	0.1%	0.0%	0.1%	0.1%	0.4%	0.2%	0.0%	0.1%	0.1%	0.4%	0.2%	0.0%
	Reach 2	social vulnerability and resiliency	Age under 18 AND Age over 65	3746.628	0.3%	0.3%	0.0%	0.0%	0.1%	0.4%	0.4%	0.0%	0.1%	0.1%	0.5%	0.2%	0.0%	0.1%	0.1%	0.6%	0.3%	0.0%	0.1%	0.1%	0.7%	0.3%	0.0%
60	Reach 2	social vulnerability and resiliency	Equivalent to High School Degree	841	0.1%	0.1%	0.0%	0.0%	0.0%	0.2%	0.2%	0.0%	0.0%	0.0%	0.3%	0.1%	0.0%	0.0%	0.0%	0.3%	0.1%	0.0%	0.0%	0.0%	0.4%	0.1%	0.0%
64	Reach 2	social vulnerability and resiliency	Households with Disability	1,127	0.2%	0.2%	0.0%	0.0%	0.0%	0.4%	0.4%	0.0%	0.0%	0.0%	0.5%	0.2%	0.0%	0.1%	0.0%	0.6%	0.2%	0.0%	0.1%	0.0%	0.7%	0.2%	0.0%
65	Reach 2	social vulnerability and resiliency	Poverty	1766	0.1%	0.1%	0.0%	0.0%	0.0%	0.2%	0.2%	0.0%	0.0%	0.0%	0.2%	0.1%	0.0%	0.1%	0.0%	0.3%	0.1%	0.0%	0.1%	0.0%	0.3%	0.1%	0.0%
66	Reach 2	social vulnerability and resiliency	Linguistic Isolation	2571	0.2%	0.2%	0.0%	0.1%	0.1%	0.3%	0.3%	0.0%	0.1%	0.1%	0.3%	0.2%	0.0%	0.1%	0.1%	0.4%	0.2%	0.0%	0.1%	0.1%	0.4%	0.2%	0.0%
68	Reach 2	social vulnerability and resiliency	Minority (non-white)	7911	0.2%	0.2%	0.0%	0.1%	0.1%	0.3%	0.3%	0.0%	0.1%	0.1%	0.4%	0.2%	0.0%	0.1%	0.1%	0.4%	0.2%	0.0%	0.1%	0.1%	0.5%	0.2%	0.0%
71	Reach 2	social vulnerability and resiliency	Single Parent	85	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
82	Reach 3	health and safety	Asthma	6958	0.2%	0.2%	0.2%	0.1%	0.2%	0.2%	0.2%	0.2%	0.1%	0.2%	0.2%	0.2%	0.2%	0.1%	2.6%	0.2%	0.2%	0.2%	0.2%	3.2%	0.3%	0.2%	0.2%
86	Reach 3	health and safety	Total Population	46770	0.2%	0.2%	0.2%	0.1%	0.2%	0.2%	0.2%	0.2%	0.1%	0.2%	0.2%	0.2%	0.2%	0.1%	2.6%	0.2%	0.2%	0.2%	0.2%	3.2%	0.3%	0.2%	0.2%
92	Reach 3	social vulnerability and resiliency	Age over 65	4984	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	1.6%	0.2%	0.1%	0.1%	0.1%	2.0%	0.2%	0.2%	0.2%
93	Reach 3	social vulnerability and resiliency	Age under 18	4615	0.2%	0.2%	0.2%	0.1%	0.2%	0.2%	0.2%	0.2%	0.1%	0.3%	0.2%	0.2%	0.2%	0.2%	3.1%	0.3%	0.3%	0.3%	0.2%	3.9%	0.3%	0.3%	0.3%
	Reach 3	social vulnerability and resiliency	Age under 18 AND Age over 65	9598.957	0.2%	0.1%	0.2%	0.1%	0.2%	0.2%	0.2%	0.2%	0.1%	0.2%	0.2%	0.2%	0.2%	0.1%	2.3%	0.2%	0.2%	0.2%	0.2%	2.9%	0.2%	0.2%	0.2%
96	Reach 3	social vulnerability and resiliency	Equivalent to High School Degree	3858	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%	0.1%	2.3%	0.2%	0.2%	0.2%	0.1%	2.9%	0.2%	0.2%	0.2%
100	Reach 3	social vulnerability and resiliency	Households with Disability	3,721	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%	0.1%	1.9%	0.2%	0.2%	0.2%	0.1%	2.4%	0.2%	0.2%	0.2%
101	Reach 3	social vulnerability and resiliency	Poverty	5789	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	1.9%	0.2%	0.2%	0.2%	0.1%	2.4%	0.2%	0.2%	0.2%
102	Reach 3	social vulnerability and resiliency	Linguistic Isolation	7071	0.2%	0.2%	0.2%	0.1%	0.2%	0.2%	0.2%	0.2%	0.1%	0.2%	0.2%	0.2%	0.2%	0.1%	2.4%	0.2%	0.2%	0.2%	0.2%	3.0%	0.3%	0.2%	0.2%
104	Reach 3	social vulnerability and resiliency	Minority (non-white)	24794	0.2%	0.2%	0.2%	0.1%	0.2%	0.2%	0.2%	0.2%	0.1%	0.2%	0.2%	0.2%	0.2%	0.1%	2.7%	0.3%	0.2%	0.2%	0.2%	3.4%	0.3%	0.2%	0.3%
107	Reach 3	social vulnerability and resiliency	Single Parent	1016	0.2%	0.2%	0.2%	0.1%	0.3%	0.3%	0.2%	0.3%	0.2%	0.3%	0.3%	0.3%	0.3%	0.2%	3.6%	0.4%	0.3%	0.3%	0.3%	4.6%	0.4%	0.4%	0.4%
118	Reach 4	health and safety	Asthma	2103	0.7%	0.7%	0.7%	1.7%	1.7%	0.7%	0.7%	0.7%	1.8%	1.8%	0.7%	0.7%	0.7%	1.9%	2.0%	0.7%	0.7%	0.7%	2.0%	2.1%	0.8%	0.7%	0.7%
122	Reach 4	health and safety	Total Population	13254	0.7%	0.7%	0.7%	1.7%	1.7%	0.7%	0.7%	0.7%	1.8%	1.8%	0.7%	0.7%	0.7%	1.9%	2.0%	0.7%	0.7%	0.7%	2.0%	2.1%	0.8%	0.7%	0.7%
128	Reach 4	social vulnerability and resiliency	Age over 65	1720	0.1%	0.1%	0.2%	0.4%	0.4%	0.1%	0.1%	0.2%	0.4%	0.4%	0.2%	0.2%	0.2%	0.4%	0.5%	0.2%	0.2%	0.2%	0.5%	0.6%	0.2%	0.2%	0.2%
129	Reach 4	social vulnerability and resiliency	Age under 18	2660	1.5%	1.5%	1.5%	3.9%	3.9%	1.5%	1.5%	1.5%	4.1%	4.1%	1.7%	1.6%	1.6%	4.3%	4.4%	1.7%	1.6%	1.6%	4.5%	4.6%	1.7%	1.6%	1.6%
	Reach 4	social vulnerability and resiliency	Age under 18 AND Age over 65	4380.155	1.0%	1.0%	1.0%	2.5%	2.5%	1.0%	1.0%	1.0%	2.6%	2.7%	1.1%	1.0%	1.0%	2.8%	2.9%	1.1%	1.0%	1.0%	2.9%	3.0%	1.1%	1.0%	1.0%
132	Reach 4	social vulnerability and resiliency	Equivalent to High School Degree	1872	0.2%	0.2%	0.2%	0.6%	0.6%	0.2%	0.2%	0.2%	0.6%	0.6%	0.3%	0.2%	0.2%	0.7%	0.7%	0.3%	0.2%	0.2%	0.7%	0.8%	0.3%	0.2%	0.3%
136	Reach 4	social vulnerability and resiliency	Households with Disability	1,045	0.4%	0.4%	0.4%	0.9%	0.9%	0.4%	0.4%	0.4%	1.0%	1.0%	0.4%	0.4%	0.4%	1.0%	1.0%	0.4%	0.4%	0.4%	1.1%	1.1%	0.4%	0.4%	0.4%
137	Reach 4	social vulnerability and resiliency	Poverty	1951	0.7%	0.7%	0.7%	1.9%	1.9%	0.7%	0.7%	0.7%	2.0%	2.0%	0.8%	0.7%	0.8%	2.1%	2.2%	0.8%	0.7%	0.8%	2.2%	2.3%	0.8%	0.8%	0.8%
138	Reach 4	social vulnerability and resiliency	Linguistic Isolation	2497	0.3%	0.3%	0.3%	0.7%	0.7%	0.3%	0.3%	0.3%	0.8%	0.8%	0.3%	0.3%	0.3%	0.8%	0.8%	0.3%	0.3%	0.3%	0.8%	0.9%	0.3%	0.3%	0.3%
140	Reach 4	social vulnerability and resiliency	Minority (non-white)	9923	0.8%	0.8%	0.8%	2.0%	2.0%	0.8%	0.8%	0.8%	2.1%	2.2%	0.9%	0.8%	0.8%	2.3%	2.3%	0.9%	0.8%	0.8%	2.4%	2.4%	0.9%	0.8%	0.9%
143	Reach 4	social vulnerability and resiliency	Single Parent	1289	2.9%	2.9%	2.9%	7.5%	7.5%	2.9%	2.9%	3.0%	7.9%	7.9%	3.2%	3.0%	3.0%	8.3%	8.5%	3.2%	3.0%	3.0%	8.7%	8.9%	3.3%	3.0%	3.1%

***** COUNT FOR DISPLACED PEOPLE IN RETREAT AREAS FOR ALT F AND G*****

		Monthly																								
		2040					2065					2090					2115					2140				
f_low_2140_100y_	g_low_2140_100y_	c_low_2040_monthly_	d_low_2040_monthly_	e_low_2040_monthly_	f_low_2040_monthly_	g_low_2040_monthly_	c_low_2065_monthly_	d_low_2065_monthly_	e_low_2065_monthly_	f_low_2065_monthly_	g_low_2065_monthly_	c_low_2090_monthly_	d_low_2090_monthly_	e_low_2090_monthly_	f_low_2090_monthly_	g_low_2090_monthly_	c_low_2115_monthly_	d_low_2115_monthly_	e_low_2115_monthly_	f_low_2115_monthly_	g_low_2115_monthly_	c_low_2140_monthly_	d_low_2140_monthly_	e_low_2140_monthly_	f_low_2140_monthly_	g_low_2140_monthly_
0.4%	0.4%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
0.4%	0.4%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
0.4%	0.4%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
0.3%	0.3%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
0.4%	0.3%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
0.3%	0.2%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%
0.3%	0.3%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
0.2%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.8%	0.7%	0.2%	0.2%	0.2%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.2%
0.4%	0.3%	0.1%	0.1%	0.1%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
0.2%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.2%	***4.2%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***
0.2%	***4.2%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***
0.1%	***2.7%***	0.0%	0.0%	0.0%	0.0%	***0.0%***	0.0%	0.0%	0.0%	0.0%	***0.0%***	0.0%	0.0%	0.0%	0.0%	***0.0%***	0.0%	0.0%	0.0%	0.0%	***0.0%***	0.0%	0.0%	0.0%	0.0%	***0.0%***
0.2%	***5.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***
0.2%	***3.8%***	0.0%	0.0%	0.1%	0.0%	***0.0%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***
0.1%	***3.7%***	0.0%	0.0%	0.0%	0.0%	***0.0%***	0.0%	0.0%	0.1%	0.0%	***0.0%***	0.0%	0.0%	0.0%	0.0%	***0.0%***	0.1%	0.1%	0.0%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***
0.1%	***3.2%***	0.0%	0.0%	0.0%	0.0%	***0.0%***	0.0%	0.0%	0.0%	0.0%	***0.0%***	0.0%	0.0%	0.0%	0.0%	***0.0%***	0.0%	0.0%	0.0%	0.0%	***0.0%***	0.0%	0.0%	0.0%	0.0%	***0.1%***
0.1%	***3.1%***	0.0%	0.0%	0.0%	0.0%	***0.0%***	0.0%	0.0%	0.0%	0.0%	***0.0%***	0.0%	0.0%	0.0%	0.0%	***0.0%***	0.0%	0.0%	0.0%	0.0%	***0.0%***	0.0%	0.0%	0.0%	0.0%	***0.0%***
0.2%	***3.9%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***
0.2%	***4.5%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***
0.3%	***6.0%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***
2.1%	***2.2%***	0.3%	0.3%	0.3%	***0.3%***	***0.3%***	0.3%	0.3%	0.3%	***0.3%***	***0.3%***	0.3%	0.3%	0.3%	***0.3%***	***0.3%***	0.3%	0.3%	0.3%	***0.3%***	***0.3%***	0.3%	0.3%	0.3%	***0.3%***	***0.4%***
2.1%	***2.2%***	0.3%	0.3%	0.3%	***0.3%***	***0.3%***	0.3%	0.3%	0.3%	***0.3%***	***0.3%***	0.3%	0.3%	0.3%	***0.3%***	***0.3%***	0.3%	0.3%	0.3%	***0.3%***	***0.3%***	0.3%	0.3%	0.3%	***0.3%***	***0.4%***
0.5%	***0.6%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***
4.7%	***4.8%***	0.7%	0.7%	0.7%	***0.7%***	***0.7%***	0.7%	0.7%	0.7%	***0.7%***	***0.7%***	0.8%	0.8%	0.8%	***0.7%***	***0.8%***	0.8%	0.8%	0.8%	***0.8%***	***0.8%***	0.8%	0.8%	0.8%	***0.8%***	***0.8%***
3.1%	***3.2%***	0.4%	0.4%	0.4%	***0.4%***	***0.4%***	0.5%	0.5%	0.5%	***0.5%***	***0.5%***	0.5%	0.5%	0.5%	***0.5%***	***0.5%***	0.5%	0.5%	0.5%	***0.5%***	***0.5%***	0.5%	0.5%	0.5%	***0.5%***	***0.5%***
0.7%	***0.8%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***
1.1%	***1.1%***	0.2%	0.2%	0.2%	***0.2%***	***0.2%***	0.2%	0.2%	0.2%	***0.2%***	***0.2%***	0.2%	0.2%	0.2%	***0.2%***	***0.2%***	0.2%	0.2%	0.2%	***0.2%***	***0.2%***	0.2%	0.2%	0.2%	***0.2%***	***0.2%***
2.3%	***2.4%***	0.3%	0.3%	0.3%	***0.3%***	***0.3%***	0.3%	0.3%	0.3%	***0.3%***	***0.3%***	0.4%	0.4%	0.4%	***0.4%***	***0.4%***	0.4%	0.4%	0.4%	***0.4%***	***0.4%***	0.4%	0.4%	0.4%	***0.4%***	***0.4%***
0.9%	***0.9%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.1%	0.1%	0.1%	***0.1%***	***0.2%***
2.5%	***2.5%***	0.4%	0.4%	0.4%	***0.4%***	***0.4%***	0.4%	0.4%	0.4%	***0.4%***	***0.4%***	0.4%	0.4%	0.4%	***0.4%***	***0.4%***	0.4%	0.4%	0.4%	***0.4%***	***0.4%***	0.4%	0.4%	0.4%	***0.4%***	***0.4%***
9.1%	***9.2%***	1.3%	1.3%	1.3%	***1.3%***	***1.3%***	1.4%	1.4%	1.4%	***1.4%***	***1.4%***	1.5%	1.5%	1.5%	***1.4%***	***1.5%***	1.5%	1.5%	1.5%	***1.5%***	***1.5%***	1.6%	1.6%	1.6%	***1.5%***	***1.6%***

	Base				100y																						
					2040					2065					2090					2115					2140		
	Reach	Social Factor Category	Variable	Baseline	c_inter_2040_100y_	d_inter_2040_100y_	e_inter_2040_100y_	f_inter_2040_100y_	g_inter_2040_100y_	c_inter_2065_100y_	d_inter_2065_100y_	e_inter_2065_100y_	f_inter_2065_100y_	g_inter_2065_100y_	c_inter_2090_100y_	d_inter_2090_100y_	e_inter_2090_100y_	f_inter_2090_100y_	g_inter_2090_100y_	c_inter_2115_100y_	d_inter_2115_100y_	e_inter_2115_100y_	f_inter_2115_100y_	g_inter_2115_100y_	c_inter_2140_100y_	d_inter_2140_100y_	e_inter_2140_100y_
10	Reach 1	health and safety	Asthma	1766	0.4%	0.4%	0.3%	0.3%	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%	0.7%	0.5%	0.6%	0.6%	0.6%	1.1%	0.9%	1.1%	1.1%	0.9%	1.7%	1.3%	1.6%
14	Reach 1	health and safety	Total Population	10826	0.4%	0.4%	0.3%	0.3%	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%	0.7%	0.5%	0.6%	0.6%	0.6%	1.1%	0.9%	1.1%	1.1%	0.9%	1.7%	1.3%	1.6%
20	Reach 1	social vulnerability and resiliency	Age over 65	2123	0.3%	0.3%	0.3%	0.3%	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%	0.5%	0.4%	0.5%	0.5%	0.5%	0.9%	0.8%	1.1%	1.1%	0.8%	1.2%	1.0%	1.5%
21	Reach 1	social vulnerability and resiliency	Age under 18	1094	0.3%	0.2%	0.3%	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%	0.4%	0.3%	0.4%	0.4%	0.4%	0.7%	0.6%	0.8%	0.8%	0.6%	0.9%	0.8%	1.1%
	Reach 1	social vulnerability and resiliency	Age under 18 AND Age over 65	3216.609	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.4%	0.3%	0.3%	0.5%	0.4%	0.4%	0.5%	0.4%	0.9%	0.7%	1.0%	1.0%	0.7%	1.1%	0.9%	1.3%
24	Reach 1	social vulnerability and resiliency	Equivalent to High School Degree	765	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.2%	0.2%	0.2%	0.2%	0.4%	0.4%	0.4%	0.4%	0.4%	0.7%	0.5%	0.5%	0.5%	0.5%	1.1%	0.9%	0.9%
28	Reach 1	social vulnerability and resiliency	Households with Disability	1,112	0.3%	0.3%	0.3%	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%	0.5%	0.4%	0.4%	0.5%	0.4%	0.8%	0.6%	0.8%	0.8%	0.6%	1.3%	1.0%	1.2%
29	Reach 1	social vulnerability and resiliency	Poverty	886	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.2%	0.2%	0.2%	0.2%	0.4%	0.3%	0.4%	0.4%	0.4%	0.6%	0.5%	0.5%	0.5%	0.5%	1.1%	0.9%	0.9%
30	Reach 1	social vulnerability and resiliency	Linguistic Isolation	1549	0.6%	0.6%	0.6%	0.6%	0.6%	0.7%	0.7%	0.7%	0.7%	0.7%	1.0%	0.9%	0.9%	1.0%	0.9%	1.8%	1.5%	1.9%	1.9%	1.5%	2.4%	2.0%	2.7%
32	Reach 1	social vulnerability and resiliency	Minority (non-white)	4151	0.3%	0.3%	0.3%	0.2%	0.2%	0.4%	0.3%	0.3%	0.3%	0.3%	0.6%	0.5%	0.5%	0.5%	0.5%	0.9%	0.7%	0.8%	0.8%	0.7%	1.5%	1.1%	1.3%
35	Reach 1	social vulnerability and resiliency	Single Parent	203	0.1%	0.1%	0.2%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.4%	0.3%	0.5%	0.5%	0.3%	0.4%	0.4%	0.6%
46	Reach 2	health and safety	Asthma	2921	0.3%	0.3%	0.0%	0.1%	0.1%	0.6%	0.6%	0.0%	0.1%	0.1%	0.8%	0.3%	0.1%	0.2%	0.2%	1.4%	0.8%	0.6%	0.7%	0.7%	2.9%	1.7%	1.5%
50	Reach 2	health and safety	Total Population	14896	0.3%	0.3%	0.0%	0.1%	0.1%	0.6%	0.6%	0.0%	0.1%	0.1%	0.8%	0.3%	0.1%	0.2%	0.2%	1.4%	0.8%	0.6%	0.7%	0.7%	2.9%	1.7%	1.5%
56	Reach 2	social vulnerability and resiliency	Age over 65	2644	0.5%	0.5%	0.0%	0.1%	0.1%	0.8%	0.8%	0.0%	0.1%	0.1%	1.2%	0.6%	0.3%	0.3%	0.3%	2.2%	1.3%	1.0%	1.1%	1.1%	4.3%	2.7%	2.4%
57	Reach 2	social vulnerability and resiliency	Age under 18	1103	0.3%	0.3%	0.0%	0.1%	0.1%	0.4%	0.4%	0.0%	0.1%	0.1%	0.6%	0.2%	0.1%	0.2%	0.2%	1.2%	0.5%	0.4%	0.5%	0.5%	2.8%	1.4%	1.2%
	Reach 2	social vulnerability and resiliency	Age under 18 AND Age over 65	3746.628	0.4%	0.4%	0.0%	0.1%	0.1%	0.7%	0.7%	0.0%	0.1%	0.1%	1.1%	0.5%	0.2%	0.3%	0.3%	1.9%	1.1%	0.8%	0.9%	0.9%	3.9%	2.3%	2.1%
60	Reach 2	social vulnerability and resiliency	Equivalent to High School Degree	841	0.2%	0.2%	0.0%	0.0%	0.0%	0.4%	0.4%	0.0%	0.0%	0.0%	0.6%	0.2%	0.1%	0.2%	0.1%	1.1%	0.6%	0.5%	0.5%	0.5%	2.8%	1.7%	1.5%
64	Reach 2	social vulnerability and resiliency	Households with Disability	1,127	0.4%	0.4%	0.0%	0.0%	0.0%	0.7%	0.7%	0.0%	0.0%	0.0%	1.1%	0.5%	0.2%	0.3%	0.3%	2.0%	1.2%	1.0%	1.0%	1.0%	4.0%	2.7%	2.4%
65	Reach 2	social vulnerability and resiliency	Poverty	1766	0.2%	0.2%	0.0%	0.0%	0.0%	0.3%	0.3%	0.0%	0.0%	0.0%	0.5%	0.2%	0.1%	0.1%	0.1%	1.0%	0.5%	0.4%	0.4%	0.4%	2.8%	1.5%	1.4%
66	Reach 2	social vulnerability and resiliency	Linguistic Isolation	2571	0.3%	0.3%	0.0%	0.1%	0.1%	0.4%	0.4%	0.0%	0.1%	0.1%	0.5%	0.3%	0.1%	0.2%	0.2%	0.9%	0.5%	0.3%	0.4%	0.4%	1.9%	1.1%	0.9%
68	Reach 2	social vulnerability and resiliency	Minority (non-white)	7911	0.3%	0.3%	0.0%	0.1%	0.1%	0.5%	0.5%	0.0%	0.1%	0.1%	0.7%	0.3%	0.1%	0.2%	0.2%	1.3%	0.7%	0.5%	0.6%	0.6%	2.6%	1.4%	1.2%
71	Reach 2	social vulnerability and resiliency	Single Parent	85	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.6%	0.0%	0.0%	0.1%	0.0%	3.3%	1.3%	1.3%
82	Reach 3	health and safety	Asthma	6958	0.2%	0.2%	0.2%	0.1%	***0.2%***	0.3%	0.2%	0.2%	0.2%	***0.5%***	0.3%	0.3%	0.4%	0.3%	***6.4%***	0.5%	0.4%	0.6%	0.4%	***9.0%***	3.9%	3.4%	3.5%
86	Reach 3	health and safety	Total Population	46770	0.2%	0.2%	0.2%	0.1%	***0.2%***	0.3%	0.2%	0.2%	0.2%	***0.5%***	0.3%	0.3%	0.4%	0.3%	***6.4%***	0.5%	0.4%	0.6%	0.4%	***9.0%***	3.9%	3.4%	3.5%
92	Reach 3	social vulnerability and resiliency	Age over 65	4984	0.1%	0.1%	0.1%	0.1%	***0.1%***	0.2%	0.2%	0.2%	0.1%	***0.3%***	0.2%	0.2%	0.2%	0.2%	***4.1%***	0.3%	0.3%	0.4%	0.3%	***5.7%***	3.1%	2.6%	2.7%
93	Reach 3	social vulnerability and resiliency	Age under 18	4615	0.2%	0.2%	0.2%	0.1%	***0.3%***	0.3%	0.3%	0.3%	0.2%	***0.6%***	0.5%	0.4%	0.5%	0.4%	***7.8%***	0.7%	0.6%	0.7%	0.7%	***11.0%***	3.6%	3.2%	3.4%
	Reach 3	social vulnerability and resiliency	Age under 18 AND Age over 65	9598.957	0.2%	0.2%	0.2%	0.1%	***0.2%***	0.2%	0.2%	0.2%	0.2%	***0.4%***	0.3%	0.3%	0.4%	0.3%	***5.9%***	0.5%	0.4%	0.5%	0.5%	***8.2%***	3.4%	2.9%	3.0%
96	Reach 3	social vulnerability and resiliency	Equivalent to High School Degree	3858	0.1%	0.1%	0.1%	0.1%	***0.2%***	0.2%	0.2%	0.2%	0.1%	***0.4%***	0.2%	0.2%	0.3%	0.2%	***5.6%***	0.4%	0.3%	0.5%	0.3%	***7.8%***	3.0%	2.6%	2.8%
100	Reach 3	social vulnerability and resiliency	Households with Disability	3,721	0.1%	0.1%	0.1%	0.1%	***0.2%***	0.2%	0.2%	0.2%	0.1%	***0.4%***	0.2%	0.2%	0.3%	0.2%	***4.8%***	0.4%	0.3%	0.4%	0.3%	***6.7%***	2.8%	2.4%	2.5%
101	Reach 3	social vulnerability and resiliency	Poverty	5789	0.1%	0.1%	0.1%	0.1%	***0.1%***	0.2%	0.2%	0.2%	0.1%	***0.3%***	0.2%	0.2%	0.2%	0.1%	***4.6%***	0.3%	0.3%	0.4%	0.2%	***6.5%***	2.5%	2.2%	2.3%
102	Reach 3	social vulnerability and resiliency	Linguistic Isolation	7071	0.2%	0.2%	0.2%	0.1%	***0.2%***	0.3%	0.2%	0.2%	0.2%	***0.5%***	0.4%	0.3%	0.4%	0.4%	***6.0%***	0.6%	0.5%	0.6%	0.6%	***8.5%***	3.9%	3.3%	3.5%
104	Reach 3	social vulnerability and resiliency	Minority (non-white)	24794	0.2%	0.2%	0.2%	0.1%	***0.2%***	0.3%	0.3%	0.3%	0.2%	***0.5%***	0.3%	0.3%	0.4%	0.3%	***6.8%***	0.5%	0.4%	0.6%	0.4%	***9.5%***	3.8%	3.2%	3.4%
107	Reach 3	social vulnerability and resiliency	Single Parent	1016	0.3%	0.3%	0.3%	0.2%	***0.3%***	0.4%	0.4%	0.4%	0.3%	***0.7%***	0.6%	0.5%	0.6%	0.5%	***9.2%***	0.8%	0.7%	0.8%	0.8%	***12.8%***	3.2%	3.0%	3.2%
118	Reach 4	health and safety	Asthma	2103	0.7%	0.7%	0.7%	***1.8%***	***1.8%***	0.8%	0.7%	0.7%	***2.0%***	***2.1%***	0.8%	0.7%	0.8%	***2.3%***	***2.5%***	0.9%	0.8%	0.9%	***2.6%***	***2.8%***	1.0%	0.9%	1.0%
122	Reach 4	health and safety	Total Population	13254	0.7%	0.7%	0.7%	***1.8%***	***1.8%***	0.8%	0.7%	0.7%	***2.0%***	***2.1%***	0.8%	0.7%	0.8%	***2.3%***	***2.5%***	0.9%	0.8%	0.9%	***2.6%***	***2.8%***	1.0%	0.9%	1.0%
128	Reach 4	social vulnerability and resiliency	Age over 65	1720	0.2%	0.1%	0.2%	***0.4%***	***0.4%***	0.2%	0.2%	0.2%	***0.5%***	***0.5%***	0.2%	0.2%	0.2%	***0.5%***	***0.7%***	0.2%	0.2%	0.2%	***0.6%***	***0.8%***	0.2%	0.2%	0.2%
129	Reach 4	social vulnerability and resiliency	Age under 18	2660	1.6%	1.5%	1.6%	***4.1%***	***4.2%***	1.7%	1.6%	1.6%	***4.7%***	***4.8%***	1.9%	1.7%	1.7%	***5.2%***	***5.4%***	2.1%	1.8%	1.8%	***5.8%***	***6.0%***	2.3%	2.0%	2.1%
	Reach 4	social vulnerability and resiliency	Age under 18 AND Age over 65	4380.155	1.1%	1.0%	1.0%	***2.7%***	***2.7%***	1.1%	1.0%	1.0%	***3.0%***	***3.1%***	1.2%	1.1%	1.1%	***3.4%***	***3.5%***	1.3%	1.1%	1.2%	***3.8%***	***3.9%***	1.5%	1.3%	1.3%
132	Reach 4	social vulnerability and resiliency	Equivalent to High School Degree	1872	0.2%	0.2%	0.2%	***0.6%***	***0.6%***	0.3%	0.2%	0.3%	***0.7%***	***0.8%***	0.3%	0.3%	0.3%	***0.8%***	***0.9%***	0.3%	0.3%	0.3%	***0.9%***	***1.0%***	0.4%	0.3%	0.3%
136	Reach 4	social vulnerability and resiliency	Households with Disability	1,045	0.4%	0.4%	0.4%	***1.0%***	***1.0%***	0.4%	0.4%	0.4%	***1.1%***	***1.1%***	0.4%	0.4%	0.4%	***1.2%***	***1.3%***	0.5%	0.4%	0.4%	***1.4%***	***1.4%***	0.6%	0.5%	0.5%
137	Reach 4	social vulnerability and resiliency	Poverty	1951	0.8%	0.7%	0.7%	***2.0%***	***2.0%***	0.8%	0.8%	0.8%	***2.3%***	***2.3%***	0.9%	0.8%	0.8%	***2.5%***	***2.7%***	1.0%	0.8%	0.9%	***2.8%***	***3.0%***	1.1%	0.9%	1.0%
138	Reach 4	social vulnerability and resiliency	Linguistic Isolation	2497	0.3%	0.3%	0.3%	***0.8%***	***0.8%***	0.3%	0.3%	0.3%	***0.9%***	***0.9%***	0.4%	0.3%	0.3%	***1.0%***	***1.0%***	0.4%	0.4%	0.4%	***1.1%***	***1.1%***	0.5%	0.4%	0.5%
140	Reach 4	social vulnerability and resiliency	Minority (non-white)	9923	0.9%	0.8%	0.8%	***2.2%***	***2.2%***	0.9%	0.8%	0.9%	***2.5%***	***2.5%***	1.0%	0.9%	0.9%	***2.7%***	***2.8%***	1.1%	0.9%	1.0%	***3.0%***	***3.1%***	1.2%	1.0%	1.1%
143	Reach 4	social vulnerability and resiliency	Single Parent	1289	3.1%	2.9%	3.0%	***8.0%***	***8.0%***	3.3%	3.0%	3.1%	***9.0%***	***9.1%***	3.6%	3.2%	3.2%	***10.0%***	***10.2%***	3.9%	3.3%	3.5%	***11.1%***	***11.3%***	4.4%	3.7%	3.9%

****** COUNT FOR DISPLACED PEOPLE IN RETREAT AREAS FOR ALT F AND G******

		Monthly																								
		2040					2065					2090					2115					2140				
f_inter_2140_100y_	g_inter_2140_100y_	c_inter_2040_monthly_	d_inter_2040_monthly_	e_inter_2040_monthly_	f_inter_2040_monthly_	g_inter_2040_monthly_	c_inter_2065_monthly_	d_inter_2065_monthly_	e_inter_2065_monthly_	f_inter_2065_monthly_	g_inter_2065_monthly_	c_inter_2090_monthly_	d_inter_2090_monthly_	e_inter_2090_monthly_	f_inter_2090_monthly_	g_inter_2090_monthly_	c_inter_2115_monthly_	d_inter_2115_monthly_	e_inter_2115_monthly_	f_inter_2115_monthly_	g_inter_2115_monthly_	c_inter_2140_monthly_	d_inter_2140_monthly_	e_inter_2140_monthly_	f_inter_2140_monthly_	g_inter_2140_monthly_
1.6%	1.3%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%
1.6%	1.3%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%
1.5%	1.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%	0.2%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%
1.1%	0.8%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%
1.4%	1.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%	0.2%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.2%	0.2%	0.3%	0.2%
0.9%	0.9%	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%
1.2%	1.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%
0.9%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%	0.2%	0.1%
2.7%	2.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.4%	0.3%	0.5%	0.5%	0.5%	0.5%	0.5%
1.3%	1.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%
0.6%	0.4%	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
1.6%	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%
1.6%	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%
2.5%	2.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%
1.3%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%
2.1%	2.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%
1.6%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2.4%	2.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%
1.4%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
1.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%	0.1%	0.1%	0.0%	0.1%	0.0%	0.2%	0.1%	0.0%	0.1%	0.1%
1.3%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%
1.3%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
3.4%	***14.2%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.1%	***0.9%***
3.4%	***14.2%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.1%	***0.9%***
2.6%	***9.4%***	0.0%	0.0%	0.0%	0.0%	***0.0%***	0.0%	0.0%	0.0%	0.0%	***0.0%***	0.1%	0.0%	0.0%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.6%***
3.4%	***16.4%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.2%	0.2%	0.2%	0.1%	***1.1%***
3.0%	***12.7%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.1%	***0.8%***
2.6%	***12.1%***	0.0%	0.0%	0.1%	0.0%	***0.0%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.8%***
2.4%	***10.5%***	0.0%	0.0%	0.0%	0.0%	***0.0%***	0.0%	0.0%	0.1%	0.0%	***0.0%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.7%***
2.1%	***9.9%***	0.0%	0.0%	0.0%	0.0%	***0.0%***	0.0%	0.0%	0.1%	0.0%	***0.0%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.6%***
3.5%	***13.8%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.1%	***0.1%***	0.1%	0.1%	0.1%	0.1%	***0.1%***	0.1%	0.1%	0.1%	0.1%	***0.8%***
3.2%	***14.7%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.1%	***0.9%***
3.2%	***18.3%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.1%	***0.2%***	0.2%	0.2%	0.2%	0.1%	***1.3%***
2.9%	***3.1%***	0.3%	0.3%	0.3%	***0.3%***	***0.3%***	0.3%	0.3%	0.3%	***0.3%***	***0.3%***	0.4%	0.4%	0.4%	***0.4%***	***0.4%***	0.6%	0.6%	0.6%	***0.9%***	***0.9%***	0.6%	0.6%	0.6%	***1.2%***	***1.2%***
2.9%	***3.1%***	0.3%	0.3%	0.3%	***0.3%***	***0.3%***	0.3%	0.3%	0.3%	***0.3%***	***0.3%***	0.4%	0.4%	0.4%	***0.4%***	***0.4%***	0.6%	0.6%	0.6%	***0.9%***	***0.9%***	0.6%	0.6%	0.6%	***1.2%***	***1.2%***
0.7%	***0.9%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.1%	0.1%	0.1%	***0.2%***	***0.2%***	0.1%	0.1%	0.1%	***0.2%***	***0.3%***
6.5%	***6.6%***	0.7%	0.7%	0.7%	***0.7%***	***0.7%***	0.8%	0.8%	0.8%	***0.8%***	***0.8%***	0.9%	0.9%	0.9%	***1.0%***	***1.0%***	1.3%	1.4%	1.4%	***2.0%***	***2.1%***	1.4%	1.5%	1.5%	***2.7%***	***2.8%***
4.2%	***4.4%***	0.5%	0.5%	0.5%	***0.5%***	***0.5%***	0.5%	0.5%	0.5%	***0.5%***	***0.5%***	0.6%	0.6%	0.6%	***0.6%***	***0.7%***	0.9%	0.9%	0.9%	***1.3%***	***1.3%***	0.9%	0.9%	0.9%	***1.8%***	***1.8%***
1.0%	***1.1%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.2%	0.2%	0.2%	***0.3%***	***0.3%***	0.2%	0.2%	0.2%	***0.4%***	***0.4%***
1.5%	***1.6%***	0.2%	0.2%	0.2%	***0.2%***	***0.2%***	0.2%	0.2%	0.2%	***0.2%***	***0.2%***	0.2%	0.2%	0.2%	***0.2%***	***0.2%***	0.3%	0.3%	0.3%	***0.5%***	***0.5%***	0.3%	0.3%	0.3%	***0.6%***	***0.7%***
3.2%	***3.4%***	0.3%	0.3%	0.4%	***0.3%***	***0.3%***	0.4%	0.4%	0.4%	***0.4%***	***0.4%***	0.4%	0.4%	0.4%	***0.5%***	***0.5%***	0.6%	0.6%	0.6%	***1.0%***	***1.0%***	0.7%	0.7%	0.7%	***1.3%***	***1.4%***
1.2%	***1.3%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.2%	0.2%	0.2%	***0.2%***	***0.2%***	0.3%	0.3%	0.3%	***0.4%***	***0.4%***	0.3%	0.3%	0.3%	***0.5%***	***0.5%***
3.4%	***3.5%***	0.4%	0.4%	0.4%	***0.4%***	***0.4%***	0.4%	0.4%	0.4%	***0.4%***	***0.4%***	0.5%	0.5%	0.5%	***0.5%***	***0.5%***	0.7%	0.7%	0.7%	***1.1%***	***1.1%***	0.8%	0.8%	0.8%	***1.4%***	***1.5%***
12.4%	***12.6%***	1.4%	1.4%	1.4%	***1.4%***	***1.4%***	1.6%	1.6%	1.6%	***1.6%***	***1.6%***	1.7%	1.7%	1.7%	***1.9%***	***1.9%***	2.6%	2.6%	2.6%	***3.9%***	***4.0%***	2.8%	2.8%	2.8%	***5.3%***	***5.4%***

	Base				100y					Monthly															
					2140					2040					2065					2090					
	Reach	Social Factor Category	Variable	Baseline	c_high_2140_100y_	d_high_2140_100y_	e_high_2140_100y_	f_high_2140_100y_	g_high_2140_100y_	c_high_2040_monthly_	d_high_2040_monthly_	e_high_2040_monthly_	f_high_2040_monthly_	g_high_2040_monthly_	c_high_2065_monthly_	d_high_2065_monthly_	e_high_2065_monthly_	f_high_2065_monthly_	g_high_2065_monthly_	c_high_2090_monthly_	d_high_2090_monthly_	e_high_2090_monthly_	f_high_2090_monthly_	g_high_2090_monthly_	c_high_2115_monthly_
10	Reach 1	health and safety	Asthma	1766	24.1%	24.1%	3.2%	3.2%	2.6%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.4%	0.4%	0.4%	0.4%	0.4%	2.5%
14	Reach 1	health and safety	Total Population	10,826	24.1%	24.1%	3.2%	3.2%	2.6%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.4%	0.4%	0.4%	0.4%	0.4%	2.5%
20	Reach 1	social vulnerability and resiliency	Age over 65	2,123	26.7%	26.7%	2.9%	3.0%	2.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.4%	0.3%	0.4%	0.4%	0.4%	1.9%
21	Reach 1	social vulnerability and resiliency	Age under 18	1,094	24.4%	24.4%	2.1%	2.2%	1.6%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.2%	0.3%	0.3%	0.3%	1.4%
	Reach 1	social vulnerability and resiliency	Age under 18 AND Age over 65	3,217	25.9%	25.9%	2.7%	2.7%	1.9%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%	0.4%	0.3%	1.7%
24	Reach 1	social vulnerability and resiliency	Equivalent to High School Degree	765	26.9%	26.9%	1.8%	1.8%	1.7%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.3%	0.2%	0.2%	0.2%	0.2%	1.7%
28	Reach 1	social vulnerability and resiliency	Households with Disability	1,112	38.7%	38.7%	2.3%	2.3%	2.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.3%	0.3%	0.3%	0.3%	0.3%	1.9%
29	Reach 1	social vulnerability and resiliency	Poverty	886	35.0%	35.0%	1.7%	1.7%	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.3%	0.2%	0.2%	0.2%	0.2%	1.6%
30	Reach 1	social vulnerability and resiliency	Linguistic Isolation	1,549	15.3%	15.3%	5.2%	5.3%	3.9%	0.2%	0.2%	0.2%	0.2%	0.2%	0.4%	0.4%	0.4%	0.4%	0.4%	0.7%	0.6%	0.7%	0.8%	0.7%	3.7%
32	Reach 1	social vulnerability and resiliency	Minority (non-white)	4,151	32.4%	32.4%	2.5%	2.5%	2.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.4%	0.3%	0.3%	0.3%	0.3%	2.2%
35	Reach 1	social vulnerability and resiliency	Single Parent	203	39.8%	39.8%	1.4%	1.4%	0.9%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%	0.2%	0.2%	0.2%	0.7%
46	Reach 2	health and safety	Asthma	2921	44.7%	44.7%	2.8%	2.9%	2.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.6%	0.2%	0.0%	0.1%	0.1%	4.1%
50	Reach 2	health and safety	Total Population	14,896	44.7%	44.7%	2.8%	2.9%	2.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.6%	0.2%	0.0%	0.1%	0.1%	4.1%
56	Reach 2	social vulnerability and resiliency	Age over 65	2,644	54.1%	54.1%	3.9%	4.0%	4.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.8%	0.3%	0.0%	0.1%	0.1%	5.6%
57	Reach 2	social vulnerability and resiliency	Age under 18	1,103	48.0%	48.0%	3.7%	3.8%	3.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.4%	0.2%	0.0%	0.1%	0.1%	5.1%
	Reach 2	social vulnerability and resiliency	Age under 18 AND Age over 65	3,747	52.3%	52.3%	3.8%	3.9%	3.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.7%	0.3%	0.0%	0.1%	0.1%	5.5%
60	Reach 2	social vulnerability and resiliency	Equivalent to High School Degree	841	36.5%	36.5%	4.2%	4.2%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.1%	0.0%	0.0%	0.0%	5.2%
64	Reach 2	social vulnerability and resiliency	Households with Disability	1,127	45.7%	45.7%	4.5%	4.5%	4.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	0.2%	0.0%	0.1%	0.0%	5.8%
65	Reach 2	social vulnerability and resiliency	Poverty	1,766	40.0%	40.0%	5.2%	5.2%	5.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.1%	0.0%	0.1%	0.0%	6.3%
66	Reach 2	social vulnerability and resiliency	Linguistic Isolation	2,571	44.6%	44.6%	2.3%	2.3%	2.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.1%	0.1%	0.4%	0.2%	0.0%	0.1%	0.1%	3.1%
68	Reach 2	social vulnerability and resiliency	Minority (non-white)	7,911	45.4%	45.4%	2.4%	2.5%	2.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.5%	0.2%	0.0%	0.1%	0.1%	3.6%
71	Reach 2	social vulnerability and resiliency	Single Parent	85	56.0%	56.0%	9.5%	9.5%	9.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	10.8%
82	Reach 3	health and safety	Asthma	6958	50.5%	50.5%	5.7%	5.4%	***22.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.3%	0.2%	0.3%	0.2%	***4.4%***	4.4%
86	Reach 3	health and safety	Total Population	46770	50.5%	50.5%	5.7%	5.4%	***22.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.3%	0.2%	0.3%	0.2%	***4.4%***	4.4%
92	Reach 3	social vulnerability and resiliency	Age over 65	4984	47.5%	47.5%	4.1%	3.8%	***14.3%***	0.0%	0.0%	0.0%	0.0%	***0.0%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.2%	0.2%	0.2%	0.1%	***2.8%***	3.5%
93	Reach 3	social vulnerability and resiliency	Age under 18	4615	49.1%	49.1%	6.6%	6.3%	***26.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.1%	***0.2%***	0.3%	0.3%	0.3%	0.2%	***5.3%***	3.9%
	Reach 3	social vulnerability and resiliency	Age under 18 AND Age over 65	9598.957	48.3%	48.3%	5.3%	5.0%	***20.0%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.2%	0.2%	0.2%	0.2%	***4.0%***	3.7%
96	Reach 3	social vulnerability and resiliency	Equivalent to High School Degree	3858	46.2%	46.2%	3.7%	3.3%	***18.3%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.2%	0.2%	0.2%	0.1%	***3.9%***	3.3%
100	Reach 3	social vulnerability and resiliency	Households with Disability	3,721	43.7%	43.7%	3.8%	3.5%	***16.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.2%	0.2%	0.2%	0.1%	***3.3%***	3.1%
101	Reach 3	social vulnerability and resiliency	Poverty	5789	46.5%	46.5%	2.9%	2.6%	***15.0%***	0.0%	0.0%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.2%	0.2%	0.2%	0.1%	***3.2%***	2.7%
102	Reach 3	social vulnerability and resiliency	Linguistic Isolation	7071	49.7%	49.7%	6.5%	6.3%	***22.9%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.3%	0.2%	0.2%	0.2%	***4.1%***	4.4%
104	Reach 3	social vulnerability and resiliency	Minority (non-white)	24794	51.9%	51.9%	5.3%	4.9%	***22.7%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.3%	0.3%	0.3%	0.2%	***4.7%***	4.1%
107	Reach 3	social vulnerability and resiliency	Single Parent	1016	48.1%	48.1%	6.9%	6.5%	***29.6%***	0.1%	0.1%	0.1%	0.0%	***0.1%***	0.2%	0.2%	0.2%	0.1%	***0.2%***	0.4%	0.4%	0.4%	0.3%	***6.2%***	3.3%
118	Reach 4	health and safety	Asthma	2103	10.8%	10.8%	1.5%	***5.4%***	***5.4%***	0.4%	0.4%	0.4%	***0.4%***	***0.4%***	0.6%	0.6%	0.6%	***1.0%***	***1.0%***	0.8%	0.7%	0.7%	***2.0%***	***2.2%***	1.1%
122	Reach 4	health and safety	Total Population	13254	10.8%	10.8%	1.5%	***5.4%***	***5.4%***	0.4%	0.4%	0.4%	***0.4%***	***0.4%***	0.6%	0.6%	0.6%	***1.0%***	***1.0%***	0.8%	0.7%	0.7%	***2.0%***	***2.2%***	1.1%
128	Reach 4	social vulnerability and resiliency	Age over 65	1720	8.9%	8.9%	0.4%	***1.5%***	***1.6%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.1%	0.1%	0.1%	***0.2%***	***0.2%***	0.2%	0.2%	0.2%	***0.5%***	***0.6%***	0.3%
129	Reach 4	social vulnerability and resiliency	Age under 18	2660	14.5%	14.5%	2.7%	***9.6%***	***9.7%***	0.8%	0.8%	0.8%	***0.9%***	***0.9%***	1.4%	1.4%	1.4%	***2.3%***	***2.3%***	1.7%	1.6%	1.6%	***4.7%***	***4.8%***	2.5%
	Reach 4	social vulnerability and resiliency	Age under 18 AND Age over 65	4380.155	12.3%	12.3%	1.8%	***6.4%***	***6.5%***	0.5%	0.5%	0.5%	***0.6%***	***0.6%***	0.9%	0.9%	0.9%	***1.5%***	***1.5%***	1.1%	1.0%	1.0%	***3.0%***	***3.2%***	1.6%
132	Reach 4	social vulnerability and resiliency	Equivalent to High School Degree	1872	7.7%	7.7%	0.4%	***1.7%***	***1.8%***	0.1%	0.1%	0.1%	***0.1%***	***0.1%***	0.2%	0.2%	0.2%	***0.3%***	***0.3%***	0.3%	0.2%	0.3%	***0.7%***	***0.8%***	0.4%
136	Reach 4	social vulnerability and resiliency	Households with Disability	1,045	7.1%	7.1%	0.7%	***2.5%***	***2.5%***	0.2%	0.2%	0.2%	***0.2%***	***0.2%***	0.3%	0.3%	0.3%	***0.5%***	***0.5%***	0.4%	0.4%	0.4%	***1.1%***	***1.1%***	0.6%
137	Reach 4	social vulnerability and resiliency	Poverty	1951	10.5%	10.5%	1.3%	***4.6%***	***4.8%***	0.4%	0.4%	0.4%	***0.4%***	***0.4%***	0.7%	0.7%	0.7%	***1.1%***	***1.1%***	0.8%	0.8%	0.8%	***2.3%***	***2.4%***	1.2%
138	Reach 4	social vulnerability and resiliency	Linguistic Isolation	2497	7.7%	7.7%	0.8%	***2.6%***	***2.5%***	0.2%	0.2%	0.2%	***0.2%***	***0.2%***	0.3%	0.3%	0.3%	***0.4%***	***0.4%***	0.3%	0.3%	0.3%	***0.9%***	***0.9%***	0.5%
140	Reach 4	social vulnerability and resiliency	Minority (non-white)	9923	10.9%	10.9%	1.5%	***5.5%***	***5.5%***	0.4%	0.4%	0.4%	***0.5%***	***0.5%***	0.7%	0.7%	0.7%	***1.2%***	***1.2%***	0.9%	0.8%	0.9%	***2.5%***	***2.5%***	1.3%
143	Reach 4	social vulnerability and resiliency	Single Parent	1289	22.3%	22.3%	4.9%	***17.2%***	***17.4%***	1.6%	1.6%	1.6%	***1.7%***	***1.7%***	2.7%	2.7%	2.7%	***4.4%***	***4.5%***	3.3%	3.0%	3.1%	***9.0%***	***9.2%***	4.8%

***** COUNT FOR DISPLACED PEOPLE IN RETREAT AREAS FOR ALT F AND G*****

2115				2140				
d_high_2115_monthly_	e_high_2115_monthly_	f_high_2115_monthly_	g_high_2115_monthly_	c_high_2140_monthly_	d_high_2140_monthly_	e_high_2140_monthly_	f_high_2140_monthly_	g_high_2140_monthly_
2.0%	2.4%	2.4%	2.1%	14.9%	14.4%	2.8%	2.8%	2.4%
2.0%	2.4%	2.4%	2.1%	14.9%	14.4%	2.8%	2.8%	2.4%
1.6%	2.1%	2.1%	1.7%	15.1%	14.6%	2.6%	2.6%	1.9%
1.2%	1.6%	1.6%	1.3%	13.4%	13.0%	1.9%	1.9%	1.4%
1.5%	1.9%	1.9%	1.5%	14.5%	14.1%	2.3%	2.3%	1.8%
1.3%	1.4%	1.4%	1.3%	14.9%	14.6%	1.6%	1.6%	1.6%
1.6%	1.8%	1.8%	1.6%	20.7%	20.3%	2.1%	2.1%	1.8%
1.3%	1.4%	1.4%	1.3%	18.6%	18.3%	1.6%	1.6%	1.5%
3.1%	3.9%	3.9%	3.2%	12.6%	11.7%	4.6%	4.7%	3.7%
1.7%	1.9%	1.9%	1.7%	18.2%	17.8%	2.2%	2.2%	2.0%
0.7%	0.9%	0.9%	0.7%	19.2%	19.0%	1.1%	1.1%	0.8%
2.7%	2.5%	2.5%	2.5%	37.7%	36.5%	2.8%	2.9%	2.9%
2.7%	2.5%	2.5%	2.5%	37.7%	36.5%	2.8%	2.9%	2.9%
3.9%	3.6%	3.6%	3.6%	46.6%	45.2%	3.9%	3.9%	3.9%
3.3%	3.1%	3.2%	3.2%	39.3%	37.9%	3.6%	3.7%	3.7%
3.7%	3.4%	3.5%	3.5%	44.4%	43.0%	3.8%	3.8%	3.9%
3.7%	3.6%	3.6%	3.6%	30.2%	29.3%	4.2%	4.2%	4.2%
4.2%	4.0%	4.0%	4.0%	38.7%	37.6%	4.5%	4.5%	4.5%
4.5%	4.4%	4.4%	4.4%	33.0%	32.0%	5.1%	5.1%	5.2%
2.1%	1.9%	2.0%	2.0%	36.9%	36.0%	2.2%	2.3%	2.3%
2.3%	2.1%	2.2%	2.2%	37.3%	36.1%	2.4%	2.4%	2.5%
7.7%	7.9%	7.7%	7.9%	45.7%	44.3%	9.3%	9.3%	9.3%
3.6%	3.8%	3.7%	***15.0%***	41.4%	41.3%	5.3%	5.0%	***21.1%***
3.6%	3.8%	3.7%	***15.0%***	41.4%	41.3%	5.3%	5.0%	***21.1%***
2.8%	2.9%	2.9%	***10.0%***	34.9%	34.8%	3.8%	3.6%	***13.8%***
3.4%	3.6%	3.6%	***17.2%***	41.2%	41.1%	5.9%	5.5%	***24.9%***
3.1%	3.3%	3.2%	***13.5%***	37.9%	37.8%	4.8%	4.5%	***19.1%***
2.9%	3.0%	2.8%	***12.7%***	37.2%	37.2%	3.6%	3.3%	***17.6%***
2.6%	2.7%	2.6%	***11.1%***	32.8%	32.7%	3.6%	3.3%	***15.4%***
2.3%	2.5%	2.3%	***10.5%***	35.3%	35.3%	2.9%	2.6%	***14.4%***
3.7%	3.8%	3.9%	***14.7%***	40.7%	40.6%	5.8%	5.5%	***21.8%***
3.5%	3.7%	3.5%	***15.5%***	42.2%	42.1%	5.0%	4.6%	***21.8%***
3.1%	3.2%	3.3%	***19.2%***	41.8%	41.8%	6.0%	5.5%	***28.2%***
0.9%	1.2%	***3.0%***	***3.2%***	5.3%	5.4%	1.5%	***3.9%***	***4.2%***
0.9%	1.2%	***3.0%***	***3.2%***	5.3%	5.4%	1.5%	***3.9%***	***4.2%***
0.2%	0.4%	***0.7%***	***0.9%***	2.9%	2.9%	0.6%	***1.0%***	***1.2%***
2.0%	2.3%	***6.8%***	***7.0%***	9.7%	9.7%	2.7%	***8.6%***	***8.8%***
1.3%	1.6%	***4.4%***	***4.6%***	7.0%	7.1%	1.9%	***5.6%***	***5.8%***
0.3%	0.4%	***1.1%***	***1.2%***	2.5%	2.5%	0.5%	***1.4%***	***1.5%***
0.5%	0.6%	***1.6%***	***1.7%***	2.9%	3.0%	0.7%	***2.1%***	***2.1%***
1.0%	1.2%	***3.3%***	***3.5%***	5.5%	5.6%	1.5%	***4.2%***	***4.5%***
0.4%	0.5%	***1.3%***	***1.4%***	2.6%	2.6%	0.7%	***1.8%***	***1.8%***
1.1%	1.2%	***3.6%***	***3.7%***	5.7%	5.7%	1.5%	***4.6%***	***4.7%***
3.8%	4.3%	***13.0%***	***13.2%***	17.8%	17.8%	4.9%	***16.3%***	***16.6%***

1% AEP

LOW CURVE

	USACE Reach	Reach 1	Reach 2			Reach 3			Reach 4		
	Equity Priority Community Class	Higher	High	Higher	Highest	High	Higher	Highest	High	Higher	Highest
	Total Population	3,714	882	2,189	3,198	72	7,000	3,448	5,809	138	2,225
2040	FWOP	60	0	0	0	0	0	0	0	0	395
	Alt C	62	0	0	0	0	0	0	0	0	152
	Alt D	62	0	0	0	0	0	0	0	0	153
	Alt E	49	0	0	0	0	0	0	0	0	153
	Alt F	47	0	0	0	0	0	0	0	0	394
	Alt G	48	0	0	0	0	0	0	0	0	394
2065	FWOP	63	0	0	0	0	0	0	0	0	415
	Alt C	65	0	0	0	0	0	0	0	0	153
	Alt D	64	0	0	0	0	0	0	0	0	154
	Alt E	52	0	0	0	0	0	0	0	0	154
	Alt F	50	0	0	0	0	0	0	0	0	414
	Alt G	50	0	0	0	0	0	0	0	0	414
2090	FWOP	69	0	0	0	0	0	0	0	0	439
	Alt C	71	0	0	0	0	0	0	0	0	167
	Alt D	55	0	0	0	0	0	0	0	0	156
	Alt E	55	0	0	0	0	0	0	0	0	155
	Alt F	63	0	0	0	0	0	0	0	0	436
	Alt G	55	0	0	0	0	0	0	0	0	438
2115	FWOP	82	0	0	0	0	0	0	0	0	459
	Alt C	82	0	0	0	0	0	0	0	0	170
	Alt D	66	0	0	0	0	0	0	0	0	158
	Alt E	65	0	0	0	0	0	0	0	0	158
	Alt F	73	0	0	0	0	0	0	0	0	456
	Alt G	65	0	0	0	0	0	0	0	0	458
2140	FWOP	99	0	0	0	0	0	0	0	0	478
	Alt C	95	0	0	0	0	0	0	0	0	173
	Alt D	78	0	0	0	0	0	0	0	0	159
	Alt E	77	0	0	0	0	0	0	0	0	160
	Alt F	84	0	0	0	0	0	0	0	0	474
	Alt G	78	0	0	0	0	0	0	0	0	477

	USACE Reach	Reach 1	Reach 2			Reach 3			Reach 4		
	Equity Priority Community Class	Higher	High	Higher	Highest	High	Higher	Highest	High	Higher	Highest
	Total Population	3714	882	2189	3198	72	7000	3448	5809	138	2225
2040	FWOP	64	0	0	0	0	0	0	0	0	419
	Alt C	66	0	0	0	0	0	0	0	0	163
	Alt D	64	0	0	0	0	0	0	0	0	154
	Alt E	52	0	0	0	0	0	0	0	0	155
	Alt F	51	0	0	0	0	0	0	0	0	418
	Alt G	51	0	0	0	0	0	0	0	0	418
2065	FWOP	94	0	0	0	0	0	0	0	0	474
	Alt C	91	0	0	0	0	0	0	0	0	172
	Alt D	74	0	0	0	0	0	0	0	0	158
	Alt E	75	0	0	0	0	0	0	0	0	159
	Alt F	73	0	0	0	0	0	0	0	0	473
	Alt G	73	0	0	0	0	0	0	0	0	473
2090	FWOP	201	28	0	0	0	227	48	0	0	528
	Alt C	163	0	0	0	0	0	0	0	0	188
	Alt D	130	0	0	0	0	0	0	0	0	165
	Alt E	128	0	0	0	0	0	0	0	0	167
	Alt F	134	0	0	0	0	0	0	0	0	525
	Alt G	130	0	0	0	0	0	0	0	0	527
2115	FWOP	724	83	8	0	0	294	107	0	0	583
	Alt C	230	0	5	0	0	0	0	0	0	204
	Alt D	162	0	0	0	0	0	0	0	0	175
	Alt E	159	0	0	0	0	0	0	0	0	179
	Alt F	165	0	0	0	0	0	0	0	0	580
	Alt G	161	0	0	0	0	0	0	0	0	582
2140	FWOP	1341	133	34	0	0	364	183	0	0	648
	Alt C	434	0	29	0	0	0	0	0	0	231
	Alt D	324	0	22	0	0	0	0	0	0	193
	Alt E	319	0	22	0	0	0	0	0	0	199
	Alt F	321	0	23	0	0	0	0	0	0	646
	Alt G	321	0	22	0	0	0	0	0	0	648

	USACE Reach	Reach 1	Reach 2			Reach 3			
	Equity Priority Community Class	Higher	High	Higher	Highest	High	Higher	Highest	High
	Total Population	3714	882	2189	3198	72	7000	3448	5809
2040	FWOP	134	1	0	0	0	0	0	0
	Alt C	126	0	0	0	0	0	0	0
	Alt D	106	0	0	0	0	0	0	0
	Alt E	108	0	0	0	0	0	0	0
	Alt F	107	0	0	0	0	0	0	0
	Alt G	107	0	0	0	0	0	0	0
2065	FWOP	959	102	10	0	0	321	131	0
	Alt C	276	0	7	0	0	0	0	0
	Alt D	251	0	7	0	0	0	0	0
	Alt E	201	0	0	0	0	0	0	0
	Alt F	200	0	0	0	0	0	0	0
	Alt G	201	0	0	0	0	0	0	0
2090	FWOP	1906	222	162	301	0	572	362	40
	Alt C	1911	222	162	299	0	570	360	41
	Alt D	505	0	140	0	0	0	0	0
	Alt E	481	0	140	0	0	0	0	0
	Alt F	481	0	140	0	0	0	0	0
	Alt G	484	0	140	0	0	0	0	0
2115	FWOP	2404	338	178	1026	0	1278	805	204
	Alt C	2405	338	178	1022	0	1274	802	204
	Alt D	2405	338	178	1022	0	1274	802	204
	Alt E	531	0	156	0	0	0	0	0
	Alt F	531	0	156	0	0	0	0	0
	Alt G	534	0	156	0	0	0	0	0
2140	FWOP	2805	443	178	1762	0	2135	1396	727
	Alt C	2807	443	178	1757	0	2130	1392	731
	Alt D	2807	443	178	1757	0	2130	1392	731
	Alt E	546	0	156	0	0	0	0	0
	Alt F	546	0	157	0	0	0	0	0
	Alt G	549	0	156	0	0	0	0	0

Reach 4	
Higher	Highest
138	2225
0	494
0	176
0	160
0	161
0	493
0	493
0	608
0	214
0	181
0	187
0	607
0	607
0	796
0	796
0	212
0	227
0	788
0	792
0	871
0	869
0	869
0	238
0	856
0	861
0	902
0	898
0	898
0	248
0	877
0	881

				Alt C															Alt D										
				USACE High					USACE Intermediate					USACE Low					USACE High					USACE Intermediate					
			Baseline	2040	2065	2090	2115	2140	2040	2065	2090	2115	2140	2040	2065	2090	2115	2140	2040	2065	2090	2115	2140	2040	2065	2090	2115	2140	2040
USACE Reach	Asset	Units	Alt_C_	USACE_Hig	USACE_Hig	USACE_Hig	USACE_Hig	USACE_Hig	USACE_Inte	USACE_Inte	USACE_Inte	USACE_Inte	USACE_Inte	USACE_Low	USACE_Low	USACE_Low	USACE_Low	USACE_Low	USACE_Hig	USACE_Hig	USACE_Hig	USACE_Hig	USACE_Hig	USACE_Inte	USACE_Inte	USACE_Inte	USACE_Inte	USACE_Inte	USACE_Low
Reach 1	California Register Historic Districts	acres	134.6	6.3	13.2	36.2	40.3	42.8	4.4	5.7	7.3	11.0	20.7	4.2	4.4	4.7	5.2	5.9	5.2	11.7	27.4	40.5	42.9	4.3	4.8	6.1	8.2	16.2	4.1
Reach 1	City Facilities	count	77.0	1.0	6.0	50.0	53.0	53.0	1.0	1.0	3.0	5.0	12.0	1.0	1.0	1.0	1.0	1.0	1.0	6.0	12.0	53.0	53.0	1.0	1.0	2.0	3.0	8.0	1.0
Reach 1	Historic Places	count	6.0	0.0	0.0	1.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 1	Landmarks	count	4.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 1	Legacy Businesses	count	12.0	1.0	2.0	5.0	6.0	7.0	0.0	0.0	2.0	2.0	3.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	3.0	6.0	7.0	0.0	0.0	2.0	2.0	2.0	0.0
Reach 1	Muni Stops	count	78.0	0.0	0.0	18.0	21.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 1	National Shelters	count	2.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 1	Schools	count	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 1	Schools (Polygon)	acres		0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Reach 1	Senior Affordable Housing	count	1.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 1	Places of Worship	count	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 1	LBE Business	count	21.0	0.0	0.0	2.0	4.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 1	Minority Owned Business	count	4.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 1	Women Owned Business	count	10.0	0.0	0.0	1.0	1.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 1	Affordable Housing	count	4.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 1	Disaster Response	count	16.0	0.0	0.0	11.0	11.0	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	11.0	11.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 1	Hazmat	count	27.0	0.0	1.0	10.0	16.0	17.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	16.0	17.0	0.0	0.0	0.0	1.0	1.0	0.0
Reach 1	Manholes	count	594.0	0.0	3.0	221.0	255.0	279.0	0.0	0.0	1.0	3.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	2.0	255.0	279.0	0.0	0.0	1.0	1.0	1.0	0.0
Reach 1	North Point Facility	acres		0.0	0.0	0.6	1.3	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	2.5	0.0	0.0	0.0	0.0	0.0	0.0
Reach 1	Bay Trail	feet	8651.3	450.2	1328.9	7421.4	7716.3	7912.4	268.5	386.5	821.1	1276.6	1393.6	224.2	264.5	304.3	350.1	392.6	450.2	1326.1	1382.3	7716.3	7912.4	268.5	386.5	690.1	1152.7	1262.4	224.2
Reach 1	Land Use Open Space	acres		1.3	2.2	7.0	7.8	8.7	1.2	1.3	1.4	2.1	2.4	1.1	1.2	1.2	1.2	1.3	1.2	1.8	4.7	8.0	8.8	1.1	1.2	1.4	2.0	2.3	1.1
Reach 1	Parks Open Space	acres		0.2	0.2	1.0	1.0	1.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.0	1.0	0.2	0.2	0.2	0.2	0.2	0.2
Reach 1	Port Open Space	acres	11.0	1.3	2.5	9.4	10.1	10.3	0.4	1.0	1.7	2.2	3.5	0.3	0.4	0.5	0.8	1.2	0.5	1.5	3.0	10.1	10.3	0.3	0.3	1.4	1.6	2.4	0.3
Reach 1	Swimming and Fishing	count	13.0	1.0	1.0	2.0	3.0	3.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	3.0	3.0	1.0	1.0	1.0	1.0	1.0	1.0
Reach 1	Bike Paths	feet	10705.1	0.0	180.3	4076.8	5111.7	5467.2	0.0	0.0	0.0	63.1	464.3	0.0	0.0	0.0	0.0	0.0	0.0	148.0	507.5	5121.7	5467.2	0.0	0.0	0.0	63.1	290.9	0.0
Reach 1	Golden Gate Bus Routes	feet	154938.9	0.0	0.0	82164.0	86309.4	90139.3	0.0	0.0	0.0	0.0	764.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86309.4	90139.3	0.0	0.0	0.0	0.0	0.0	0.0
Reach 1	Regional Bus Routes	count		0.0	0.0	5.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 1	Ferry Stations	count		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 1	Muni Pattern Stops	count	225.0	0.0	0.0	61.0	66.0	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.0	75.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 1	Muni Routes	feet	33785.2	0.0	0.0	16635.0	17898.5	19153.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17898.5	19153.5	0.0	0.0	0.0	0.0	0.0	0.0
Reach 1	Streets	feet		4.9	140.1	18849.5	23797.0	27901.2	1.0	4.9	47.3	132.4	153.7	1.0	1.0	1.0	4.3	4.9	4.2	141.5	233.1	23797.0	27901.2	1.0	4.2	16.3	97.9	117.1	1.0
Reach 2	California Register Historic Districts	acres	177.0	3.2	11.6	58.3	68.4	82.7	2.0	2.9	3.6	5.7	17.6	1.4	1.9	2.3	2.6	2.9	3.1	11.4	29.5	68.5	82.7	2.0	2.9	1.5	2.2	9.9	1.4
Reach 2	Cultural Districts	acres	51.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	City Facilities	count	65.0	3.0	13.0	42.0	47.0	48.0	2.0	3.0	3.0	10.0	16.0	1.0	2.0	3.0	3.0	3.0	3.0	13.0	18.0	47.0	48.0	2.0	3.0	1.0	6.0	10.0	1.0
Reach 2	Historic Places	count	31.0	3.0	5.0	11.0	17.0	20.0	2.0	3.0	3.0	3.0	5.0	1.0	2.0	3.0	3.0	3.0	3.0	5.0	3.0	17.0	20.0	2.0	3.0	1.0	1.0	3.0	1.0
Reach 2	Healthcare Facilities	count		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Landmarks	count	58.0	0.0	1.0	5.0	11.0	33.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	11.0	33.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Legacy Businesses	count	14.0	0.0	1.0	5.0	5.0	6.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	5.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Muni Stops	count	149.0	0.0	0.0	74.0	89.0	96.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	89.0	96.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	National Shelters	count	4.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Schools	count	15.0	0.0	0.0	5.0	6.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Schools (Polygon)	acres		0.0	0.0	2.5	5.3	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	5.4	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Senior Affordable Housing	count	2.0	0.0	0.0	1.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Places of Worship	count	15.0	0.0	0.0	5.0	5.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	LBE Business	count	313.0	0.0	1.0	98.0	123.0	143.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	123.0	143.0	0.0	0.0	0.0	1.0	1.0	0.0
Reach 2	Minority Owned Business	count	108.0	0.0	0.0	35.0	44.0	57.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44.0	57.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Women Owned Business	count	121.0	0.0	0.0	48.0	61.0	66.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	61.0	66.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Affordable Housing	count	29.0	0.0	0.0	6.0	10.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Contaminated Lands	count	1.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Disaster Response	count	17.0	0.0	4.0	15.0	15.0	16.0	0.0	0.0	2.0	2.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	8.0	15.0	16.0	0.0	0.0	1.0	1.0	3.0	0.0
Reach 2	Hazmat	count	114.0	0.0	0.0	41.0	61.0	73.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	61.0	73.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Manholes	count	1075.0	4.0	12.0	409.0	512.0	586.0	1.0	3.0	6.0	10.0	13.0	0.0	1.0	1.0	2.0	3.0	4.0	12.0	1.0	512.0	586.0	1.0	3.0	1.0	1.0	1.0	0.0
Reach 2	Bay Trail	feet	10421.0	245.8	246.8	7732.2	7735.6	7733.9	245.8	245.8	246.3	247.4	292.2	247.3	245.8	245.8	245.8	245.8	241.4	242.4	243.4	7735.8	7734.0	241.4	241.4	242.9	242.3	242.3	242.9
Reach 2	Land Use Open Space	acres		0.0	0.0	9.5	11.8	13.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.8	13.4	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Parks Open Space	acres		0.0	0.0	9.3	9.9	10.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.9	10.1	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Port Open Space	acres	18.7	1.8	5.9	16.0	17.5	18.3	1.0	1.6	2.5	4.5	6.1	0.8	1.0	1.2	1.3	1.6	1.7	5.8	4.1	17.6	18.3	1.0	1.5	1.4	3.0	4.1	0.8
Reach 2	Swimming and Fishing	count	3.0	1.0	2.0	2.0	3.0	3.0	0.0	1.0	1.0	2.0	2.0	0.0	0.0	0.0	0.0	1.0	1.0	2.0	1.0	3.0	3.0	0.0	1.0	0.0	1.0	1.0	0.0
Reach 2	AC Transit Routes	feet	9649.7	0.2	0.2	3147.0	4923.8	6105.6	0.2	0.2	0.2	0.2	2.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	2.5	4923.8	6105.6	0.2	0.2	0.2	0.2	2.5	0.2
Reach 2	Amtrak Routes	feet	2091.8	0.0	0.0	20.8	20.8	20.8	0.0	0.0	0.0	0.0	20.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.6	20.6	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	BART Routes	feet	6284.5	0.0	460.7	2629.7	2917.2	3080.3	0.0	0.0	129.9	460.7	460.7	0.0	0.0	0.0	0.0	0.0	0.0	470.1	484.8	2917.2	3080.3	0.0	0.0	129.9	484.8	484.8	0.0
Reach 2	Bart Stations	count		0.0	0.0	7.0	7.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Bike Paths	feet	41570.4	0.0	0.0	21449.9	25324.4	27664.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25324.4	27664.9	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Golden Gate Bus Routes	feet	243223.0	0.0	0.0	53274.6	118018.0	141649.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	118018.0	141649.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Regional Bus Routes	count		0.0	0.0	13.0	45.0	52.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.0	52.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Ferry Stations	count		0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Light Rail Stations (Muni)	count		0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Muni Pattern Stops	count	879.0	0.0	0.0	439.0	542.0	589.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	542.0	589.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Muni Routes	feet	87148.7	0.0	0.0	43249.5	50158.5	55282.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50158.5	55282.7	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Samtrans Line	feet	7602.1	0.0	0.0	2292.1	3373.1	4229.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3373.1	4229.7	0.0	0.0	0.0	0.0	0.0	0.0
Reach 2	Samtrans Stations	count		0.0	0.0	0.0	2.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0

Reach 2	Streets	feet		0.0	0.0	44340.5	57521.6	69242.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57521.6	69242.3	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	California Register Historic Districts	acres	404.9	1.0	6.1	68.2	118.5	158.0	0.9	0.9	4.7	5.5	25.1	0.8	0.8	0.9	0.9	1.0	0.9	5.0	26.0	118.5	158.0	0.8	0.9	3.8	3.9	18.9	0.7
Reach 3	Cultural Districts	acres	619.0	0.0	0.0	90.6	136.5	220.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	136.5	220.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	City Facilities	count	181.0	3.0	9.0	88.0	126.0	132.0	1.0	3.0	3.0	5.0	21.0	1.0	1.0	2.0	3.0	3.0	3.0	9.0	23.0	126.0	132.0	1.0	3.0	3.0	4.0	19.0	1.0
Reach 3	Historic Places	count	17.0	0.0	0.0	1.0	3.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Healthcare Facilities	count		0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Landmarks	count	14.0	0.0	0.0	4.0	5.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Legacy Businesses	count	32.0	1.0	1.0	6.0	6.0	8.0	0.0	1.0	1.0	1.0	2.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	2.0	6.0	8.0	0.0	1.0	1.0	1.0	1.0	0.0
Reach 3	Muni Stops	count	194.0	0.0	0.0	54.0	71.0	84.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71.0	84.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	National Shelters	count	5.0	0.0	0.0	0.0	1.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Schools	count	23.0	0.0	0.0	3.0	4.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Schools (Polygon)	acres		0.0	0.0	5.8	12.1	13.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.1	13.2	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Senior Affordable Housing	count	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Places of Worship	count	17.0	0.0	0.0	1.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	LBE Business	count	313.0	0.0	7.0	37.0	46.0	97.0	0.0	0.0	0.0	7.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0	46.0	97.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Minority Owned Business	count	110.0	0.0	7.0	19.0	26.0	57.0	0.0	0.0	0.0	7.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0	26.0	57.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Women Owned Business	count	93.0	0.0	0.0	5.0	5.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Affordable Housing	count	134.0	0.0	0.0	26.0	38.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Contaminated Lands	count	11.0	0.0	0.0	4.0	4.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Disaster Response	count	23.0	1.0	4.0	14.0	18.0	18.0	1.0	1.0	0.0	1.0	7.0	1.0	1.0	1.0	1.0	1.0	1.0	4.0	9.0	18.0	18.0	1.0	1.0	0.0	1.0	7.0	1.0
Reach 3	Hazmat	count	270.0	0.0	2.0	57.0	80.0	107.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	3.0	80.0	107.0	0.0	0.0	0.0	0.0	2.0	0.0
Reach 3	Manholes	count	2341.0	18.0	43.0	708.0	919.0	1090.0	12.0	15.0	23.0	43.0	47.0	11.0	12.0	13.0	14.0	15.0	17.0	40.0	32.0	919.0	1090.0	12.0	15.0	18.0	28.0	29.0	11.0
Reach 3	Contaminated Lands in Southern Wat	count	343.0	0.0	1.0	84.0	114.0	167.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	114.0	167.0	0.0	0.0	0.0	1.0	1.0	0.0
Reach 3	Bluegreenway	feet	8675.7	618.2	1067.0	4394.5	7288.8	7779.3	216.4	505.0	716.6	1039.5	1079.3	174.5	210.9	306.0	434.4	545.4	423.5	725.1	698.0	7288.8	7779.3	46.1	319.9	467.7	644.8	677.7	27.2
Reach 3	Bay Trail	feet	14204.8	170.9	318.6	9208.1	11354.1	11543.0	138.2	152.2	195.1	268.4	815.7	125.7	134.5	143.1	145.9	153.8	170.9	329.7	76.7	11354.1	11543.0	138.2	152.2	26.2	39.5	55.9	125.7
Reach 3	Land Use Open Space	acres		0.0	0.0	4.6	6.7	9.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	9.2	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Parks Open Space	acres		0.0	0.0	0.0	1.9	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	3.4	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Port Open Space	acres	40.6	1.9	3.7	27.3	37.8	38.8	1.5	1.8	2.2	3.3	5.1	1.4	1.5	1.6	1.7	1.8	1.9	3.8	5.6	37.8	38.8	1.5	1.8	2.0	2.6	3.7	1.4
Reach 3	Swimming and Fishing	count	3.0	0.0	0.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	AC Transit Routes	feet	18819.6	0.0	0.0	3402.3	5454.6	7814.7	0.0	0.0	0.0	0.0	462.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.4	5453.5	7813.6	0.0	0.0	0.0	0.0	38.4	0.0
Reach 3	Amtrak Routes	feet	12424.4	0.0	0.0	4189.5	5846.1	7551.4	0.0	0.0	0.0	0.0	157.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5846.1	7551.4	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Bike Paths	feet	96802.2	68.1	216.4	27790.0	39394.3	45413.7	54.3	62.4	75.2	180.0	222.6	50.1	54.3	55.9	60.1	63.6	68.1	243.0	189.6	39394.3	45413.7	54.3	62.4	74.9	153.2	169.6	50.2
Reach 3	Golden Gate Bus Routes	feet	44691.7	0.0	0.0	36.2	3570.2	7904.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3570.2	7904.6	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Regional Bus Routes	count		0.0	0.0	0.0	1.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Ferry Stations	count		0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Muni Pattern Stops	count	588.0	0.0	0.0	206.0	257.0	287.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	257.0	287.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Muni Routes	feet	152328.1	103.6	172.3	48513.3	68940.1	81149.1	88.1	97.0	109.0	142.0	357.9	80.1	87.9	92.1	95.9	97.5	103.3	167.0	148.9	68939.1	81148.0	87.2	96.3	109.8	142.6	145.1	79.5
Reach 3	Caltrain Line	feet		0.0	0.0	33533.3	36760.1	36884.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36760.1	36884.4	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Samtrans Line	feet	19386.5	0.0	0.0	0.0	62.3	3329.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	62.3	3329.7	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Samtrans Stations	count		0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 3	Streets	feet		226.0	1114.6	114542.7	159135.5	196363.2	208.4	220.0	934.8	1085.3	1518.5	202.3	207.3	210.3	216.8	222.3	217.4	793.0	788.5	159132.2	196359.9	198.2	210.8	597.8	746.1	760.0	192.7
Reach 4	California Register Historic Districts	acres	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Cultural Districts	acres	927.4	28.8	37.6	275.5	414.7	565.2	25.6	27.7	32.4	36.0	40.2	23.9	24.4	26.3	27.0	27.8	26.2	32.8	35.9	414.7	565.2	23.9	25.3	27.7	29.5	32.3	23.6
Reach 4	City Facilities	count	134.0	0.0	0.0	30.0	62.0	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	62.0	75.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Landmarks	count	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Legacy Businesses	count	16.0	0.0	0.0	4.0	9.0	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0	11.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Muni Stops	count	126.0	0.0	0.0	20.0	42.0	55.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.0	55.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	National Shelters	count	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Schools	count	10.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Schools (Polygon)	acres		0.0	0.0	0.0	0.1	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	2.1	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Places of Worship	count	16.0	0.0	0.0	0.0	1.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	LBE Business	count	257.0	0.0	0.0	37.0	84.0	145.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	84.0	145.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Minority Owned Business	count	114.0	0.0	0.0	13.0	26.0	48.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.0	48.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Women Owned Business	count	46.0	0.0	0.0	5.0	12.0	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	18.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Affordable Housing	count	11.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Contaminated Lands	count	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Disaster Response	count	10.0	0.0	1.0	9.0	9.0	9.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	9.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Hazmat	count	102.0	0.0	0.0	30.0	50.0	62.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	62.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Manholes	count	1654.0	18.0	19.0	447.0	680.0	811.0	16.0	17.0	17.0	18.0	19.0	15.0	15.0	15.0	17.0	17.0	18.0	19.0	22.0	680.0	811.0	16.0	17.0	15.0	16.0	21.0	15.0
Reach 4	Southeast Treatment Plant	acres		0.0	0.0	10.0	25.9	30.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.9	30.7	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Contaminated Lands in Southern Wat	count	145.0	0.0	1.0	40.0	64.0	88.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	64.0	88.0	0.0	0.0	0.0	1.0	1.0	0.0
Reach 4	Bluegreenway	feet	9057.9	406.9	428.0	3412.0	4742.2	5512.5	402.1	405.8	408.7	420.7	434.6	399.2	402.1	401.8	399.7	405.8	418.2	435.1	502.1	4769.6	5512.6	413.2	417.0	409.7	416.3	431.0	410.4
Reach 4	Bay Trail	feet	16882.6	2149.9	2355.0	8132.4	11498.4	13347.6	1975.9	2108.2	2209.9	2329.0	2509.8	1884.9	1949.0	2041.1	2082.4	2108.6	2061.3	2228.7	2456.4	11525.2	13348.9	1913.5	2022.4	2060.8	2151.7	2241.0	1823.4
Reach 4	Land Use Open Space	acres		10.3	10.7	11.4	12.0	12.3	10.1	10.2	10.4	10.6	10.9	10.0	10.1	10.1	10.2	10.2	10.3	10.7	11.4	12.0	12.3	10.1	10.2	10.4	10.6	10.9	10.0
Reach 4	Parks Open Space	acres		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Port Open Space	acres	43.6	20.6	22.8	31.2	35.1	38.2	19.7	20.3	21.3	22.4	23.6	19.4	19.7	19.9	20.1	20.4	20.3	22.5	25.0	35.3	38.2	19.4	20.0	20.9	22.0	23.2	19.1
Reach 4	Bike Paths	feet	54739.3	27.3	37.3	10257.8	19015.3	24533.7	25.9	27.2	26.7	32.1	42.4	25.6	26.1	26.9	27.0	27.2	38.7	39.9	39.5	19015.3	24533.7	37.2	38.5	31.1	34.2	38.6	36.6
Reach 4	Regional Bus Routes	count		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Muni Pattern Stops	count	454.0	0.0	0.0	40.0	94.0	142.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	94.0	142.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Muni Routes	feet	87101.2	82.7	90.0	7262.5	17029.1	25042.1	81.8	82.3	83.6	88.6	105.5	81.4	81.7	77.0	79.7	82.4	41.9	49.7	129.4	17029.1	25042.1	41.0	41.5	42.4	47.4	67.2	40.4
Reach 4	Caltrain Line	feet		0.0	0.0	700.4	1277.0	1589.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1277.0	1589.9	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Samtrans Line	feet	26164.0	0.0	0.0	0.0	0.0	1034.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1034.7	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Samtrans Stations	count		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reach 4	Streets	feet		797.8	928.5	42105.3	80602.6	110099.2	746.5	773.4	837.1	920.3	995.8	734.3	746.1	754.5	767.9	774.1	779.7	904.1	1110.1	80749.1	110098.6	728.6	758.0	795.8	872.4	967.8	715.3

				Alt E															Alt F													
USACE Low				USACE High					USACE Intermediate					USACE Low					USACE High					USACE Intermediate					USACE Low			
2065	2090	2115	2140	2040	2065	2090	2115	2140	2040	2065	2090	2115	2140	2040	2065	2090	2115	2140	2040	2065	2090	2115	2140	2040	2065	2090	2115	2140	2040	2065	2090	2115
USACE_Lov	USACE_Lov	USACE_Lov	USACE_Lov	USACE_Hig	USACE_Hig	USACE_Hig	USACE_Hig	USACE_Hig	USACE_Inte	USACE_Inte	USACE_Inte	USACE_Inte	USACE_Inte	USACE_Lov	USACE_Lov	USACE_Lov	USACE_Lov	USACE_Lov	USACE_Hig	USACE_Hig	USACE_Hig	USACE_Hig	USACE_Hig	USACE_Inte	USACE_Inte	USACE_Inte	USACE_Inte	USACE_Inte	USACE_Lov	USACE_Lov	USACE_Lov	USACE_Lov
4.3	3.9	4.4	5.1	5.5	10.8	27.3	30.9	33.4	3.8	5.0	6.1	8.5	16.6	3.6	3.8	3.9	4.4	5.0	5.4	10.7	27.4	31.0	33.4	3.7	4.8	6.5	8.9	16.9	3.5	3.6	4.4	4.9
1.0	0.0	0.0	0.0	0.0	5.0	13.0	15.0	15.0	0.0	0.0	2.0	4.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	13.0	15.0	15.0	0.0	0.0	2.0	4.0	9.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	5.0	6.0	8.0	9.0	0.0	0.0	1.0	5.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	6.0	8.0	9.0	0.0	0.0	1.0	5.0	6.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
264.5	304.3	350.1	392.6	637.8	1432.2	1690.1	1985.5	2181.5	365.1	544.1	690.1	1238.4	1569.9	336.6	359.9	304.3	350.1	392.6	450.2	1421.7	1688.0	1988.4	2188.3	268.5	382.6	834.6	1255.0	1575.0	224.2	264.5	677.4	708.5
1.1	1.2	1.2	1.3	1.5	3.1	6.2	7.1	8.0	1.3	1.4	1.5	2.7	3.5	1.2	1.3	1.2	1.3	1.4	1.4	3.1	6.2	7.2	8.0	1.2	1.3	1.7	2.8	3.6	1.1	1.2	1.3	1.4
0.2	0.2	0.2	0.2	0.3	0.6	1.0	1.0	1.0	0.3	0.3	0.4	0.5	0.7	0.2	0.3	0.3	0.3	0.3	0.3	0.6	1.0	1.0	1.0	0.3	0.3	0.4	0.5	0.7	0.2	0.3	0.3	0.3
0.3	0.4	0.7	1.1	1.2	1.7	2.4	2.6	2.8	0.4	1.0	1.5	1.6	2.3	0.3	0.4	0.5	0.8	1.1	1.2	1.7	2.4	2.7	2.8	0.3	1.0	1.5	1.6	2.3	0.3	0.3	0.5	0.8
1.0	1.0	1.0	1.0	1.0	1.0	2.0	3.0	3.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	3.0	3.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
0.0	0.0	0.0	0.0	0.0	695.0	1318.3	2357.8	2714.0	0.0	0.0	0.0	350.3	1003.4	0.0	0.0	0.0	0.0	0.0	0.0	601.7	1399.2	2371.3	2709.0	0.0	0.0	0.0	437.9	1031.6	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	1.0	1.0	3.3	0.0	388.6	518.6	770.5	935.0	0.0	0.0	11.2	257.0	403.1	0.0	0.0	0.0	0.0	0.0	1.5	388.6	510.1	761.9	928.0	1.5	1.5	11.0	229.2	391.6	1.5	1.5	0.0	0.0
1.9	1.2	1.4	1.4	0.4	4.9	28.3	31.2	31.2	0.3	0.4	0.3	1.0	8.7	0.3	0.3	0.2	0.2	0.2	0.5	5.2	28.4	31.5	31.5	0.4	0.5	1.0	1.6	9.1	0.4	0.4	0.8	0.9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.0	1.0	1.0	1.0	0.0	8.0	17.0	20.0	20.0	0.0	0.0	0.0	5.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	17.0	20.0	20.0	0.0	0.0	0.0	5.0	9.0	0.0	0.0	0.0	0.0
2.0	1.0	1.0	1.0	0.0	2.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	3.0	8.0	8.0	8.0	0.0	0.0	1.0	1.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	8.0	8.0	8.0	0.0	0.0	1.0	1.0	3.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
241.4	242.4	242.5	242.5	10.7	10.7	11.5	14.4	14.4	10.7	10.7	11.5	11.5	11.5	10.7	10.7	11.5	11.5	11.5	70.8	72.4	74.1	78.5	79.7	71.2	70.8	74.2	74.1	73.0	71.8	71.2	74.8	74.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	0.7	0.7	0.7	0.3	3.5	3.5	4.0	4.0	0.2	0.2	0.8	2.4	3.5	0.2	0.2	0.1	0.1	0.2	0.5	3.8	3.8	4.3	4.3	0.4	0.5	1.2	2.8	3.7	0.4	0.4	0.6	0.6
0.0	0.0	0.0	0.0	0.0	1.0	1.0	2.0	2.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	2.0	2.0	0.0	0.0	1.0	2.0	2.0	0.0	0.0	1.0	1.0
0.2	0.2	0.2	0.2	3.3	3.3	2.5	2.5	2.5	3.3	3.3	0.2	0.2	2.5	3.3	3.3	0.2	0.2	0.2	0.2	0.2	3.5	3.5	3.5	0.2	0.2	3.5	3.5	3.5	0.2	0.2	3.4	3.4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	483.8	484.7	484.5	484.6	0.0	0.0	129.9	484.7	484.7	0.0	0.0	0.0	0.0	0.0	0.0	486.7	484.3	484.4	484.5	0.0	0.0	133.8	484.3	484.3	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.8	0.7	0.7	0.7	1.1	4.9	33.4	85.3	107.9	0.9	1.0	4.1	4.3	19.4	0.9	0.9	0.9	0.9	0.9	1.0	5.6	47.7	86.6	109.0	0.8	1.0	7.3	11.1	29.9	0.8	0.8	1.2	1.3
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	2.0	3.0	3.0	0.0	5.0	20.0	45.0	45.0	0.0	0.0	0.0	1.0	16.0	0.0	0.0	0.0	0.0	0.0	3.0	7.0	51.0	78.0	78.0	1.0	3.0	3.0	32.0	47.0	1.0	1.0	2.0	3.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	2.0	2.0	2.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	0.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	6.0	6.0	6.0	0.0	0.0	6.0	6.0	6.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	0.0	0.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	1.0	1.0	1.0	0.0	3.0	9.0	11.0	11.0	0.0	0.0	0.0	1.0	7.0	0.0	0.0	1.0	1.0	1.0	1.0	4.0	8.0	10.0	10.0	1.0	1.0	0.0	0.0	7.0	1.0	1.0	0.0	0.0
0.0	0.0	0.0	0.0	1.0	3.0	4.0	7.0	8.0	1.0	1.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	2.0	5.0	7.0	8.0	0.0	0.0	0.0	1.0	3.0	0.0	0.0	0.0	0.0
12.0	12.0	14.0	15.0	17.0	41.0	47.0	72.0	78.0	11.0	17.0	18.0	39.0	41.0	11.0	11.0	12.0	14.0	15.0	0.0	9.0	20.0	37.0	43.0	0.0	0.0	4.0	18.0	20.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	3.0	8.0	36.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	7.0	35.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
44.7	126.7	216.7	346.9	211.5	446.0	952.7	2706.7	3196.9	8.9	137.1	222.1	448.0	479.0	8.8	8.8	17.2	80.1	172.9	875.1	1496.8	1474.9	2551.8	3004.4	418.8	730.1	966.9	1411.1	1447.5	348.5	404.2	533.1	681.5
134.5	21.7	23.0	24.2	24.3	46.6	123.2	920.0	941.7	20.6	22.7	26.2	39.5	56.9	20.6	20.6	21.7	23.0	24.2	766.7	812.7	805.7	806.0	805.7	486.0	666.7	801.9	805.2	805.9	450.9	485.5	501.0	542.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.5	1.6	1.7	1.8	2.0	3.2	13.3	21.3	22.3	1.5	1.9	2.2	2.9	3.7	1.4	1.5	1.6	1.7	1.8	1.1	2.5	13.0	19.1	20.1	0.8	1.0	1.4	2.2	3.4	0.7	0.8	0.8	0.9
0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	1.4	1.4	39.3	39.3	39.3	1.4	1.4	0.0	0.0	39.3	1.4	1.4	0.0	0.0	0.0	0.0	0.0	38.6	39.0	39.0	0.0	0.0	4.9	4.9	38.6	0.0	0.0	4.9	4.9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
54.3	55.9	60.1	63.6	68.5	188.8	251.4	996.2	1012.6	54.7	62.7	74.6	175.9	195.4	49.2	54.7	55.9	60.1	63.6	776.9	804.0	797.1	797.5	797.7	447.5	745.4	792.8	797.0	795.2	417.1	439.9	474.2	704.9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
87.0	89.8	96.3	98.1	132.2	280.7	277.5	276.3	274.3	92.6	111.8	145.5	256.5	273.7	82.9	93.0	93.4	102.9	107.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
197.4	195.9	204.2	208.9	378.6	1451.9	1514.8	5779.6	8702.6	318.3	357.3	1056.2	1414.9	1455.6	302.5	316.4	320.7	337.7	354.4	514.1	1369.6	2703.5	5043.1	7589.1	203.1	480.5	1899.9	2478.6	2657.0	146.4	190.7	208.5	424.7
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23.9	24.3	24.8	25.5	29.4	36.4	42.5	45.1	46.8	26.8	28.5	31.9	34.9	38.3	26.4	26.8	27.2	27.9	28.6	73.2	94.2	120.5	134.4	140.3	57.3	69.0	81.6	91.0	101.1	51.3	56.8	63.2	66.8
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	7.0	11.0	16.0	17.0	6.0	6.0	6.0	7.0	11.0	6.0	6.0	6.0	6.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	5.0	8.0	9.0	9.0	9.0	5.0	5.0	5.0	8.0	8.0	5.0	5.0	5.0	5.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	8.0	9.0	0.0	0.0	4.0	4.0	4.0	0.0	0.0	1.0	2.0
15.0	15.0	17.0	16.0	20.0	28.0	38.0	42.0	42.0	18.0	19.0	21.0	25.0	29.0	16.0	16.0	18.0	20.0	20.0	54.0	63.0	87.0	127.0	135.0	47.0	53.0	64.0	74.0	83.0	43.0	45.0	59.0	59.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0	1.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	7.0	11.0	13.0	1.0	1.0	3.0	3.0	3.0	0.0	1.0	2.0	3.0
413.2	402.7	400.7	406.8	415.9	443.7	701.3	773.5	849.8	410.7	413.7	417.5	430.6	450.4	404.4	410.7	410.5	408.4	414.5	381.7	396.6	1397.4	1636.5	1781.9	376.8	380.6	378.4	385.0	398.1	374.0	376.8	373.8	371.1
1886.6	1907.9	1948.6	1969.1	2183.7	2375.1	3315.6	3843.4	4386.5	2034.2	2140.2	2220.6	2338.8	2520.9	1964.9	2014.4	2051.3	2093.4	2119.5	2143.6	2348.0	3378.5	3946.1	4512.7	1972.8	2101.9	2211.6	2318.2	2455.8	1883.8	1945.8	2065.3	2115.1
10.1	10.1	10.2	10.2	10.3	10.7	11.4	12.0	12.3	10.1	10.2	10.4	10.6	10.9	10.0	10.1	10.1	10.2	10.2	10.3	10.7	11.4	12.0	12.3	10.1	10.2	10.4	10.6	10.8	10.0	10.1	10.1	10.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19.3	19.6	19.8	20.1	21.1	23.7	26.6	29.1	31.6	19.9	20.7	21.8	23.2	24.6	19.5	19.8	20.2	20.5	20.8	20.1	22.4	26.1	29.9	33.0	19.1	19.8	20.9	22.2	23.7	18.7	19.0	19.3	19.6
37.4	30.8	31.0	31.1	41.9	54.7	80.4	80.3	79.4	40.0	41.8	43.1	53.5	71.3	39.3	40.0	42.8	43.0	43.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41.0	35.8	38.6	41.3	99.9	104.7	216.6	335.0	333.2	96.7	99.7	100.2	105.3	143.4	98.0	96.4	93.6	96.4	99.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
727.9	707.0	725.7	732.5	1879.6	2107.3	2991.5	3579.1	4167.3	1732.4	1844.8	1934.5	2071.2	2260.5	1688.9	1726.7	1734.5	1798.5	1833.1	1390.7	1766.3	5495.5	8696.8	10582.1	980.1	1338.5	3319.8	3519.0	4003.1	950.5	970.6	2757.5	2933.7

	Alt G														
	USACE High					USACE Intermediate					USACE Low				
2140	2040	2065	2090	2115	2140	2040	2065	2090	2115	2140	2040	2065	2090	2115	2140
USACE_Lov	USACE_Hig	USACE_Hig	USACE_Hig	USACE_Hig	USACE_Hig	USACE_Inte	USACE_Inte	USACE_Inte	USACE_Inte	USACE_Inte	USACE_Lov	USACE_Lov	USACE_Lov	USACE_Lov	USACE_Low_2140
5.5	5.4	9.7	25.9	29.1	30.9	3.7	4.8	6.1	7.8	15.6	3.5	3.6	3.9	4.4	5.0
0.0	0.0	5.0	13.0	15.0	15.0	0.0	0.0	2.0	4.0	9.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	1.0	1.0	2.0	2.0	2.0	0.0	0.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	1.0	3.0	3.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
750.5	276.6	630.1	992.4	1309.3	1485.9	210.4	255.4	340.5	672.0	849.5	181.7	204.1	257.3	272.2	298.3
1.5	1.4	2.0	4.5	5.0	5.3	1.2	1.3	1.5	1.9	2.2	1.1	1.2	1.2	1.3	1.3
0.3	0.3	0.6	1.0	1.0	1.0	0.3	0.3	0.4	0.5	0.7	0.2	0.3	0.3	0.3	0.3
1.1	1.2	1.7	2.5	2.7	2.9	0.3	1.0	1.5	1.6	2.4	0.3	0.3	0.5	0.8	1.1
1.0	1.0	1.0	2.0	3.0	3.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
0.0	0.0	83.2	350.2	990.0	1295.0	0.0	0.0	0.0	63.1	146.4	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.6	107.9	233.8	485.3	649.3	0.7	0.6	15.0	98.2	117.4	0.7	0.7	0.7	0.7	0.6
0.9	0.6	5.3	28.5	31.4	31.5	0.5	0.6	0.6	1.3	8.9	0.4	0.4	0.4	0.5	0.5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	8.0	17.0	20.0	20.0	0.0	0.0	0.0	5.0	9.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	2.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	3.0	8.0	8.0	8.0	0.0	0.0	1.0	1.0	3.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
74.0	69.8	71.8	71.4	73.6	72.2	71.1	70.4	70.8	71.4	70.3	71.7	71.1	69.2	69.2	69.4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.6	0.5	3.9	3.8	4.3	4.3	0.4	0.5	1.1	2.7	3.8	0.4	0.4	0.4	0.4	0.4
1.0	0.0	1.0	1.0	2.0	2.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0
3.4	0.2	0.2	2.5	2.5	2.5	0.2	0.2	0.2	0.2	2.5	0.2	0.2	0.2	0.2	0.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	487.5	484.8	484.7	484.8	0.0	0.0	129.9	484.8	484.8	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.3	1.0	5.2	48.0	83.6	91.5	0.8	1.0	7.1	10.9	29.9	0.8	0.8	0.9	0.9	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.0	3.0	10.0	62.0	89.0	89.0	1.0	3.0	8.0	41.0	58.0	1.0	1.0	3.0	4.0	8.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	1.0	1.0	2.0	2.0	2.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0	1.0
0.0	0.0	0.0	18.0	20.0	20.0	0.0	0.0	4.0	15.0	16.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	5.3	10.5	10.6	0.0	0.0	1.1	2.0	3.2	0.0	0.0	0.2	0.3	0.4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	10.0	10.0	10.0	0.0	0.0	10.0	10.0	10.0	0.0	0.0	0.0	2.0	2.0
0.0	0.0	0.0	2.0	2.0	2.0	0.0	0.0	2.0	2.0	2.0	0.0	0.0	0.0	2.0	2.0
0.0	0.0	0.0	2.0	2.0	2.0	0.0	0.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	10.0	14.0	15.0	0.0	0.0	8.0	10.0	10.0	0.0	0.0	3.0	3.0	5.0
0.0	0.0	0.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	1.0	4.0	9.0	12.0	12.0	1.0	1.0	0.0	1.0	7.0	1.0	1.0	1.0	1.0	1.0
0.0	0.0	4.0	23.0	28.0	28.0	0.0	0.0	4.0	9.0	18.0	0.0	0.0	3.0	3.0	3.0
0.0	33.0	90.0	249.0	292.0	293.0	15.0	31.0	99.0	178.0	231.0	13.0	15.0	30.0	74.0	80.0
0.0	2.0	4.0	29.0	44.0	53.0	0.0	2.0	6.0	13.0	19.0	0.0	0.0	1.0	2.0	3.0
804.2	352.7	494.0	4394.4	6221.0	6201.6	35.1	214.5	1012.8	2339.5	2713.5	30.8	34.5	519.0	654.0	778.5
685.6	24.6	304.3	4004.6	5869.2	5873.8	20.4	22.5	1052.3	2032.0	2762.2	19.9	20.4	597.2	636.1	825.5
0.0	0.0	0.0	1.1	1.1	1.1	0.0	0.0	0.7	0.9	0.9	0.0	0.0	0.0	0.0	0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	2.1	3.4	19.9	28.0	29.1	1.6	1.9	4.5	6.0	8.5	1.5	1.6	2.7	3.1	3.4
0.0	0.0	0.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.9	0.0	0.0	39.5	39.5	39.5	0.0	0.0	0.0	0.0	39.5	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
738.2	68.1	437.9	10149.6	13420.6	13501.4	54.3	62.8	1989.6	4632.2	8072.9	50.1	54.3	781.6	974.7	1119.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	76.0	77.0	77.0	0.0	0.0	6.0	64.0	67.0	0.0	0.0	0.0	0.0	4.0
0.0	197.5	737.0	13272.8	15575.1	15543.9	117.6	162.9	4801.6	8830.5	11119.1	80.8	115.3	686.4	2314.7	3085.7
0.0	0.0	0.0	5754.7	7148.7	7149.8	0.0	0.0	0.0	0.5	4923.7	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
467.1	1078.3	3475.7	59326.5	70019.1	71499.6	619.6	991.0	29191.9	39832.1	51472.1	327.1	597.6	12228.1	16681.0	19704.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70.4	85.6	110.2	184.1	198.9	204.9	59.0	80.0	131.5	148.6	162.1	55.0	58.4	92.4	100.2	109.1
6.0	8.0	11.0	19.0	24.0	25.0	8.0	8.0	12.0	14.0	19.0	8.0	8.0	8.0	8.0	9.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	6.0	6.0	6.0	0.0	0.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	1.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	3.0	3.0	20.0	31.0	31.0	0.0	3.0	20.0	20.0	20.0	0.0	0.0	3.0	12.0	12.0
0.0	2.0	2.0	9.0	14.0	14.0	0.0	2.0	9.0	9.0	9.0	0.0	0.0	2.0	2.0	2.0
0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.0	5.0	8.0	9.0	9.0	9.0	5.0	5.0	5.0	8.0	8.0	5.0	5.0	5.0	5.0	5.0
3.0	6.0	6.0	16.0	20.0	20.0	1.0	3.0	15.0	15.0	15.0	1.0	1.0	6.0	7.0	10.0
60.0	90.0	127.0	284.0	335.0	344.0	77.0	88.0	169.0	208.0	253.0	69.0	75.0	136.0	140.0	145.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.0	7.0	8.0	16.0	20.0	22.0	6.0	7.0	10.0	11.0	11.0	4.0	6.0	6.0	7.0	8.0
376.4	1133.3	1820.2	3282.0	3648.6	3753.7	562.8	872.2	1403.4	1681.1	1996.8	544.1	554.1	568.6	780.1	924.1
2129.1	2568.4	3046.3	6679.0	7558.9	8102.8	2235.0	2417.3	3869.3	5364.2	5707.7	2130.6	2205.4	2318.2	2390.1	2885.7
10.2	10.3	10.7	11.4	12.0	12.3	10.1	10.2	10.4	10.6	10.9	10.0	10.1	10.1	10.2	10.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19.8	22.2	25.1	30.9	35.0	38.1	20.9	21.8	24.8	26.4	28.0	20.5	20.9	21.5	21.9	23.3
0.0	1193.5	1572.9	4667.7	4895.1	4894.4	742.7	1068.2	2192.0	3799.3	4295.3	689.8	742.2	964.6	1144.8	1508.8
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	14.0	14.0	14.0	0.0	0.0	3.0	3.0	3.0	0.0	0.0	0.0	0.0	2.0
0.0	232.1	305.5	2551.4	3045.7	3172.8	217.9	230.0	357.0	1608.9	1969.6	209.2	213.7	220.9	225.8	230.4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3119.7	7170.2	9078.8	22650.6	27354.8	29130.8	4706.7	6738.3	15898.1	18020.8	19814.3	4451.1	4671.3	11330.2	12288.1	13174.8