Regional Shoreline Adaptation Plan:

Data Sources and Analytical Methodology Report

December 2024

San Francisco
Bay Conservation
and Development
Commission (BCDC)

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Purpose

The purpose of this report is to broadly lay out the role of data and mapping in the Regional Shoreline Adaptation Plan (RSAP). Data and mapping supports the RSAP guideline development and implementation, by describing assumptions about hazard layers, communicating key aspects of regional vulnerability, informing spatially specific guidelines based on existing and new analysis, and developing the content and functionality of a mapping platform. Since the RSAP is planning guidance for the region, the data and mapping analysis that are used in the RSAP will not be regulatory in nature, but will inform planning work at the subregional scale. The sections below describe technical details of key aspects of the RSAP data and mapping, including coastal flood hazards, exposure analysis, strategic regional priority analysis and methods, and data inventory.

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Cover Photo:
Cargill Salt Ponds. Jenn Hyman, BCDC Staff

Coastal Flood Hazards

Summary
The Regional Shoreline Adaptation Plan utilizes combined coastal hazard layers to support exposure analysis, guideline development and implementation. These layers represent the potential future flooding condition from tidal inundation, groundwater rise, and storm surge for four future sea level rise (SLR) scenarios. The scenarios used are based on the California Sea Level Rise Guidance (2024) and combine hazard data from two sources, the Adapting to Rising Tides (ART) Sea Level Rise flood maps and USGS Coastal Storm Modeling System (CoSMoS) shallow groundwater (GW) rise maps. These layers are intended to support Subregional Shoreline Adaptation Plan development and inform planning but are not intended to be used for project-level design.

Description
Data from the ART SLR flood maps[1] is used to represent future flooding from sea level rise and storm surge/extreme tides, while the USGS CoSMoS groundwater hazard maps are used to represent shallow groundwater rise and groundwater emergence/flooding.[2]

The ART SLR flood maps use a Total Water Level (TWL) approach for estimating flood extent that differs from FEMA and other established engineering practices. For the ART SLR flood maps, TWL refers to the combination of tides, storm surge, and sea level rise to contribute to a water level and flood extent above Mean Higher High Water (MHHW) but does not include wave run up. TWL is not used to describe the combined hazard scenarios in the RSAP.

A comparison of the USGS CoSMoS Coastal Flood data and ART SLR flood data (by BCDC staff) concluded that at low water levels the ART SLR flood maps better reflect the dynamics associated with flooding in urbanized/developed shorelines, due to the extensive ground truthing that was conducted as part of the mapping methodology as well as better inclusion of local flood protection structures. For these reasons, the ART SLR flood data was identified as the best available data source on sea level rise for the San Francisco Bay.

Shallow groundwater mapping includes areas that will experience emergent (surface) groundwater flooding as well as estimates of the depth to groundwater (below surface) for future SLR scenarios. At the time of analysis, USGS CoSMoS-GW is the only source of shallow groundwater maps available for the whole region. CoSMoS-GW is a hydraulic model based on USGS's MODFLOW model calibrated for the San Francisco Bay.[3] Additional Groundwater modeling has been completed by SFEI and the Pathways Climate Institute for Alameda, Marin, San Francisco, and San Mateo Counties, but is not yet available for the whole nine county Bay Area.[4] Where subregional groundwater modeling exists we encourage jurisdictions to analyze the shortcomings and

1 BCDC ART (2017). Adapting To Rising Tides Bay Area Sea Level Rise & Mapping Project: County/SF Bay [spatial data file]. SF Bay Conservation and Development Commission. Accessed at https://explorer.adaptingtorisingtides.org/download.

2 "Groundwater Hazard Map," Our Coast, Our Future. (USGS and Point Blue Conservation Science, 2021), https://www.ourcoastourfuture.org/hazard-map/.

3 Befus, K.M., Barnard, P.L., Hoover, D.J. et al. Increasing threat of coastal groundwater hazards from sea-level rise in California. Nat. Clim. Chang. 10, 946–952 (2020). https://doi.org/10.1038/s41558-020-0874-1

4 C. L. May et al., Shallow Groundwater Response to Sea-Level Rise: Alameda, Marin, San Francisco, and San Mateo Counties (Pathways Climate Institute and San Francisco Estuary Institute, 2022), https://www.sfei.org/documents/shallow-groundwater-response-sea-level-rise-alameda-marin-san-francisco-and-san-mateo.

advantages of each model and choose the analysis that best fits their jurisdiction. If local models do not exist we encourage supporting local groundwater rise modeling. Where that is infeasible, we recommend carefully reviewing the assumptions in CoSMoS-GW model and assumptions in the hazard layers assembled in the combined hazard layer to ensure that planners understand and are comfortable with those assumptions. In general, the CoSMos-GW model is intended as a screening tool to identify locations that may experience increasing groundwater hazards as sea levels rise and is not a substitute for local hydraulic modeling for project development.

A key modeled parameter in the USGS CoSMoS-GW shallow groundwater model results is a measure of groundwater geology called hydraulic conductivity (K). Hydraulic conductivity measures how permeable the subsurface is. For purposes of the regional shallow groundwater rise hazard maps and exposure analysis, a Moderate hydraulic conductivity value of K = 1.0 meter/day was chosen. USGS CoSMoS recommends K = 1 as the default assumption when little is known, or there is significant variation in the subsurface geology. The Bay Area has highly variable geology, so using the moderate hydrologic connectivity minimizes maximum error. However, this assumption is unlikely to be precisely accurate for some regions in the Bay Area because of the highly variable conditions. Where better local information exists, we highly encourage adjusting the assumptions. As an additional evaluation step, three CoSMoS hydraulic conductivity models (K=0.1, K=1.0, and K=10) were compared to the SFEI modeling. This confirmed the decision to use the K=1.0 data.

While mapped depth to groundwater can exceed 15 ft in areas, for the purposes of the RSAP Minimum Categories and Assets (Section 3.3.2), groundwater depths deeper than 9 ft were excluded from analysis because they were not considered to have a potential impact to the topic area asset data. Including a depth to 9ft is a highly conservative assumption, because most underground infrastructure will not be affected by groundwater rise at that depth. However, in some cases, such as a location with hazardous material at or near the groundwater table, awareness of potential groundwater rise may assist planners in considering adaptation options. To provide more options to planners related to the impact of groundwater rise on their particular asset for the purposes of a vulnerability assessment, the combined hazard maps bin “Shallow” groundwater as three depth classes: Very Shallow (0-3 ft), Shallow (3-6 ft), and Moderately Shallow (6-9 ft). To further refine the accuracy of the groundwater rise data to areas where groundwater depth was most impacted by sea level rise, BCDC staff also confined the groundwater rise hazard maps based on methodology developed by Hill et al. (2023).[5] This constrained the data set to areas where a change in groundwater between existing conditions and the future scenario was greater than 4 in and areas where the groundwater table is within 10 m of the surface. This is because impacts below 4 in are considered nominal and likely will not require region-wide adaptation actions.

Using ArcPro and ArcPy (the ESRI Python extension), the ART SLR flood data and USGS CoSMoS Groundwater data were combined to create the coastal hazard maps for four sea level rise scenarios based on the California Sea Level Rise Guidance (2024) statewide averages:

- 0.8 feet (2050)
- 3.1 feet (2100 Intermediate)
- 4.9 feet (2100 Intermediate-High)
- 6.6 feet (2100 High)

For each scenario, a 100-year storm surge value was added that is approximately 3.5 ft greater than the sea level rise value. This value comes from the AECOM Tidal Datums and Extreme Tides Study (2016) that was produced for the San Francisco

5 K. Hill, D. Hirschfeld, C. Lindquist, F. Cook, and S. Warner, “Rising Coastal Groundwater as a Result of Sea-Level Rise Will Influence Contaminated Coastal Sites and Underground Infrastructure,” Earth's Future 11, no. 9 (2023): e2023EF003825.

Statewide Averages and Closest Regionally Available Data Used in Coastal Hazard Maps

2024 California Sea Level Rise Guidance (Statewide Averages)		**Closest Regionally Available Data to California Sea Level Rise Guidance Scenarios**					
		Tidal Inundation (ART Flood Explorer)	*Difference**	Groundwater Rise (USGS CoSMos-GW)	*Difference*	Storm Surge** (ART Flood Explorer)	*Difference**
0.8 ft	2050	1.0 ft	*(+0.2 ft)*	0.8 ft	*(--)*	4.3 ft	*(-0.2 ft)*
3.1 ft	2100 Intermediate	3.0 ft	*(-0.1 ft)*	3.3 ft	*(+0.2 ft)*	6.4 ft	*(-0.2 ft)*
4.9 ft	2100 Intermediate-High	4.3 ft	*(-0.6 ft)*	4.9 ft	*(--)*	8.0 ft	*(-0.4 ft)*
6.6 ft	2100 High	6.4 ft	*(-0.2 ft)*	6.6. ft	*(--)*	9.0 ft	*(-1.1 ft)*

*Table 1. The closest regionally available data is mapped in Figures 3-4 through 3-7 in the Regional Shoreline Adaptation Plan. The 3.1ft (2100 Intermediate) scenario is also mapped in this document (Figure 1). *The difference between the 2024 California Sea Level Rise Guidance average and the data mapped. **Closest available to the California Sea Level Rise Guidance (2024)+ 3.5 ft. 3.5ft comes from the AECOM 2016 Tidal Datums and Extreme Tides Study that was produced for the San Francisco Bay. The 3.5' 100-year storm surge estimate is intended for high-level planning purposes and should not take the place of site-specific hydrodynamics modeling or engineering analyses.*

Bay.[6] Only groundwater rise data for SLR scenarios and not for the added storm surge water levels were included in the analysis. This is due to a lack of scientific consensus of how acutely storm surge affects groundwater, how the ffects of storm surge on groundwater diminish as you move inland, and variation in how quickly groundwater returns to pre storm depths.[7]

As seen in Table 1, California Sea Level Rise Guidance (2024) recommendations did not always perfectly reflect the water levels available in either the ART SLR flood data or the CoSMoS data. In both cases, the closest value to the recommended California Sea Level Rise Guidance (2024) scenario was chosen. All tidal inundation and groundwater values were within 0.6 feet of the California Sea Level Rise Guidance (2024), with most being significantly closer (Table 1). One limitation of choosing to use the ART data was that it caps out at 108" or 9 feet (Table 1). This led to a greater disparity between the predicted storm surge level for the California Sea Level Rise Guidance (2024) 2100 High (10.1 feet) and the mapped storm surge (9 feet).

These hazards combined created the following 10 categories which show where multiple hazards are present in the same area:

- Tidal Inundation + Emergent Groundwater
- Emergent Groundwater
- Storm Surge + Emergent Groundwater
- Storm Surge + Very Shallow Groundwater (0-3 ft)
- Storm Surge + Shallow Groundwater (3-6 ft)
- Storm Surge + Moderately Shallow Groundwater (6-9 ft)
- Storm Surge
- Very Shallow Groundwater (0-3 ft)
- Shallow Groundwater (3-6 ft)
- Moderately Shallow Groundwater (6-9 ft)

While the data distinguishes between three levels

6 M. Mak et. Al., San Francisco Bay Tidal Datums and Extreme Tides Study, (AECOME, February 2016), 20160429.SFBay_Tidal-Datums_and_Extreme_Tides_Study.FINAL_.pdf (adaptingtorisingtides.org).

7 M. Mak et. Al., San Francisco Bay Tidal Datums and Extreme Tides Study, (AECOME, February 2016), 20160429.SFBay_Tidal-Datums_and_Extreme_Tides_Study.FINAL_.pdf (adaptingtorisingtides.org).

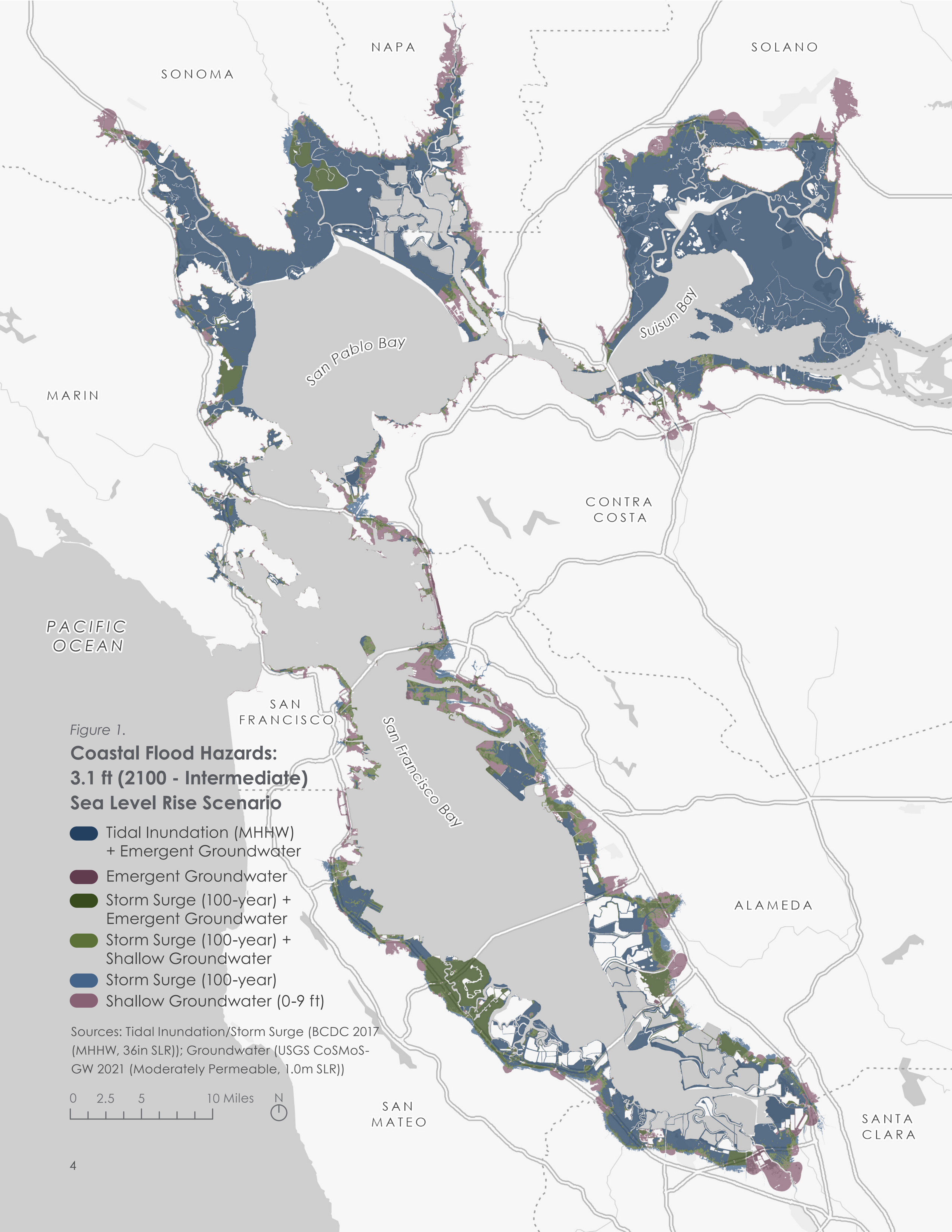

Figure 1.

Coastal Flood Hazards: 3.1 ft (2100 - Intermediate) Sea Level Rise Scenario

of shallow groundwater, for legibility, the Coastal Hazard Maps in the Coastal Flood Hazards and Sea Level Rise Scenarios Standard Section combine the shallow groundwater categories into one (0-9 ft).

Additionally, simplified versions of the Coastal Flood Hazard Maps appear in the RSAP Introduction (Figures 1-4 and 1-5). These maps further simplified the hazards to only show the hazard that would have the largest impact on the affect area. Impact was assessed in the following order: Tidal Inundation, Emergent Groundwater, Strom Surge, and finally Shallow Groundwater. For example, areas labeled tidal inundation may also include emergent grounwater, areas labeled as emergent groundwater may also be affected by storm surge and areas labeled storm surge may also have shallow groundwater. These simplified Coastal Flood Hazard maps are only intended for informational purposes and are not intended for use in creating a Subregional Shoreline Adaptation Plan.

Data Access

Python scripts and step by step analysis can be found on the BCDC-GIS Github under RSAP-combined-hazards.

Hamilton Wetlands.
Photo by Jaime Lopez, BCDC Staff

Exposure Analysis

Summary

The core analysis conducted for the RSAP is the exposure of Minimum Categories and Assets GIS data to coastal flood hazards representing future flooding conditions based on scenarios described in the California Sea Level Rise Guidance (2024). This regional exposure analysis is used to inform subregional Vulnerability Assessments. There are several components to this analysis including defining the RSAP Analysis area, inventorying best available data sources and methods, and running exposure analysis.

RSAP Exposure Analysis Area

The RSAP Exposure Analysis Area is defined as the Bay, its shoreline, and watersheds that feed into BCDC's jurisdiction. The primary purpose of defining this area is to create an analysis zone for the purpose of calculating regional exposure summaries. To build off work previously conducted in the region, the RSAP identified SFEI's Operational Landscape Unit (OLU) framework as relevant to helping define this area.[8] Primary and contributing watershed OLU boundaries were combined to create an overall RSAP Exposure Analysis Area to be used in hazard exposure analysis (Figure 2). Small modifications to the OLU framework were made to include areas of the BCDC jurisdiction west of the Golden Gate Bridge (using the extent of NHD HUC 12 Watershed boundaries), Treasure Island, and other small islands (e.g. Coast Guard Island, Stryker Island, Ryer Island, Roe Island).

Primary OLUs alone were considered not sufficient to capture the full extent of potential future groundwater rise impacts being considered in the RSAP. The full nine Bay Area county boundaries were similarly not sufficient because they include areas of the outer coast and Eastern Contra Costa and Solano counties that will not be analyzed for exposure to hazards (and are outside BCDC jurisdiction). While this analysis area is being used to clip assets that may be of risk, exposure summaries may be presented at the primary OLU, county, or other sub regional scales.

Planning Area Processing Steps:

1. Add RSAP areas west of Golden Gate Bridge, based on extents of relevant HUC 14 watershed boundaries.
2. Add significant Bay islands (Treasure Island, Angel Island, Chipps Island, Coast Guard Island) to the nearest OLU.
3. Dissolved primary, Baylands, and watershed OLU boundaries by OLU

Hazard Exposure Analysis Methods and Data Sources

RSAP Minimum Categories and Assets represented as vector point, line, or polygon GIS data were analyzed for their exposure to future SLR, storm surge, and groundwater flooding using ArcPy scripts and ESRI's ArcGIS Pro Version 3.2. The primary geoprocessing tools used in the analysis were the Intersect and Spatial Join functions in an ArcPy scripting model.

GIS data was initially processed to a common projection (NAD83 UTM Zone 10N), joined with jurisdiction types, and clipped to the RSAP analysis area (i.e. OLU based primary, contributing watershed, and bayland units) (Figure 2). Individual

8 J. Beagle, J. Lowe, K. McKnight, S. M. Safran, L. Tam, and S. Jo Szambelan, San Francisco Bay Shoreline Adaptation Atlas: Working with Nature to Plan for Sea Level Rise Using Operational Landscape Units, SFEI Contribution No. 915 (Richmond, CA: SFEI & SPUR, 2019)

GIS datasets were additionally processed to combine relevant data inputs (i.e. DTSC and WB contaminated sites), clean data (i.e. remove elevated transportation segments), and create a legible symbology.

For the majority of assets, the intersect functions overlaid asset vectors with flood hazard data to calculate asset specific summaries of exposure to each flood scenario (i.e. absolute miles highways exposed and percent of highways exposed compared to RSAP exposure analysis area). The total values used to calculate percentages include the full extent of the unexposed assets in the RSAP Exposure Analysis Area (Table 2).

For assets that rely on estimates of housing or jobs exposed to flooding, additional analysis steps were conducted to minimize errors associated with overestimating flooding impacts. These include utilizing Microsoft building footprint data, as well as a threshold of 10% of parcel area intersected with hazard layers to determine exposed parcels and associated housing units or job spaces. This method follows methodsdeveloped for the MTC/BCDC led SLR Funding and Investment Framework.[9]

A limitation of the overall approach to exposure analysis was the inability to field-validate the elevation of individual assets in relation to predicted water levels to confirm the exposure indicated in our desktop analysis and develop greater understanding of vulnerability and risk.

Subregional shoreline adaptation plans should, at a minimum, be based on the results of the regional exposure analysis. However, subregions should verify regional exposure analysis to the extent feasible with local data. This local data may provide more accurate hazard and vulnerability assessments and could justify differences between regional exposure analysis and subregional plans.

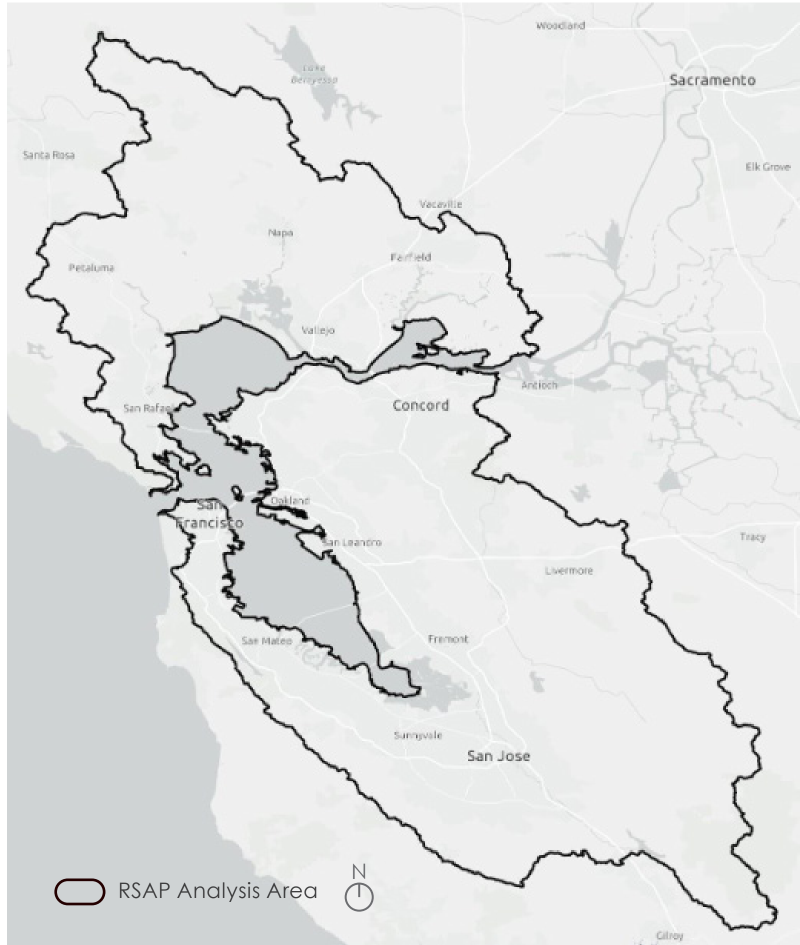

Figure 2. *RSAP Exposure Analysis Area, including Primary and Watershed OLU extents with small modifications to include areas west of Golden Gate bridge, Treasure Island, Alcatraz, and other small Bay islands.*

9 "Sea Level Rise Adaptation Funding and Investment Framework Technical Methodology Report Draft," (MTC/ABAG and BCDC, July 2023), https://www.adaptingtorisingtides.org/wp-content/uploads/2023/07/SLR_Framework_TechnicalMethodologyReport.pdf.

Data Processing and Summary Steps for RSAP Minimum Categories and Assets

Minimum Asset Category		Description
Transportation & Transit	Datasets	*Passenger rail + stations (MTC 2019); Highways (Caltrans 2023); Freight Rail (Caltrans 2024); SF Bay Plan designated Seaports and Airport Priority Use Areas (BCDC 2023); Ferry terminals (BCDC 2024)*
	Data Processing	*Airports (Added Moffett field from PUA + digitized Palo Alto Airport); Ferry Terminals (Digitized and added Mission Bay, Richmond, Treasure Island)*
	Analysis	*Intersect with coastal flood hazards (additionally conduct spatial join for polygon features – Seaports, Airports, Ferry Terminals). Remove elevated segments: Multipart to singlepart, Select by location (with bridge polygon dataset), Delete selected segments and Dissolve*
	Exposure Attributes	*Highways: Highway route prefix, number; Passenger Rail + Stations: Operator, route, station name; Freight Rail: Operator; Airports/Seaports: Name, Ferry Terminals: Name, operator*
	Summary	*Highways, Passenger Rail, Freight Rail: Miles exposed; Passenger Rail Stations: # exposed; Airports/Seaports: Acres exposed; Ferry Terminals: # + acres exposed; Absolute, percentage of total, and percentage of total exposed by City/Place + OLU + County*
Shoreline Contamination	Datasets	*Contaminated Sites (Waterboard/DTSC 2023); Landfills (Waterboard/SFEI 2020); Superfund Sites (US EPA 2023)*
	Data Processing	*Crosswalk agency status codes/assign Site status (Table 3)** Combine Address fields: Select MERGE_SRC = DTSC_Sites_BayArea; Calculate field (FROM selected); Bussiness_N = Project_NA; Case_Type = Site_type; Added URL field for Geotracker or Envirostor*
	Analysis	*Intersect with coastal flood hazards (additionally conduct spatial join with coastal flood hazards for polygon features – Landfills, Superfund sites)*
	Exposure Attributes	*Contaminated Sites: Lead Agency; Business Entity; DTSC/WB site; Status* *Landfills: Name, Status; Superfund Site: Site Name*
	Summary	*Contaminated Sites: # of open/closed contaminated sites exposed; Landfills: # and Acreage of active/closed landfills exposed; Superfund Site: # and Acreage of Superfund sites; Absolute, percentage of total, and percentage of total exposed by City/Place + OLU + County*
Community Health & Well-Being	Datasets	*Healthcare Facilities (OSHPD 2023)*
	Data Processing	*Filter Healthcare Facilities to "Emergency Service"*
Development, Housing, and Economy	Datasets	*Residential Units, Job Spaces (MTC 2023)*
	Data Processing	*Joined Plan Bay Area 1050+ Job and Housing Estimates to regional parcel dataset*
	Analysis	*Utilizing SLR Funding Investment Framework methods (MTC/BCDC 2023)*
	Exposure Attributes	*Impacted parcels = (percent_parcel_area_flooded_6p4 > 10 Or percent_total_buildings_flooded_6p4 > 0); Vulnerable housing impacted: (percent_parcel_area_flooded_6p4 > 10 Or percent_total_buildings_flooded_6p4 > 0) And (combined_vulnerability LIKE '%Contamination%' Or combined_vulnerability LIKE '%Social%')*
	Summary	*Residential Units and job spaces: 2010 and predicted 2050 residential units and job spaces exposed; Absolute, percentage of total, and percentage of total exposed by City/Place + OLU + County*
Public Access & Recreation	Datasets	*Active Transportation Network (MTC 2022); SF Bay Trail (MTC 2024); Open Space (Bay Area Protected Area Database (BPAD), CLN 2018)*
	Data Processing	*(Filter BPAD to 'Open Access' and 'Land based')*
	Analysis	*Intersect with coastal flood hazards (additionally conduct spatial join with coastal flood hazards for polygon features – BPAD)*

Minimum Asset Category		Description
Public Access & Recreation	Exposure Attributes	*Trails: Trail name, Status (Existing/Proposed); Open Space: Park name, Agency name*
	Summary	*Trails: Miles of trails exposed; Open Space: Acres of parks exposed; Absolute, percentage of total, and percentage of total exposed by City/Place + OLU + County*
Critical Infrastructure and Services	Datasets	*Electrical powerplants, substations, Natural gas stations (CEC 2022); Publicly Owned Wastewater Treatment Works and Wet Weather Facilities (BACWA 2024); Healthcare Facilities (OSHPD 2023); Oil Refineries (HIFLD 2020/BCDC 2023); Cell Towers (HIFLD 2024); Emergency Operating Centers (CalOES 2024)*
	Data Processing	*Filter Healthcare Facilities to "Emergency Service"*
	Analysis	*Intersect with coastal flood hazards (additionally conduct spatial join with coastal flood hazards for polygon features – Oil Refineries)*
	Exposure Attributes	*Electrical: Name, Type, Owner, Capacity (powerplants only); Publicly Owned Wastewater Treatment Works: Name; Health Care Facilities: Name, Facility type, License type; Oil Refineries: Name, Operator*
	Summary	*Electrical: # of powerplants, stations, substations exposed; Publicly owned wastewater treatment works: # of treatment works exposed; Health Care Facilities: # of facilities exposed; Oil Refineries: Acres of refineries exposed; Absolute, percentage of total, and percentage of total exposed by City/Place + OLU + County*

Table 2. *This table summarizes the priority datasets intended to represent RSAP Minimum Categories and Assets standards, data processing analysis, and summary steps. **Table 3..*

Albany Bulb.
Photo by Jenn Hyman, BCDC Staff

Contaminated Site Data Processing - Contaminated Site Status Crosswalk

Department of Toxic Substances Control			State Water Resources Quality Control Board		
Open*	**Closed****	**Other****	**Open***	**Closed****	**Other****
Active	Certified	Inactive – Needs evaluation	Active	Completed- Case closed	Inactive- Withdrawn
Inactive- Action Required	No action required	Refer: 1248 Local agency	Open	Open- Closed/ with monitoring	Informational item
Certified/Operation & Maintenecne	No further action	Refer: Local agency	Open-Assessment & Interim Remedial Action	Pre-Title 27 CAI-Closed/with monitoring	
Certified O&M – Land Use Restrictions Only	No evidence of release	Refer: RCRA	Open-Active		
Certified Land Use Restriction Only		Refer: SMBRP	Open-Operating		
		Refer: RWQCB	Open-Site Assessment		
		Refer: EPA	Open-Verification Monitoring		
		Refer: IWMB	Open-Inactive		
		Refer: Other agency	Open-Remediation		
		Backlog	Open-Proposed		
			Open-Closing/ with monitoring		
			Open- Eligible for closure		
			Open- Long term management		

Table 3. *Crosswalk of Contaminated Sites Status. *Included in the RSAP Existing Conditions, Hazard Exposure analysis, and Strategic Regional Priority Mapping Layers. **Included in the RSAP Existing Conditions and Hazard Exposure analysis Mapping Layers.*

Open - Eligible for Closure

Open - Long Term Management

Strategic Regional Priorities

Summary

Strategic Regional Priorities (SRPs) are key policies of regionally significant issues that stem from the One Bay Vision. They include regional challenges and opportunities that must be addressed and integrated into Subregional Adaptation Plans to achieve adaptation goals across region-wide systems and patterns. Achieving these regional "big moves" relies on Subregional Plans including critical actions in specific locations.

Strategic Regional Priorities Methods and Data Sources

Strategic Regional Priorities build off the exposure analysis to identify subsets of minimum categories and assets representative of the One Bay Vision. Strategic Regional Priorities methods vary between topic areas and utilize complementary data in some cases (Table 4).

Datasets Sources and Analysis Performed in Creation of Strategic Regional Priority Maps

Strategic Regional Priorities		Description
Community Health & Well-Being	Datasets	*The Urban Displacement Project's California Renter Estimated Displacement Risk Model (2022)*
	Data Analysis	*This map shows Community Health and Well-Being Strategic Regional Priorities including those census block groups exposed to the 0.8 ft (2050) sea level rise scenario and characterized by the California Renter Estimated Displacement Risk Model (UC Berkeley 2022) as areas where renters at or below 80% Area Median Income (AMI) are "at risk for displacement". This map shows the full boundary of potentially impacted census block groups, even if the extent of flooding is small.*
Ecosystem Health and Resilience	Datasets	*Tidal and Non-tidal Baylands Habitat Map 2020 (SFEI 2024); Migration Space (SFEI 2024); Baseline Transition Zone (Fulfrost 2018); Eelgrass Suitability (Audubon 2024).*
	Data Analysis	*This map shows Ecosystem Health and Resilience Strategic Regional Priorities including existing tidal Baylands habitats as well as nontidal Baylands restoration and connectivity opportunities. Baylands refer to the area between the maximum and minimum extent of the tides, including areas that would be subject to tidal influence if not for unnatural obstructions. This includes the present mudflats and marshes and historical baylands (former marshes and mudflats that have been diked and drained). Marsh migration space includes both connected and disconnected undeveloped areas. Eelgrass suitability is mapped for areas with a 70% model accuracy. Ecosystem health and resilience assets exposed to 0.8 ft (2050) SLR scenario as well as those assets identified locally are required to be included in a subregional vulnerability assessment.*
Critical Infrastructure and Services	Datasets	*Publicly Owned Wastewater Treatment Works and Wet Weather Facilities (BACWA 2024); Electrical powerplants (CEC 2022); Healthcare Facilities (OSHPD 2023); Emergency Operations Centers (CalOES 2024); SF Bay Plan designated Water Related Industry Priority Use Areas (BCDC 2023)*
	Data Analysis	*This map shows Critical Infrastructure and Services Strategic Regional Priorities including Publicly Owned Wastewater Treatment Works and Wet Weather Facilities, Healthcare facilities providing emergency services, emergency operations centers, and SF Bay Plan designated Water-related Industry Priority Use Areas exposed to the 6.6 ft (2100 High) SLR scenario (All coastal flood hazards). SF Bay Plan designated Water-related Industry Priority Use Areas include Waterfront land uses by industries that require access to deep water shipping. Critical Infrastructure and Services assets exposed to 0.8 ft (2050) SLR scenario, including water supply, pumping, and treatment facilities, as well as those assets identified locally, are required to be included in a subregional vulnerability assessment.*

Strategic Regional Priorities		Description
Collaborative Governance, Flood Management, and Funding	Datasets	*Sea Level Rise (SLR) Flood Connectivity between Bay Area Jurisdictions (CHARG 2020)*
	Data Analysis	*This map shows jurisdictions that might experience flooding across their boundaries from 3 ft SLR + 100-year storm event (MHHW + 84")*
Housing, Development, and Land Use	Datasets	*Plan Bay Area 2050 Growth Geographies (MTC 2021)*
	Data Analysis	*This map shows development, housing, and land use strategic regional priorities, Plan Bay Area 2050 Growth Geographies, including Priority Development Areas, Transit Rich and High Resource Areas exposed to 6.6 ft SLR scenario (all coastal flood hazards). This map shows the full boundaries of Growth Geographies potentially impacted, even if the extent of flooding is small. Development, land use, and housing assets exposed to 0.8 ft (2050) SLR scenario as well as those assets identified locally are required to be included in a subregional vulnerability assessment.*
Public Access and Recreation	Datasets	*SF Bay Plan designated Waterfront Park and Beach Priority Use Areas (BCDC 2023); SF Bay Trail (MTC 2024); SF Bay Area Water Trail (SCC 2021)*
	Data Analysis	*This map shows public access and recreation strategic regional priorities including SF Bay Plan designated Waterfront Park and Beach Priority Use Areas, existing and planned San Francisco Bay Trail, and SF Bay Water Trail sites. Public access and recreation assets exposed to 0.8 ft (2050) SLR scenario, including SF Bay Water Trail sites, as well as those assets identified locally are required to be included in a subregional vulnerability assessment.*
Shoreline Contamination	Datasets	*Contaminated Sites (DTSC/Waterboard 2023); Landfills (SFEI/WB 2020); Superfund Sites (US EPA 2023); CalEnviroScreen 4 (OEHHA 2021); Contamination Vulnerability (BCDC 2023)*
	Data Analysis	*This map shows shoreline contamination strategic regional priorities that include contaminated sites, landfills, and superfund sites exposed to the 0.8 ft (2050) sea level rise scenario, but does not include the coastal flood hazard for shallow groundwater rise deeper than 6 ft, with Open-Active status (Contaminated sites only), that are located in census tracts with CalEnvironscreen score percentile above 75 or Pollution Burden score percentile above 95, or identified as contamination vulnerable in BCDC's Community Vulnerability mapping. Shoreline contamination sites exposed to the 0.8 ft (2050) sea level rise scenario outside Environmental Justice communities, with status other than "Open-Active", or exposed to shallow groundwater rise with depth to water between 6-9 feet, as well as those sites identified locally are required to be included in a subregional vulnerability assessment. EJ Screening Criteria: CIscoreP > 75 Or PolBurdP > 95; contamVulnRank IN ('High contamination vulnerability', 'Highest contamination vulnerability', 'Moderate contamination vulnerability')*
Transportation and Transit	Datasets	*Passenger rail + stations (MTC 2019); Highways (Caltrans 2023); Freight Rail (Caltrans 2024); SF Bay Plan designated Seaports and Airport Priority Use Areas (BCDC 2023); Ferry terminals (BCDC 2024)*
	Data Analysis	*This map shows transportation and transit strategic regional priorities that include passenger rail and stations, highways, freight rail, ferry terminals, and SF Bay Plan designated Seaport and Airport Priority use areas exposed to the 6.6 ft SLR scenario (all coastal flood hazards). Transportation and transit assets exposed to the 0.8 ft (2050) sea level rise scenario as well as those assets identified locally are required to be included in a subregional vulnerability assessment.*

Table 4. *This table summarizes the data sources and analysis for the Strategic Regional Priorities.*

Data Access

Scripting and data acess can be found on the BCDC-GIS Github under RSAP-Analysis.

Data Inventory and Guideline Data Sources

Summary

RSAP guidance elements relate to planning processes, existing conditions, and adaptation strategies and pathways. BCDC intends to make data to support these guidelines available to support the creation of subregional adaptation plans (Table 5).

Datasets Available to Support Planning Process

RSAP Element	Dataset
Adaptation Strategies and Pathways	Beaches (SFEI & SPUR 2019)
	Creek to baylands reconnection (SFEI & SPUR 2019)
	Ecotone levees (SFEI & SPUR 2019)
	Green stormwater infrastructure (SFEI & SPUR 2019)
	Migration space preparation (SFEI 2024)
	Mudflat augmentation (SFEI & SPUR 2019)
	Nearshore reefs (SFEI & SPUR 2019)
	Polder management (SFEI & SPUR 2019)
	Submerged Aquatic Vegetation (SFEI & SPUR 2019)
	Tidal marshes (SFEI & SPUR 2019)
Boundaries	City and Census Designated Place (CAL Fire 2022);
	Counties (US Census 2019)
	Operational Landscape Units (SFEI & SPUR 2019)
	RSAP Analysis Area (BCDC 2024)
Coastal and nearshore hydrological conditions	Disconnected Low Lying Areas (ART 2017)
	FEMA Flood Zones (FEMA 2024)
	Shoreline Overtopping (ART 2017)
	Tidal Datums + 100 year still water elevation (AECOM 2016)
	Saline Groundwater Wedge (Befus et al. 2020).
	Wind Waves (DHI 2016)
Coastal Flood Hazards	0.8 ft (2050) SLR Scenario (BCDC 2024)
	3.1 ft (2100 Intermediate) SLR Scenario (BCDC 2024)
	4.9 ft (2100 Intermediate-High) SLR Scenario (BCDC 2024)
	6.6 ft (2100 High) SLR Scenario (BCDC 2024)
Community Health and Well-Being	CalEnviroScreen 4 (OEHHA 2021)
	California Renter Estimated Displacement Risk Model (UC Berkeley 2022)
	Community Vulnerability (BCDC 2023)

RSAP Element	Dataset
Critical Infrastructure	Cell Towers (HIFLD 2023)
	Emergency Operations Centers (CalOES 2024)
	Fire Stations (HIFLD 2023)
	Healthcare Facilities (OSHPD 2023)
	Natural Gas Station (CEC 2022)
	Oil Refineries (BCDC 2024)
	Police Stations (HIFLD 2023)
	Power Plants (CEC 2022)
	Public Trust Granted Lands (SLC 2023)
	Publicly-Owned Wastewater Treatment Works and Wet Weather Facilities (BACWA 2024)
	Substations (CEC 2023)
	Water Related Industry Priority Use Area (BCDC 2023)
Ecosystem Health and Resilience	BAARI Streamlines (SFEI 2016)
	Baylands Habitat Map (SFEI 2024)
	Baylands Resilience Framework (SFEI 2024)
	Eelgrass Suitability (Audubon 2024)
	Existing Estuarine-Upland Baseline Transition Zone (Fulfrost 2018)
	Federal ESA Critical Habitat (NMFS 2023)
	Federal ESA Critical Habitat (USFWS 2024)
	Migration Space (SFEI 2024)
	Undeveloped Uplands (NOAA CCAP 2024)
Governance, Flood Management	Community Based Organizations Directory (BCDC 2024)
	Jurisdiction/OLU overlap analysis (BCDC/SFEI 2024))
	Sea Level Rise Flood Connectivity (CHARG 2020)
Historical conditions	Historic Baylands (SFEI 1998)
Housing, Development, and Land Use	Job Spaces (MTC 2020)
	Plan Bay Area 2050 Growth Geographies (MTC 2021)
	Residential Units (MTC 2020)
	SAPMAP/SLR Project Inventory (MTC/BCDC 2024)
Physical Conditions	BHM Topobathy (SFEI 2020)
	Existing Depth to Groundwater (USGS 2021)
	InSAR Vertical Land Motion (Govorcin 2022)
	SF Bay Mud Thickness (USGS 1969)
	San Francisco Bay Shore Inventory (SFEI 2016)

RSAP Element	Dataset
Public Access and Recreation	Active Transportation Network (MTC 2022)
	Bay Area Protected Area Database (CLN 2018)
	Public Trust Granted Lands (SLC 2023)
	SF Bay Plan Waterfront Parks Beaches designated Priority Use Areas (BCDC 2023)
	SF Bay Trail (MTC 2024)
	SF Bay Area Water Trail Sites (SCC 2021)
Shoreline Contamination	Contaminated Sites (DTSC/Waterboard 2023)
	Landfills (SFEI/WB 2020)
	Superfund Sites (US EPA 2023)
Transportation and Transit	Airports (MTC 2018)
	Ferry Terminals (BCDC 2024)
	Freight Rail (Caltrans 2023)
	Highways (Caltrans 2024)
	Passenger Rail (MTC 2019)
	Passenger Rail Stations (MTC 2019)
	Seaports (Caltrans 2016)
	SF Bay Plan Airport Priority Use Area (BCDC 2023)
	SF Bay Plan Seaport Priority Use Areas (BCDC 2023)
	Transit Stops (MTC 2021)

Table 5. *This table summarizes datasets used in the Regional Shorline Adaptation Plan.*

Data Access

Scripting and data acess can be found on the BCDC-GIS Github under RSAP-Analysis.

San Francisco Bay Conservation and
Development Commission (BCDC)

Regional Shoreline Adaptation Plan Report