



Bayview-Hunter's Point is on the right, with the demolished Candlestick Park baseball stadium on the left and the abandoned Hunter's Point Naval Base on the right. Photo by Wayne Hsieh is licensed under CC BY-NC 2.0.

Local Assessments Section H: **SAN LEANDRO** *Operational Landscape Unit*

JURISDICTIONS WITHIN THIS SECTION

Alameda County

*Oakland
Alameda
San Leandro*



HOW TO USE THE LOCAL ASSESSMENTS



WHO IS THIS FOR?

Anyone interested in understanding their local shared vulnerabilities to flooding and sea level rise.

Local jurisdictions

- Cities
- Counties
- Special Districts
- Utilities Providers

Stakeholder Groups

- Non-profits/NGOs
- For-profits/Private
- Associations
- Interested Parties

General Public

- Residents

State/Regional

- Caltrans
- MTC/ABAG

HOW IS IT ORGANIZED?



Local assessments are organized by four regional systems assessed: Transportation, Vulnerable Communities, Priority Development Areas (PDAs), and Priority Conservation Areas (PCAs).

Each part of the local assessment provides varying levels of details at three scales: 1) Operational Landscape Unit (OLU), 2) Individual Descriptions, and 3) Shared Stories of Vulnerabilities in Focus Areas/Areas of Impact. This assessment can be reviewed in whole, or individual parts can be reviewed separately depending on interest and level of detail desired.



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Where are we in the region?

This OLU spans from immediately south of the I-80 San Francisco-Oakland Bay Bridge touchdown to Oyster Bay in San Leandro, including the entirety of the shorelines belonging to the Cities of Oakland and Alameda, and a small segment belonging to the City of San Leandro. The area is highly developed with a wide variety of uses including downtown Oakland commercial and business use, housing, recreation, entertainment, sporting, the Port of Oakland, natural shorelines and the Oakland International Airport. The OLU includes several culverted streams that are in the south and contaminated lands throughout the shoreline, largely due to historical and ongoing maritime uses.



Approximate area of the San Leandro OLU. Map data © 2019 by Google

FOCUS AREA B:
*West Oakland and
Downtown Oakland*

Potential Oakland
Gateway Area PCA

Port of
Oakland

West Oakland
BART

SF Bay Trail

Downtown & Jack London Square
PDA

SF Water Trail PCA

Alameda
Gateway Landing
Ferry Terminal

Naval Air
Station PDA

SF Bay Trail

SR-61

Northern
Waterfront PDA

SF Bay
Water Trail PCA

FOCUS AREA C:
Alameda

IMPACT AREA D:
*Oakland International
Airport*

FOCUS AREA A:
*East Oakland, Coliseum,
and San Leandro Bay*

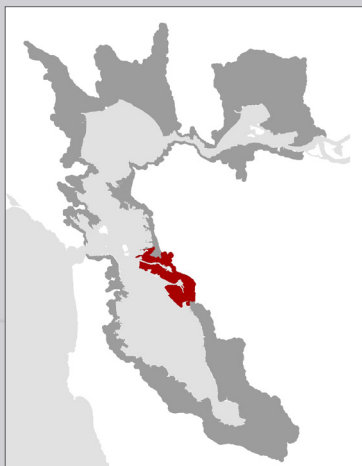
Oakland Urban
Greening PCA

Oakland
Priority Estuaries
PCA

Oakland
Priority Coliseum/Oakland
Creeks PCA Airport BART
Oakland Coliseum
AMTRAK/CC BART Station
Area PDA

SF Bay Trail
Oakland
Recreational Trails
PCA

SF Bay Trail
Oakland
International
Airport
Oakland
Airport BART



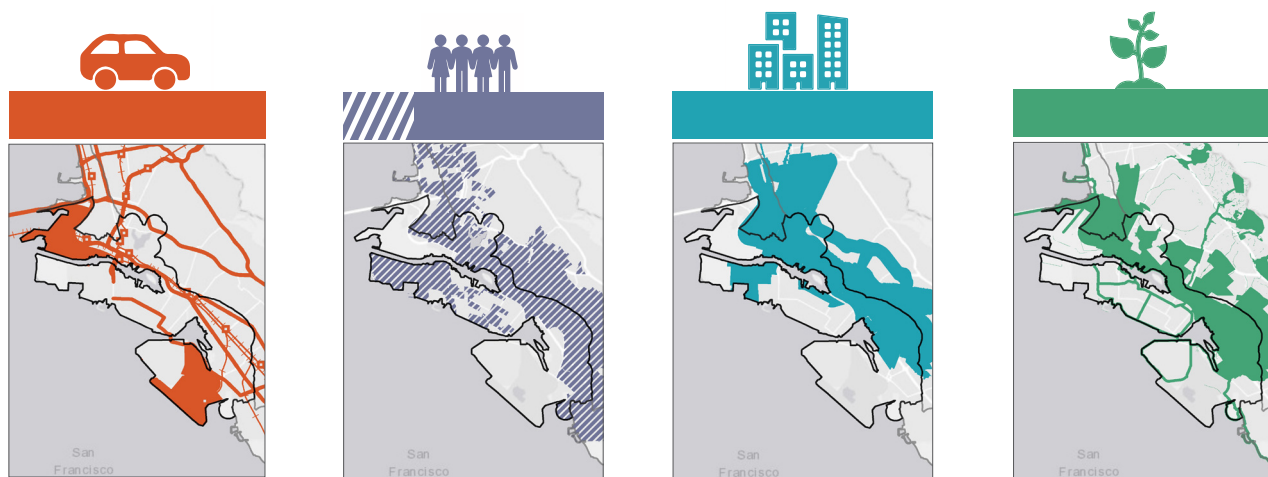
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What regional systems are here?

Operational Landscape Unit (OLU) boundaries were used to organize and help identify regionally significant assets that were co-located together (Methodology can be found in Section 3.0 Local Assessments).

The map on page H-4 shows the entire OLU, including all the regional systems present. Colors are used throughout this document to help navigate across these four regional systems. Individual assets that were assessed as part of this local vulnerability assessment are listed in the bullets below and can also be found on the labels on the map (Figure 1h).

Figure 1h. MAP OF REGIONAL SYSTEMS AND LIST OF INDIVIDUAL ASSETS ASSESSED WITHIN BELOW:



TRANSPORTATION

- Oakland International Airport
- Coliseum Station Complex (Coliseum BART, Amtrak, Oakland Airport Connector BART)
- West Oakland BART
- Alameda Gateway Landing Ferry Terminal
- Union Pacific Railroad
- I-880
- Port of Oakland
- Doolittle Drive (SR-61)
- Webster/Posey Tubes (SR-260)
- Local Roads

VULNERABLE COMMUNITIES

- West Oakland Community
- East Oakland, Deep East Oakland & San Leandro Community
- Alameda Community
- Downtown Oakland Community

PRIORITY DEVELOPMENT AREAS (PDAs)

- Coliseum BART Station Area PDA
- Downtown & Jack London Square PDA
- Naval Air Station PDA
- Northern Waterfront PDA

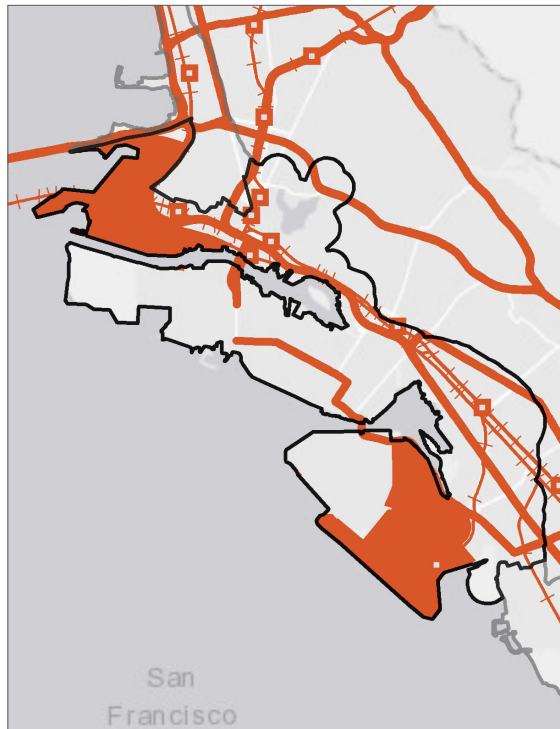
PRIORITY CONSERVATION AREAS (PCAs)

- Oakland Priority Creeks PCA
- Oakland Priority Estuaries PCA
- Oakland Recreational Trails PCA
- Oakland Priority Creek Trails PCA
- Potential Oakland Gateway Area PCA
- Regional Trail System Gaps PCA
- San Francisco Bay Trail PCA
- San Francisco Bay Water Trail PCA



What was assessed?

TRANSPORTATION



Oakland International Airport. Map data © 2019 by Google.

Oakland International Airport • Oakland International Airport (OAK) is located approximately 6.5 miles southeast of downtown Oakland on Bay Farm Island. OAK is owned and operated by the Port of Oakland (Port), which is an autonomous department of the City of Oakland that receives no tax money from the city and funds its own operations. The airport property is organized into two distinct facility areas: South Field and North Field. South Field, the airport area south of Ron Cowan Parkway, is used by commercial airline service and air cargo. North Field, north of Ron Cowan Parkway, is used for general aviation. OAK is classified as a medium-hub commercial airport, carrying 6.4 million passengers in 2017, an 8% increase in enplanements since 2016.¹ Additionally, it is the largest cargo service airport for the region, which handled 1.6 million tons in 2017² and serves as the regional hub for FedEx and has seaport/airport connections to the Port of Oakland. Finally, the airport serves as a lifeline facility to bring in supplies and personnel in the event of an emergency.³ It is first exposed to flooding at 36" TWL, at which point the entire airport, including North and South Field, Terminal 1, Control Tower, Fire Station #22, and South Field Tank Farm would be exposed to flooding. Additionally, ground transportation access to the airport from Doolittle Drive, Airport Drive., Ron Cowan Parkway, and the BART Oakland Airport Connector would be disrupted.

Coliseum Station Complex • The station complex of Amtrak's Oakland Coliseum station, Bay Area Rapid Transit (BART)'s Coliseum station, and BART's Oakland Airport Connector is located in East Oakland. The three stations, located about 600 feet apart, are connected to each other and to the Oakland-Alameda County Coliseum/Oracle Arena sports complex with an accessible pedestrian bridge. The BART station opened in 1972, serving the then-new Coliseum and the surrounding East Oakland neighborhood. The Amtrak platform was added in 2005 to provide a connection between BART and Amtrak's Capitol Corridor service. In 2014, the complex became the terminus of the Coliseum-Oakland International Airport line, thus connecting Oakland International Airport to rail transit. The station also serves as a transfer point for AC Transit buses and business park shuttles. The BART Oakland Airport Connector is first exposed at 48" TWL, while the Coliseum BART and Amtrak are first exposed at 66" TWL.

West Oakland BART • The West Oakland BART Station is located in the West Oakland residential and industrial community. The station serves both local residents and riders from throughout the region with its excellent freeway access and short ride to downtown San Francisco. The station has at-grade pedestrian access, parking facilities, and power facilities that are exposed at 52" TWL.

Alameda Gateway Landing Ferry Terminal • The Water Emergency Transportation Authority (WETA) ferry service transports approximately 2.5 million commuters and tourists across the Bay Area each year and the Oakland/Alameda route has increased ridership 91% since 2012.⁴ WETA's 2016 strategic plan identifies growth in ridership, increased congestion in other modes of transportation, and increased demand for new ferry routes as primary reasons for expanded service in the coming decades.⁵ Current service includes routes between San Francisco, Oakland, Vallejo, South San Francisco, and Alameda. Future service will include expansion of the fleet to Richmond, Treasure Island, Redwood City, and expanded service to San Francisco Ferry Building, as well as the construction of a new Central Bay Maintenance Facility. In addition to WETA's transportation role, the ferry fleet is intended to be deployed to evacuate stranded people and mobilize first responders in the event of an earthquake or major catastrophe, which disables Bay Area bridges or roads. The ferry service was deployed in this manner after the Loma Prieta earthquake and I-80 San Francisco-Oakland Bay Bridge collapse. Critical components of the ferry system include ferry terminals and maintenance facilities. Within this OLU, the Alameda Gateway Landing Ferry Terminal is located on Main Street on the Northeast side of Alameda Island and is first exposed to flooding at 24" TWL.

I-880 • Interstate 880 is an eight lane north-south highway, with its northern terminus in Oakland at the junction of I-80 and I-580, known as the MacArthur Maze, near the eastern approach of the I-80 San Francisco-Oakland Bay Bridge. It runs parallel to the Bay connecting Oakland to San Jose and serves the Port of Oakland, Oakland International Airport, Norman Y. Mineta San Jose International Airport, and key East Bay cities. From a regional perspective, I-880 provides a critical link for the movement of goods between the Port of Oakland and the Central Valley and averages 25,359 trucks per day.⁶ I-880 is also critical for commuter movement between significant residential and commercial areas and job centers and averages 237,000 vehicles per day.⁷

In this OLU, I-880 is exposed to flooding at several places along its route, primarily south of the Lake Merritt Channel and adjacent to the Oakland Coliseum (between 66th Avenue and Hegenberger Avenue) starting at 48" TWL. Several on-ramps are also vulnerable to flooding that will prevent vehicles from accessing the freeway. This includes the 5th Street southbound on-ramp, 66th Street on-ramp, and Hegenberger Avenue). There is a pump located just north of the Coliseum, indicating existing groundwater issues.

Port of Oakland • The Port of Oakland is a deep-water Port located in the City of Oakland along the Oakland Outer Harbor Channel, Middle Harbor Enhancement Area, Oakland Estuary/Harbor Channel, Middle Harbor and Inner Harbor areas. It was the first major port on the Pacific Coast of the United States to build terminals for container ships and in 2016 was the seventh busiest port in the United States by cargo volume and handled 99 percent of containerized goods moving through Northern California.⁸ The Port of Oakland's maritime facilities include berth terminals, railway terminals, twenty deep-water berths and thirty-five container cranes. It is owned and operated by the Port of Oakland, which is an autonomous department of the City of Oakland that is governed by a Board of Commissioners and funds its own operations. In this OLU, the Port is first exposed to flooding at 48" TWL on the western edge of the Charles P. Howard Terminal, when flooding overtops a shoreline protection structure at the Clay Street Ferry Terminal. By 52" TWL, significant flooding occurs along Embarcadero West, across Middle Harbor Road and into the Union Pacific/BNSF Railway area. Flooding impacts increase significantly with increasing TWLs.

**Note: This asset spans two OLUs, with the northwestern portion extending into the East Bay Crescent OLU. Additionally, Port flooding leads to flooding in Emeryville, outside of this OLU.*

Union Pacific Railroad • The Union Pacific Railroad (UPRR) is an important heavy freight rail supporting the reliable movement of goods to market across the Bay Area. The rail connects many Bay Area ports and moves goods to areas across the region. UPRR owns the right-of-way for the rail line from Santa Clara county through this OLU and out of the region. On this rail line, Amtrak, Capitol Corridor, and San Joaquin Transit have passenger rights. Within this OLU, UPRR plays a critical connection to and from the Port of Oakland, and runs throughout the OLU including through the Port, Jack London Square, and the Coliseum Area. It is first exposed at 52" TWL.

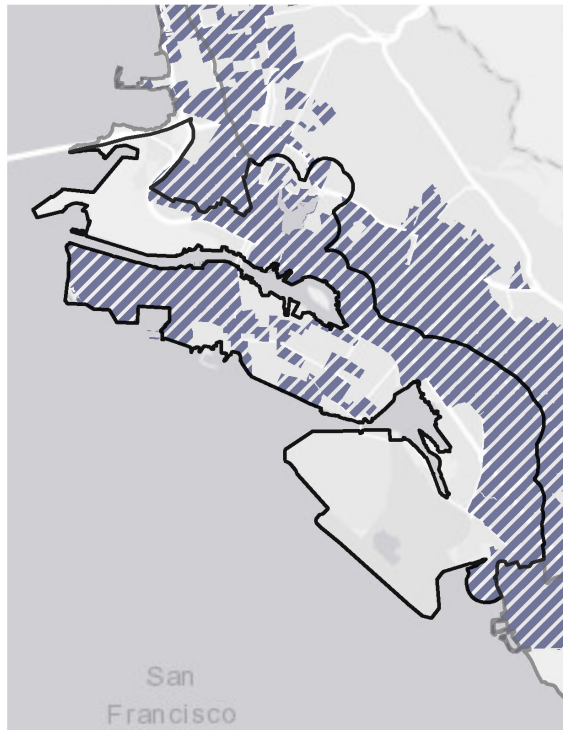
Doolittle Drive (SR-61) • State Route 61/Doolittle Drive is a 2-to 4-lane surface road that connects Alameda to Bay Farm Island and the Oakland International Airport. It runs along the northeast shore of Bay Farm Island, from the bridge to the island of Alameda southeast to Oakland, onto the mainland, and into San Leandro. SR-61 provides access for commuter movement, goods movement, residents and emergency response between Alameda and Bay Farm Island and averages 31,750 vehicles per day.⁹ Most of SR-61 was built prior to 1964. Significant changes and upgrades were made to the section adjacent to the airport in 1982. Caltrans is the owner and operator of SR-61. There are also two culverts in poor condition near the Chuck Corica Golf Complex and at the end of Airport Channel. The road is in generally good condition, according to the most recent pavement condition survey, and is maintained regularly. This roadway serves as de facto shoreline protection for the Oakland International Airport and experiences flooding impacts between 24-36" TWL.

Webster and Posey Tubes (SR-260) • SR-260 includes the Webster and Posey Tubes in Alameda. The Webster and Posey tubes are underwater tunnels that connect Alameda and Oakland and compose SR-260. The Webster and Posey tubes were built in 1963 and 1927, respectively and were seismically retrofitted in the mid-2000's. The tubes serve 60,000 vehicles¹⁰ and 719 trucks¹¹ per day. The Posey tube is the second-oldest underwater vehicular tunnel in the US.¹² Recent capital improvement to the tubes included improved pedestrian walkways in the Posey tube in 2017. An improved SMART connection from the Posey Tube and I-880 is planned for 2021. The Alameda approach to both tubes begin to see impacts from flooding at 36" TWL. Water depths at this total water level are anything from 0-2 feet to 12+ feet depending on the depth of the tube. The Oakland approach to both tubes is not impacted by flooding directly, but access streets in Jack London Square and connections from I-880 are impacted starting at about 66" TWL. SR-260 becomes SR-61 as it crosses to Bay Farm Island.

Local Roads • 98th Avenue (exposed at 36" TWL), Airport Drive (exposed at 36" TWL), Hegenberger Road (exposed at 48" TWL), and San Leandro Street from 54th Avenue to 98th Avenue (exposed at 48" TWL) serve as main arterials through this OLU and are exposed to flooding.



VULNERABLE COMMUNITIES



West Oakland: Map data © 2019 by Google.

West Oakland Community • For the purposes of this report, 12 block groups were assigned to a functional community called “West Oakland.” This community overlaps the border of the San Leandro and East Bay Crescent OLU. The block groups that were assessed can be referenced in the appendix. This is a placeholder designation for a set of block groups that have a moderate, high, or highest social vulnerability ranking within the West Oakland area. We have provided some history and context for these areas, primarily gathered via desktop research, and in some cases stakeholder and community vetting. This should be considered a starting point. Before this is used for any planning purposes, this data should be ground-truthed and vetted with the communities considered. Similarly, block groups or communities with a similar vulnerability rank could and likely will have very different needs, considerations, and capacities that are critical to bring into the planning process.

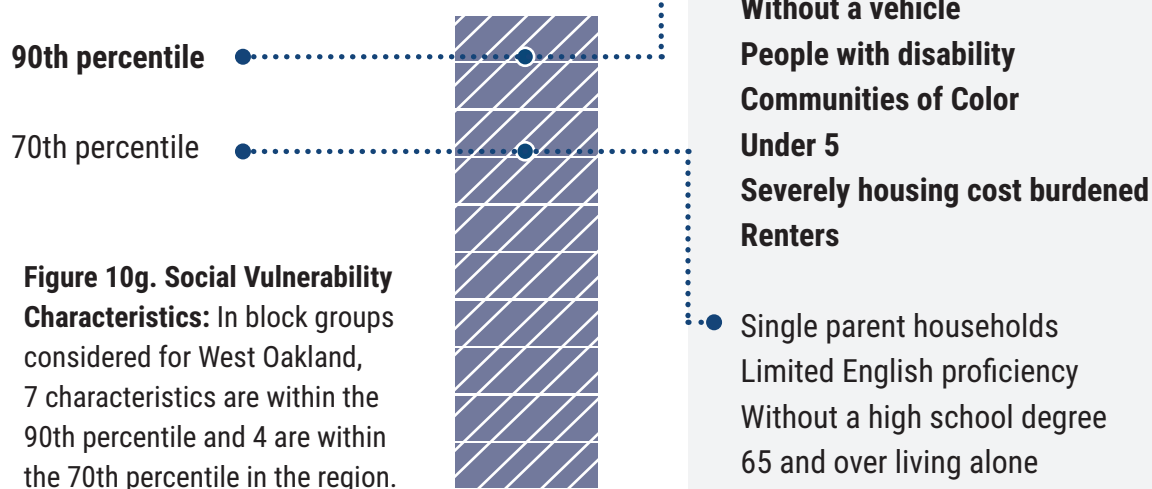
Twelve block groups are considered moderate or highest social vulnerability. Seven social vulnerability characteristics are exhibited in at least one block group in the 90th percentile, with four characteristics in the 70th percentile in the region (Figure 2h).

In this assessment, we include the details for block groups that exhibit social vulnerability characteristics and are exposed to flooding in this OLU, many of which overlap with the San Leandro OLU, for areas that exhibit social vulnerability characteristics and are exposed to flooding impacts as the “West Oakland Community” This includes twelve block groups that make up parts of

the neighborhoods including Clawson, McClymonds, Prescott, Lower Bottoms, Ralph Bunche, Oak Center, Cypress Village and Acorn, Old Oakland, China Town, Lakeside, Peralta-Laney, and Acorn Industrial. In this description, we acknowledge that we are not members of the community and thus we cannot speak on behalf of the lived experiences of its residents. Our intent is to elevate this community as part of the region's interconnected systems and use this description to help set a sense of place.

West Oakland contains areas of mixed residential and light industrial uses, including rail yards and the Port of Oakland. Goods from the Port of Oakland are moved primarily by diesel trucks, which cause air quality problems in the West Oakland communities as well as increased traffic congestion on regional freeways. Additionally, the community is adjacent to many major freeways, including the I-880, I-980 and I-580, contributing to the poor air quality and health issues in this area. The I-880, also known as the Cypress Freeway, divides neighborhoods and separated the community from

SOCIAL VULNERABILITY PERCENTILES IN WEST OAKLAND



SOCIAL VULNERABILITY RANK:

- ☐ Low
- ☒ **Moderate**
- ☐ High
- ☒ **Highest ***

GENTRIFICATION AND DISPLACEMENT RISK:

- ☐ Moderate Income - Not Losing Low Income Households
- ☐ At Risk of Gentrification and/or Displacement
- ☒ **Ongoing Gentrification and/or Displacement ***

*In block groups considered, this ranking occurred most frequently.
Data Source: ART Bay Area Regional Community Vulnerability Indicators, BCDC (2018).

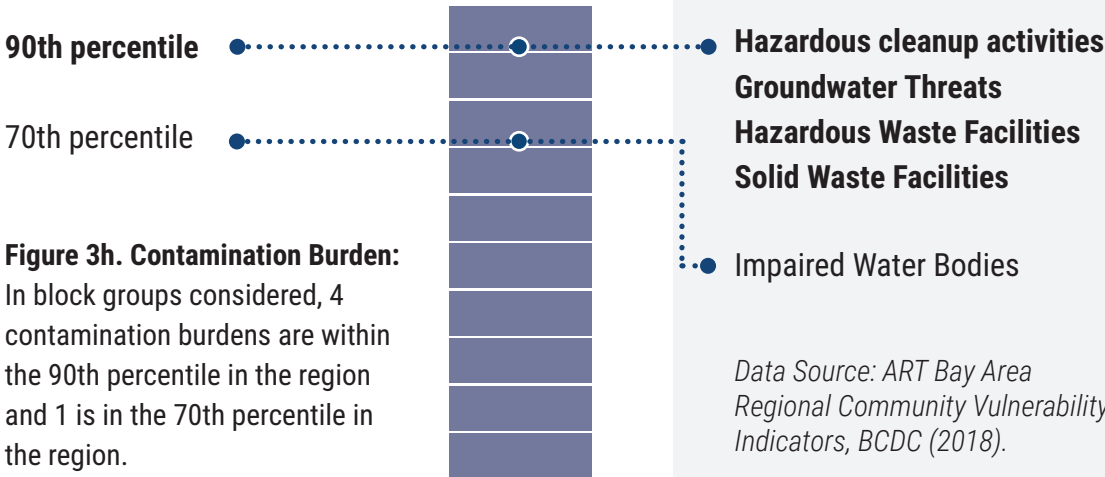


Downtown Oakland. This area also has had a lack of a grocery store for decades and high unemployment rates.

Residential households in the West Oakland community begin to be impacted by significant flooding starting at 52" TWL, where a threshold occurs from overtopping of shoreline protection structures south of the San Francisco – Oakland Bay Bridge touchdown as well as from embankment underneath the Macarthur Maze junction leads to significant flooding of the West Oakland community. Flooding impacts increase significantly again at 66" TWL and increase steadily until another threshold is reached at 108" TWL.

The communities of West Oakland are exposed to some of the highest levels of air pollution in the Bay area and a 2008 California Air Resources Board (CARB) study found that West Oakland residents are exposed to diesel air pollution at a rate of nearly three times greater than average for the Bay Area. Heavy industrial pollution from the Port of Oakland and associated activities, including the East Bay Municipal Utilities District (EBMUD) main wastewater treatment plant, among others. Goods from the Port of Oakland are moved primarily by diesel trucks, which cause air quality problems in the West Oakland communities as well as increased traffic congestion on regional freeways. Additionally, the community is adjacent to many major freeways, including the I-880, I-980 and I-580, contributing to the poor air quality and health issues in this area. The I-880, also known as the Cypress Freeway,

CONTAMINATION BURDEN
PERCENTILES IN WEST OAKLAND



divides neighborhoods and separates the community from Downtown Oakland.

The presence of contaminated lands (Figure 3h) is also a significant area of concern, particularly in places where sites are exposed to flooding. Within the West Oakland community, there are multiple contaminated sites, including sites listed by the California Department of Toxic Substances Control (DTSC), California Water Quality Control Boards Groundwater Threats, and Leaking Underground Storage Tanks. Additionally, there is a federally listed Superfund site called “AMCO Chemical” located adjacent to the community.¹³ Within the West Oakland community, there are also high percentages of contamination vulnerability. The communities of West Oakland are exposed to some of the highest levels of air pollution in the Bay area and a 2008 California Air Resources Board (CARB) study found that West Oakland residents are exposed to diesel air pollution at a rate of nearly three times greater than average for the Bay Area. Heavy industrial pollution from the Port of Oakland and associated activities, including the East Bay Municipal Utilities District (EBMUD) main wastewater treatment plant, among others.

There are four contamination burdens exhibited in at least one block group at the 90th percentile (Figure 3h), with one in the 70th percentile.

**Note: This community spans the border between the East Bay Crescent OLU and San Leandro OLU. The community descriptions are the same in both Local Assessments, even though block groups cross OLU boundaries. The Focus Area in this Local Assessment will discuss impacts where flooding occurs from overtopping in this OLU. Please see the East Bay Crescent OLU for details on flooding and overtopping that occur from the East Bay Crescent OLU.*



Aerial view of Downtown Oakland and Emeryville. Photo by Dan is licensed under CC BY-NC 2.0

East Oakland, Deep East Oakland & San Leandro Community

• For the purposes of this report, 27 block groups were assigned to a functional community called “East Oakland, Deep East Oakland & San Leandro.” The block groups that were assessed can be referenced in the appendix. This is a placeholder designation for a set of block groups that have a moderate, high, or highest social vulnerability ranking within the East Oakland area. We have provided some history and context for these areas, primarily gathered via desktop research, and in some cases stakeholder and community vetting. This should be considered a starting point. Before this is used for any planning purposes, this data should be ground-truthed and vetted with the communities considered. Similarly, block groups or communities with a similar vulnerability rank could and likely will have very different needs, considerations, and capacities that are critical to bring into the planning process.

For the purposes of this assessment, ‘East Oakland’ is a neighborhood south of Lake Merritt and east of Alameda Island, including

SOCIAL VULNERABILITY PERCENTILES IN EAST OAKLAND AND SAN LEANDRO

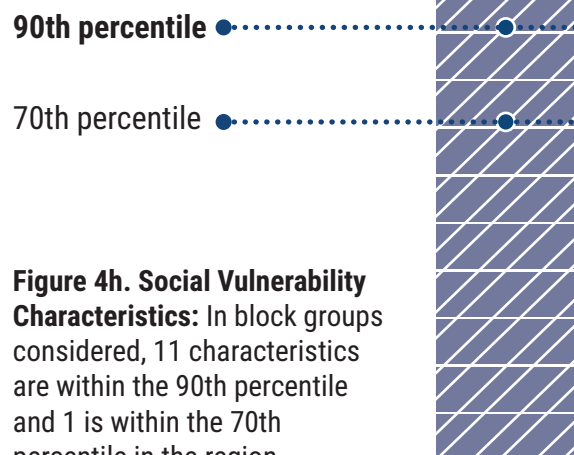


Figure 4h. Social Vulnerability Characteristics: In block groups considered, 11 characteristics are within the 90th percentile and 1 is within the 70th percentile in the region.

SOCIAL VULNERABILITY RANK:

- ☐ Low
- ☒ Moderate
- ☒ High
- ☒ Highest *

GENTRIFICATION AND DISPLACEMENT RISK:

- ☐ Ongoing Exclusion
- ☐ Low Income - Not Losing Low Income Households
- ☒ At Risk of Gentrification and/or Displacement
- ☒ Ongoing Gentrification and/or Displacement *

*In block groups considered, this ranking occurred most frequently.
Data Source: ART Bay Area Regional Community Vulnerability Indicators, BCDC (2018).



- Low income
- Not U.S. citizens
- Without a vehicle
- People with disability
- Communities of Color
- Limited English proficiency
- Without a high school degree
- Under 5
- Severely housing cost burdened
- 65 and over living alone
- Renters
- Single parent households

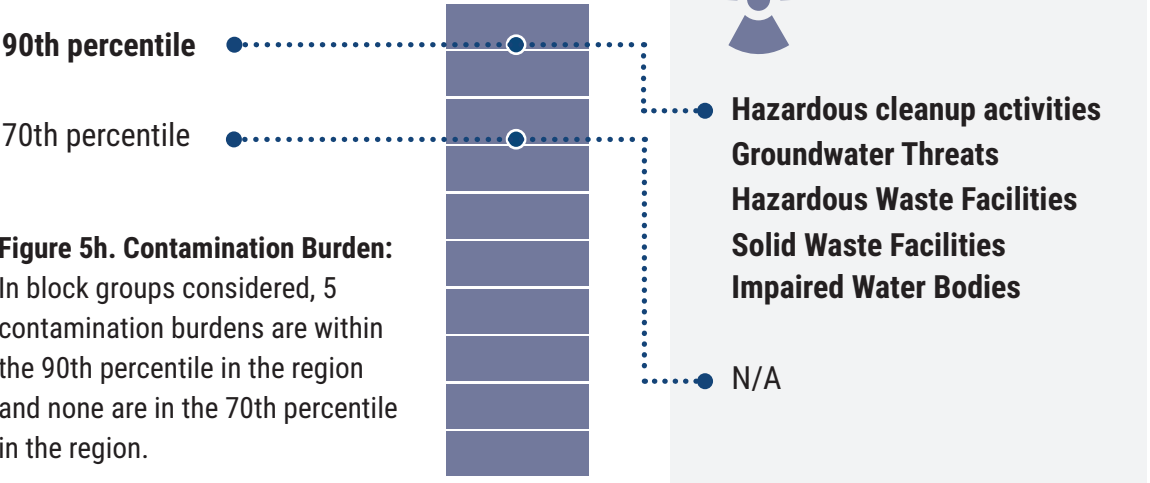
San Leandro Bay. According to the East Oakland Neighborhood Initiative, “The “Deep East” area of Oakland is a mix of residential neighborhoods sitting cheek-to-jowl with old, heavy industrial land usages and transportation infrastructure (freight and passenger railroad lines, airport, and freeways). The policies of redlining (i.e. blocking certain people from housing, banking, food access, health, and employment) extractive disinvestment, dissolution of community resources and deliberate marginalization of racially defined neighborhoods, where pollution and dumping can occur with impunity, are all clear examples of bad policies that have left their stamp on the fabric of East Oakland.”¹⁴

Eleven social vulnerability characteristics are exhibited in at least one block group in the 90th percentile, with one characteristic in the 70th percentile in the region (Figure 4h). Significant portions of East Oakland are exposed at 48” TWL.

The presence of contaminated lands is also a significant area of concern, particularly in places where sites are exposed to flooding. Within the East Oakland community, there are multiple contaminated sites, including sites listed by the California Department of Toxic Substances Control (DTSC), California Water Quality Control Boards Groundwater Threats, and Leaking Underground Storage Tanks. Within this community, there are also high percentages of contamination vulnerability.

There are five contamination burdens exhibited in at least one block group at the 90th percentile (Figure 5h), with none in the 70th percentile.

CONTAMINATION BURDEN PERCENTILES IN EAST OAKLAND AND SAN LEANDRO



Alameda Community

• For the purposes of this report, 14 block groups were assigned to a functional community called “Alameda.” The block groups that were assessed can be referenced in the appendix. This is a placeholder designation for a set of block groups that have a moderate, high, or highest social vulnerability ranking within the Alameda area. We have provided some history and context for these areas, primarily gathered via desktop research, and in some cases stakeholder and community vetting. This should be considered a starting point. Before this is used for any planning purposes, this data should be ground-truthed and vetted with the communities considered. Similarly, block groups or communities with a similar vulnerability rank could and likely will have very different needs, considerations, and capacities that are critical to bring into the

SOCIAL VULNERABILITY RANK:

- ☐ Low
- ☒ Moderate
- ☒ High *
- ☒ Highest *

*In block groups considered, this ranking occurred most frequently. *Data Source: ART Bay Area Regional Community Vulnerability Indicators, BCDC (2018).*

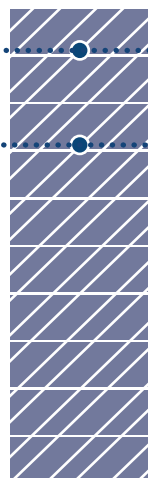
GENTRIFICATION AND DISPLACEMENT RISK:

- ☒ Moderate High Income- At Risk of Exclusion
- ☒ Moderate High Income - Not Losing Low Income Households
- ☒ At Risk of Gentrification and/or Displacement *
- ☒ Ongoing Gentrification and/or Displacement *

SOCIAL VULNERABILITY PERCENTILES IN ALAMEDA

90th percentile

70th percentile



- Low income
- Without a vehicle
- People with disability
- Single parent households
- Limited English proficiency
- Under 5
- Severely housing cost burdened
- 65 and over living alone
- Renters
- Not U.S. citizens
- Communities of Color
- Without a high school degree
- Renters

Figure 6h. Social Vulnerability Characteristics: In block groups considered, 9 characteristics are within the 90th percentile and 4 are within the 70th percentile in the region.

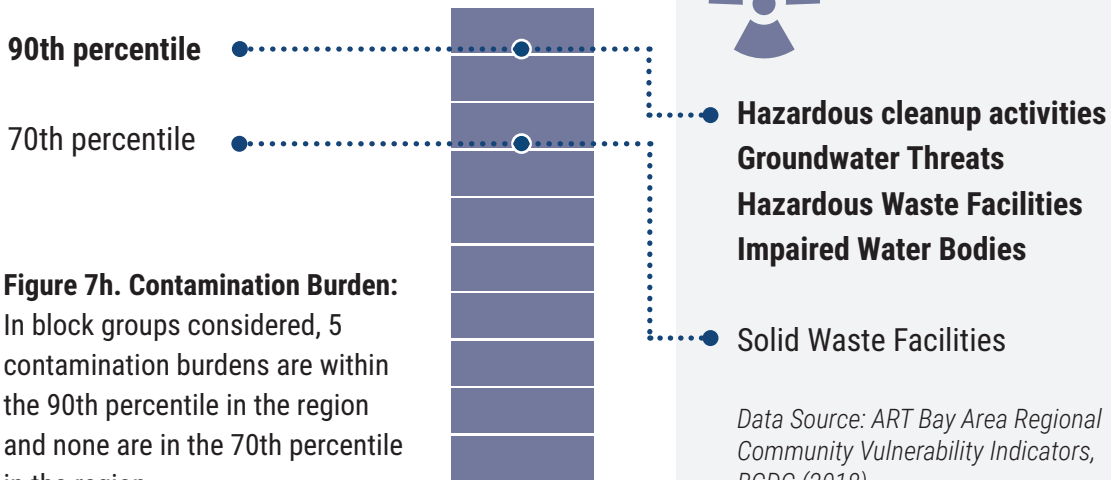


planning process.

Fourteen block groups are considered moderate, high, or highest social vulnerability. Nine social vulnerability characteristics are exhibited in at least one block group in the 90th percentile, with four characteristics in the 70th percentile (Figure 6h).

There are four contamination burdens exhibited in at least one block group at the 90th percentile (Figure 5h), with one in the 70th percentile.

CONTAMINATION BURDEN PERCENTILES IN ALAMEDA



Downtown Oakland Community

• For the purposes of this report, 8 block groups were assigned to a functional community called “Downtown Oakland.” The block groups that were assessed can be referenced in Appendix. This is a placeholder designation for a set of block groups that have a moderate, high, or highest social vulnerability ranking within the Downtown Oakland area. We have provided some history and context for these areas, primarily gathered via desktop research, and in some cases stakeholder and community vetting. This should be considered a starting point. Before this is used for any planning purposes, this data should be ground-truthed and vetted with the communities considered. Similarly, block groups or communities with a similar vulnerability rank could and likely will have very different needs, considerations, and capacities that are critical to bring into the planning process.

SOCIAL VULNERABILITY RANK:

- ☐ Low
- ☒ **Moderate ***
- ☒ **High**
- ☒ **Highest**

*In block groups considered, this ranking occurred most frequently.

Data Source: ART Bay Area Regional Community Vulnerability Indicators, BCDC (2018).

GENTRIFICATION AND DISPLACEMENT RISK:

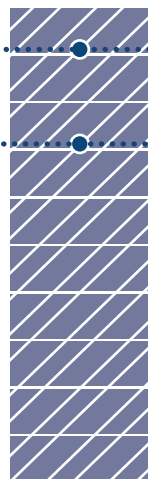
- ☐ Moderate High Income- At Risk of Exclusion
- ☐ Moderate High Income - Not Losing Low Income Households
- ☐ At Risk of Gentrification and/or Displacement
- ☒ **Ongoing Gentrification and/or Displacement ***



SOCIAL VULNERABILITY PERCENTILES IN DOWNTOWN OAKLAND

90th percentile

70th percentile



- **Low income**
Not U.S. citizens
Without a vehicle
People with disability
Limited English proficiency
Severely housing cost burdened
65 and over living alone
Renters
- **Communities of Color**
Without a high school degree
Single parent households
Under 5

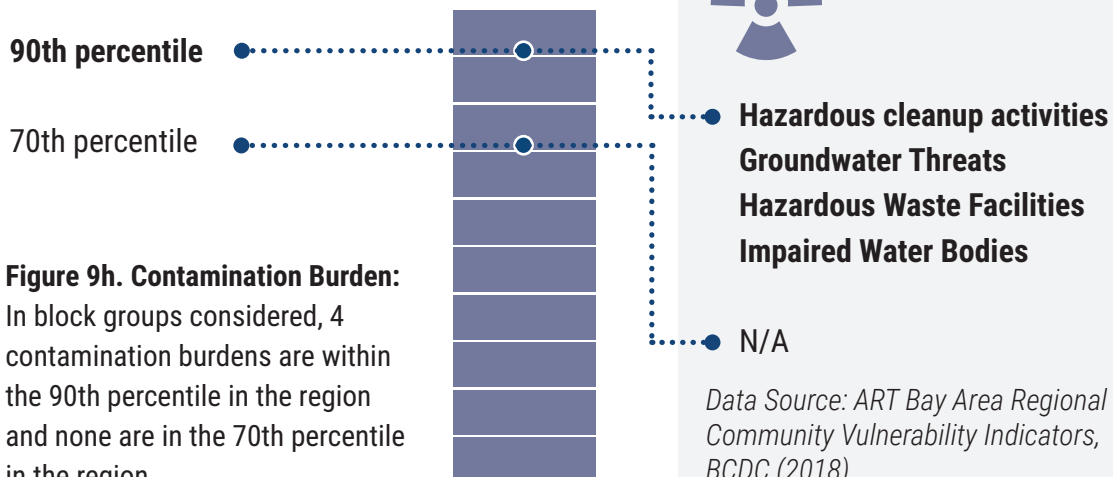
Figure 8h. Social Vulnerability Characteristics: In block groups considered, 9 characteristics are within the 90th percentile and 4 are within the 70th percentile in the region.



Eight block groups are considered moderate, high, or highest social vulnerability. Nine social vulnerability characteristics are exhibited in at least one block group in the 90th percentile, with four characteristics in the 70th percentile in the region (Figure 8h).

There are four contamination burdens exhibited in at least one block group at the 90th percentile (Figure 9h), with none in the 70th percentile.

CONTAMINATION BURDEN PERCENTILES IN DOWNTOWN OAKLAND



EXPOSURE OF CRITICAL SERVICES AND FACILITIES IN ALL VULNERABLE COMMUNITIES

Critical Facilities/Services Impacted		12"	24"	36"	48"	52"	66"	77"	84"	96"	108"
Police and Fire Stations	Alameda Fire Training Division (W Ranger Ave, Alameda)										
	Oakland Fire Training Division (Victory Ct, Oakland)										
	Oakland Fire Department Station 22 (Air Cargo Rd, Oakland)										
	Oakland Airport Police Department (Earhart Rd, Oakland)										
	Oakland Fire Department Station 27 (Pardee Drive, Oakland)										
	Oakland Fire Department station 29 (66th Avenue, Oakland)										
Schools	Woodstock Child Development (Pacific Ave, Alameda)										
	Island High School (Pacific Ave, Alameda)										
	Earhart Elementary School (Packet Landing Rd, Alameda)										
	Frank Otis Elementary School (Fillmore St, Alameda)										
	Lincoln Elementary School (11th St, Oakland)										
	Education for Change (Hegenberger Road, Oakland)										
	Encinal High School (Central Ave, Alameda)										
	Alternatives in Action High School (E 17th St, Oakland)										
	Aspire Public Schools (22nd Avenue, Oakland)										
	Beacon Day Schools Inc. (Livingston Street, Oakland)										
	Acts Christian Academy (66th Avenue, Oakland)										
	Coastline Christian Schools (N Loop Rd, Alameda)										
	Online Cyberspace Prep School (7th Street, Oakland)										

Table 1h. Critical Services and Facilities: First exposure of critical services and facilities. Blue bars represent when asset is first exposed to flooding.

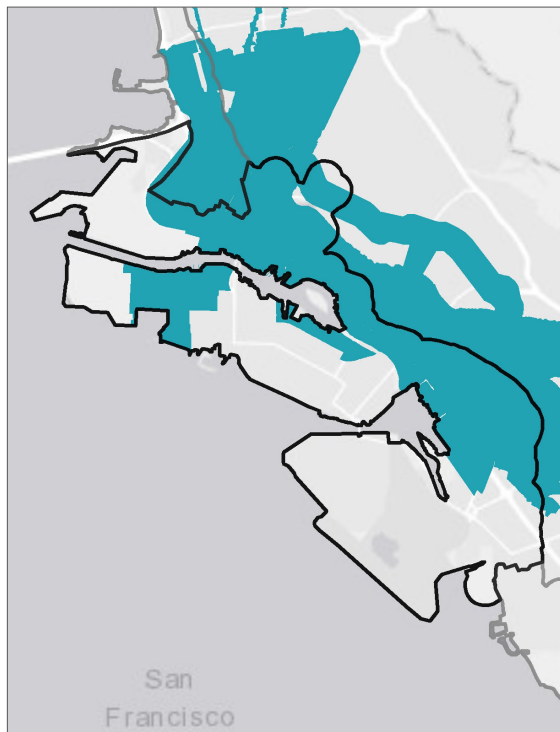


Critical Facilities/Services Impacted		12"	24"	36"	48"	52"	66"	77"	84"	96"	108"
Places of Faith	Saint Albert the Great Catholic Church (Holly St, Alameda)										
	Temple Israel (Mecartney Rd, Alameda)										
	Union Baptist Church (71st Avenue, Oakland)										
	Paradise Baptist Church (Empire Rd, Oakland)										
	Acts Full Gospel Church (66th Ave, Oakland)										
Health Clinics	East Oakland Planned Parenthood Mar Monte (Enterprise Way, Oakland)										
	Behavioral Health Care Services (Embarcadero, Oakland)										
	Frank Kiang Medical Center (East 18th Street, Oakland)										
	Order Of Malta Clinic of Northern California (Harrison St, Oakland)										
	West Oakland Planned Parenthood Mar Monte (7th Street, Oakland)										

Table 1h (cont.). Critical Services and Facilities: First exposure of critical services and facilities. Blue bars represent when asset is first exposed to flooding.



PRIORITY DEVELOPMENT AREAS (PDAS)



Coliseum BART Station Area PDA. Map data © 2020 by Google.

Coliseum BART Station Area PDA • The Coliseum BART Station Area PDA is an approximately 1,500-acre Transit Town Center PDA located in East Oakland. The PDA extends from the San Leandro Bay/Martin Luther King Jr. Regional Shoreline in the west to approximately International Boulevard to the east, and 54th Ave to the north to 85th Ave to the south. The PDA is served by the Coliseum and Oakland Airport BART station, Amtrak, and AC Transit, and connects the BART system to the Oakland Airport. Major freeways include I-880.

The Coliseum area is currently home to a sports arena, industrial, commercial, and residential uses. The vision for the area includes creating a Coliseum Transit Village comprised of mixed-use development that capitalizes on proximity to BART, Amtrak, and AC Transit services. The area will include mixed income housing, new streets, a city park and restoration of a portion of Lion Creek. The BART parking lot will be replaced with housing and neighborhood-serving retail. The plan calls for improved streets and pedestrian linkages between transit areas, schools and activity centers, parks and libraries. The area is envisioned to become a world-class sports, entertainment, and science and technology district that balances retail, entertainment, arts, culture, and live and work uses.¹⁵

First exposure of Coliseum parking lots occurs at 36" TWL, with significant flooding throughout the neighborhood at 48" TWL and extensive flooding by 66" TWL (Table 2h).

CURRENT AND FUTURE HOUSING AND JOBS IN THE COLISEUM BART STATION AREA PDA



Residential Housing Units

Existing in 2010:	1,867
Projections for 2040:	13,260
Percent Growth:	610%



Job Spaces

Existing in 2010:	14,180
Projections for 2040:	19,798
Percent Growth:	40%

Data Source: Plan Bay Area 2040, MTC/ABAG (2017).

Critical services and facilities may be impacted by flooding. Table 2h provides details on critical services potentially at risk of flooding within the communities analyzed. First impacts of exposure of assessed critical facilities begins at 12" TWL and increase through 108" TWL.

Total water levels (TWLs) are used to represent various combinations of temporary and/or permanent flooding that may occur with future sea level rise. Values in the table reflect potential risks to critical facilities in the absence of adaptation planning.

EXPOSURE OF CRITICAL FACILITIES IN COLISEUM BART STATION AREA PDA

Critical Facilities/Services Impacted		12"	24"	36"	48"	52"	66"	77"	84"	96"	108"
Utilities	PG&E storage yard (along I-880 north of High St.)	⚡									
	Natural Gas Pipelines (along I-880)	⋮		🔥							
	PG&E Substation (Worth Street and Edes Avenue)	⋮	⋮	⋮	⋮	⚡					
Other	Contaminated sites (throughout)	☢️									
	Commercial Waste & Recycling LLC (Julie Ann Way and Coliseum Way)	⋮		☢️							

Table 2h. Critical Services and Facilities: First exposure of critical services and facilities. Blue bars represent when asset is first exposed to flooding.

Downtown & Jack London Square PDA • The Downtown & Jack London Square PDA is a 1,300-acre Regional Center PDA located in Downtown Oakland, extending from I-980 the west to Lake Merritt to the east, and from the shoreline to the south to I-580 to the north. It covers Broadway, the main street of Oakland and downtown gateway to Jack London Square, as well as adjacent residential neighborhoods and the “Pill Hill” medical campuses. It is served by three BART stations (Lake Merritt, City Center 12th Street, and 19th Street), several AC Transit bus routes that connect throughout the East Bay and the region, and a ferry terminal at Jack London Square with service to San Francisco.

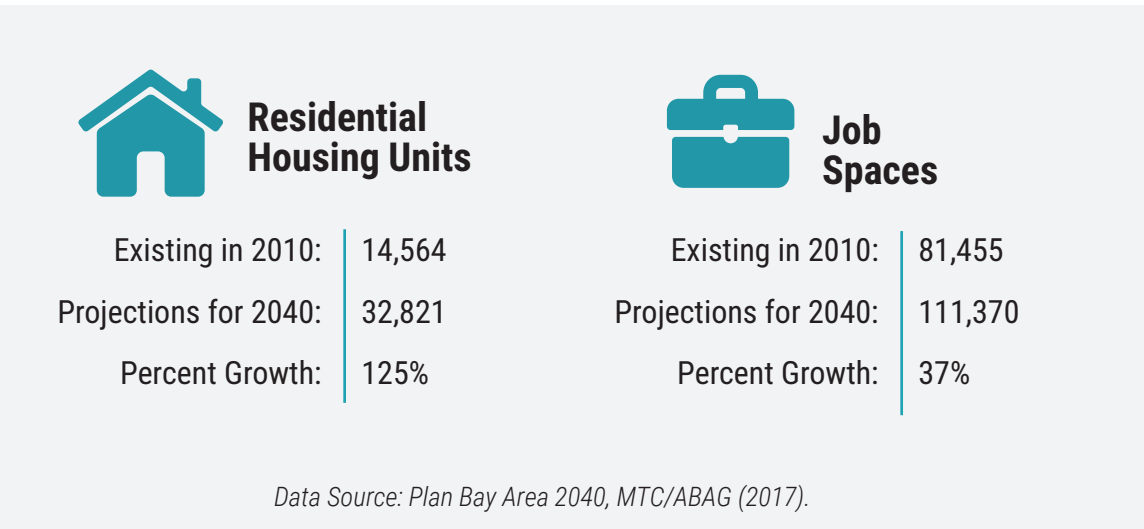
This PDA is critical due to its high number of existing jobs and housing and high capacity for growth. The Downtown Oakland Special Area Plan seeks to improve walkability, increase access to public transit and expand public transit options, and provide an “entertainment and business destination” for downtown Oakland and the Waterfront.¹⁶

The PDA is first exposed at 24” TWL along Estuary Park, with extensive flooding along Jack London Square and the shoreline by 66” TWL.

Critical services and facilities may be impacted by flooding. Table 3h provides details on critical services potentially at risk of flooding within the communities analyzed. First impacts of exposure of assessed critical facilities begins at 36” TWL and increase through 108” TWL.

Total water levels (TWLs) are used to represent various combinations of temporary and/or permanent flooding that may occur with future sea level rise. Values in the table reflect potential risks to critical facilities in the absence of adaptation planning.

CURRENT AND FUTURE HOUSING AND JOBS IN THE DOWNTOWN & JACK LONDON SQUARE PDA



EXPOSURE OF CRITICAL FACILITIES IN THE DOWNTOWN & JACK LONDON SQUARE PDA

Critical Facilities/Services Impacted		12"	24"	36"	48"	52"	66"	77"	84"	96"	108"
Utilities	Two natural gas pipelines (2nd Street, 4th Street, Fallon Street, 10th Street)										
	Two natural gas pipelines (2nd Street, 4th Street, Fallon Street, 10th Street)										
	Oakland Power Plant (50 Martin Luther King Street)										
	Embarcadero-Market Natural Gas Station (Embarcadero West and Market Street)										
	PG&E substations (Martin Luther King Junior Way and 2nd Street)										

Table 3h. Critical Services and Facilities: First exposure of critical services and facilities. Blue bars represent when asset is first exposed to flooding.

Naval Air Station PDA • The Naval Air Station PDA is a 1,000-acre Transit Town Center PDA located in the western portion of Alameda on former Naval Air Station land. It extends from Monarch Street to the west to College of Alameda to the east (excluding the existing neighborhood of Woodstock) and from the edges of the island to the north and south. It is served by AC Transit and contains the Alameda Ferry Terminal, which serves both Oakland and San Francisco.

This area includes substantial acres of underutilized former Naval Air Station land, as well as some existing newer residential development and industrial and commercial uses, including distilleries, wineries, and breweries. The overall vision for the redevelopment of this area is to create a transit-oriented, mixed-use, sustainable development that provides homes for a variety of family sizes and income levels, jobs for the region to replace those lost by the closure of the base, as well as parks and open spaces for conservation and regional recreation.

First exposure occurs at 24" TWL, with significant flooding at 48" TWL. It is nearly completely inundated by 108" TWL. Critical services and facilities may be impacted by flooding. Table 4h

EXPOSURE OF CRITICAL FACILITIES IN THE NAVAL AIR STATION PDA

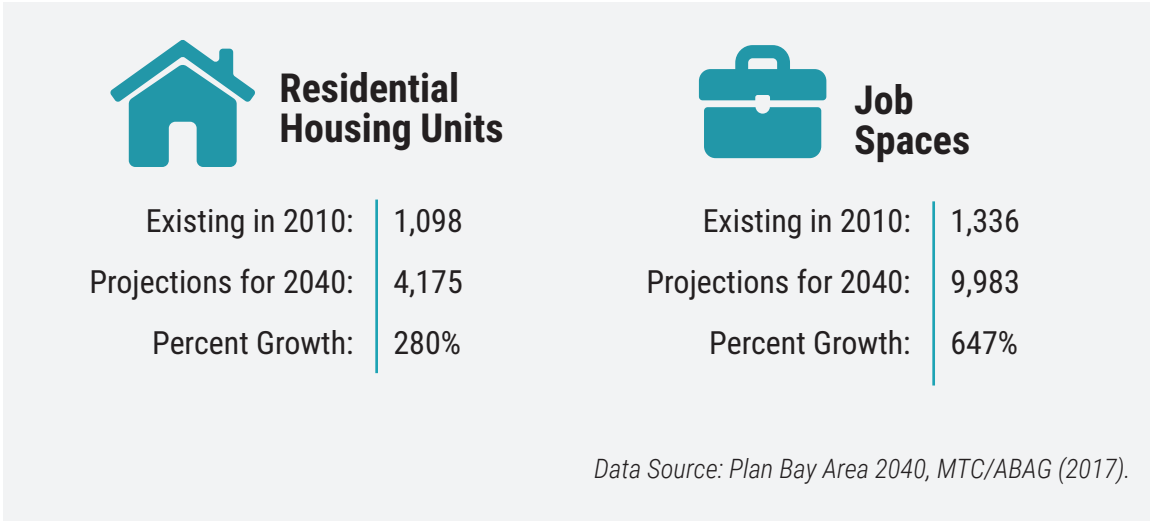
Critical Facilities/Services Impacted		12"	24"	36"	48"	52"	66"	77"	84"	96"	108"
Utilities	Alameda Power Plant (Singleton Avenue and Mosley Avenue)										
	PG&E substation (Singleton Avenue and Mosley Avenue)										
	PG&E substation (Atlantic Avenue and Skyhawk Street)										

Table 4h. Critical Services and Facilities: First exposure of critical services and facilities. Blue bars represent when asset is first exposed to flooding.

provides details on critical services potentially at risk of flooding within the communities analyzed. First impacts of exposure of assessed critical facilities begins at 36" TWL and increase through 108" TWL.

Total water levels (TWLs) are used to represent various combinations of temporary and/or permanent flooding that may occur with future sea level rise. Values in the table reflect potential risks to critical facilities in the absence of adaptation planning.

CURRENT AND FUTURE HOUSING AND JOBS IN THE NAVAL AIR STATION PDA



Northern Waterfront PDA • The Northern Waterfront PDA is a 330-acre Transit Neighborhood located along the northern waterfront portion of Alameda along Alameda Harbor and Brooklyn Basin. It runs along Sherman Street to the west, Buena Vista Avenue to the south, and Lincoln Avenue to the east. It is served by AC Transit.

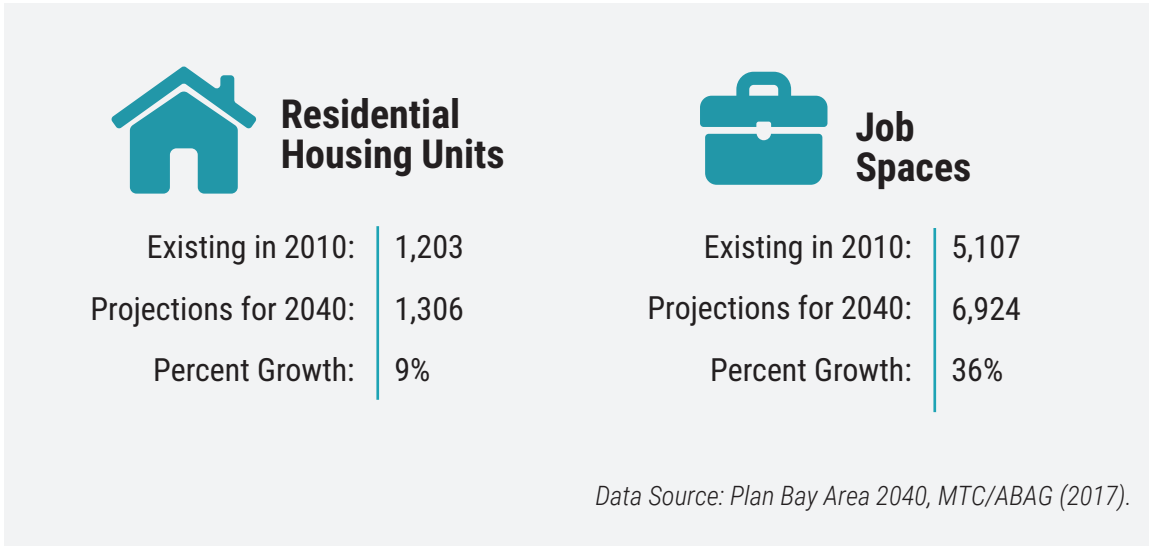
This PDA currently contains industrial and commercial uses along the waterfront surrounded by medium-density residential. The City of Alameda envisions this area being redeveloped as a series of mixed use, waterfront and transit-oriented neighborhoods that will provide a mix of jobs and transit-oriented housing types to serve the next generation of Alameda residents. The plans propose that a mix of uses are developed on former industrial and auto-oriented lands and preserve former railroad right of way for future bus rapid transit or light rail improvements. The Clement Avenue corridor through the Northern Waterfront is a designated transit priority right of way. The plans emphasize the importance of a mix of uses and a diversity of housing types for all income and household types.

It is first exposed at 48" TWL adjacent to the harbor, with significant additional flooding at 66" TWL (Table 5h).

Critical services and facilities may be impacted by flooding. Table 5h provides details on critical services potentially at risk of flooding within the communities analyzed. First impacts of exposure of assessed critical facilities begins at 66" TWL and increase through 108" TWL.

Total water levels (TWLs) are used to represent various combinations of temporary and/or permanent flooding that may occur with future sea level rise. Values in the table reflect potential risks to critical facilities in the absence of adaptation planning.

CURRENT AND FUTURE HOUSING AND JOBS IN THE NORTHERN WATERFRONT PDA



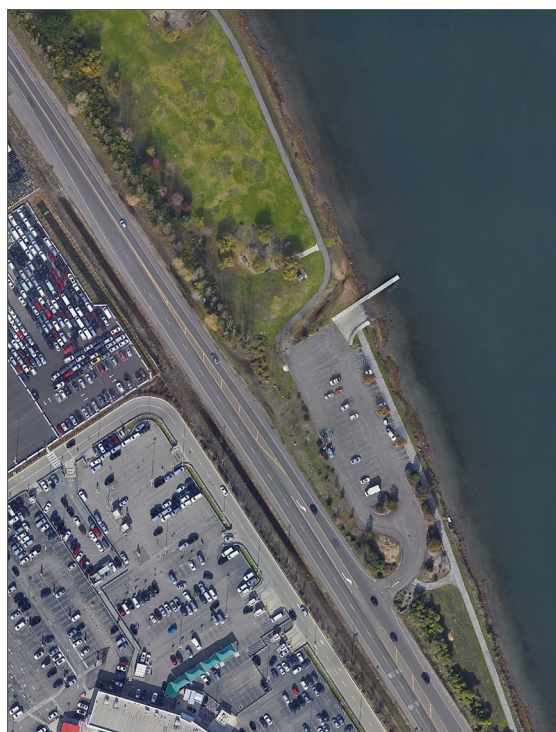
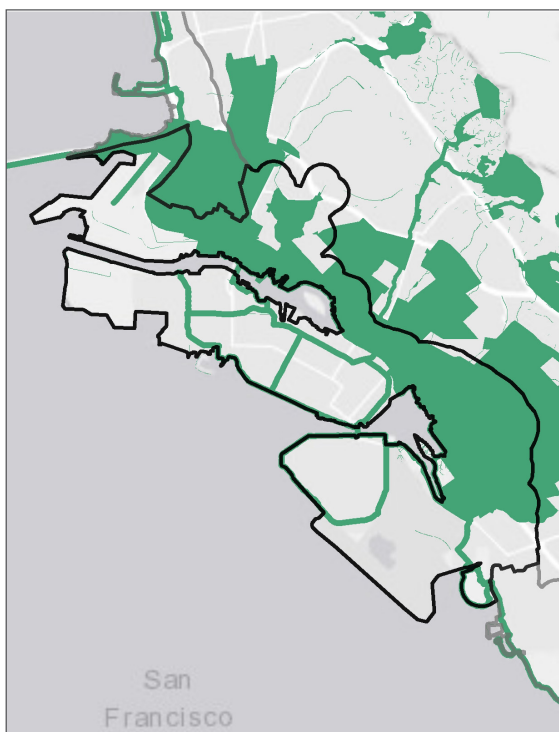
EXPOSURE OF CRITICAL FACILITIES IN THE NORTHERN WATERFRONT PDA

Critical Facilities/Services Impacted		12"	24"	36"	48"	52"	66"	77"	84"	96"	108"
Utilities	Contaminated sites										
	Jenney Substation (Clement Ave and Walnut Street)										

Table 5h. Critical Services and Facilities: First exposure of critical services and facilities. Blue bars represent when asset is first exposed to flooding.



PRIORITY CONSERVATION AREAS (PCAS)



A Water Trail boat launch site on Airport Channel near OAK. Map data © 2019 by Google

San Francisco Bay Water Trail PCA

• The San Francisco Bay Area Water Trail is a network of launching and landings sites for non-motorized watercrafts (e.g. kayaks, stand-up paddleboards, wind and kite surf, etc.) around the San Francisco Bay and its major tributaries, including the San Joaquin River, Napa River, and Petaluma River.¹⁷ Within this OLU, there are four Water Trail Designated Trailheads at Tidewater, Crown Beach, Encinal Beach, and Estuary Park. The trailheads in this OLU are first exposed at 12" TWL, with significant flooding and impacts to access at 36" TWL.

PCA DESIGNATION:

- ☐ Natural Landscapes
- ☐ Agricultural Lands
- ☐ Urban Greening
- ☒ **Regional Recreation**

FUNCTIONS/BENEFITS:

- **Recreation**
- **Economic Development**
- **Wildlife Habitat**

Data Source: MTC/ABAG Priority Conservation Areas Program (2017).



San Francisco Bay Trail • The San Francisco Bay Trail is a 500-mile regional trail that, upon completion, will circumnavigate the bay. The trail connects people and communities to each other, to parks and open space, to home, work and recreation, and to countless areas of cultural and historic interest. It provides opportunities for health and fitness, increase transportation options, opportunities to observe, learn about, and care for the environment, and provides economic benefits to the region through increased tourism.¹⁸ Within this OLU, the Bay Trail is present throughout the shoreline, including the perimeter of Alameda Island and the northern end of Bay Farm Island. It is first exposed at 12" TWL, with significant flooding impacts at 36" TWL when more than half of the Bay Trail segments in this OLU are exposed.

PCA DESIGNATION:

- ☒ **Natural Landscapes**
- ☐ Agricultural Lands
- ☐ Urban Greening
- ☐ Regional Recreation

FUNCTIONS/BENEFITS:

- **Recreation**
- **Community Health**
- **Transportation**
- **Economic Development**
- **Environmental Stewardship**

Data Source: MTC/ABAG Priority Conservation Areas Program (2017).

Oakland Priority Creek Trails PCA • This PCA focuses on two key creek trails in Oakland: Sausal Creek Trail and San Leandro Creek Trail. Sausal Creek is designated as a Priority Stream under the Conservation Lands Network. It has two tributaries: Shepherd Creek and Palo Seco Creek that unite just below SR-13 in the Oakland Hills. It flows next to the Piedmont border and parallels Fruitvale Avenue through regional parks, recreational paths, important natural habitat, critical wildlife habitat linkages, priority restoration sites, and parcels of undeveloped land. It supports a native trout population and provides valuable habitat for threatened and endangered plant species. Trails along Sausal Creek include several trails that are managed and maintained by East Bay Regional Park District (EBRPD). The San Leandro Creek trail is located across Oakland and San Leandro city boundaries, posing a unique opportunity for collaboration. The creek supports a native trout population and has sites identified for creek restoration. It is designated as a Priority Stream by the Conservation Lands Network, as well as the United States Fish and Wildlife Service. There are many undeveloped parcels to help preserve creek functions and serve as opportunities for restoration and trails. San Leandro Creek drains into the Martin Luther King Regional Shoreline and forms wetlands when it reaches the Bay, which provide important bird habitat. There are proposed Class 1 bikeways along the creek greenway and EBRPD trails. The Bay Trail encircles the mouth of the creek. Both creeks and associated trails are first exposed at 12" TWL. San Leandro Creek experiences significant overtopping beginning at 36" TWL, and Sausal Creek experiences significant overtopping beginning at 77" TWL.

There are many ecosystem services of the PCA including providing habitat, recreation, and stormwater services of runoff retention, groundwater recharge, and flood water retention (Figure 10h).

PCA DESIGNATION:

- ☒ **Natural Landscapes**
- ☐ Agricultural Lands
- ☒ **Urban Greening**
- ☒ **Regional Recreation**

FUNCTIONS/BENEFITS:

- **Recreation**
- **Community Health**
- **Climate and Resilience**
- **Wildlife Habitat**
- **Compact Growth**

Data Source: MTC/ABAG Priority Conservation Areas Program (2017).



Sausal Creek in Oakland in the Oakland Priority Creek Trails PCA. Photo by Fragmentary Evidence is licensed under CC BY-NC-ND 2.0.

ECOSYSTEM SERVICES OF OAKLAND PRIORITY CREEK TRAILS PCA



Habitats

Bird Hot Spots | 124 acres



Stormwater

Annual Runoff Retention	184 million gallons
Groundwater Recharge	2.6 million gallons
Flood Water Retention	14.5 million gallons



Recreation

Approximate Visitation Rates | 31 photo user days (PUD)



Carbon Storage

No soil organic matter quantified. | N/A

Figure 10h. Ecosystem Services of the PCA. Statistics on habitats, recreation, carbon storage and stormwater retention in PCAs. *Data by the ART Bay Area Natural Capital Project (2019).*

Oakland Priority Estuaries PCA • This PCA includes Lake Merritt and the Lake Merritt Channel. The Lake Merritt Channel was historically impassable due to a culvert at one end and a 12-lane roadway at the other. In 2013, a 750-foot section was re-opened after 140 years by removing the 12th Street dam, culverts, pedestrian dams, and the 12-lane roadway. The 100-foot-wide free flowing channel allows kayaks and other small craft to make their way from Lake Merritt to the Bay. Tidal marsh along the channel was restored by replanting where the dam had previously prevented the natural spread of marsh vegetation. The project also included a paved trail and pedestrian bridge. Lake Merritt itself is an EPA-designated impaired water body with high levels of PCBs, mercury, lead, and pesticides. Gulch/Pleasant Valley Creek Watershed, covering the City of Piedmont and Lower Hills District of the City of Oakland, drains into the lake prior to the Bay. The area serves as a stopover along the Pacific Flyway for egrets, herons, Canada geese, and more. It is surrounded by dense urban areas and serves as an urban wildlife refuge. It is first exposed at 24" TWL along the mouth of the Lake Merritt Channel, with the banks of Lake Merritt itself overtopped at 77" TWL.

There are many ecosystem services of the PCA including providing habitat, recreation, stormwater services of runoff retention, groundwater recharge, and flood water retention, and carbon storage (Figure 11h).

PCA DESIGNATION:

- ☒ **Natural Landscapes**
- ☐ Agricultural Lands
- ☒ **Urban Greening**
- ☒ **Regional Recreation**

FUNCTIONS/BENEFITS:

- **Recreation**
- **Open Space**
- **Economic Development**
- **Community Health**

Data Source: MTC/ABAG Priority Conservation Areas Program (2017).

ECOSYSTEM SERVICES OF OAKLAND PRIORITY ESTUARIES PCA



Habitats

Brown Pelican	62 acres
Bird Hot Spots	62 acres
Lagoon	186 acres



Stormwater

Annual Runoff Retention	56.3 million gallons
Groundwater Recharge	2.8 million gallons
Flood Water Retention	6.2 million gallons



Recreation

Approximate Visitation Rates	308 photo user days (PUD)
------------------------------	---------------------------



Carbon Storage

Acres x % weighted soil organic matter	44
--	----

Figure 11h. Ecosystem Services of the PCA. Statistics on habitats, recreation, carbon storage and stormwater retention in PCAs. *Data by the ART Bay Area Natural Capital Project (2019).*

Oakland Recreational Trails PCA • This PCA is located along two creeks, Lion Creek and San Leandro Creek. Lion creek has unique challenges in management due to historic contamination from the Lyona Heights Sulfur Mine. Cleanup efforts began in 2014. Restoration projects along Lion Creek beginning in 2010 created wetland habitat for fish, birds, and wildlife as well as restored the creek bed with divergent structures for up and downstream water flow. San Leandro Creek has similar issues with contamination, with ongoing maintenance and restoration of flood walls and contaminant impacts on invertebrates and crustaceans. Trails along Lion Creek and San Leandro Creek are first exposed at 36" TWL.

There are many ecosystem services of the PCA including providing recreation, and stormwater services of runoff retention, groundwater recharge, and flood water retention (Figure 12h).

ECOSYSTEM SERVICES OF OAKLAND RECREATIONAL TRAILS PCA



Habitats

No habitat quantified. | N/A



Stormwater

Annual Runoff Retention	6.9 million gallons
Groundwater Recharge	100,300 gallons
Flood Water Retention	584,100 gallons



Recreation

Approximate
Visitation Rates | 4 photo user
days (PUD)



Carbon Storage

No soil organic matter
quantified. | N/A

Figure 12h. Ecosystem Services of the PCA. Statistics on habitats, recreation, carbon storage and stormwater retention in PCAs. *Data by the ART Bay Area Natural Capital Project (2019).*

PCA DESIGNATION:

- ☐ Natural Landscapes
- ☐ Agricultural Lands
- ☐ Urban Greening
- ☒ **Regional Recreation**

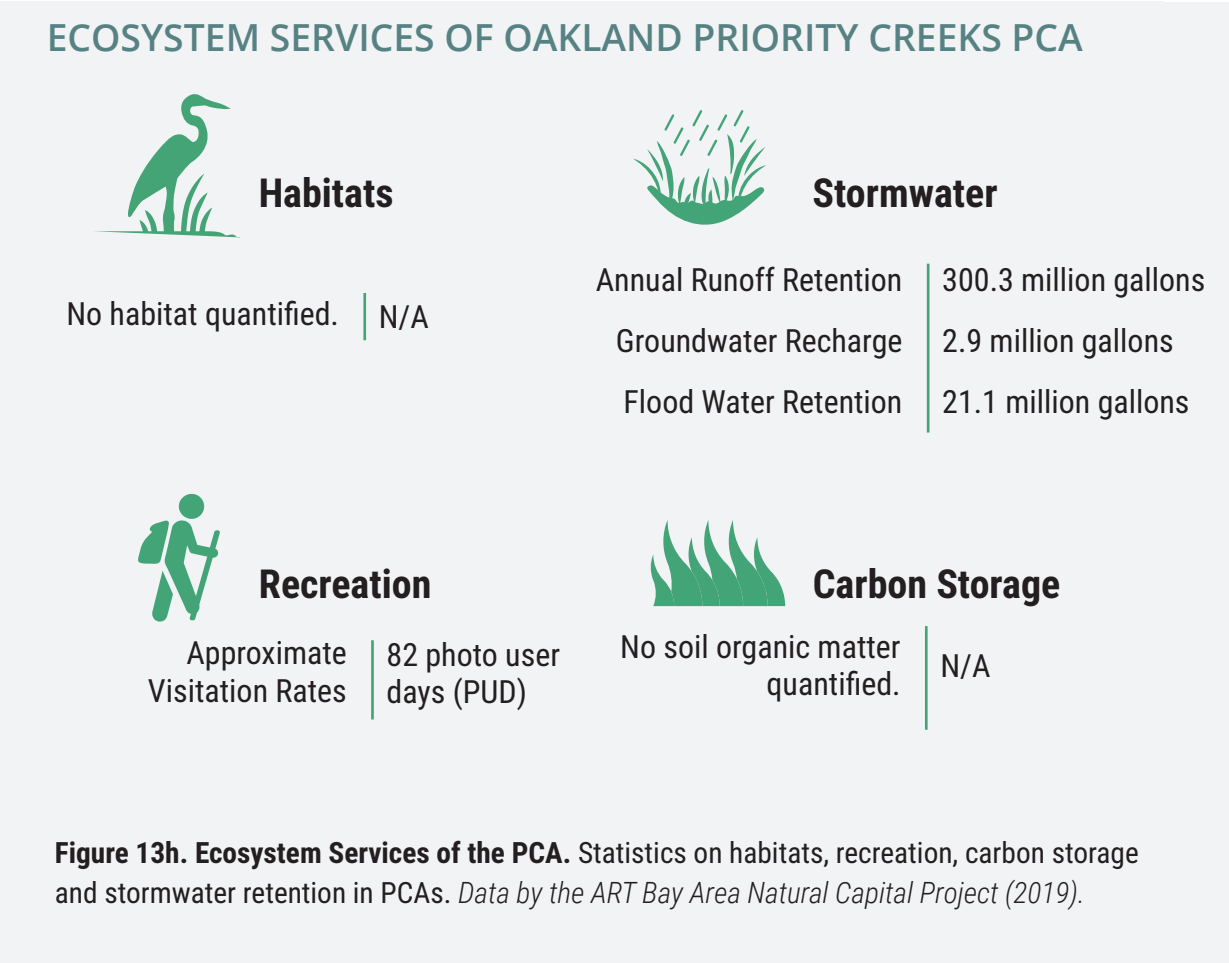
FUNCTIONS/ BENEFITS:

- **Recreation**
- **Wildlife Habitat**
- **Water Supply and Water Quality**
- **Climate Resilience**

Data Source: MTC/ABAG Priority Conservation Areas Program (2017).

Oakland Priority Creeks PCA • This PCA encompasses creeks throughout the City of Oakland. Within this OLU, creeks included in the PCA are: Lake Merritt Channel (exposed at 24" TWL with overtopping to local roads), East Creek Slough (upstream exposed at 12" TWL, mouth exposed at 24" TWL), all channels/creeks into San Leandro Bay in the Coliseum area including San Leandro Creek, Sausal Creek, many small creeks in Arrowhead Marsh, and channels at the tip of Bay Farm Island (all exposed at 12" TWL). All creeks within this OLU are open creeks, priority restoration sites, or hills to bay culverts attributed to the Oakland Urban Greening PCA or the Oakland Natural Landscapes PCA. They are meant to protect streams, meet conservation targets under the Conservation Lands Network, support watershed health, protect downstream water uses by protecting creek health, protect critical riparian ecosystems, protect the diversity of animals that use those creeks for corridors, increase urban tree cover in areas expected to experience urban heat island effects, support local urban greening initiatives, and to increase areas with carbon storage potential.

There are many ecosystem services of the PCA including providing recreation, and stormwater services of runoff retention, groundwater recharge, and flood water retention (Figure 13h).



PCA DESIGNATION:

- ☒ **Natural Landscapes**
- ☐ Agricultural Lands
- ☒ **Urban Greening**
- ☐ Regional Recreation

Data Source: MTC/ABAG Priority Conservation Areas Program (2017).

FUNCTIONS/ BENEFITS:

- **Recreation**
- **Wildlife Habitat**
- **Water Supply and Water Quality**
- **Climate Resilience**
- **Community Health**

Potential Oakland Gateway Area PCA • This proposed 45- to 170-acre PCA would be a major new shoreline park located at the touchdown of the San Francisco – Oakland Bay Bridge (I-80). The proposed area has been part of plans by nine agencies to develop the shoreline area into a major shoreline park destination. The area currently includes hiking and biking trails along the eastern half of the I-80 San Francisco-Oakland Bay Bridge. The lead agency for this proposed PCA is the East Bay Regional Parks District, in coordination with Caltrans, who owns the property and the Bay Area Toll Authority, who has provided funding for marsh restoration as well as to fund potential amenities including bathrooms and a commercial kitchen. If completed, this area would become part of the larger Oakland Greening PCA.

There are many ecosystem services of the PCA including providing recreation, and stormwater services of runoff retention, groundwater recharge, and flood water retention (Figure 14h).

PCA DESIGNATION:

- ☒ **Natural Landscapes**
- ☐ Agricultural Lands
- ☐ Urban Greening
- ☒ **Regional Recreation**

Data Source: MTC/ABAG Priority Conservation Areas Program (2017).

FUNCTIONS/ BENEFITS:

- **Recreation**
- **Wildlife Habitat**
- **Water Supply and Water Quality**

ECOSYSTEM SERVICES OF POTENTIAL OAKLAND GATEWAY AREA PCA



Habitats

No habitat quantified. | N/A



Stormwater

Annual Runoff Retention	28.9 million gallons
Groundwater Recharge	1.6 million gallons
Flood Water Retention	4.6 million gallons



Recreation

Approximate Visitation Rates | 50 photo user days (PUD)



Carbon Storage

No soil organic matter quantified. | N/A

Figure 14h. Ecosystem Services of the PCA. Statistics on habitats, recreation, carbon storage and stormwater retention in PCAs. *Data by the ART Bay Area Natural Capital Project (2019).*

Regional Trail Systems Gaps PCA • The Regional Trail Systems Gaps PCA is an effort by East Bay Regional Park District to close gaps in the regional trails systems in the East Bay. Within this OLU, it is located in the northern section of the OLU from the Port of Oakland to Lake Merritt. The segment in this OLU is first exposed at 52" TWL along I-80, UPRR, Howard Terminal, and the Lake Merritt Channel.

There are many ecosystem services of the PCA including providing habitat, recreation, and stormwater services of runoff retention, groundwater recharge, and flood water retention (Figure 15h).

ECOSYSTEM SERVICES OF REGIONAL TRAIL SYSTEMS GAPS PCA



Habitats

Brown Pelican	62 acres
Bird Hot Spots	62 acres
Lagoon	185 acres



Stormwater

Annual Runoff Retention	822.5 million gallons
Groundwater Recharge	31.6 million gallons
Flood Water Retention	85.2 million gallons



Recreation

Approximate Visitation Rates	30 photo user days (PUD)
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Carbon Storage

No soil organic matter quantified.	N/A
------------------------------------	-----

Figure 15h. Ecosystem Services of the PCA. Statistics on habitats, recreation, carbon storage and stormwater retention in PCAs. *Data by the ART Bay Area Natural Capital Project (2019).*

PCA DESIGNATION:

☒ **Natural Landscapes**

☐ Agricultural Lands

☐ Urban Greening

☒ **Regional Recreation**

FUNCTIONS/ BENEFITS:

- **Recreation**
- **Wildlife Habitat**
- **Water Supply and Water Quality**

Data Source: MTC/ABAG Priority Conservation Areas Program (2017).

The Bay Trail on Burma Road in Oakland. Photo by Dianne Yee is licensed under CC BY-NC-ND 2.0.



Focus Area A:

East Oakland, Coliseum, and San Leandro Bay

Location

This Focus Area is centered around the East Oakland Area south of Lake Merritt, including the Oakland Coliseum Area, San Leandro Bay, and surrounding communities. It is bounded by Lake Merritt (north), 98th Avenue (south), San Leandro Bay (west), and International Boulevard (east). It is approximately 8 square miles (Figure 16h).

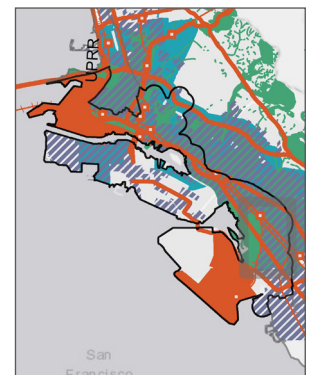


Figure 16h. LEFT: Identification of where Focus Area is within OLU. RIGHT: Map of Focus Area containing regional systems. Individual assets assessed in this Focus Area are labeled on the map and listed on the following page.



Why shared stories of vulnerability?

This Focus Area was selected because it contains a variety of regional systems, including numerous transportation routes, a PDA, multiple PCAs, and the East Oakland community. Due to overlap and dependencies among these regional systems in this area, the vulnerabilities of these systems to flooding and sea level rise are discussed together in shared stories of the shoreline, overtopping, and exposure to flooding as water levels rise. The goal of communicating shared vulnerabilities and consequences is to encourage multi-benefit solutions through collaborations and coordination.

◀ Figure 16h. MAP OF REGIONAL SYSTEMS AND LIST OF INDIVIDUAL ASSETS ASSESSED WITHIN THIS FOCUS AREA LISTED BELOW:



TRANSPORTATION

- Coliseum Station Complex (Coliseum BART, Amtrak, Oakland Connector BART)
- Union Pacific Railroad
- I-880
- Port of Oakland
- Local Roads



VULNERABLE COMMUNITIES

- East Oakland, Deep East Oakland & San Leandro Community



PRIORITY DEVELOPMENT AREAS (PDAs)

- Coliseum BART Station Area PDA



PRIORITY CONSERVATION AREAS (PCAs)

- Regional Trail System Gaps PCA
- Oakland Recreational Trails PCA
- Oakland Priority Creeks PCA
- Oakland Priority Creek Trails PCA
- San Francisco Bay Trail PCA

Shoreline today and into the future

SHORELINE TYPE STORY

What is the shoreline made up of now?

The shoreline in the Focus Area is mixed, including shoreline protection structures, berms, natural shorelines, engineered levees, wetlands, and transportation structures.

SHORELINE DEVELOPMENT STORY

How will the shoreline change in the future?

This area is actively undergoing significant development activities that may influence impacts of sea level rise. There are also a number of activities that have recently been permitted by BCDC or have ongoing permit applications in progress. In addition, the East Oakland Neighborhoods Initiative (EONI) has developed a community plan to guide future development.¹⁹ These major potential shoreline changes include:

- Bay Trail projects:
 - Oakland, Lake Merritt
 - Oakland, Tidewater to Fruitvale
- **Brooklyn Basin:** Large-scale residential and commercial development along the waterfront with aims to restore natural shorelines²⁰
- **Oakland Estuary bridge developments**
- **Doolittle Drive East Bay Regional Park**



Lake Merritt shoreline in Oakland. Photo by Hitchster is licensed under CC BY 2.0.



Martin Luther King Jr. Regional Shoreline. Photo by MagicMediaProduction is licensed under CC BY-NC-ND 2.0.

Current and future flooding risk

OVERTOPPING STORY

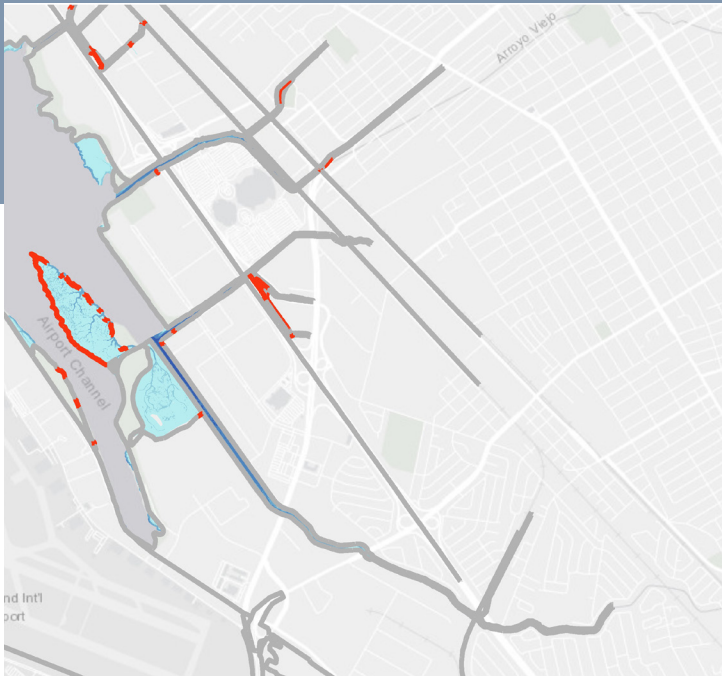
Where is water coming over the shoreline?

At 12" TWL, small amounts of overtopping occur along the many creeks and channels that flow into San Leandro Bay, including San Leandro Creek, East Creek Slough, Damon Slough, Lion Creek, and several small channels (Figure 17h). Arrowhead Marsh is also fully overtopped at 12" TWL. This overtopping increases with increasing water levels, however significant impact (i.e. flooding) is not experienced from the overtopping until 36" TWL, at which point channels south of the Oakland Coliseum are significantly overtopped adjacent to the Coliseum parking lot. Also at 36" TWL, overtopping begins on the south facing shore near Tidewater Avenue and East Creek Slough. At 48" TWL, significant overtopping occurs along the shorelines of Damon Slough and the channel south of the Coliseum. Overtopping also continues near Tidewater Avenue and progresses along the banks of San Leandro Creek. Also at 48" TWL, UPRR rail is overtopped. I-880 is overtopped at 48" TWL. Overtopping progresses as water levels rise. At 66" TWL, significant portions of I-880 from East Creek Slough to Hegenberger Road are overtopped, as well as a paralleling segment of rail. At 77" TWL, the entire shoreline, including the San Leandro Bay shore and creeks and channels are overtopped, as well as both rail lines east of the Coliseum. Overtopping increases with increasing water levels.

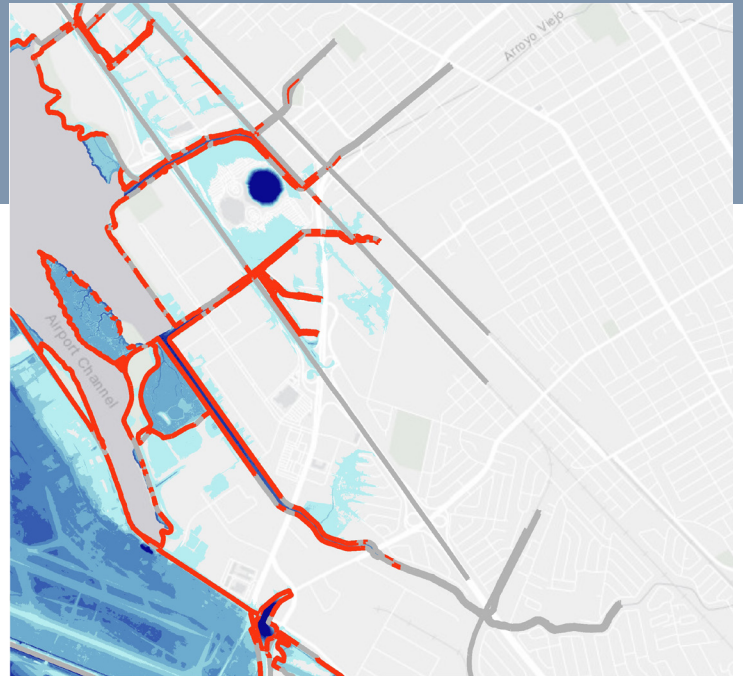
FLOODING EXPOSURE STORY

Where does flooding occur?

At 12" TWL, Arrowhead Marsh, marsh north of Damon Slough, and marsh along Martin Luther King Junior Shoreline are exposed (Figure 18h). At 36" TWL, flooding enters the Coliseum parking lot on the southern end via the channel immediately south. Flooding also enters the south facing shore of East Creek Point. At 48" TWL, I-880 is flooded between 66th Avenue and Hegenberger Road. Flooding enters the Coliseum area from both the north (Damon Slough) and south sides (channel) and increases in the East Creek Point Area. Flooding also begins to occur more widely throughout the Focus Area, including east of San Leandro Creek between Hegenberger Road and 98th Street, west of San Leandro Creek between Bay Farm Island and Hegenberger Road, south of Hegenberger Road and east of I-880, and on the north side of the Coliseum area west of San Leandro Street. This exposes the BART Oakland Airport Connector. At 52" TWL, flooding in all of these locations increases, and flooding begins to occur between the two rail lines that run adjacent to Railroad Avenue and San Leandro Street. At 66" TWL, most neighborhoods are significantly flooded east of San Leandro Boulevard, and BART Coliseum Station is exposed. Amtrak's Capital Corridor is also impacted at 66" TWL. At 77" TWL, flooding reaches east of San Leandro Boulevard and increases in depth as water levels increase.



12" TWL



48" TWL

OVERTOPPING AND FLOODING ▲

Figure 17h. Two total water levels selected that demonstrate first overtopping and/or significant flooding thresholds. Visit the Bay Shoreline Flood Explorer (explorer.adaptingtorisingtides.org) to see more TWLs.

- No overtopping
- Overtopping
- Shallower depth of flooding
- Deeper depth of flooding

FIRST FLOODING OF REGIONAL SYSTEMS ASSESSED

Regional Systems Impacted	12"	24"	36"	48"	52"	66"	77"	84"	96"	108"
San Francisco Bay Trail PCA										
San Francisco Bay Water Trail PCA										
Oakland Priority Creeks PCA										
Coliseum BART Station Area PDA										
East Oakland Community										
Local roads- 98 th Ave.										
Downtown & Jack London Square PDA										
Local roads- Hegenberger Rd.										
Coliseum Station Complex										
I-880										
Local roads- San Leandro St.										

Figure 18h. First exposure of regional systems. Individual assets within the four regional systems in this area are shown and colored bars represent when each asset is first exposed to flooding impacts.

Shared vulnerabilities to flooding

SHARED VULNERABILITY STORIES

Vulnerability assessments were conducted on individual assets and then shared vulnerabilities were identified for regional systems within each focus area. The vulnerability statements below reflect shared stories of vulnerability. Our goal is to emphasize the interconnections among and across local systems, and encourage shared multi-benefits adaptation solutions.

1. Community and Critical Transportation



This Focus Area exhibits transportation, housing, and community vulnerability that will be exacerbated by flooding as each of those systems are disrupted. Disruption from flooding will likely have disproportionate impacts for East Oakland communities that experience high vulnerability indicators. This area houses many regionally significant transportation assets, including I-880, BART, Amtrak, UPRR, and airport access. If disrupted, impacts to transportation and economy will be felt locally, regionally, and nationally. This major transit center provides regional access for people, and the PDA here is planned to become a major entertainment and economic center that is hoped will drive additional economic activity for the region. Disruptions in access to the Coliseum BART and Amtrak stations would negatively affect commuter movement and goods movement and could lead to cascading economic effects within the region.



Jack London Square ferry terminal in Oakland. Photo by Daniel Ramirez is licensed under CC BY 2.0.

Shared consequences to flooding

SHARED CONSEQUENCE STORIES

This section translates shared vulnerability statements into stories of shared consequences. The ART program considers consequences through frames of sustainability: Society and Equity, the Economy and the Environment.



Society and Equity • This area contains numerous block groups with populations containing a high number of high vulnerabilities, with many residential housing units exposed to flooding. San Leandro Street connects the road network to Coliseum BART and Amtrak trains so any disruptions would disproportionately affect transit-dependent households. Hegenberger Road and 98th Avenue connect Bay Farm Island and the airport with Oakland and beyond. It carries 18,000 riders per day as well as several transit routes. They may serve transit-dependent communities. They provide access to the airport for travelers and workers (at the airport and related facilities), as well as the movement of cargo and supplies necessary to serve the airport. Hegenberger Road is also an Oakland evacuation route and could be used for emergency response. If these local roads were out of service, it would have a serious effect on travelers and commuters and could disrupt the operation of the airport, as well as the safety of nearby communities. I-880 passes through the East Oakland community (and disruption of this commuter route may disproportionately impact these communities. MLK Jr. Shoreline and creek trails along San Leandro Creek and Sausal Creek provide commuting options, recreation, access to the shoreline, and wildlife viewing; these opportunities are free to the public, including several underserved / low-income communities in the vicinity. The shoreline also provides school programs and volunteer programs. If the shoreline is eroded or flooded, or the Bay Trail undercut, these recreational and program opportunities would be lost for the local communities.

Economy • This area houses many regionally significant transportation assets, including I-880, BART, Amtrak, UPRR, and airport access. If disrupted, impacts to transportation and economy will be felt locally, regionally, and nationally. The Coliseum area is slated for redevelopment with economic goals slated to have local and regional impacts. Disruptions in access to the Coliseum BART and Amtrak stations (on San Leandro Street) would negatively affect commuter movement and goods movement and could lead to cascading economic effects within the region. This major transit center provides regional access for people, and the PDA here plans to become a major entertainment and economic center that will drive additional economic activity for the region. If the region floods, this economic impact and opportunity will be lost. Hegenberger Road and 98th Avenue provide arterial access for commuter movement, goods movement, residents and emergency response between Oakland and Bay Farm Island. They also provide access to the Coliseum. Interruptions to commuters and goods movement could have a local to regional economic effect, and disruption of airport operations could have a national to international effect. I-880 connects both the Port of Oakland and Oakland International Airport and the disruption of the movement of cargo from either of these facilities would have dramatic regional economic consequences. MLK Jr. Shoreline provides \$4.8M in recreation value per year, which would be reduced or lost as sea level rise changes and diminishes shoreline and habitat. It also provides commuting options via the Bay Trail that could be lost or disrupted.



Environment • Wetlands in this Focus Area serve as critical buffers to inland areas but are being eroded. Hegenberger Road Crosses San Leandro Creek near MLK shoreline and has part of the Bay Trail on it. Pollutants on the road could wash into the Bay with floodwaters, and construction could threaten habitat and water quality in San Leandro Creek. The Shoreline provides habitat for at least one endangered species, the Ridgway's Rail, which could be lost due to sea level rise. In addition, various types of ecosystems (high marsh, mid marsh, seasonal wetlands) could be lost as sea level rise causes them to downshift to low marsh, mudflat, or subtidal.



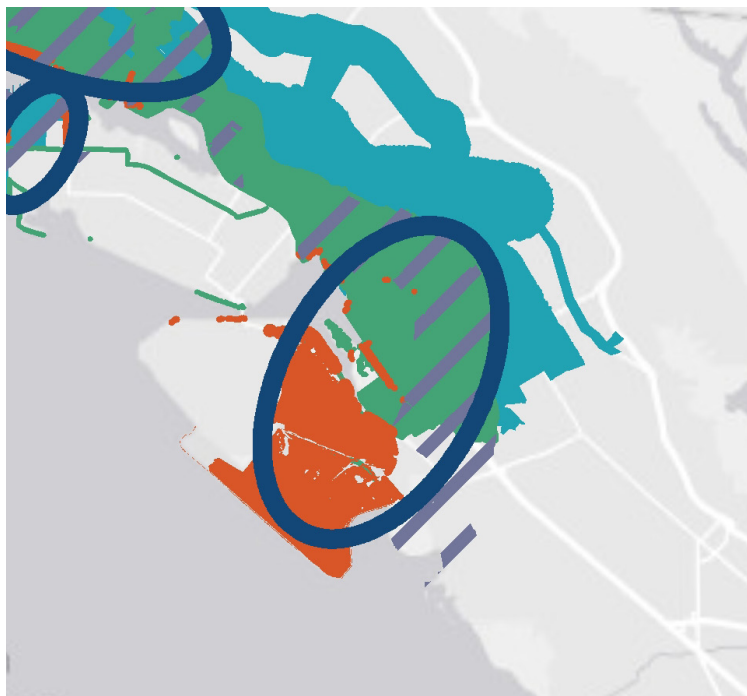
Advancing adaptation solutions

FITTING INTO REGIONAL STORY

How are local areas contributing to Regional Hot Spots?

The regional scale analysis of ART Bay Area identified clusters of highest consequences around the region, called “Regional Hot Spots.” These areas include places that contain the top five highest consequences in the region for 1) any transportation asset and 2) either a PDA or PCA, and 3) the presence of a vulnerable community block group at any given water level.

Regional Hot Spot at 36” TWL



- Regional Hot Spot
- Transportation Infrastructure
- Vulnerable Community
- PDA
- PCA

Figure 19h. East Oakland/Coliseum Hot Spot: From 36” TWL to 108” TWL, this Focus Area contains clusters of assets that have among the highest consequences of flooding in the region.

Datasets were identified for each regional system to provide a measure of consequence to quantify impacts in the event of flooding. A full list of consequences used for each regional system can be found in Chapter 2.1 Regional Hot Spots.

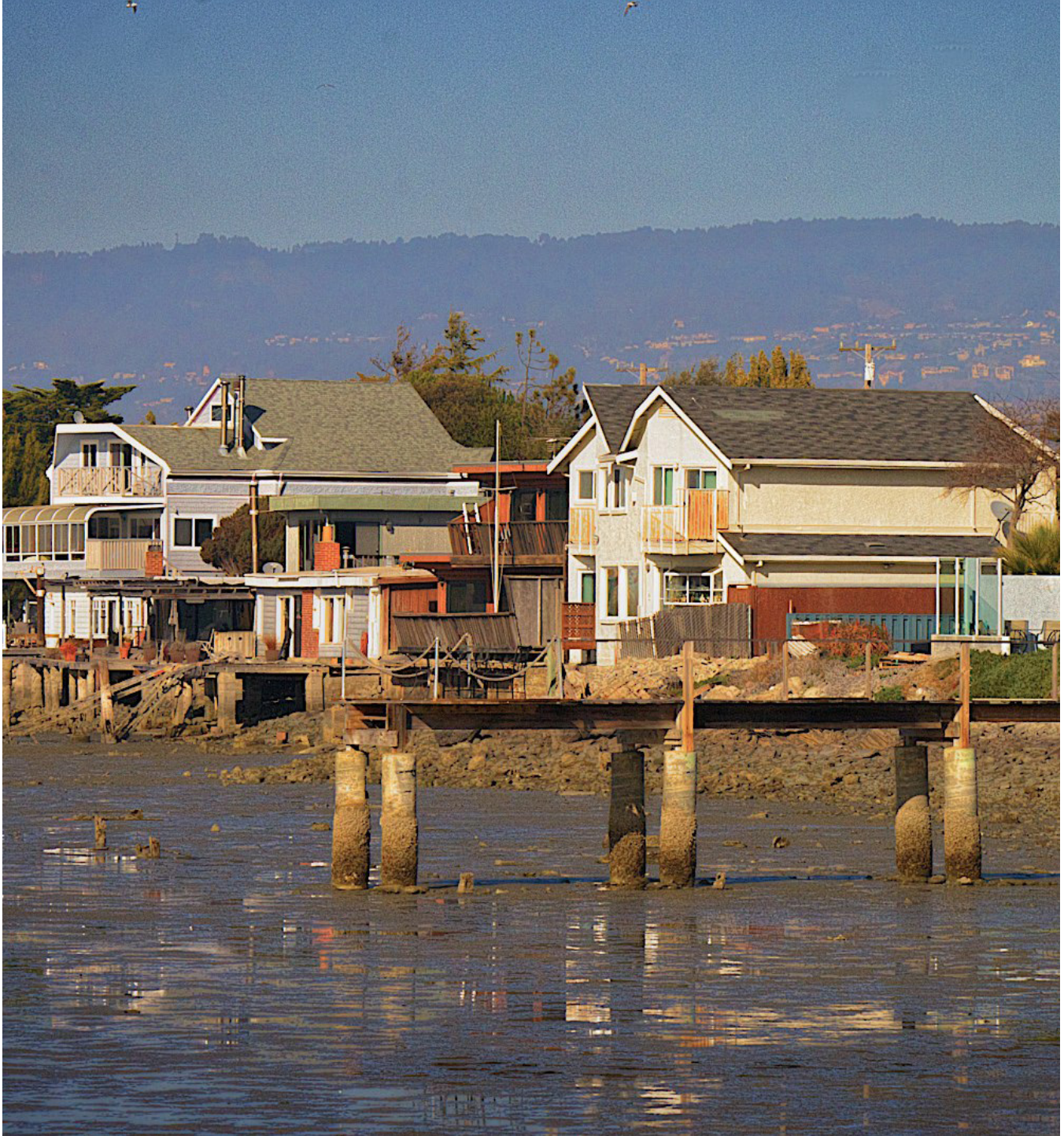
The East Oakland/Coliseum Focus Area is a Regional Hot Spot, meaning it contains a cluster of assets that have among the highest consequences of flooding in the region.

The East Oakland/Coliseum cluster is driven by the Coliseum BART PDA (2010 job spaces, 2040 residential units, and growth in residential units), Oakland Airport (both passenger boardings and cargo), and socially vulnerable and contaminated block groups.

It becomes a Regional Hot Spot starting at 36” TWL, and continues to higher total water levels (Figure 19h).

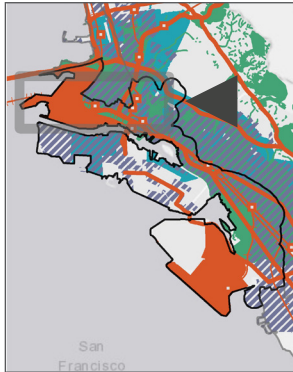
Chapter 4 Regional Adaptation provides adaptation responses for regional issues.

Homes on San Leandro Bay. Photo by Charlie Day is licensed under CC BY-ND 2.0.



Focus Area B:

West Oakland and Downtown Oakland



Location

This Focus Area includes the West Oakland community from the border of the OLU, along the shoreline including the Port of Oakland, down through Jack London Square and through the east side of Lake Merritt (Figure 20h).

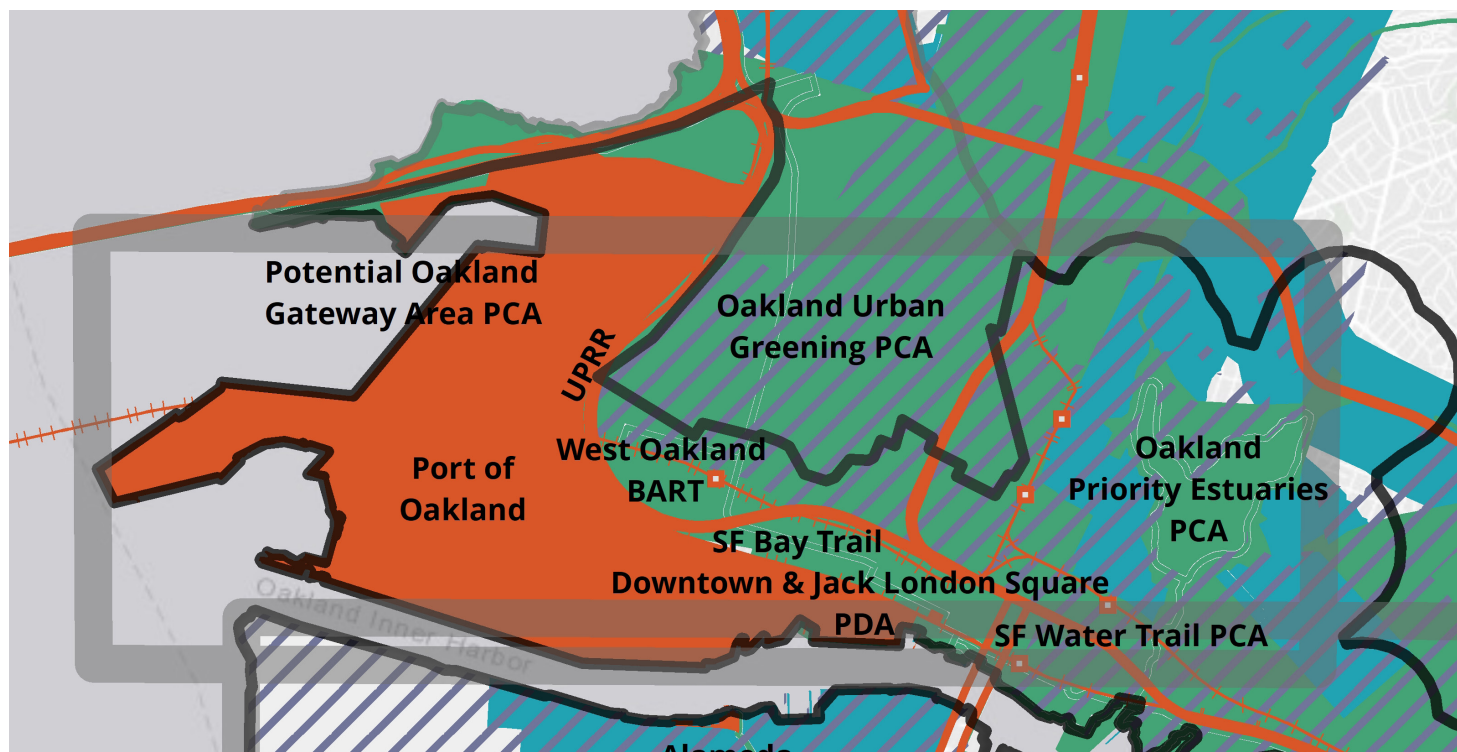
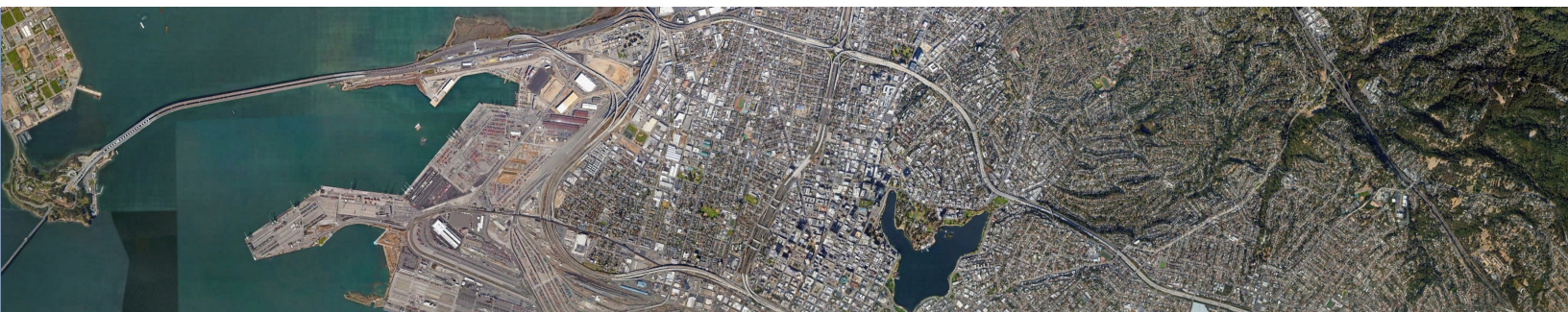


Figure 20h. Right: Identification of where Focus Area is within OLU. Left: Map of Focus Area containing regional systems. Individual assets assessed in this Focus Area are labeled on the map and listed on the following page.



Map data ©2019 by Google.

Why shared stories of vulnerability?

This Focus Area was selected because it contains a variety of regional systems, including numerous transportation routes, a PDA, multiple PCAs, and the West Oakland community. Due to overlap and dependencies among these regional systems in this area, the vulnerabilities of these systems to flooding and sea level rise are discussed together in shared stories of the shoreline, overtopping, and exposure to flooding as water levels rise. The goal of communicating shared vulnerabilities and consequences is to encourage multi-benefit solutions through collaborations and coordination.

Figure 20h. MAP OF REGIONAL SYSTEMS AND LIST OF INDIVIDUAL ASSETS ASSESSED WITHIN THIS FOCUS AREA LISTED BELOW:



TRANSPORTATION

- Port of Oakland
- Union Pacific Railroad
- I-880
- West Oakland BART



VULNERABLE COMMUNITIES

- West Oakland Community
- Downtown Oakland Community



PRIORITY DEVELOPMENT AREAS (PDAs)

- Downtown & Jack London Square PDA



PRIORITY CONSERVATION AREAS (PCAs)

- Potential Oakland Gateway Area PCA
- Oakland Priority Estuaries PCA
- Regional Trail System Gaps PCA
- San Francisco Bay Trail PCA
- San Francisco Bay Water Trail PCA

Shoreline today and into the future

SHORELINE TYPE STORY

What is the shoreline made up of now?

The shoreline in this Focus Area is mixed, including shoreline protection structures, berms, natural shorelines, and embankments.

SHORELINE DEVELOPMENT STORY

How will the shoreline change in the future?

This area is actively undergoing significant development activities that may influence impacts of sea level rise. There are also a number of activities that have recently been permitted by BCDC or have ongoing permit applications in progress. These major potential shoreline changes include:

- **Middle Harbor Shoreline Park.** 38-acre, mixed use shoreline park operated by the Port of Oakland.²¹
- **Howard Terminal.** “The Howard Terminal Project would feature a new open-air waterfront multi-purpose Major League Baseball stadium with a capacity of 35,000 that would serve as the new home for the Oakland A’s.”²²
- **Emeryville Cove.** Dock overhaul, wave attenuation
- **Powell street/Emeryville interchange**
- **Oakland Bulk Export Terminal**
- **Port of Oakland- 7th Street interchange project.** Public access improvements
- **Future Gateway Park, I-80 touchdown.** This project covers both sides of the freeway and encompasses extensive shoreline work. The project will come on in phases, with the Caltrans Pier Retention Project up first. Bay trail improvements and connections will play a role.



Downtown Oakland and Lake Merritt. Photos by SF Baykeeper, Cole Burchiel, and LightHawk.

Current and future flooding risk

OVERTOPPING STORY

Where is water coming over the shoreline?

At 12" TWL, small amounts of overtopping occur along the south side of the I-80 San Francisco-Oakland Bay Bridge touchdown and at the Lake Merritt Channel opening (Figure 21h). At 24" TWL, existing overtopping increases but does not expand to new areas in the OLU. At 36" TWL, overtopping increases between Howard Terminal (Port of Oakland) and Lake Merritt Channel. Overtopping also begins along Middle Harbor Shoreline Park and increases on the south side of the I-80 San Francisco-Oakland Bay Bridge touchdown. At 48" TWL, existing overtopping increases and small amounts of overtopping occur immediately northwest of Howard Terminal. At 66" TWL, shoreline protection structures bordering the east and west of Howard Terminal are overtopped, and the full shoreline from Howard Terminal to Lake Merritt Channel is overtopped. At 77" TWL, the majority of the Lake Merritt shoreline is overtopped. At 96" TWL, overtopping increases to the northwest of Howard Terminal towards the Oakland International Container Terminal, and the full north facing shoreline from the Ben E. Nutter Terminal to the I-80 San Francisco-Oakland Bay Bridge touchdown is overtopped. At 108" TWL, the entire shoreline within this Focus Area is overtopped.

FLOODING EXPOSURE STORY

Where does flooding occur?

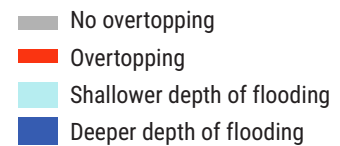
At 24" TWL, small amount of flooding enters the south side of the peninsula that is the I-80 San Francisco-Oakland Bay Bridge touchdown (Figure 22h). Areas surrounding the Lake Merritt Channel, including Estuary Park, Peralta Community College District, and several business centers and parking lots. At 48" TWL, the Downtown & Jack London Square PDA is exposed, as is the southbound on-ramp to I-880 at 5th Street. Existing flooding increases as water levels increase until 52" TWL, when flooding along the I-80 San Francisco-Oakland Bay Bridge touchdown moves inland to the community of West Oakland and the northern portion of the Port of Oakland. The Port of Oakland is also exposed at 52" TWL south of I-880 near Jack London Square, Howard Terminal, the Roundhouse Property, and the Oakland Intermodal Transportation Yard and UPRR. Also at 52" TWL, the southeast corner of BNSF International Gateway Terminal is exposed, as well as segments of the I-880 on-ramp at Union Street south of Prescott Street. Access to the Port and rail facilities are also impacted at 52" TWL, as is West Oakland BART Station. 52" TWL is also when water first floods north of I-880 into the south end of West Oakland. At 66" TWL, Port headquarters are flooded. At 77" TWL, areas at the TransPac terminal and Nutter terminal are exposed. The shoreline of Lake Merritt is also overtopped, extending flooding inland and north of the Lake. Existing flooding increases throughout the Focus Area as water levels increase.



12" TWL

OVERTOPPING AND FLOODING

Figure 21h. Total water levels selected that demonstrate first overtopping and/or significant flooding thresholds. Visit the Bay Shoreline Flood Explorer (explorer.adaptingtorisingtides.org) to see more TWLs.



FIRST FLOODING OF REGIONAL SYSTEMS ASSESSED

Regional Systems Impacted	12"	24"	36"	48"	52"	66"	77"	84"	96"	108"
Oakland Priority Creeks PCA										
Potential Oakland Gateway Area PCA										
Regional Trail System Gaps PCA										
San Francisco Bay Trail PCA										
San Francisco Bay Water Trail PCA										
West Oakland Community										
Union Pacific Railroad										
Downtown & Jack London Square PDA										
Oakland Priority Estuaries PCA										
I-880										
Port of Oakland										
West Oakland BART										
Local Roads										

Figure 22h. First exposure of regional systems. Individual assets within the four regional systems in this area are shown and colored bars represent when each asset is first exposed to flooding impacts.

Shared vulnerabilities to flooding

SHARED VULNERABILITY STORIES

Vulnerability assessments were conducted on individual assets and then shared vulnerabilities were identified for regional systems within each focus area. The vulnerability statements below reflect shared stories of vulnerability. Our goal is to emphasize the interconnections among and across local systems, and encourage shared multi-benefits adaptation solutions.

1. Community Vulnerability, Transportation, Shipping, and Contamination



Communities in West Oakland are socially vulnerable and also experience high contamination exposure from a variety of sources. Significant flooding occurs within the community, impacting housing and community services such as schools and churches. Contaminants present at nearby sites could be mobilized by floodwaters or rising groundwater, causing public health concerns in these communities. Aging storm water drainage could exacerbate early flooding. I-880 passes through the West Oakland community and disruption of this commuter and trucking route may disproportionately impact these communities. Additionally, the community relies on the actions of several uncoordinated shoreline owners and managers for flood protection, exacerbating vulnerabilities.

2. Regional Port



At the Port of Oakland, temporary or permanent disruption would affect people's employment and capacity to ship and receive goods. There is not another large-capacity container port in the region to which goods could be rerouted in the event of significant closures at the port of Oakland. The Port is indirectly vulnerable due to flooding on I-880, which connects both the Port of Oakland and Oakland International Airport, as well as on the rail system serving the Port. Disruption of the movement of cargo would have dramatic regional economic consequences. The Port also supports employment in a variety of sectors, and disruption of port activities means disruption of port-related jobs. The Port also provides shoreline flood protection for neighboring communities, many of which are socially vulnerable.



Port of Oakland. Photos by SF Baykeeper, Cole Burchiel, and LightHawk.



Shared consequences to flooding

SHARED CONSEQUENCE STORIES

This section translates shared vulnerability statements into stories of shared consequences. The ART program considers consequences through frames of sustainability: Society and Equity, the Economy and the Environment.



Society and Equity • Temporary or permanent disruption at the seaport would affect people's employment and capacity to ship and receive goods. Disruption of shipment of perishable, agricultural goods is a risk given the port's rapidly expanding business in exporting agricultural products. Disruption of rail access to the seaport could result in new truck traffic and air pollution within the surrounding neighborhoods and congestion on the local roads and Interstate system. I-880 passes through numerous the West Oakland community and disruption of this commuter route may disproportionately impact these communities. Flooding in this the Downtown & Jack London Square PDA occurs primarily in Jack London Square and along the Lake Merritt Creek. Impacts to residential housing and commercial areas near the shoreline at Jack London square will have major consequences for those living in that area, as well as reducing services for people living nearby. The presence of populations with medium to high social vulnerability may have more severe consequences for these groups as they have characteristics such as being a renter and not having a car, making them more reliant on a functioning public transit option.



Economy • The areas impacted by flooding including commercial and industrial zoning uses, impacting the local economy due to a loss of these industrial and commercial areas. The seaport supports employment in a variety of sectors, ranging from directly Port-related jobs such as longshoremen, to rail & truck operators, to farmers in the Central Valley. Disruption of port activities means disruption of port-related jobs, which are on average better than average wage jobs for the region. There is not another large-capacity container port in the region to which to reroute goods in the event of significant closures at the port of Oakland. I-880 connects both the Port of Oakland and Oakland International Airport and the disruption of the movement of cargo from either of these facilities would have dramatic regional economic consequences.

Environment • Contaminants present at various sites within the Port could be released into the Bay with floodwaters or contamination rising groundwater. These sites includes: soil and groundwater near Berths 25 and 26, a leaky underground storage tanks near the old Albers Milling Company site at Berth 30, and the former Oakland Army base lands. If rail is disrupted, an alternative may be to increase the use of trucks to bring goods to and from the Port, with associated air quality impacts. This area has many natural areas along the shoreline that are exposed to flooding. This can limit the amount of open space areas for natural ecosystems as well as reduce recreational options for residents and visitors who use trails around the lake and San Francisco Bay for enjoyment. Additionally, urban development combined with sea level rise will constrain wetlands from migrating to keep pace with flooding.



Advancing adaptation solutions

FITTING INTO REGIONAL STORY

How are local areas contributing to Regional Hot Spots?

The regional scale analysis of ART Bay Area identified clusters of highest consequences around the region, called “Regional Hot Spots.” These areas include places that contain the top five highest consequences in the region for 1) any transportation asset and 2) either a PDA or PCA, and 3) the presence of a vulnerable community block group at any given water level.

Datasets were identified for each regional system to provide a measure of consequence to quantify impacts in the event of flooding. A full list of consequences used for each

Regional Hot Spot at 36” TWL



- Regional Hot Spot
- Transportation Infrastructure
- Vulnerable Community
- PDA
- PCA

Figure 23h. Downtown Oakland/West Oakland Hot Spot: From 36” TWL to 108” TWL, this Focus Area contains clusters of assets that have among the highest consequences of flooding in the region.

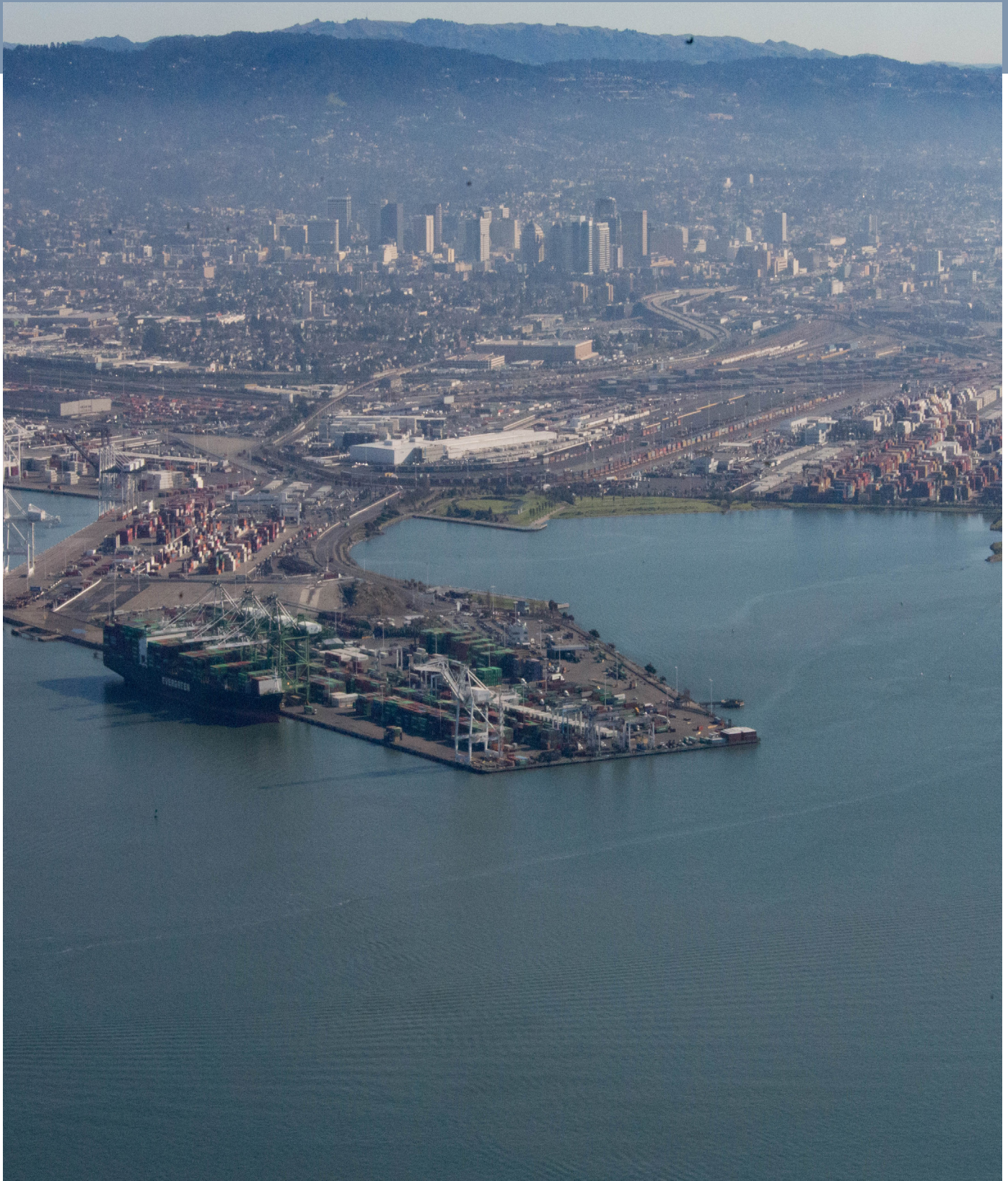
regional system can be found in Chapter 2.1 Regional Hot Spots.

The West Oakland and Downtown Oakland Focus Area is a Regional Hot Spot, meaning it contains a cluster of assets that have among the highest consequences of flooding in the region.

The Downtown Oakland/West Oakland cluster is driven by the Downtown & Jack London Square PDA (2010 and 2040 residential units, residential units growth, and job units growth), Port of Oakland, and Jack London Ferry terminal, as well as significant social vulnerability and contamination.

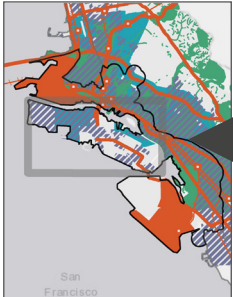
It becomes a Regional Hot Spot starting at 36” TWL, and continues to higher total water levels (Figure 23h).

Chapter 4 Regional Adaptation provides adaptation responses for regional issues.



Port of Oakland and Downtown Oakland in the distance. Photos by SF Baykeeper, Cole Burchiel, and LightHawk.

Focus Area C: *Alameda*



Location

This Focus Area includes all of Alameda Island. It is roughly 7 square miles (Figure 24h).

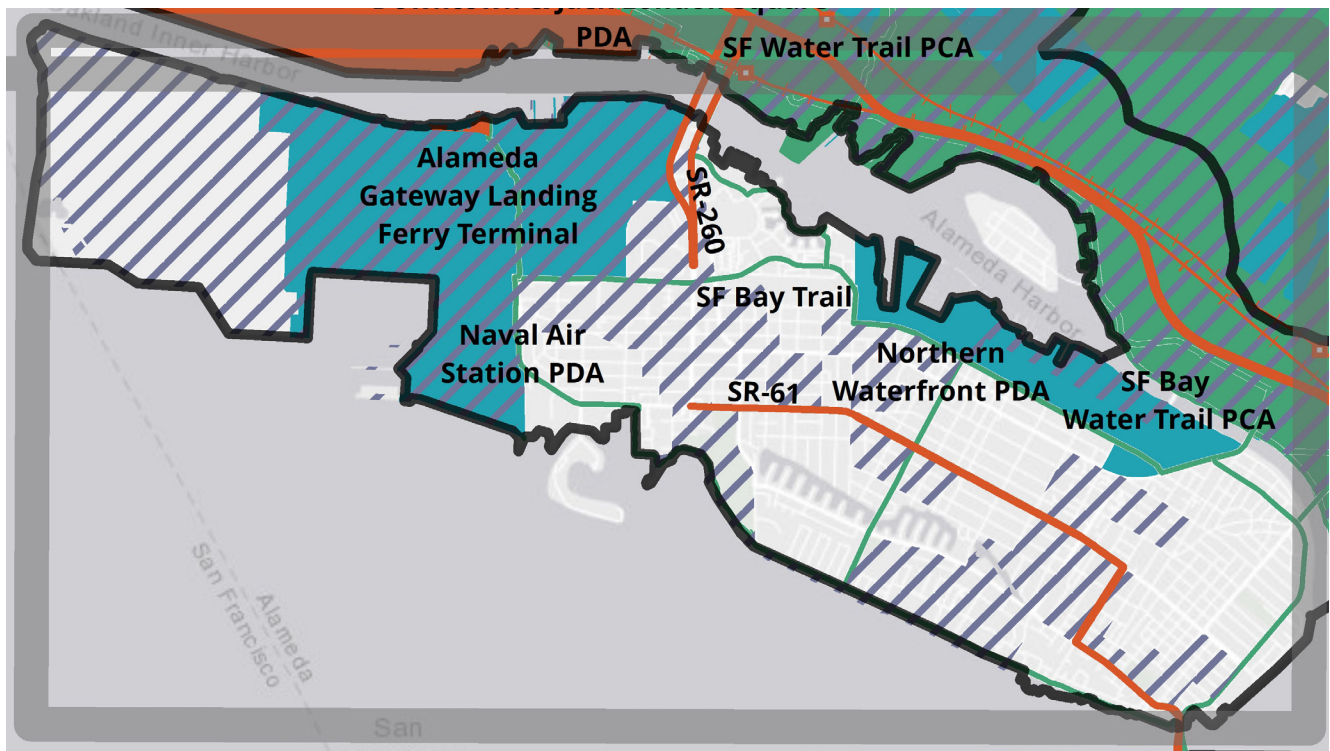


Figure 24h. Top: Identification of where Focus Area is within OLU. Bottom: Map of Focus Area containing regional systems. Individual assets assessed in this Focus Area are labeled on the map and listed on the following page.



Why shared stories of vulnerability?

This Focus Area was selected because it contains a variety of regional systems, including key transportation routes, PDAs, and PCAs. Due to overlap and dependencies among these regional systems in this area, the vulnerabilities of these systems to flooding and sea level rise are discussed together in shared stories of the shoreline, overtopping, and exposure to flooding as water levels rise. The goal of communicating shared vulnerabilities and consequences is to encourage multi-benefit solutions through collaborations and coordination.

Figure 24h. MAP OF REGIONAL SYSTEMS AND LIST OF INDIVIDUAL ASSETS ASSESSED WITHIN THIS FOCUS AREA LISTED BELOW:



TRANSPORTATION

- Alameda Gateway Ferry Terminal
- SR-260 (Webster Tube)
- SR-61 (Doolittle Drive)



VULNERABLE COMMUNITIES

- Alameda Community



PRIORITY DEVELOPMENT AREAS (PDAs)

- Naval Air Station PDA
- Northern Waterfront PDA



PRIORITY CONSERVATION AREAS (PCAs)

- San Francisco Bay Trail PCA
- San Francisco Bay Water Trail PCA

Shoreline today and into the future

SHORELINE TYPE STORY

What is the shoreline made up of now?

The shoreline in this Focus Area is mostly shoreline protection structures, with some berms, natural shorelines, wetlands, and embankments. The northern portion of Alameda Island is primarily fill.

SHORELINE DEVELOPMENT STORY

How will the shoreline change in the future?

This area is actively undergoing significant development activities that may influence impacts of sea level rise. There are also a number of activities that have recently been permitted by BCDC or have ongoing permit applications in progress. These major potential shoreline changes include:

- Alameda Point
- Mixed use development at Alameda Point²³
- Encinal Beach and Encinal Terminal
- WETA Operation and Maintenance Facility
- Crown Beach- beach nourishment project
- US Coast Guard Island revetment project
- San Leandro Island redevelopment projects
- Mixed Use Development and Waterfront Park at 5th and Bette Streets
- Additional industrial area shoreline developments



Alameda. Photos by SF Baykeeper, Cole Burchiel, and LightHawk.



Current and future flooding risk

OVERTOPPING STORY

Where is water coming over the shoreline?

At 12" TWL, small amounts of overtopping occur along the southwest shore of Alameda in a currently underdeveloped part of the island. At 24" TWL, small pockets of overtopping occur on the north side of the island near the ferry terminal. At 36" TWL, overtopping increases along the western edge of the island along the north and south sides. Overtopping also begins to occur on the southeastern edge of the island adjacent to San Leandro Bay. Overtopping also occurs immediately adjacent to the Webster and Posey Tubes (SR-260). At 48" TWL, the majority of the island is overtopped to some degree. Overtopping increases with increasing water levels. (Figure 25h).

FLOODING EXPOSURE STORY

Where does flooding occur?

At 12" TWL, a small, underdeveloped section of the former Navy Base at the southwestern end of the island is exposed. At 24" TWL, water enters the Naval Air Station PDA and surrounding area at the northwest end of Alameda is flooded. This includes local road surround the ferry terminal including Red Line Avenue and Main Street. At 24" TWL, access via local roads and parking areas surrounding the Alameda Gateway Ferry Terminal is impacted. At 36" TWL, the entrances to the Webster and Posey Tubes (SR-260) are flooded, including the ventilation and fan systems used for the tunnels. Also at 36" TWL, the southeastern side of the island begins to flood along Fernside Boulevard and SR-61 as it attached to Bay Farm Island. At 48" TWL, existing flooding extends, and the Northern Waterfront PDA is flooded. Flooding along Otis Drive in southwestern Alameda also extends significantly. Access to the Webster and Posey Tubes (SR-260) is impacted from the Oakland side at 66" TWL when Jack London Square and I-880 approaches are flooded. Existing flooding increases as water levels increase (Figure 26h).



12" TWL



48" TWL

OVERTOPPING AND FLOODING ▲

Figure 25h. Two total water levels selected that demonstrate first overtopping and/or significant flooding thresholds. Visit the Bay Shoreline Flood Explorer (explorer.adaptingtorisingtides.org) to see more TWLs.

- No overtopping
- Overtopping
- Shallower depth of flooding
- Deeper depth of flooding

FIRST FLOODING OF REGIONAL SYSTEMS ASSESSED

Regional Systems Impacted	12"	24"	36"	48"	52"	66"	77"	84"	96"	108"
San Francisco Bay Trail PCA										
San Francisco Water Trail PCA										
Northern Waterfront PDA										
Naval Air Station PDA										
Alameda Gateway Ferry Terminal										
Webster/Posey Tubes SR-260										
Local roads- Park St. and Fruitvale bridges										

Figure 26h. First exposure of regional systems. Individual assets within the four regional systems in this area are shown and colored bars represent when each asset is first exposed to flooding impacts.

Shared vulnerabilities to flooding

SHARED VULNERABILITY STORIES

Vulnerability assessments were conducted on individual assets and then shared vulnerabilities were identified for regional systems within each focus area. The vulnerability statements below reflect shared stories of vulnerability. Our goal is to emphasize the interconnections among and across local systems, and encourage shared multi-benefits adaptation solutions.

1. Limited Access and Egress



Alameda has limited options for getting on and off the island. The ferry terminal is vulnerable due to exposure of its electrical systems and gangways. Additionally, the ferry serves a critical emergency

Alameda. Photo by SF Baykeeper, Cole Burchiel, and Lighthawk.



function role in a disaster. Temporary or permanent disruption in access to existing terminals would inhibit WETA from performing this function. The Posey Tube is a primary route for commuters and travelers to access services and goods in Oakland and beyond. Even a temporary closure of the road would have significant impacts on regional commuter and goods movement since there are limited local alternatives. Alameda has a high population of residents a car, making it challenging for them to access goods and services if transit routes are disrupted.



Shared consequences to flooding

SHARED CONSEQUENCE STORIES

This section translates shared vulnerability statements into stories of shared consequences. The ART program considers consequences through frames of sustainability: Society and Equity, the Economy and the Environment.



Society and Equity • The Posey Tube is a primary route for commuters and travelers to access services and goods in Oakland and beyond. If disrupted, the ability to get off the island in an emergency would be limited to four bridges on the east end of the island. The large presence of residents who are renters, very low income, and single parents, without a car and have a disability will affect how flooding impacts disrupt the PDAs current and future residents. Each of these characteristics presents a new set of challenges, for example, people without a car will have a difficult time getting to goods and services if transit routes are disrupted. If WETA ferry services experience major disruptions and would-be passengers are forced to drive rather than take the train, air quality would decrease due to increased exhaust from cars during road congestion. Disruption of service or access to ferry terminal facilities would inhibit WETA's emergency response mandate in the event of a catastrophic event.



Economy • The Webster and Posey Tubes (SR-260) carry approximately 57,000 cars and the tubes serve approximately 535 daily truck trips each day. Even a temporary closure of the road would have significant impacts on regional commuter and goods movement since there are limited local alternatives. PDAs on Alameda are envisioned to become major employment centers, but there is not currently a large amount of jobs in the PDAs. Loss of the WETA ferry service would affect the approximately 2.5 million travelers that use the service to access jobs, recreation, or services in the Bay Area.

Environment • This area has both a long history of contamination and is also home to endangered species. Near the Alameda Gateway Landing terminal, there was past copper contamination from shipbuilding activities. The Navy cleaned up this site in 2010 using an emergent technology to embolize copper in the soil. Groundwater testing will continue until 2020 to determine the success of cleanup activities. Copper is highly mobile in groundwater. If WETA ferry services experience major disruptions and would-be passengers are forced to drive rather than take the train, air quality would decrease due to increased exhaust from cars during road congestion.



Advancing adaptation solutions

FITTING INTO REGIONAL STORY

How are local areas contributing to Regional Hot Spots?

The regional scale analysis of ART Bay Area identified clusters of highest consequences around the region, called “Regional Hot Spots.” These areas include places that contain the top five highest consequences in the region for 1) any transportation asset and 2) either a PDA or PCA, and 3) the presence of a vulnerable community block group at any given water level.

Datasets were identified for each regional system to provide a measure of consequence to quantify impacts in the event of flooding. A full list of consequences used for each

Regional Hot Spot at 36” TWL



- Regional Hot Spot
- Transportation Infrastructure
- Vulnerable Community
- PDA
- PCA

Figure 27h. Alameda Hot Spot: From 36” TWL to 108” TWL, this Focus Area contains clusters of assets that have among the highest consequences of flooding in the region.

regional system can be found in Chapter 2.1 Regional Hot Spots.

The Alameda Focus Area is a Regional Hot Spot, meaning it contains a cluster of assets that have among the highest consequences of flooding in the region.

The Alameda cluster is driven by the Naval Air Station PDA (2010 residential units), Alameda Gateway Ferry Terminal, and Bay Trail, as well as socially vulnerable and contaminated block groups.

It becomes a Regional Hot Spot starting at 36” TWL, and continues to higher total water levels (Figure 27h).

Chapter 4 Regional Adaptation provides adaptation responses for regional issues.

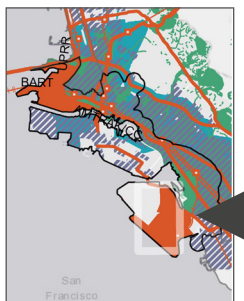


Alameda. Photo by SF Baykeeper, Cole Burchiel, and LightHawk.



Area of Impact D:

Oakland International Airport



Location

This Area of Impact includes the Oakland International Airport, Bay Farm Island, and Doolittle Drive (Figure 28h).

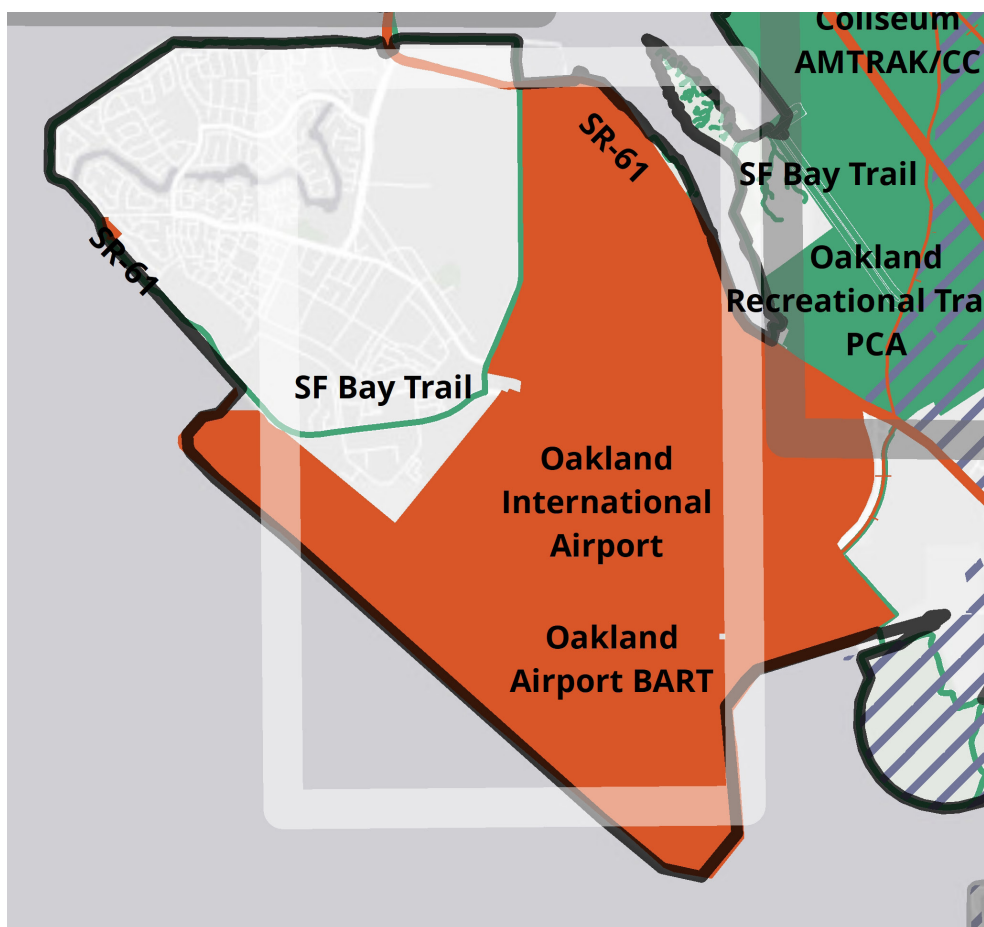


Figure 28h. Top: Identification of where Area of Impact is within OLU. Bottom: Map of Area of Impact containing regional systems. Individual assets assessed in this Area of Impact are labeled on the map and listed on the following page.



Why shared stories of vulnerability?

This Area of Impact was selected because it contains a variety of regional transportation systems and presents significant vulnerability in disrupting air travel. It also contains a PCA. Due to overlap and dependencies among these regional systems in this area, the vulnerabilities of these systems to flooding and sea level rise are discussed together in shared stories of the shoreline, overtopping, and exposure to flooding as water levels rise. The goal of communicating shared vulnerabilities and consequences is to encourage multi-benefit solutions through collaborations and coordination.

Figure 28h. MAP OF REGIONAL SYSTEMS AND LIST OF INDIVIDUAL ASSETS ASSESSED WITHIN THIS AREA OF IMPACT LISTED BELOW:



Shoreline today and into the future

SHORELINE TYPE STORY

What is the shoreline made up of now?

The primary shoreline types around the Bay side of OAK and Bay Farm Island (from south to north) are engineered levees. These transition to berms around the northern face of Bay Farm Island before becoming engineered levees again between the Bay Farm Bridge and San Leandro Bay. Doolittle Drive is the first line of defense along parts of San Leandro Bay, with natural shorelines dominating as it curves around into the Airport Channel of Martin Luther King Jr. Shoreline Park. There is secondary shoreline protection within the Oakland International Airport, including berms and embankments.

SHORELINE DEVELOPMENT STORY

How will the shoreline change in the future?

This area is actively undergoing development activities that may influence impacts of sea level rise. There are also a number of activities that have recently been permitted by BCDC or have ongoing permit applications in progress. These major potential shoreline changes include:

- **Oakland International Airport** - Perimeter dyke improvements for flood defense (cost \$47 million), as part of its 5-year capital improvement plan. Partial funding received from State Local Levee Assistance Program (LLAP), \$6.4 million.
- **Bay Trail Improvements (Doolittle Drive Trail and Tidewater Day Use Area)**- Project scope is expanded to incorporate sea level rise adaptation considerations
- **Doolittle Drive Adaptation and Arrowhead Marsh Accretion**- Exploring nature-based adaptation strategies to sea level rise; currently in design concept phase

Oakland International Airport. Photo by SF Baykeeper, Cole Burchiel, and LightHawk.



Current and future flooding risk

OVERTOPPING STORY

Where is water coming over the shoreline?

At 12" TWL, berms and natural shorelines within the Airport Channel are overtopped. At 24" TWL, low points in engineered levees at the base of Airport Channel and at the northern end of Harbor Bay Parkway are overtopped including a small stretch of Doolittle Drive at Harbor Bay Parkway. At 36" TWL, larger sections of Doolittle Drive overtop as well as internal berms and embankments within OAK. Additionally, an embankment that follows Island Drive, McCartney Road, and Maitland Drive also are overtopped, as well as lagoons on Bay Farm Island. At 48" TWL, small stretches of the OAK outboard-engineered levees overtop near San Leandro (Figure 29h).

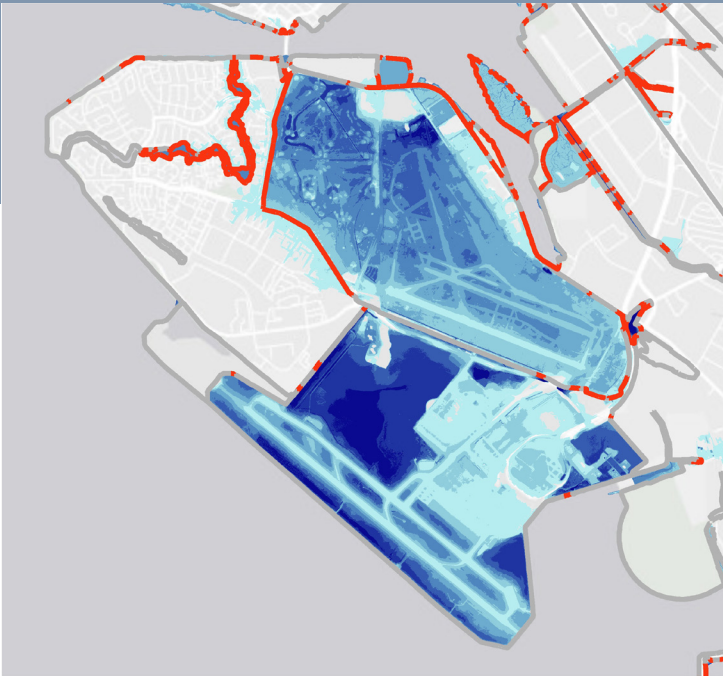
FLOODING EXPOSURE STORY

Where does flooding occur?

At 12" TWL, primarily small wetlands within San Leandro Bay are exposed to flooding. At 24" TWL, a small segment of Doolittle Drive at the northern end of Harbor Bay Parkway is exposed. At 36" TWL, all of OAK is exposed to flooding, including the North and South Fields, Terminal 1, Control Tower, Fire Station #22, and South Field Tank Farm. Additionally, ground transportation access to the airport from Doolittle Drive, Airport Drive, Ron Cowan Parkway, and the BART OAK Connector would be exposed, as well as access roads such as Airport Drive, Ron Cowan Parkway, and Harbor Bay Parkway. Additionally, residential areas on Bay Farm Island are exposed to flooding, including major access roads Island Drive and McCartney Road. (Figure 30h).



12" TWL



36" TWL

OVERTOPPING AND FLOODING ▲

Figure 29h. Two total water levels selected that demonstrate first overtopping and/or significant flooding thresholds. Visit the Bay Shoreline Flood Explorer (explorer.adaptingtorisingtides.org) to see more TWLs.

- No overtopping
- Overtopping
- Shallower depth of flooding
- Deeper depth of flooding

FIRST FLOODING OF REGIONAL SYSTEMS ASSESSED

Regional Systems Impacted	12"	24"	36"	48"	52"	66"	77"	84"	96"	108"
San Francisco Bay Trail PCA										
SR-61/Doolittle Drive										
Oakland International Airport										
Coliseum Station Complex										

Figure 30h. First exposure of regional systems. Individual assets within the four regional systems in this area are shown and colored bars represent when each asset is first exposed to flooding impacts.

Shared vulnerabilities to flooding

SHARED VULNERABILITY STORIES

Vulnerability assessments were conducted on individual assets and then shared vulnerabilities were identified for regional systems within each focus area. The vulnerability statements below reflect shared stories of vulnerability. Our goal is to emphasize the interconnections among and across local systems, and encourage shared multi-benefits adaptation solutions.

1. Communities



The Oakland Airport is vulnerable due to exposed runways, connecting roads, and transit access. Interruptions to operations would affect the ability of people and cargo to travel to and from the Bay Area and create pressures at other airports. The disruption of operations could have an effect on local employment, at the airport and at facilities associated with the airport (hotels, car rental companies). Additionally, the airport is a lifeline facility and needs to be operable in the event of an emergency. If it is inoperable, it may not be able to fulfill its role in emergency response, which would reduce the resilience of local communities. The airport also is located adjacent to the vulnerable community of East Oakland, and disruptions to jobs would affect local employment and mobilization of contaminants such as jet fuel due to flooding would have consequences for public health.

2. Impacts to Ecosystems



Sensitive ecosystems, including wetlands and the Bay, are immediately adjacent to the airport and at least one pipeline serving the airport goes underneath a wetland. These ecosystems provide habitat for many species, including several endangered species. The airport stores and transports jet fuel and diesel fuel. Damage to fuel lines or storage facilities due to pipeline erosion or flooding could harm the Bay and wetlands. In addition, changes to the dikes and rip-rap that protect North Field could have an environmental impact. Due to the presence of pipelines in the perimeter dike, a catastrophic failure of the dike could cause environmental damage if the pipelines were to break and release fuel into the Bay.

Shared consequences to flooding

SHARED CONSEQUENCE STORIES

This section translates shared vulnerability statements into stories of shared consequences. The ART program considers consequences through frames of sustainability: Society and Equity, the Economy and the Environment.



Society and Equity • OAK serves approximately 6.4 million

commercial passengers in 2017. Interruptions to operations would affect people's ability to travel to and from the Bay Area and create pressures at other airports. The disruption of operations could have an effect on local employment, at the airport and at facilities associated with the airport (hotels, car rental companies). The airport is a lifeline facility and needs to be operable in the event of an emergency (e.g., bringing in supplies, personnel, etc.). If the terminals are flooded or damaged, it may not be able to fulfill its role in emergency response, which would reduce the resilience of local communities. The airport is located adjacent to the Vulnerable Community of East Oakland, disruptions in local employment or release of contaminants would have consequences for public health.



Economy • OAK generates thousands of jobs and brings money into the local economy. In 2013, there were approximately 14,000 on-airport jobs. Airlines/businesses would leave and passengers would fly at other Bay Area airports if Terminal 1 had to be rebuilt or relocated. North Field includes some cargo facilities for Oakland International Airport, which serves as the West Coast hub for FedEx and also has a large UPS presence. The airport ranks 1st in the region in terms of tons of cargo handled, and interruptions to cargo facilities could slow the exchange of goods in the region and affect employment.



Environment • Sensitive receptors, including wetlands and the Bay, are immediately adjacent to the facility and at least one pipeline goes underneath a wetland. The facility stores and transports jet fuel and diesel fuel. If a storage container or pipeline were to break and leak due to a climate or seismic event, it could harm the Bay and wetlands. North Field borders San Francisco Bay, including parks and marshes that are part of MLK Regional Shoreline and which provide habitat for many species, including several endangered ones. Any hazardous materials at the site could be washed out to the Bay with floodwaters. In addition, changes to the dikes and rip-rap that protect North Field could have an environmental impact. Due to the presence of pipelines in the perimeter dike, a catastrophic failure of the dike could cause environmental damage if the pipelines were to break and release fuel into the Bay.

Advancing adaptation solutions

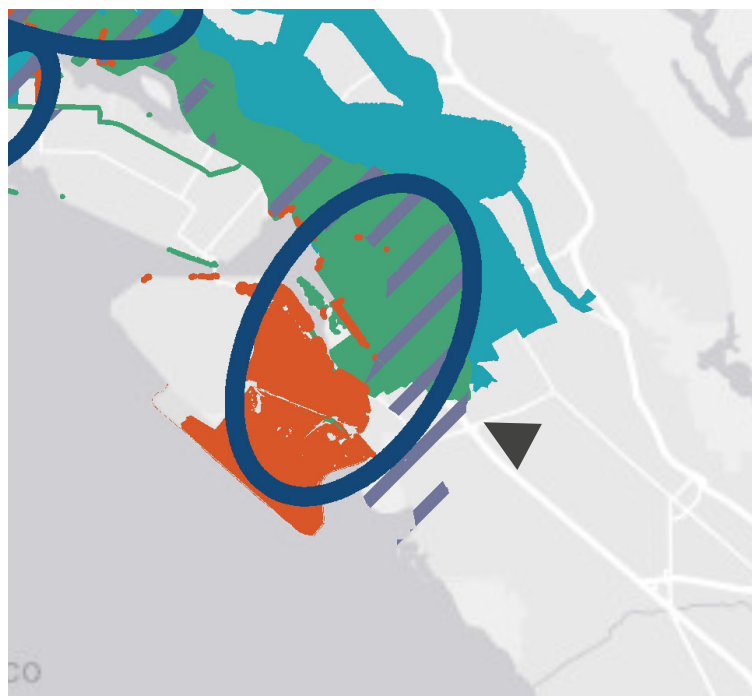
FITTING INTO REGIONAL STORY

How are local areas contributing to Regional Hot Spots?

The regional scale analysis of ART Bay Area identified clusters of highest consequences around the region, called “Regional Hot Spots.” These areas include places that contain the top five highest consequences in the region for 1) any transportation asset and 2) either a PDA or PCA, and 3) the presence of a vulnerable community block group at any given water level.

Datasets were identified for each regional system to provide a measure of consequence to quantify impacts in the event of flooding. A full list of consequences used for each regional system can be found in Chapter 2.1 Regional Hot Spots.

Regional Hot Spot at 36” TWL



- Regional Hot Spot
- Transportation Infrastructure
- Vulnerable Community
- PDA
- PCA

Figure 31h. East Oakland/Coliseum Hot Spot: From 36” TWL to 108” TWL, this Focus Area contains clusters of assets that have among the highest consequences of flooding in the region.

The Oakland International Airport Area of Impact is within the East Oakland/Coliseum Regional Hot Spot, meaning it contains a cluster of assets that have among the highest consequences of flooding in the region.

The East Oakland/Coliseum cluster is driven by the Coliseum BART PDA (2010 job spaces, 2040 residential units, and growth in residential units), Oakland Airport (both passenger boardings and cargo), and socially vulnerable and contaminated block groups.

It becomes a Regional Hot Spot starting at 36” TWL, and continues to higher total water levels (Figure 31h).

Chapter 4 Regional Adaptation provides adaptation responses for regional issues.



Oakland International Airport. Photo by Sheila Sund licensed by CC BY 2.0

Endnotes

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