December 2022

Local Hazard Mitigation Plan

San Francisco Bay Area Rapid Transit District

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Introduction

Hazard mitigation is a sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. A local hazard mitigation plan (LHMP) identifies the hazards a community or region faces, assesses their vulnerability to the hazards and identifies specific actions that can be taken to reduce the risk from the hazards. The Federal Disaster Mitigation Act of 2000 (DMA 2000) outlines a process which cities, counties, and special districts can follow to develop a LHMP. Development of this plan is a requirement for mitigation benefits from California Governor's Office of Emergency Service (Cal OES) and the Federal Emergency Management Agency (FEMA). Updates to the LHMP are required every five years.

The San Francisco Bay Area Rapid Transit District (the District or BART) prepared this single-jurisdiction LHMP (Plan herein) to be compliant to federal requirements described 44 CFR Section 201.6 Local Mitigation Plans. The Plan reflects the District's commitment to reduce or eliminate risks associated with natural disasters on BART operations and the communities that depend on BART for transit services.

The Plan follows the guidelines outlined in the FEMA Local Mitigation Planning Handbook (March 2013) and FEMA Local Mitigation Plan Review Guide (October 2011). The five key elements of the Plan aim to produce a roadmap for identifying and mitigating hazard exposure.

A. Planning Process
B. Hazard Identification and Risk Assessment
C. Mitigation Strategy
D. Plan Review, Evaluation, and Implementation
E. Plan Adoption

The Plan includes participation from other local jurisdictions and members of the community to strengthen and enhance mitigation response.

1.1 Planning Boundaries

The scope of the Plan covers the District's jurisdiction, namely, District's operated property within BART's Right-of-Way.

The Plan is a single-jurisdiction plan. Due to the geographical uniqueness of the BART system, partnering in a multi-jurisdictional plan is challenging. Generally, multi-jurisdiction plans that do exist in the Bay Area (e.g. San Mateo County Multijurisdictional LHMP) do not encompass the same geography as the District's. MTC's Multi-Jurisdiction Hazard Mitigation Plan does encompass BART's geography[1]; District may consider consolidating with MTC on hazard mitigation planning in the future.

[1] Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) | Metropolitan Transportation Commission (ca.gov)

1.1.1 BART System Description

BART is a heavy-rail public transit system serving the San Francisco Bay Area. BART operates on 131 miles of track, with 50 stations in five counties (San Francisco, San Mateo, Alameda, Contra Costa, and Santa Clara). BART carries approximately 405,000 weekday passenger trips (prior to COVID-19 pandemic)[2]. Refer to Appendix A for more detailed description.

BART also operates eBART, a diesel multiple unit light rail system, and the Oakland Airport Connector (OAC), an automated driverless people-mover.

1.1.2 BART Asset Profile

The Plan leverages asset data from the BART M&E Asset Register and Asset Risk Register for conducting the hazard risk assessment and identifying mitigation measures. The register identifies 219 types of assets[3]. The following is a high-level description of some of the key fixed assets.

- **Passenger stations** - There are currently 50 stations in the existing system. There are three basic types of station construction – aerial, at-grade, and subway. The stations are further classified between center platforms (located between tracks), and external platforms (located on the outside of the two tracks).

- **Trackway** - Three basic types of trackway construction are used: at-grade, aerial, and subway. At-grade tracks are typically ballasted track using concrete ties. Aerial and subway tracks are typically constructed using concrete slab track with direct fixation fasteners. Continuous walkways are provided adjacent to all tracks to provide for emergency evacuation and maintenance access.

- **Substations** – substations provide traction power used for vehicle propulsion. Traction power is stepped down from 34.5 kV AC to 1 kV DC and sent to the electrified third rail system mounted outside of and in parallel with the running rails.

- **Switching Stations** – These stations are the receiving points for high voltage power from the electric utility. The switching stations convert the power to 34.5 kV AC and distributed to substations.

- **Train Control Rooms** – These rooms house the automatic train control system equipment. The system provides vital train functions including train detection, speed control and switch machine operations. The system also provides non-vital train functions including platform functions, automatic route requests, and communication with operations control center.

- **Shops/Yards** – BART has four yards. The yards provide dispatching of trains for revenue service; train storage during non-revenue and off-peaks periods; and train washing and cleaning. BART has four shops co-located with the yards for repair and

[2] https://www.bart.gov/about
[3] M&E Asset Register dated 2019-09-04 Rev 4.

maintenance of train cars. A fifth shop provides maintenance of non-revenue vehicles. BART has dedicated shops for other BART services (eBART, Oakland Airport Connector).

BART prioritizes its assets (e.g. criticality) based on the impact of an asset failure on reliable and safe service capabilities. BART has defined the following criticality ratings (from 1 to 5):

1 – Failure results in immediate risk of injury or death.

2 – Failure results in immediate impact to service capabilities including shutdown of any single or multiple operations or systems. This failure will prevent service to the public due to operational, safety, or environmental issues.

3 – Failure results in a limited impact to service capabilities or shut down of any single or multiple operations or systems. Asset(s) assigned this criticality may have redundancy or established by-pass equipment or systems but may limit the service schedule. Although this asset(s) could become highly critical if the redundancy or by-pass fails, identified issues should be planned and scheduled with a higher work order priority.

4 – Failure results in a limited impact to service capabilities with a contingency that does not depend on a back-up system.

5 – Failure has no impact to service capabilities.

For planning purposes, the Plan's hazard exposure assessment is conducted for assets with criticality rating of 1 or 2.

Planning Process

Regulation Checklist
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the places for each jurisdiction? (44 CFR 201.6(c)(1))
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (44 CFR 201.6(b)(2))
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (44 CFR 201.6(b)(1) and 201.6(c)(1))
A4. Does the Plan document the review and incorporation of existing plans, studies, reports, and technical information? (44 CFR 201.6(b)(3))
A5. Is there discussion on how the community(ies) will continue public participation in the plan maintenance process? (44 CFR 201.6(c)(4)(iii))
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (44 CFR 201.6(c)(4)(i))

2.1 Overview

This section outlines the efforts undertaken in the preparation of the Plan and process taken.

2.2 Schedule

The following Table 1 summarizes the key planning activities and dates carried out by the Core Administrative Team with support from District staff.

Table 1: Activity Schedule

Date	Activity
7/26/21 - 7/29/21	Cal OES/FEMA local hazard mitigation planning workshop (Code G318)
8/10/21	Kick off Meeting; identify responsibilities
9/07/21	Title VI/EJC Meeting 1
September to October 2021	Develop hazard profiles and GIS maps; vulnerability assessment

Date	Activity
September to October 2021	Review existing documents including the Plan, District plans; Update goals; update engagement strategy; update capability assessment and critical facilities list;
12/14/2021	Title VI/EJC Meeting 2
12/21/2021	Emergency Preparedness Task Force Committee Meeting 1
Nov 2021 thru Feb 2022	Compile status of existing mitigation strategies; compile mitigation strategies, as needed.
Feb - April 2022	Compile and update draft Plan
3/15/22- 3/31/22	External agency surveys
4/5/2022	Title VI/EJC Meeting 3
4/12/2022	Emergency Preparedness Task Force Committee Meeting 2
March/April	Core Administrative Team review of draft Plan
May	EPTFC and other District staff review of draft Plan
May	Revisions to draft Plan
6/3/22 – 7/3/22	Public comment period; Plan posted on bart.gov and sent to external stakeholders
July	Incorporation of public comments
TBD (est. August)	Submittal to CalOES/FEMA Review
TBD (est. Winter 2022)	Board Adoption

2.3 Existing Document Review

The following key existing documents were reviewed and incorporated into the Plan.

Table 2: Document Review List

Study/Plan/Reports	Key Information
ABAG, Bay Area Risk Landscape Draft Report	Hazard characterization
ABAG, Disasters Affecting the San Francisco Bay Area, Federally Declared Disasters 1950-2015, State Declared Disasters 1950-2012	Declared disasters
ABAG, Policy Agenda for Recovery, March 2015	Resiliency information
After action reports from haywire. Appendix to plan	Seismic information
BART, Capital Needs Inventory 2021	Mitigation strategies
BART, Emergency Plan	Emergency response procedures
BART, FY 22 Annual Adopted Budget	Financial Information
BART, Local Hazard Mitigation Plan, 2017	Current LHMP plan
BART, M&E Asset Register, 2021	Asset information, criticality
BART Sea Level Rise and Flooding Resiliency Study, 2020	SLR and flooding information
BART, Seismic Vulnerability Study, 2002	Seismic information
BART, Site specific liquefaction studies	Hazard information
BART, Strategic Plan Framework, 2015	District goals
Cal Adapt	Climate change information
California Fourth Climate Change Assessment	Climate change information
CalOES, State Hazard Mitigation Plan, 2018	Hazard information, hazard mitigation strategies

Study/Plan/Reports	Key Information
FEMA, Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards, 2013	Mitigation strategies
Haywired, (participated, includes projection of downtime)	Seismic information
USGS San Francisco Bay Area Maps	Tsunami and Inundation Maps

2.4 Core Administrative Team

A Core Administrative Team is tasked with leading the update of the Plan. The team members include:

- Norman D. Wong, Principal Engineer, Office of District Architect
- Michael Brill, Emergency Manager, Office of the Police Chief, BART Police Department
- Phoebe Cheng, Group Manager, Civil/Structural/Track Engineering, & Construction Engineering Services

Together, the administrative team is responsible for coordinating the planning process, reviewing and updating sections of the Plan. Key efforts carried out or coordinated by the Core Administrative Team include but are not limited to:

- Participation in Cal OES LHMP workshop
- Review of progress since the last Plan update
- Review of existing District plans
- Identification of critical assets
- Hazards identification and risks assessment
- Mitigation strategies development
- Engagement with the Core Planning Teams:
    - Emergency Preparedness Task Force Committee
    - Title VI Environmental Justice Advisory Committee
- Engagement with local agencies in the planning process
- Solicitation and incorporation of feedback from external stakeholders and the public.

2.5 Core Planning Teams

There were two Core Planning Teams invited to participate in the Plan development and planning process. The first Core Planning Team is the Task Force Committee called the Emergency Preparedness Task Force Committee (EPTFC). The second Core Planning Team is the Title VI/Environmental Justice Advisory Committee. The Plan could not be successfully developed without the inclusion of these teams.

Engagement discussions and comments received from the Core Planning Teams were incorporated into the final Plan submitted to the CalOES/FEMA.

2.6 Internal Engagement

As part of the planning process, the following internal engagements were conducted to ensure there was coordination and agreement within various BART departments on the Plan.

See Appendix B for documentation of engagement activities.

2.6.1 Emergency Preparedness Task Force Committee (EPTFC)

The Emergency Preparedness Task Force Committee (EPTFC) serves as a steering committee to the District's Emergency Preparedness Program**.** They assist the Core Administrative Team in plan evaluation and decision making. Functions of the EPTFC include:

- Advise, approve, and endorse plans.
- Provide subject matter expertise in regards to preparedness, training, prevention, mitigation, response and recovery strategies for district restoration of critical infrastructure and essential services.
- Peer review Emergency Plan and Local Hazard Mitigation Plan.
- Act as a working group on emergency preparedness projects and activities.
- Facilitate and promote preparedness and mitigation strategies.
- Adopt and promote emergency preparedness policies and procedures.

The committee is represented by various departments in BART and participants are senior managers from the following departments:

- System Safety
- Office of Civil Rights
- Chief Information Officer
    - GIS Mapping Program (EGIS)
- Office of External Affairs
    - Government and Community Relations
    - Communications
- Operations
    - Maintenance and Engineering
    - Transportation Operations
    - System Service
    - Rolling Stock & Shops
    - Operations Planning
- BART Police
    - Security and Emergency Preparedness Program
    - Operations/Support Services

- Administration and Budget
- Employee Relations
    - Human Resources
    - Labor Relations
- Planning & Development and Design & Construction
    - Earthquake Safety Program
    - Property Development & Real Estate
    - Customer Access
- Director of Fire Life Safety

The goal of engaging the EPTFC was to understand existing efforts and gain direction on appropriate future action in their area of operation and expertise.

The Core Administrative Team held two engagements with the EPTFC. The EPTFC were notified through electronic meeting invitation.

Engagement 1 (December 12, 2021)

The Core Administrative Team introduced the need for the Plan and update. The Core Administrative Team provided plan overview including planning approach, team members, deliverables, timeline, and role of the EPTFC. Hazard assessments were also reviewed. The goal of the engagement was to introduce plan and gain input on plan approach and hazard vulnerabilities.

Engagement 2 (April 12, 2022)

The Core Administrative Team presented mitigation strategies. The EPTFC provided feedback and prioritized draft mitigation strategies for the Plan via survey. Survey forwarded to other responsible departments for feedback.

The goal of the meeting was to review and prioritize the draft mitigation strategies. The EPTFC provided valuable input in relation to existing programs to continue, critical issues to be addressed, urgent facility upgrade priorities, and existing capital improvement programs. Input received through this engagement process was incorporated into the final Plan submitted to the CalOES.

2.7 External Engagement

As part of the planning process, the following processes were included to ensure neighboring communities, local and regional agencies were given opportunity to be involved in the planning process.

See Appendix B for documentation of engagement activities.

2.7.1 Webpage

The District maintains a dedicated webpage for the Plan at the BART.gov public website. The webpage includes periodic updates to the plan as the plan update progress. The webpage can be found with the following URL.

https://www.bart.gov/about/planning/policies/hazard

2.7.2 Title VI/Environmental Justice Advisory Committee

The Title VI/Environmental Justice Advisory Committee consists of members from community-based organizations that represent Title VI and Environmental Justice populations within the BART service area. The Committee serves as a forum for public participation for the District on issues related to its Environmental Justice and Title VI Programs. Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Title VI of the Civil Rights Act of 1964, prohibits discrimination based on race, color or national origin in programs or activities which receive federal financial assistance. The Title VI Advisory Committee holistically represents the District's jurisdiction by being reflective of the community served, both demographically and geographically. The Committee encourages the full and fair participation of minority and low-income populations in the District's transportation decision-making process.

The advisory committee was selected as an ideal and primary means for community engagement because minority and low-income populations are disproportionately more sensitive to natural disasters than other populations. The following are the community-based organizations represented on the Title VI/Environmental Justice Advisory Committee:

- Contra Costa Health Services, Director of Communication Wellness-Prevention Program
- We Lead Ours
- Christ the King, Pastor
- Contra Costa Employment & Human Services
- Department of Economics, Cal State University East Bay, Assistant Professor
- Marin Clean Energy
- Urban Habitat Boards and Commission Leadership Institute & City of San Francisco
- Huckleberry Youth Program, Director of Youth Justice

Hosted by the Office of Civil Rights, BART engaged in three advisory meetings with the Committee. The Committee was notified through email with agenda. These meetings were held on:

Engagement 1 (September 07, 2021)

The Core Administrative Team introduced the purpose and goals of the Plan.

Engagement 2 (December 14, 2021)

The Core Administrative Team provided an overview of the planning approach and findings of the hazards assessments to the BART system. The goal of the engagement was to gain feedback on plan process and hazard assessments.

Engagement 3 (April 5, 2022)

The Core Administrative Team introduced the draft mitigation strategies of the Plan and solicited feedback.

Input received through this engagement process was incorporated into the final Plan submitted to the CalOES.

2.7.3 Local Cities and Counties

The Core Administrative Team solicited input on Plan updates via email correspondence and survey from the following agencies and personnel.

- Alameda County Sherriff's Office of Emergency Services, Senior Emergency Services Coordinator
- Contra Costa County, Sheriff's Office of Emergency Services, Emergency Services Manager
- SF Municipal Transportation Agency, Emergency Management, System Security and Special Events Manager
- County of San Mateo, Office of Emergency Services
- County of Santa Clara, Office of Emergency Management, Director
- City of San Jose San Jose Fire Department, Fire Captain
- City of Milpitas, Assistant Fire Marshal
- City of Fremont, Fire Department
- Union City, City's Emergency Services Coordinator
- City of Hayward, Hayward Fire Department, Deputy Fire Chief
- City of Alameda, Sustainability and Resilience Manager
- City of San Leandro, Public Works Department
- City of Oakland, Fire Department, Battalion Chief
- City of Berkeley, Fire Department, Assistant Fire Chief
- City of Richmond, Fire Department, Battalion Chief
- City of San Bruno, Fire Department, Fire Battalion Chief
- Colma Fire Protection District, Captain/Paramedic
- San Francisco Fire Department, Captain
- Central County Fire Department , Battalion Chief

Solicited input was incorporated into the final Plan submitted to the CalOES.

2.7.4 Public Comment

The District solicited public comment on the Plan.

The draft Plan was posted on the BART website in June 2022 for a 30-day public comment period. Announcements were made to the public through news announcement.

2.7.5 Surveys

The District solicited feedback via surveys from local cities and counties, the Title VI/EJC advisory committee, and the EPTFC. See Appendix B1.3 for survey questions. Surveys were utilized in conjunction with meetings for the Title VI/EJC advisory committee and the EPTFC.

Survey responses were reviewed and incorporated into the final Plan submitted to the CalOES.

2.8 Plan Maintenance

The Core Administrative Team, as identified in Section 2.4, is responsible for periodic monitoring, evaluation, and update of Plan. The Core Administrative Team will meet on the anniversary of the Plan adoption for review and will recommend updates, if any, to the EPTFC, as identified in Section 2.6.1. The EPTFC will ensure that monitoring of Plan is conducted. This monitoring will be on an on-going basis undertaken by the Core Administrative Team responsible for development of the Plan.

2.8.1 Continued Public Participation

Necessary public participation in the plan maintenance process will leverage existing community forums such as the Title VI/Environmental Justice Advisory Committee.

Hazard Identification and Risk Assessment

Regulation Checklist
B1. Does the Plan include a description of the type, location, and the extent of all natural hazards that can affect each jurisdiction? (44 CFR 201.6(c)(2)(i) and 44 CFR 201.6(c)(2)(iii))
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (44 CFR 201.6(c)(2)(i))
B3. Is there a description of each identified hazards' impact on the community as well as an overall summary of the communities' vulnerability for each jurisdiction? (44 CFR 201.6(c)(2)(ii))
B4. Does the Plan address NFIP insured structures within each jurisdiction that have been repetitively damaged by floods? (44 CFR 201.6(c)(2)(ii))

3.1 Hazard Assessment

Hazard exposure mapping was performed by the District's EGIS department using geographical information system (GIS) tools and available data sets from ABAG's Resilience Program[4]. GIS exposure mapping was performed for hazards having potential to threaten the BART system. These included earthquakes, tsunamis, landslides, flood, sea level rise, wildfire. Hazard exposure evaluation assesses potential exposure levels of the hazard to BART assets. Under each hazard scenario, critical assets were identified for high exposure areas. Each assessment includes description characterizing the hazard including type, location, extent, probability of occurrence, trend from climate change, potential impacts, historical occurrences, and overall vulnerability. To extent feasible, assessment includes pertinent information about existing efforts, existing protections, hazard sensitivity, and adaptive capacity.

Overall, the main hazard of concern to BART facilities are related to earthquakes, followed by flooding and fire. This is based on findings from the hazard assessment and feedback from internal stakeholders.

The BART service area has experienced several disasters over the past decades, including earthquakes, floods, droughts, wildfires, energy shortages, landslides, and severe storms. The most significant disasters impacting the District were the Loma Prieta earthquake and the East Bay Hills Firestorm. Events such as these when left unmitigated can diminish BART's ability to provide safe, reliable, quality transit services for the community. Diminished levels of BART service would have severe implications for the community. Passengers who shift from BART to private automobiles due to poor service would exacerbate congestion on highways that already exceed capacity. A reduction in BART riders and increase in automobile users would further increase vehicle miles travelled, leading to greater

[4] Data & Research | Association of Bay Area Governments (ca.gov)

greenhouse gas emissions, air pollution, and respective losses in the region's economic and environmental health.

3.2 Earthquake

Type: Earthquakes occur when two tectonic plates slip past each other beneath the earth's surface, causing sudden and rapid shaking of the ground. Earthquakes originate on fault planes below the surface, where two or more plates meet. As the plates move past each other, they tend to not slide smoothly and become "locked," building up stress and strain along the fault. Eventually the stress causes a sudden release of the plates, and the stored energy is released as seismic waves, causing ground acceleration to radiate from the point of release, the "epicenter."

Additionally, earthquakes are often not isolated events, but are likely to trigger a series of smaller aftershocks along the fault plane, which can continue for months to years after a major earthquake, producing additional damage.

The energy released in earthquakes can produce five different types of hazards:

- Fault rupture
- Ground shaking
- Liquefaction
- Earthquake-induced landslides
- Tsunamis and seiches

Location: Major faults cross through all nine Bay Area counties. Every point within the Bay Area is within 30 miles of an active fault, and 97 of the 101 cities in the Bay Area are within ten miles of an active fault. Figure 1 shows the location of active faults relative to the BART system.

All of the Bay Area is prone to very strong to violent shaking potential. This is the major reason earthquakes pose the largest threat to much of BART's system and require the bulk of existing and planned hazard mitigation efforts.

Extent: Figure 2 shows earthquake intensity levels in the Bay area for the 10% probability of exceedance over the next 50 years event[5]. The Modified Mercalli Intensity (MMI) scale is the value used to describe the intensity of the earthquake. This may be a more meaningful measurement of severity to the nonscientist, than the magnitude, because the intensity refers to the effects experienced or "felt". The following are short descriptions of the effects that may occur from the MMI levels shown in the figure.

> MMI VIII - Severe. Damage to masonry buildings ranges from collapse to serious damage unless modern design. Wood-frame structures rack, and, if not bolted, shifted off foundations. Underground pipes broken.

[5] ABAG, San Francisco Bay Area Risk 2017 Profile, Figure 5

MMI IX – Violent. Poorly built structures destroyed with their foundations. Even some well-built wooden structures and bridges heavily damaged and needing replacement. Water thrown on banks of canals, rivers, lakes, etc.

Probability: Figure 2 shows earthquake intensity levels in the Bay area for the 10% probability of exceedance over the next 50 years event[6]. Figure 2 shows that for that event, Bay Area will experience earthquake intensity level of MMI VIII or IX. Based on the most recent earthquake forecast model for California, the USGS and other scientists estimate a 72-percent probability that at least one earthquake of Magnitude 6.7 or greater, capable of causing widespread damage, will strike the San Francisco Bay Area within 30 years. [7] Smaller magnitude earthquakes are more likely to occur, like the 2014 South Napa earthquake, potentially producing local damage.

In March 2015, the USGS released an update to its 2008 earthquake probabilities for California faults using forecast model called the Uniform California Earthquake Rupture Forecast 3 (UCERF3) [8]. The model provides detailed assessment on the likelihood of each fault segment producing M6.7, M7.0 and M8.0 and greater earthquakes. These probabilities are based on data such as fault length; how much energy the faults release annually through fault slip; and, known historical return periods for the fault. Notable faults that has high probability of producing a M6.7 earthquake are Northern San Andreas (6.4% probability in 30 years), Hayward (14.3% probability in 30 years), and Calaveras (7.4% probability in 30 years).

Climate Change: Sea level rise from climate change is expected to raise shallow groundwater near the shoreline which in turn may exacerbate liquefaction risk in those areas.

3.2.1 Potential Impacts

In 2000, the District hired a team of consultants led by Bechtel Infrastructure and HNTB to evaluate all the facilities and components in the BART system. Completed in 2002, the Seismic Vulnerability Study was the most comprehensive evaluation of BART facilities since original construction of the system. It involved one and one-half years of engineering and statistical analyses, which included developing scenario earthquakes, computer models, damage predictions, upgrade options, and cost-benefit analyses. The study incorporated information from the 1994 Northridge, California and 1995 Kobe, Japan earthquakes.

The original system, consisting of 34 stations and 74 miles of track, was designed to criteria that were considered conservative at the time. However, lessons learned from subsequent earthquakes, including more knowledge about seismicity and behavior of structures, led BART to believe that the system had vulnerabilities that needed to be mitigated. The evaluation contained in the BART Seismic Risk Analysis Report and BART System Wide Seismic Vulnerability Study Report confirmed that the system and specific

[6] ABAG, San Francisco Bay Area Risk 2017 Profile, Figure 5
[7] California State Hazard Mitigation Plan, September 2018

[8] USGS Fact Sheet 2015–3009: UCERF3: A New Earthquake Forecast for California's Complex Fault System

facilities/components in the original system were vulnerable to damage that would leave the system with significant life safety and operability impacts. The original BART system, completed between 1972 and 1976, has a service area spanning three Counties-Alameda, Contra Costa and San Francisco. System extensions including SFO were built during the 1990s and employed more stringent and up-to-date seismic criteria than the original system, and thus did not require upgrades.

Since the formation of the Earthquake Safety Program (ESP), the District has made extensive progress in reducing the potential seismic impacts. See Section 4.3 under existing programs for more details. In 2018, USGS published the HayWired Scenario Study evaluating a M7.0 earthquake on the Hayward Fault[9]. BART ran the HayWired ground shaking data through ShakeCast for the BART system with retrofits from ESP and found that the system largely performed well. Of the 38 stations and yards evaluated, 20 would experience minor to no damage; 10 would be operable after short term repairs; 7 would be safe but not operable; and only 1 would be unsafe or at risk of collapse[10].

BART has performed site-specific liquefaction vulnerability analysis for facilities in the system, and found that in general the facilities are not vulnerable to seismic-induced liquefaction, either because liquefaction does not actually occur at the facility site (based on local geotechnical site investigation data), or the effect is minor and does not induce damage to structure.

In 2012, BART implemented an Earthquake Early Warning (EEW) System which is powered by ShakeAlert, an earthquake early warning system, run by the U.S. Geological Survey (USGS). [11] ShakeAlert includes real-time information on ground motion records and estimates. The EEW system allows BART to rapidly detect, assess, and respond to imminent seismic activity. Upon detection of seismic activity above a certain threshold, BART issues an automated speed restriction to trains to reduce risk of derailment and protect riders, workers, and infrastructure. BART is also using USGS's ShakeCast, a system for providing rapid estimates of levels of damage after an earthquake event and allows BART to prioritize inspections and deploy resources effectively[12].

Vulnerability Summary: The District is vulnerable to seismic hazard. Several efforts including the ESP, BART's EEW, and use of ShakeCast, help to mitigate that risk.

[9] USGS Rolls Out Groundbreaking Earthquake Study: The HayWired Earthquake Scenario
[10] Appendix 4 BART Damage Assessment to HayWired Scenario Ground Shaking
[11] BART and USGS extend ShakeAlert agreement | bart.gov
[12] National Engineers Week 2022 | BARTable

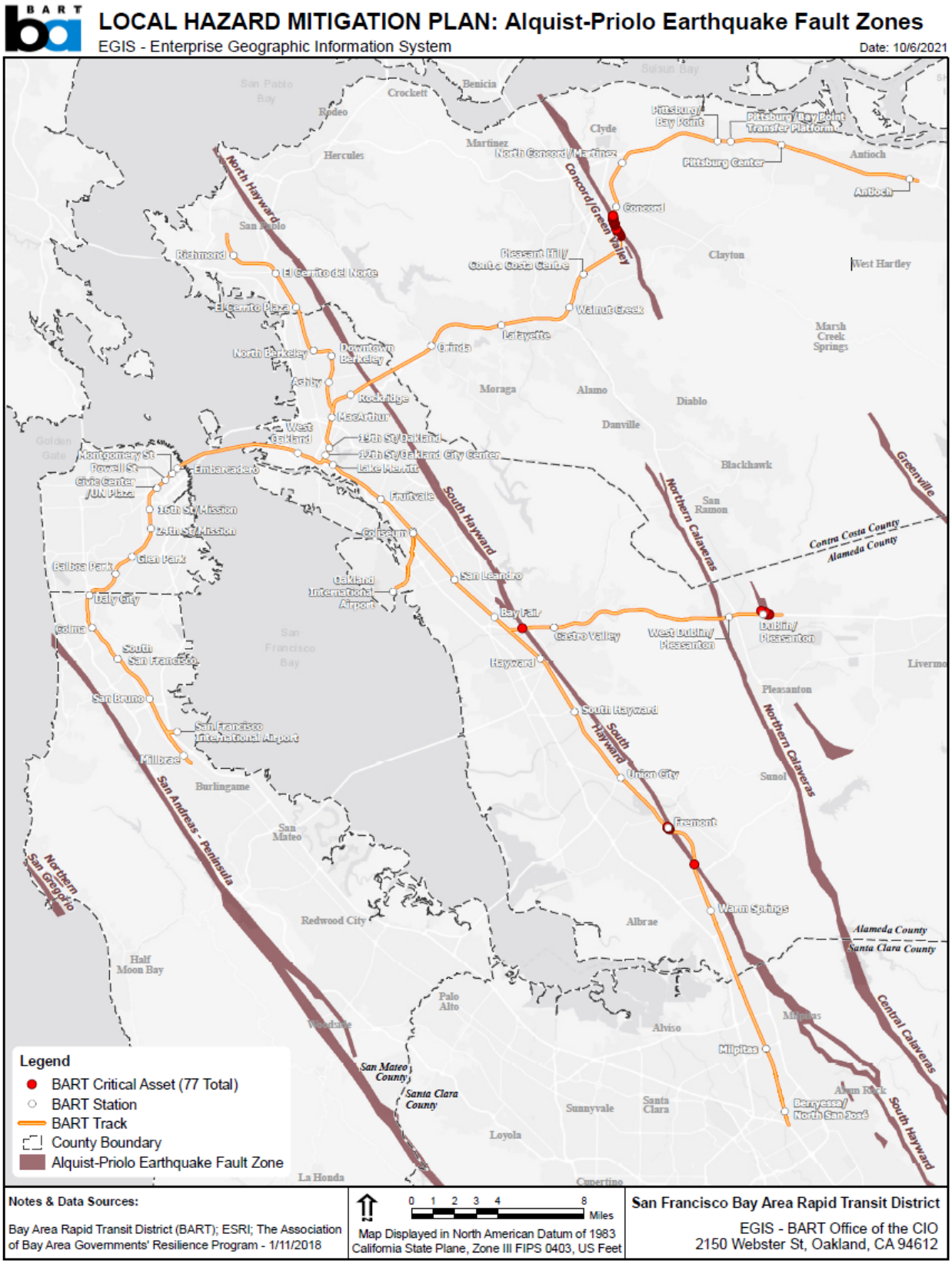

Figure 1 Fault Zones

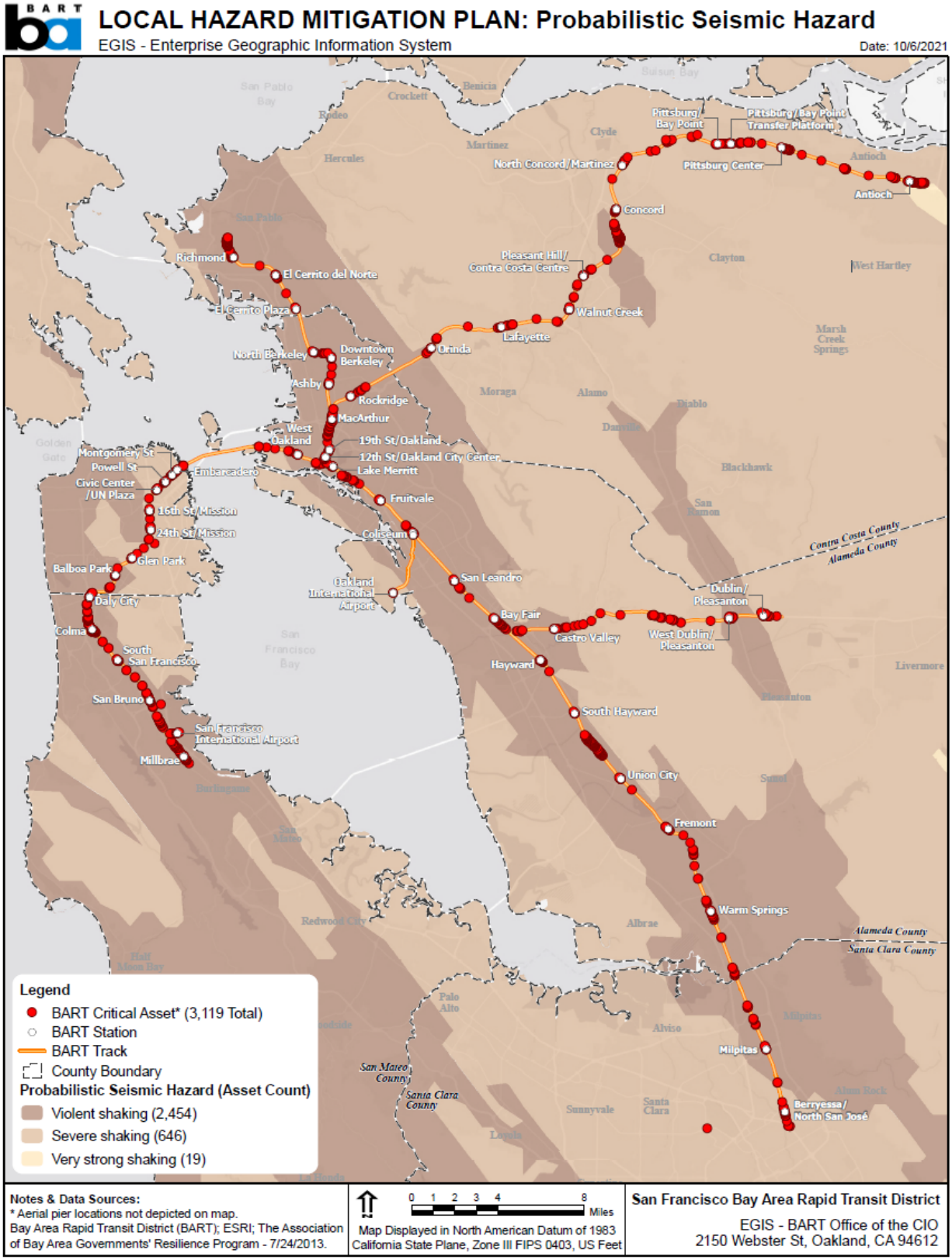

Figure 2 Seismic Hazard

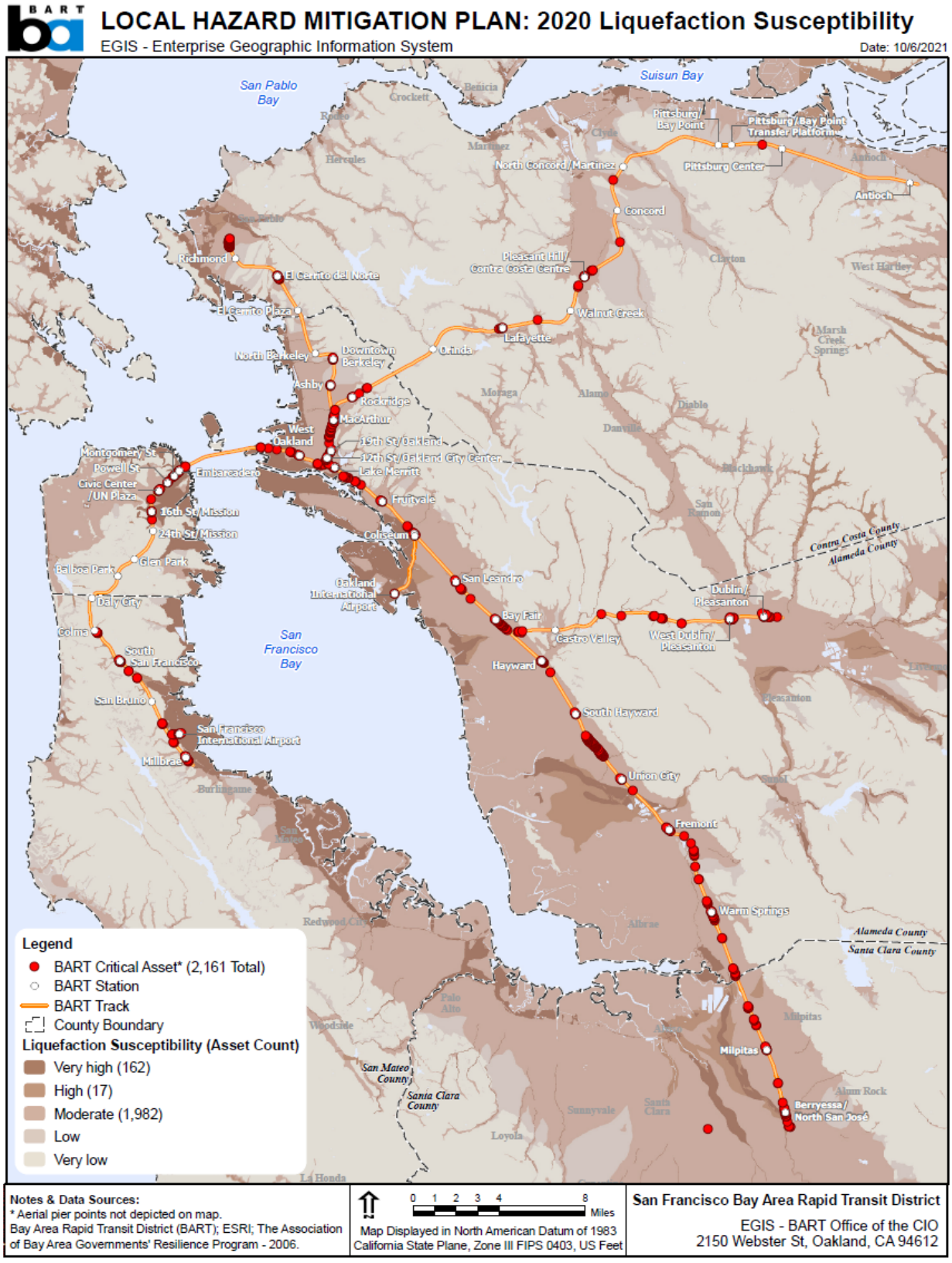

Figure 3 Liquefaction Susceptibility

3.2.2 Historical events

3.2.2.1 Napa Earthquake (August 2014)

A 6.0 magnitude earthquake struck the Bay Area on August 24, 2014. The event, localized approximately six miles southwest of Napa Valley, caused an estimated $360 million in damages and resulted in over 200 injuries, including one fatality. Napa Division Fire Chief John Callanan stated that the event triggered six major fires. While this earthquake was not in our service area, it is noted that our Earthquake Early Warning System detected the earthquake. BART's earthquake early warning system provided up to 10 seconds of notice prior to the event, which would have allowed any moving trains enough time to stop or slow down, preventing derailments, injuries, and deaths. Given the time of the earthquake (3:20 AM) no trains were in operation and no action was necessary by BART. No earthquake-related disruptions were identified, demonstrating progress by BART's extensive seismic retrofit program.[13]

3.2.2.2 Loma Prieta Earthquake (October 1989)

The Loma Prieta Earthquake of 1989 is an example of the kind of large-scale disaster which could strike the Bay Area. The event killed 63 persons and injured 3,757. Cal OES estimates the quake caused approximately $10 Billion of damage.[14]

BART's success in maintaining continuous service directly after the 1989 Loma Prieta earthquake reconfirmed the system's importance as a transportation "lifeline." While the earthquake caused transient movements in the Tube there was no significant permanent movement and BART service was uninterrupted except for a short inspection period immediately following the quake. With the closure of the Bay Bridge and the Cypress Street Viaduct along the Nimitz Freeway, BART became the primary passenger transportation link between San Francisco and East Bay communities. Its average daily transport of 218,000 passengers before the earthquake increased to an average of 308,000 passengers per day during the first full business week following the earthquake. The Loma Prieta earthquake prompted the development of BART's Earthquake Safety Program.

3.3 Tsunamis

Type: Large underwater displacements from major underwater earthquake fault ruptures or landslides can lead to ocean waves called "tsunamis." Since tsunamis have high velocities, the damage from a level of inundation is far greater than in a normal flood event. Similarly, water sloshing in lakes during an earthquake, called "seiche," is also capable of producing damage.

Tsunamis can result from off-shore earthquakes within the Bay Area or from distant events. It is most common for tsunamis to be generated by offshore subduction faults such as those in Washington, Alaska, Japan, and South America. Tsunami waves generated at those far-off

[13] http://sfappeal.com/2014/08/barts-earthquake-early-warning-system-could-have-broader-applications/
[14] California State Hazard Mitigation Plan, September 2018

sites can travel across the ocean and can reach the California coast with several hours of warning time.

Local tsunamis can also be generated from offshore strike-slip faults. Because of their close proximity, we would have little warning time. However, the Bay Area faults that pass through portions of the Pacific coastline or under portions of the Bay are not likely to produce significant tsunamis because they move side to side, rather than up and down, which is the displacement needed to create significant tsunamis. They may have slight vertical displacements, or could cause small underwater landslides, but overall there is a minimal risk of any significant tsunami occurring in the Bay Area from a local fault. The greatest risk to the Bay Area is from tsunamis generated by earthquakes elsewhere in the Pacific.

Location: Figure 4 illustrates the Cal OES tsunami evacuation planning zones. These are areas that may inundate based on modeling several potential earthquake sources and hypothetical extreme undersea, near-shore landslide sources. Zones are intended for local jurisdictional, coastal planning uses only. With respect to overlap with BART's right-of-way, this includes the coastal areas of San Francisco and Oakland.

Extent and Probability: In 2013, the USGS, in partnership with the US Department of the Interior, published a tsunami scenario as part of the Science Application for Risk Reduction (SAFRR) series.[15] In the scenario, the multi-disciplinary team modeled a M9.1 offshore Alaskan earthquake to study impacts to California. If the tsunami reaches the central coast at high tide, the Bay Area can expect heights ranging from two to seven meters near the shore. The study suggests that this scenario inundation may have a 100-year return period.

Climate Change: Climate change is causing sea levels to rise. Higher sea level may broaden the extent of tsunami risk.

3.3.1 Potential Impacts

The San Francisco Bay has not yet experienced a tsunami with capacity to impact the BART system. The Figure 4 map is limited to evacuation planning, not infrastructure vulnerability assessments. Flooding in these evacuation zones would have major impacts in damage of property as well as service delays.

Vulnerability Summary: 119 critical assets are within the tsunami evacuation planning zone. Asset types include trackway, passenger station, substation, train control room. Areas with potential damage include San Francisco Embarcadero, West Oakland, Oakland Airport Connector, and Oakland Coliseum areas.

[15] SAFRR (Science Application for Risk Reduction) Tsunami Scenario--Executive Summary and Introduction: Chapter A in The SAFRR (Science Application for Risk Reduction) Tsunami Scenario (usgs.gov), USGS Open-File Report 2013-1170 and CGS Special Report 229, chapter A

3.3.2 Historical Events

Though the Bay Area has experienced tsunamis, it has not experienced significant tsunami damage. Refer to Table 7.J in CA State Hazard Mitigation Plan (2018) for a summary of tsunami damage along the California coast since 1946.

In 2011, BART monitored conditions of the March 11 tsunami warning; no service changes were made.[16]

[16] Tsunami warning prompts preparations at BART | bart.gov

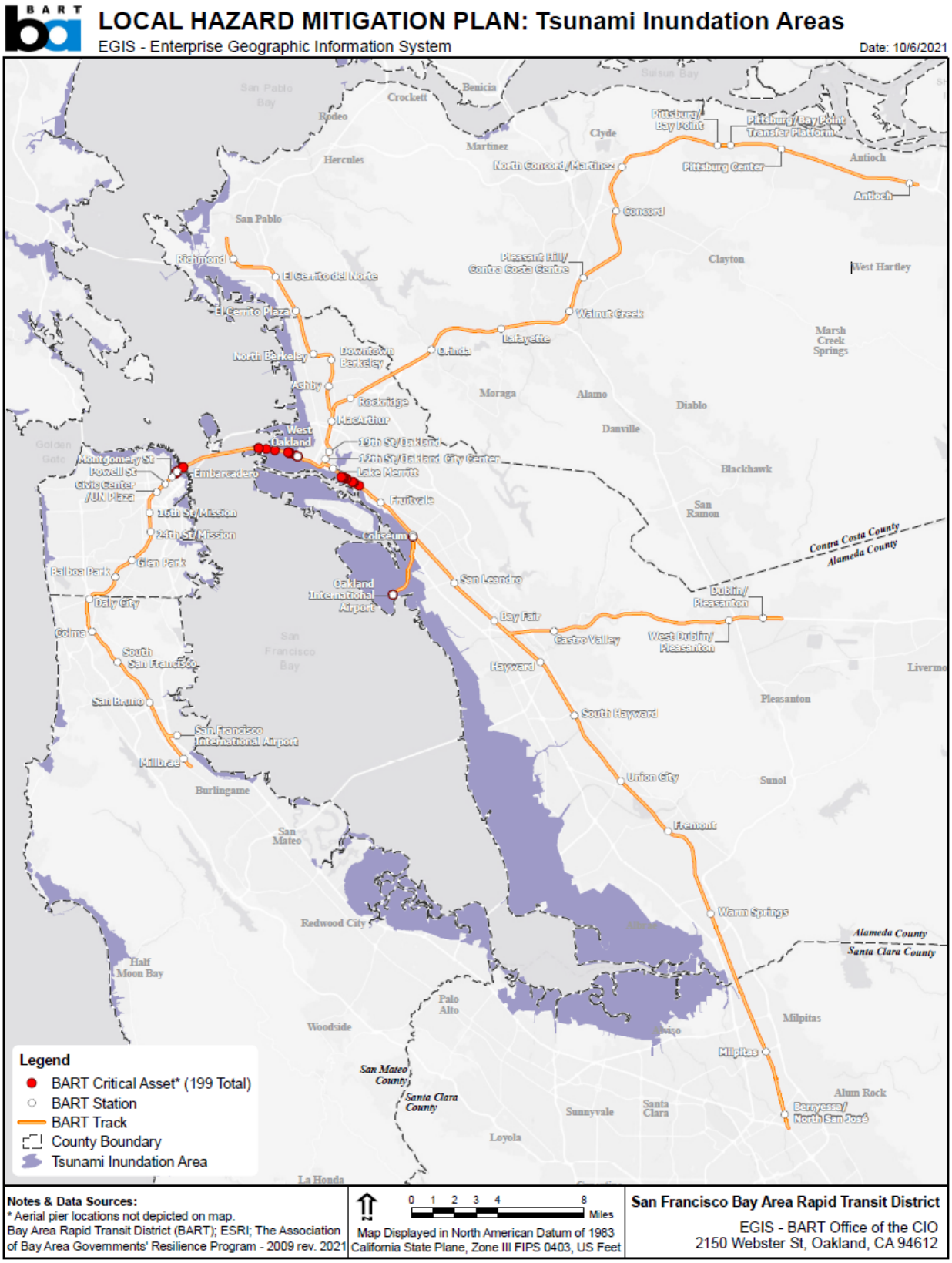

Figure 4 Tsunami Inundation Areas

3.4 Landslides

Type: Landslide is the sliding down of a mass of earth or rock from a mountain or hill. In the Bay Area, landslides can occur because of either earthquakes (earthquake-induced landslides), or during heavy and sustained rainfall events (weather induced landslides). A given area can be at risk for both earthquake-induced landslides as well as landslides caused by rain-saturated soils but the variables that contribute to each landslide risk are different. Typically, an earthquake-induced landslide occurs when seismic energy at the top of a slope gets concentrated and breaks off shallow portions of rock. In rainfall-induced landslides, the slide can begin much deeper in the slope, in very-saturated layers of soil.

Location: Figure 5 and 6 show areas of potential landslide. Note data set in Figure 5 and 6 are not comprehensive and show hazard zone where available. The greatest risk of landslide occurring is in the mountainous regions of the Bay Area including the C-line and L-Line crossing the East Bay hills.

The GIS mapping shown below shows areas with potential for land sliding and not explicit threat to BART systems. Previous assessments have identified that four miles of trackways and two facilities (LSR Substation and radio tower in Dublin) are in areas of existing susceptible landslide zones.

Extent: The movement of landslide material can vary from abrupt collapses to slow gradual slides and at rates which range from almost undetectable to extremely rapid. Sudden and rapid events are the most dangerous because of a lack of warning and the speed at which material can travel down the slope as well as the force of its resulting impact. Extremely slow landslides, also known as earthflows, might move no more than a meter a year. [17] There is currently no method to estimate the scale of individual landslides in terms of size or extent based on available maps.

Probability: For both types of landslides, there currently are no methods available to estimate the probabilities of future landslides at a local, or jurisdictional scale. Steep slopes and varied types of underlying soils can influence the likelihood of landslides. Additionally, surface and subsurface drainage patterns also affect landslide hazard, and vegetation removal can increase landslide likelihood.

Climate Change: Climate change is not expected to change the seismic risk, but climate change could change the behavior of winter storms and affect weather induced landslide. Greater severity of winter storm may increase chances of landslide. Additionally, if fires burn greater portions of landslide- vulnerable hillsides, removing vegetation and increasing storm runoff, the landslide probability will increase. Currently, there is not enough evidence to suggest with certainty that future landslide probabilities will increase across the region.

[17] Slow-Motion Landslides (usgs.gov)

3.4.1 Potential Impacts

The BART system along the hilly regions (C and L line) is sited along major freeways and is not likely to be directly impacted by landslide. However, landslides in those areas could potentially impact roads needed to travel to BART.

Liquefaction-triggered underwater slope movements may occur for underwater assets where there is sloped stratigraphy. These adverse effects are being mitigated under the ESP.

In 2018, BART conducted an embankment erosion study on BART A-, C-, L-, M-, and R- lines to understand the presence and severity of erosion of abutments, aerial structures end-slopes, and track way embankments[18]. Through site reconnaissance, most erosional features were observed generally very low to moderate severity. However, some abutments slopes or embankments were identified to have moderately severe to severe erosion. From erosion study, the District has identified slope repair work to mitigate these risks.

Vulnerability Summary: 15 critical assets are within the weather induced most landslide areas and 15 in earthquake induced zones. The types of assets include trackway, substation, train control room. District has identified slope repair work to mitigate risk due to erosion.

3.4.2 Historical Events

No past known landslide events have been known to impact BART services.

[18] BART, Slope Reconnaissance Screening Report, March 2018.

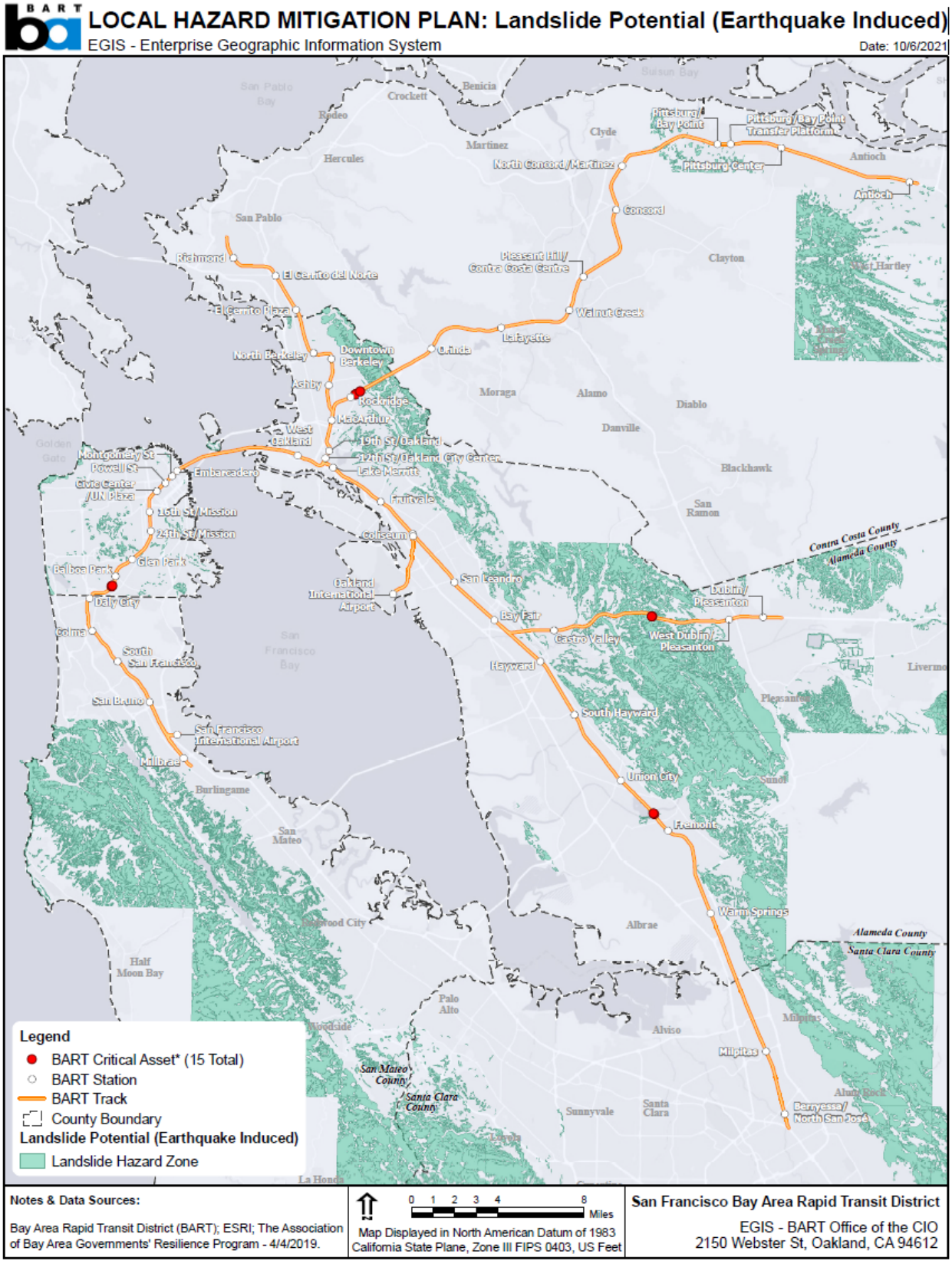

Figure 5 Landslide Potential (Earthquake Induced)

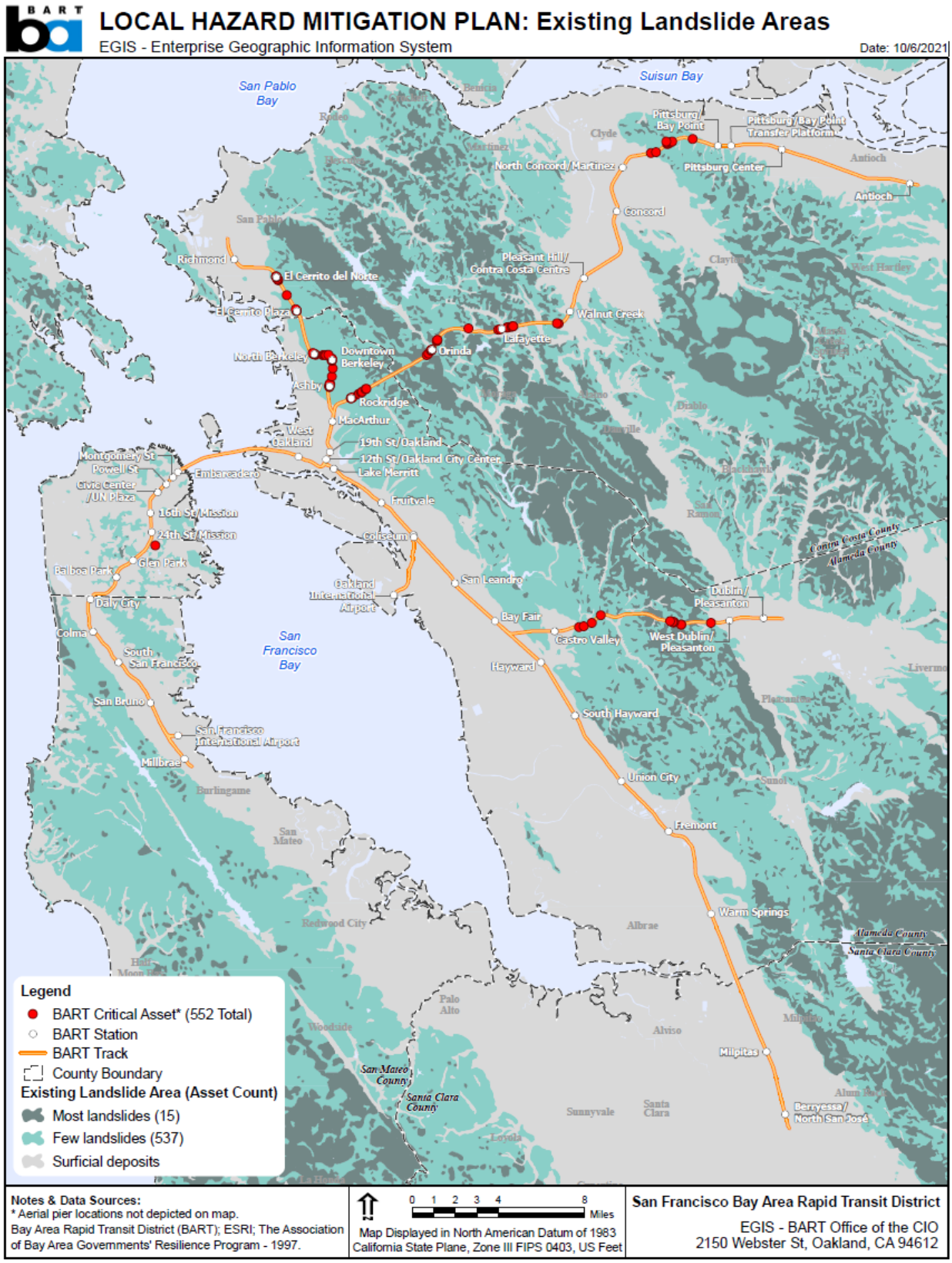

Figure 6 Landslide Areas (Weather Induced)

3.5 Flooding

Type: Flooding is a temporary condition that causes the partial or complete inundation of land that is normally dry. Flooding occurs when streams, rivers, lakes, reservoirs, or coastal water bodies are abnormally high and overflow into adjacent low-lying areas, areas at risk of recurring floods known as floodplains.

Flooding can occur from several sources. Near the shoreline, flooding can occur from a combination of high tide, storm surges, or tsunami (see Tsunami in Section 3.4). In low lying areas near streams or creeks, flooding can occur from riverine overflow during extreme storm events. Local flooding may occur when storm drainage systems are overwhelmed by incoming water. BART may be especially exposed to the threat of water since many assets are at or below grade. During severe storm events, water intrusion to BART assets can occur from exposed entrances/exits and in the form of leaks from aged assets.

FEMA mapped flood plains and expected USGS predicted rainfall intensities are planned for during BART's standard design and construction process. However, elevated flood plain levels and increased rainfall during more intense storms are becoming more frequent and concentrated.

Location and Extent: Figure 7 Flood Hazard Zones shows overlaps of the BART system to current FEMA flood zones. The flood map shows several assets are in areas subject to flooding either in the 100- or 500-year FEMA flood plain zones.

Probability: 100- year floods have a probability of occurrence of one percent in any given year. 500-year floods have a probability of occurrence of 0.2 percent in any given year.

Climate Change: Climate change causes great frequency of extreme storm events which will increase the frequency of flooding events. Sea level rise has the potential to influence the impact of coastal, riverine, and shoreline flooding.

3.5.1 Potential Impacts

Flooding can impact BART by damaging facility property, blocking pathways, and causing service delays. BART has not yet experienced severe flooding (100- or 500- year flood events), resulting in extensive damage to facilities or right of way. However, episodes of rain events have caused service disruptions in winter months.

A past study for the four-station extension to San Francisco International Airport identified that water levels from a 100-year storm in Colma Creek running through South San Francisco could potentially flood the South San Francisco station.

Vulnerability Summary: 371 critical assets are in the 500-year floodplain zone or 100-year floodplain zone (AE). The types of assets include trackway, passenger stations, switching stations, substations, and train control rooms. The BART Facilities Standards require that critical structures are set above the 500-year floodplain.

3.5.2 Historical Events

From 1992 to February 2018, California has had 34 state-proclaimed flood emergencies and 15 federally declared flood disasters.[19] Since 1992, every county in California has been declared a federal disaster area at least once for a flooding event.

Wet weather incidents have affected the BART system in the past typically due to water intrusion into the system including track, platforms, train control rooms.[20]

[19] California State Hazard Mitigation Plan, September 2018
[20] Don't Save BART's Rainforest: Water Intrusion in the Tunnels | bart.gov

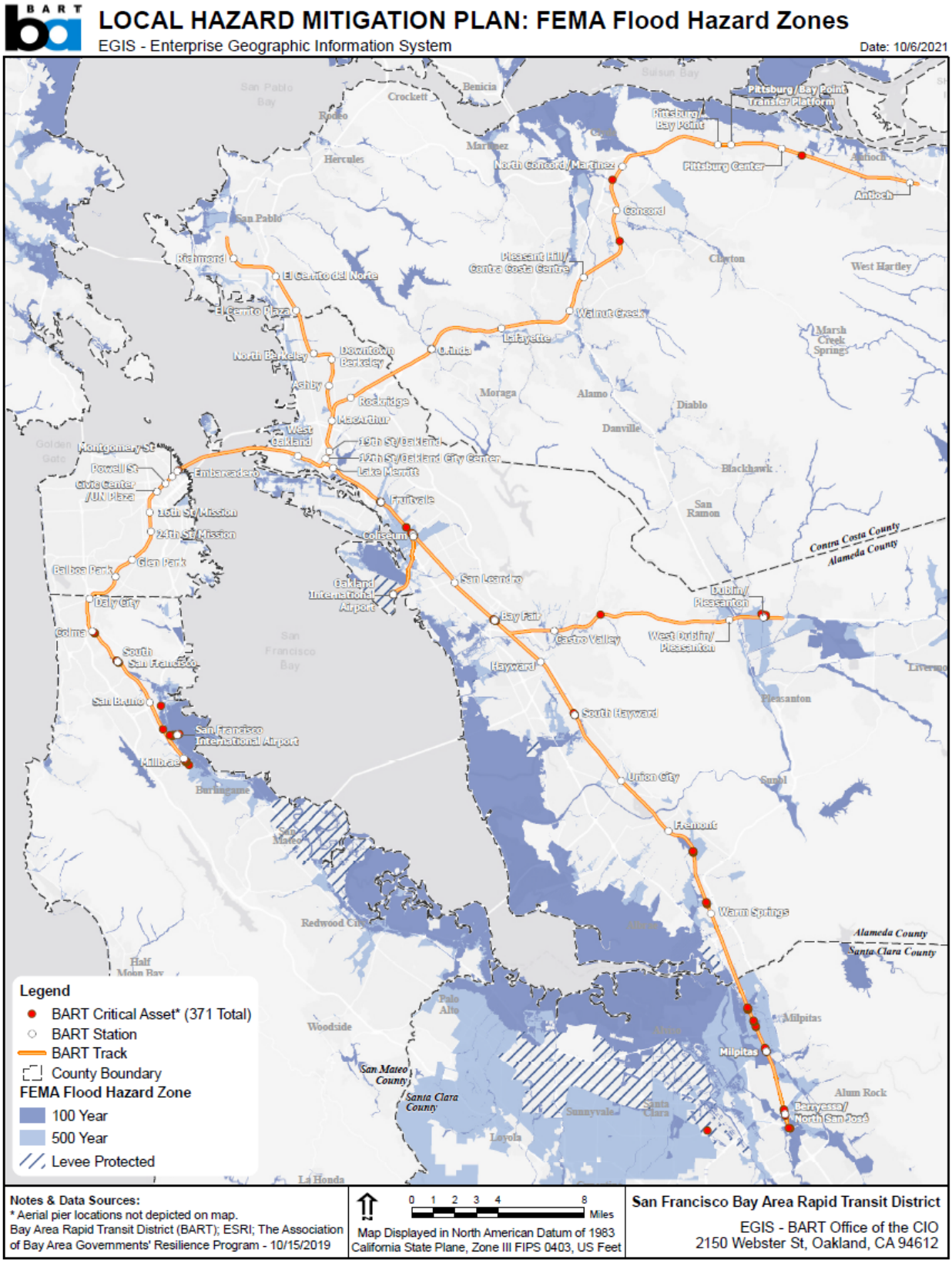

Figure 7 Flood Hazard Zones (FEMA)

3.6 Sea Level Rise

Type: Sea level rise (SLR) is the increase in sea level; it is caused by global warming resulting in added water from melting land ice and the expansion of sea water as it warms. It has the potential to increase the frequency and severity of coastal, riverine and localized nuisance flooding. Without intervention, rising sea levels may cause more frequent and longer flooding of existing flood-prone areas, shoreline erosion, elevate groundwater, and permanent inundation in the coastal zones. In San Francisco Bay area, sea level is projected to rise 0.9 to 2.7 feet by mid-century (year 2050), and 1.6 to 10.2 feet by end of century (year 2100).[21]

As sea levels rise, groundwater and salinity levels are also predicted to rise. USGS have conducted research (USGS CoSMos-groundwater) to understand changes in shallow groundwater due to sea level rise. This will increase the risk of groundwater seepage into below grade assets including sensitive electrical and mechanical equipment. In addition, increasing groundwater levels may increase liquefaction susceptibility, and may increase the need for routine flood management activities.

Location and Extent: Figure 8 shows the exposure map illustrating projected sea-level rise. The greatest exposures include the W-line and Y-line around the San Francisco International Airport and the Oakland Airport Connector at the Oakland International Airport. Both the San Francisco Airport and Port of Oakland are aware of the low-lying conditions of these areas and are doing extensive work to address these risks and enhance existing shoreline protections[22], [23]. Exposure also exists at the Embarcadero waterfront, and parts of Oakland (Coliseum, Oakland Shops, West Oakland).

Probability: State of CA SLR guidance includes probabilities of exceedance for SLR for timeframes from 2030 through 2150[24]. For critical infrastructure, the state recommends using projections from the extreme risk aversion category (H++) which do not have probabilities of exceedance.

Climate Change: Climate change is causing sea levels to rise. Sea level rise will depend on level of mitigation of emissions. The state guidance includes sea level rise based on various emission scenarios (RCP2.6, aggressive emissions reduction; RCP 8.5, business as usual).[25]

3.6.1 Potential Impacts

SLR will exacerbate coastal and riverine flooding. Table 3 provides a matrix showing how the same total water elevation may be encountered under differ SLR and extreme tide conditions. See Section 3.5.1 for potential impacts from flooding.

[21] State of California Sea-Level Rise Guidance, 2018 update
[22] Shoreline Protection Program | San Francisco International Airport (flysfo.com)
[23] OAK Airport completes Phase 1 of its $30 million Flood Hazard Protection Project - Port of Oakland
[24] State of California Sea-Level Rise Guidance, 2018 update
[25] State of California Sea-Level Rise Guidance, 2018 update

Sea Level Rise	MHHW (≈ daily high tide) Permanent inundation	Extreme Tide (by recurrence interval) Temporary flooding						
		1-yr (≈ King Tide)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr (1% annual chance)
+0	0	12	19	23	27	32	36	41
+6	6	18	25	29	33	38	42	47
+12	12	24	31	35	39	44	48	53
+18	18	30	37	41	45	50	54	59
+24	24	36	43	47	51	56	60	65
+30	30	42	49	53	57	62	66	71
+36	36	48	55	59	63	68	72	77
+42	42	54	61	65	69	74	78	83
+48	48	60	67	71	75	80	84	89
+54	54	66	73	77	81	86	90	95
+60	60	72	79	83	87	92	96	101

Table 3: Matrix of Sea Level Rise and Extreme Tide Level[26]

Vulnerability Summary: 64 critical assets are in a SLR impact area of 4 feet or less. The types of assets include passenger stations, substations, and train control rooms. Shoreline projects such as Embarcadero Seawall Program, SFO Shoreline Protection Program, and Oakland Airport's levee improvement work provide some protections against SLR flooding. In 2020, District conducted a SLR and Flooding Resiliency study evaluating vulnerability and risk to the BART system[27]. Study findings found substantial potential damage could result from future SLR inundation. Internally, BART Facilities Standards requires projects to assess project against SLR. Externally, the District is engaging local and regional agencies on climate adaptation. For example, District is supporting the Bay Adapt Joint Platform. The Joint Platform is a regional strategy for adapting to sea level rise[28].

3.6.2 Historical Events

SLR is an emerging issue. Therefore, no historical events have occurred.

[26] Adapting to Rising Tides, Memo: Climate Impacts, Scenarios and Total Water Levels, Table 1
[27] Bart Sea Level Rise And Flooding | ResilientCA
[28] Joint Platform – Bay Adapt

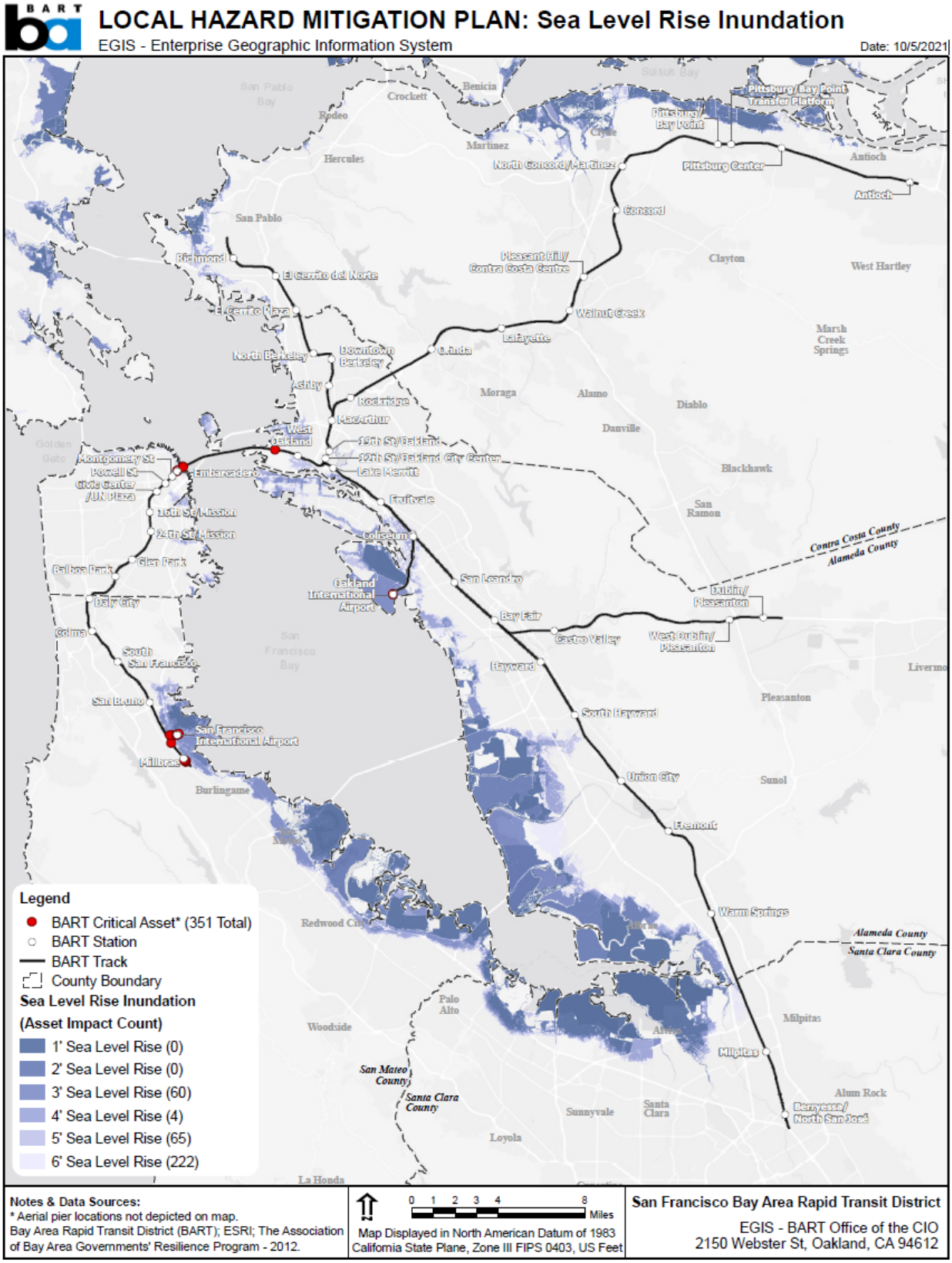

Figure 4 Sea Level Rise Inundation

3.7 Fire

Type: Wildfire is defined here as any free-burning vegetative fire that initiates from an unplanned ignition, whether natural (e.g., lightning) or human-caused (e.g., powerlines, mechanical equipment, escaped prescribed fires), where the management objective is full suppression. While wildfires can potentially lead to benefits to an ecosystem if within the range of natural variability for a given ecotype and geographical area, they can also lead to deleterious effects to both the natural and built environment.

Location: Figure 9 Wildfire Zones illustrate the wildfire severity in the State Responsible Areas (SRAs) and very high severity regions for Local Responsible Areas (LRAs). Federal Areas are not available via Cal Fire and are not presented in the figure.

Extent: In recent years, the size of fires have grown significantly. In CY 2020, California experienced 9,917 fires, impacting 4,257,863 acres or approximately 429 acres per fire.[29]

Probability: Figure 9 shows fire hazard severity which represents the likelihood of an area burning over a 30-50-year time period.[30] Fire hazard severity takes into account the amount of vegetation, the topography, and weather (temperature, humidity, and wind).

Climate Change: Projecting future wildfires is complicated, and results depend on the time period for the projection and what interacting factors are included in the analysis. Because wildfires are affected by multiple and sometimes complex drivers, projections of wildfire in future decades in California range from modest changes from historical conditions to relatively large increases in wildfire regimes.[31]

3.7.1 Potential Impacts

Fires occurring on or near BART facilities may damage facility property and causing service delays. BART services Richmond, where there may be station closures or shelter in place orders due to fire or hazardous materials release from the Richmond Refinery.

Due to aging infrastructure of BART system, assets not in a state of good repair may be more vulnerable to equipment malfunction and potential sources of fire. BART's Measure RR program is intended to make the system safer and more reliable.[32]

Vegetation exists on BART's right of way (ROW). There are 70 miles of ground cover require weed control. [33] BART maintains a team of groundworkers to control weeds and vegetation and reduce risk of fire.

[29] Calfire, 2020 Fire Season | Welcome to CAL FIRE

[30] California Department of Forestry and Fire Protection's Fire and Resource Assessment Program (FRAP)

[31] California's Fourth Climate Change Assessment.

[32] Measure RR Bond Oversight Committee | bart.gov

[33] As fire season heats up, BART grounds crews are in high gear to reduce risk | bart.gov

An indirect impact of wildfire are smoke and air quality. In recent years, California has been plagued by unprecedented series of wildfires that have produced a significant amount of smoke and impacted the Bay Area's air quality.

A second indirect impact is loss of electricity. BART depends on PG&E transmission and distribution lines for power. Wildfires can damage the electrical grid. Conversely, electrical lines may contribute to the start of wildfires. Severe weather (dry conditions and high wind) can cause trees and debris to hit electrical lines and start fires. In response to the wildfire risk, PG&E is enforcing public safety power shutoffs (PSPS). PSPS are intentional power outages to reduce risk of wildfires caused by damages to electric lines[34]. Recognizing the operational risk of these events, BART has implemented redundant electrical feeds at many of its critical facilities. For those without redundant feeds, BART has operational response plans in place to back-up vulnerable circuits with either standby generation located onsite, or using mobile generators which can be moved freely around BART's system.

Risk to wildfire is higher in the mountainous regions along the Pittsburg/Bay Point and Dublin/Pleasanton lines where there is more vegetation and woods in the surrounding area. However, on these lines, BART is sited alongside the freeway providing buffer to wildfire exposure. Vegetation adjacent to BART's Right-of-Way is limited and in small isolated patches. Drought conditions can heighten the risk of urban wildland interface fires.

Vulnerability Summary: 42 critical assets are in moderate to very high wildfire severity zones. Asset types include substation, train control room, switch station, and trackway. Fire risk is mitigated with vegetation and weed control on BART ROW.

3.7.2 Historic Events

Refer to Figure 10 for perimeters of past wildfires occurring in the Bay Area. The 1991 fire (known as the Tunnel Fire) in the Oakland-Berkeley Hills was one of the largest urban-wildland fire in the Bay Area at the time. In Oakland 2,777 units were destroyed or badly damaged and 69 additional units were destroyed in Berkeley.[35] The Oakland Hills fire caused a minor service disruption (less than 24 hours) for replacement of a short stretch of rail.

Below are other fire incidents that disrupted BART operations.

March 24, 2006, fire encountered at power substation near South Hayward station.[36]

October 10, 2008, trackside electrical fire encountered near West Oakland Station.[37]

March 30, 2010, small fire along track encountered on equipment between Civic Center and Powell St. stations. [38]

[34] Learn about Public Safety Power Shutoffs (PSPS) (pge.com)
[35] State of California Hazard Mitigation Plan (2018), California Governor's Office of Emergency Services

[36] Service restored between the Hayward and Fremont BART stations | bart.gov
[37] West Oakland fire disrupts morning commute | bart.gov
[38] Trackside fire leads to major delays during Tuesday morning commute | bart.gov

June 14, 2012, fire broke at senior housing construction site near BART tracks in West Oakland.[39]

July 9, 2015, a fire broke beneath a car in Oakland. Fire was suspected to result from an electric arc from the third rail.[40]

July 9, 2021, a fire on a nearby encampment in Oakland causes spot fires on vegetation near BART tracks.[41]

[39] BART Transbay service restored: expect residual delays | bart.gov
[40] Service restored after early-morning train incident; residual delays possible | bart.gov
[41] Fire rips through Oakland encampment, spreads to BART tracks causing delays (sfchronicle.com)

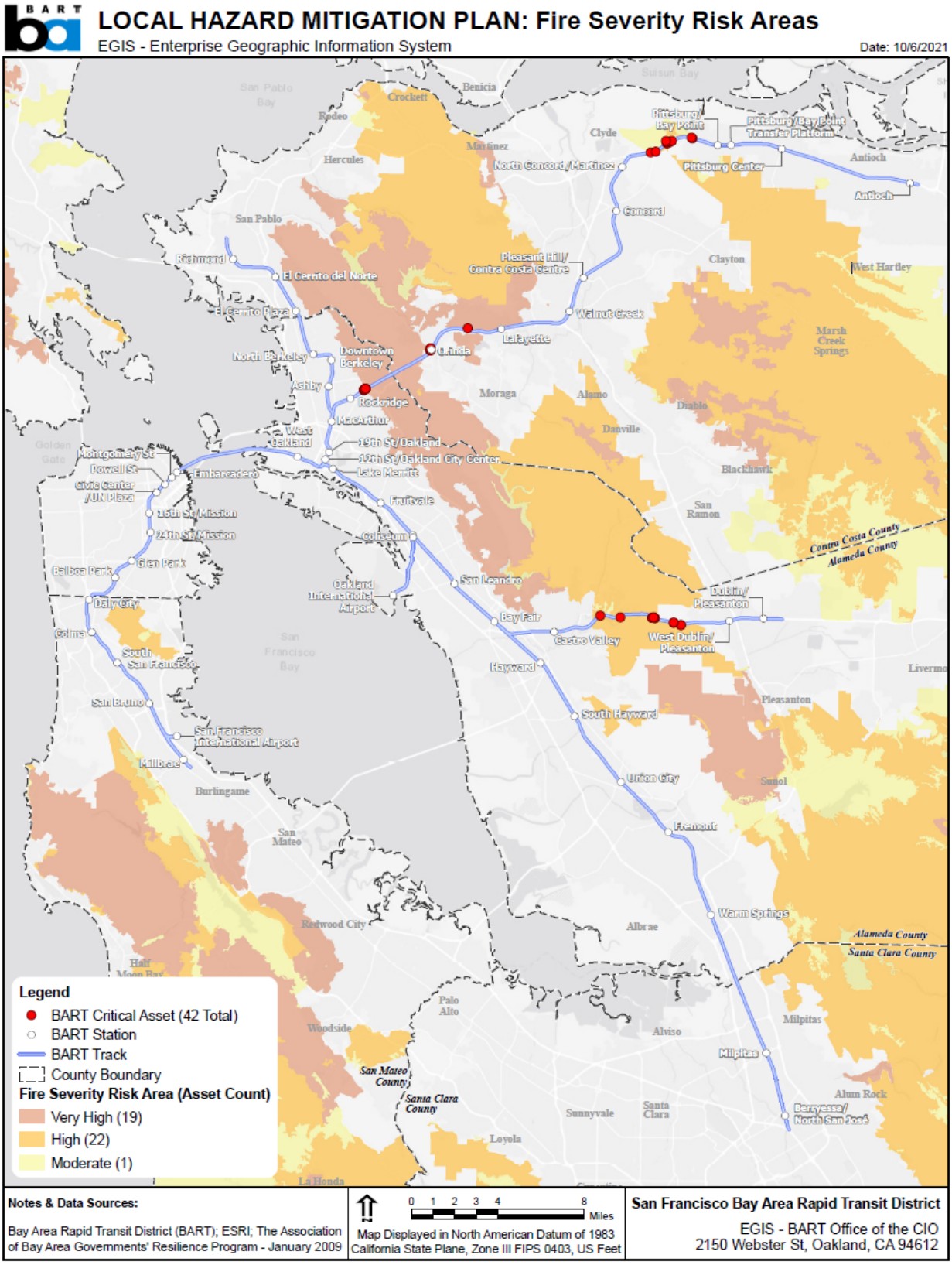

Figure 9 Fire Severity Risk Areas

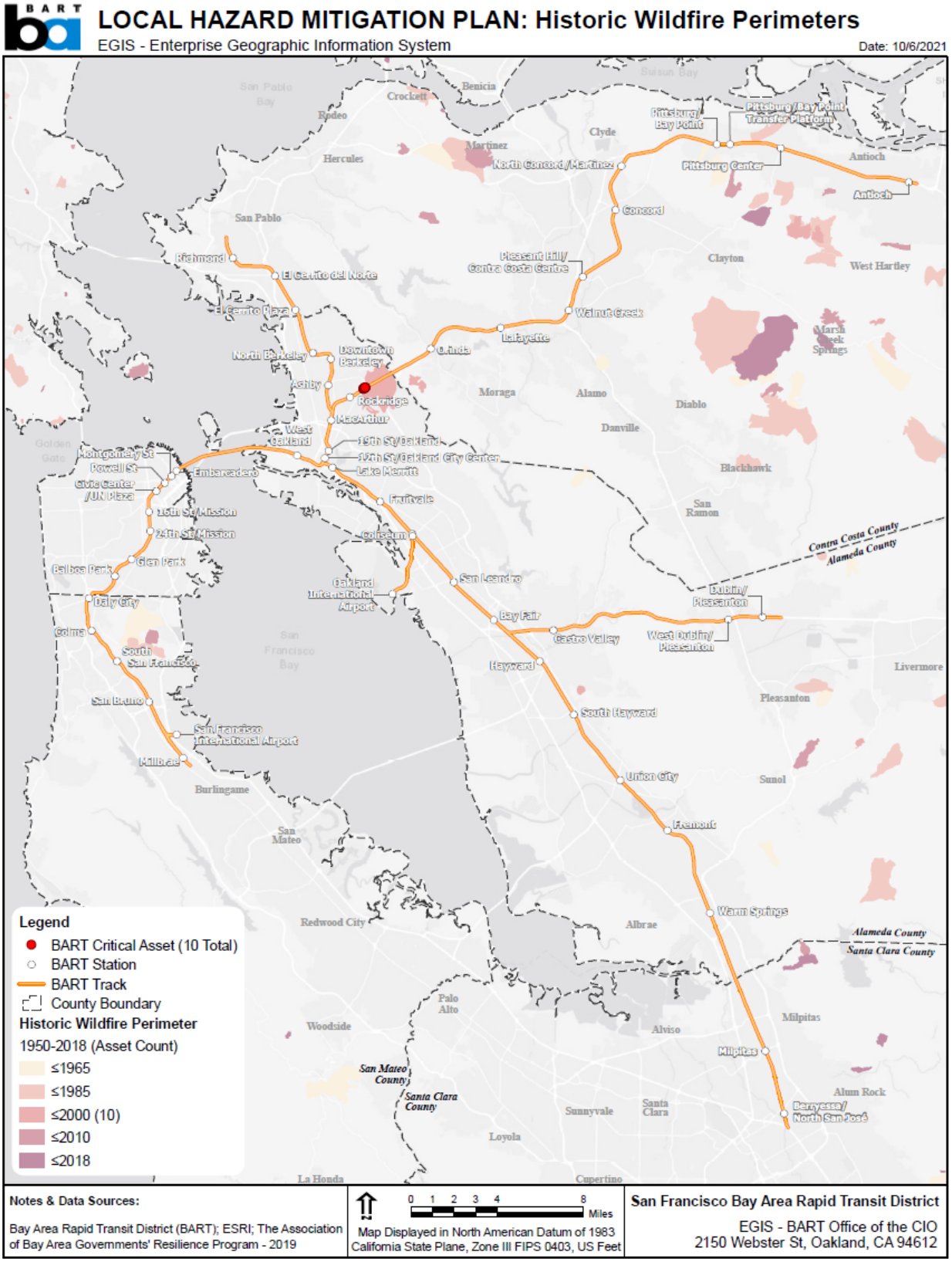

Figure 10 Historic Wildfire Perimeters

3.8 Drought

Type: A drought is characterized as a period of below-average precipitation in a particular region which culminates in water supply shortages. Such storages may be surface or ground level. A drought is a gradual phenomenon that occurs over several dry years, depleting reservoirs and groundwater basins without the expected annual recharge from winter precipitation.

Location: Figure 11 drought severity illustrates areas impacted by drought as of 2021. Drought is not localized, but extends statewide or across a larger expanse of western states.

Extent: Duration of droughts can last many years. Studies of tree rings have shown that drought periods in California's history can last more than 200 years and there have been multiple droughts in the past thousand years lasting 10 to 20 years.[42]

Probability: Multi-year droughts of statewide scale occur periodically. See Section 4.8.2 for a list of past droughts affecting the Bay Area.

Climate Change: Climate change is likely increasing the occurrence and severity of droughts.[43] Climate modeling (RCP 4.5 and 8.5 scenarios) indicates substantial declines in snowpack in the Sierra Nevada. The mean snow water equivalent (SWE) declines to less than two-thirds of its historical average by 2050, averaged over several model projections under both RCP 4.5 and 8.5 scenarios[44]. By 2100, SWE declines to less than half the historical median under RCP 4.5, and less than one-third under RCP 8.5.

3.8.1 Potential Impacts

Increased fire hazard risk is a consequence of drought conditions. There are multiple drought related factors that contribute to increased fire hazard: longer fire season, drier vegetation, and hot days. Additionally, drought reduces the water supplies available to fight wildfires, leading to larger and more extended fires. The Bay Area is adversely impacted by the severe reduction in snow pack in the Sierras, the source of two-thirds of the region's water.

When drought conditions do occur, BART can curtail use of water for such purposes as station cleaning, washing trains, and landscape irrigation. At minimum, the District requires a water supply to support fire protection of the system. Without fire protection, BART facilities would be forced to shut down impacting community mobility.

Vulnerability Summary: The entire Bay Area is vulnerable to the drought hazard. Water is necessary for fire protection. BART pursues opportunities where feasible to advance water conservation. Refer to BART sustainability program for details.

[42] Mercury News, (2014), http://www.mercurynews.com/2014/01/25/california-drought-past-dry-periods-have-lasted-more-than-200-years-scientists-say/
[43] Cal-Adapt
[44] California's Fourth Climate Change Assessment (2018)

3.8.2 Historic Events

Major droughts occurred in California include 1975-77, 1987-1992, 2007-2009, 2012-2017[45]. Between 1975 and 1977, California experienced one of its most severe droughts. Most surface storage reservoirs were substantially drained in 1976, leading to widespread water shortages when 1977 turned out to be even drier. Thirty-one counties were affected, resulting in $2.67 billion in crop damage. From 1987 to 1992, storage in major reservoirs had dropped to 54 percent of average. Shortages led to stringent water rationing and severe cutbacks in agricultural production, including threats to survival of permanent crops such as trees and vines. Water years 2007-2009 were collectively the 15th driest three-year period for Department of Water Resource's eight-station precipitation index. In February 2009, for the first time in its history, the State of California proclaimed a statewide drought. The statewide drought of 2012-2017 will be remembered as one of the most severe and costliest droughts of record in California. By April 2017, the state had expended $6.6 billion in drought response and mitigation programs and had been declared a federal disaster area.

As of 2021, following the second driest year on record, California is entering into another drought period. In 2021, the State issue a drought emergency proclamation urging Californians to conserve water.[46] August 2021 was the driest and hottest August on record since reporting began.

[45] California State Hazard Mitigation Plan, September 2018
[46] Governor Newsom Expands Drought Emergency Statewide, Urges Californians to Redouble Water Conservation Efforts | California Governor, 10/19/2021

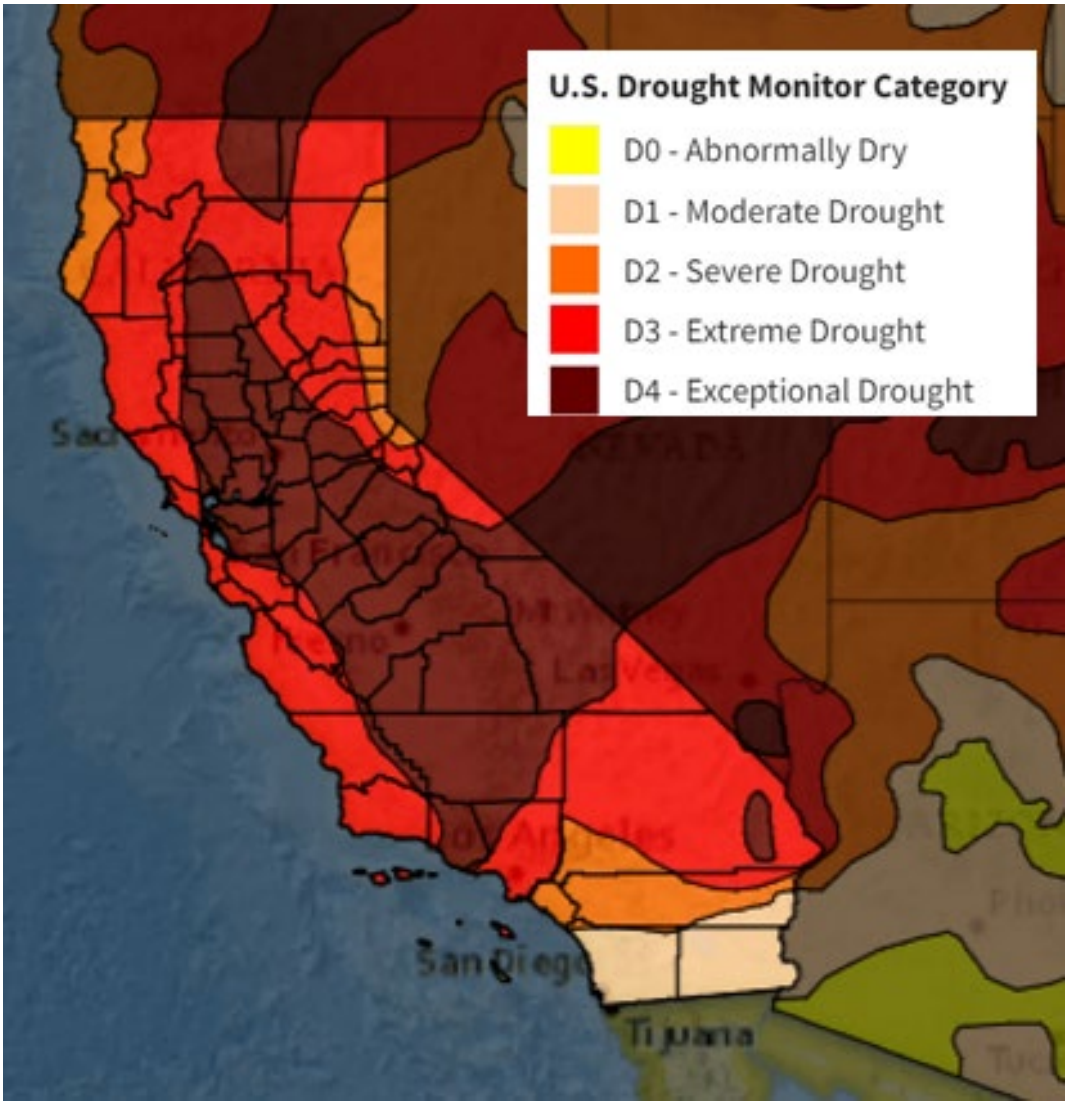

Figure 11 Drought Severity (as of 2021)

3.9 Extreme Heat

Type: Extreme heat occurs when the heat index, a function of heat and relative humidity, is high. The Bay Area, especially the parts further away from the coast and bay which lack cooling effect from ocean and bay water, can experience extreme heat days.

Heat emergencies occur when residents are subject to heat exhaustion and heatstroke, and are more likely to occur in areas not adapted to heat and without air conditioning, cooling centers, or vegetation to mediate heat impacts in exposed areas. Certain populations are typically the most at risk during extreme heat emergencies, including people with disabilities, chronic diseases, the elderly, and children.

Location: Extreme heat issues are most likely to impact the BART system in the inland areas including the C and L lines.

Extent: Extreme heat days pose a public health threat, causing symptoms such as exhaustion, heat cramps, and sunstroke if the heat index is over 90̊ F. The National Weather Service has developed a Heat Index Program Alert which gets triggered when heat index temperature is expected to be or exceed 105̊ for at least two days and nights[47].

The intensity of extreme heat may be defined differently for each location in the region. In San Francisco County an extreme heat day is defined as a day above 78°, while for inland portions of Solano County extreme heat is defined as a day above 100°. The threshold is the 98th percentile historic maximum temperature. The threshold is set locally to recognize services and buildings in cooler climates may not be designed to handle moderate heat, while those areas where high heat has always been an occurrence, already have measures to address their historic temperatures.

Probability: California has historically (from 1950 to 2005) experienced 4 extreme heat days a year.[48] Extreme heat typically occurs between July and August.

Climate Change: Climate change is expected to generate an increase in ambient average air temperature, particularly in the summer. The outer Bay Area will likely experience greater temperature increases than coastal or bayside jurisdictions, though likely not as great as in the eastern-most inland communities. Increased frequency, intensity, and duration of extreme heat events and heat waves are also expected as regional climate impacts.

Cal-adapt projects under scenario RCP 4.5, average number of heat days to reach 21 from mid to end-of-century[49].

3.9.1 Potential Impacts

Extreme heat events have the potential to severely impact BART service. Increases in overall temperatures strain the regional power network and could lead to more frequent PG&E brown-outs resulting in service delays within the system. In addition, extreme heat can cause BART's own electrical systems to overheat which would impact delivery to the third rail and stations. BART has experienced overheat of train control equipment, in part due to the aging infrastructure.

Heat waves could impact patron and employee health and safety particularly among vulnerable populations.

In rail systems, extreme heat may cause rail buckling. Kinks have occurred in the BART system. BART has observed it occurring during the summer primarily in the C and L lines. When temperatures are forecasted to over 100 degrees Fahrenheit, BART conducts track inspections to look for signs of misalignment. .

Indirect impacts of extreme heat include disruptions or strains in the electric grid. BART relies on PG&E for transmission and distribution of power.

[47] Heat Watch vs. Warning (weather.gov)
[48] Cal-Adapt
[49] Cal-Adapt

Vulnerability Summary: Assets in the inland areas including the C and L lines will be most at risk. The types of assets vulnerable will be those with electrical and mechanical equipment including substations, train control rooms, passenger stations, and ventilations structures. BART's RR program to renew aging infrastructure is mitigating overheating electrical systems. Refer to Measure RR program under existing programs.

3.9.2 Historical Events

Few heat events were proclaimed at the state level or declared as a federal disaster between 1960 and 2009.[50] In an extended California heat wave in 2006, over 650 deaths occurred.[51] Nineteen heat-related events occurred from 1999 to 2009 that had significant impacts on human health, resulting in about 11,000 excess hospitalizations.[52]

California has historically (from 1950 to 2005) experienced 4 extreme heat days a year.[53]

3.10 Other Hazards

Other hazards include those outside of geologic and weather-related hazard types commonly recognized in mitigation plans. Other hazards may pose a risk to BART system. The following are short narratives of other hazards.

3.10.1 Epidemics, Pandemics, Vector-borne Diseases

California faces a variety of diseases that can threaten the lives, health, safety, and property of individuals and communities, and negatively affect California's environment, economy, and infrastructure. These diseases include seasonal influenza, pandemic influenzas (H1N1 (swine flu), avian influenza), mosquito-borne diseases (such as West Nile virus), lyme disease, valley fever, and most recently COVID-19.[54]

Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus.[55] COVID-19 causes mild to moderate respiratory illness. Older people and those with underlying medical conditions like cardiovascular disease, diabetes, chronic respiratory disease, or cancer are more likely to develop serious illness.

In responding to COVID-19, BART has been a leader in addressing the potential spread of the disease.[56],[57] BART has been actively monitoring the pandemic situation and maintaining active communication lines with local, state, and federal public health and emergency officials. All of BART's activities have been in accordance with the CDC, California Department of Public Health, and county public health departments to keep

[50] California State Hazard Mitigation Plan, September 2018
[51] Safeguarding California: Reducing Climate Risk
[52] California's Fourth Climate Change Assessment
[53] Cal-Adapt
[54] California State Hazard Mitigation Plan, September 2018
[55] Coronavirus (who.int)
[56] BART updates related to the coronavirus (COVID-19) | BARTable
[57] https://www.bart.gov/news/articles/2020/news20200225

employees and riders safe. Refer to the Response and Prevention Efforts Section at the following link: https://www.bart.gov/news/articles/2020/news20200225 for a complete list and summary of BART's implemented actions to address COVID-19. The following highlights just a few of those actions:

- BART spearheaded a COVID-19 task force with representatives from each transit agency in the California. Safety department representatives worked together and shared information to develop systematic procedures and a common approach to successfully navigate the challenges during the pandemic.
- BART was the first transit agency in California to develop and implement an employee mandatory vaccination policy.
- BART was among the first transit agencies to fog trains and facilities. BART shifted away from daily fogging after CDC lowered the risk on surface transmission.
- BART made vaccination shots available to employees and family members.
- BART upgraded filters in all train cars the to MERV-14 and upgraded UV lighting in HVAC duct work to remove viruses in the air.
- BART cleans hand-contact surfaces at stations with hospital-grade disinfectant. Hand-sanitizers are made available at each station.
- BART cleans and disinfects train cars including handrails and stanchions.
- On COVID-19 protection and prevention. Information is posted in BART stations and sent through email, text, and Twitter.
- BART provides employee communication on COVID-19 protection and guidance at employee
- BART maintains inventory stock of PPE such as disinfectant, hand sanitizers, face masks, and hand wipes to support operations

3.10.2 Terrorism and Domestic Violent Extremism

Terrorism and domestic violent extremism (DVE) is the calculated use of unlawful violence threat of unlawful violence to incite fear, to coerce or to intimidate governments, peoples, or societies in pursuit of goals that are generally political, religious, or ideological in nature. Like terrorism, DVE use similar violent tactics and method to promote their ideology and goals.

Tactics and method of terrorism and DVE utilize the full suite of threats including chemical, biological, radiological, nuclear, and explosive (CBRNE), active shooter, and vehicle ramming. California has not been immune to these types of attacks and in recent years has seen a rise in active shooter, vehicle ramming, and explosive attacks. Places where people gather, including mass transit systems, are vulnerable to attacks because of the large

numbers of people that gather in one place and the overall openness of these types of systems.

BART is a transit industry leader in security. The BART Police Department maintains a high visibility police presence patrolling inside stations and on trains and responding to emergencies. Specialized units such as Core Asset Protection (CAP) Teams and Canine units, and specialized technology systems such as alarm system, video surveillance, and intrusion detection, provide a layered approach to security. Additionally, BART provides policy and training for District staff in Transit Security, a course approved the Transportation Security Administration (TSA) that includes planning, preparedness, response, and recovery to the full suite of threats. The BART Police Department also interfaces with federal, state, and local law enforcement and intelligence partners to understand the threats in real time. The District maintains a robust public awareness campaign to encourage patrons to report unattended packages or suspicious behavior to BART Police.

3.10.3 Severe Storms

Severe storms are generally violent atmospheric disturbances occurring over land or water. Severe storms refer to events that are beyond or near the ends of the range of observed weather patterns and behavior. Two types of storms include thunderstorms and winter storms. Thunderstorms may produce high wind, tornadoes, large hail, flooding and flash flooding. Winter storms may produce freezing rain, sleet, heavy snow, and strong winds. El Nino and La Nina are two types of storms that affect California often. El Nino refers to large scale ocean-atmosphere climate phenomenon linked to periodic warming in oceanic surface temperatures in the equatorial Pacific. La Nina refers to the periodic cooling of oceanic surface temperatures in the equatorial Pacific.

High winds are a common characteristic of severe storms. High winds cause down trees and power lines. Debris that fall onto tracks due to high wind can disrupt transit service and cause delays. To avoid such disruptions, BART trims trees and bushes that could fall onto or near the trackway.

Mitigation Strategy

Regulation Checklist
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources, and its ability to expand on and improve these existing policies and programs? (44 CFR 201.6(c)(3))
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements as appropriate? (44 CFR 201.6(c)(3)(ii))
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (44 CFR 201.6(c)(3)(i))
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (44 CFR 201.6(c)(3)(ii) and 44 CFR 201.6(c)(3)(iv))
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (44 CFR 201.6(c)(3)(iii) and 44 CFR 201.6(c)(3)(iv))
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (44 CFR 201.6(c)(4)(ii))

4.1 Mitigation Goal

The mitigation goal of the Plan is to maintain and enhance a disaster-resilient District by reducing the potential for loss of life, property damage, and environmental degradation from natural disasters, while supporting economic recovery from such disasters. This goal is unchanged from the previous plan and continues to be the goal of BART in designing a hazard mitigation program.

4.2 Mitigation Measures

Mitigation measures are in Appendix C. These mitigation measures represent the action plan for District to pursue and implement. Appendix C includes the prioritization of mitigation measures and identifies the timeframe, potential funding, and lead departments for implementation.

Mitigation measures were identified from the following sources:

- Incomplete and ongoing measures from the previous plan,
- Industry best practices (including FEMA Mitigation Ideas (2013)),
- Feedback from internal and external engagement activities,

- Relevant actions identified in BART's capital needs inventories.

Prioritization of mitigation actions was established by a rating method (low, medium, high) and rated by the EPTFC and other District personnel. Participating members of the EPTFC rated each action based on action's importance and alignment to the following criteria:

- Hazard risk reduction
- Cost to benefit value
- Environmental benefit
- Equitable outcomes
- Safety impact

Thirty-seven (37) actions were identified and prioritized. Of the actions, eight (8) were rated as high priority, twenty-eight (28) were rated medium priority, and one (1) was rated low priority. Note, all actions identified are important; low does not mean that the action is not important but that it is holds a lower rating relative to other actions identified.

4.3 Existing Mitigation Authorities, Policies, Programs, and Resources

The following are the District's authorities, policies, programs, and resources that support efforts to mitigate hazards. This section provides a snapshot of capabilities from which the District develops its mitigation strategy.

4.3.1 Authority

BART is a special purpose transit district that governs the BART system. The governance of the District is vested in a Board of Directors composed of nine members, each representing an election district within the District. As a special district, BART has authority of a transit district per CA Code of Public Utilities, Section 28500-27509. Authorities include authority to enter contracts; acquire real property; construct and operate facilities; issue debt; make investments; and levy taxes.

4.3.2 Policies

The District has adopted a number of policies that align with and shape hazard mitigation. Those include

- Safety management policy (2020)
- Asset management policy (2019)
- Sustainability policy (2017)
- Safe transit policy (2017)
- Strategic plan framework (2015)
- Environmental justice policy (2012)

A full list of Board-adopted policies may be found at https://www.bart.gov/about/bod/policies.

4.3.3 Programs

Programs below highlight the major programs related to mitigation and are not inclusive of all mitigation-related activities that occur on an ongoing basis at BART. For example, the Maintenance and Engineering Department conduct maintenance activities such vegetative management to reduce trackway intrusion and reduce any obstructions (such as downed trees), and conduct scheduled maintenance of emergency equipment, such as generators.

4.3.3.1 National Flood Insurance Program

BART does not participate in the National Flood Insurance Program (NFIP). BART elects to use private insurance in lieu of NFIP.

4.3.3.2 Emergency Management Program

BART maintains the Emergency Operations Plan which provides a blueprint for how BART organizes and responds to a variety of incidental and emergencies that BART could encounter. It assigns staff to emergency roles and positions, defines tasks during planning, response and recovery phases of emergency management. The EOP provides direction for the communication and coordination of people, equipment, and systems in times of emergency.

4.3.3.3 Measure RR Program

In November 2016, voters passed Measure RR, which authorized BART to issue bonds for $3.5 billion to rebuild the aging BART system. [58] The overall goal of the Better BART rebuilding program is to make the system safer and more reliable and to reduce traffic. The program includes investments to renew or improve tracks, power lines, structures, infrastructure, stations, train control, access, and crowd relief.

4.3.3.4 Earthquake Safety Program

The Earthquake Safety Program (ESP) is expected to be complete by 2023. As of 2022, 38 contracts are complete with one (TBT retrofit) nearing completion.

The Earthquake Safety Program is tasked with upgrading vulnerable portions of the original BART system to ensure safety for the public and BART employees. Portions of the original system with the highest traffic are being upgraded not only for life safety but also to ensure that they can return to operation shortly after a major earthquake. The upgrades will be accomplished by using the accepted seismic standards and procedures to improve the seismic resilience of BART facilities.

The Earthquake Safety Program addresses the original BART system completed between 1972 and 1976, with a service area spanning three counties-Alameda, Contra Costa and San Francisco. System extensions, which were built later mostly during the 1990s, employed more stringent and up-to-date seismic criteria than the original system, and thus do not require upgrades.

The Earthquake Safety Program budget is $1.457 billion. Funding sources include:

- $980 million from General Obligation Bonds (Regional Measure AA)
- $116 million from California Department of Transportation Local Seismic Safety Retrofit Program

[58] We're Rebuilding. | bart.gov

- $93 million from Regional Measure 2 (RM2), State Transportation Improvement Program (STIP), Prop 1B
- $60 million from investment return
- $194 million from Measure RR
- $11.5 million from Transportation Congestion Relief Program (TCRP)
- $3 million from FEMA Pre-Disaster Mitigation Program

4.3.3.5 Water Intrusion Program

The Water Intrusion Program is a rehabilitation program to address water leaks. Water leaks are caused by infrastructure degradation from structural fatigue, environmental impacts, materials performance, and high rates of usage in actual operating conditions. Program efforts include water intrusion mitigations in BART tunnels, substations, train control rooms, escalator and elevator machine rooms, stations and platform joints.

4.3.3.6 Annual Winterization

On an annual basis, the BART Operating Departments engage in preparatory efforts to ready the system for the rainy season. These activities include:

- Cleaning the right of way, station and shop culverts and drains.
- Patching and repairing reported roof leaks at stations, traction power substations, train control hut, shops and yard facilities.
- Testing and making necessary repairs to elevator, escalator, and station sump pumps.
- Trimming trees and bushes that could create a potential hazard.
- Securing backup generators and staging them at vital locations.
- Reviewing procedures for deployment of staff to critical areas for 'Storm Watch' during periods of heavy rain and high wind.
- Reviewing protocols with for response to mutual problems with San Francisco Municipal Transportation Agency (SFMTA).
- Reviewing System Service protocols for response to flooding and wet conditions at stations.
- Inventorying and ordering materials to ensure necessary maintenance materials will be readily available.
- Ensuring that maintenance vehicles are properly stocked to respond to weather related issues.
- Designating vehicles that will always have a generator hitched to it for quicker response.
- Ensuring adequate inventory of emergency supplies in stations and facilities.
- Ordering large floor mats to be installed as necessary to mitigate slip and fall risk.
- Leak inspections of all rooms during and after the first rain.

4.3.3.7 Sustainability Program

The sustainability program aims to support a sustainable, healthy, and vibrant Bay Area through actions and investments that create a less car-dependent region and a greener transportation system.

The District has a long history of advancing sustainability. In 2003, the District adopted its first Sustainability Policy that directed the District to integrate best practices in sustainability in the organization. In 2017, the District adopted an updated Sustainability Policy which committed the District to advance regional sustainability by providing safe, affordable, equitable, and environmentally friendly transit to move people to jobs, recreation, and services. In concert with the District's Sustainability Policy, adopted in 2017, BART published a 10-year Sustainability Action Plan that details the targets, current progress, and future actions to integrate sustainability as a standard practice throughout BART. The plan was created with input from numerous BART departments and in coordination with broader regional and American Public Transportation Association (APTA) sustainability goals. The detailed roadmap includes performance metrics to measure outcomes of actions that support BART's commitment to provide safe, affordable, equitable, and environmentally-friendly transit. BART's energy, greenhouse gas emissions, and water targets were derived from Business as Usual (BAU) scenarios that utilize the baseline values in 2015 and planned growth in the number of stations, planned extensions to the existing lines, and expected improvements to the system. The committed and aspirational targets represent percentage reductions from the projected BAU values in 2025. The policy and action plan may be found at https://www.bart.gov/sustainability/policies.

Each calendar year, the District publishes an annual report which communicates progress in BART's 10-year Sustainability Action Plan. The annual sustainability reports may be found at https://www.bart.gov/sustainability.

4.3.3.8 Strategic Asset Management Program

The Strategic Asset Management program aims to optimally manage BART's assets and asset systems, their associated performance, risks and expenditures. The program follows federal guidelines delineated in MAP 21 and the International Standard ISO 55000 for asset management. The updated asset management policy was adopted by the BART Board in April 2019 and includes the following three goals with respect to asset management 1) prioritize passenger and employee safety, comply with oversite agency requirements and industry best practice, and maintain state of good repair; 2) be transparent and foster collaboration throughout District; 3) inform decision-making to ensure safety, sustainability, fiscal responsibility, and social equity. The asset management team coordinates activities and oversees the implementation of the policy.

4.3.4 Resources

The District issues a financial annual budget each fiscal year. Current and prior financial annual budgets may be found at https://www.bart.gov/about/financials.

The District organizes finances into operating and capital budgets. The operating budget funds the annual operation and maintenance of the BART system. The operating budget sources include passenger and parking revenue, taxes, and financial assistance from local, state and federal sources. The capital budget funds the construction, expansion, renovation, or replacement of physical assets (new train cars, station improvements, etc.) Capital funding consists of federal/state/local grants, voter approved bonds and measures specifically for capital improvements, and allocations from the operating budget.

Per the FY22 adopted budget report, the District's long term outlook is a highly uncertain fiscal future (FY22-FY25) primarily due to uncertainties from the COVID-19 pandemic. Factors driving this uncertainty include timing and pace of pandemic end; post-pandemic market size or market share; impact of pre-pandemic trends; and long-term market size and regional growth patterns.

4.4 Plan Integration

Upon readoption of the Plan, the Core Administrative Team will work with the relevant BART departments to incorporate the elements of the Plan into existing planning mechanisms capital improvement planning and budgeting mechanisms. Elements will be incorporated into various planning documents when those plans and policies are updated or when new ones are developed. Specifically, Core Administrative Team will integrate the Plan into the following activities:

- Incorporate the hazard and vulnerability analysis information in the emergency preparedness plan and procedures.
- Incorporate mitigation strategies into capital needs inventories.
- Incorporate hazard maps data into the District EGIS system.
- Incorporate mitigation strategies into department workplans as appropriate.

Plan Review, Evaluation, and Implementation

Regulation Checklist
D1. Was the plan revised to reflect changes in development? (44 CFR 201.6(d)(3))
D2. Was the plan revised to reflect progress in local mitigation efforts? (44 CFR 201.6(d)(3))
D3. Was the plan revised to reflect changes in priorities? (44 CFR 201.6(d)(3))

5.1 Plan Update

This Plan is an update from the 2017 plan. The lead in updating this Plan was taken by the Core Administrative Team.

As required by the Disaster Mitigation Act of 2000, BART will update this plan at least once every five years. In this update, the followings sections have been revised to better reflect actions pertinent to the BART system.

- The Planning Process (Section 2) was reviewed for appropriateness. Documents references have been updated to reflect new information sources.
- The Hazard Identification and Risk Assessment (Section 3) has been updated to incorporate the new hazard and asset information for the region. Specific information on BART has also been updated to reflect additional engineering studies, institutional understanding of assets, and progress of mitigation activities that have occurred in the past five years.
- Mitigation Strategy (Section 4) have been updated to reflect changes in priorities. Measures have been updated to reflect changes in development and progress of mitigation efforts.
- For status of mitigation actions in the previous plan, refer to Appendix D.

Plan Adoption

Regulation Checklist
E1. Does the Plan include documentation that the Plan has been formally adopted by the governing body of the jurisdiction requesting approval? (44 CFR 201.6(c)(5))
E2. For mulit-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (44 CFR 201.6(c)(5))

The BART Board of Directors formally adopts the Plan in a public board meeting via resolution after pre-approval (approval pending adoption) by FEMA. See Appendix E for formal adoption of the Plan.

Plan Point of Contact

Point of Contact
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Oakland, CA 94612
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Alternate Point of Contact
Name: Michael Brill
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Email: Michael.brill@bart.gov

Alternate Point of Contact
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Appendix A

BART System Overview

A1 BART System Overview

A1.1 BART System

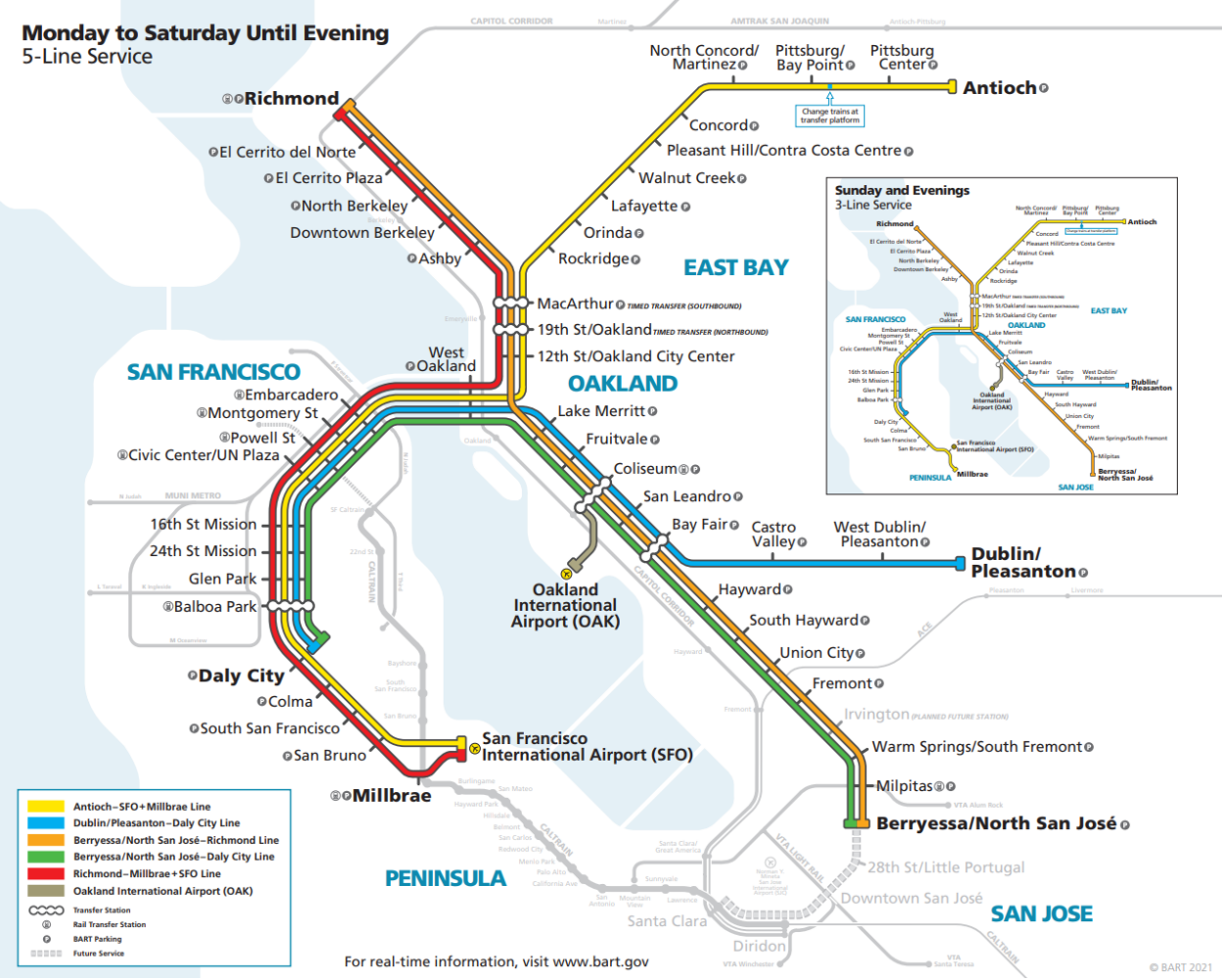


Figure A1 BART System Map

A1.2 BART Service Hours

BART runs weekdays 5am to midnight; Saturdays 6am to midnight; Sundays 8am to 9pm.[59] .

[59] Schedules | bart.gov

A1.3 BART Fares

Fares are based on a mileage formula. A standard one-way fare can range from $2.10 to $13.85.[60]

Children 4 and under ride free. Discounts are available for youth (5 to 18 of age), seniors (over 65), low-income adults, persons with disabilities, and high-value purchases.

A1.4 eBART

eBART is a service that began May 26, 2018[61]. eBART is a 10-mile long service that connects Pittsburg/Bay Point Station to Antioch. eBART provides much needed relief on State Route 4.

eBART uses a train called a diesel multiple unit (DMU).

A1.5 Oakland Airport Connector

Oakland Airport Connector (OAC) is a service that began in 2014[62]. OAC is a 3.2-mile long extension from BART Coliseum Station to Oakland International Airport.

OAC uses an automated, driverless people-mover system that used an automated guideway transit technology.

[60] Fare Calculator | bart.gov
[61] BART to Antioch: East Contra Costa BART Extension | bart.gov
[62] New BART service to Oakland International Airport now open | bart.gov

Appendix B

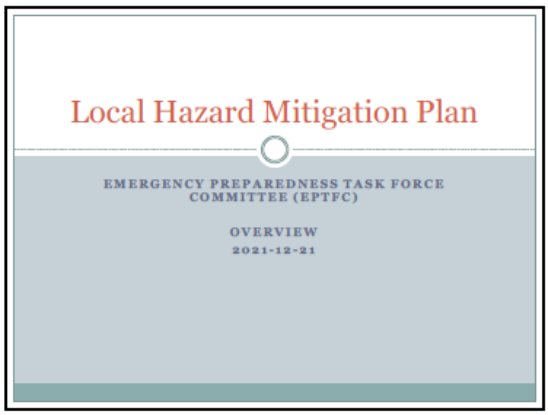
Engagement Documentation

B1 Engagement Materials

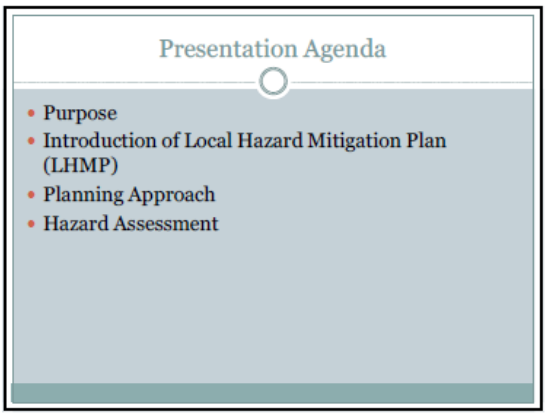
B1.1 Emergency Preparedness Program Task Force Committee Meetings

B1.1.1 December 21, 2021

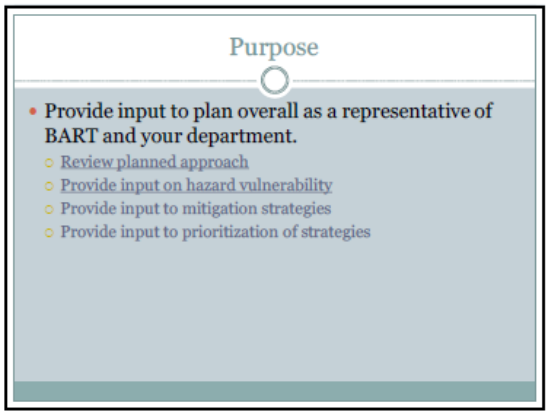
Meeting Attendees: Phoebe Cheng, Norman Wong, Michael Brill, James Allison, Thomas Moloney, Aileen Hernandez, Chuck Bernardo, Shihua Nie.


Local Hazard Mitigation Plan
EMERGENCY PREPAREDNESS TASK FORCE COMMITTEE (EPTFC)
OVERVIEW
2021-12-21

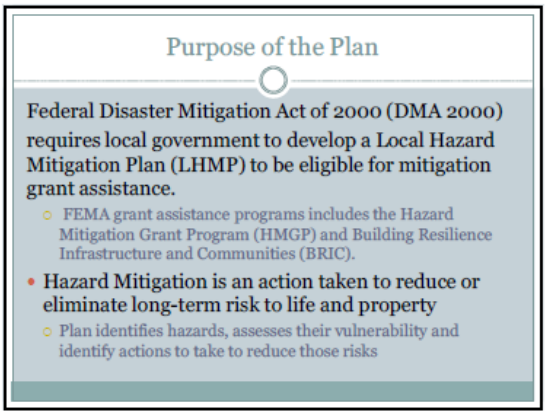
1


Presentation Agenda
Purpose
Introduction of Local Hazard Mitigation Plan (LHMP)
Planning Approach
Hazard Assessment

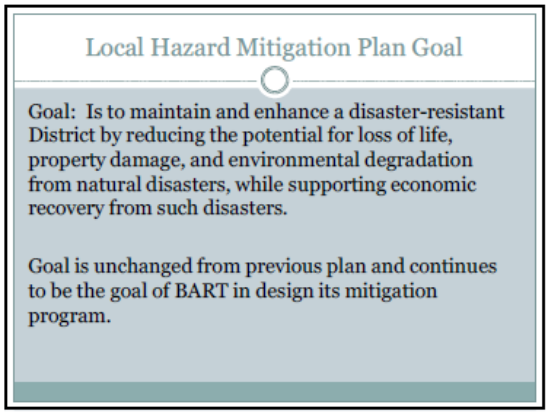
2


Purpose
Provide input to plan overall as a representative of BART and your department.
Review planned approach
Provide input on hazard vulnerability
Provide input to mitigation strategies
Provide input to prioritization of strategies

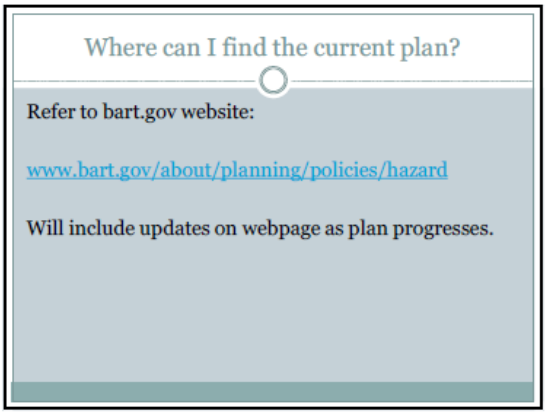
3


Purpose of the Plan
Federal Disaster Mitigation Act of 2000 (DMA 2000) requires local government to develop a Local Hazard Mitigation Plan (LHMP) to be eligible for mitigation grant assistance.
FEMA grant assistance programs includes the Hazard Mitigation Grant Program (HMGP) and Building Resilience Infrastructure and Communities (BRIC).
Hazard Mitigation is an action taken to reduce or eliminate long-term risk to life and property
Plan identifies hazards, assesses their vulnerability and identify actions to take to reduce those risks

4


Local Hazard Mitigation Plan Goal
Goal: Is to maintain and enhance a disaster-resistant District by reducing the potential for loss of life, property damage, and environmental degradation from natural disasters, while supporting economic recovery from such disasters.
Goal is unchanged from previous plan and continues to be the goal of BART in design its mitigation program.

5


Where can I find the current plan?
Refer to bart.gov website:
www.bart.gov/about/planning/policies/hazard
Will include updates on webpage as plan progresses.

6

Plan Elements

1) Introduction
2) Planning process
   1) Staff and tasks in planning
   2) Engagement
3) Hazard profiles
   1) Profile descriptions (type, location, extent, probability, climate change, impacts, historical events)
4) Mitigation strategy
   1) Mitigation goal and measures
   2) Existing programs and resources
   3) Strategies
5) Plan Review/ Plan Adoption

7

Planning Boundary

Cover District's jurisdiction, namely, District's operated property within BART right-of-way (ROW).

Emphasis on BART's critical assets. Notable asset types:

- Passenger stations
- Trackway
- Substations and switching stations
- Train control rooms
- Shops/yards

8

Planning Approach: Teams

Admin Team
- Review LHMP
- Review past/current applicable plans, reports & studies
- Review GIS documents
- Identify opportunities for public meetings and/or workshops
- Solicit input from citizens and subject matter experts
- Identify information gaps in plan

Internal
- Emergency Prep. Task Force Committee (EPTFC)
- Subject matter experts (as needed)

External
- Title VI EJC Committee
- Local cities and counties

9

Planning Approach: Timeline

Activity	Date
Kick off	Aug 2021
Review LHMP, existing docs, update hazard profiles	Aug to Nov 2021
Meetings (Title VI EJC ; EPTFC)	Dec 2021
Mitigation action review and development	Dec 2021 to Feb 2022
Meetings (Title VI EJC ; EPTFC)	Mar 2022
Compile and update draft	Mar/Apr 2022
Review and revisions	Apr/May 2022
Public comment period	May/June 2022
Incorporation of public comments	July 2022
CalOES/FEMA for review	Aug to Oct 2022
Board Adoption of plan	Winter 2022

10

Hazard and Risk Assessment

Natural hazards identified:

- Earthquake (4) –
  - Fault lines and shaking, landslides, liquefaction and tsunamis
- Weather (4)
  - Flooding, landslides, wildfires, extreme heat, drought
- Sea level rise
- Pandemics

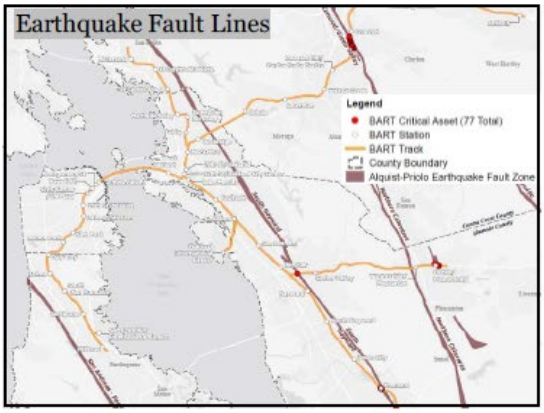
11

Hazard	BART Data Sources	External Data Sources
General (all hazards)	BART news (service disruptions)	CA State Hazard Mitigation Plan (2018) ABAG Risk Profiles Cal-Adapt
Earthquake	Seismic vulnerability study (2002) Appendix 4, BART Damage Assessment to HayWired Scenario Ground Shaking	USGS HayWired (2018) USGS Uniform California Earthquake Rupture Forecast (2015)
Liquefaction	Liquefaction studies	
Tsunami		USGS Science Application for Risk Reduction (2013)
Landslide (seismic/weather induced)	Slope Reconnaissance Screening Report (2018)	
Flooding		FEMA flood maps
Wildfire		Calfire CA Fire and Resource Assessment Program (FRAP)
Extreme heat		
Drought		US Drought Monitor
Sea Level Rise (SLR)	BART SLR and Flooding Resiliency Study (2020)	USGS CoSMos-groundwater State of CA SLR Guidance (2018) Adapting to Rising Tides
Pandemics		CDC

12

Hazard	District Efforts
General (all hazards)	Emergency Preparedness Program Power redundancy projects
Earthquake	Earthquake Safety Program
Liquefaction	n/a
Tsunami	Monitor for warnings from NOAA
Landslide (seismic/weather induced)	Slope stabilization work (planned)
Flooding	Design reqts to withstand 500-year floods for critical assets Water intrusion program Low-impact development
Wildfire	Vegetation control on District property
Extreme heat	-Improve temperature control in train control rooms (Measure RR); infrastructure renewal; AC in BART cars. -Canopy and trees for cooling and shading
Drought	Drought resistant landscaping Water efficient fixtures and irrigation Recycled water in train washing
Sea Level Rise (SLR)	Project reqts to conduct assessment and address Engage regional partners on adaptation
Pandemics (Covid)	BART welcome back plan (upgraded air filters; face masks; test sites at BART stations; social distancing; train fogging; communications)

13



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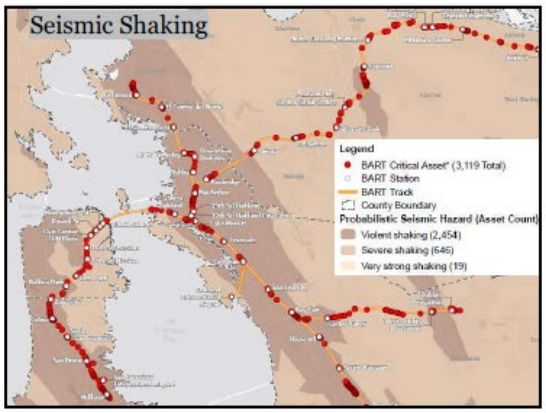

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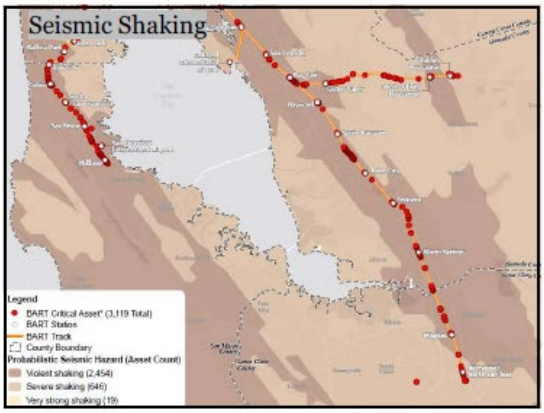

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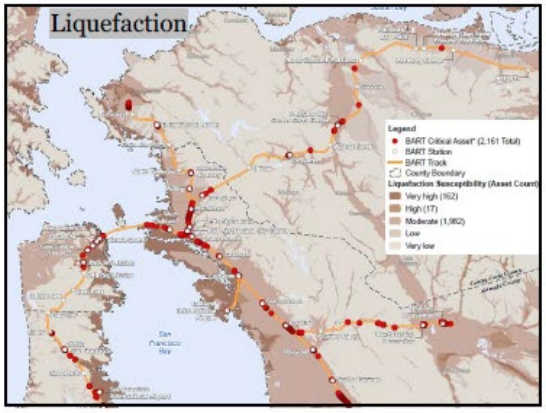

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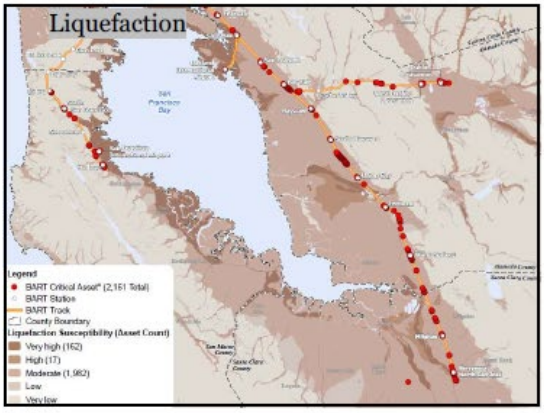

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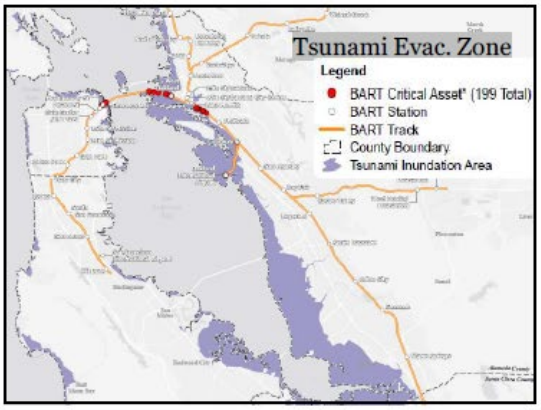

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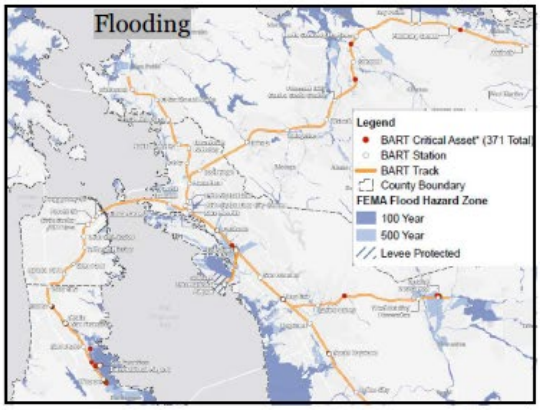

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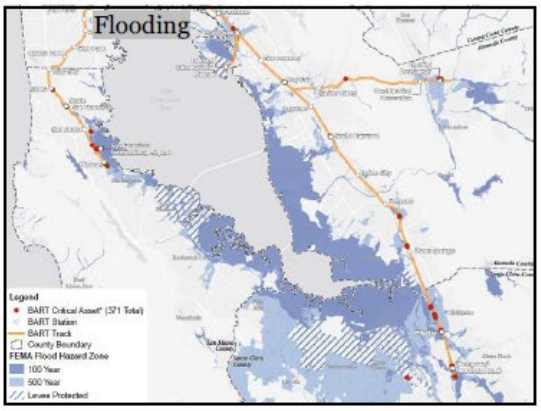

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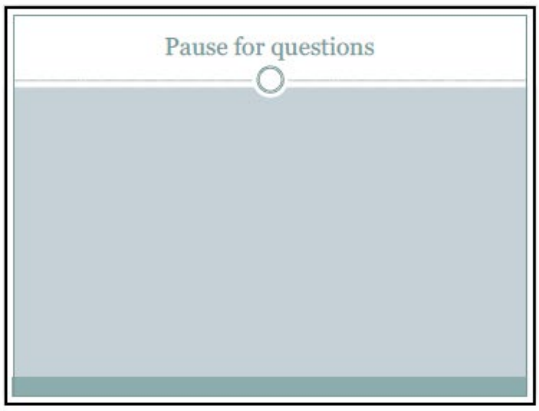

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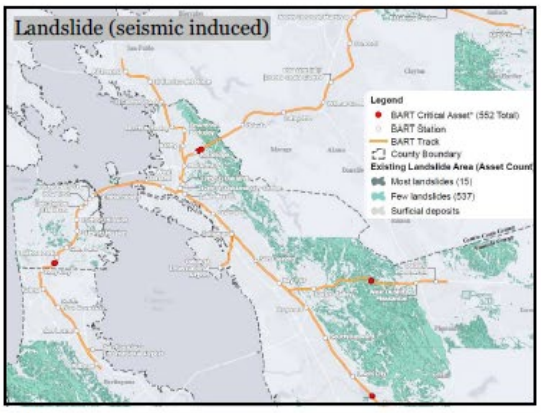

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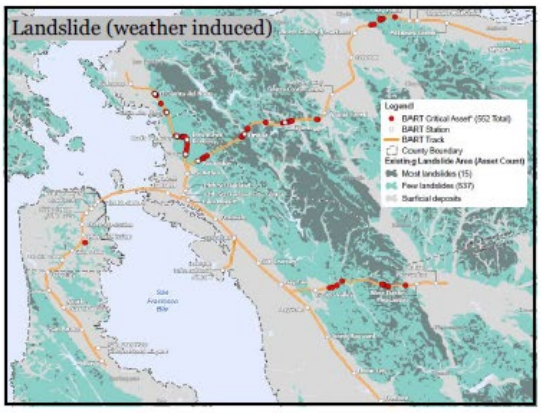

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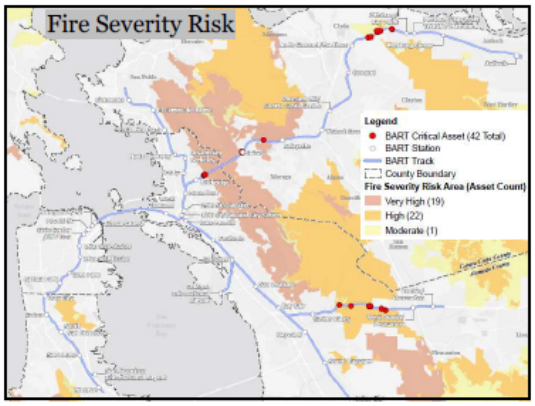

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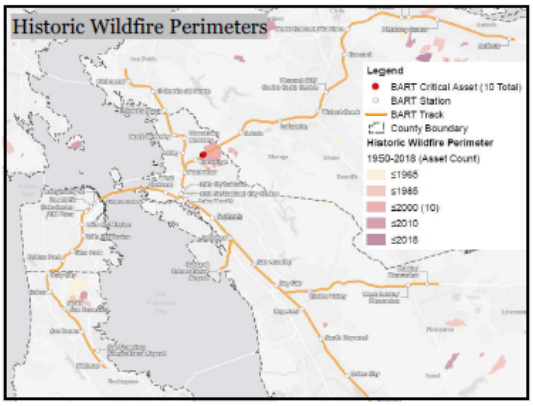

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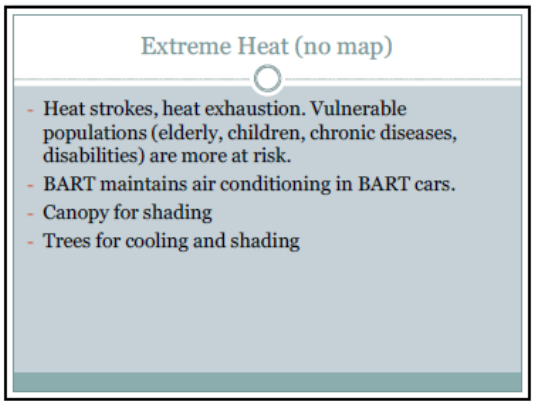

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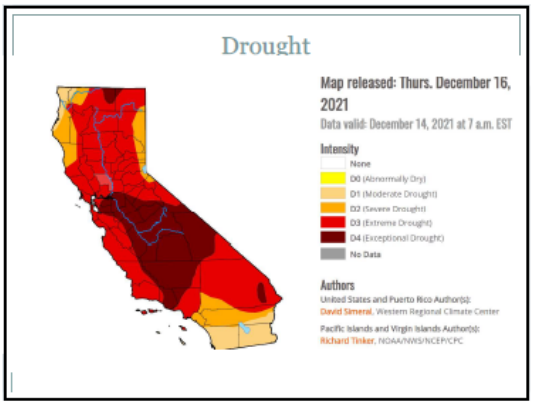

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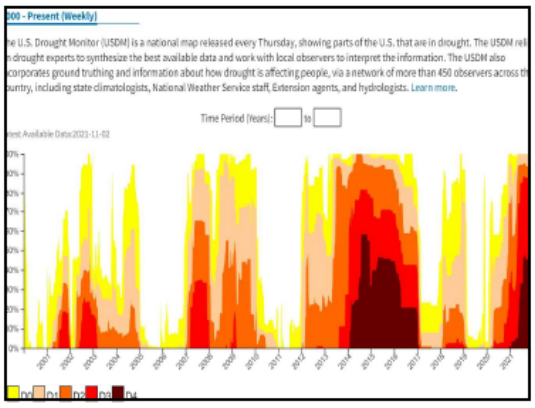

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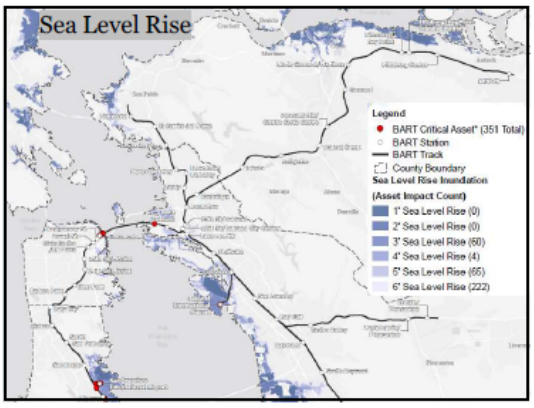

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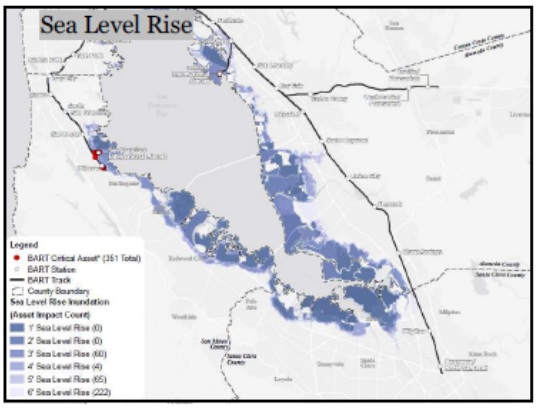

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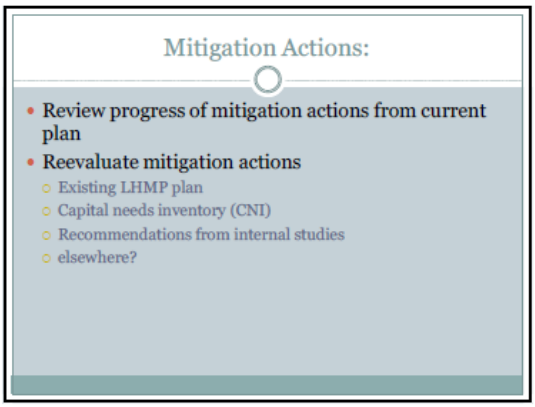

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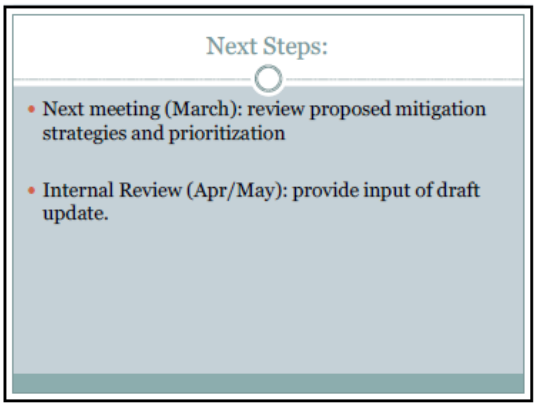
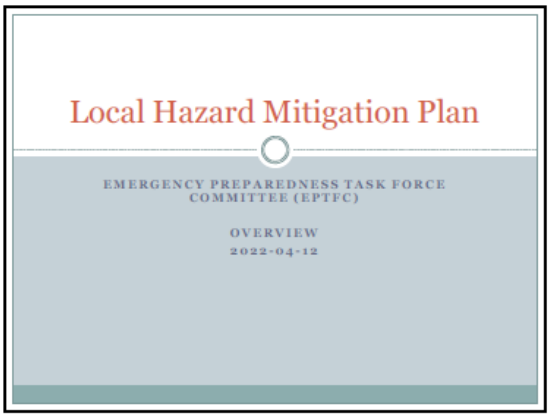


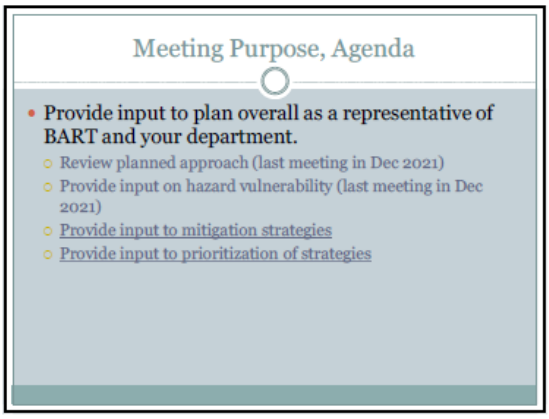
33

B1.1.2 April 12, 2022

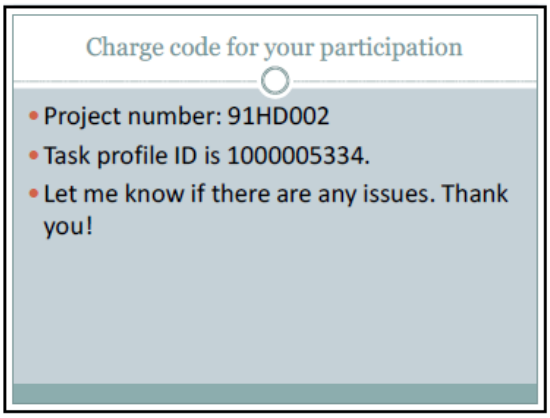
Meeting Attendees: Norman Wong, Michael Brill, Bernard Smits, Jefre Riser, Donald Dean, Ravi Misra, Monica Meagher, Aileen Hernandez, Thomas Moloney, Tian Feng, Balvir Thind, Shane Edwards, Phoebe Cheng, Ravi Gundimeda, Jeffery Lau, Alaric Degrafinried, Wendy Wheeler, Ni Lee, Maceo Wiggins.


Local Hazard Mitigation Plan
EMERGENCY PREPAREDNESS TASK FORCE COMMITTEE (EPTFC)
OVERVIEW
2022-04-12

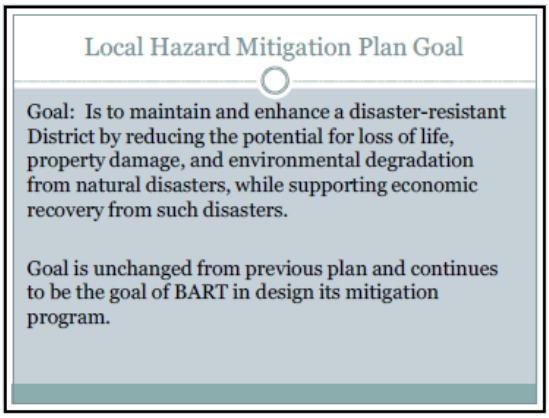
1


Meeting Purpose, Agenda
Provide input to plan overall as a representative of BART and your department.
Review planned approach (last meeting in Dec 2021)
Provide input on hazard vulnerability (last meeting in Dec 2021)
Provide input to mitigation strategies
Provide input to prioritization of strategies

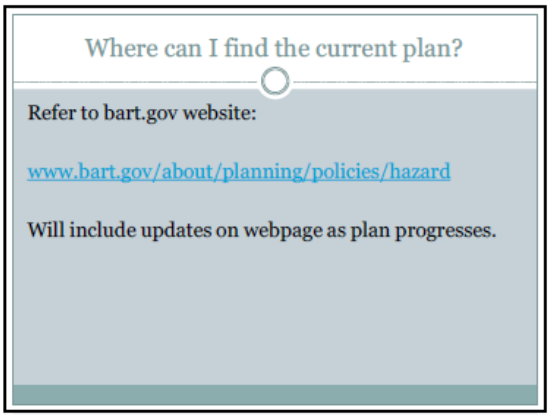
2


Charge code for your participation
Project number: 91HD002
Task profile ID is 1000005334.
Let me know if there are any issues. Thank you!

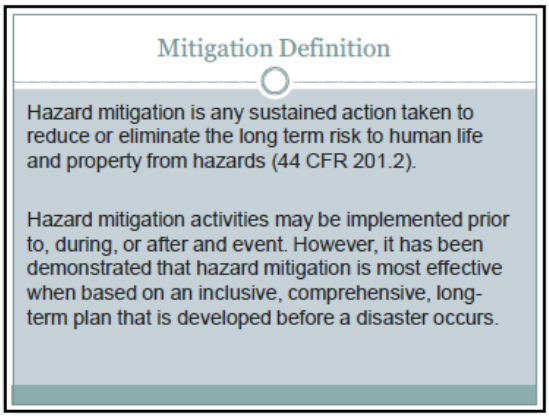
3


Local Hazard Mitigation Plan Goal
Goal: Is to maintain and enhance a disaster-resistant District by reducing the potential for loss of life, property damage, and environmental degradation from natural disasters, while supporting economic recovery from such disasters.
Goal is unchanged from previous plan and continues to be the goal of BART in design its mitigation program.

4


Where can I find the current plan?
Refer to bart.gov website:
www.bart.gov/about/planning/policies/hazard
Will include updates on webpage as plan progresses.

5


Mitigation Definition
Hazard mitigation is any sustained action taken to reduce or eliminate the long term risk to human life and property from hazards (44 CFR 201.2).
Hazard mitigation activities may be implemented prior to, during, or after and event. However, it has been demonstrated that hazard mitigation is most effective when based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs.

6

Mitigations

37 mitigations identified. Compiled based on

a) Best practices
b) Mitigations identified by District (e.g. CNI)
c) Incomplete or ongoing from existing LHMP
d) Engagement activities

Please rate each action low, medium, or high priority. In rating each action, please consider the action's importance and alignment to the following criteria:

1) Hazard risk reduction
2) Cost to benefit value
3) Environmental benefit
4) Equitable outcomes
5) Safety impact

7

Questions

8

Survey

Survey Link: https://forms.gle/vCdd5tQRSSBKardz9

Hit 'Next' to advance to next page.

First few pages
Page 1) Contact Info
Page 2) Vulnerability Info
Page 3) pause here!

9

Rating Rubric

Please rate each action low, medium, or high priority. In rating each action, please consider the action's importance and alignment to the following criteria:

1) Hazard risk reduction
2) Cost to benefit value
3) Environmental benefit
4) Equitable outcomes
5) Safety impact

10

Hazard Legend (Survey)

EQ - Earthquake,
LI - Liquefaction,
TS - Tsunami,
LS - Landslide,
FL-Flood,
SLR - Sea Level Rise,
F - Fire,
DR - Drought,
EH - Extreme Heat,
SS - Severe Storms,
PEV - Pandemics, Endemic, Vector-borne Diseases

11

Multiple Hazards

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Relevant Capital Needs Inventory IDs
1	Backup Emergency Operations Center	Establish a back-up Emergency Operations Center with redundant communications systems.	
2	Portable Emergency Equipment	Purchase portable equipment including hoses, pumps, emergency generators, radios, vehicles, oxygen tanks to allow to support response and recovery of service in locations and/or assets prone to failure.	SY0030, PM0349, PM0427, SY0219, SY0254
4	Safe Evacuations	Improve evacuation and evacuation communications. Improvements include upgrades for water sensors, signage, transfer trip systems, and replacement of cross passage doors and hatch doors.	WF0305, PM0252, WF0048, WF0346, PM0364
10	Power Resilience - Emergency Lighting	Minimize the likelihood that power interruptions will adversely impact emergency lighting. Improvements include providing, upgrading, or replacing uninterruptible power supply (UPS) and dedicated circuits for emergency lighting systems.	PM0054, PM0065, PM0066, PM0076, PM0384, PM0385, PM0386, PM0396, PM0474
11	Power Resilience - General	Minimize the likelihood that power interruptions will adversely impact lifeline utility systems or critical facilities by ensuring that there is redundancy and reliability in power systems. Improvements include providing, upgrading, or replacing uninterruptible power supply (UPS), train control batteries, transformers, power distribution networks including cabling and switching equipment, and fixed emergency generators.	PM0209, PM0211, PM0245, PM0260, PM0261, PM0294, PM0313, PM0336, PM0363, PM0365, PM0366, PM0423, PM0463, PM0475, PM0476, PM0478, PM0481, PM0482, SY0009, SY0163

12

Multiple Hazards (cont'd)

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Relevant Capital Needs Inventory IDs
16	Public Communication	Improve communication systems to the public when there are system disruptions due to natural disasters.	SY0190
20	Asset Management Integration	Include climate risk information into Asset Management	
30	Climate Risk of Projects	Incorporate best available climate risk in design criteria and projects	
31	Redundant Systems	Provide or enhance redundant systems to reduce interruption to core network and system elements. Systems include networks, systems, fare collections, and radio.	SY0176
32	Systems Disaster Recovery Planning	Enhance or conduct disaster recovery planning for systems to minimize disruption to service.	SY0185
38	Emergency Dispatch Center	Provide or replace emergency dispatch center to better support disaster response.	

13

Earthquake and Liquefaction

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Relevant Capital Needs Inventory IDs
21	Enhance Seismic Detection and Recovery	Detection efforts include installing cameras in seismic sensitive locations and revisiting detection thresholds. Efforts include conducting inventory and model structural fragilities for the BART system. Recovery efforts include procurement and storage of materials for seismic disaster response.	WF0556, WF0397, WF0347
22	Seismic Retrofit Work	Continue ongoing seismic infrastructure retrofit of the BART system. Update structures to comply with seismic standards	WF0369
33	Inspect and Repair Facilities for Structural	Inspect facilities for structural risk. Repair facilities to address structural issues and reduce structural risk.	WF0062, WF0104, WF0432, WF0456, WF0457, WF0494, WF0511

14

Landslide

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Relevant Capital Needs Inventory IDs
3	Erosion Control, Slope Stabilization	Upgrade and repair facility foundations, embankments, and drainage to mitigate erosion issues. Work that may be included are excavation, fill placement, cut-fill transitions, slope stability, drainage and erosion control, slope setbacks, expansive soils, collapsible soils, environmental issues, geological and geotechnical investigations, grading plans and specifications, protection of adjacent properties, and review and permit issuance.	WF0256, WF0401, WF0519, WF0527, WF0528

15

Water-Related

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Relevant Capital Needs Inventory IDs
5	Storm Drainage System	Repair or replace dilapidated roofs, storm drains, pipelines, sump pumps, and channels to enable them to perform to their design capacity in handling water flows as part of regular maintenance activities.	FM0173, WF0123, WF0133, WF0219, WF0156, WF0267, WF0268, WF0298, WF0435, WF0454, WF0455, WF0497, WF0500, WF0533, WF0548
14	Adaptation Investigation and Research	Conduct study to further understand adaptation needs. Stay informed of scientific information compiled by regional and state sources on the subject of rising sea levels and global warming, especially on actions that local governments can take to mitigate this hazard including special design and engineering of facilities in low-lying areas.	
18	Low Impact Development	For new development or redevelopments, incorporate low impact development (LIDs) to mitigate storm water runoff and peak flows in the watershed.	WF0382

16

Water-Related (cont'd)

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Relevant Capital Needs Inventory IDs
6	Sandbags and Sheeting	Purchase sandbags and plastic sheeting in anticipation of rainstorms and deliver those materials to key BART sites.	
9	Flood Safe Facilities (Water Intrusion)	Repair cracks and leaks resulting in water intrusion via sealing and other water proofing techniques.	FM0376, FM0389, WF0039, WF0217, WF0271, WF0402, WF0407, WF0453, WF0524, WF0529, WF0530, WF0531
24	Elevate/Protect Critical Facilities	Elevate/protect critical assets in flood risk areas.	WF0262, WF0266, WF0376
28	Engage in Regional Planning for Flooding and Sea Level Rise	Support and engage in county and/or other regionally-led planning efforts in mitigation of flooding from sea level rise and other weather related issues.	

17

Fire

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Relevant Capital Needs Inventory IDs
13	Fire Suppression and Alarm Systems	Upgrade facilities to ensure a reliable system fire suppression for existing and new development. Work includes replacing/upgrading old fire alarm systems, water piping, control wiring, adequate wet standpipes, fire hose cabinet, and chemical fire suppression systems. Provide CCTV camera in tunnels to remotely monitor for fire issues.	FM0069, FM0072, FM0123, FM0154, FM0166, FM0250, FM0281, FM0299, FM0326, FM0339, FM0340, FM0369, FM0372, FM0397, FM0404, FM0470, WF0260
23	Fire Hazard Removal	Conduct removal of debris and vegetation from district property that pose a fire hazard.	WF0512, WF0210, WF0162, WF0246
35	Enhance Fire Safety	Upgrade communications systems at fire command posts. Assess and implement fire safety enhancements for control towers. Add fire command posts in critical locations.	FM0493, FM0496, SY0302

18

Fire (cont'd)

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Relevant Capital Needs Inventory IDs
7	Water Distribution System	Repair or replace water distribution systems on BART facilities including sewer and water lines and valves that are not in a state of good repair.	WF0339, PM0398, PM0189
36	Fire Breaks	Create firebreaks along BART right-of-way to reduce fire risks.	
37	Fire Life Safety Training Facility	Build a fire life safety training facility to train first responders to BART system.	
39	Address Homelessness Needs	Homeless encampments on BART right-of-way pose a fire risk. BART is in process of developing a Strategic Homelessness Action Plan. See https://www.bart.gov/guide/social-resources for details. Efforts will include advocacy and partnerships to support health and wellbeing of homeless individuals.	

19

Drought

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Relevant Capital Needs Inventory IDs
7 (Note: repeated from prior slide)	Water Distribution System	Repair or replace water distribution systems on BART facilities including sewer and water lines and valves that are not in a state of good repair.	WF0339, PM0398, PM0189
8	Investigate High Usage Facilities	Track the water use of each facility and investigate and address facilities that have high water usage.	
15	Improve Water Systems	Improve water efficiency, upgrading to low flow water fixtures, water recycling, and other water conservation techniques.	PM0182
29	Irrigation and Landscape Improvements	Upgrade irrigation and landscaping for water efficiency that reduces maintenance needs and conserve water.	PM0134, WF0513, WF0514

20

Extreme Heat

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Relevant Capital Needs Inventory IDs
34	Sun Shields	Provide sun shields for equipment located outdoors to reduce risk of overheating.	SY0220

21

Pandemics, Endemics, Vector-borne Diseases

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Relevant Capital Needs Inventory IDs
40	Contagious Virus Planning	Maintain and update District's Contagious Virus Response Plan.	
41	Covid-19 Prevention Program	Maintain and implement BART's Covid-19 Prevention Program.	
42	HVAC Filters on BART Train Cars	Replace HVAC filters on BART train cars. Air filtration plays an important role in preventing transmission of coronavirus	

22

Legend

EQ - Earthquake, LI - Liquefaction, TS - Tsunami, LS - Landslide, FL-Flood, SLR - Sea Level Rise,
F - Fire, DR - Drought, EH - Extreme Heat, SS - Severe Storms, PEV - Pandemics, Endemic, Vector-borne Diseases

23

Next Steps:

- Additional time for survey (1 week) to provide additional input on mitigation strategies
- Review draft plan (April/May): provide input of draft of plan.
- Public comment period (May/June)
- CalOES/FEMA review (Aug to Oct)
- Board Adoption (winter)

24

B1.2 Title IV/EJC Meetings

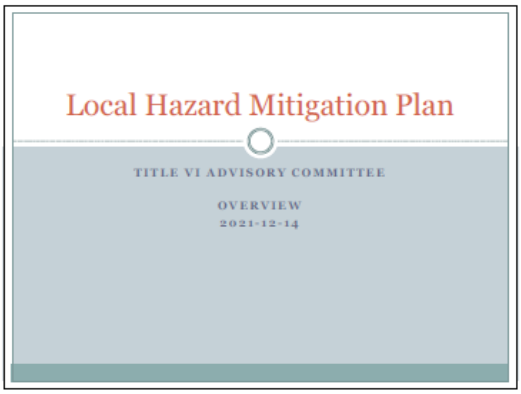
B1.2.1 September 7, 2021

Meeting Attendees: Norman Wong, Sonjia Johnson, Emily Alter, Mad (Madeline) Stano, Adoubou Traore, Cedrita Claiborne, Aisha Knowles, Denise Coleman, Fr. Paulson Mundanmani, Anni Chung, Joel Flammand, Diana Vuong, Anne Kwong, Dwayne Aikens Jr.

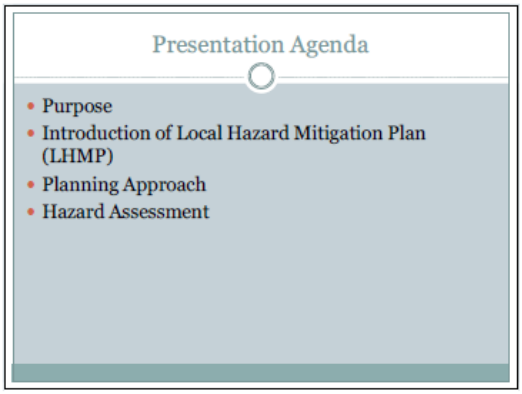
No presentation materials.

B1.2.2 December 14, 2021

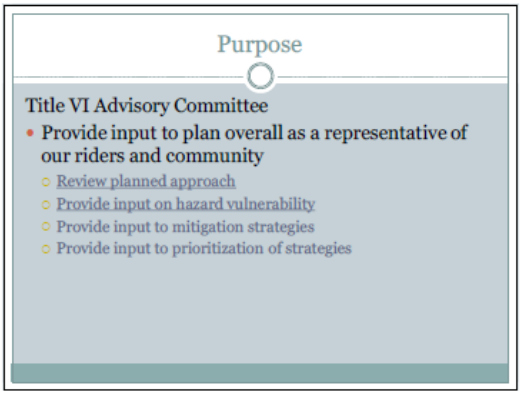
Meeting Attendees: Norman Wong, Sonjia Johnson, Emily Alter, Director Robert Raburn, Maceo Wiggins, Hannah Lindelof, Joel Flammand, Anne Kwong, Cathie Lam, Maria De Lourdes Richardson, Cedrita Claiborne, Aisha Knowles, Raymond Pascual, Lisa Raffetto, Diana Vuong, Frances Fisher, Aleta Dupree, Adoubou Traore.


Local Hazard Mitigation Plan
TITLE VI ADVISORY COMMITTEE
OVERVIEW
2021-12-14

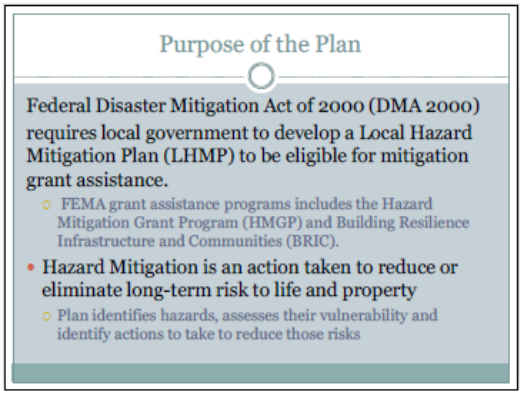
1


Presentation Agenda
Purpose
Introduction of Local Hazard Mitigation Plan (LHMP)
Planning Approach
Hazard Assessment

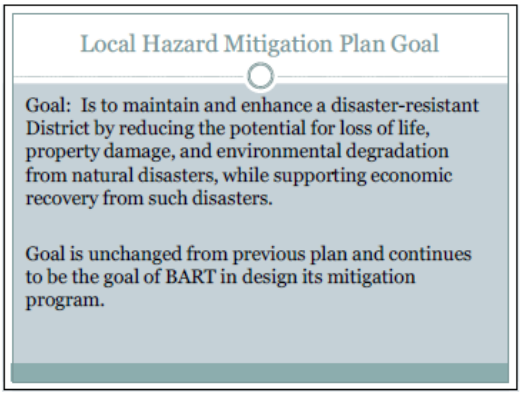
2


Purpose
Title VI Advisory Committee
Provide input to plan overall as a representative of our riders and community
Review planned approach
Provide input on hazard vulnerability
Provide input to mitigation strategies
Provide input to prioritization of strategies

3


Purpose of the Plan
Federal Disaster Mitigation Act of 2000 (DMA 2000) requires local government to develop a Local Hazard Mitigation Plan (LHMP) to be eligible for mitigation grant assistance.
FEMA grant assistance programs includes the Hazard Mitigation Grant Program (HMGP) and Building Resilience Infrastructure and Communities (BRIC).
Hazard Mitigation is an action taken to reduce or eliminate long-term risk to life and property
Plan identifies hazards, assesses their vulnerability and identify actions to take to reduce those risks

4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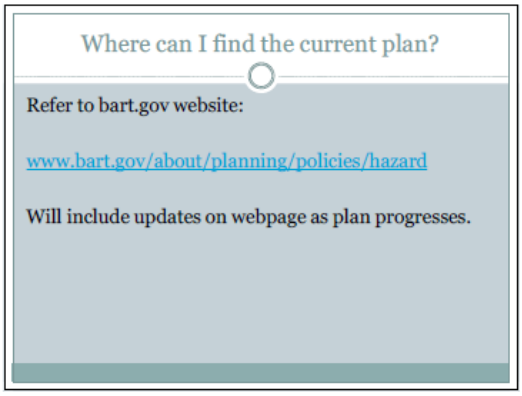
5


Where can I find the current plan?
Refer to bart.gov website:
www.bart.gov/about/planning/policies/hazard
Will include updates on webpage as plan progresses.

6

Plan Elements

1) Introduction
2) Planning process
   a) Staff and tasks in planning
   b) Engagement
3) Hazard profiles
   a) Profile descriptions (type, location, extent, probability, climate change, impacts, historical events)
4) Mitigation strategy
   a) Mitigation goal and measures
   b) Existing programs and resources
   c) Strategies
5) Plan Review/ Plan Adoption

7

Planning Boundary

Cover District's jurisdiction, namely, District's operated property within BART right-of-way (ROW).

Emphasis on BART's critical assets. Notable asset types:

- Passenger stations
- Trackway
- Substations and switching stations
- Train control rooms
- Shops/yards

8

Planning Approach: Teams

Admin Team
- Review LHMP
- Review past/current applicable plans, reports & studies
- Review GIS documents
- Identify opportunities for public meetings and/or workshops
- Solicit input from citizens and subject matter experts
- Identify information gaps in plan

Internal
- Emergency Prep. Task Force Committee (EPTFC)
- Subject matter experts (as needed)

External
- Title VI EJC Committee
- Local cities and counties

9

Planning Approach: Timeline

Activity	Date
Kick off	Aug 2021
Review LHMP, existing docs, update hazard profiles	Aug to Nov 2021
Meetings (Title VI EJC ; EPTFC)	Dec 2021
Mitigation action review and development	Dec 2021 to Feb 2022
Meetings (Title VI EJC ; EPTFC)	Mar 2022
Compile and update draft	Mar/Apr 2022
Review and revisions	Apr/May 2022
Public comment period	May/June 2022
Incorporation of public comments	July 2022
CalOES/FEMA for review	Aug to Oct 2022
Board Adoption of plan	Winter 2022

10

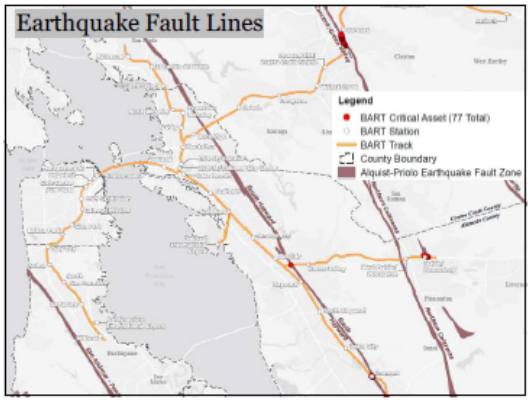
Hazard and Risk Assessment

Nine (9) natural hazards identified:

- Earthquake (4) –
  - Fault lines and shaking, landslides, liquefaction and tsunamis
- Weather (4)
  - Flooding, landslides, wildfires, extreme heat, drought
- Sea level rise

11

Earthquake Fault Lines



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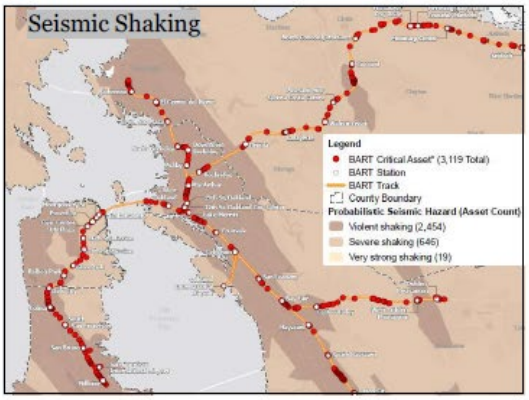

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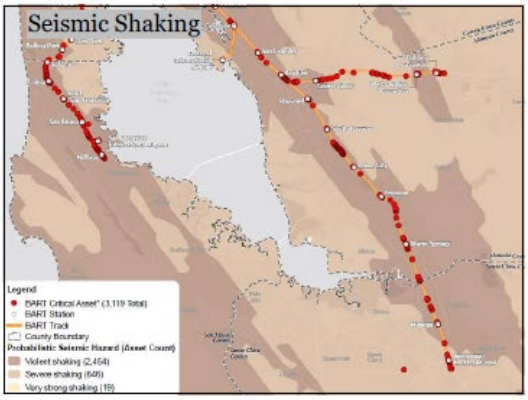

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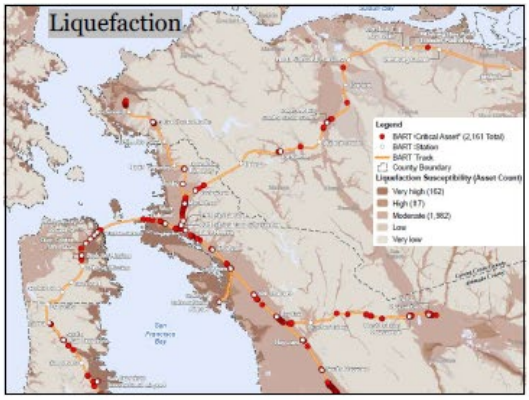

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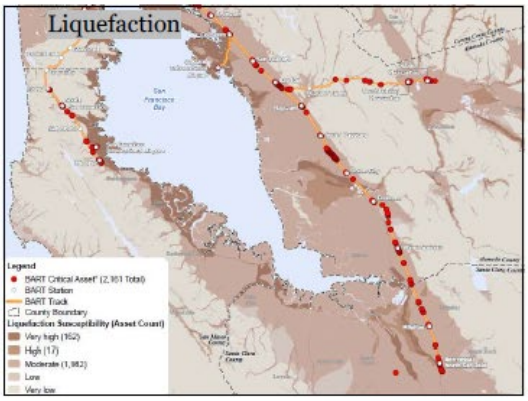

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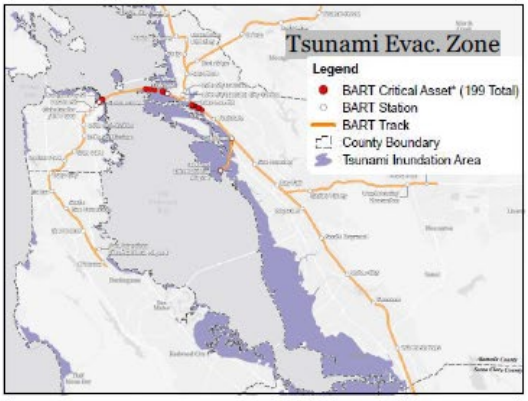

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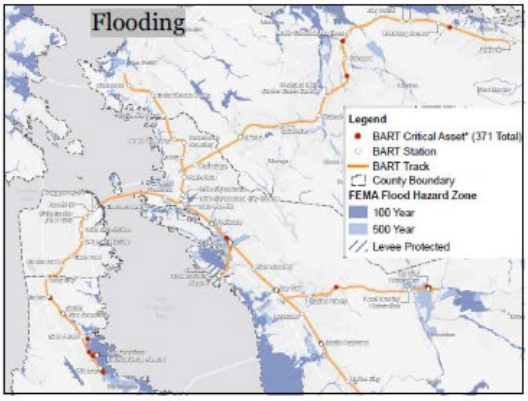

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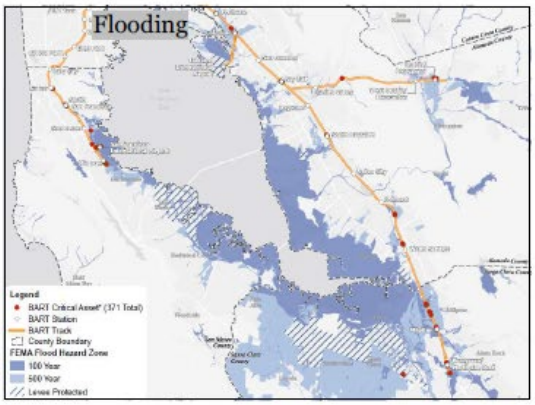

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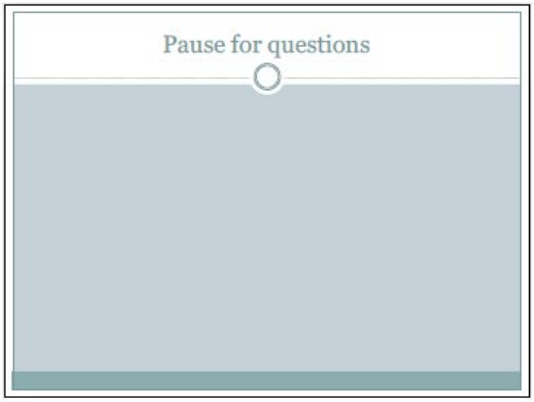

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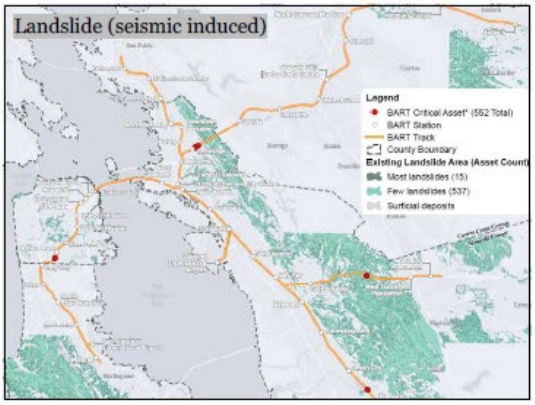

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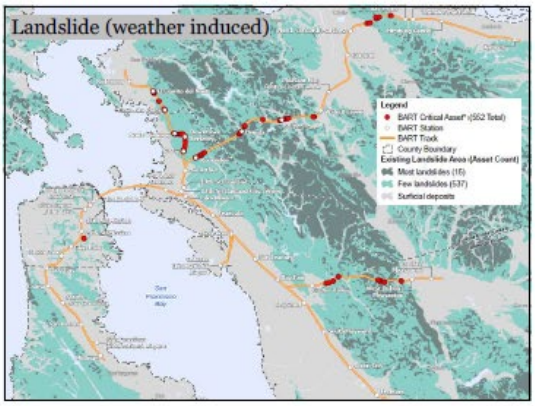

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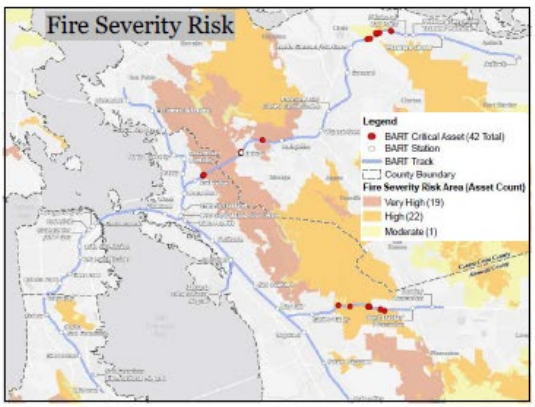

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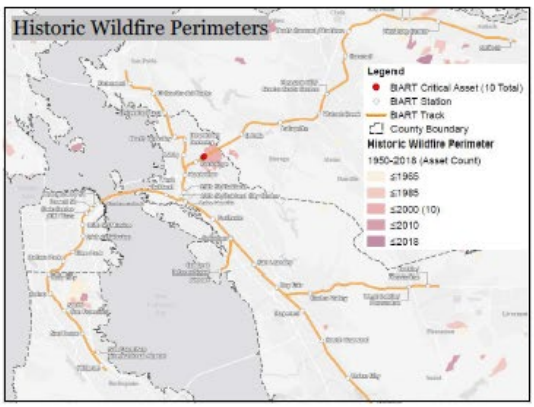
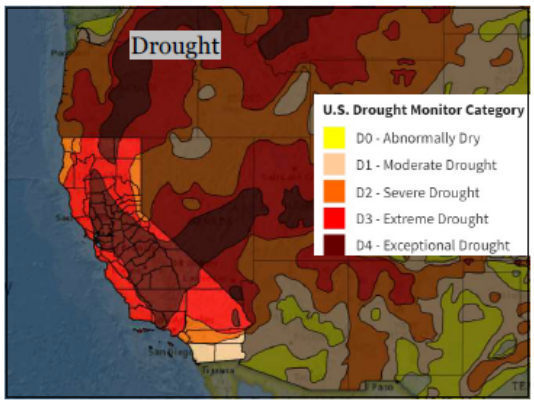


24

Extreme Heat (no map)

- Heat strokes, heat exhaustion. Vulnerable populations (elderly, children, chronic diseases, disabilities) are more at risk.
- BART maintains air conditioning in BART cars.
- Canopy for shading
- Trees for cooling and shading

25



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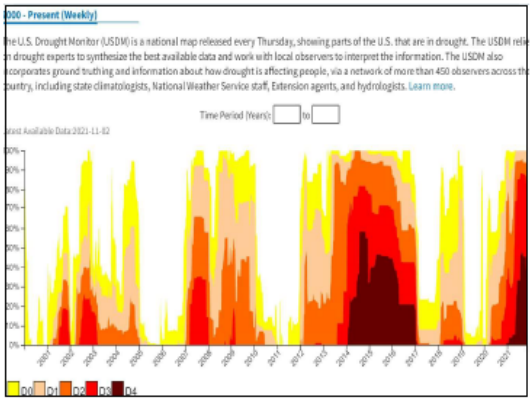

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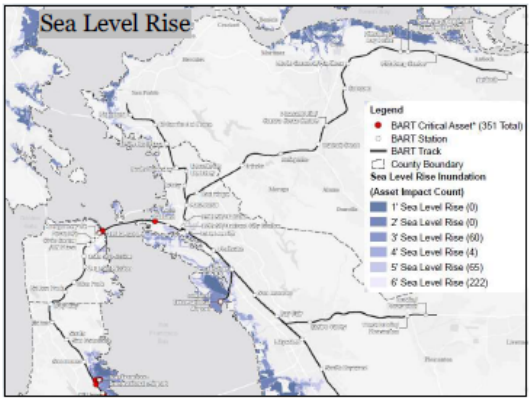

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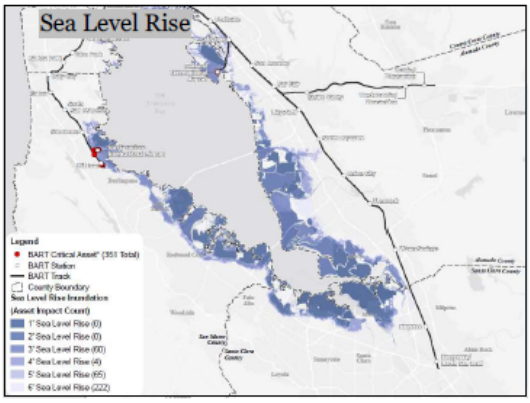


29

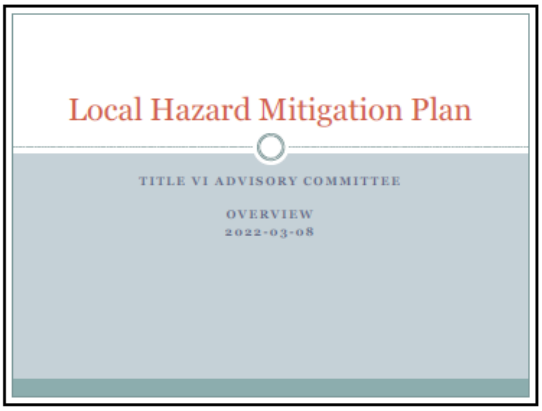
Next Steps:

- Next meeting (March): review proposed mitigation strategies and prioritization
- Public comment (May/June): provide input of draft update.

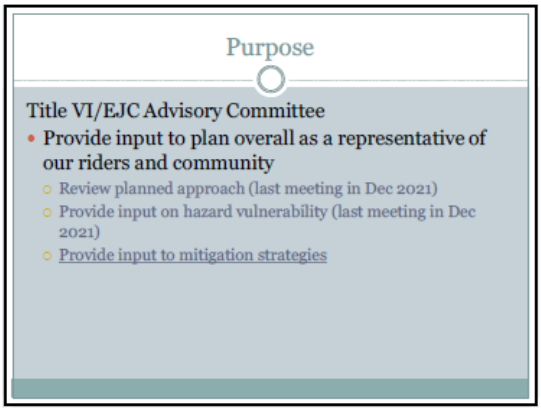
30

B1.2.3 April 5, 2022

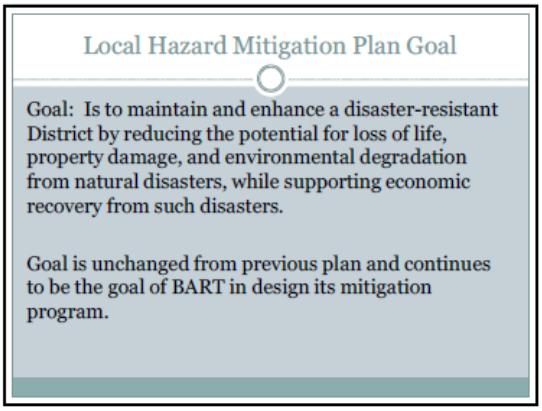
Meeting Attendees: Norman Wong, Sonjia Johnson, Emily Alter, Aleta Dupree, Anne Kwong, Denise Coleman, Diana Vuong, Director Robert Raburn, Dwayne Aikens, Helen Lim, Maceo Wiggins, Hannah Lindelof, Joel Flammand, Maceo Wiggins, Maria De Lourdes Richardson, Michael Eiseman, Fr. Paulson Mundanmani, Susan Ma.


Local Hazard Mitigation Plan
TITLE VI ADVISORY COMMITTEE
OVERVIEW
2022-03-08

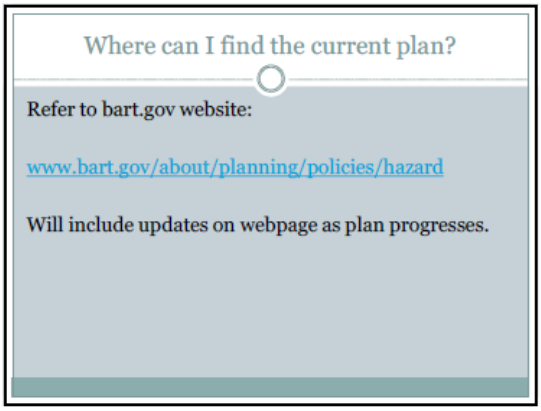
1


Purpose
Title VI/EJC Advisory Committee
Provide input to plan overall as a representative of our riders and community
Review planned approach (last meeting in Dec 2021)
Provide input on hazard vulnerability (last meeting in Dec 2021)
Provide input to mitigation strategies

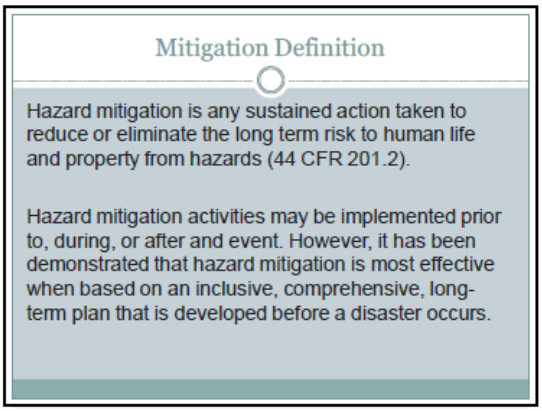
2


Local Hazard Mitigation Plan Goal
Goal: Is to maintain and enhance a disaster-resistant District by reducing the potential for loss of life, property damage, and environmental degradation from natural disasters, while supporting economic recovery from such disasters.
Goal is unchanged from previous plan and continues to be the goal of BART in design its mitigation program.

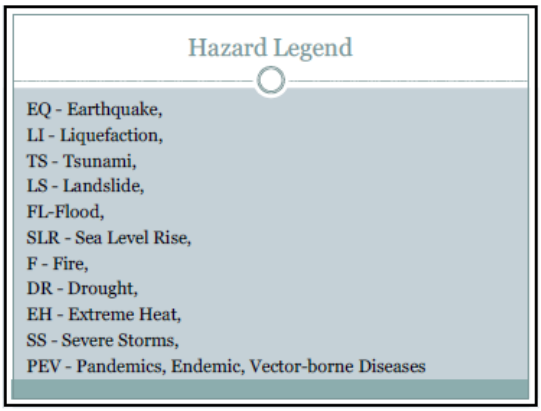
3


Where can I find the current plan?
Refer to bart.gov website:
www.bart.gov/about/planning/policies/hazard
Will include updates on webpage as plan progresses.

4


Mitigation Definition
Hazard mitigation is any sustained action taken to reduce or eliminate the long term risk to human life and property from hazards (44 CFR 201.2).
Hazard mitigation activities may be implemented prior to, during, or after and event. However, it has been demonstrated that hazard mitigation is most effective when based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs.

5


Hazard Legend
EQ - Earthquake,
LI - Liquefaction,
TS - Tsunami,
LS - Landslide,
FL-Flood,
SLR - Sea Level Rise,
F - Fire,
DR - Drought,
EH - Extreme Heat,
SS - Severe Storms,
PEV - Pandemics, Endemic, Vector-borne Diseases

6

Note on Mitigation Strategies

Following strategies are in draft form and subject to change.

Survey available to provide your feedback.
https://forms.gle/Axixoi8zfo9ufnC26

7

Multiple Hazards

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
1	Backup Emergency Operations Center	Establish a back-up Emergency Operations Center with redundant communications systems.	EQ, LI, TS, FL, F, SS
2	Portable Emergency Equipment	Purchase portable equipment including hoses, pumps, emergency generators, radios, vehicles, oxygen tanks to allow to support response and recovery of service in locations and/or assets prone to failure.	EQ, LI, TS, LS, FL, F, EH, SS
4	Safe Evacuations	Improve evacuation and evacuation communications. Improvements include upgrades for water sensors, signage, and replacement of cross passage doors and hatch doors.	EQ, LI, TS, LS, FL, F, EH, SS
10	Power Resilience - Emergency Lighting	Minimize the likelihood that power interruptions will adversely impact emergency lighting. Improvements include providing, upgrading, or replacing uninterruptible power supply (UPS) and dedicated circuits for emergency lighting systems.	EQ, LI, TS, LS, FL, F, EH, SS
11	Power Resilience - General	Minimize the likelihood that power interruptions will adversely impact lifeline utility systems or critical facilities by ensuring that there is redundancy and reliability in power systems. Improvements include providing, upgrading, or replacing uninterruptible power supply (UPS), train control batteries, transformers, power distribution networks including cabling and switching equipment, and fixed emergency generators.	EQ, LI, TS, LS, FL, F, EH, SS

8

Multiple Hazards

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
31	Redundant Systems	Provide or enhance redundant systems to reduce interruption to core network and system elements. Systems include networks, systems, fare collections, and radio.	EQ, LI, TS, LS, FL, F, EH, SS
32	Systems Disaster Recovery Planning	Enhance or conduct disaster recovery planning of systems to minimize disruption to service.	EQ, LI, TS, LS, FL, F, EH, SS
38	Emergency Dispatch Center	Provide or replace emergency dispatch center to better support disaster response.	EQ, LI, TS, LS, FL, F, EH, SS
16	Public Communication	Improve communication systems to the public when there are system disruptions due to natural disasters.	EQ, LI, TS, LS, FL, F, DR, EH, SS, PE
20	Asset Management Integration	Include climate risk information into Asset Management	EQ, LI, TS, LS, FL, F, DR, EH, SS
30	Climate Risk of Projects	Incorporate best available climate risk in design criteria and projects	LI, TS, LS, FL, F, DR, EH, SS

9

Earthquake and Liquefaction

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
21	Enhance Seismic Detection and Recovery	Detection efforts include installing cameras in seismic sensitive locations and revisiting detection thresholds. Efforts includes conducting inventory and model structural fragilities for the BART system. Recovery efforts include procurement and storage of materials for seismic disaster response.	EQ, LI, LS
22	Seismic Retrofit Work	Continue ongoing seismic infrastructure retrofit of the BART system. Update structures to comply with seismic standards	EQ, LI, LS
33	Inspect and Repair Facilities for Structural	Inspect facilities for structural risk. Repair facilities to address structural issues and reduce structural risk.	EQ, LI, LS

10

Landslide

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
3	Erosion Control, Slope Stabilization	Upgrade and repair facility foundations, embankments, and drainage to mitigate erosion issues. Work that may be included are excavation, fill placement, cut-fill transitions, slope stability, drainage and erosion control, slope setbacks, expansive soils, collapsible soils, environmental issues, geological and geotechnical investigations, grading plans and specifications, protection of adjacent properties, and review and permit issuance.	LS

11

Water-Related

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
5	Storm Drainage System	Repair or replace dilapidated roofs, storm drains, pipelines, sump pumps, and channels to enable them to perform to their design capacity in handling water flows as part of regular maintenance activities.	FL, SS
18	Low Impact Development	For new development or redevelopments, incorporate low impact development (LIDs) to mitigate storm water runoff and peak flows in the watershed.	FL, SS
14	Adaptation Investigation and Research	Conduct study to further understand adaptation needs. Stay informed of scientific information compiled by regional and state sources on the subject of rising sea levels and global warming, especially on actions that local governments can take to mitigate this hazard including special design and engineering of facilities in low-lying areas.	FL, SLR

12

Water-Related (cont'd)

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
28	Engage in Regional Planning for Flooding and Sea Level Rise	Support and engage in county and/or other regionally-led planning efforts in mitigation of flooding from sea level rise and other weather related issues.	FL, SLR
6	Sandbags and Sheeting	Purchase sandbags and plastic sheeting in anticipation of rainstorms, and deliver those materials to key BART sites.	TS, FL
24	Elevate/Protect Critical Facilities	Elevate/protect critical assets in flood risk areas.	TS, FL, SLR
9	Flood Safe Facilities (Water Intrusion)	Repair cracks and leaks resulting in water intrusion via sealing and other water proofing techniques.	TS, FL, SLR, SS

13

Fire

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
33	Fire Suppression and Alarm Systems	Upgrade facilities to ensure a reliable system fire suppression for existing and new development. Work includes replacing/upgrading old fire alarm systems, water piping, control wiring, adequate wet stand pipes, fire hose cabinet, and chemical fire suppression systems. Provide CCTV camera in tunnels to remotely monitor for fire issues.	F
23	Fire Hazard Removal	Conduct removal of debris and vegetation from district property that pose a fire hazard.	F
35	Enhance Fire Safety	Upgrade communications systems at fire command posts. Assess and implement fire safety enhancements for control towers. Add fire command posts in critical locations.	F

14

Fire (cont'd)

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
36	Fire Breaks	Create firebreaks along BART right-of-way to reduce fire risks.	F
37	Fire Life Safety Training Facility	Build a fire life safety training facility to train first responders to BART system.	F
39	Address Homelessness Needs	Homeless encampments on BART right-of-way pose a fire risk. BART is in process of developing a Strategic Homelessness Action Plan. See https://www.bart.gov/guide/social-resources for details. Efforts will include advocacy and partnerships to support health and wellbeing of homeless individuals.	F
7	Water Distribution System	Repair or replace water distribution systems on BART facilities including sewer and water lines and valves that are not in a state of good repair.	F, DR

15

Drought

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
8	Investigate High Usage Facilities	Track the water use of each facility and investigate and address facilities that have high water usage.	DR
15	Improve Water Systems	Improve water efficiency, upgrading to low flow water fixtures, water recycling, and other water conservation techniques.	DR
29	Irrigation and Landscape Improvements	Upgrade irrigation and landscaping for water efficiency that reduces maintenance needs and conserve water.	DR
7 (Note: duplicate from prior slide)	Water Distribution System	Repair or replace water distribution systems on BART facilities including sewer and water lines and valves that are not in a state of good repair.	F, DR

16

Extreme Heat

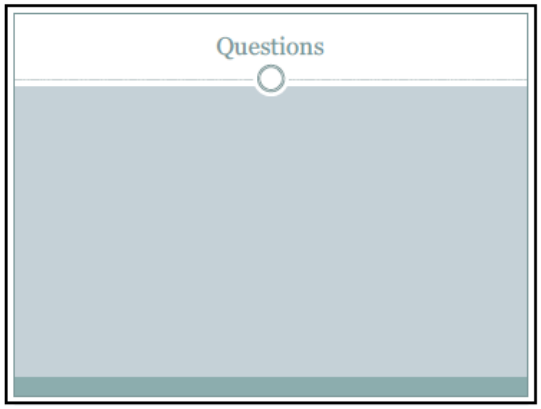
Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
34	Sun Shields	Provide sun shields for equipment located outdoors to reduce risk of overheating.	EH

17

Pandemics, Endemics, Vector-borne Diseases

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
40	Contagious Virus Planning	Update and maintain District's Contagious Virus Response Plan.	PEV
41	Covid-19 Prevention Program	Maintain and implement BART's Covid-19 Prevention Program.	PEV
42	HVAC Filters on BART Train Cars	Replace HVAC filters on BART train cars. Air filtration plays an important role in preventing transmission of coronavirus	PEV

18


Questions

19


Next Steps:
Survey (1 week) to provide additional input on mitigation strategies.
https://forms.gle/Axixoi8zfo9ufnC26
Public comment (May/June): provide input of draft update.

20

B1.3 Surveys

B1.3.1 Internal Stakeholders

BART LHMP Survey

Welcome. Thank you in advance for your participation. This survey is intended to better understand stakeholder views with regard to natural hazards and mitigations to reduce hazard risk. Feedback from this survey will support update of BART's Local Hazard Mitigation Plan.

For additional information please visit https://www.bart.gov/about/planning/policies/hazard

Contact Information

1. Name

2. Group or Division Name

3. Role or Title

Hazard Information

4. What hazards are you most concerned about? Select all that apply.

Check all that apply.

- [ ] Earthquake
- [ ] Liquefaction
- [ ] Tsunami
- [ ] Landslide
- [ ] Flooding
- [ ] Sea Level Rise
- [ ] Fire
- [ ] Drought
- [ ] Extreme Heat
- [ ] Severe Storms
- [ ] Pandemics, Endemics, Vector-borne Diseases
- Other: [ ] _____

General Mitigations (multiple hazards addressed)

Please rate each action low, medium, or high priority. In rating each action, please consider the action's importance and alignment to the following criteria:

1) Hazard risk reduction
2) Cost to benefit value
3) Environmental benefit
4) Equitable outcomes
5) Safety impact

5.

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
1	Backup Emergency Operations Center	Establish a back-up Emergency Operations Center with redundant communications systems.	EQ, LI, TS, FL, F, SS

Mark only one oval.

- ◯ Low
- ◯ Medium
- ◯ High

6.

2	Portable Emergency Equipment	Purchase portable equipment including hoses, pumps, emergency generators, radios, vehicles, oxygen tanks to allow to support response and recovery of service in locations and/or assets prone to failure.	EQ, LI, TS, LS, FL, F, EH, SS

Mark only one oval.

- ◯ Low
- ◯ Medium
- ◯ High

7.

4	Safe Evacuations	Improve evacuation and evacuation communications. Improvements include upgrades for water sensors, signage, and replacement of cross passage doors and hatch doors.	EQ, LI, TS, LS, FL, F, EH, SS

Mark only one oval.

- ◯ Low
- ◯ Medium
- ◯ High

8.

10	Power Resilience - Emergency Lighting	Minimize the likelihood that power interruptions will adversely impart emergency lighting. Improvements include providing, upgrading, or replacing uninterruptible power supply (UPS) and dedicated circuits for emergency lighting systems.	EQ, LI, TS, LS, FL, F, EH, SS

Mark only one oval.

- ◯ Low
- ◯ Medium
- ◯ High

9.

11	Power Resilience - General	Minimize the likelihood that power interruptions will adversely impact lifeline utility systems or critical facilities by ensuring that there is redundancy and reliability in power systems. Improvements include providing, upgrading, or replacing uninterruptible power supply (UPS), train control batteries, transformers, power distribution networks including cabling and switching equipment, and fixed emergency generators.	EQ, LI, TS, LS, FL, F, EH, SS

Mark only one oval.

- ◯ Low
- ◯ Medium
- ◯ High

10.

16	Public Communication	Improve communication systems in the public when there are system disruptions due to natural disasters.	EQ, LI, TS, LS, FL, F, DR, EH, SS, PEV

Mark only one oval.

- ◯ Low
- ◯ Medium
- ◯ High

11.

20	Asset Management Integration	Include climate risk information into Asset Management	EQ, LI, TS, LS, FL, F, DR, EH, SS

Mark only one oval.

- ◯ Low
- ◯ Medium
- ◯ High

12.

30	Climate Risk of Projects	Incorporate best available climate risk in design criteria and projects	LI, TS, LS, FL, F, DR, EH, SS

Mark only one oval.

- Low
- Medium
- High

13.

31	Redundant Systems	Provide or enhance redundant systems to reduce interruption to core network and system elements. Systems include networks, systems, fare collections, and radio.	EQ, LI, TS, LS, FL, F, EH, SS

Mark only one oval.

- Low
- Medium
- High

14.

32	Systems Disaster Recovery Planning	Enhance or conduct disaster recovery planning of systems to minimize disruption to service.	EQ, LI, TS, LS, FL, F, EH, SS

Mark only one oval.

- Low
- Medium
- High

15.

38	Emergency Dispatch Center	Provide or replace emergency dispatch center to better support disaster response.	EQ, LI, TS, LS, FL, F, EH, SS

Mark only one oval.

- Low
- Medium
- High

16. Are there other actions you'd like BART to consider in this category? If yes, please describe.

Seismic (earthquake, liquefaction) Mitigation

Rating criteria (repeated for convenience):
1) Hazard risk reduction
2) Cost to benefit value
3) Environmental benefit
4) Equitable outcomes
5) Safety impact

17.

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
21	Enhance Seismic Detection and Recovery	Detection efforts include installing cameras in seismic sensitive locations and revisiting detection thresholds. Efforts includes conducting inventory and model structural fragilities for the BART system. Recovery efforts include procurement and storage of materials for seismic disaster response.	EQ, LI, LS

Mark only one oval.

- Low
- Medium
- High

18.

22	Seismic Retrofit Work	Continue ongoing seismic infrastructure retrofit of the BART system. Update structures to comply with seismic standards	EQ, LI, LS

Mark only one oval.

- Low
- Medium
- High

19.

33	Inspect and Repair Facilities for Structural	Inspect facilities for structural risk. Repair facilities to address structural issues and reduce structural risk.	EQ, LI, LS

Mark only one oval.

- Low
- Medium
- High

20. Are there other actions you'd like BART to consider in this category? If yes, please describe.

Landslide Mitigation

Rating criteria (repeated for convenience):
1) Hazard risk reduction
2) Cost to benefit value
3) Environmental benefit
4) Equitable outcomes
5) Safety impact

21.

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
3	Erosion Control, Slope Stabilization	Upgrade and repair facility foundations, embankments, and drainage to mitigate erosion issues. Work that may be included are excavation, fill placement, cut-fill transitions, slope stability, drainage and erosion control, slope setbacks, expansive soils, collapsible soils, environmental issues, geological and geotechnical investigations, grading plans and sperifications, protection of adjacent properties, and review and permit issuance.	LS

Mark only one oval.

- Low
- Medium
- High

22. Are there other actions you'd like BART to consider in this category? If yes, please describe.

Water-related (SLR, Tsunami, Flooding, Severe Storms) Mitigation

Rating criteria (repeated for convenience):
1) Hazard risk reduction
2) Cost to benefit value
3) Environmental benefit
4) Equitable outcomes
5) Safety impact

23.

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
5	Storm Drainage System	Repair or replace dilapidated roofs, storm drains, pipelines, sump pumps, and channels to enable them to perform to their design capacity in handling water flows as part of regular maintenance activities.	FL, SS

Mark only one oval.

- Low
- Medium
- High

24.

14	Adaptation Investigation and Research	Conduct study to further understand adaptation needs. Stay informed of scientific information compiled by regional and state sources on the subject of rising sea levels and global warming, especially on actions that local governments can take to mitigate this hazard including special design and engineering of facilities in low-lying areas.	FL, SLR

Mark only one oval.

- Low
- Medium
- High

25.

18	Low Impact Development	For new development or redevelopments, incorporate low impact development (LIDs) to mitigate storm water runoff and peak flows in the watershed.	FL, SS

Mark only one oval.

- Low
- Medium
- High

26.

6	Sandbags and Sheeting	Purchase sandbags and plastic sheeting in anticipation of rainstorms, and deliver those materials to key BART sites.	TS, FL

Mark only one oval.

- Low
- Medium
- High

27.

9	Flood Safe Facilities (Water Intrusion)	Repair cracks and leaks resulting in water intrusion via sealing and other water proofing techniques.	TS, FL, SLR, SS

Mark only one oval.

- Low
- Medium
- High

28.

24	Elevate/Protect Critical Facilities	Elevate/protect critical assets in flood risk areas.	TS, FL, SLR

Mark only one oval.

- Low
- Medium
- High

29.

28	Engage in Regional Planning for Flooding and Sea Level Rise	Support and engage in county and/or other regionally-led planning efforts in mitigation of flooding from sea level rise and other weather related issues.	FL, SLR

Mark only one oval.

- Low
- Medium
- High

30. Are there other actions you'd like BART to consider in this category? If yes, please describe.

Fire Mitigation

Rating criteria (repeated for convenience):
1) Hazard risk reduction
2) Cost to benefit value
3) Environmental benefit
4) Equitable outcomes
5) Safety impact

31.

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
23	Fire Suppression and Alarm Systems	Upgrade facilities to ensure a reliable system fire suppression for existing and new development. Work includes replacing/upgrading old fire alarm systems, water piping, control wiring, adequate wet stand pipes, fire hose cabinet, and chemical fire suppression systems. Provide CCTV camera in tunnels to remotely monitor for fire issues.	F

Mark only one oval.

- Low
- Medium
- High

32.

23	Fire Hazard Removal	Conduct removal of debris and vegetation from district property that pose a fire hazard.	F

Mark only one oval.

- Low
- Medium
- High

33.

35	Enhance Fire Safety	Upgrade communications systems at fire command posts. Assess and implement fire safety enhancements for control towers. Add fire command posts in critical locations.	F

Mark only one oval.

- Low
- Medium
- High

34.

7	Water Distribution System	Repair or replace water distribution systemson BART facilities including sewer and water lines and valves that are not in a state of good repair.	F, DR

Mark only one oval.

- Low
- Medium
- High

35.

36	Fire Breaks	Create firebreaks along BART right-of-way to reduce fire risks.	F

Mark only one oval.

- Low
- Medium
- High

36.

37	Fire Life Safety Training Facility	Build a fire life safety training facility to train first responders to BART system.	F

Mark only one oval.

- Low
- Medium
- High

37.

39	Address Homelessness Needs	Homeless encampments on BART right-of-way pose a fire risk. BART is in process of developing a Strategic Homelessness Action Plan. See https://www.bart.gov/guide/social-resources for details. Efforts will include advocacy and partnerships to support health and wellbeing of homeless individuals.	F

Mark only one oval.

- Low
- Medium
- High

38. Are there other actions you'd like BART to consider in this category? If yes, please describe.

Drought Mitigation

Rating criteria (repeated for convenience):
1) Hazard risk reduction
2) Cost to benefit value
3) Environmental benefit
4) Equitable outcomes
5) Safety impact

39.

7 (Note: duplicate from prior slide)	Water Distribution System	Repair or replace water distribution systems on BART facilities including sewer and water lines and valves that are not in a state of good repair.	F, DR

Mark only one oval.

- Low
- Medium
- High

40.

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
38	Investigate High Usage Facilities	Track the water use of each facility and Investigate and address facilities that have high water usage.	DR

Mark only one oval.

- Low
- Medium
- High

41.

33	Improve Water Systems	Improve water efficiency, upgrading to low flow water fixtures, water recycling, and other water conservation techniques.	DR

Mark only one oval.

- Low
- Medium
- High

42.

29	Irrigation and Landscape Improvements	Upgrade irrigation and landscaping for water efficiency that reduces maintenance needs and conserve water.	DR

Mark only one oval.

- Low
- Medium
- High

43. Are there other actions you'd like BART to consider in this category? If yes, please describe.

Extreme Heat Mitigation

Rating criteria (repeated for convenience):
1) Hazard risk reduction
2) Cost to benefit value
3) Environmental benefit
4) Equitable outcomes
5) Safety impact

44.

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
34	Sun Shields	Provide sun shields for equipment located outdoors to reduce risk of overheating.	EH

Mark only one oval.

- Low
- Medium
- High

45. Are there other actions you'd like BART to consider in this category? If yes, please describe.

Pandemics, Endemics, and Vector-borne Diseases Mitigations

Rating criteria (repeated for convenience):
1) Hazard risk reduction
2) Cost to benefit value
3) Environmental benefit
4) Equitable outcomes
5) Safety impact

46.

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
40	Contagious Virus Planning	Maintain and update District's Contagious Virus Response Plan.	PEV

Mark only one oval.

- Low
- Medium
- High

47.

41	Covid-19 Prevention Program	Maintain and implement BART's Covid-19 Prevention Program.	PEV

Mark only one oval.

- Low
- Medium
- High

48.

42	HVAC Filters on BART Train Cars	Replace HVAC filters on BART train cars. Air Filtraison plays an important role in preventing transmission of coronavirus	PEV

Mark only one oval.

- Low
- Medium
- High

49. Are there other actions you'd like BART to consider in this category? If yes, please describe.

Other

50. Are there mitigation efforts your group or division is undertaking or has undertaken that may reduce hazard risk to BART facilities or services? If yes, please describe.

51. Is there anything else you'd like BART to consider in preparing for natural disasters?

B1.3.2 Title IV/EJC

BART LHMP Survey

Welcome. Thank you in advance for your participation. This survey is intended to better understand stakeholder views with regard to natural hazards and mitigations to reduce hazard risk. Feedback from this survey will support update of BART's Local Hazard Mitigation Plan.

For additional information please visit https://www.bart.gov/about/planning/policies/hazard

Contact Information

1. Name
2. Organization
3. Role or Title
4. Email
5. Phone Number

Hazard Information

6. What hazards are your organization most concerned about? Select all that apply.

Check all that apply.

- [ ] Earthquake
- [ ] Liquefaction
- [ ] Tsunami
- [ ] Landslide
- [ ] Flooding
- [ ] Sea Level Rise
- [ ] Fire
- [ ] Drought
- [ ] Extreme Heat
- [ ] Severe Storms
- [ ] Pandemics, Endemics, Vector-borne Diseases

Other: [ ] _____

Mitigation Information: General

The following are mitigations BART is considering to address hazard risks in general.

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
1	Backup Emergency Operations Center	Establish a back-up Emergency Operations Center with redundant communications systems.	EQ, LI, TS, FL, F, SS
2	Portable Emergency Equipment	Purchase portable equipment including hoses, pumps, emergency generators, radios, vehicles, oxygen tanks to allow to support response and recovery of service in locations and/or assets prone to failure.	EQ, LI, TS, LS, FL, F, EH, SS
4	Safe Evacuations	Improve evacuation and evacuation communications. Improvements include upgrades for water sensors, signage, and replacement of cross passage doors and hatch doors.	EQ, LI, TS, LS, FL, F, EH, SS
10	Power Resilience - Emergency Lighting	Minimize the likelihood that power interruptions will adversely impact emergency lighting. Improvements include providing, upgrading, or replacing uninterruptible power supply (UPS) and dedicated circuits for emergency lighting systems.	EQ, LI, TS, LS, FL, F, EH, SS
11	Power Resilience - General	Minimize the likelihood that power interruptions will adversely impact lifeline utility systems or critical facilities by ensuring that there is redundancy and reliability in power systems. Improvements include providing, upgrading, or replacing uninterruptible power supply (UPS), train control batteries, transformers, power distribution networks including cabling and switching equipment, and fixed emergency generators.	EQ, LI, TS, LS, FL, F, EH, SS

cont'd

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
31	Redundant Systems	Provide or enhance redundant systems to reduce interruption to core network and system elements. Systems include networks, systems, fare collections, and radio.	EQ, LI, TS, LS, FL, F, EH, SS
32	Systems Disaster Recovery Planning	Enhance or conduct disaster recovery planning of systems to minimize disruption to service.	EQ, LI, TS, LS, FL, F, EH, SS
38	Emergency Dispatch Center	Provide or replace emergency dispatch center to better support disaster response.	EQ, LI, TS, LS, FL, F, EH, SS
16	Public Communication	Improve communication systems to the public when there are system disruptions due to natural disasters.	EQ, LI, TS, LS, FL, F, DR, EH, SS, PEV
20	Asset Management Integration	Include climate risk information into Asset Management	EQ, LI, TS, LS, FL, F, DR, EH, SS
30	Climate Risk of Projects	Incorporate best available climate risk in design criteria and projects	LI, TS, LS, FL, F, DR, EH, SS

Hazard Legend

EQ - Earthquake,	LI - Liquefaction,	TS - Tsunami,
LS - Landslide,	FL-Flood,	SLR - Sea Level Rise,
F - Fire,	DR - Drought,	EH - Extreme Heat,
SS - Severe Storms,	PEV - Pandemics, Endemic, Vector-borne Diseases	

7. Are there implementation concerns you would like BART to consider?

_____

_____

_____

_____

_____

8. Are there other efforts you'd like BART to consider in this category? If yes, please describe.

_____

_____

_____

_____

_____

Mitigation Information: Seismic

The following are mitigations BART is considering to address seismic risks (earthquakes, liquefaction).

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
21	Enhance Seismic Detection and Recovery	Detection efforts include installing cameras in seismic sensitive locations and revisiting detection thresholds. Efforts includes conducting inventory and model structural fragilities for the BART system. Recovery efforts include procurement and storage of materials for seismic disaster response.	EQ, LI, LS
22	Seismic Retrofit Work	Continue ongoing seismic infrastructure retrofit of the BART system. Update structures to comply with seismic standards	EQ, LI, LS
33	Inspect and Repair Facilities for Structural	Inspect facilities for structural risk. Repair facilities to address structural issues and reduce structural risk.	EQ, LI, LS

Hazard Legend

EQ - Earthquake,	LI - Liquefaction,	TS - Tsunami,
LS - Landslide,	FL-Flood,	SLR - Sea Level Rise,
F - Fire,	DR - Drought,	EH - Extreme Heat,
SS - Severe Storms,	PEV - Pandemics, Endemic, Vector-borne Diseases	

9. Are there implementation concerns you would like BART to consider?

10. Are there other efforts you'd like BART to consider in this category? If yes, please describe.

Mitigation Information: Landslide

The following are mitigations BART is considering to address landslide risks.

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
3	Erosion Control, Slope Stabilization	Upgrade and repair facility foundations, embankments, and drainage to mitigate erosion issues. Work that may be included are excavation, fill placement, cut-fill transitions, slope stability, drainage and erosion control, slope setbacks, expansive soils, collapsible soils, environmental issues, geological and geotechnical investigations, grading plans and specifications, protection of adjacent properties, and review and permit issuance.	LS

Hazard Legend

EQ - Earthquake,	LI - Liquefaction,	TS - Tsunami,
LS - Landslide,	FL-Flood,	SLR - Sea Level Rise,
F - Fire,	DR - Drought,	EH - Extreme Heat,
SS - Severe Storms,	PEV - Pandemics, Endemic, Vector-borne Diseases	

11. Are there implementation concerns you would like BART to consider?

12. Are there other efforts you'd like BART to consider in this category? If yes, please describe.

Mitigation Information: Water-related

The following are mitigations BART is considering to address water-related risks (e.g. flooding, severe storm, sea level rise, tsunami).

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
3	Storm Drainage System	Repair or replace dilapidated roofs, storm drains, pipelines, sump pumps, and channels to enable them to perform to their design capacity in handling water flows as part of regular maintenance activities.	FL, SS
18	Low Impact Development	For new development or redevelopments, incorporate low impact development (LIDs) to mitigate storm water runoff and peak flows in the watershed.	FL, SS
14	Adaptation Investigation and Research	Conduct study to further understand adaptation needs. Stay informed of scientific information compiled by regional and state sources on the subject of rising sea levels and global warming, especially on actions that local governments can take to mitigate this hazard including special design and engineering of facilities in low-lying areas.	FL, SLR

cont'd

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
28	Engage in Regional Planning for Flooding and Sea Level Rise	Support and engage in county and/or other regionally-led planning efforts in mitigation of flooding from sea level rise and other weather related issues.	FL, SLR
6	Sandbags and Sheeting	Purchase sandbags and plastic sheeting in anticipation of rainstorms, and deliver those materials to key BART sites.	TS, FL
24	Elevate/Protect Critical Facilities	Elevate/protect critical assets in flood risk areas.	TS, FL, SLR
9	Flood Safe Facilities (Water Intrusion)	Repair cracks and leaks resulting in water intrusion via sealing and other water proofing techniques.	TS, FL, SLR, SS

Hazard Legend

EQ - Earthquake,	LI - Liquefaction,	TS - Tsunami,
LS - Landslide,	FL-Flood,	SLR - Sea Level Rise,
F - Fire,	DR - Drought,	EH - Extreme Heat,
SS - Severe Storms,	PEV - Pandemics, Endemic, Vector-borne Diseases	

13. Are there implementation concerns you would like BART to consider?

14. Are there other efforts you'd like BART to consider in this category? If yes, please describe.

Mitigation Information: Fire

The following are mitigations BART is considering to address fire risks.

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
13	Fire Suppression and Alarm Systems	Upgrade facilities to ensure a reliable system fire suppression for existing and new development. Work includes replacing/upgrading old fire alarm systems, water piping, control wiring, adequate wet stand pipes, fire hose cabinet, and chemical fire suppression systems. Provide CCTV camera in tunnels to remotely monitor for fire issues.	F
23	Fire Hazard Removal	Conduct removal of debris and vegetation from district property that pose a fire hazard.	F
35	Enhance Fire Safety	Upgrade communications systems at fire command posts. Assess and implement fire safety enhancements for control towers. Add fire command posts in critical locations.	F

cont'd

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
36	Fire Breaks	Create firebreaks along BART right-of-way to reduce fire risks.	F
37	Fire Life Safety Training Facility	Build a fire life safety training facility to train first responders to BART system.	F
39	Address Homelessness Needs	Homeless encampments on BART right-of-way pose a fire risk. BART is in process of developing a Strategic Homelessness Action Plan. See https://www.bart.gov/guide/social-resources for details. Efforts will include advocacy and partnerships to support health and wellbeing of homeless individuals.	F
7	Water Distribution System	Repair or replace water distribution systems on BART facilities including sewer and water lines and valves that are not in a state of good repair.	F, DR

Hazard Legend

EQ - Earthquake,	LI - Liquefaction,	TS - Tsunami,
LS - Landslide,	FL-Flood,	SLR - Sea Level Rise,
F - Fire,	DR - Drought,	EH - Extreme Heat,
SS - Severe Storms,	PEV - Pandemics, Endemic, Vector-borne Diseases	

15. Are there implementation concerns you would like BART to consider?

16. Are there other efforts you'd like BART to consider in this category? If yes, please describe.

17. Are there implementation concerns you would like BART to consider?

Mitigation Information: Drought

The following are mitigations BART is considering to address drought risks.

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
8	Investigate High Usage Facilities	Track the water use of each facility and investigate and address facilities that have high water usage.	DR
15	Improve Water Systems	Improve water efficiency, upgrading to low flow water fixtures, water recycling, and other water conservation techniques.	DR
29	Irrigation and Landscape Improvements	Upgrade irrigation and landscaping for water efficiency that reduces maintenance needs and conserve water.	DR
7 (Note: duplicate from prior slide)	Water Distribution System	Repair or replace water distribution systems on BART facilities including sewer and water lines and valves that are not in a state of good repair.	F, DR

Hazard Legend

EQ - Earthquake,	LI - Liquefaction,	TS - Tsunami,
LS - Landslide,	FL-Flood,	SLR - Sea Level Rise,
F - Fire,	DR - Drought,	EH - Extreme Heat,
SS - Severe Storms,	PEV - Pandemics, Endemic, Vector-borne Diseases	

18. Are there other efforts you'd like BART to consider in this category? If yes, please describe.

Mitigation Information: Extreme Heat

The following are mitigations BART is considering to address extreme heat risks.

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
34	Sun Shields	Provide sun shields for equipment located outdoors to reduce risk of overheating.	EH

Hazard Legend

EQ - Earthquake,	LI - Liquefaction,	TS - Tsunami,
LS - Landslide,	FL-Flood,	SLR - Sea Level Rise,
F - Fire,	DR - Drought,	EH - Extreme Heat,
SS - Severe Storms,	PEV - Pandemics, Endemic, Vector-borne Diseases	

19. Are there implementation concerns you would like BART to consider?

20. Are there other efforts you'd like BART to consider in this category? If yes, please describe.

Mitigation Information: Infectious Diseases

The following are mitigations BART is considering to address risks of infectious diseases (pandemics, endemics, vector–born diseases).

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
40	Contagious Virus Planning	Maintain and update District's Contagious Virus Response Plan.	PEV
41	Covid-19 Prevention Program	Maintain and implement BART's Covid-19 Prevention Program.	PEV
42	HVAC Filters on BART Train Cars	Replace HVAC filters on BART train cars. Air filtration plays an important role in preventing transmission of coronavirus	PEV

Hazard Legend

EQ - Earthquake,	LI - Liquefaction,	TS - Tsunami,
LS - Landslide,	FL-Flood,	SLR - Sea Level Rise,
F - Fire,	DR - Drought,	EH - Extreme Heat,
SS - Severe Storms,	PEV - Pandemics, Endemic, Vector-borne Diseases	

21. Are there implementation concerns you would like BART to consider?

22. Are there other efforts you'd like BART to consider in this category? If yes, please describe.

Other

23. Is there anything else you'd like BART to consider in preparing for natural disasters?

B1.3.3 External Agencies

BART LHMP Survey

Welcome. Thank you in advance for your participation. This survey is intended to better understand stakeholder views with regard to natural hazards and mitigations to reduce hazard risk. Feedback from this survey will support update of BART's Local Hazard Mitigation Plan.

For additional information please visit https://www.bart.gov/about/planning/policies/hazard

Contact Information

1. Name

2. Organization

3. Role or Title

4. Email

5. Phone Number

Hazard Information

6. What hazards are your organization most concerned about? Select all that apply.

Check all that apply.

- ☐ Earthquake
- ☐ Liquefaction
- ☐ Tsunami
- ☐ Landslide
- ☐ Flooding
- ☐ Sea Level Rise
- ☐ Fire
- ☐ Drought
- ☐ Extreme Heat
- ☐ Severe Storms
- ☐ Pandemics, Endemics, Vector-borne Diseases

Other: ☐ _____

Mitigation Information: General

The following are mitigations BART is considering to address hazard risks in general.

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
1	Backup Emergency Operations Center	Establish a back-up Emergency Operations Center with redundant communications systems.	EQ, LI, TS, FL, F, SS
2	Portable Emergency Equipment	Purchase portable equipment including hoses, pumps, emergency generators, radios, vehicles, oxygen tanks to allow to support response and recovery of service in locations and/or assets prone to failure.	EQ, LI, TS, LS, FL, F, EH, SS
4	Safe Evacuations	Improve evacuation and evacuation communications. Improvements include upgrades for water sensors, signage, and replacement of cross passage doors and hatch doors.	EQ, LI, TS, LS, FL, F, EH, SS
10	Power Resilience - Emergency Lighting	Minimize the likelihood that power interruptions will adversely impact emergency lighting. Improvements include providing, upgrading, or replacing uninterruptible power supply (UPS) and dedicated circuits for emergency lighting systems.	EQ, LI, TS, LS, FL, F, EH, SS
11	Power Resilience - General	Minimize the likelihood that power interruptions will adversely impact lifeline utility systems or critical facilities by ensuring that there is redundancy and reliability in power systems. Improvements include providing, upgrading, or replacing uninterruptible power supply (UPS), train control batteries, transformers, power distribution networks including cabling and switching equipment, and fixed emergency generators.	EQ, LI, TS, LS, FL, F, EH, SS

cont'd

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
31	Redundant Systems	Provide or enhance redundant systems to reduce interruption to core network and system elements. Systems include networks, systems, fare collections, and radio.	EQ, LI, TS, LS, FL, F, EH, SS
32	Systems Disaster Recovery Planning	Enhance or conduct disaster recovery planning of systems to minimize disruption to service.	EQ, LI, TS, LS, FL, F, EH, SS
38	Emergency Dispatch Center	Provide or replace emergency dispatch center to better support disaster response.	EQ, LI, TS, LS, FL, F, EH, SS
16	Public Communication	Improve communication systems to the public when there are system disruptions due to natural disasters.	EQ, LI, TS, LS, FL, F, DR, EH, SS, PEV
20	Asset Management Integration	Include climate risk information into Asset Management	EQ, LI, TS, LS, FL, F, DR, EH, SS
30	Climate Risk of Projects	Incorporate best available climate risk in design criteria and projects	LI, TS, LS, FL, F, DR, EH, SS

Hazard Legend

EQ - Earthquake,	LI - Liquefaction,	TS - Tsunami,
LS - Landslide,	FL-Flood,	SLR - Sea Level Rise,
F - Fire,	DR - Drought,	EH - Extreme Heat,
SS - Severe Storms,	PEV - Pandemics, Endemic, Vector-borne Diseases	

7. Are there implementation concerns you would like BART to consider?

8. Are there other efforts you'd like BART to consider in this category? If yes, please describe.

Mitigation Information: Seismic

The following are mitigations BART is considering to address seismic risks (earthquakes, liquefaction).

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
21	Enhance Seismic Detection and Recovery	Detection efforts include installing cameras in seismic sensitive locations and revisiting detection thresholds. Efforts includes conducting inventory and model structural fragilities for the BART system. Recovery efforts include procurement and storage of materials for seismic disaster response.	EQ, LI, LS
22	Seismic Retrofit Work	Continue ongoing seismic infrastructure retrofit of the BART system. Update structures to comply with seismic standards	EQ, LI, LS
33	Inspect and Repair Facilities for Structural	Inspect facilities for structural risk. Repair facilities to address structural issues and reduce structural risk.	EQ, LI, LS

Hazard Legend

EQ - Earthquake,	LI - Liquefaction,	TS - Tsunami,
LS - Landslide,	FL-Flood,	SLR - Sea Level Rise,
F - Fire,	DR - Drought,	EH - Extreme Heat,
SS - Severe Storms,	PEV - Pandemics, Endemic, Vector-borne Diseases	

9. Are there implementation concerns you would like BART to consider?

10. Are there other efforts you'd like BART to consider in this category? If yes, please describe.

Mitigation Information: Landslide

The following are mitigations BART is considering to address landslide risks.

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
3	Erosion Control, Slope Stabilization	Upgrade and repair facility foundations, embankments, and drainage to mitigate erosion issues. Work that may be included are excavation, fill placement, cut-fill transitions, slope stability, drainage and erosion control, slope setbacks, expansive soils, collapsible soils, environmental issues, geological and geotechnical investigations, grading plans and specifications, protection of adjacent properties, and review and permit issuance.	LS

Hazard Legend

EQ - Earthquake,	LI - Liquefaction,	TS - Tsunami,
LS - Landslide,	FL-Flood,	SLR - Sea Level Rise,
F - Fire,	DR - Drought,	EH - Extreme Heat,
SS - Severe Storms,	PEV - Pandemics, Endemic, Vector-borne Diseases	

11. Are there implementation concerns you would like BART to consider?

12. Are there other efforts you'd like BART to consider in this category? If yes, please describe.

Mitigation Information: Water-related

The following are mitigations BART is considering to address water-related risks (e.g. flooding, severe storm, sea level rise, tsunami).

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
5	Storm Drainage System	Repair or replace dilapidated roofs, storm drains, pipelines, sump pumps, and channels to enable them to perform to their design capacity in handling water flows as part of regular maintenance activities.	FL, SS
18	Low Impact Development	For new development or redevelopments, incorporate low impact development (LIDs) to mitigate storm water runoff and peak flows in the watershed.	FL, SS
14	Adaptation Investigation and Research	Conduct study to further understand adaptation needs. Stay informed of scientific information compiled by regional and state sources on the subject of rising sea levels and global warming, especially on actions that local governments can take to mitigate this hazard including special design and engineering of facilities in low-lying areas.	FL, SLR

cont'd

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
28	Engage in Regional Planning for Flooding and Sea Level Rise	Support and engage in county and/or other regionally-led planning efforts to mitigate/address offlooding from sea level rise and other weather related issues.	FL, SLR
6	Sandbags and Sheeting	Purchase sandbags and plastic sheeting in anticipation of rainstorms, and deliver those materials to key BART sites.	TS, FL
24	Elevate/Protect Critical Facilities	Elevate/protect critical assets in flood risk areas.	TS, FL, SLR
9	Flood Safe Facilities (Water Intrusion)	Repair cracks and leaks resulting in water intrusion via sealing and other water proofing techniques.	TS, FL, SLR, SS

Hazard Legend

EQ - Earthquake,	LI - Liquefaction,	TS - Tsunami,
LS - Landslide,	FL-Flood,	SLR - Sea Level Rise,
F - Fire,	DR - Drought,	EH - Extreme Heat,
SS - Severe Storms,	PEV - Pandemics, Endemic, Vector-borne Diseases	

13. Are there implementation concerns you would like BART to consider?

14. Are there other efforts you'd like BART to consider in this category? If yes, please describe.

Mitigation Information: Fire

The following are mitigations BART is considering to address fire risks.

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
43	Fire Suppression and Alarm Systems	Upgrade facilities to ensure a reliable system fire suppression for existing and new development. Work includes replacing/upgrading old fire alarm systems, water piping, control wiring, adequate wet stand pipes, fire hose cabinet, and chemical fire suppression systems. Provide CCTV camera in tunnels to remotely monitor for fire issues.	F
93	Fire Hazard Removal	Conduct removal of debris and vegetation from district property that pose a fire hazard.	F
35	Enhance Fire Safety	Upgrade communications systems at fire command posts. Assess and implement fire safety enhancements for control towers. Add fire command posts in critical locations.	F

cont'd

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
36	Fire Breaks	Create firebreaks along BART right-of-way to reduce fire risks.	F
37	Fire Life Safety Training Facility	Build a fire life safety training facility to train first responders to BART system.	F
39	Address Homelessness Needs	Homeless encampments on BART right-of-way pose a fire risk. BART is in process of developing a Strategic Homelessness Action Plan. See https://www.bart.gov/guide/social-resources for details. Efforts will include advocacy and partnerships to support health and wellbeing of homeless individuals.	F
7	Water Distribution System	Repair or replace water distribution systems on BART facilities including sewer and water lines and valves that are not in a state of good repair.	F, DR

Hazard Legend

EQ - Earthquake,	LI - Liquefaction,	TS - Tsunami,
LS - Landslide,	FL-Flood,	SLR - Sea Level Rise,
F - Fire,	DR - Drought,	EH - Extreme Heat,
SS - Severe Storms,	PEV - Pandemics, Endemic, Vector-borne Diseases	

15. Are there implementation concerns you would like BART to consider?

16. Are there other efforts you'd like BART to consider in this category? If yes, please describe.

17. Are there implementation concerns you would like BART to consider?

Mitigation Information: Drought

The following are mitigations BART is considering to address drought risks.

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
8	Investigate High Usage Facilities	Track the water use of each facility and investigate and address facilities that have high water usage.	DR
15	Improve Water Systems	Improve water efficiency, upgrading to low flow water fixtures, water recycling, and other water conservation techniques.	DR
29	Irrigation and Landscape Improvements	Upgrade irrigation and landscaping for water efficiency that reduces maintenance needs and conserve water.	DR
7 (Note: duplicate from prior slide)	Water Distribution System	Repair or replace water distribution systems on BART facilities including sewer and water lines and valves that are not in a state of good repair.	F, DR

Hazard Legend

EQ - Earthquake,	LI - Liquefaction,	TS - Tsunami,
LS - Landslide,	FL-Flood,	SLR - Sea Level Rise,
F - Fire,	DR - Drought,	EH - Extreme Heat,
SS - Severe Storms,	PEV - Pandemics, Endemic, Vector-borne Diseases	

18. Are there other efforts you'd like BART to consider in this category? If yes, please describe.

Mitigation Information: Extreme Heat

The following are mitigations BART is considering to address extreme heat risks.

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
34	Sun Shields	Provide sun shields for equipment located outdoors to reduce risk of overheating.	EH

Hazard Legend

EQ - Earthquake,	LI - Liquefaction,	TS - Tsunami,
LS - Landslide,	FL-Flood,	SLR - Sea Level Rise,
F - Fire,	DR - Drought,	EH - Extreme Heat,
SS - Severe Storms,	PEV - Pandemics, Endemic, Vector-borne Diseases	

19. Are there implementation concerns you would like BART to consider?

20. Are there other efforts you'd like BART to consider in this category? If yes, please describe.

Mitigation Information: Infectious Diseases

The following are mitigations BART is considering to address risks of infectious diseases (pandemics, endemics, vector–borne diseases).

Mitigation No. (tentative numbering)	Mitigation Name	Mitigation Description	Hazards Addressed*
40	Contagious Virus Planning	Maintain and update District's Contagious Virus Response Plan.	PEV
41	Covid-19 Prevention Program	Maintain and implement BART's Covid-19 Prevention Program.	PEV
42	HVAC Filters on BART Train Cars	Replace HVAC filters on BART train cars. Air filtration plays an important role in preventing transmission of coronavirus	PEV

23. Are there mitigation efforts your organization (i.e., city, county, or other agency) is undertaking or has undertaken that may reduce hazard risk to BART facilities or services? If yes, please describe.

24. Is there anything else you'd like BART to consider in preparing for natural disasters?

Hazard Legend

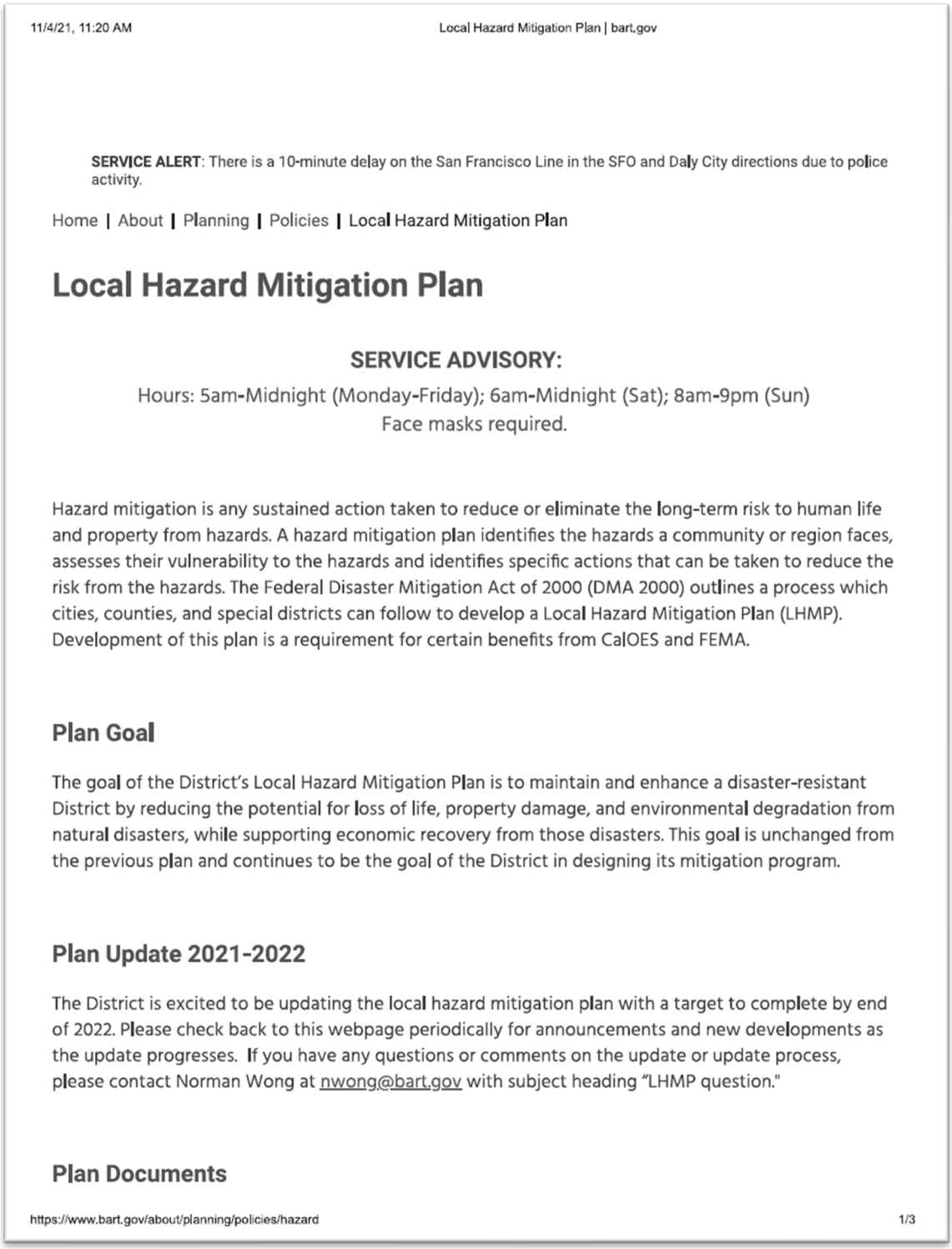
EQ - Earthquake,	LI - Liquefaction,	TS - Tsunami,
LS - Landslide,	FL-Flood,	SLR - Sea Level Rise,
F - Fire,	DR - Drought,	EH - Extreme Heat,
SS - Severe Storms,	PEV - Pandemics, Endemic, Vector-borne Diseases	

21. Are there implementation concerns you would like BART to consider?

22. Are there other efforts you'd like BART to consider in this category? If yes, please describe.

Other

B1.4 Website and News Announcement



11/4/21, 11:20 AM Local Hazard Mitigation Plan | bart.gov

SERVICE ALERT: There is a 10-minute delay on the San Francisco Line in the SFO and Daly City directions due to police activity.

Home | About | Planning | Policies | Local Hazard Mitigation Plan

Local Hazard Mitigation Plan

SERVICE ADVISORY:

Hours: 5am-Midnight (Monday-Friday); 6am-Midnight (Sat); 8am-9pm (Sun)
Face masks required.

Hazard mitigation is any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. A hazard mitigation plan identifies the hazards a community or region faces, assesses their vulnerability to the hazards and identifies specific actions that can be taken to reduce the risk from the hazards. The Federal Disaster Mitigation Act of 2000 (DMA 2000) outlines a process which cities, counties, and special districts can follow to develop a Local Hazard Mitigation Plan (LHMP). Development of this plan is a requirement for certain benefits from CalOES and FEMA.

Plan Goal

The goal of the District's Local Hazard Mitigation Plan is to maintain and enhance a disaster-resistant District by reducing the potential for loss of life, property damage, and environmental degradation from natural disasters, while supporting economic recovery from those disasters. This goal is unchanged from the previous plan and continues to be the goal of the District in designing its mitigation program.

Plan Update 2021-2022

The District is excited to be updating the local hazard mitigation plan with a target to complete by end of 2022. Please check back to this webpage periodically for announcements and new developments as the update progresses. If you have any questions or comments on the update or update process, please contact Norman Wong at nwong@bart.gov with subject heading "LHMP question."

Plan Documents

https://www.bart.gov/about/planning/policies/hazard 1/3

Language Assistance

If you need language assistance services, please call 510-464-6752.
Si necesita servicios de asistencia de idiomas, llame al 510-464-6752.
如需語言協助服務，請致電 510-464-6752.

Kung kailangan mo ang tulong ng mga serbisyo ng wika, paki tawagan ang (510) 464-6752.
Nếu quý vị cần được giúp đỡ về ngôn ngữ, xin vui lòng gọi số 510-464-6752.
통역이 필요하신 분은, 510-464-6752로 문의하십시오.

Bay Area Rapid Transit (BART)

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Appendix C

Mitigation Strategies

Mitigation Strategies

Priority Level	Mitigation No.	Mitigation Name	Mitigation Description	Relevant Capital Needs Inventory IDs	Expected Timeframes for Completion (Years)	Potential Funding Sources	Hazards Addressed*	Lead Department
High	1	Power Resilience - General	Minimize the likelihood that power interruptions will adversely impact lifeline utility systems or critical facilities by ensuring that there is redundancy and reliability in power systems. Improvements include providing, upgrading, or replacing uninterruptible power supply (UPS), train control batteries, transformers, power distribution networks including cabling and switching equipment, and fixed emergency generators.	PM0209, PM0211, PM0245, PM0260, PM0261, PM0294, PM0313, PM0336, PM0363, PM0365, PM0366, PM0423, PM0463, PM0475, PM0476, PM0478, PM0481, PM0482, SY0169	1-10	Grants, Capital	EQ, LI, TS, LS, FL, F, EH, SS	Maintenance and Engineering
High	2	Fire Suppression and Alarm Systems	Ensure a reliable system fire suppression for existing and new development. Work includes providing, upgrading, or replacing fire alarm systems, water piping, control wiring, adequate wet standpipes, fire hose cabinet, and chemical fire suppression systems. Provide CCTV camera in tunnels to remotely monitor for fire issues.	PM0069, PM0072, PM0123, PM0154, PM0166, PM0259, PM0281, PM0299, PM0326, PM0339, PM0340, PM0369, PM0372, PM0397, PM0404, PM0470, WF0260	1-10	Grants, Capital	F	Maintenance and Engineering
High	3	Inspect and Repair Facilities for Structural	Inspect facilities for structural risk. Repair facilities to address structural issues and reduce structural risk.	WF0062, WF0104, WF0432, WF0456, WF0457, WF0494, WF0511	1-10	Grants, Capital	EQ, LI, LS	Maintenance and Engineering
High	4	Safe Evacuations	Improve evacuation and evacuation communications. Improvements include upgrades for water sensors, signage, transfer trip systems, and replacement of cross passage doors and hatch doors.	WF0305, PM0252, WF0048, WF0346, PM0364	1-10	Grants, Capital	EQ, LI, TS, LS, FL, F, EH, SS	Maintenance and Engineering
High	5	Seismic Retrofit Work	Continue ongoing seismic infrastructure retrofit of the BART system. Update structures to comply with seismic standards.	WF0369	1-10	Grants, Capital	EQ, LI, LS	Maintenance and Engineering, Design and Construction

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Mitigation Strategies

Priority Level	Mitigation No.	Mitigation Name	Mitigation Description	Relevant Capital Needs Inventory IDs	Expected Timeframes for Completion (Years)	Potential Funding Sources	Hazards Addressed*	Lead Department
High	6	Seismic Retrofit Work: Berkeley Hills Tunnel	Provide short- and long-term strategies to reduce seismic risk of Berkeley Hills Tunnel (BHT). Provide interim strategies prior to any retrofit.		1-10	Grants, Capital	EQ	Maintenance and Engineering, Design and Construction
High	7	Power Resilience - Emergency Lighting	Minimize the likelihood that power interruptions will adversely impact emergency lighting. Improvements include providing, upgrading, or replacing uninterruptible power supply (UPS) and dedicated circuits for emergency lighting systems.	PM0054, PM0065, PM0066, PM0076, PM0384, PM0385, PM0386, PM0396, PM0474	1-10	Grants, Capital	EQ, LI, TS, LS, FL, F, EH, SS	Maintenance and Engineering
High	8	Redundant Systems	Provide or enhance redundant systems to reduce interruption to core network and system elements. Systems include networks, systems, fare collections, and radio.	SY0176	1-10	Grants, Capital	EQ, LI, TS, LS, FL, F, EH, SS	Maintenance and Engineering, OCIO
Medium	9	Systems Disaster Recovery Planning	Enhance or conduct disaster recovery planning for systems to minimize disruption to service.	SY0185	1-10	Grants, Capital	EQ, LI, TS, LS, FL, F, EH, SS	Maintenance and Engineering
Medium	10	Enhance Seismic Detection and Recovery	Detection efforts include installing cameras in seismic sensitive locations and revisiting warning thresholds used in the Early Warning System. Efforts include conducting inventory and model structural fragilities for the BART system. Recovery efforts include procurement and storage of materials for seismic disaster response.	WF0556, WF0397, WF0347	1-10	Grants, Capital	EQ, LI, LS	Maintenance and Engineering
Medium	11	Enhance Fire Safety	Upgrade communications systems at fire command posts. Assess and implement fire safety enhancements for control towers. Add fire command posts in critical locations.	PM0493, PM0496, SY0302	1-10	Grants, Capital	F	Maintenance and Engineering, Fire Life Safety

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Mitigation Strategies

Priority Level	Mitigation No.	Mitigation Name	Mitigation Description	Relevant Capital Needs Inventory IDs	Expected Timeframes for Completion (Years)	Potential Funding Sources	Hazards Addressed*	Lead Department
Medium	12	Flood Safe Facilities (Water Intrusion)	Repair cracks and leaks resulting in water intrusion via sealing and other water proofing techniques.	PM0376, PM0389, WF0039, WF0217, WF0271, WF0402, WF0407, WF0453, WF0524, WF0529, WF0530, WF0531	1-10	Grants, Capital	TS, FL, SLR, SS	Maintenance and Engineering
Medium	13	Fire Hazard Removal	Conduct removal of debris and vegetation from district property that pose a fire hazard.	WF0512, WF0210, WF0162, WF0246	1-5	Operating, Grants, Capital	F	Maintenance and Engineering
Medium	14	Elevate/Protect Critical Facilities	Elevate or protect critical assets in flood risk areas.	WF0262, WF0266, WF0376	1-10	Grants, Capital	TS, FL, SLR	Maintenance and Engineering, Design and Construction
Medium	15	Address Homelessness Needs	Homeless encampments on BART right-of-way pose a fire risk. BART is in process of developing a Strategic Homelessness Action Plan. See https://www.bart.gov/guide/social-resources for details. Efforts will include advocacy and partnerships to support health and wellbeing of homeless individuals.		Ongoing	Operating, Grants, Capital	F	Planning & Development
Medium	16	Fire Life Safety Training Facility	Build a fire life safety training facility to train first responders to BART system.		1-10	Grants, Capital	F	Fire Life Safety
Medium	17	Backup Emergency Dispatch Center	Provide backup emergency dispatch center.		1-10	Grants, Capital	EQ, LI, TS, LS, FL, F, EH, SS	Police

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Mitigation Strategies

Priority Level	Mitigation No.	Mitigation Name	Mitigation Description	Relevant Capital Needs Inventory IDs	Expected Timeframes for Completion (Years)	Potential Funding Sources	Hazards Addressed*	Lead Department
Medium	18	Portable Emergency Equipment	Purchase portable equipment including hoses, pumps, emergency generators, radios, vehicles, oxygen tanks to allow to support response and recovery of service in locations and assets prone to failure.	SY0030, PM0349, PM0427, SY0219, SY0254	1-5	Grants, Capital	EQ, LI, TS, LS, FL, F, EH, SS	Maintenance and Engineering
Medium	19	Erosion Control, Slope Stabilization	Upgrade and repair facility foundations, embankments, and drainage to mitigate erosion issues. Work that may be included are excavation, fill placement, cut-fill transitions, slope stability, drainage and erosion control, slope setbacks, expansive soils, collapsible soils, environmental issues, geological and geotechnical investigations, grading plans and specifications, protection of adjacent properties, and review and permit issuance.	WF0256, WF0401, WF0519, WF0527, WF0528	1-10	Grants, Capital	LS	Maintenance and Engineering
Medium	20	Storm Drainage System	Repair or replace dilapidated roofs, storm drains, pipelines, sump pumps, and channels to enable them to perform to their design capacity in handling water flows as part of regular maintenance activities.	PM0173, WF0123, WF0133, WF0219, WF0267, WF0268, WF0298, WF0435, WF0454, WF0455, WF0497, WF0500, WF0533, WF0548	1-10	Grants, Capital	FL, SS	Maintenance and Engineering
Medium	21	Fire Breaks	Create firebreaks along BART right-of-way to reduce fire risks.		1-10	Operating, Grants, Capital	F	Fire Life Safety, Maintenance
Medium	22	Backup Operation Centers	Provide a backup Emergency Operations Center and a backup Operation Control Center.		1-10	Grants, Capital	EQ, LI, TS, FL, F, SS	Police, Transportation
Medium	23	Water Distribution System	Repair or replace water distribution systems on BART facilities including sewer and water lines and valves that are not in a state of good repair.	WF0339, PM0398, PM0189	1-10	Grants, Capital	F, DR	Maintenance and Engineering

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Mitigation Strategies

Priority Level	Mitigation No.	Mitigation Name	Mitigation Description	Relevant Capital Needs Inventory IDs	Expected Timeframes for Completion (Years)	Potential Funding Sources	Hazards Addressed*	Lead Department
Medium	24	Climate Risk of Projects	Incorporate best available climate risk in design criteria and projects.		Ongoing	Grants, Capital	LI, TS, LS, FL, SLR, F, DR, EH, SS	Maintenance and Engineering, Design and Construction
Medium	25	HVAC Filters on BART Train Cars	Replace HVAC filters on BART train cars. Air filtration plays an important role in preventing transmission of coronavirus.		Ongoing	Operating, Grants, Capital	PEV	RS&S
Medium	26	Public Communication	Improve communication systems to the public when there are system disruptions due to natural disasters.	SY0190	1-5	Grants, Capital	EQ, LI, TS, LS, FL, F, DR, EH, SS, PEV	Maintenance and Engineering
Medium	27	Contagious Virus Planning	Update and maintain District's Contagious Virus Response Plan.		Ongoing	Operating, Grants	PEV	Safety
Medium	28	Covid-19 Prevention Program	Maintain and implement BART's Covid-19 Prevention Program.		Ongoing	Operating, Grants, Capital	PEV	Safety
Medium	29	Engage in Regional Planning for Flooding and Sea Level Rise	Support and engage in county and other regionally-led planning efforts in mitigation of flooding from sea level rise and other weather related issues.		Ongoing	Operating, Grants	FL, SLR	Office of District Architect
Medium	30	Sandbags and Sheeting	Purchase sandbags and plastic sheeting in anticipation of rainstorms and deliver those materials to key BART sites.		1-5	Operating, Grants, Capital	TS, FL, SS	Maintenance
Medium	31	Sun Shields	Provide sun shields for equipment located outdoors to reduce risk of overheating.	SY0220	1-10	Grants, Capital	EH	Maintenance and Engineering
Medium	32	Investigate High Usage Facilities	Track the water use of each facility and Investigate and address facilities that have high water usage.		Ongoing	Operating, Grants, Capital	DR	Sustainability
Medium	33	Improve Water Systems	Improve water efficiency, upgrading to low flow water fixtures, water recycling, and other water conservation techniques.	PM0182	1-5	Operating, Grants, Capital	DR	Sustainability

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Mitigation Strategies

Priority Level	Mitigation No.	Mitigation Name	Mitigation Description	Relevant Capital Needs Inventory IDs	Expected Timeframes for Completion (Years)	Potential Funding Sources	Hazards Addressed*	Lead Department
Medium	34	Asset Management Integration	Include climate risk information into Asset Management.		1-5	Operating	EQ, LI, TS, LS, FL, SLR, F, DR, EH, SS	Office of District Architect, Asset Management
Medium	35	Adaptation Investigation and Research	Conduct study to further understand adaptation needs. Stay informed of scientific information compiled by regional and state sources on the subject of rising sea levels and global warming, especially on actions that local governments can take to mitigate this hazard including special design and engineering of facilities in low-lying areas.		1-5	Operating, Grants	FL, SLR	Office of District Architect
Medium	36	Low Impact Development	For new development or redevelopments, incorporate low impact development (LIDs) to mitigate storm water runoff and peak flows in the watershed.	WF0382	Ongoing	Grants, Capital	FL, SS	Maintenance and Engineering, Design and Construction
Low	37	Irrigation and Landscape Improvements	Upgrade irrigation and landscaping for water efficiency that reduces maintenance needs and conserve water.	PM0134, WF0513, WF0514	1-10	Grants, Capital	DR	Maintenance and Engineering, Design and Construction

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Appendix D

Status of Mitigation Strategies from the 2017 LHMP

Status of Mitigation Strategies from the 2017 LHMP

Rank	Mitigation No.	Mitigation Name	Mitigation Description	Status as of 2022	Include in Plan Update?
High	1	Emergency Operations Center	Establish a back-up Emergency Operations Center with redundant communications systems.	Not started	Yes
High	2	Portable Emergency Equipment	Purchase portable equipment including hoses, pumps, emergency generators, radios to allow for continuity and recovery of service in locations and/or assets prone to failure.	In progress	Yes
High	3	Erosion Control	Upgrade and repair facility foundations, embankments, and drainage to mitigate erosion issues. Work that may be included are excavation, fill placement, cut-fill transitions, slope stability, drainage and erosion control, slope setbacks, expansive soils, collapsible soils, environmental issues, geological and geotechnical investigations, grading plans and specifications, protection of adjacent properties, and review and permit issuance.	Complete	Yes
High	4	Safe Evacuations	Improve evacuation and evacuation communications. Improvements include upgrades for water sensors, emergency lighting, cable protection, cameras, signage, and replacement of cross passage doors and hatch doors.	In progress	Yes
High	5	Storm Drainage System	Repair or replace dilapidated roofs, storm drains, pipelines, sump pumps, and channels to enable them to perform to their design capacity in handling water flows as part of regular maintenance activities.	In progress	Yes
High	6	Sandbags and Sheeting	Purchase sandbags and plastic sheeting in anticipation of rainstorms, and deliver those materials to key BART sites.	Ongoing	Yes
High	7	Water Distribution System	Repair or replace water distribution systems on BART facilities including sewer and water lines and valves that are not in a state of good repair.	In progress	Yes
High	8	Investigate High Usage Facilities	Track the water use of each facility and Investigate and address facilities that have high water usage.	Ongoing	Yes
High	9	Flood Safe Facilities (Water Intrusion)	Repair cracks and leaks resulting in water intrusion via sealing and other water proofing techniques. Replace corroded equipment/components resulting from water intrusion impacts.	In progress	Yes

Status of Mitigation Strategies from the 2017 LHMP

Rank	Mitigation No.	Mitigation Name	Mitigation Description	Status as of 2022	Include in Plan Update?
Medium	10	Power Resilience	Minimize the likelihood that power interruptions will adversely impact lifeline utility systems or critical facilities by ensuring that there is redundancy and reliability in power systems. Improvements include procuring uninterruptible power supply (UPS), replacing train control batteries, upgrading emergency lighting systems including dedicated circuits, upgrading and installing new transformers, replacing old power distribution networks including cabling and switching equipment, and upgrading installing new emergency generators.	In progress	Yes
Medium	11	Retrofit Cooling Equipment	Retrofit or replace emergency cooling equipment for computer room.	Complete	No
Medium	12	Fire Suppression and Alarm Systems	Upgrade facilities to ensure a reliable system fire suppression for existing and new development. Work includes replacing/upgrading old fire alarm systems, water piping, control wiring, adequate wet stand pipes, fire hose cabinet, and chemical fire suppression systems.	In progress	Yes
Medium	13	Best Available Science	Conduct study to further understand adaptation needs. Stay informed of scientific information compiled by regional and state sources on the subject of rising sea levels and global warming, especially on actions that local governments can take to mitigate this hazard including special design and engineering of facilities in low-lying areas.	In progress	Yes
Medium	14	Improve Water Systems	Improve water efficiency, upgrading to low flow water fixtures, water recycling, and other water conservation techniques.	Ongoing	Yes
Medium	15	Public Communication	Improve communication systems to the public including personal planning when there are system disruptions due to natural disasters.	In progress	Yes
Medium	16	Construct Resilient Systems	Ensure that systems in BART developments are constructed in ways that reduce or eliminate water damage. Mitigation includes replacing and installing new canopies to protect system from rain weather.	Complete	No
Medium	17	Low Impact Development	For new development or redevelopments, incorporate low impact development (LIDs) to mitigate storm water runoff and peak flows in the watershed.	Ongoing	Yes
Medium	18	Promote Low-Carbon Travel	In addtion to promoting riding BART, promote active modes of transportation to BART such as biking and walking to further reduce the region's carbon footprint. Work includes improvements in bike facilities and pedestrain pathways, and transit oriented developments.	Ongoing	No
Low	19	Asset Management Integration	Include climate risk information into Asset Management	Not started	Yes

Status of Mitigation Strategies from the 2017 LHMP

Rank	Mitigation No.	Mitigation Name	Mitigation Description	Status as of 2022	Include in Plan Update?
Low	20	Conduct Structural Fragility Inventory	Conduct inventory and model structural fragilities for the BART system	In progress	Yes
Low	21	Seismic Retrofit Work	Continue ongoing seismic infrastructure retrofit of the BART system. Including incorporation of seismic design criteria in the BART's Facilities Standards and design of a bypass for the Berkeley Hills Tunnel.	In progress	Yes
Low	22	Fire Hazard Removal	Conduct clean up of debris from district property that pose a fire hazard.	Not started	Yes
Low	23	Elevate/Protect Critical Facilities	Elevate/protect critical assets in FEMA flood plain areas to lower the risk of service disruption.	Not started	Yes
Low	24	BART Emergency Plan Update	Integrate climate change considerations into BART's Emergency Plan	Complete	No
Low	25	Emergency Response Training	Improve emergency response training for employees.	Complete	No
Low	26	Watershed Analysis	Conduct (or partner with the local watershed jurisdiction to conduct) a watershed analysis of runoff and drainage systems to predict areas of insufficient capacity in the storm drain and natural creek system.	Not started	No
Low	27	Engage in Regional Planning for Flooding and Sea Level Rise	Support and engage in county and/or other regionally-led planning efforts in mitigation of flooding from sea level rise and other weather related issues.	Ongoing	Yes
Low	28	Irrigation and Landscape Improvements	Upgrade irrigation and landscaping for water efficiency that reduces maintenance needs and conserve water.	In progress	Yes
Low	29	Climate Risk of Projects	Incorporate best available climate risk in design criteria and projects	Ongoing	Yes

Appendix E

Adoption Resolution and Approval