



METROLINK®

Blueprint for Climate Vulnerability Assessment and Adaptation Plan

FEBRUARY 2022

This project is supported by a Caltrans SB1 Adaptation Planning Grant and provides a summary of the full Plan, which is publicly available on SCRRRA's website.





Metrolink is the nation's third-largest passenger rail system based on its 538 total route miles serving six Southern California counties with a cumulative population of 21.5 million people—more than half of California's total population. Approximately 15 million people live within 5 miles of Metrolink's 62 stations throughout Southern California.

PROJECT PURPOSE

Recent events, such as the wildfires that raged through California in the summer and fall of 2020 and 2021 are clear evidence of the climate-related threats faced by jurisdictions, businesses, and residents. Metrolink has long been prepared to handle periodic flooding, wildfires, and go-slow heat orders. However, the increasing size, scale, and frequency of these extreme weather events requires a new level of attention.

The Southern California Regional Rail Authority (SCRRA), the owner/operator of the Metrolink system, commissioned this Climate Vulnerability Assessment and Adaptation Plan (CVA, the project), to better understand the vulnerability of the Metrolink rail system, its other assets, and its core ridership to existing and future changes in the climate. The rail service is a critical component of the region's transportation system, forming an accessible connection between affordable housing and key economic centers.

The timing for this study is critical because SCRRA has initiated delivery for the first set of multiple projects, which are part of a 10-year major investment in a comprehensive, regional multi-agency program to restructure and revolutionize regional rail in the Southern California service area, known as the Southern California Optimized Rail Expansion (SCORE) Program. To safeguard these investments over their useful life, which ranges from 20 to 100+ years, consideration of future climate conditions will be essential for project planning, design, and delivery. This investment program also is a significant opportunity to increase the overall resilience of the Metrolink rail system and the people it serves. Furthermore, this study aligns with the following SCRRA initiatives: the Transit Asset Management Plan, the Strategic Business Plan, the Fleet Management Plan, the Climate Action Plan, and the Rehabilitation Plan.

WHAT DOES SCRRA AIM TO ACHIEVE?

The Climate Vulnerability Assessment and Adaptation Plan addresses the following:

- identifies the parts of the network that are most vulnerable to extreme weather events, including extreme heat, riverine flooding, sea level rise, drought, wildfire, and landslides;
- includes prioritized climate-adaptation strategies and a roadmap for implementation to enhance the resiliency of the passenger rail system in Southern California while ensuring the health and safety of passengers;
- identifies opportunities for collaboration with new and existing partners, to address emergency management and climate resilience;
- identifies opportunities for integration of SCRRA's ongoing seismic preparations with climate adaptation efforts;
- focuses on the protection of the mobility of Southern Californians, keeping equity in mind and focusing on the most vulnerable, disadvantaged, and transit-dependent populations; and
- includes communication strategies regarding climate hazards and resilience efforts for staff and the general public.

PROJECT GUIDING PRINCIPLES

Assessing and prioritizing climate-related risks is essential to understand Metrolink's overall vulnerability to a changing climate. The guiding principles for the project were developed to align with the SCRRA Board of Directors adopted Strategic Business Plan. The project team was guided by the following principles:

- **Safety is Foundational:** Improve the resiliency of infrastructure and mitigate the impacts of climate change to ensure a safe, reliable regional rail system.
- **Connect and Leverage Partnerships:** Collaborate with partners on climate action and align with regional climate-related projects and plans to improve efficiency in climate resilience for the region.
- **Modernize Business Practices:** Prioritize strategies that mainstream climate adaptation measures throughout SCRRA's planning, operations, and program delivery groups. Maximize efficiency of resilience investments by identifying synergies between climate adaptation and seismic response, and evaluate projects based on economic, environmental, and social values.
- **Advancing Key Regional Goals:** Create an adaptive plan that can be updated as new information becomes available, and prioritize nature-based adaptation strategies that can be more cost-effective than traditional infrastructure and provide additional co-benefits. Prioritize disadvantaged communities that have fewer resources to cope with the impacts of climate change, and for which improved transit accessibility can help improve social equity.

METROLINK'S RIDERSHIP AND SOCIAL VULNERABILITY

This assessment identifies the communities in Metrolink's service area that are particularly sensitive to climate hazards due to socioeconomic factors such as age, income, vehicle access, or race/ethnicity. In Metrolink's home catchment areas (the areas around Metrolink stations that include 90 percent of trip origins), 31.4 percent of people (5.4 million) live in census tracts designated as Disadvantaged Communities (DAC) by SB 535, and 46 percent of people (8.3 million) live in AB 1550 Low-Income census tracts. Metrolink's ridership continues to become more ethnically diverse, with the percentage of non-Caucasian riders increasing from 45 percent in 2000 to 68 percent in 2018. System-wide, approximately 15 percent of riders do not have a car available on weekdays (and 29 percent of Antelope Valley Line riders do not have a car to meet their mobility needs). The proportion of seniors, aged 65 and older, has risen to 7 percent and is expected to continue to rise.

Key Vulnerability Findings by Climate Hazard



SEA LEVEL RISE

- SLR vulnerability is confined to the coastal stretches of track in Orange and San Diego counties. The SLR vulnerability of the Orange subdivision was studied in-depth as part of the OC Rail Infrastructure Defense against Climate Change Plan, led by the OCTA. The results from that study were leveraged for this project.
- Coastal track on the Orange subdivision have a minimum elevation of 17 feet and therefore are not projected to be exposed to permanent inundation from SLR. However, sections already are exposed to overtopping from waves during storm events, which could cause damage to track and other assets. This vulnerability will increase as SLR occurs.
- At the San Clemente Pier station, structures seaward of the track currently are exposed to wave runup during a 100-year storm event. However, the track and the parking lot landward of the track likely would not be exposed until late-century.
- Although the CVA focuses on mid-century vulnerability, by late-century, almost the entire coastal stretch of the Orange subdivision (from Mile Post 200.3 to 207.3) could be exposed to overtopping from storm surges, as could both stations (San Clemente and San Clemente Pier) and all bridges, culverts, signals, and communications equipment. About one-third of this track has a “likely” (66 percent) chance of being exposed by 2070.
- Most of the San Diego subdivision (not owned/maintained by SCRRA) is not vulnerable to SLR because the track is further inland and/or elevated on bluffs. However, one segment of track just south of the Orange County border and north of the outlet of San Mateo Creek/Trestles bridge currently is exposed to waves from the 100-year storm. In addition, shoreline erosion could undercut track by mid-century, where it is closest to the shoreline just east of San Onofre Creek. By late-century, some stretches of track fronted by Trails State Beach south of the San Onofre Nuclear Power Plant could become exposed to undercutting as well.



RIVERINE FLOODING/PRECIPITATION

- Major areas of flood vulnerability are in Simi Valley, Burbank, Santa Clarita, Redlands, and Perris. Track, stations, and facilities in these areas are within the 100-year floodplain. These areas also are projected to experience an increase in precipitation mid-century, meaning that the 100-year floodplain could be flooded more frequently.
- In some areas, long continuous stretches of track are vulnerable, while in other locations where track crosses a flood channel, short sections may be vulnerable where the 100-year floodplain extends slightly outside the channel. Different types of adaptation strategies likely will need to be considered for these two types of flood vulnerabilities.
- The approaches for several bridges across the system are within the 100-year floodplain, suggesting that these bridges could be vulnerable to overtopping/substructure damage during flood events. However, as this study did not assess depth of flooding versus bridge height, these preliminary findings should be verified. Bridges that were not determined to be potentially exposed to overtopping still may be vulnerable to damage from scour from high velocity flows within a channel or river, even if flooding does not occur.
- Four tunnels (25, 26, 27, and 28) are known to be exposed frequently to flooding during precipitation events currently and have pumps in place to maintain service, although keeping these pumps operational is an annual maintenance challenge.
- Tunnels 26, 27, and 28 are within watersheds projected to have a 6 to 7 percent increase in 100-year precipitation mid-century, compared to historic rates, although this is projected to decrease to a 5.5 percent increase over historic rates by late-century. Tunnel 25 is projected to experience increases in 100-year precipitation through late-century (4 percent increase mid-century, 6 percent increase late-century versus historic rates). The current pump capacity may not be sufficient to handle increased flows during storm events.
- Overall, assets have medium to high sensitivity to flooding because of the potential for high velocity flows to damage structures or for standing water to cause service delays or damage electrical components.



EXTREME HEAT

- Most inland areas of the system are projected to experience temperatures above 110°F annually by mid-century, with portions including most of the San Gabriel, Shortway, Redlands, and Perris Valley subdivisions experiencing temperatures above 115°F. Although this report focuses on mid-century impacts, track with high vulnerability to heat is projected to increase substantially by late-century (Lancaster to Palmdale, Redlands to Ontario, and a longer stretch of the Perris Valley Line).
- Track is vulnerable to thermal misalignment under extreme conditions, as evidenced by recent events on the Valley subdivision in September 2020 and June 2021. Because extreme temperatures are projected to increase across all inland parts of the system, impacts potentially could occur anywhere, not just in those areas projected to have the highest temperatures—almost the entire system is rated to have medium vulnerability by mid-century. Large portions of the system are likely to experience frequent conditions requiring Level 2 speed restrictions by mid-century, and almost all the non-coastal areas will be exposed to these extreme temperatures by late-century.
- Stations in inland areas are projected to experience temperatures as high as 115°F, severely affecting both passenger safety and comfort. The most vulnerable stations are those in Los Angeles, Riverside, and San Bernardino counties that do not have adequate amenities (such as platform shading, seating, and/or drinking fountains/hydration stations) to help passengers cope with heat while waiting for trains. High vulnerability stations have been identified on the Ventura, Valley, San Gabriel, Perris, and Redlands subdivisions. Although the four future stations on the Redlands subdivision were not formally included in this vulnerability assessment, they are in an area with projected high exposure to extreme heat.
- Unmanned infrastructure, such as signals, mountain top communications facilities, bridges, culverts, and tunnels, are not projected to have high vulnerability, although extreme heat may contribute to general wear and tear. Track-level communications equipment, such as communication shelters, were determined by SCRRA engineers not to have high vulnerability because of existing air-conditioning equipment with backup power.

Key Vulnerability Findings by Climate Hazard



WILDFIRE

- Wildfire vulnerability is restricted to portions of the system that are within or adjacent to wildland areas. As most routes are within urban/suburban zones, wildfire vulnerability is confined to specific areas, mostly stretches of the Ventura and Valley subdivisions.
- Assets with the highest wildfire vulnerability are mountain top communications towers. They are sensitive to fire and are in high wildfire exposure areas at the tops of mountains where fire is likely to travel uphill via dry vegetation.
- Most stations and facilities do not have high vulnerability because they either are not in exposed areas or they are surrounded by buffers (parking lots, cleared right-of-way (ROW)), and thus they are unlikely to be directly affected.
- Track vulnerability was determined to be low overall, as track in wildland areas runs through a ROW cleared of vegetation. However, wildfires occurring near a section of track may cause slow orders or delays.



LANDSLIDE/MUDSLIDE

- Landslide and mudslide hazards are local and usually are determined based on site-specific geotechnical studies. The results of this assessment should be interpreted as revealing regional patterns only (not at the asset level).
- This hazard can affect Metrolink assets where they are near steep unstable slopes. Thus, vulnerability is mainly confined to portions of the system running through mountainous terrain along the Ventura, Valley, and Orange County subdivisions. The rest of the system runs on relatively flat land.
- No stations or facilities were determined to be vulnerable to landslide hazards. These asset types are on flat land that is not near landslide/mudslide hazard zones.
- Some bridges and tunnel portals in mountainous areas are vulnerable, especially when bridge foundations or supports are within high exposure areas.
- A review of mountain top communications facilities revealed that none have high vulnerability to landslides or mudslides.



SEISMIC/EARTHQUAKE

- Most track (as well as signals and track-level communications) across the system was determined to have medium vulnerability, with three segments rated as high vulnerability on the Valley subdivision.
- Bridges in high exposure areas with physical attributes contributing to high sensitivity were rated as having high vulnerability. These bridges mainly are on the Ventura, Valley, and San Gabriel subdivisions.
- Tunnel 25 was determined to have high seismic vulnerability.
- A concentration of facilities at the center of the system in Downtown Los Angeles have high seismic vulnerability. Maintenance facilities, such as the Central Maintenance Facility (CMF), contain hazardous materials that could spill because of seismic events and potentially affect adjacent communities.
- Vulnerability of stations is low to medium. Many stations do not have major structural components or buildings, and therefore would be unlikely to suffer major damage. A survey of station managers revealed that no stations are known to have seismic deficiencies, including those with buildings and indoor areas.
- Seismic exposure is lower in mountainous areas than in valleys, where fault lines and liquefaction zones are concentrated. Therefore, mountain top communications facilities have the lowest seismic vulnerability of any asset type.
- These vulnerability statements are based on current seismic hazard. The interaction between climate change and seismic hazard is not well understood, but its influence is unlikely to be significant compared to total seismic hazard.



DROUGHT

- Direct impacts from drought were determined to be low systemwide. Although drought frequency and severity are projected to increase across the region, sensitivity of Metrolink assets to damage from drought is low.
- Drought may indirectly increase exposure to other hazards. For example, prolonged drought could increase wildfire hazards, and areas cleared of vegetation by wildfire are more prone to landslides. Oscillations between wet and dry years also may lead to more intense flooding when precipitation occurs.

AREAS OR ASSETS WITH HIGH VULNERABILITY TO MULTIPLE HAZARDS

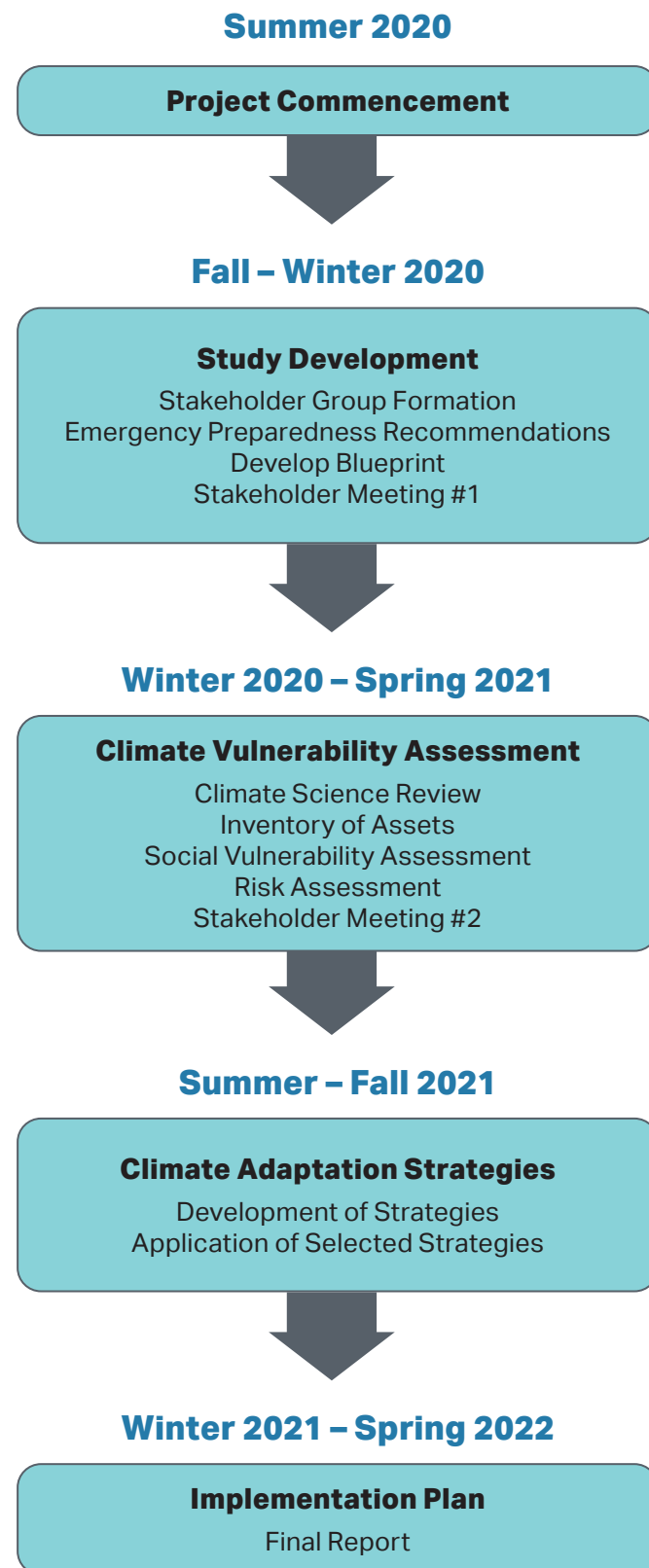
- Facilities, track, and the station at the southern end of the Perris Valley subdivision have high vulnerability to both extreme heat and flooding. Similarly, a segment of track in Redlands has high vulnerability to both heat and flooding.
- The Northridge and Simi Valley stations on the Ventura line have high vulnerability to both extreme heat and flooding.
- Portions of coastal track along the bluffs in Orange County have high vulnerability to both SLR and landslides. This combined vulnerability is addressed in greater detail in OCTA's OC Rail Infrastructure Defense against Climate Change Plan.
- Several tunnels have high vulnerability to multiple hazards, including Tunnel 25 (flooding, seismic) and Tunnels 26 and 27 (flooding, landslides).
- Stretches of track on the Valley subdivision running through Santa Clarita have high vulnerability to flooding, earthquakes, and/or landslides, as well as medium vulnerability to extreme heat.
- Bridge 41.260-MT on the Valley subdivision and Bridge 428.630-MT on the Ventura subdivision have high vulnerability to flooding and earthquakes.

SOCIAL VULNERABILITY

- LA Union Station, San Bernardino-Downtown, Downtown Burbank, Van Nuys, Glendale, Lancaster, High Desert, and Perris South catchment areas stand out as having both high proportions and high absolute numbers of households in communities that are both socially vulnerable and transit-dependent (TDC).
- SB 535 DACs tend to be more concentrated in denser urban areas while AB 1550 LICs are spread throughout the Metrolink service area. Catchment areas with the highest proportions of households in DACs include Sun Valley (91 percent), Rialto (72 percent) and Commerce (72 percent). Catchment areas with the highest proportions of households in LICs include Sun Valley (87 percent), Lancaster (86 percent), and Cal State LA (82 percent).
- TDCs are present throughout the Metrolink service area. Catchment areas with the highest proportions of households in TDCs include Lancaster (44 percent), Glendale (38 percent), and Van Nuys (36 percent). Catchment areas with the greatest absolute numbers of households in TDCs include LA Union Station, San Bernardino-Downtown, and Van Nuys.

PROJECT TIMELINE

This diagram highlights the key project tasks and key points in the process when stakeholders were engaged.



STAKEHOLDER ENGAGEMENT

The stakeholder group included representation from 20+ groups, representing public health, environmental justice, climate focused community-based/non-profit organizations, emergency management, and local/state government. Note that a separate emergency preparedness stakeholder focus group was created (highlighted on next page) to discuss a multi-agency response.

Stakeholder collaboration on this project was important to ensure that opportunities to leverage and build on existing climate-related work were maximized. Recent projects such as the San Bernardino County Climate Vulnerability Assessment and Resilience Strategy, the LA Metro Climate Action and Adaptation Plan, and SCAG resources on Adaptation and Resilience Planning for Providers of Public Transportation were leveraged. In addition, current and ongoing regional climate adaptation efforts—such as the SCAG Regional Climate Adaptation Framework, OCTA Defense Against Climate Change Plan, and LA County Climate Vulnerability Assessment—will all benefit from coordinating on data and approaches and from sharing results and insights.

Stakeholder Group

BNSF Railway Company (BNSF)
California Department of Transportation (Caltrans)
City of Los Angeles
Climate Resolve
Los Angeles County
Los Angeles County Metropolitan Transportation Authority (LACMTA)
Los Angeles Department of Transportation (LADOT)
Los Angeles Regional Collaborative for Climate Action and Sustainability (LARC)
Los Angeles – San Diego – San Luis Obispo Corridor Agency (LOSSAN)
North County Transit District (NCTD)
Orange County Transportation Authority (OCTA)
Public Health Alliance of Southern California
Riverside County Transportation Commission (RCTC)
San Bernardino County Transportation Authority (SBCTA)
Southern California Area Government (SCAG)
Union Pacific Railroad (UPRR)
Ventura County Transportation Commission (VCTC)

HOW DOES SCRRRA RESPOND AND SUPPORT PARTNER AGENCIES DURING AN EMERGENCY EVENT?

Emergency response capabilities are important for SCRRRA in two ways: having the ability to maintain its own resources and operations in the face of climate-change-related impacts and disruptions, and being able to contribute to an emergency response effort following a significant incident.

SCRRRA's current emergency management program has a solid foundation, but the more frequent and severe extreme weather events caused by climate change will add strain on existing elements of the program. To better prepare for these periods of unstable and severe climate conditions, SCRRRA examined protocols specific to its role as a regional mobility provider during an emergency and intends to fortify institutional relationships and procedures with its partner agencies at the local, regional, and state level.

SCRRRA's established emergency management framework comprises the following core elements:

- **Mitigation:** Activities that eliminate the potential for a disaster, or reduce the impacts of a disaster or the organization's vulnerability to a given disaster or emergency.
- **Prevention:** Actions to prevent a disaster or emergency and to safeguard employees, passengers, vehicles and facilities (i.e., Preventive Maintenance, Standard Operating Procedures).
- **Preparedness:** Training, resourcing, and other activities conducted prior to an emergency or disaster with the goal of protecting lives and minimizing damage.
- **Response:** Actions taken after a disaster to provide emergency assistance.
- **Recovery:** Short- and long-term activities that return all operations to normal and/or improved standards.

Metrolink's emergency management roles and responsibilities include the following:

Internal Roles & Responsibilities

- Protect the safety and security of personnel, riders, visitors, and others at risk from all hazards (including those related to climate change) while on the public transit system.
- Protect SCRRRA facilities, physical assets, and electronic information.
- Coordinate movement of trains and associated staff.
- Conduct repairs to locomotives, cars, rail, and other equipment in a timely and safe manner.
- Coordinate response activities with SCRRRA contractors.
- Protect SCRRRA's reputation, brand, and image.
- Provide transportation services to the public as feasible.
- Prevent environmental contamination.
- Maintain customer service by minimizing interruptions or disruptions of transit operations.
- Provide travel continuity, restoration, and resumption of normal transit operations in the most timely and effective manner possible.

External Roles & Responsibilities

- Conduct movement of people, goods, supplies, and equipment in support of the response.
- Coordinate emergency response activities with local public safety agencies/first responders.
- Coordinate transportation emergency response activities with member agencies, local agencies, and partner transit agencies by providing or requesting, as appropriate, alerts/notifications, situation status information, resources, and/or other information pertinent to the response activities.
- Provide logistical support to other government agencies, as required, in performance of their essential functions.
- Participate in interagency emergency response activations, trainings, exercises, and workgroups, as applicable.

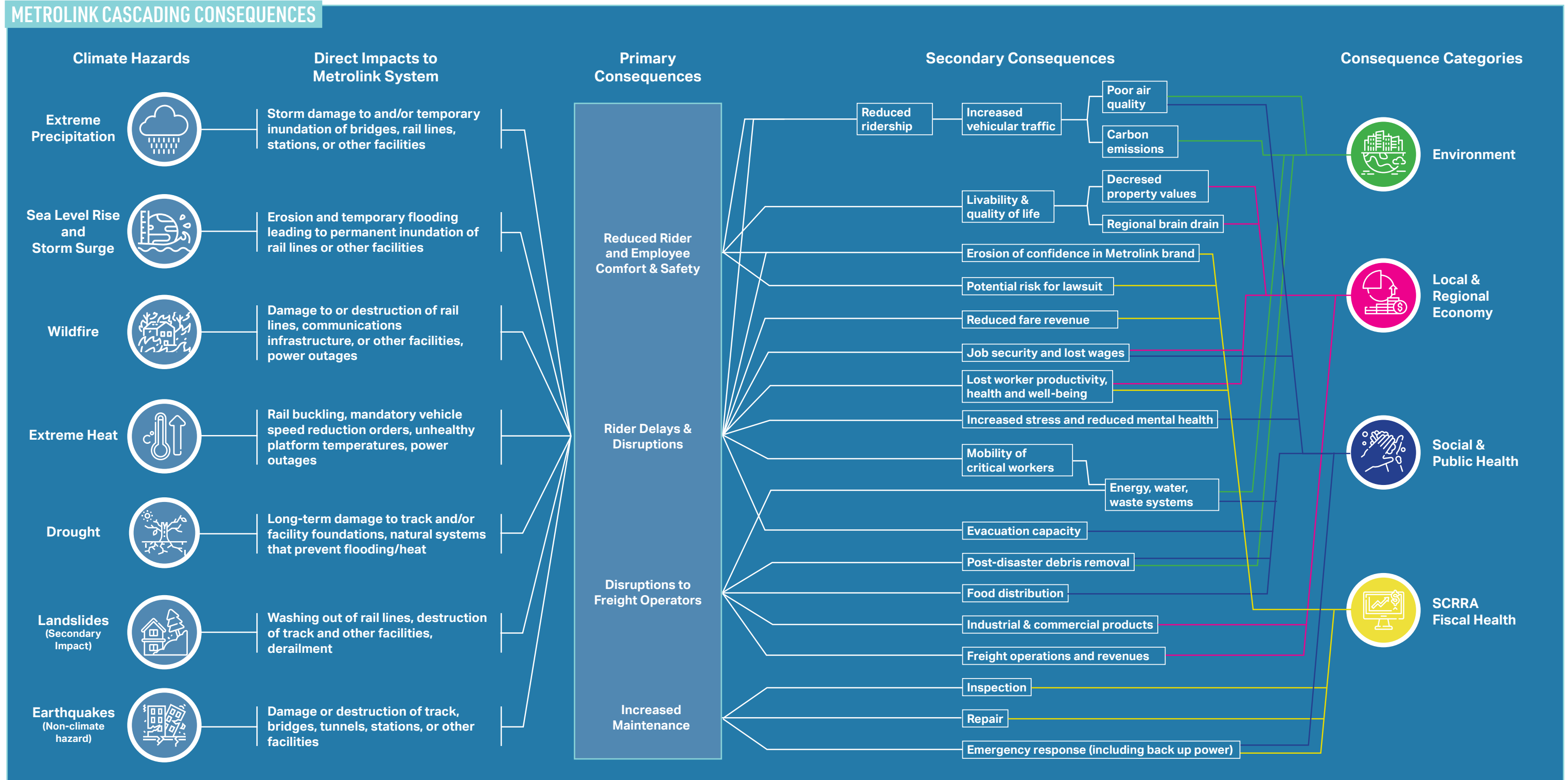
SCRRRA maintains preparedness to support outward-facing, multi-agency response efforts through cooperation and planning with the following partner agencies:

- City of Covina Emergency Management
- City of Lancaster Emergency Management
- LACMTA
- Los Angeles County Office of Emergency Management
- NCTD Orange County Sheriff's Department
- OCTA
- RCTC

WHY IS COLLABORATION SO IMPORTANT?

Metrolink's commuter service and rail infrastructure are key components of the Southern California region's transportation system. Any direct impacts to SCRRRA assets caused by climate hazards will result in a series of cascading and interconnected consequences that will extend across jurisdictions and sectors. Therefore, many different stakeholders—from freight operators to transit agencies to riders—have a vested interest in the climate resilience of the Metrolink system.

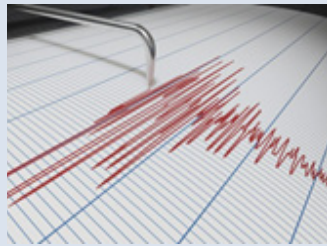
The diagram below depicts examples of these cascading consequences. Climate hazards cause direct impacts to the Metrolink system; these result in primary consequences, which in turn cause secondary consequences. The secondary consequences are mapped to four categories (environment, economy, social and public health, and SCRRRA fiscal health) to demonstrate their cross-sectoral nature. It should be noted that, even though SCRRRA does not move freight, disruptions to freight operators running on SCRRRA-owned track could result in substantial secondary consequences.



WHAT TYPES OF STRATEGIES WILL MAKE SCRRRA MORE RESILIENT TO CLIMATE CHANGE?

Armed with an understanding of the network’s climate vulnerabilities gained through the vulnerability assessment process, adaptation strategies have been identified that range from immediate implementation (such as updating design and planning guidelines) to long-term solutions (such as physical infrastructure protection). Some strategies will be implemented solely by SCRRRA; others may require extensive regional collaboration. The strategies have been grouped into the following four categories:

Emergency Preparedness Strategies



Address Metrolink’s potential role in conducting emergency transportation efforts following a major incident, such as an earthquake or wildfire, and its internal capabilities to respond and recover quickly.

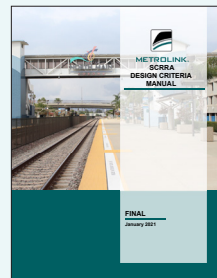
Example: Develop scenario-specific response plans to guide SCRRRA activities following a major incident, and supporting the current effort to deploy an earthquake early warning system to automate the stopping/slowing of trains.

SCRRRA activities following a major incident, and supporting the current effort to deploy an earthquake early warning system to automate the stopping/slowing of trains.

Outcome

- SCRRRA is more prepared to minimize the impacts of disruptions and can better support regional response efforts.

Governance Strategies



Address integrating climate resilience into policy, planning, design guidelines, regulatory compliance (permitting), and operations and maintenance.

Example: Update SCRRRA Design Criteria Manual to include climate change considerations, such as ensuring stations provide adequate shade for passengers.

Outcome

- Climate resilience is mainstreamed across SCRRRA’s decision making and capital planning ensuring investments made now are climate-proofed.
- Efficiency of both SCRRRA’s adaptation efforts and other regional adaptation efforts are maximized.
- Active engagement with stakeholders improves climate adaptation opportunities that span beyond jurisdictional boundaries.

Structural Strategies

Protect or adapt physical infrastructure such as raising assets out of reach of flood waters, shading commuters from the sun or heavy rain, or hardening bridge abutments against scour. Nature-based solutions will be prioritized because they can provide co-benefits such as improved air quality, habitat creation, and improvement of the public realm. Some structural strategies may provide energy resilience by hardening distribution feeders or developing district-scale microgrids/resilience hubs that could be considered with utility and city partners.



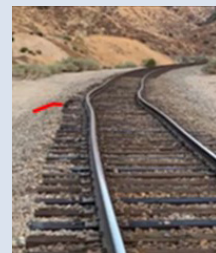
Example: The structural strategies are organized as a “toolkit” by climate hazard and depending on the asset type, a number of adaptation strategies may be appropriate to improve resilience.

Outcome

- SCRRRA’s existing assets are resilient to a changing climate and disruptions in service are minimized.

Informational Strategies

Address gaps in understanding the vulnerability of assets due to a lack of information (e.g., feasibility studies, ongoing monitoring, or data collection). Furthermore, awareness of climate hazards and adaptation will be built through education and outreach, and potential funding opportunities will be identified to support the implementation of strategies.



Example: Monitor rail temperatures and track alignment to identify patterns between extreme heat and sun kinks.

Outcome

- SCRRRA has the information necessary to develop targeted adaptation strategies
- SCRRRA is better positioned to make the business case for funding.

Example Applications of the Structural Strategies Toolkit



Flooding: Install linear swales along flood-prone track, to direct water away from the track bed.

Extreme Heat: Replace wood ties with concrete ties, which are heavier and more resistant to movement, reducing chances of thermal misalignment.

Extreme Heat: Add station amenities to help riders cope with extreme heat (e.g., shading parking lots/platforms, seating under shade structures, misters, and air conditioning or fans in indoor waiting areas).

Flooding: use permeable pavers instead of concrete to reduce runoff volumes in parking areas that are exposed to stormwater flooding.

Sea Level Rise: Construct improved revetments (larger rock armor size, more gradual slope, higher crest) where rail is exposed (or is projected to be exposed) to excessive runoff and overtopping from waves during a 100-year storm event.

Sea Level Rise: Support beach nourishment projects and restoration to slow beach erosion and reduce wave runup. Nourishment can be sand placement, but gravel and/or cobble also can be considered where appropriate. (Effort would be performed by other agencies outside the rail ROW - see Governance Strategies).

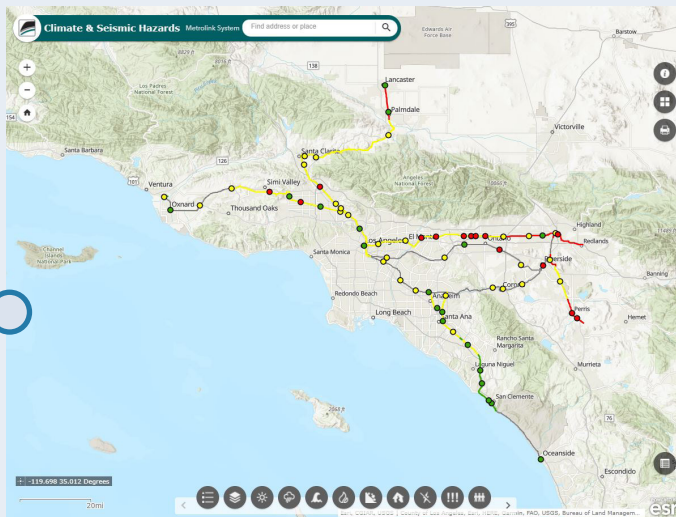


APPLICATION OF FOUR STRATEGIES

In addition to developing the adaptation strategies, four strategies were selected to expand on further. These strategies were selected to provide guidance and support for future implementation of adaptation strategies.

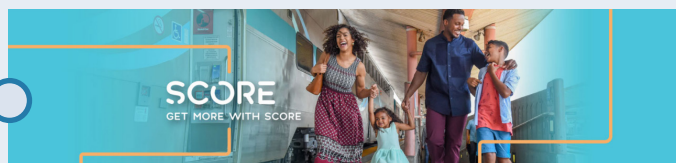
1. Create a web-based Climate Vulnerability Assessment Dashboard:

An interactive web-based dashboard was developed that visually displays the vulnerability assessment results and includes the climate hazard maps and asset-level vulnerability ratings. The purpose of this dashboard is to facilitate the ongoing /mainstreaming of climate adaptation across SCRRRA operations and ensure that outputs easily can be explored/accessed by SCRRRA staff.



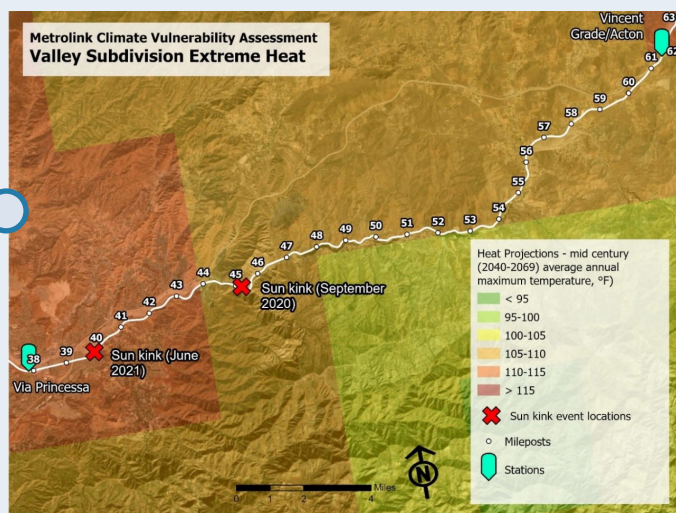
2. Align SCORE and Capital Projects with recommended climate adaptation strategies:

Five SCORE projects were reviewed to identify applicable climate vulnerabilities based on the CVA and recommend climate adaptation strategies from the structural strategy toolkit. The purpose of this effort was to identify opportunities to improve resilience of SCORE projects currently in early design and demonstrate how the CVA outputs—assessment and toolkit—can be applied at a project level.



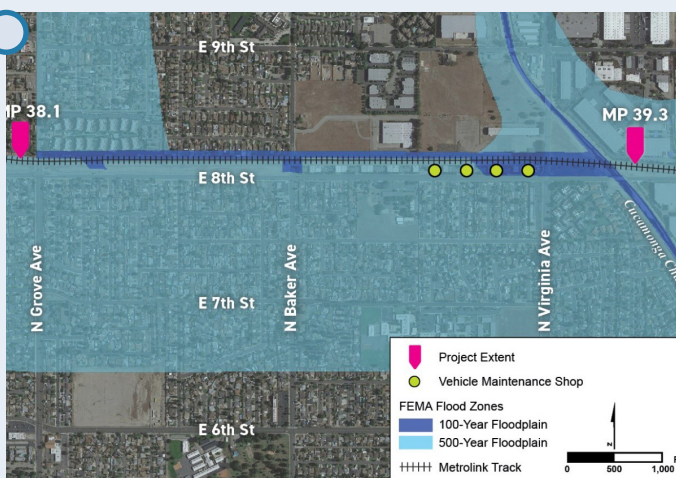
3. Improve track resilience to extreme heat:

A detailed review of track conditions and extreme heat was completed on a subset of the Antelope Valley Line prone to sun kinks. The purpose of this effort was to address an existing climate hazard at a higher granularity than the regional analysis, demonstrate how existing Metrolink data/resources can be leveraged to rate local risk, identify track typologies that can improve resilience, and provide recommendations to improve resilience.



4. Improve track resilience to precipitation flooding:

A detailed review of track conditions and flooding (originating from the Cucamonga Channel) was completed on a subset of the San Gabriel Sub. The purpose of this effort was to demonstrate how existing SCRRRA data/resources could be leveraged at the site level, to address flooding hazards and provide a framework for identifying opportunities for nature-based solutions in Metrolink ROW.



GLOSSARY OF TERMS

The following definitions have been adapted from those provided in the California Adaptation Planning Guide, 2020 (Governor's Office of Emergency Services).

Adaptation (Climate Change): Making changes in response to current or future conditions (such as the increased frequency and intensity of climate-related hazards), usually to reduce harm and to take advantage of new opportunities. Climate change adaptation describes actions that address the projected impacts on all aspects of community function that may result from climate change. This can include impacts related to hazard events (flood, wildfire, drought, or severe storms), as well as slow changes; ecosystem structure and function; and public health.

Climate Change refers to a change in the climate that can be identified by changes in the mean and/or variability of its properties and that persists for an extended period, typically decades or longer.

Climate Hazard (or Climate Threat): An event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, damage to the environment, interruption of business, or other types of harm or loss.

Disadvantaged Communities (DAC) - SB535: Areas disproportionately affected by environmental pollution and other hazards that can lead to negative public health effects, exposure, or environmental degradation, or with concentrations of people that are of low income, high unemployment, low levels of homeownership, high rent burden, sensitive populations, or low levels of educational attainment. DACs are defined in accordance with SB535, based on CalEvoScreen 3.0 statewide percentile scores.

Energy Resilience: Ensuring a reliable supply of energy and continued operations in the event of a power failure (during an extreme event) or during a public safety power shutoff (PSPS); for example using microgrids, distributed energy resources, or hardened distribution feeders.

Environmental Justice: The fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies.

Extreme (Climate) Event: An event occurs when a weather or climate variable exceeds the upper or lower thresholds of its observed range.

Low-Income Communities: AB1550 defines low-income communities as census tracts with median household incomes at or below 80 percent of the statewide median income (California Air Resources Board).

Nature-based Solutions: Adaptation strategies that harness natural systems to function, often providing ecological, aesthetic, or social benefits beyond their primary purpose.

Risk: Risk is the potential for damage or loss created by the interaction of hazards with assets such as buildings, infrastructure, or natural and cultural resources. For natural hazards, risk tends to be calculated based on evaluation of the probability (likelihood) of a hazard event occurring, vulnerability, and the event's potential consequences.

Resilience (Climate): The capacity of any entity—an individual, a community, an organization, or a natural system—to prepare for disruptions, to recover from shocks and stresses, and to adapt and grow from a disruptive experience. Adaptation actions contribute to increasing resilience.

Social Vulnerability: Social vulnerability is the susceptibility of a given population to harm from exposure to a hazard, directly affecting its ability to prepare for, respond to, and recover.

Vulnerability is the exposure of human life and property to damage from natural and human-made hazards. Climate vulnerability describes the degree to which natural, built, and human systems are at risk of exposure to climate change impacts. Vulnerability can increase because of physical (built and environmental), social, political, and/or economic factor(s). Vulnerability comprises the following components:

- **Exposure** is the presence of people and physical assets in areas that are subject to harm.
- **Sensitivity** is the degree to which people and physical assets would be affected by changing climate conditions.

CONTACT INFORMATION

Joseph McNeely P.E.
Principal Engineer
E: McNeelyJ@scrra.net

Lisa Colicchio
Director, Special Projects Sustainability Initiatives
E: colicchiol@scrra.net

David Huang
Planning Manager
E: HuangD@scrra.net

Consultant Support:
AECOM

