



CLIMATE RESILIENCE PLAN

A ROADMAP TO MAINTAIN BUSINESS CONTINUITY IN A CHANGING CLIMATE





The Climate Resilience Plan establishes the Authority's program to achieve climate resilience holistically by understanding and preparing for changes in sea level rise, precipitation patterns, and extreme heat.

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Prepared by:

AECOM

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Contents

Executive Summary 7

Introduction..... 11

Vision for Climate Resilience..... 14

Integration with Airport Sustainability Program and Other Airport Initiatives 15

Stakeholder Engagement..... 20

Climate Science..... 22

SLR Mapping..... 26

Vulnerability and Risk Assessment..... 30

Runways and Taxiways Vulnerability Profile 32

Airport Facilities (Landside and Airside) Vulnerability Profile 34

Tenant Facilities Vulnerability Profile 38

Transportation Network Vulnerability Profile 40

Least Tern Nesting Habitat Vulnerability Profile 42

Goals and Targets 45

Climate Resilience Focus Areas and Initiatives 51

1: Governance – How we manage climate adaptation..... 52

2: Awareness – How we learn about climate change..... 56

3: Infrastructure – How we build with resilience..... 60

Funding Sources and Strategy 67

Implementation and Monitoring Program 73

List of Acronyms 76

Acknowledgments / Contributions..... 78

Endnotes..... 79

Appendices 81

APPENDIX A: Inventory..... 82

APPENDIX B: SLR MAPS 84

APPENDIX C: Detailed Climate Science 92

List of Figures

Figure 1: Process to Develop CRP	13
Figure 2: CRP Focus Areas.....	14
Figure 3: CRP Integration with Existing Policies and Programs.....	15
Figure 4: ADP Overview.....	18
Figure 5: Authority Departments Involved in the Development of the Plan	20
Figure 6: Main External Stakeholder Groups for the Authority’s CRP.....	21
Figure 7: Emission Scenario Projections	22
Figure 8: Graphic Representation of SLR.....	27
Figure 9: SLR Flood Extent (0.8 foot).....	28
Figure 10: SLR Flood Extent (1.6 feet)	28
Figure 11: SLR Flood Extent (2.5 feet)	29
Figure 12: SLR Flood Extent (4.9 feet).....	29
Figure 13: Vulnerability assessment steps	30
Figure 14: Timeframe of Goals and Metrics	49
Figure 15: West side flood depths: 100-year storm surge event + 0.8 foot of SLR (2030 – Rare Flooding)	62
Figure 16: West side flood depths: 100-year storm surge event + 1.6 feet of SLR (2050 – Rare Flooding).....	62
Figure 17: East side flood depths: 100-year storm surge event + 0.8 foot of SLR (2030 – Rare Flooding).....	62
Figure 18: East side flood depths: 100-year storm surge event + 1.6 feet of SLR (2050 – Rare Flooding)	62
Figure 19: Examples of temporary flood barriers: Tiger Dam (left) and Aquafence (right)	63

List of Tables

Table 1: Summary of Major Climate Stressors.....	23
Table 2: CRP SLR Projections	25
Table 3: Comparison of OPC-Recommended SLR Projections and Available Mapping Projections	26
Table 4: CRP Goals, Metrics, and Targets.....	46
Table 5: Adaptation Initiative Focus Area Descriptions.....	52
Table 6: Governance initiatives and tactics	53
Table 7: Awareness Initiatives and Tactics.....	56
Table 8: Infrastructure Initiatives and Tactics.....	60
Table 9: Details for Adaptation Strategy I.3.....	63
Table 10: Potential Funding Sources to Implement CRP Strategies.....	68
Table 11: Airport CRP Goals with Timeframe	74



Executive Summary

The San Diego International Airport (Airport) is a metropolitan facility, surrounded by San Diego Bay and the downtown San Diego area. Given the location and geography of the Airport, climate change represents a challenge for the San Diego County Regional Airport Authority (Authority). Airport infrastructure and operations have been established based on historical environmental conditions and may require adaptation to an evolving climate that could potentially bring higher sea levels, more intense rainfall, and more extreme heat. To maintain business continuity and prevent asset damage, it is important to take a proactive stance, find ways to adapt, and take advantage of built-in adaptive capacity in existing assets and practices.

The Authority considers climate resilience one of the critical elements of its sustainability program, warranting the development of a dedicated Climate Resilience Plan (CRP or Plan) as part of the suite of plans that comprise the overarching Sustainability Management Plan.

The CRP, like other sustainability-focused plans, has been developed through a grant provided by the Federal Aviation Administration.

Achieving Climate Resilience

The CRP serves as the Authority's strategy for achieving uninterrupted business continuity in future climate conditions. The Authority is proactively working toward long-term solutions that would allow for improvements in areas related to climate resilience that go beyond complying with existing regulations. These initiatives range from improving storm drainage capacity in low-lying areas to collaborating with regional stakeholders to explore large-scale coastal flood protection strategies.

Vision:

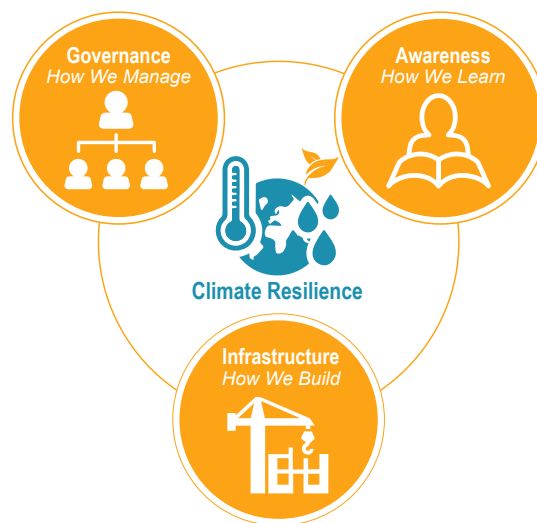
To deliver uninterrupted airport service in a changing climate and provide resilience leadership in the aviation industry.

Ensuring that extreme weather events do not impact Airport operations or Authority assets, or affect the customer experience, will demonstrate the success of these climate resilience strategies. The Authority is committed to addressing changing climate conditions proactively as part of its operational requirements and mission to make the Airport a leader in sustainability.

A Plan to Manage a Changing Climate

The CRP provides an organized framework for enhancing climate resilience by adapting existing infrastructure and practices, while incorporating future climate conditions into future projects. The Authority envisions addressing climate change through three primary focus areas: how we manage (governance), how we learn (awareness), and how we build (infrastructure).

This Plan builds on existing Authority initiatives and programs to define an overarching strategy aimed at creating a more resilient airport. The Authority developed goals, with associated targets and metrics, to represent where the Airport will be in the next 15 to 20 years, in terms of climate resilience. The targets and metrics are supported by a comprehensive set of initiatives, or actions, that drive the execution of the CRP and were developed to minimize airport disruptions due to future climate conditions. The final step is the development of a monitoring and implementation plan to serve as an operational tool that will support the Authority in fulfilling its strategy.



The CRP focuses on adapting existing and future assets and operations to projected climate conditions, but does not address mitigation efforts to slow the process of a changing climate. Details regarding the Authority's approach for carbon management and greenhouse gas emissions are described in the Carbon Neutrality Plan and complementary Clean Transportation Plan and Strategic Energy Plan.

Aspirational Goals	Metric(s)	Target(s)	Target Timeframe
1. Reduce risks associated with climate change to ensure business continuity, and to maintain a quality passenger experience	Reduction in number of negative impacts to facilities due to extreme weather events (flooding, heat)	Zero reports of negative impacts to airport facilities due to flooding or extreme heat days (such as damage or closure)	By 2035
	Passenger comfort and access to airport facilities during extreme weather events (e.g. flooding, heat)	50% fewer logged complaints from the public related to thermal comfort and flooding (create baseline first year)	By 2035
2. Integrate climate resilience into Airport operations and development decisions	Number of capital projects screened for climate resilience	100% of capital projects are screened	By end of 2020, then Ongoing
3. Provide regional and industry leadership in climate resilience	Number of projects planned and reviewed with regional partners	100% of applicable (i.e. climate-related) projects have stakeholder participation	Ongoing

Source: Developed as part of Airport Authority inter-department outreach, Fall 2018.







01

Introduction



The Authority is committed to incorporating climate change adaptation strategies through a clear vision and engagement with stakeholders, and has completed a baseline assessment to highlight climate resilience efforts to date, reviewed the latest climate science, and identified assets that are vulnerable to climate change.

The San Diego County Regional Airport Authority (Authority) has a long-standing commitment to sustainability, leading with progressive initiatives in the San Diego region and the broader aviation industry. With global climate change, Southern California, similar to much of the country, is likely to directly experience social, economic, and environmental impacts. The frequency, intensity, spatial extent, duration, and timing of extreme weather events are expected to increase while slow-onset incremental changes may lead to a fundamental transformation of the existing socioeconomic system. Many airports are vulnerable to these events as the risks of flooding, flight disruptions, and cancellations may increase. It is important to understand the risks and initiate adaptation measures for existing and future infrastructure while also managing operations to become more resilient to future conditions.

The Climate Resilience Plan establishes the Authority's program to achieve climate resilience holistically by understanding and preparing for changes in sea level rise, precipitation patterns, and extreme heat.

The aviation industry continues to make advancements in the improvement of economic, social, and environmental outcomes through the identification and implementation of innovative sustainability strategies; the Authority is committed to maintaining a leadership position and inspiring others to take a similar approach. Driven by this commitment, the Authority has completed ambitious projects, such as the construction of the world's first Leadership in Energy and Environmental Design (LEED) Platinum-certified airport terminal (Terminal 2 West Expansion "Green Build," completed in 2013 and certified in 2014), and has developed innovative and effective greenhouse gas (GHG) reduction programs that were recognized by the San Diego International Airport's (Airport's) achievement of Level 3 certification under the Airports Council International (ACI) Airport Carbon Accreditation (ACA) program.

Leadership in sustainability and resilience means not only reducing waste and emissions, but also pioneering innovative climate change adaptation strategies and approaches. Maintaining the functionality of critical infrastructure is a priority for climate adaptation efforts, and because of proximity to the ocean, airports in coastal cities are one of the most threatened types of infrastructure. The Authority believes that, to ensure that the Airport is able to continue serving the San Diego region into the future, the impacts of climate change must be considered and planned for proactively.

The Climate Resilience Plan (CRP) has been developed as a standalone document and is intended to address specific issues related to enhancing the Authority's resilience to climate stressors. Figure 1 outlines the steps for developing the CRP. First, a vision was developed to inspire the Authority and commit it to achieving enhanced climate resilience to future conditions. Next, an impact assessment was performed to better understand the Authority's existing vulnerability to a suite of climate stressors. Goals were developed to translate the vision into reality by setting desired outcomes for what climate resilience means for the Authority. Each goal is associated with targets, or performance measures, to ensure that the Authority is progressing toward satisfying the goals, as defined. Initiatives were then developed to address assets identified as vulnerable to future climate conditions during the baseline impact assessment. To support successful completion of the initiatives and goals, possible funding opportunities were identified (Section 4) and an implementation monitoring plan (Section 5) was created.

Figure 1: Process to Develop CRP



Vision for Climate Resilience

The vision for the CRP is to deliver uninterrupted airport service in a changing climate and provide resilience leadership in the aviation industry.

The Authority recognizes the magnitude of the threat caused by climate change and understands that planning for climate resilience must be integrated into every level of operations and decision-making. The Authority considered broader issues than sea level rise (SLR) solely and, accordingly, the following climate stressors were evaluated in the CRP:

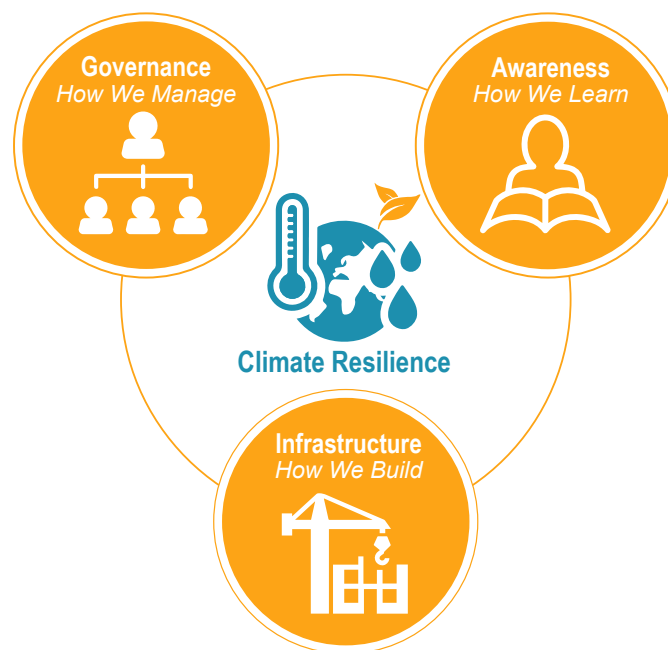
- SLR and storm surge
- Precipitation
- Extreme heat
- Secondary stressors such as drought, wildfire, and marine layer clouds (these were considered but not evaluated)

The vision for the CRP was developed collaboratively with Airport staff and represents a consensus on the Authority's role in enhancing climate resilience. The Authority's vision for climate resilience is supported by the following goals:

1. Reduce risks associated with climate change to ensure business continuity, and to maintain a quality passenger experience.
2. Integrate climate resilience into Airport operations and development decisions.
3. Provide regional and industry leadership in climate resilience.

The Authority understands that achieving climate resilience relies on more than adapting physical infrastructure to accommodate future conditions. It is also important to consider the role of the policies that manage Authority operations. Equally significant are the available opportunities to learn more about the changing climate's impacts on the Airport, so that more informed decisions can be made. Based on this premise, the Authority focused the CRP on three areas (infrastructure, governance, and awareness) to develop a comprehensive and holistic strategy for climate resilience.

Figure 2: CRP Focus Areas



Integration with Airport Sustainability Program and Other Airport Initiatives

The Authority is committed to integrating climate resilience throughout existing operations while managing financial, social, and environmental risks, obligations, and opportunities.

The Authority's approach for sustainability is far-reaching, touching virtually every aspect of Airport operations and development. This approach is embodied in the Authority's definition of sustainability for the Airport, formalized in the Board-approved Sustainability Policy, and is communicated regularly through the Authority's ongoing sustainability reporting efforts (e.g., the Annual Sustainability Report).

The structure of the CRP was influenced by, and developed in coordination with, several other existing plans, policies, programs, and initiatives, as summarized in the following sections.

Sustainability Plans

Sustainability is consistent with and vigorously reinforces the Authority's Mission Statement: to operate San Diego's air transportation gateways in a manner that promotes the region's prosperity and protects its quality of life. The Authority has established seven programmatic sustainability elements that are part of the Airport's environmental sustainability management program:

- Carbon neutrality
- Clean transportation
- Climate resilience
- Zero waste
- Biodiversity
- Sustainable energy
- Water stewardship

Figure 3: CRP Integration with Existing Policies and Programs



Each programmatic area has a dedicated strategic action plan that formalizes goals, initiatives, and an implementation plan for that area. Together, the compendium of plans serves as the Authority's approach for managing environmental sustainability at the Airport and supports the Authority's commitment to endorse the sustainability elements of: economic viability, operational excellence, natural resource conservation, and social responsibility.

Airport Planning Documents

The Authority is planning for the future and shaping what the Airport will look like in the decades to come through the Airport Development Plan (ADP), currently being finalized, and the 5-year and 20-year rolling Capital Improvement Program (CIP). The ADP recommends improvements that will allow the Airport to meet demand through 2035; the CIP identifies specific projects that are planned for construction, several of which could reflect recommendations of climate resilience strategies in the design (e.g., new Terminal 1). Further information about the ADP can be found in the inset (Figure 4).

Airport Climate Resilience - Efforts to Date

The Authority has already started to evaluate climate stressors in design/planning documents and has participated regionally with other organizations.

- **Sea Level Rise Adaptation Strategy for San Diego Bay (2012)**

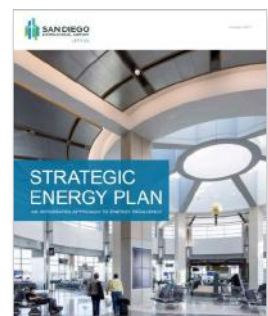
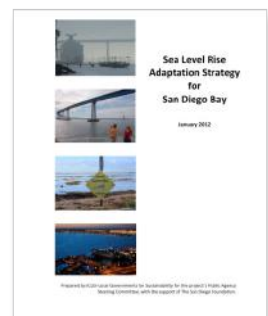
The Authority served on the steering committee for this study, which evaluated the impacts of SLR to natural and built environments around San Diego Bay. The assessment included SLR projections of up to 69 inches by the end of the century, identification of the timing and extent of flood impacts by sector (e.g., transportation, stormwater, and energy facilities), and development of potential adaptation strategies for stakeholders around the Bay to reduce projected flood vulnerabilities.

- **SAN Strategic Master Drainage Plan (2015)**

This document provides a long-term vision to help the Authority prioritize and phase stormwater infrastructure improvements to increase the flood resilience of the Airport and meet development needs through 2035. The document included a comprehensive study of the Airport's hydrology, identifying potential ponding areas caused by 5-, 10-, 50-, and 100-year 24-hour precipitation events and the influence of coastal water levels on stormwater conveyance, which included up to 2 feet of SLR and 2.4 feet of storm surge for year 2050. Opportunities were also explored for on-site stormwater collection and reuse, and Best Management Practices (BMPs) and Low-Impact Development opportunities were identified to enhance stormwater quality.

- **SAN Strategic Energy Plan (2016)**

This document outlines the Authority's framework for managing its energy resources while preparing to accommodate passenger growth, future development, and a changing climate. It includes a variety of strategies to improve on-site energy resilience. Relevant climate resilience strategies include adding redundancy into the energy system to minimize disruptions to Airport operations and updating the CIP evaluation process to incorporate consideration of a project's ability to support and/or enhance the Airport's operational resilience.



- **SAN Water Stewardship Plan (2017)**

This document outlines how the Authority proactively addresses the issues of water conservation, water quality, and flood risk, while enabling operational growth of the Airport and protection of the region's limited resources. The plan describes six primary actions that are intended to comprehensively address the Airport's risks and opportunities related to water quality, conservation, and flood risk. The influence of a variable climate on these issues relating to water at the Airport is strongly emphasized throughout the document; strategies include the requirement of flood-resilient designs for new development and the inclusion of climate risks in the Airport Emergency Plan.



- **San Diego Climate Collaborative**

The Authority serves on the steering committee for the San Diego Regional Climate Collaborative and has participated in several of its working groups and studies, including those focused on economic vulnerability to SLR and "green" storm water infrastructure. The organization is dedicated to supporting regional efforts to advance comprehensive solutions to reduce GHG and prepare for local climate change impacts.



Regional Studies

The CRP and associated goals and initiatives are also influenced by a host of other regional plans, policies, and programs:

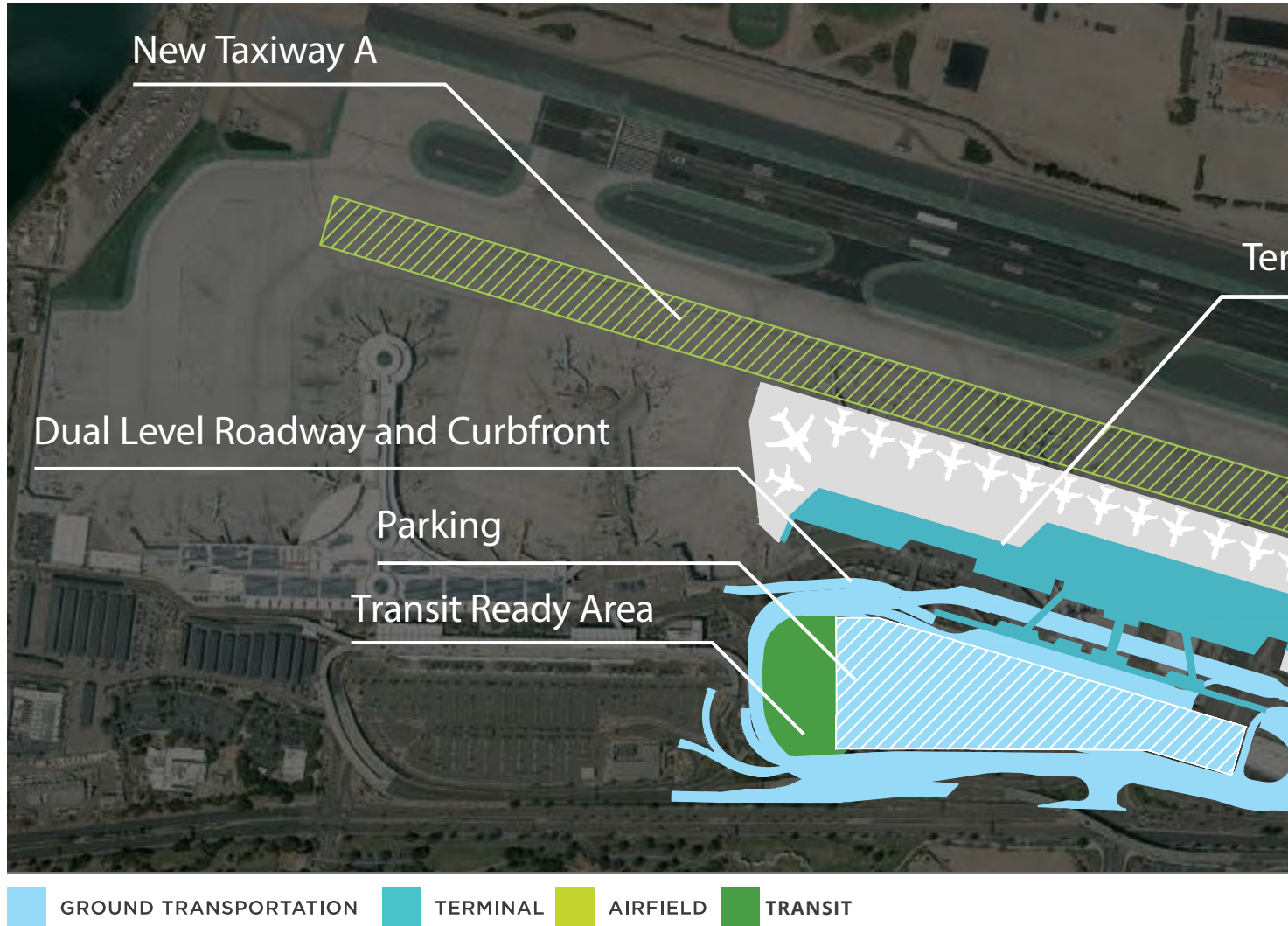
- San Diego's Changing Climate: A Regional Wake-up Call (2009)
- Sea Level Rise Adaptation Strategy for San Diego Bay (2012)
- San Diego, 2050 Is Calling. How Will We Answer? (2013)
- ICLEI: Case Study – Climate Preparedness in the San Diego County Multi-Jurisdictional Hazard Mitigation Plan Update (2016)
- Regional Economic Vulnerability to Sea Level Rise in San Diego County (2018)
- California's Fourth Climate Change Assessment – San Diego Region Report (2018)
- Port of San Diego Sea Level Rise Adaptation Plan - required by Assembly Bill 691 (2019)

Aviation Studies and Guidance Manuals

The CRP and associated goals and initiatives are also influenced by organizations that provide BMPs, reports, and studies:

- Sustainable Aviation Guidance Alliance
- Port Authority of New York and New Jersey Climate Resilience Guidelines
- Transportation Research Board (TRB) Airport Climate Adaptation and Resilience (2012)
- TRB Climate Change Adaptation Planning: Risk Assessment for Airports (2015)
- EUROCONTROL – Adapting Aviation to Climate Change
- California Ocean Protection Council (OPC) State of California Sea Level Rise Guidance (2018)

Figure 4: ADP Overview



Our ADP - Driving sustainability planning through 2035 and beyond

In 2017, the Airport served over 22 million passengers, up from the 20 million it served just the year before. This translates to an average of 550 flights per day, making SAN a top or “Core” 30 airport in the US, thus playing an important role in the national aviation system. ADP represents the Airport’s master planning effort to determine the facilities needed to meet the region’s air travel demand through the year 2035. The ADP’s overarching goal is to optimize the Airport’s 661-acre site to accommodate this growing demand, while maintaining high levels of passenger

satisfaction. The centerpiece of the ADP is the replacement of the Airport’s 50-year-old Terminal 1 with a more efficient and comfortable facility. The new Terminal 1 will increase from 19 gates to as many as 30 gates and will include more gate-area seating, restaurants, and shops, as well as expanded security check point lanes. Similar to the curbside of the Airport’s Terminal 2, the new Terminal 1 will also separate arriving and departing passenger traffic with an elevated departures roadway that will include curbside check-in.

Terminal 1 Replacement

Airfield Apron & Taxiway A/B Upgrades

New Airport Entry Roadway

A new on-airport entry roadway will provide a dedicated Airport access point from west-bound Laurel Street and North Harbor Drive, for vehicles coming to the Airport from the east, and will also include a multi-use path for pedestrians and bicyclists. This will help reduce traffic on North Harbor Drive. In addition, all buses currently moving to and from the Rental Car Center will be removed from Harbor Drive and routed exclusively through the new on-airport entry and link road. On the airside, Taxiway B will be realigned to meet FAA standards and a new Taxiway A will allow bidirectional flow of aircraft. Future phases could include an expansion of Terminal 2 West (the Stinger). Areas have also been preserved for a transit station to directly serve the terminals and for on-airport exit lanes that can be integrated into future regional transportation network

improvements, which are now being evaluated as part of SANDAG's new Regional Transportation Plan. Please note that the Authority, at this time, has not approved or committed to undertake any of the project elements included in the ADP. Any formal approval of the ADP is dependent on completion of appropriate state and federal environmental review.

The CRP is a part of the Authority's broader sustainability management planning framework, helping to establish long-term environmental stewardship goals for the Airport. As such, the CRP will help inform the further design and implementation of the ADP, as well as guide the Airport's daily operations in the future.

Stakeholder Engagement

Effective climate adaptation requires early and continuous engagement of stakeholders at relevant scales, from individuals to state and national organizations.

As the Authority relies on tenants, airlines, cargo, ground transportation firms, and others to implement its business model, it also relies on engagement with these same entities to advance its climate resilience strategy.

Stakeholder engagement is central to climate change adaptation planning, because the Authority can implement actions to reduce risk in areas where it has more direct control, but must engage business interests and other third parties in areas where it may have limited influence. Considering key internal and external stakeholders is essential for ensuring a holistic approach to stakeholder engagement and optimizing buy-in, accountability, and support of climate resilience strategies.

During public review of the CRP, the Authority will present the details of the CRP to internal and external stakeholders and will update the plan, if needed, based on feedback received.

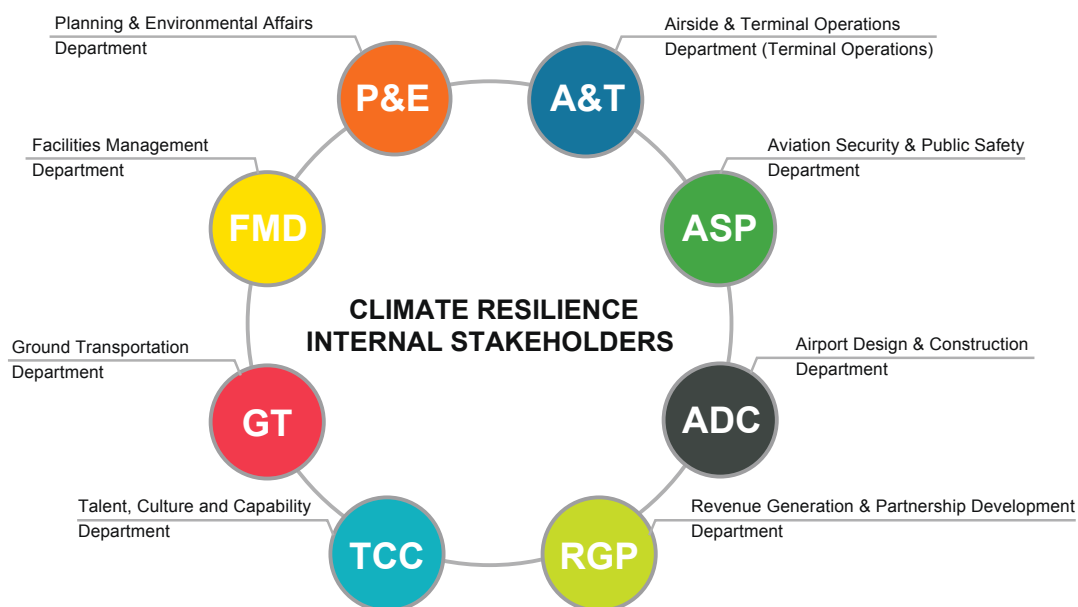


CRP Baseline and Initiatives Workshop September 17, 2018.

Internal Stakeholders

A workshop was held with internal stakeholders at the Airport to ensure accurate information and alignment with operations, and to identify the best and most feasible initiatives. Authority staff from the following departments participated in the workshop or provided supporting background information for plan development:

Figure 5: Authority Departments Involved in the Development of the Plan

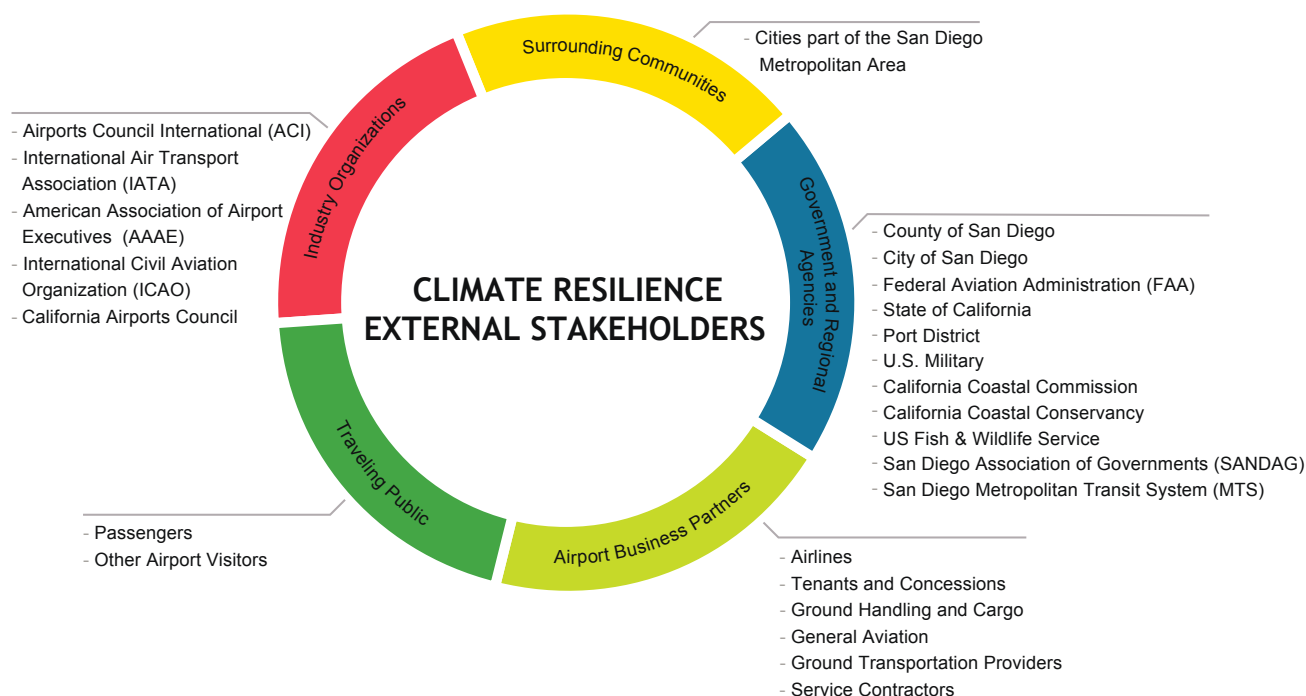


External Stakeholders

To enhance the climate resilience of the Airport and surrounding area, it is crucial that the Authority engage with the community, traveling public, regional planning partners, and Airport business partners and service companies, including concessions, airlines, ground handlers, cargo, and ground transportation firms. Because of this, the Authority is committed to continued and expanded collaboration to enhance climate resilience with the following external stakeholders:

- **Airport Business Partners** may have assets vulnerable to future climate impacts. It is important that the Authority and Airport business partners work together on the development and implementation of strategies to enhance overall Airport climate resilience.
- **Industry Organizations**, including other airports and industry organizations, serve as significant collaborators on funding for research and development, and creative ways to enhance Airport resilience to evolving climate conditions.
- **Government and Regional Agencies** provide big-picture insight and can help strategize on comprehensive solutions to facilitate climate change planning and regional flood protection as well as provide funding opportunities for strategy implementation.
- **The Traveling Public and Surrounding Communities**, where engagement is appropriate, can provide a means to collaborate, share expertise, and leverage resources.

Figure 6: Main External Stakeholder Groups for the Authority's CRP



Climate Science

The Authority has reviewed the latest state and local climate projections to understand how future conditions may impact Airport operations and assets.

The term “climate change” is used to explain variations in the global or regional climate over long periods of time (more than 30 years). Although the climate fluctuates naturally, increases in GHG emissions over the last century due to human activity has caused rapid changes compared to the pace of natural variations observed throughout Earth’s recordable history. Widespread evidence exists to show climate trend deviations. Scientists have documented increases in atmospheric and oceanic temperatures, melting of glaciers, reduction of ice sheets and snowpack, shifting rainfall patterns, intensification of storm events, and rising sea levels.

This section presents the relevant climate science data for the San Diego region, to establish the foundation for evaluating the Airport’s vulnerability to climate change impacts. It relies on the best and most up-to-date available science. A brief summary of each climate stressor is provided below, followed by Table 1, which outlines the data, sources, and reference to San Diego’s most recent climate report: San Diego, 2050 is Calling, How Will We Answer.

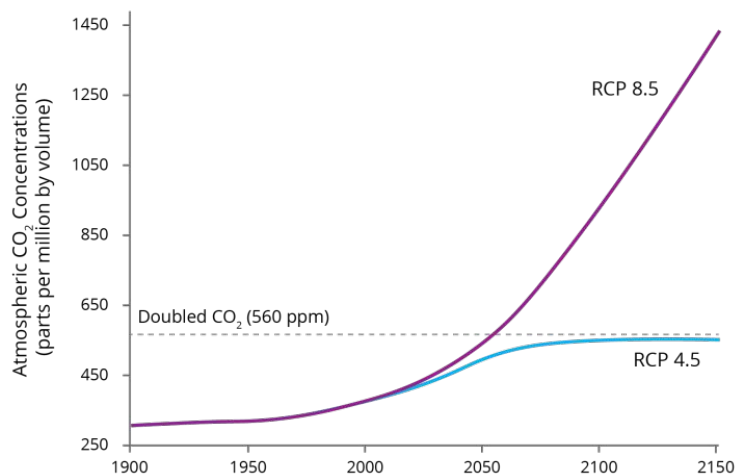
Based on the Airport’s Strategic Master Drainage Plan, flooding from extreme precipitation events will be the biggest climate challenge for the Airport; however, additional climate stressors will also be experienced. Local air temperatures will continue to increase, with an anticipated longer duration of heat waves and an elevated number of extreme heat days (> 89 degrees Fahrenheit [°F]) each year. Less frequent, but more intense rainfall may cause higher-magnitude flood events and may increase the frequency of droughts. Coastal flooding due to SLR and storm surge is not a serious concern for the Airport until a 4.5-foot increase, which is defined by California State guidance as a medium- to high-risk aversion projection that would potentially take place by the end of the century.

Modeling Climate Change

A considerable amount of uncertainty surrounds future climate conditions. General Circulation Models (GCMs) are a tool used by climate researchers to better understand potential future changes in our global climate. GCMs incorporate the physical processes of the atmosphere, ocean, and land surface to simulate the response of the climate system to changing GHG emissions. The models are based on well-established physical principles and have been demonstrated to reproduce observable features of recent climate and past climate changes.

Because the level of future GHG emissions will be affected by population, economic development, environmental changes, technology, and policy decisions, the Intergovernmental Panel on Climate Change developed a range of possible future emissions that are used in climate models to provide scientific consistency across future modeling efforts. The most recent set of scenarios, Representative Concentration Pathways (RCPs), present a range of four primary future scenarios, ranging from RCP 2.6 (low emission scenario) to RCP 8.5 (high emission scenario). RCP 2.6 is not used in the CRP, because it represents a very ambitious pathway in which emissions peak at 2020 and then decline significantly. Figure 7 demonstrates the two future scenarios that were considered for this assessment: RCP 4.5 and 8.5. The RCP 8.5, also known as the “business-as-usual” scenario, represents a continued acceleration of GHG emissions similar to what is occurring today through the end of the century. RCP 4.5 is an intermediate, and more likely, scenario to represent the lower bound of future emissions. It assumes the implementation of significant mitigation globally by mid-century, which causes emissions to peak by 2040. Selection of these scenarios allows for an evaluation of the bookends for likely future conditions that may drive climate impacts at the Airport.

Figure 7: Emission Scenario Projections



Climate Stressors and Impacts

Airport assets and operations were evaluated for their vulnerability to climate-related stressors, including flooding from precipitation, extreme heat, flooding from SLR and extreme coastal storm events (Table 1). Secondary stressors such as wildfires, water supply, and wind and fog were also considered for their impact on the Airport. This section describes potential changes to the evaluated climate stressors in the San Diego region for mid-century (2050 through 2064) and end-of-century (2070 through 2099). For SLR, “mid-century” refers to 2050 and “end of century” refers to 2100, reflecting the latest available State Sea Level Rise Guidance¹.

Table 1: Summary of Major Climate Stressors

Climate Stressor*	Mid-Century	End-of-Century	Source
 Precipitation	No significant change	Less frequent but more intense precipitation +0.2-in annual increase	SAN Drainage Study, CAL-Adapt
 Heat	+6 extreme heat days per year on average Heat waves 1.4 days longer on average	+22 extreme heat days per year on average Heat waves 3.9 days longer on average	CAL-Adapt
 SLR	5 percent chance that SLR will meet or exceed 1.4 feet	5 percent chance SLR will meet or exceed 4.5 feet 50 percent chance SLR will meet or exceed 2.6 feet	State of California Sea Level Rise Guidance (OPC 2018 ²)

Notes:

*A more detailed table of evaluated stressors and projections is presented in Appendix C.

SLR – sea level rise



Precipitation

- **Continued year-to-year variability and periodic drought conditions**

Future rainfall projections suggest continued year-to-year variability similar to what the region has experienced historically. Average annual rainfall will continue to be similar to the 1950 through 2005 historical observation of 9.8 inches through mid-century and will increase slightly by end-of-century. Periodic drought conditions are also expected to continue. Variability in and intensification of precipitation may necessitate the continuation of xeriscaping and development of on-site water storage.

- **Less frequent but more intense precipitation events**

End-of-century projections indicate an 8 percent increase in rainfall intensity for large storm events. Increases in rainfall during storms may result in elevated levels of temporary flooding in low-lying areas, assuming that no action is taken to address vulnerabilities.



Heat

- **Increased frequency of extreme heat days**

The number of extreme heat days, defined as days above 89°F in San Diego, is expected to increase based on future projections. The average number of extreme heat days is projected to increase from the existing 3.5 days per year to 23 days per year by end-of-century. An increase in the number of extreme heat days may necessitate precautions for both outdoor Airport staff and passengers, and may increase the number of days requiring climate control for indoor Airport facilities. An increase in extreme heat may also elevate the number of days with ground-level ozone levels reaching harmful concentrations. Higher temperatures accelerate the formation of ozone, a primary component to smog, and could affect local air quality and the health of passengers and outdoor Airport employees.

- **Increased duration of heat waves**

The duration of heat waves, defined as one or more days of extreme heat, is also projected to increase. By end-of-century, the existing annual average heat wave of two days is expected to increase to 5.8 days.

Extended periods of extreme heat will warrant extra precautions to protect Airport employees and passengers from heat-related health risks. Extended periods of extreme heat may also affect Airport operations, causing infrastructure and equipment deterioration, and may increase the number of days requiring climate control for indoor Airport facilities.



Sea Level Rise

- **SLR Projections**

Over the past century, sea levels have increased in the San Diego area by 0.7 foot (NOAA Sea Level Rise Trends 2018³). Rising sea levels represents new challenges for the area. As water levels rise, the frequency and extent of flooding will increase. Areas once considered to be outside of the floodplain will begin to experience periodic coastal flooding or permanent inundation. Future sea levels in San Diego have a 5 percent probability of meeting or exceeding a 0.7-foot and 1.4-foot increase, by 2030 and 2050, respectively. Because of the uncertainty in future GHG emissions, SLR projections with a lower probability are also considered for end-of-century planning. By 2100, there is a 50 percent probability that water levels will meet or exceed a 2.6-foot increase, and a 5 percent probability they will meet or exceed a 4.5-foot increase (OPC 2018⁴). Potential impacts of changes in sea levels to Airport assets and operations are discussed in the vulnerability and risk assessment section.

- **Storms**

There is general consensus among scientists that climate change will affect aspects of coastal storms such as the intensity, frequency, and storm path; however, a clear consensus has not emerged on the nature of these changes for the Southern California coast. As a result, the magnitude of extreme storm surge is based on an analysis of existing conditions and does not consider the influence of future changes.

Table 2: CRP SLR Projections

Year	Probability	OPC SSLR Projections
2030	5 percent chance that SLR meets or exceeds:	0.7 foot
2050	5 percent chance that SLR meets or exceeds:	1.4 feet
2100	50 percent chance that SLR meets or exceeds (low projection):	2.6 feet
	5 percent chance that SLR meets or exceeds (high projection):	4.5 feet

Notes:

CRP – Climate Resilience Plan

OPC – Ocean Protection Council

SLR – sea level rise

In addition to the probabilistic projections discussed above, the Authority also evaluated the Airport’s vulnerability to a worst-case SLR scenario caused by rapid loss of the West Antarctic ice sheet. This scenario, referred to as H++, is recommended by the latest OPC SLR guidance for extreme high-risk aversion projects or assets (OPC 2018⁵).

Other Stressors

- **Wildfire risk will remain high**

Wildfire risk in the region is projected to remain high through mid- and end-of-century timeframes. Although the area surrounding the Airport is highly urbanized and not vulnerable to wildfire damage, smoke from nearby fires in the greater San Diego area may cause poor visibility, affect flight paths, and affect outdoor air quality for passengers and Airport employees.

- **Water supply will decrease**

Long-term increases in temperature, compounded by variations in precipitation and low snowpack, may worsen droughts and threaten local water sources. By end-of-century, the San Diego region could experience a 20 percent reduction in water supply (Multi-Jurisdictional Hazard Mitigation Plan 2015 Update⁶). A reduction in water supply may create a need for enhanced water conservation measures for the Authority and the greater San Diego Region.

- **Vector-borne diseases may increase**

Warming temperatures and changes in precipitation may affect vector-borne pathogen transmission and disease patterns in Southern California by creating conditions favorable for invasive mosquitos. Above-normal temperatures will cause lower mosquito mortalities and lengthen the duration of the transmission season. Increased temperatures may also accelerate the physiological processes of mosquitos, resulting in faster larval development and shorter generation times, and may shorten the required incubation period for infected mosquitos⁷. An increase in the magnitude of heavy precipitation events and changes in stormwater management practices during drought conditions may also increase areas of standing water, causing a higher abundance of mosquito habitat areas. Changes to conditions promoting mosquito-borne diseases may affect outdoor conditions and pose elevated risks for Airport employees.

- **Wind and fog patterns are under study**

Wind direction and fog have the potential to create significant impacts on aircraft operations at the Airport. As a single-runway airport, these impacts can reduce capacity and create delays in aircraft operations. Climate change impacts on wind and fog for Southern California are being actively researched and there is currently not enough science to support a significant trend in future projections. As the CRP is updated during future periodic revisions, the literature will be reevaluated for improvements in the understanding of these complex climate stressors.

SLR Mapping

The Authority has applied the most recent state level guidance to generate maps of areas exposed to recurring flooding from the maximum high tides and rare flooding caused by extreme coastal storm events.

Flood maps are a valuable tool for evaluating the potential exposure of infrastructure, habitats, and other assets to future water level conditions. The maps are a useful means to evaluate the timing and extent (e.g., depth and duration) of flooding that may be experienced based on projections of SLR. Flood maps also help planners to identify critical flooding thresholds where an entire area may be compromised.

The SLR maps developed for the CRP were derived from flood layers produced by the United States Geological Survey’s Coastal Storm Modeling System (CoSMoS), version 3.0. Flood layers were modified to reflect recent changes in ground elevations due to development projects in the southeastern and southwestern corners of the Airport property. The flood maps provide a high-level overview of areas of the Airport that may be exposed to recurring flooding by maximum high-tide conditions and rare flooding by extreme storm surge events.

Maximum high-tide conditions align with annual king tide elevations in San Diego. King tides are the largest annual tide events and occur several days each year when a spring tide coincides with the moon being in its closest position to the Earth. In Southern California, king tide events are approximately 1.5 feet above the average daily high tide. They can cause flooding of low-lying coastal areas, particularly if coinciding with a storm event. Assets exposed to king tides are considered to have recurring flooding, because they will be temporarily exposed two to three times each year. Many assets exposed to annual king tides will require long-term modification to maintain functionality and prevent damage from repeated salt-water exposure.

Extreme coastal storm events are represented by the 100-year storm surge. This event has a 1 percent chance of occurring in any given year and is commonly used as an indicator to inform assessments of flood risk and the need for mitigation⁸. Assets exposed to the 100-year storm surge event are considered to be “rarely flooded,” because they would be temporarily flooded only during very infrequent extreme coastal storm events.

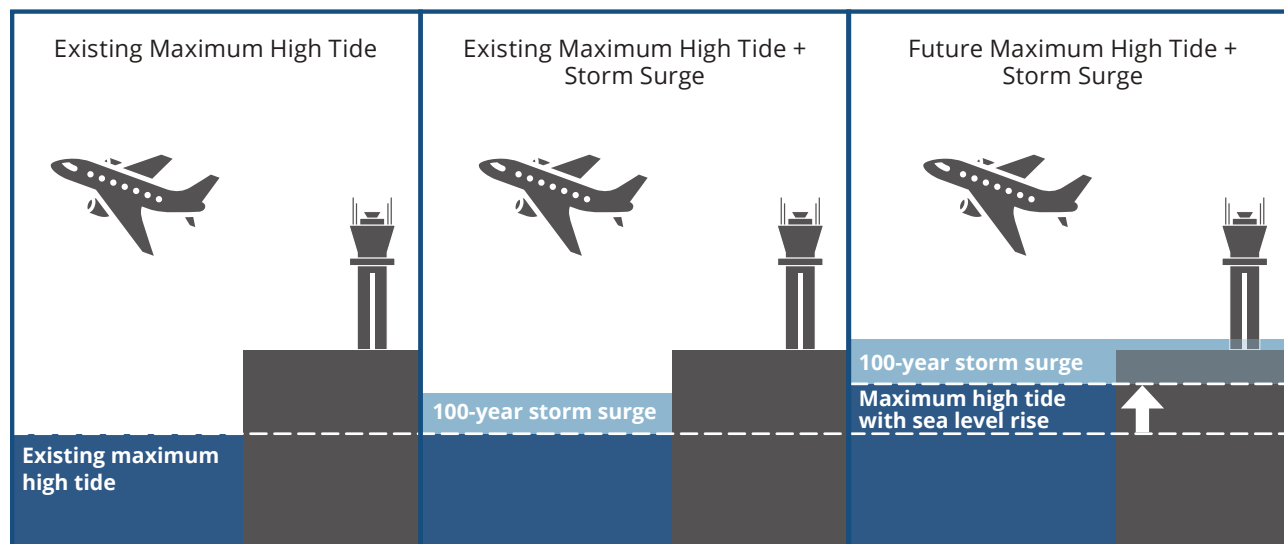
Four SLR amounts—0.8 foot, 1.6 feet, 2.5 feet, and 4.9 feet—were selected for flood exposure and added to the maximum high tide and extreme storm surge (Figure 8). The mapping scenarios represent the closest available CoSMoS layers to SLR projections for 2030, 2050, and 2100, based on the latest OPC SLR guidance. Two projections (2.5 feet and 4.9 feet) were selected to account for the increased range of uncertainty of GHG emissions at the end of the century.

Table 3: Comparison of OPC-Recommended SLR Projections and Available Mapping Projections

Year	Probability	OPC SLR Projections	CoSMoS Mapping Projection
2030	5 percent chance that SLR meets or exceeds:	0.7 foot	0.8 foot
2050	5 percent chance that SLR meets or exceeds:	1.4 feet	1.6 feet
2100	50 percent chance that SLR meets or exceeds (low projection):	2.6 feet	2.5 feet
	5 percent chance that SLR meets or exceeds (high projection):	4.5 feet	4.9 feet

Notes:
CoSMoS – Coastal Storm Modeling System
OPC – Ocean Protection Council
SLR – sea level rise

Figure 8: Graphic Representation of SLR



Consideration was also given to the worst-case H++ SLR scenario (10.2 feet of SLR in 2100), but the entire San Diego coastal region is exposed to flooding by the year 2100 based on this scenario. Although it is warranted to have H++ included in the CRP, specific adaptation measures to successfully address it will need to be evaluated, chosen, and implemented at a regional scale. Therefore, it is recommended that monitoring of the latest climate science continue and a collaborative regional approach be pursued at this time to prepare for a worst-case scenario, such as H++.

Figure 9 through Figure 12 present maps of flood extents due to the maximum high tide (indicated by blue) and the 100-year storm surge (indicated by blue-green) for each of the evaluated future scenarios. Flooding does not begin to impact Airport property until 1.6 feet of SLR, when 100-year storm surge flooding begins to expose a small portion of the western side of the Airport. By 2.5 feet of SLR, 100-year storm surge flooding expands to also include the southeastern portion of the Airport. By 4.9 feet of SLR, flooding due to the maximum high tide is also expected to expose the southeastern and western portions of the Airport property. Details regarding the vulnerability of Airport assets in areas exposed to flooding are described in the Vulnerability and Risk Assessment section.



Figure 9: SLR Flood Extent (0.8 foot)



Figure 10: SLR Flood Extent (1.6 feet)

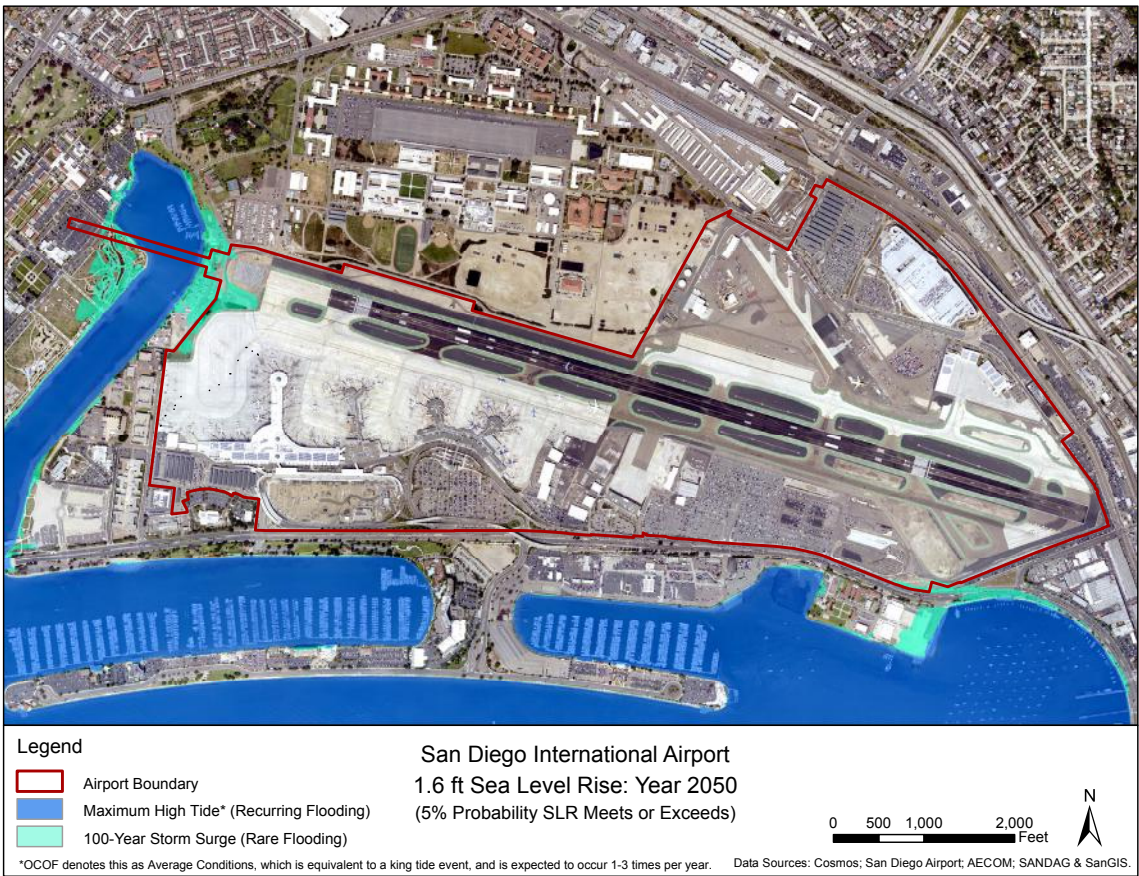
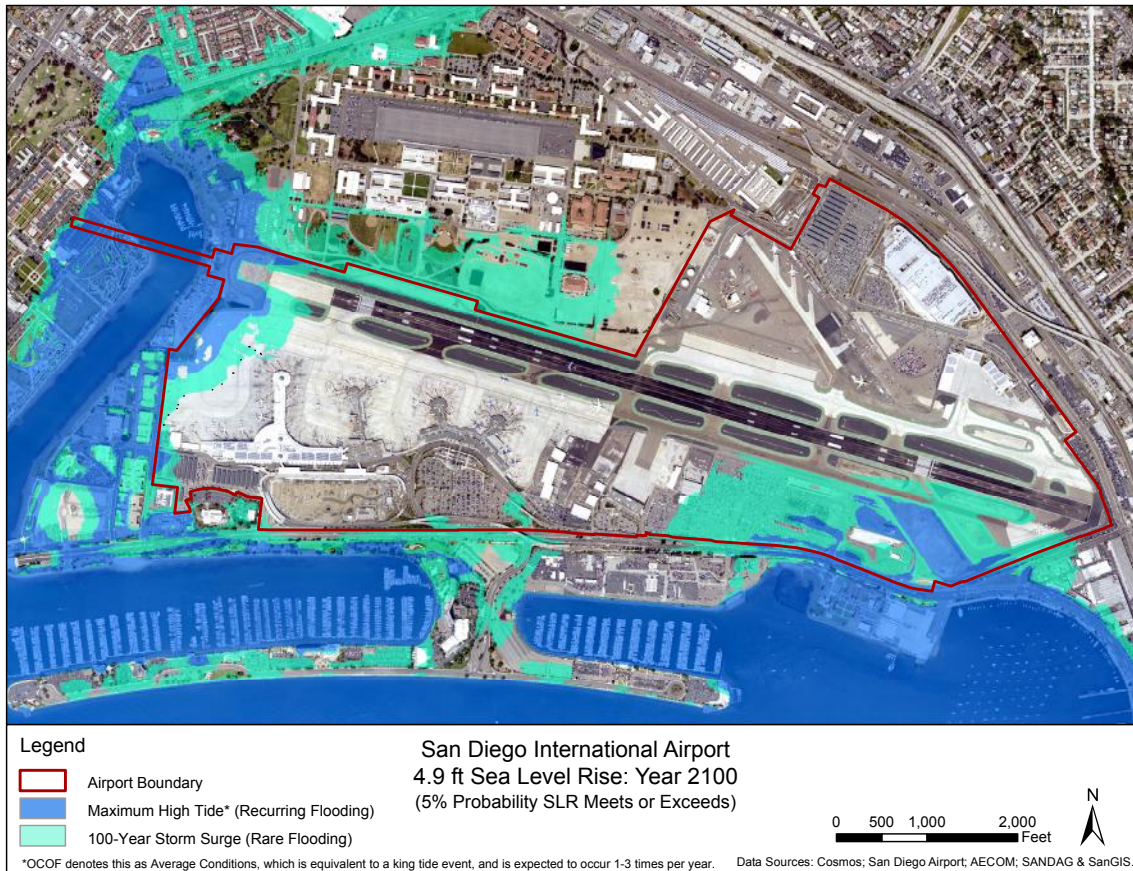


Figure 11: SLR Flood Extent (2.5 feet)



Figure 12: SLR Flood Extent (4.9 feet)



Vulnerability and Risk Assessment

The Authority has carried out a comprehensive vulnerability assessment to evaluate the risks (economic, social, and environmental) posed to assets by future climate conditions.

Building the Airport's resilience to climate change begins with a climate vulnerability assessment of assets and operations. Vulnerability is expressed in terms of:

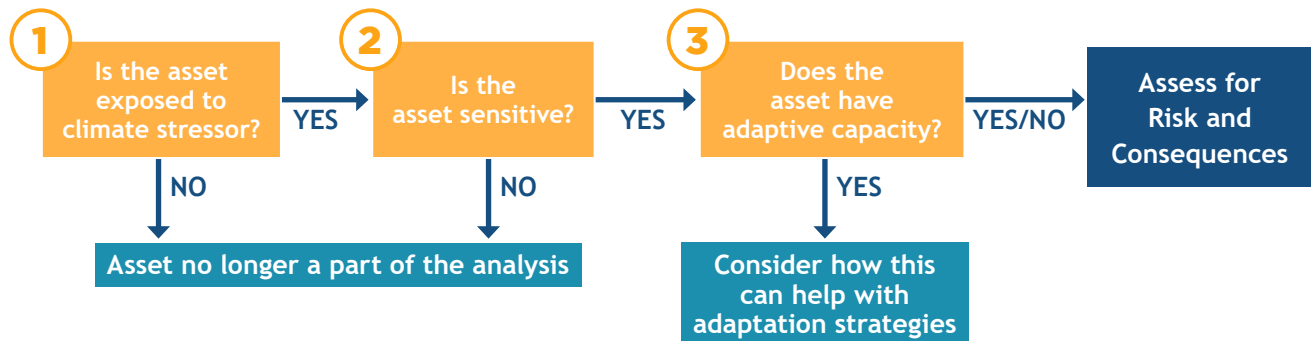
Exposure – the nature and degree to which an asset or system is exposed to climate stressors

Sensitivity – the degree to which the physical condition and functionality of an asset, population, or system is affected by climate stressors

Adaptive Capacity – the ability of an asset or system to evolve in response to, or cope with, the impacts of climate stressors

The flow diagram in Figure 13 below illustrates the steps for prioritizing assets for adaptation to climate vulnerabilities. Exposure is the greatest indicator of an asset's susceptibility to climate stressors. Evaluating sensitivity and adaptive capacity, however, provides valuable information on the degree to which an asset would be impaired once exposed, and the inherent characteristics that allow the asset to readily respond or adapt. Assets are considered most vulnerable if they are exposed to climate stressors, have high sensitivity, and have low adaptive capacity.

Figure 13: Vulnerability assessment steps



The vulnerability assessment included an evaluation of the following climate stressors:

- SLR and storm surge
- Precipitation (rain event)
- Extreme heat
- Other stressors: drought and wildfire

Assets important to the Airport's economy and operations were identified, grouped, and analyzed based on the following categories:

- Runways and taxiways (including navigational systems)
- Airport facilities (landside and airside)
- Tenant facilities
- Ground transportation network (access roads and parking lots)
- Least tern nesting habitat

Asset categories provide a framework to evaluate potential impacts. For each asset category, criteria were developed to evaluate the characteristics that would increase the sensitivity (e.g., presence of electrical equipment, dark-colored material, and asphalt) and adaptive capacity (e.g., ability to elevate, relocate, or retrofit infrastructure). Individual assets were then evaluated against the criteria to assess their relative vulnerabilities.

For assets identified as vulnerable, a high-level risk assessment was also completed by analyzing the potential consequences that could occur due to climate change impacts. This was done by considering the economic, social, and environmental consequences of flooding for each asset type on a qualitative basis, as summarized below.

Economic Consequences

- Asset damage (electrical or mechanical systems may be damaged by changing climate conditions)
- Operation disruptions (climate impacts may cause lost revenue due to facility limitations of temporary closure)

Social Consequences

- Loss of jobs (Airport closure, even if temporary, could affect direct and indirect Airport employees, with negative consequences for working families)
- Passenger experience (any effect on the quality of the passenger experience could reflect negatively on the Airport)
- Life safety (climate impacts could increase the safety risk of Airport staff and passengers)

Environmental Consequences

- Loss of least tern habitat (loss of suitable habitat will affect sustainability of local least tern populations)
- Reduction in water quality (climate change exposure of the Airport may affect the quality of the surrounding San Diego Bay)

The results of the analysis have been summarized in the following vulnerability profiles, which were created for each infrastructure category and used as a basis for establishing priorities for future climate change adaptation planning. Each profile includes a summary section that highlights the assets in bold that are most vulnerable.



Runways and Taxiways Vulnerability Profile

Asset Overview

San Diego International Airport is a single-runway airport with six main taxiways (B, C, D, F, H, and J) and 14 cross taxiways along taxiways B and C. The runway extends 9,400 feet, and only one parallel taxiway (B) extends the full runway length. The runway is composed of asphalt and the taxiways are made of concrete. Both have embedded light fixtures, which are used during nighttime operations or during times of restricted visibility.

For optimal efficiency, all taxiways are considered critical. However, the following cross taxiways are given lower priority due to their less frequent use: B5, C3, C5, and J.

Navigational aid systems are considered essential to Airport operations and ensure safe and efficient movement of aircraft during approach, departure, and taxiing maneuvers. It is critical to have all visual and navigational aid equipment working properly and maintained in good condition.

A list of the evaluated assets and their locations is included in Appendix A.

Exposure

- **SLR:** Several runway/taxiway assets are expected to first be impacted by storm surge (rare flooding) by 1.6 feet of SLR (year 2050). Assets are not expected to be impacted by the maximum high tide (recurring flooding) until 4.9 feet of SLR (year 2100).
- **Precipitation:** Heavy rainfall already results in ponding on low-lying areas of the Airport. Rising sea levels may prevent efficient stormwater drainage during rain events, increasing the areas subject to temporary flooding.
- **Extreme heat:** Although the runway, taxiways, and associated assets will be exposed to the same amount of incoming solar radiation, the ground surface surrounding the runways and taxiways is primarily dark in color, which can elevate local surface temperatures and increase their exposure to extreme heat⁹.
- **Other:** Wildfires, due to extended drought conditions in the open space surrounding San Diego, are not expected to directly expose the Airport. However, winds may direct smoke from the fires to the Airport, affecting flight schedules, local air quality, facilities, and operations.

Sensitivity

- **Flooding (SLR and precipitation):** The runway and taxiways are highly sensitive to flooding because they contain electrical light fixtures, which may be obstructed or damaged if exposed to floodwater for longer than designed. Standing water on the runways and taxiways could prevent aircraft from landing and takeoff (see Consequences, below). Navigational aid equipment is also highly sensitive to flooding, because electrical components may become inoperable if submerged in water for long periods.
- **Extreme heat:** Runways and taxiways are sensitive to repeated long periods of extreme heat. Asphalt runways may experience pavement distress when surface temperatures exceed 100 °F¹⁰. Extreme heat can also affect runway operations, because large planes will need a longer runway to gain sufficient speed to lift off the ground with the lower air density. Navigational aid equipment is also sensitive to extreme heat. Elevated air temperatures can reduce the ability to transmit power, and power outages may occur due to an overloaded electrical grid. Equipment components may also malfunction if temperatures exceed the design threshold.
- **Other:** Runway and taxiway assets are not structurally sensitive to exposure from wildfire smoke, although their operations may be impacted due to pilot visibility (see Consequences, below).

Adaptive Capacity

- **Flooding (SLR and precipitation):** Taxiways have adaptive capacity, because there are multiple pathways to surrounding Airport infrastructure; however, there may still be operation disruptions and delays, particularly for taxiways B, C, F, and H, which were identified as critical to Airport operations. Some GPS-based navigation equipment can be designated to replicate ground-based navigational aids, thereby increasing redundancy and adaptive capacity for navigational equipment.
- **Extreme heat:** The runway has low adaptive capacity to extreme heat, because the possibility of extending the runway's length is restricted by the surrounding water and land uses. Components of navigational aid equipment may be adaptable to heat through modifications of electrical housing and incorporation of redundancy.

Consequences

- A loss of runway and taxiways due to flooding or extreme heat impacts will cause the Airport to experience a disruption or delay of aircraft operations. Without a means to efficiently move passengers or cargo, the Airport Authority will face economic losses.
- Repeated flooding events on the runway and taxiways may cause damage and necessitate resurfacing ahead of the general maintenance schedule.
- Flooding and extreme heat may damage navigational aids, requiring expensive repairs that may disrupt Airport operations.
- Standing water on in-pavement lights obstructs the beam intensity; this may limit their visibility to the point that they do not comply with FAA regulations.
- Longer duration of flooding may attract wildlife, which can impact flight operations.
- Any changes to the runway and taxiway asphalt mix for higher heat thresholds could require additional effort and could interrupt aircraft operations during construction.
- Wildfire smoke may affect flights taking off and landing at the Airport, as high particulate concentrations pose a risk of damaging airplane engines and reducing visibility.
- Loss of power during extreme heat days will impact the ability of aircraft to safely take off and land, and disrupt the operational efficiency of the Airport.
- Any disruptions to passenger travel will likely cause a negative customer experience, reflecting poorly on the Airport Authority.

Future Development

- As a part of the ADP, Taxiway A will be added to the Airport taxiway complex. The eastern portion of the planned taxiway location is expected to experience temporary flooding in 2100, based on the existing elevations.
- Relocation of the Automated Surface Observation System (ASOS) and the existing Runway Visual Range (Runway 27) are expected to experience storm surge flooding in 2050 due to SLR and ponding during heavy rain events under existing conditions.

Summary

- Airport operations could be severely compromised if runways, taxiways, and/or navigational aid systems are exposed to temporary flood conditions or impacted by extreme heat days. Protective measures should be established to ensure their functionality.
- The following assets are exposed to flooding from heavy rain events under existing conditions, and improved drainage strategies should be considered to prevent ponding: **Taxiways B, C, H, and J; and navigational aid systems (the Glide Slope Antenna, Runway Visual Range [Runway 9 and 27], and the Local Transmitter Building).**
- The following navigational aid systems are exposed to storm surge by 2050: **Localizer Antenna (Runway 27), DME Antenna, Runway 9 Approach Lighting System, and the Localizer Transmitter Building;** protective strategies should be considered to prevent temporary flooding.
- The runway and taxiways are not exposed to recurring coastal flooding until 4.9 feet of SLR (year 2100). However, SLR conditions in 2050, when combined with heavy rainfall events, may cause ponding on **Taxiway F, the Runway 27 Engineered Materials Arrest System, and navigational systems (DME Antenna [Runway 27]).**
- Navigational aid equipment supporting safety and efficiency of the runway and taxiways is also vulnerable to extreme heat because it is dependent on electricity. Back-up power (redundancy) is critical, including identifying the location and elevation of the **generators** to ensure that they are not vulnerable.
- **Future development of Taxiway A, the relocated Runway Visual Range (Runway 27), and ASOS** presents opportunities to ensure that the designs prevent these assets from being exposed to future SLR and/or heavy rain events.



Airport Facilities (Landside and Airside) Vulnerability Profile

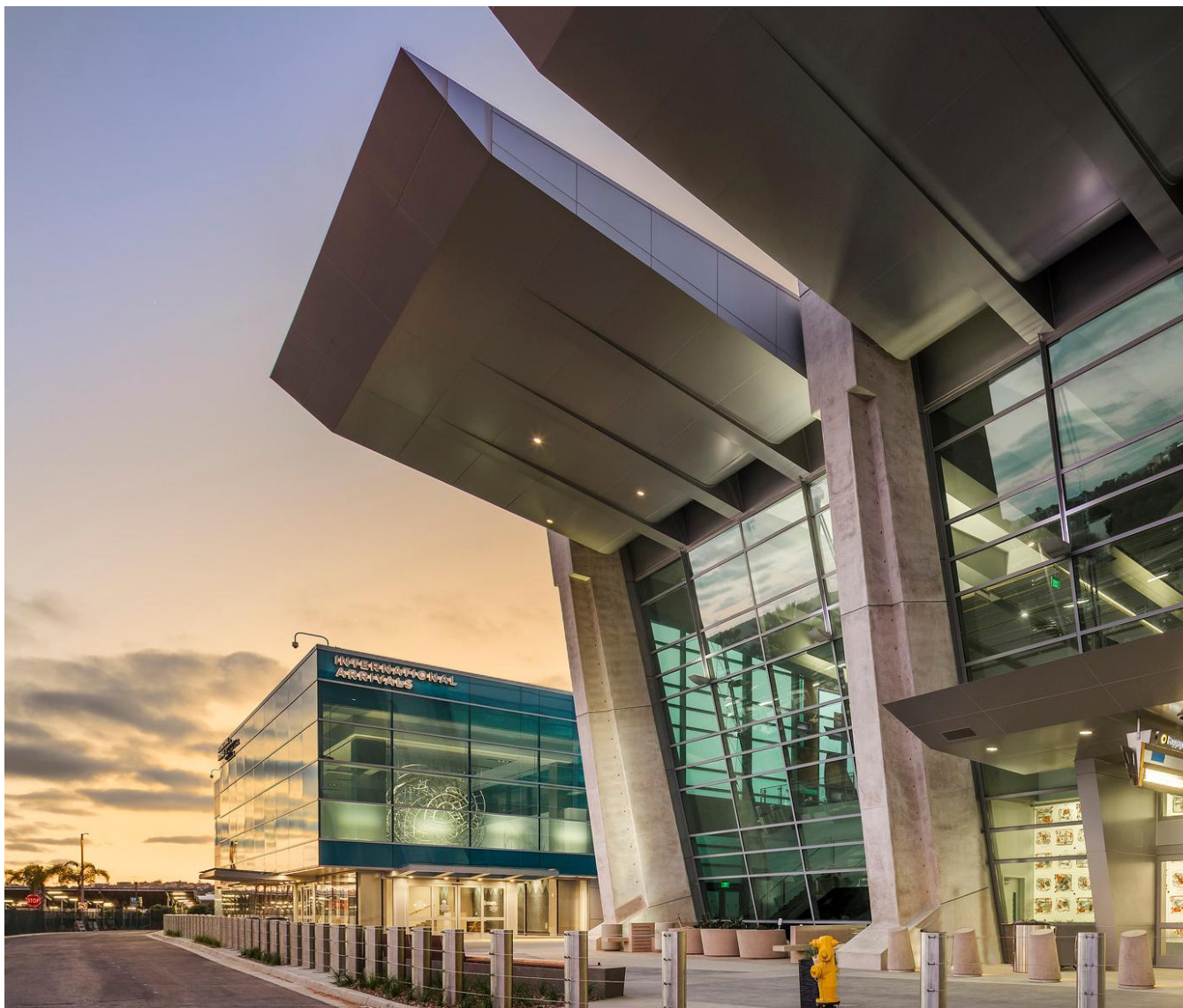
Asset Overview

Airport facilities are divided into landside and airside facilities. Landside facilities are outside of the secure Airport operations area (AOA) and provide for the processing of passengers, cargo, freight, and ground transportation vehicles. Landside facilities include passenger terminals, administration buildings, vehicle storage areas (surface lots), and utilities.

Airside facilities include security fencing/gates, aircraft aprons (tarmac), Airport support facilities (e.g., the Airport Traffic Control Tower), and Airport support infrastructure. Airside facilities are largely regulated by criteria and standards developed by the FAA to emphasize safety and efficiency while protecting federal investment in Airport transportation infrastructure.

All tenant-owned facilities are addressed in a separate vulnerability profile.

A list of the evaluated assets and their locations is included in Appendix A.



Exposure

- **SLR:** Several airside assets are expected to first be impacted by storm surge (rare flooding) by 1.6 feet of SLR (year 2050). Airside assets are not expected to be impacted by the maximum high tide (recurring flooding) until 4.9 feet of SLR (year 2100).
Several landside assets are expected to first be impacted by storm surge (rare flooding) by 2.5 feet of SLR (year 2100). Landside assets are not expected to be impacted by the maximum high tide (recurring flooding) until 4.9 feet of SLR (year 2100).
- **Precipitation:** Heavy rainfall already results in ponding on low-lying areas of the Airport. Rising sea levels may prevent efficient stormwater drainage during rain events, increasing the areas subject to temporary flooding.
- **Extreme heat:** Extreme heat may cause surface lots to become malleable, increase the energy use needed to cool buildings, and possibly result in power loss due to an overloaded electrical grid. Although Airport assets will be exposed to the same amount of incoming solar radiation, the color of the ground surface surrounding the individual assets can elevate local temperatures^{11 12}. For example, all landside, and many airside assets are surrounded by dark asphalt, which may expose assets to higher temperatures. In contrast, several airside assets, such as the terminals and Fixed-Based Operator (FBO) hangars, are surrounded by lighter-colored concrete, which reflects more incoming solar radiation.
- **Other:** Wildfires due to extended drought conditions in the open space surrounding San Diego are not expected to directly expose the Airport. However, winds may direct smoke from the fires to the Airport facilities.

Sensitivity

- **Flooding (SLR and precipitation):** Key considerations in determining sensitivity include the presence of electrical equipment or electrical infrastructure and buildings. Buildings have a high sensitivity to temporary flooding because they may experience widespread structural damage to even temporary exposure. These assets also typically have electrical components that may be damaged if exposed to water.

Utilities, such as the NTC (Terminal 2 West Parking Lot) solar array, microgrid vaults, and pump station have a high sensitivity to flooding. These assets rely on electrical components that may require repair or replacement if exposed to water.

Tarmac and other surface lot materials have a low sensitivity to temporary flooding. The Airport currently publishes a Notice to Airmen and coordinates with Air Traffic Control when the runway is wet. If tarmacs are submerged to a depth deemed unsafe by the pilots, aircraft access will cease, but it should be possible to resume access quickly after waters have receded. Repeated temporary flooding may cause tarmac or surface lots to begin to deteriorate. Similarly, temporary flooding of surface lots may prevent use of the lot while flooded, but access can be resumed after floodwaters have subsided.

Although sections of the AOA fence are exposed to flooding, it is not sensitive to water. Secured gates are addressed separately, as a part of the fence.

- **Extreme heat:** During extreme heat days, an increasing amount of energy will be required to cool the building space¹³. Elevated air temperatures can also reduce the ability to transmit power, and power outages may occur due to an overloaded electrical grid. The following airside buildings have dark roofs, which may increase their sensitivity to extreme heat days: the Aboveground Fuel Facility and the Aircraft Rescue and Firefighting (ARFF) building. The Airport's Strategic Energy Plan includes a resiliency component and factors hotter temperatures into future heating and cooling needs for Airport facilities.

Surface lot materials are sensitive to repeated prolonged periods of extreme heat. They are made of asphalt, which may soften and experience deformation, cracking, or splitting due to heat exposure. Although surface lots may still be usable once damaged, the need for repairs will increase in frequency¹⁴. The Airport Shuttle Storage Area is a dark-colored parking lot with no shade protection, which may increase the lot's sensitivity to extreme heat days.

- The Employee Lot Solar Array and NTC Solar Array are also sensitive to extreme heat. The efficiency of photovoltaic (PV) panels decreases with increasing temperatures. PV panels are also dark in color and may contribute to the local heat island effect in the area¹⁵.
- Tarmac materials are less sensitive to repeated or prolonged periods of extreme heat. Although concrete does soften during high temperatures, it will maintain its structure and functionality.
- Although the AOA fence and Northside Boneyard are exposed to extreme heat, they are not sensitive to it.
- **Other:** Building structures are not sensitive to wildfire smoke, but the filters in air handling systems may be sensitive to the build-up of particulates in the air¹⁶. Parking lots and utilities are not sensitive to exposure from wildfire smoke or drought.



Airport Facilities (Landside and Airside) Vulnerability Profile

Adaptive Capacity

- **Flooding (SLR and precipitation):** Buildings have limited adaptive capacity because they are not easily elevated or relocated.
Parking lots and Airport tarmac areas have limited adaptive capacity. Although there may be other parking lots or aprons on the Airport property, they are likely already in use and are not designed as backup options. They are also large assets that are not easily modified.
Utilities have adaptive capacity, because sensitive electrical components can be retrofitted or elevated to adapt to future conditions.
The pump station, ARFF, and Gates P-18A and B have generators (#17, 5, and 4, respectively), providing backup electrical supply and increasing the asset's adaptive capacity.
- **Extreme heat:** Office buildings and storage facilities have a high adaptive capacity to extreme heat. Retrofits can be applied relatively easily to increase the energy efficiency of cooling systems. Terminals 2W and 2E have generators (#10 and 11, respectively) providing backup electrical supply in the case of a power outage, thereby increasing the asset's adaptive capacity.
Solar arrays have some inherent adaptive capacity. They can be modified to allow for increased airflow between the PV panel and roof structure, or the panels can be upgraded to a higher-efficiency module.
Surface lots have a high adaptive capacity to extreme heat. Modifications can be applied to the existing surface using cool pavement techniques to reduce the absorption of solar radiation.
Electrical components in utilities have high adaptive capacity at a local level for extreme heat. Retrofits and cooling techniques can easily be applied to maintain operation during extreme heat days. However, region-wide outages may still affect the power supply at the Airport.

Consequences

- Many Airport landside and airside facilities are critical for Airport functionality, and loss of assets may result in operational delays or closures.
- The ARFF is a life-safety asset. Loss of this asset's uninterrupted functionality will affect the operations at the Airport. To maintain a Part 139 certificate, ARFF is required to remain operable and able to respond to emergencies 24 hours a day.
- The Aboveground Fuel Facility provides aircraft with refueling services; loss of this asset will result in Airport delays and possible closures. Flooding of this asset may also introduce pollutants to San Diego Bay.
- Flooding on aircraft parking aprons and at passenger loading gates will make aircraft parking unavailable, delaying the exiting and boarding of passengers and the offloading of cargo.
- Flooding or overheating of the electric vault may cause power outages at the Airport.
- A loss of the pump station near the Employee Parking Lot may cause localized flooding during storm events.
- Closure of the Rental Car Center (RCC) will affect the ability of passengers to rent a vehicle once arriving at the Airport.
- Flooding at landside of Terminal 2 will affect the ability of passengers to efficiently enter or exit the Airport terminal facilities.
- Repeated flooding of parking lots or airline aprons may cause damage and necessitate repairs ahead of the general maintenance schedule.
- Failure of the NTC Solar Array may result in expensive repairs and additional dependency on the electrical grid.
- Failure of the microgrid vaults may result in power outages throughout the Airport, affecting Airport operations.
- Loss of backup generators will lower the redundancy of power supply for Airport assets that rely on electricity to function.
- Airport terminal and office building intake of wildfire smoke may lower indoor air quality at the Airport.

Future Development

- As a part of proposed cargo development, the DHL, UPS, and FedEx aprons will be consolidated into one future cargo development area.
- Improvements proposed as part of the ADP include the new Terminal 1, waste-sorting compacting facility, triturator, West Fueling Rack, RON Parking, and Airport Administration Office¹⁷. All of these new assets are planned in locations vulnerable to ponding during heavy rain events in 2050.
- The future location of the Airport Fueling Operations Facility is also in an area vulnerable to ponding during heavy rain events in 2050.
- Several future development areas are also projected to be flooded due to the 100-year storm surge by 2100, including the West Fuel Rack, ASOS, RON Parking, On Airport Access Road, Airport, Administration Office, Airline Support Facilities, waste sorting/compacting facility, Runway Visual Range (Runway 27) and triturator.
- The electric vault is planned for relocation as a part of the ADP.
- The New Facilities Management Department Campus will be located on the northern side of the Airport. The maintenance storage area and Facilities Maintenance Department Workshop area are scheduled for relocation as a part of those proposed improvements.

Summary

- Airport operations could be affected if facilities are exposed to flood conditions or extreme heat days. Protective measures should be established to ensure their functionality.
- **Microgrid vaults** along the southeastern corner of the Airport property near North Harbor Drive are exposed to storm surge by 2050, and protective strategies should be considered to maintain uninterrupted power supply during storm events.
- The following assets are exposed to flooding from heavy rain events, based on existing conditions, and improved drainage strategies should be considered to prevent ponding: **Airport Shuttle Storage; RCC; Generators 2, 3, 4, 5, 10, 14, and 16; Aboveground Fuel Facility; ARFF; FBO Apron; RON; Terminal 2 West (Airside); Northside Boneyard; Microgrid Vaults; and Gates P-02, 04B, 08, 18A, and 18B.**
- By 2050, the assets exposed to flooding from heavy rain events expand to include the following: **Terminal 2W (Landside), NTC Solar Array, DHL Apron, Gate P-13 and VSR P-14, Terminal 2E (Airside), and Generator 9.** Adaptation strategies should be considered to prevent future ponding.
- Airport facilities dependent on electricity and cooling systems are vulnerable to extreme heat and backup power (redundancy) is critical; therefore, the **elevation of backup generators** should be evaluated to ensure that they are above flood levels.
- Cool pavement techniques could reduce the extreme heat exposure of the **Airport Bus Storage Area.**
- Cool roofing strategies could reduce the extreme heat exposure of the **Aboveground Fuel Facility** and the **ARFF**, but glare issues must be considered.
- The ADP presents opportunities to ensure that the design of the new **Terminal 1 and other ADP associated facilities** prevents these assets from being exposed to future heavy rain events.
- Establishing post-wildfire maintenance and cleaning plans for **air filtration systems** of Airport buildings can protect against clogged filters, which can lead to failing components.



Tenant Facilities Vulnerability Profile

Asset Overview

In addition to serving traveling passengers, the Airport hosts a number of tenants that lease space from the Airport Authority. Tenants include a wide range of Airport users, such as government agencies (e.g., FAA), vendors providing aircraft and aviation services, companies handling cargo and mail, and general aviation aircraft owners.

The facilities associated with the tenants vary depending on specific tenant requirements, but include office buildings (and associated surface parking lots), warehouses, on-site storage, and aircraft hangars.

The Airport also includes several concessions, which are not highlighted in this profile because they are located in facilities operated by the Airport Authority.

A list of the evaluated assets and their locations is included in Appendix A.

Exposure

- **SLR:** No tenant facilities are expected to be impacted by storm surge (rare flooding) or by the maximum high tide (recurring flooding) by the end of the century.
- **Precipitation:** Heavy rainfall already results in ponding on low-lying areas of the Airport. Rising sea levels may prevent efficient stormwater drainage during rain events, increasing the areas subject to temporary flooding.
- **Extreme heat:** Extreme heat may cause surface lots to become malleable, increase the energy use needed to cool buildings, and possibly result in power loss due to an overloaded electrical grid. Although these assets will be exposed to the same amount of incoming solar radiation, the ground surface surrounding the individual assets is primarily dark in color and may elevate local temperatures^{18 19}. For example, many tenant facilities are surrounded by dark asphalt, which may expose assets to higher temperatures.
- **Other:** Wildfires due to extended drought conditions in the open space surrounding San Diego are not expected to directly expose the Airport. However, winds may direct smoke from the fires to the Airport tenant facilities.

Sensitivity

- **Flooding (SLR and precipitation):** Key considerations in determining sensitivity include the presence of electrical equipment or electrical infrastructure, buildings, and cargo storage facilities. Buildings, cargo storage, and airplane hangars have a high sensitivity to temporary flooding because they may experience widespread structural damage to even temporary exposure. These assets also typically have electrical components that may be damaged if exposed to water.
Surface lots have a low sensitivity to temporary flooding. If lots are submerged by a depth of more than a few inches, vehicles will not be able to enter or exit the lot, but it should be possible to resume access quickly after waters have receded. High-velocity flows of floodwater may cause erosion of the surface lot foundation. Repeated temporary flooding may cause the surface lot to begin to deteriorate.
- **Extreme heat:** During extreme heat days, an increasing amount of energy will be required to cool the building space²⁰. Elevated air temperatures can also reduce the ability to transmit power, and power outages may occur due to an overloaded electrical grid. The following buildings have dark-colored roofs, which may increase their sensitivity to extreme heat days: the Fuel Farm Administration Building and the Wind Tunnel. The dark-colored solar PV panels installed on the roof of the Wind Tunnel contribute to the building's increased sensitivity to extreme heat. High air temperatures dampen the efficiency of the solar panels, which can severely reduce power production. Their dark color can contribute to a local heat island effect²¹.
Surface lot materials are sensitive to repeated prolonged periods of extreme heat. They are made of dark asphalt, which may soften and experience deformation, cracking, or splitting due to heat exposure. Although the surface lots may still be usable once deformed, the need for repairs will increase in frequency²².
- **Other:** Building structures are not sensitive to wildfire smoke, but the filters in air handling systems may be sensitive to the build-up of particulates in the air²³.
Roadways and surface lots are not sensitive to exposure from wildfire smoke or drought.

Adaptive Capacity

- **Flooding (SLR and precipitation):** Buildings have limited adaptive capacity because they are not easily elevated or relocated.

Surface lots also have limited adaptive capacity. Although there may be other lots on the Airport property, they are likely to be in use and are not designed as a backup surface area. They are also large assets that may require a lot of effort and expense to be elevated above the floodplain. However, regrading to higher elevations has proven to be a successful means of protecting other Airport assets in the past.

- **Extreme heat:** Office buildings and storage facilities have a high adaptive capacity to extreme heat. Retrofits, such as increased efficiency windows, increasing insulation thickness, and modifying to a light-colored roof, can be applied relatively easily to increase the energy efficiency of the cooling system.
Solar arrays have some inherent adaptive capacity. They can be modified to allow for increased airflow between the PV panel and roof structure, or the panels can be upgraded to a higher-efficiency module.
Surface lots have a high adaptive capacity to extreme heat. Modifications can be applied using cool pavement techniques to reduce the absorption of solar radiation.

Consequences

- Loss of the reliable use of facilities may result in economic losses for tenants and the Airport Authority.
- Limited use or inoperability of cargo facilities may damage or delay the transport of time-sensitive shipments, which may affect the larger San Diego Area.
- Repeated flooding or extreme heat events may cause damage to surface lots and necessitate resurfacing ahead of the general maintenance schedule.
- Flooding of tenant surface lots may limit the ability of employees to conveniently store their vehicles while on site.
- Loss of tenant facility operations or access may affect jobs.
- Loss of tenant facilities may impact aircraft operations, with a reduction in or complete loss of the ability to provide aircraft storage, maintenance, or ground support services.

Future Development

- As a part of the proposed cargo development, the apron and temporary facilities used by DHL, FedEx, and UPS are planned to be consolidated into one air cargo development area. The proposed cargo development area shown on the 2018 Future Airport Layout Plan is in a location that may be vulnerable to ponding during heavy rain events under existing conditions.
- The Air Freight Terminal and United Freight Office are scheduled for removal as part of the proposed ADP improvements.

Summary

- The economy of the Airport could be affected if tenant facilities are exposed to flood conditions. Protective measures should be established to ensure that tenant assets have uninterrupted functionality.
- The **FBO Building** and the **FBO hangars** are exposed to flooding from heavy rain events, based on existing conditions; adequate drainage strategies should be considered to prevent ponding.
- The new air cargo development area presents opportunities to ensure the design of the new cargo development area prevents this asset from being exposed to future SLR and/or heavy rain events.
- Cool roofing strategies can decrease the extreme heat exposure of the future **Fuel Farm, Administration Building**, and existing **Wind Tunnel** as long as they do not create glare issues for the Airport Traffic Control Tower.
- Establishing post-wildfire maintenance and cleaning plans for **air filtration systems** of Airport buildings can protect against clogged filters, which can lead to failing components.
- Adding climate change language to **tenant design guidelines** will ensure that tenants include climate considerations in facility planning and design.



Transportation Network Vulnerability Profile

Asset Overview

The transportation network on and surrounding the Airport includes freeways, parking lots, and primary/secondary roadways to access Airport terminals and parking lots. Roadway ownership is shared by the Airport Authority, City of San Diego, and the California Department of Transportation (Caltrans). Primary roadways consist of critical business and/or emergency access routes to Airport assets or public safety. Secondary roads provide alternative access routes to assets. Also included in Airport transportation is a trolley system operated by the Metropolitan Transit System. However, trolley stops were not included in the CRP, because they are not anticipated to be impacted and are not controlled by the Authority.

Roads and parking lots are mostly asphalt construction, with many of the newer roadways having curbs, gutters, and drainage systems that prolong their design life. The main vehicle types using the roadway network are standard vehicles (cars and light trucks) and container trucks. Roadway networks connect Airport terminals, parking, and on-site facilities. Parking lots are primarily used by Airport passengers and employees.

A list of the evaluated assets and their locations is included in Appendix A.

Exposure

- **SLR:** Several transportation routes are expected to be impacted by storm surge (rare flooding) by 1.6 feet of SLR (year 2050). Assets are not expected to be impacted by the maximum high tide (recurring flooding) until 4.9 feet of SLR (year 2100).
- **Precipitation:** Heavy rainfall already results in ponding on low-lying areas of the Airport property. Rising sea levels may prevent efficient stormwater drainage during rain events, increasing the areas subject to temporary flooding.
- **Extreme heat:** Extreme heat may result in deformation of access roadways and parking lots at the Airport. Although these assets will be exposed to the same amount of incoming solar radiation, the ground surface surrounding the roadways and parking lots is primarily dark in color²⁴. The Employee Parking Lot, RCC Parking Lot, RCC Shuttle Parking Lot, and Taxi Hold Lot are large, dark-surface areas made of asphalt, increasing their exposure to extreme heat.
- **Other:** Wildfires due to extended drought conditions in the open space surrounding San Diego are not expected to directly expose the Airport. However, winds may direct smoke from the fires to the Airport facilities.

Sensitivity

- **Flooding (SLR and precipitation):** Road and parking lot materials have a low sensitivity to temporary flooding. If roads are submerged by a depth of more than a few inches, vehicle movement may be impacted, causing delays or stopping traffic, but it should be possible to resume movement quickly after waters have receded. High-velocity flows of floodwater may cause erosion of the road foundation. Repeated temporary flooding may cause the roadway to begin to deteriorate.
- **Extreme heat:** Road and parking lot materials are sensitive to repeated prolonged periods of extreme heat. They are made of asphalt, which may soften and experience deformation, cracking, or splitting due to heat exposure. Although the roads and parking lots may still be usable once deformed, the need for repairs will increase in frequency²⁵.
- **Other:** Roadways and parking lots are not sensitive to exposure from wildfire smoke or drought.

Adaptive Capacity

- **Flooding (SLR and precipitation):** Road networks typically have a high adaptive capacity, due to the presence of alternative routes (redundancy). For example, Palm Street, Washington Street, and Sassafras Street provide alternative routes to the northern side of the Airport and Employee Parking Lot, thereby lowering the vulnerability of Admiral Boland Way. The southern side of the Airport has limited access redundancy and is the only point of entrance to the Airport terminals.

Raising roadways above the flood elevation, or relocating roadways, is anticipated to have a high cost to the extensive ancillary reconstruction required for connected facilities. There is also the added complexity that many of the roadways connecting to the Airport are not owned by the Airport Authority.

Parking lots have some inherent adaptive capacity. Although they are large assets, they can be regraded relatively easy to be above the floodplain. Regrading elevations has proven successful in protecting other Airport assets in the past. However, the parking lots have limited redundancy; there may be other lots on the Airport property, but those lots are likely to be in use and are not designed as backup parking areas.

- **Extreme heat:** Roadways and parking lots have a high adaptive capacity to extreme heat. Modifications can be applied using cool pavement techniques (which can be painted onto the existing surface) to reduce the absorption of solar radiation.

Consequences

- A loss of the access roadway network will result in disruption or closure of Airport operations. Without a means for passengers and employees to access terminals or cargo facilities, the Airport Authority will face economic losses.
- Repeated flooding or extreme heat events on the roadway and parking lot may cause surface degradation and necessitate resurfacing ahead of the general maintenance schedule.
- Flooding of Airport parking lots may limit the capacity of available parking at the Airport.
- Any disruptions to passenger travel will likely cause a negative customer experience, reflecting poorly on the Airport.

Future Development

- Air Lane and Winship Lane are also scheduled for removal as part of the proposed ADP improvements. Both roads are exposed to temporary flooding due to SLR plus storm surge in 2100, and precipitation flooding in 2050.
- Sections of the planned Dedicated On-Airport Access Roadway are expected to experience flooding from storm surge flooding and the maximum high tide due to SLR by 2100, and precipitation flooding by 2050.

Summary

- Airport operations could be severely compromised if transportation routes and parking lots are exposed to flood conditions or impacted by recurrent days of extreme heat. Protective measures should be established to ensure that transportation routes remain functional, or alternative routes should be planned.
- The following primary roadways and parking lots are exposed to flooding from heavy rain events under existing conditions, and improved drainage strategies should be considered to prevent ponding: **Admiral Boland Way, North Harbor Drive, Sassafras Street, Vehicle Service Road, Employee Lot, and Taxi Holding Lot.**
- The following primary roadways are exposed to storm surge by 2050: **Vehicle Service Road, North Harbor Drive, and West Laurel Street.** Protective strategies should be considered to maintain accessibility.
- Combined with SLR, primary roads exposed to heavy rainfall will expand to include the following: **McCain Road, Spruance Road, and West Laurel Street.** Long-term strategies should be considered to maintain future Airport access.
- The following parking lots are exposed to extreme heat and may increase the urban heat island effect at the Airport: the **Employee Lot, RCC Parking Lot, RCC Shuttle Lot, and Taxi Hold Area (this also includes the TNC Hold Lot and Cell Phone Lot).**
- Future development of **Terminal 1** as a part of the ADP presents opportunities to ensure that the design of parking lots and the dedicated On-Airport Access Roadway prevents these assets from being exposed to future SLR and/or heavy rain events.



Least Tern Nesting Habitat Vulnerability Profile

Asset Overview

The California least tern (*Sterna antillarum browni*), a subspecies of least tern that nests from April to September in Southern California, is a federally and state-listed endangered seabird. Although least tern prefer to nest in small, scattered clusters on flat sandy areas with minimal vegetation, colonies have nested since the 1970s on sand and gravel in the four oval areas between the runway and taxiways at the Airport. The Airport's ability to provide suitable nesting habitat, protection from predators, and access to foraging in nearby San Diego Bay makes it one of the most productive least tern nesting sites in Southern California.

The four ovals where least tern colonies nest (the habitat asset being evaluated in the CRP) are prohibited from development due to the bird's status as an endangered species. There are several other nesting areas around San Diego Bay and county, and the Airport Authority currently works closely with the United States Fish and Wildlife Service and the Zoological Society of San Diego to protect the California least tern and its habitat.

A list of the evaluated assets and their locations is included in Appendix A.

Exposure

- **SLR:** Least tern habitats are not expected to be impacted by storm surge (rare flooding) or the maximum high tide (recurring flooding) until 2.5 feet or 4.9 feet of SLR (year 2100).
- **Precipitation:** Heavy rainfall already results in ponding on low-lying areas of the Airport and prevents efficient stormwater drainage, increasing the areas subject to temporary flooding.
- **Extreme heat:** The least tern nesting habitats at the Airport are open, sandy areas that are unprotected from solar radiation. All nesting oval areas are also surrounded by dark-colored Airport surfaces that could increase local temperatures.
- **Other:** The least tern nesting habitats are open and exposed, and there may be an increase of predators during drought conditions when food sources for carnivores such as raptors, owls, crows, fox, raccoon, and coyote become limited elsewhere.

Sensitivity

- **Flooding (SLR and precipitation):** Habitats are sensitive to increased frequency, duration, and depth of flooding. The least tern habitat is naturally resilient to occasional storm surge events or flooding from heavy rainfall; however, recurring or extreme events may permanently damage or destroy the nesting grounds. An increase in rainfall could also increase vegetation growth, which will lower the suitability of the habitat for least tern nesting and may require more staff maintenance.
- **Extreme heat:** The least tern nesting habitat at the Airport is characterized by open sandy/gravel areas with little to no vegetation. The nesting areas are sensitive to extreme heat days, because of the vulnerability of young chicks that are able to regulate temperature effectively for only a short amount of time under a heat stress of 113°F²⁶.
- **Other:** Least tern habitats are not sensitive to drought or wildfire.

Adaptive Capacity

- **Flooding (SLR and precipitation):** The adaptive capacity of the least terns depends on their inherent resiliency to change, ability to recover from individual events, and ability to migrate in response to climate pressures; the location of nearby habitats that can serve as refugia. Least tern nesting habitats have limited adaptive capacity, specifically requiring a flat, sandy area in close proximity to San Diego Bay. There are several other suitable sites around San Diego Bay where least terns actively nest, but they are also likely to be vulnerable to future climate stressors, such as flooding.
- **Extreme heat:** Similar to flooding, least terns have a low adaptive capacity to extreme heat. The nesting birds prefer open sandy areas with little to no vegetation for their nesting habitat.

Consequences

- Loss of least tern habitat at the Airport will limit nesting options for the migrating seabird and may cause a decline in their local populations.
- As a breeding location for the least tern, the natural habitat offers unique bird watching opportunities for the public through tours at the Airport. Loss of the habitat will eliminate exposure of the public to local least tern colonies currently established on Airport property.
- Extreme heat days (over 113°F) may result in fatalities of unhatched or newly hatched least terns.
- If temporary flooding of habitat areas occurs during least tern nesting, it could result in the loss of newly hatched chicks or eggs, affecting future least tern populations.
- Drought conditions could result in an increase in predators of young chicks and eggs, if owls, raptors, and other animals adapt by modifying their food sources.
- Scouring from heavy rain events may cause erosion at least tern habitats.

Future Development

- Future development as a part of the ADP is not expected to affect existing least tern habitat in the Airport property.

Summary

- California least tern populations could be compromised if their nesting habitat at the Airport is impacted by flooding or extreme heat. Indirect impacts as a result of drought could increase predation on least tern chicks and their eggs. Protective measures should be taken to preserve the birds and their habitat locations, where possible.
- **Nesting Habitat Areas 1 and 4** were identified as exposed to flooding from heavy rain events, based on existing conditions.
- Combined SLR conditions in 2050 with heavy rain events may also cause ponding in **Nesting Habitat Areas 2 and 3**.
- Alternative nesting sites for the least tern exist around San Diego Bay, but may also be vulnerable to changing climate conditions.





02

Goals and Targets

The Authority has established goals and evaluation metrics as a driving framework for implementing climate adaptation into all levels of planning, operations, and development.

The Authority has identified three goals, with associated targets and metrics to form the foundation for the CRP. Airport stakeholders reviewed and provided feedback on the goals and related targets to ensure that achievement is feasible.

The goals represent where the Authority wants to be in the next 15 to 20 years, and will drive the implementation of the CRP initiatives. These goals are intended to minimize Airport disruptions due to future climate conditions, while also showcasing the Airport's efforts to serve as an example of climate change resilience in the aviation industry.

Although the goals are relatively broad in nature, they are supported by metrics, targets, and a timeframe for achievement, which allows for quantitative and practical management, as well as the ability to convey progress against the goals to a larger audience.

The goals and associated initiatives have a time horizon up to 2035; however, given the ongoing evolution of climate science regarding model improvement and enhanced understanding of climate system interdependencies, the CRP should be periodically reviewed and revised, as needed. For example, targets and timeframes could be subject to change if our understanding of the timing of future conditions improves.

Regulations may also play a role in accelerating progress on some of the goals in this Plan, given the increasingly proactive role of the State of California in addressing climate change impacts.

Table 4 presents the goals and metrics developed to implement the CRP. This table is intended to guide Authority staff with targets and a timeframe to help stay on track and accomplish the initiatives identified in the Plan.

Table 4: CRP Goals, Metrics, and Targets

Aspirational Goals	Metric(s)	Target(s)	Target Timeframe
1. Reduce risks associated with climate change to ensure business continuity, and to maintain a quality passenger experience	Reduction in number of negative impacts to facilities due to extreme weather events (e.g., flooding and heat)	Zero reports of negative impacts on Airport facilities due to flooding or extreme heat days (such as damage or closure)	By 2035
	Passenger comfort and access to Airport facilities during extreme weather events (e.g., flooding and heat)	50 percent fewer logged complaints from the public related to thermal comfort and flooding (create baseline first year)	By 2035
2. Integrate climate resilience into Airport operations and development decisions	Number of capital projects screened for climate resilience	100 percent of capital projects are screened	By end of 2020, then Ongoing
3. Provide regional and industry leadership in climate resilience	Number of projects planned and reviewed with regional partners	100 percent of applicable (i.e., climate-related) projects have stakeholder participation	Ongoing

Source: Developed as part of Airport Authority inter-department outreach, Fall 2018.



Goal #1: Reduce risks associated with climate change to ensure business continuity and to maintain a quality passenger experience

The Authority prioritizes maintaining a high-quality passenger experience at all times and under all conditions. As climate change begins to impact the Airport, the Authority will need to address risks to business continuity and quality of service.

The CRP outlines specific initiatives to reduce risk from flooding and extreme heat. The Authority will strive to maintain passenger access and comfort by minimizing delays and disruptions during extreme weather events, and by monitoring incidents, complaints, and delays or cancellations.

Enabling Factors	Potential Obstacles
• Maintaining business continuity is already a priority for all Airport operations. • State regulations increasingly require the incorporation of future climate considerations into project design. • The FAA increasingly sees climate resilience as a critical planning and operational issue.	• Ensuring climate resilience of capital projects may require additional funding to build to higher elevations or more robust design standards. • FAA and other air transportation infrastructure-focused design standards (e.g., cool roof/pavement technologies) must be considered when implementing climate resilience strategies.

Goal #2: Integrate climate resilience into Airport operations and development decisions

The Authority understands that climate resilient design and operations cannot be an afterthought and should be embedded at all levels of operations and development.

The CRP identifies a series of planning and design guidelines that are recommended to be updated to include the consideration of climate stressors. The CRP also recommends that the Authority formalize its commitment to climate resilience by pursuing resilience credits on relevant projects using third-party rating systems such as LEED or Envision, and calls for 100 percent of all future capital projects to be screened for climate resilience.

Enabling Factors	Potential Obstacles
• Development of new resilience standards to formalize resilience evaluation. • State regulations increasingly require the incorporation of future climate considerations into project design. • The FAA increasingly sees climate resilience as a critical planning and operational issue.	• Ingrained protocols and status quo. Uncertainty in climate projections makes developing specific design criteria challenging.

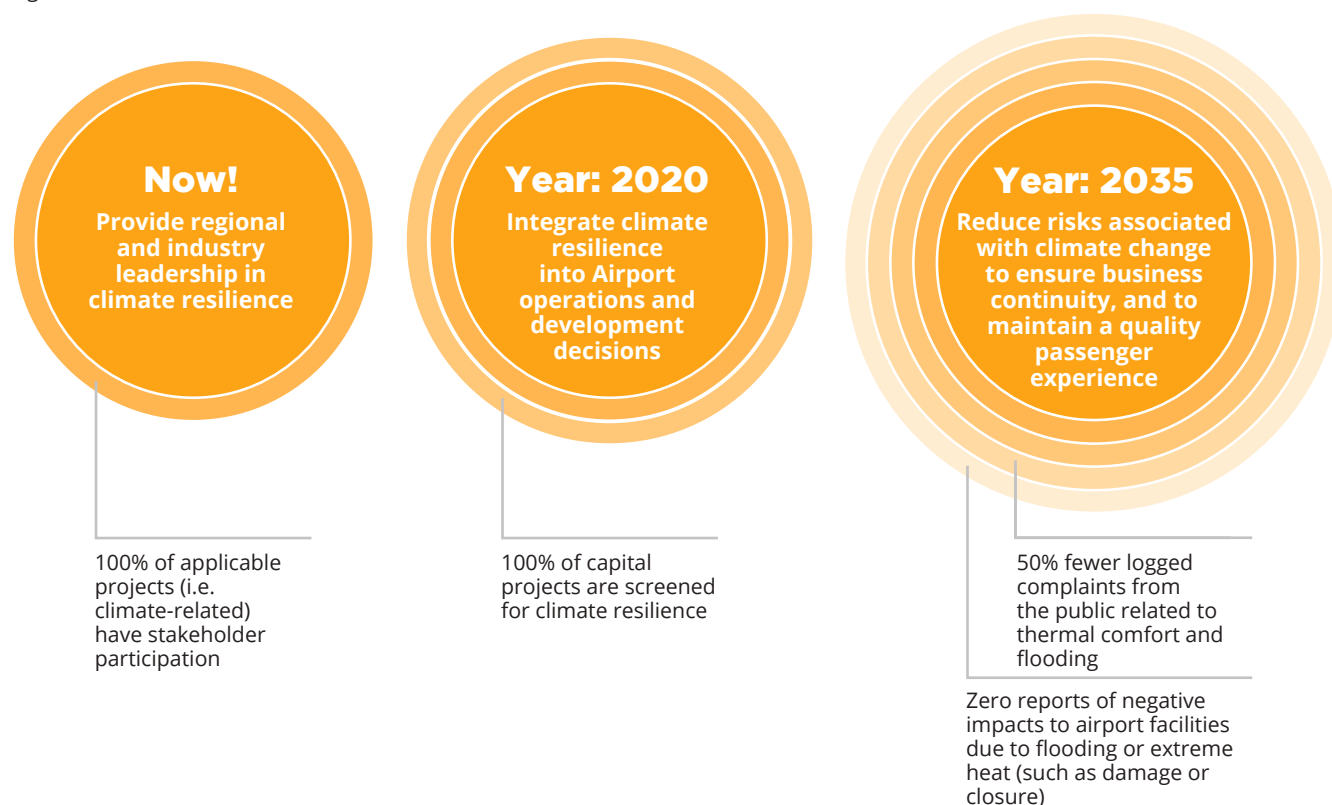
Goal #3: Provide regional and industry leadership in climate resilience

The Authority prides itself in being an industry leader in sustainability. Ensuring San Diego's climate resilience is a challenge that will require coordination and partnership across the public and private sectors and overlapping regional and local government entities.

As the gateway to San Diego for local residents and visitors alike, the Airport has a central role to play in engaging the public in conversations around the importance of climate change adaptation. Therefore, the CRP includes initiatives for stakeholder participation in specific projects, organization of outreach events, and participation in studies on emerging climate topics.

Enabling Factors	Potential Obstacles
• There is increased public interest in, and awareness of, the need for climate change adaptation. • Regional stakeholders have completed climate resilience studies. • Stakeholder networks in the region and industry are already established, recognized, and supported.	• Limited leaders or best practices have been documented in terms of climate resilience in the aviation industry, providing little opportunity for industry comparison. • Project-dedicated funding is potentially limited or sporadic.

Figure 14: Timeframe of Goals and Metrics







03

Climate Resilience Focus Areas and Initiatives

The Authority has established a comprehensive and progressive set of initiatives to increase climate resilience and maintain high-quality service under future conditions.

Supporting the achievement of the Authority’s goals are programmatic focus areas and a set of initiatives to advance progress for the CRP. The initiatives are supported by tactics, which are specific tasks to achieve an initiative. In other words, the initiatives describe the “what” and the tactics describe the “how.”

Focus areas and supporting initiatives and tactics were selected considering ongoing and future Airport design, planning, and operations, and were validated with feedback from Authority staff.

Developing Focus Areas to Advance Climate Resilience

Fundamental to the development of the CRP and organization of focus areas was a holistic approach to enhancing the climate resilience of existing and future Airport operations and assets. This meant not only considering the retrofit of individual assets to accommodate future climate conditions, but also integrating climate concerns into Airport operations and policy, and forthcoming communication to important stakeholders and the public.

Therefore, focus areas are categorized according to three approaches to climate adaptation: governance, awareness, and infrastructure.

1: Governance initiatives - how we manage climate adaptation: provide leadership and direction to design, plan, build, and operate Airport facilities in response to a changing climate.

2: Awareness initiatives - how we learn about climate change: highlight how to educate and learn about a changing climate to make more informed decisions that enhance the resilience of an asset or area.

3: Infrastructure initiatives - how we build with resilience: physical modifications to existing assets or future design elements that protect an asset from damage caused by future climate conditions.

Table 5: Adaptation Initiative Focus Area Descriptions

Focus Area	Description
Governance - How we manage climate adaptation	Policy, planning, design guidelines, regional collaboration, and industry leadership
Awareness - How we learn about climate change	Education, outreach, additional studies, future considerations, and ongoing monitoring
Infrastructure - How we build with resilience	Physical strategies to protect and accommodate

1: Governance - How we manage climate adaptation

Incorporating climate change into governance provides leadership and direction to design, plan, build, and operate Airport facilities in response to a changing climate. These initiatives address vulnerabilities through policies, plans, coordination, guidelines, and regulation. By addressing climate change in overarching policies and in technical guidelines, planners and designers consider adaptation strategies from the start of a project, advancing the long-term reduction of the Airport’s exposure to potential climate impacts.

Table 6: Governance initiatives and tactics

ID	Initiative	Tactics	Authority Lead Department	Time Horizon
G.1	Add climate resilience language to relevant policy and design guidelines	1. Update San Diego County Regional Airport Authority Policy: General Operations, Section 8.31, Sustainability	P&E	Near-Term
		2. Update ADP	P&E	Near-Term
		3. Update Airport Transit Plan	P&E	Mid-Term
		4. Update BMP Design Manual for Permanent Site Design and Storm Water Treatment	ADC	Mid-Term
		5. Update Sustainable Design and Construction Guidelines (in development)	ADC	Near-Term
		6. Update Tenant Improvement Guidelines (flood protection, cool roof, cool pavements, solar canopies, air filtration, low flow water fixtures, etc.)	A&T	Mid-Term
		7. Update Stormwater Capture and Reuse Plan	ADC	Near-Term
		8. Update CIP document	Finance and Risk Management	Mid-Term
G.2	Add climate resilience to business operation and maintenance plans and procedures	1. Update Business Continuity Plan	ASP	Mid-Term
		2. Update Employee Safety Plan	TCC	Mid-Term
		3. Develop system to notify Airport employees of poor air quality days	TCC	Mid-Term
		4. Establish building air filtration post-wildfire maintenance and cleaning plan	FMD	Mid-Term
G.3	Develop climate resilience guidance document for staff to identify applicable climate stressors and vulnerabilities		P&E	Mid-Term
G.4	Select a resilience lead for relevant Airport Working Groups to implement and/or oversee the initiatives and tactics provided in the CRP		P&E	Near-Term
G.5	Collaborate with external stakeholders	1. Discuss initiatives with regional agencies/organizations (City of San Diego, County of San Diego, Port of San Diego, Caltrans, SANDAG, San Diego Gas & Electric, utilities, etc.)	P&E	Mid-Term
		2. Discuss ongoing climate resiliency efforts with San Diego Regional Climate Collaborative	P&E	Mid-Term
		3. Discuss efforts with aviation industry leaders (AAAE, ACI-North America, ICAO, TRB, CAC, ACRP, etc.).	P&E	Mid-Term
		4. Support projects with local universities and research organizations	P&E	Mid-Term

Notes:

Near-Term – 0 to 5 Years
Mid-Term – 5 to 10 Years
Long-Term – 10+ Years

AAAE – American Association of Airport Executives
ACI – Airport Council International
ACRP – Airport Cooperative Research Program
ADC – Airport Design and Construction
ASP – Aviation Security and Public Safety
A&T – Airside and Terminal Operations
CAC – California Airports Council

CRP – Climate Resilience Plan
FMD – Facilities Management
ICAO – International Civil Aviation Organization
P&E – Planning and Environmental Affairs
TCC – Talent, Culture and Capability
TRB – Transportation Research Board

G.1: Add climate resilience language to policy and design guidelines

Adding climate change language to Authority policies and design guidelines ensures that potential climate impacts are considered during the planning and development of projects.

Updated policy language will frame the application of future climate conditions as an active task for the Authority, with a timetable for execution and continual data updates. Overarching documents, such as the Airport Transit Plan, are high-level and focus on the Authority's priorities.

Design guidelines, such as the BMP Design Manual for Permanent Site Design and Storm Water Treatment, are more detailed and are intended to provide guidance to technical practitioners. Updating design guidelines with adaptation strategies will ensure that projects are designed to function through the anticipated lifespan of the asset, even as the climate changes.

It is also recommended that existing Airport tenants be notified that they may be located in areas that are vulnerable to ponding due to heavy rain events, and encourage them to start considering how to implement adaptation strategies (e.g., sealing entryways or elevating sensitive property above the ground elevation) for their own assets.

G.2: Add climate resilience to business operation and maintenance plans and procedures

As the climate changes, the Authority will have to deal with changes in the frequency and intensity of climate stressors (e.g., more frequent extreme heat days, heavier rainfall events) that require different planning approaches or responses than are currently in place. Extreme events over short durations often result in significant consequences, and though the Authority may be prepared to respond to these events on an individual basis, the cumulative impact of more severe and frequent events may warrant a change in business practices. Although longer-term changes in annual or seasonal conditions cause less immediate impacts, their cumulative impacts over time may increase the cost of Airport operations (e.g., additional maintenance of facilities and roadways).

Incorporating climate change language and considerations in daily business operations and maintenance plans and programs will help the Authority become more resilient to unanticipated events. Adjustments to the maintenance programs—ranging from minor to major changes—can help minimize the current and future risks to effective business continuity. For example, the Authority has, as an ad hoc measure, provided facemasks to outdoor staff when air quality was poor during wildfire events. These events may become more frequent in the future and it may therefore be beneficial to develop a more detailed plan (storage of masks, when to distribute, to whom, etc.).

G.3: Develop climate resilience guidance for staff to identify applicable climate stressors and vulnerabilities

Climate change will affect many of the climate stressors that the Authority evaluates during the planning, design, construction, and maintenance of Airport assets. To maintain uninterrupted core services and functions, Authority staff will need to proactively address how projected changes in future conditions will affect Airport operations. As the Authority continues to assess its vulnerabilities and prepare for impacts of climate change on assets and operations, staff will be increasingly asked to lead, manage, or participate in information sharing and impact evaluations.

A climate resilience guidance document that provides an overview of the climate change adaptation process and criteria to identify climate vulnerabilities for Airport operations will provide staff with a baseline understanding and capability to support ongoing efforts. It is recommended that this type of "cheat sheet" include climate stressor considerations, future SLR maps, precipitation (flood event) maps, and a checklist to help staff determine whether proposed projects are vulnerable based on the lifespan of the proposed project.

G.4. Select a resilience lead for relevant Airport Working Groups to implement and/or oversee the initiatives and tactics provided in the CRP

Selection of a resilience lead for each relevant Airport Working Group will be critical for coordinating and implementing the developed CRP initiatives as a part of the Authority's ongoing efforts. The resilience leads will be responsible for preparing guidance, considering operational changes, and helping develop and acquire tools for climate adaptation planning. They may also coordinate efforts with local, state, and federal governments, along with representatives of the community, to better plan and mitigate risks associated with a changing climate at a regional level. The resilience lead could also help with prioritizing and tracking the implementation of the climate resiliency initiatives and tactics within the focus of their working group.

G.5. Collaborate with external stakeholders

Partnerships and collaboration with local and regional stakeholders, including the public, are necessary for effective climate change adaptation planning. Throughout the planning process, it is important to share information about impacts and risks, while providing opportunities for collaboration and co-creation of adaptation strategies.

Beginning in September 2018, the Authority participated in the San Diego Unified Port District Sea Level Rise Ad Hoc committee as a representative agency. The Ad Hoc committee, which included both agencies and businesses located on or dependent upon the resources of San Diego Bay, was formed to discuss issues related to potential SLR in San Diego Bay. Although the Ad Hoc committee has been dissolved, it is anticipated that the group will be reconstituted in 2019 in a different forum to continue to discuss issues raised during the committee meetings.

The Authority is also actively engaged with the San Diego Regional Climate Collaborative, a network focused on sharing expertise, leveraging resources, and advancing comprehensive solutions to facilitate climate change planning. The Authority continues to coordinate regularly to ensure that the Collaborative is aware of climate adaptation actions taking place at the Airport.

There are also opportunities to collaborate with other airports and aviation organizations (e.g., ACI-North America) that provide climate resilience BMPs and support industry leaders. Furthermore, there are researchers associated with universities and organizations that are interested in further understanding climate change impacts on aviation, such as fog patterns and Santa Ana wind changes.

Stakeholder engagement also allows for cost sharing to fund multi-objective, regional solutions that can be planned and implemented through a joint effort.

2: Awareness - How we learn about climate change

Informational initiatives will help the Authority make more informed decisions that enhance the resilience of an asset or area. Initiatives are based on increasing awareness around education, outreach, additional studies, and monitoring.

Table 7: Awareness Initiatives and Tactics

ID	Initiative	Tactics	Authority Lead Department	Time Horizon
A.1	Review CIP project list to determine whether any projects are vulnerable to climate stressors		P&E	Near-Term
A.2	Include climate adaptation implementation updates in the Authority's Sustainability Report		P&E	Mid-Term
A.3	Monitor climate science (SLR, precipitation, extreme heat, other) and reevaluate vulnerabilities and initiatives, as necessary		P&E	Mid-Term
A.4	Evaluate climate resilience through third-party rating systems	1. Complete the LEED Climate Resilience Screening Tool for projects pursuing LEED certification	P&E	Near-Term
		2. Evaluate climate resilience credits for projects pursuing LEED or Envision	ADC	Near-Term
		3. Complete a RELi pilot project (like LEED for resilience)	ADC	Near-Term
A.5	Complete studies to be better prepared and informed regarding a changing climate	1. Evaluate the most appropriate temporary flood protection options for storm surge (before I.3 is implemented)	FMD	Long-Term
		2. Review existing backup generators to determine climate resilience	FMD	Long-Term
		3. Monitor how least tern habitats react to the changing climate	P&E	Long-Term
A.6	Provide outreach opportunities to engage staff and the public	1. Include climate-related activities for kids (ACE or the Airport Explorers program)	MAS	Mid-Term
		2. Include signage to educate passengers on implemented climate-related measures (through new public service announcement contract)	MAS	Mid-Term
		3. Add climate resilience initiatives to the Airport's website	MAS	Mid-Term
		4. Add sustainability and climate resilience content to existing public tours	MAS	Mid-Term
		5. Create a climate resilience themed Arts Program	MAS	Mid-Term
		6. Add climate resilience to the Airport's monthly tenant safety meetings, which include tenants and airlines	P&E, A&T	Mid-Term

ID	Initiative	Tactics	Authority Lead Department	Time Horizon
A.7	Determine the real cost of climate adaptation and identify funding opportunities	1. Require existing and proposed projects that are vulnerable to climate stressors to determine the cost of inaction (include potential damage, repair, and operational disruptions based on project lifespan)	FMD	Mid-Term
		2. Require projects to complete alternatives analysis that considers climate resilience of different types of materials (such as asphalt versus concrete), where applicable	ADC	Mid-Term
		3. Monitor/track weather event impacts, damage sustained, length of disruption, and costs to repair to help justify future capital costs for climate adaptation	P&E	Mid-Term
		4. Monitor federal, state and regional agencies for potential funding opportunities to support implementation of climate adaptation strategies	P&E	Mid-Term
A.8	Coordinate with other plans in the Airport's environmental sustainability management program and developed for the SMP to highlight related resiliency strategies		P&E	Near-Term

Notes:

Near-Term – 0 to 5 Years

Mid-Term – 5 to 10 Years

Long-Term – 10+ Years

ADC – Airport Design and Construction

A&T – Airside and Terminal Operations

FMD – Facilities Management

LEED – Leadership in Energy and Environmental Design

MAS – Marketing & Air Service Development

P&E – Planning and Environmental Affairs

SLR – sea level rise

A.1 Review current CIP project list to determine whether any projects are vulnerable to climate stressors

CIP projects are major infrastructure projects that have been programmed for funding and are in the planning phase. With the increasing frequency and magnitude of climate change stressors, it is imperative that any climate vulnerabilities of CIP projects be identified and, if necessary, adaptation strategies are developed early on so that future assets are not compromised.

A.2. Include climate adaptation implementation updates in the Authority's Sustainability Report

The 2017 San Diego International Airport Sustainability Report highlights activities for the Authority's five strategic areas: community, customer, employee, financial, and operational. The report is used to assist the Authority in tracking and communicating performance across economic, social, and environmental areas. The report already includes a section titled "Working to Combat Climate Change," and it is recommended to highlight the implementation of climate resilience initiatives to keep the public engaged and informed.

A.3. Monitor climate science (SLR, precipitation, extreme heat, other) and reevaluate vulnerabilities and initiatives, as necessary

To ensure that the Authority's climate adaptation approach reflects the latest climate projections and adaptation best practices, it is recommended to monitor climate science and guidance updates, reevaluate the list of vulnerable assets, and update SLR modeling as necessary. For example, the recently released California Climate Change Assessment is revised every 3 to 4 years, as scientific updates become available.

Monitoring is a critical component of successful adaptation planning efforts. Consistent evaluation tracks evidence of climate change impacts on Airport assets, sustained damage, length of disruption, and costs to repair. Findings can be used to inform the timing and magnitude of modifications needed to further protect the asset or area from evolving climate conditions. The Authority should continue to work with other agencies in close proximity to San Diego Bay to develop a monitoring system that can provide real-time climate data and be used to indicate when specific adaptation strategies are needed.

A.4. Evaluate climate resilience through third-party rating systems

Third-party rating systems allow for the use of existing frameworks to determine building resilience and to identify resilient design and operation improvement opportunities.

The United States Green Building Council (USGBC), which oversees the LEED program, recognizes the importance of addressing climate change in the design of new buildings and has developed a free Excel-based "LEED Climate Resilience Screening Tool," which is helpful in understanding which sustainability strategies (credits) should be prioritized based on climate. The USGBC has also created several LEED pilot credits that focus specifically on resilient design (credits: IPp98-100).

The Institute for Sustainable Infrastructure, which oversees the ENVISION program, recognizes the importance of addressing climate change in the design of new infrastructure. The rating system includes an entire category titled "Climate and Risk" (credits: CR2.1-2.6).

Furthermore, there is a new resiliency rating system called RELi, which USGBC adopted in November 2017 and is currently updating (as of early 2019). Once finalized, this rating system may provide a structured methodology for incorporating climate resilience into projects from the planning phase all the way to maintenance and operations. It is recommended that the Authority participate in a RELi pilot study to determine whether (1) the rating system is appropriate for airports, (2) there are design considerations that should be included in projects, and (3) there are operational changes that would make the Airport more resilient.

A.5. Complete studies to be better prepared and informed regarding a changing climate

Focused studies can address existing data gaps or increase understanding of climate change impacts on a particular asset or specific area of the Airport. Results of the studies can be used to further the understanding of vulnerabilities and risks, to be better able to plan for future conditions, and to maintain business continuity at the Airport. The Authority has identified a preliminary list to include:

- Evaluate temporary flood protection options (e.g., sandbags, self-inflating sand-less bags, Aqua fence, or Tiger Dams) to determine which are most feasible based on a storage, cost, ease of deployment, and maintenance, to preemptively prepare for a future storm event.
- Update the backup generator study to determine the climate resilience of existing generators (e.g., elevation above flood levels, facilities they serve, capacity, and power source).
- Continue to monitor least tern habitats and climate impacts (e.g., exposure to extreme heat, storm surge, precipitation ponding, and drought effects).

A.6. Provide outreach opportunities to engage staff and the public

Throughout the climate change planning process, it is important to engage the public, share information about impacts and risks, and provide opportunities for the public to participate. Early and consistent engagement can impact people's ability and willingness to process, accept, and act on enhancing resilience to future climate conditions. Communication of impacts of climate change on the Airport and potential adaptation solutions can be optimized if early conversations are based on core community values such as preparedness, prevention, and responsibility. It is important that the stakeholders have the opportunity to provide input on potential alternatives being considered.

Opportunities include providing signage to educate passengers on the implementation of climate-related measures, engaging with children in programs such as ACE or Airport Explorers, adding climate initiatives on the website, adding climate resilience to public tours, adding climate resilience to the Authority's art program (public art installation, temporary exhibit, or performing art) to raise awareness, and highlighting climate resilience in existing tenant programs (e.g., Lindbergh Airport Manager's Committee).

A.7. Determine the real cost of climate adaptation and identify funding opportunities

To maintain public safety, protection of investments, and business continuity of the Airport during existing and future climate conditions, a major challenge will be securing access to capital for project development, such as the adaptation initiatives outlined in this Plan. However, the cost of inaction may exceed proactive protective measures should the Airport's assets be exposed to conditions that exceed their design criteria. Therefore, it is important to compare the cost of action versus inaction for ongoing and future projects and repairs at the Airport. Results of this comparison can be used to decide whether enhanced protection alternatives should be built into the project design to provide defense against future climate stressors and episodic events.

Equally important to identifying protection alternatives is regular monitoring for potential grant funding opportunities. Securing grant funding could assist in the execution of identified climate resilience strategies and will allow the Authority the flexibility to apply the strategies deemed necessary to protect Airport investments and maintain public safety.

Furthermore, it is recommended to begin tracking weather event impacts, damage sustained, length of disruption, and costs to repair, to help justify future capital costs to prevent future impacts (e.g., from floods or electricity outages).

A.8. Coordinate with other plans in the Airport's environmental sustainability management program and developed for the SMP to highlight related resiliency strategies

In addition to the CRP, the Authority is actively completing separate action plans for other focus areas at the Airport, including air quality and GHG emissions, transportation, waste, and protected habitat. Climate change will likely affect many aspects of Airport operations, including those covered in the Airport's environmental sustainability management program. Therefore, it will be beneficial to incorporate strategies that address climate change impacts directly into each plan included in the SMP, to enhance the future resilience of all entities managed by the Authority.

3: Infrastructure - How we build with resilience

Incorporating a consideration of future climate conditions into the retrofit of existing assets or design of future assets should provide protection from future climate change impacts. There are many possible approaches to incorporating climate adaptation into project design and planning, depending on the type of project and scale and scope of protection.

Table 8: Infrastructure Initiatives and Tactics

ID	Initiative	Tactics	Authority Lead Department	Time Horizon
I.1	Review current large-scale infrastructure projects and develop a list of recommended climate adaptation strategies	1. Develop criteria for Environmental Chapter of the ADP Programmatic Document	P&E	Near-Term
		2. Continue to coordinate with ADC for North Side Improvements	ADC	Near-Term
		3. Develop criteria for Rehabilitate Runway/Taxiways Project (energy-saving LED lights, runway pavement, and eight cross taxiways)	ADC	Mid-Term
		4. Continue to coordinate with ADC for South Side ASF development area	ADC	Near-Term
I.2	Reduce heat island effect by resurfacing dark rooftops and pavements with remaining lifespans of more than 10 years	1. Increase the roof's solar reflectance when reroofing occurs: Aboveground Fuel Facility	ADC	Mid-Term
		2. Increase the roof's solar reflectance when reroofing occurs: Airport Rescue and Fire Fighting Facility	ADC	Mid-Term
		3. Increase the roof's solar reflectance when reroofing occurs: Fuel Farm Administration Building	ADC	Mid-Term
		4. Increase the roof's solar reflectance when reroofing occurs	ADC	Mid-Term
		5. Increase the roof's solar reflectance when reroofing occurs: Taxi Hold Area building	FMD	Mid-Term
		6. Apply cool site coating: Airport Bus Storage Area	FMD	Mid-Term
		7. Apply cool site coating: RCC Parking Lot	FMD	Mid-Term
I.3	Raise shoreline to protect assets from SLR and storm surge	1. Coordinate with the Marine Corps and City of San Diego to design a flood protection barrier along Neville Road (outside Airport Authority jurisdiction) to reduce the risk of temporary flooding	P&E	Long-Term
		2. Coordinate with the Port and City of San Diego to raise the pedestrian/bicycle path along North Embarcadero, near the eastern end of North Harbor Drive (outside Airport Authority jurisdiction) to reduce the risk of temporary flooding	P&E	Long-Term

ID	Initiative	Tactics	Authority Lead Department	Time Horizon
I.4	Reduce stormwater runoff	1. Implement a Stormwater Capture and Reuse Plan	ADC	Near-Term
		2. When areas require repaving, use infiltration techniques: RCC Shuttle Parking Lot, Northside Boneyard, and Taxi Hold Lot	ADC	Long-Term
		3. Support the City of San Diego and San Diego Canyonlands' Maple Canyon restoration efforts to address downstream sedimentation and flooding issues at the intersection of Pacific Highway and Laurel Street (outside of Airport Authority jurisdiction)	P&E	Near-Term
I.5	Improve stormwater drainage in areas projected to experience ponding during existing conditions heavy rain events (24-hour + 100-year rain event)	1. Inspect all existing outfalls and verify placement and condition of back flow preventers; install or replace if missing or nonfunctional	FMD	Mid-Term
		2. Install a pump station at the outfalls identified in the Strategic Master Drainage Plan: Outfalls A, B1, B2, H, and J	ADC	Long-Term

Notes:

Near-Term – 0 to 5 Years

Mid-Term – 5 to 10 Years

Long-Term – 10+ Years

ADC – Airport Design and Construction

ASF – Airport Support Facilities

FMD – Facilities Management

P&E – Planning and Environmental Affairs

RCC – Rental Car Center

SLR – sea level rise

I.1. Review current large-scale infrastructure projects and develop a list of recommended climate adaptation strategies

To meet the Airport's sustainability goals, the Authority has already implemented several strategies (e.g., GreenBuild, and Water Capture and Reuse Plan) that also indirectly enhance the Airport's resilience to future climate conditions. Large-scale infrastructure projects currently underway at the Airport, including replacement of Terminal 1, airfield improvements, and a new on-Airport entry roadway as a part of the ADP, present the Authority with an immediate opportunity to apply additional adaptation strategies. Given the considerable capital costs of these projects and the fact that their operational lives will extend into the timeframe where climate change impacts will become more apparent, it is imperative that adaptation strategies be included in these projects before construction is completed.

I.2 Reduce heat island effect by resurfacing dark rooftops and pavements with remaining lifespans of more than 10 years

Resurfacing dark rooftops with white surfaces can cool roof surface temperatures by 50 to 65°F in peak summer weather²⁷. Light-colored roofs transfer less heat to the building, reducing the need for air conditioning to keep indoor air temperatures comfortable and reducing electrical demands during peak hours.

Similarly, applying light-colored coating to pavement can decrease surface and local air temperatures. For example, in the City of Los Angeles, test applications of a light gray coating called CoolSeal reduced pavement temperatures by 10°F. It is estimated that application to the greater city areas will reduce the urban heat island effect by 3°F²⁸. Reducing the urban heat island effect at the Airport will improve the passenger experience and employee safety during summer months.

Due to FAA regulations regarding reflectivity of surfaces near the runway, cool roof and pavement technologies may not be applicable everywhere.

I.3 Raise shoreline to protect assets from SLR and storm surge

There are currently two low areas of the shoreline surrounding the Airport: (1) west of Neville Road and (2) the eastern end of North Harbor Drive. These areas provide a flood pathway to Authority assets.

Neville Road: By year 2030 (0.8 foot of SLR), portions of the shoreline along Neville Road are projected to be temporarily overtopped by the storm surge 100-year event. By year 2050 (1.6 feet of SLR), the stretch of shoreline vulnerable to overtopping nearly doubles in length. Within the Airport boundary, the duration of the potential temporary flooding is projected to last for several hours, which is typical for large storm events.

Figure 15: West side flood depths: 100-year storm surge event + 0.8 foot of SLR (2030 – Rare Flooding)



Source: Flood layers edited from CoSMoS

Figure 16: West side flood depths: 100-year storm surge event + 1.6 feet of SLR (2050 – Rare Flooding)



Source: Flood layers edited from CoSMoS

North Harbor Drive: Overtopping is not expected to occur along the eastern side of the Airport until 2050 (1.6 feet of SLR), when the shoreline at the intersection of Laurel Street and North Harbor Drive and along the Coast Guard property would be exceeded during a 100-year storm surge event. Flooding in this area due to the 100-year storm surge also impacts Harbor Drive, which is a primary access route to the Airport. Within the Airport boundary, the duration of temporary flooding due to the 100-year storm surge is projected to last for 1 to 2 hours; however, Harbor Drive may experience flooding conditions for up to 16 hours.

Recurring flooding due to the maximum high tide is not projected to occur at the Airport until 2100, with 2.5 feet of SLR and storm surge events.

Figure 17: East side flood depths: 100-year storm surge event + 0.8 foot of SLR (2030 – Rare Flooding)



Source: Flood layers edited from CoSMoS

Figure 18: East side flood depths: 100-year storm surge event + 1.6 feet of SLR (2050 – Rare Flooding)



Source: Flood layers edited from CoSMoS

Protecting the shoreline using a barrier such as a seawall increases the coastal edge elevation and prevents rising sea levels from inundating low-lying areas. Barriers will need to be designed in such a way that they can be adapted, or raised, to account for further modifications that may be necessary to provide flood protection beyond 2050 as sea levels continue to rise.

Alternatively, it may be more cost-effective to first consider temporary flood barriers, such as a Tiger Dam or Aquafence (Figure 19). Tiger Dam is a temporary water-filled bladder technology that is reusable, stackable, and capable of creating an impervious barrier to protect against flooding long distances (several miles). Aquafence is a portable barrier constructed of marine-grade laminate panels to provide edge reinforcement flood protection.

Figure 19: Examples of temporary flood barriers: Tiger Dam (left) and Aquafence (right)



Because the low areas along the shoreline are outside of the Authority's jurisdiction, it will be important to coordinate with neighboring stakeholders, such as the Port District, Coast Guard, and City of San Diego, to erect a sea wall or elevate the shoreline to be capable of providing flood protection for all the vulnerable assets in the area.

Table 9 summarizes the low-lying areas of shoreline, exposure scenarios, and flood protection strategies. To include an additional factor of safety, an extra foot of freeboard is recommended to provide protection for storm conditions that could cause wave action to exceed the projected temporary flood levels.

Table 9: Details for Adaptation Strategy I.3.

Priority Areas to Raise Shoreline	Exposure Scenario	Strategy*
1. Shoreline West of Neville Road	0.8 foot + 100-year storm surge (2030)	Build ~700 linear feet of barrier (e.g., seawall and Tiger Dam) along Neville Road to provide temporary flood protection for at least 2 feet of flooding.
	1.6 feet + 100-year storm surge (2050)	Build ~1,300 linear feet of barrier (e.g., seawall and Tiger Dam) along Neville Road to provide temporary flood protection for at least 2 feet of flooding.
2. Intersection of Laurel go and North Harbor Drive	0.8 foot + 100-year storm surge (2030)	No flooding
		Elevate ~1,250 linear feet of pedestrian/bicycle path (currently a type of seawall) along the Embarcadero to provide flood protection for at least 1 foot of flooding. Also, build ~1,100 linear feet of a permanent barrier along the eastern side of the Coast Guard property, which could be a potential flood pathway, to provide temporary flood protection for at least 2 feet of flooding.

Note:

*Strategies are intended to provide a preliminary approach to flood protection. A concept design would need to be developed to further evaluate appropriate flood protection levels.

I.4 Reduce stormwater runoff

Changes in precipitation trends can increase stormwater runoff and can overwhelm the stormwater system, causing contaminant exposure to San Diego Bay and ponding in low-lying areas. A combination of several strategy types is often applied to reduce stormwater runoff, decrease peak flows, and or provide on-site treatment of excess stormwater. Common approaches to reducing stormwater runoff are discussed in the following paragraphs.

Stormwater capture and reuse. Capturing and reusing excess stormwater provides an opportunity to reduce stress on the stormwater system, lower the levels of contaminants being introduced to the watershed, and enhance water conservation capabilities. The process often entails storing stormwater runoff in a surface pond or underground catchment reservoir and then repurposing the water (e.g., irrigation).

The Authority is currently evaluating stormwater quality, quantity, reuse, and recommended infrastructure through a Stormwater Capture and Reuse Plan as a part of the Phase II Strategic Stormwater Master Plan. The primary goal of the Plan is to reduce concentrations of copper and zinc that are currently impacting San Diego Bay. However, capture and reuse of stormwater will also reduce frequency and magnitude of localized flooding and provide an alternative source of water for Airport operations during periods of drought.

Infiltration. Infiltration techniques (e.g., infiltration basins, permeable pavement, and bioretention-biofiltration) allow excess stormwater to flow through the pervious surface to reduce peak volumes of runoff. Once it flows through the surface, the runoff can be temporarily stored in a reservoir below until it infiltrates into underlying groundwater or is diverted and discharged through an underground drain. Infiltration techniques are effective for removing heavy metals, oils, and grease, providing an initial form of on-site runoff treatment. Application of infiltration techniques to paved areas of the Airport, such as parking lots, can help reduce localized flooding and pollutant runoff.

Infiltration should be designed in coordination with the stormwater capture and reuse plan to ensure applicability of placement in the overall strategy to reduce stormwater flooding on Airport property.

Restoration. Restoring the greater watershed will reduce the effects of sedimentation on downstream businesses, transportation, and infrastructure. For example, the San Diego Canyonlands team is currently in the process of stabilizing and restoring habitat to 3.66 acres of the City of San Diego Open Space Reserve to slow and infiltrate stormwater flows in Maple Canyon, west of Balboa Park and approximately 0.5 mile from the Airport. Increased sedimentation of the canyon during storm events has the potential to block storm drain inlets and cause flooding to areas adjacent to the Airport, which may impact Airport access.

I.5 Improve stormwater drainage in areas projected to experience ponding during existing conditions heavy rain events (24-hour + 100-year rain event)

Stormwater infrastructure at the Airport is designed to collect runoff, convey it away from development, and discharge it to San Diego Bay as quickly as possible through a series of outfalls. As sea levels rise, the efficiency of the gravity-driven stormwater system to discharge to the Bay will be reduced. When the elevation of outfalls are exceeded by Bay water levels, stormwater may become backed up, causing ponding and localized flooding at low-lying areas of the Airport. The outfalls and stormwater system may also provide a conduit through which elevated Bay waters could travel, exacerbating localized flooding with marine water.

Retrofitting stormwater outfalls with backflow-prevention devices and pumps can reduce or prevent the system from experiencing infiltration from high tides and storm events. Although the Airport is drained by numerous stormwater outfalls, the Authority only owns two of these structures, located in the Navy Channel west of the Airport. Therefore, it may be necessary to coordinate with neighboring agencies for the outfalls on which the Airport depends for efficient stormwater drainage, but which are not owned or maintained by the Authority.







04

Funding Sources and Strategy

The Authority has identified potential funding opportunities for resilience and climate adaptation initiatives.

Considering the challenges associated with raising capital for planning and project development, being able to identify and access available funding sources can further support successful implementation of the initiatives outlined in this Plan.

For this reason, the Authority will be regularly monitoring potential grant opportunities in addition to available funding put aside in the Airport's annual operating budget or for capital improvement projects detailed in the CIP and ADP.

Currently, there is a range of potential funding opportunities that could be pursued, both specific to the aviation industry and for climate change projects in general. Such funding is provided by the FAA, government agencies (local, regional, state, and federal), or other organizations. Table 10 highlights several programs and associations which may help fund initiatives identified in the CRP.

It should be noted that climate resilience is not always a separate project type, but instead a design requirement that will need to be planned and designed for in all capital projects going forward. However, it is currently unclear whether traditional sources of Airport capital funding will cover the additional costs of ensuring a project's resilience against future conditions.

The Authority will continue to track grant opportunities as they become available and/or identify synergy projects (such as a solar canopy project that produces energy and lowers ground temperatures).

Table 10: Potential Funding Sources to Implement CRP Strategies

Organization and/or Funding Program	Type	Program Summary	Potential Areas for Application
FAA - AIP	Grant Program	AIP provides grants to public agencies for the planning and development of public-use airports included in the NPIAS. Eligible projects include improvements related to enhancing airport safety, capacity, security, and environmental concerns.	This funding program could potentially be used to help fund a number of capital improvement projects, such as raising low areas of the shoreline or increasing the capacity of the stormwater drainage system as climate change impacts become a threat to Airport assets. It is currently unclear whether the FAA will fund additional project costs necessary to design for future conditions that exceed current design standards.
California State Lands Commission - AB 691 Grant Funding	Grant Program	AB 691 requires trustees of Public Trust Lands to prepare and submit an assessment by July 1, 2019, that includes a SLR vulnerability study, an estimate of potential costs of impacts, and proposed mitigation/adaptation measures. After these reports are submitted to the State Lands Commission and vulnerabilities are evaluated state-wide, it is anticipated that a grant program will be developed and made available to Public Lands trustees.	Although the requirements and amount of funding that will be available are currently unknown, the official AB 691 website includes a funding section that highlights several past or current grant programs. Although the Airport is likely not eligible for those programs currently listed, the Authority should continually monitor this web page and coordinate with the Port District in anticipation of dedicated AB 691 funding being announced.

Organization and/or Funding Program	Type	Program Summary	Potential Areas for Application
TRB - ACRP	Research Program	As a division of the National Academies, TRB promotes innovation and progress in transportation through research. Recipients receive research support by engaging in active TRB research that is documented in academic papers.	The Authority can use the program to complete further studies (e.g., evaluating the most appropriate system to provide protection against future extreme weather conditions). This grant will also be an opportunity to collaborate with universities or research organizations on climate resilience studies. The Authority has already participated in numerous ACRP studies, including those related to climate adaptation.
California State Coastal Conservancy – Proposition 1 Grants	Grant Program	The Coastal Conservancy is a nonregulatory agency that supports projects that protect coastal resources and increase opportunities for the public to enjoy the coast. The Coastal Conservancy provides Proposition 1 grant funding to implement multi-beneficial projects that enhance the shoreline, including improving wildlife habitat, improving water quality, preparing communities for impacts of climate change, and assisting the public in enjoying beaches.	The Authority could use Proposition 1 grants to fund the implementation of strategies to improve the stormwater drainage system, protect low-lying areas of the shoreline from SLR overtopping during storm events, or protect least tern nesting habitat.
California State Coastal Conservancy – Climate Ready Program	Grant Program	This grant program is part of California Climate Investments, a statewide program that invests Cap-and-Trade revenues in projects addressing climate change. The program seeks to support multi-benefit projects that use natural systems to assist communities in adapting to the impacts of climate change.	San Francisco International Airport received a grant through this program to prepare a SLR adaptation plan, including conceptual adaptation strategy development. It is anticipated that the Coastal Conservancy will continue to award grants on a yearly basis.
USDOT – TIFIA Program	Credit/Loans	Although airport infrastructure enhancements are generally not eligible for this credit program, it has been used by both Chicago O'Hare and Los Angeles International to fund surface transportation improvements and connections. The current federal administration's Legislative Outline for Rebuilding Infrastructure in America advocates for this program to be extended to ports and airports, although this would require congressional approval.	The City of San Diego could use this credit assistance (loan) program to pay for upfront costs of the modification or protection of access roads. If federal legislation modifies eligibility for airports, the Authority could pursue this credit program for a wider array of infrastructure improvements.

Organization and/or Funding Program	Type	Program Summary	Potential Areas for Application
Private Activity Bonds	Bonds	Private activity bonds are issued by state or local governments on behalf of a project's private developers. Private activity bonds allow a private entity to benefit from federal income tax exemptions.	Twenty-seven private activities are eligible for private activity bonds, including a number of adaptation and resilience-oriented projects, such as sewage facilities, solid waste disposal facilities, and qualified green building and sustainable design projects.
Resiliency Bonds	Bonds	Resilience bonds are an innovative new financial mechanism, currently being explored by reinsurers, that modifies traditional catastrophe bonds to provide insurance savings that can be captured as rebates to invest in resilient infrastructure projects. Resiliency bonds are expected to become more widely available because traditional catastrophe bonds are becoming a financial risk to insurers due to increased frequency of natural disasters.	When the Authority purchases a multi-year parametric catastrophe bond, the insurer takes the expected impact of planned adaptive infrastructure into account and lowers the premium the Authority has to pay. These savings would then be used to fund the adaptive infrastructure.
FEMA Hazard Mitigation Assistance Programs	Grant Program	FEMA offers three basic hazard mitigation assistance programs: Pre-Disaster Mitigation, Flood Mitigation Assistance, and Hazard Mitigation Grants Program. A 4:1 federal-to-local match is required.	The Pre-Disaster Mitigation grant could be used to prepare for flooding by elevating low areas of shoreline or improving stormwater drainage capacity. However, grant applicants must be local governments who have completed a FEMA-approved hazard mitigation plan, so any funding received by the Airport would have to be part of a larger grant with the City of San Diego as the applicant. Neither the Authority nor the Port would be eligible to be a direct applicant.
California Infrastructure and Economic Development Bank - Infrastructure State Revolving Fund Program	Credit/Loans	State Revolving Funds provide low-interest loans for investment in infrastructure (e.g., water, power, and communications facilities,).	The Authority could use funds from this program to finance strategies that increase the capacity of the stormwater system.
USACE - Technical Assistance	Technical Assistance	The USACE budget supports the administration's core mission areas—commercial navigation, reducing risks from riverine flooding and flooding along coastlines, and restoring aquatic ecosystems.	USACE support could be used to elevate low-lying areas of the shoreline around the Airport. This would require the Authority to partner with the Marine Corps, as well as the Port and the City of San Diego.

Organization and/or Funding Program	Type	Program Summary	Potential Areas for Application
California State Water Resources Control Board Water Recycling Funding Program	Grant Program	The Water Recycling Funding Program provides grants to assist public agencies with the construction of pilot projects for beneficial use of treated municipal wastewater. Applicants must demonstrate that the pilot project will develop new information that does not currently exist regarding technologies to increase potable water reuse through new innovations.	The Authority is eligible to apply funding for this program toward their water capture and reuse program.
SANDAG TransNet Environmental Mitigation Grant Program	Grant Program	This grant provides funding for land management and acquisition programs that mitigate habitat impacts for regional transportation projects. The funding is tied to mitigation requirements and the environmental clearance approval process for projects outlined in the Regional Transportation Plan.	Funds from this grant could be applied to the future conditions adaptation of the least tern habitat on the Airport property as a way to offset disturbance caused by regional transportation projects. It is currently unclear whether projects that reduce risk to least tern habitat under future conditions would qualify as mitigating current disturbance.
United States Department of Housing and Urban Development Community Development Block Grant-Disaster Recovery Program	Grant Program	The Department of Housing and Urban Development provides flexible grants to help cities, counties, and states recover from Presidentially declared disasters, especially in low-income areas, subject to availability of supplemental appropriations. Most recently, the US Virgin Islands received \$23 million for ports and airports enhancements as part of a \$243-million recovery plan in the wake of Hurricanes Irma and Maria.	Although this source cannot be used for preemptive adaptation, in the event of a natural disaster, the Authority could pursue funds for rebuilding Airport infrastructure as portion of a larger long-term recovery plan for the city and/or region.

Notes:

AB – Assembly Bill

ACRP – Airport Cooperative Research Program

AIP – Airport Improvement Program

FAA – Federal Aviation Administration

FEMA – Federal Emergency Management Agency

NPIAS – National Plan of Integrated Airport Systems

TIFIA – Transportation Infrastructure - Finance and Innovation Act

TRB – Transportation Research Board

USACE – United States Army Corps of Engineers

USDOT – United States Department of Transportation

In addition to the funding sources listed in Table 10, it is recommended that the Authority consider the following internal revenue streams to generate additional funding necessary to implement adaptation strategies, as applicable based on the project and eligibility requirements:

- Customer facility charges
- Airport revenue bonds
- Passenger facility charges.





05

Implementation and Monitoring Program

The CRP offers a roadmap as a starting point to ensure that the goals are tracked over time and ultimately achieved.

The CRP is an operational plan for the Authority to enhance climate resilience, ensure business continuity of Airport operations during future conditions, and provide climate resilience leadership in the aviation industry.

The Plan is intended to be a hands-on management tool that will be regularly referenced and updated as needed, or required. This will be particularly important as climate science models and future projections evolve and improve. Robust supporting tools and resources are needed for the implementation plan to serve its primary purpose—to support, enable, and monitor progress toward meeting the established goals and targets.

The Authority is already working on initiatives that are part of the CRP, and tracks several metrics. Ongoing efforts include the following:

- Collaboration with regional stakeholders regarding climate resilience
- Passenger access and comfort to and within Airport facilities
- Tracking flood event impacts on operations

The Authority will identify a champion, or staff lead, to coordinate the efforts to implement the climate resilience initiatives and track progress and achievements.

Although the Authority has already taken important steps toward preparing for future climate conditions, there is still room for this Plan to evolve over time. Table 11 presents the draft goals and metrics developed to implement the Authority's CRP. Table 11 is intended to guide staff with targets, timeframe, and monitoring procedure/method to stay on track and accomplish the initiatives identified in the Plan. Progress towards the achievement of goals and implementation of climate resilience strategies is communicated in the Authority's annual Sustainability Report. This report is available online at sustain.san.org.

Table 11: Airport CRP Goals with Timeframe

Goals	Metric(s)	Aspirational Target(s)	Target Timeframe
1. Reduce risks associated with climate change to ensure business continuity, and to maintain a quality passenger experience	Reduction in number of negative impacts to facilities due to extreme weather events (e.g., flooding and heat)	Zero reports of negative impacts to airport facilities due to flooding or extreme heat days (such as damage or closure)	By 2035
	Passenger comfort and access to Airport facilities during extreme weather events (e.g., flooding and heat)	50 percent fewer logged complaints from the public related to thermal comfort and flooding (create baseline first year)	By 2035
2. Integrate climate resilience into Airport operations and development decisions	Number of capital projects screened for climate resilience	100 percent of capital projects are screened	By end of 2020, then Ongoing
3. Provide regional and industry leadership in climate resilience	Number of projects planned and reviewed with regional partners	100 percent of applicable (i.e., climate-related) projects have stakeholder participation	Ongoing

Source: Developed as part of Airport Authority inter-department outreach, Fall 2018.



Ticketing



Gates 20-51

TERMINAL

2



List of Acronyms

AAAE	American Association of Airport Executives
AB	Assembly Bill
ACA	Airport Carbon Accreditation Program
ACI	Airport Council International
ACRP	Airport Cooperative Research Program
ADC	Airport Design and Construction
ADP	Airport Development Plan
AIP	Airport Improvement Program
Airport	San Diego International Airport
AOA	airport operations area
ASP	Aviation Security and Public Safety
ARFF	Aircraft Rescue and Firefighting
ASF	Airport Support Facilities
ASOS	Automated Surface Observation System
A&T	Airside and Terminal Operations
Authority	San Diego County Regional Airport Authority
BMP	Best Management Practice
CAC	California Airports Council
Caltrans	California Department of Transportation
CIP	Capital Improvement Program (or Plan)
CoSMoS	Coastal Storm Modeling System
CRP	Climate Resilience Plan
°F	Fahrenheit
FAA	Federal Aviation Administration
FBO	Fixed-Base Operator
FEMA	Federal Emergency Management Agency
GCM	General Circulation Model
GHG	greenhouse gas
ICAO	International Civil Aviation Organization
NPIAS	National Plan of Integrated Airport Systems
OPC	Ocean Protection Council
P&E	Planning and Environmental Affairs

Plan	Climate Resilience Plan
PV	photovoltaic
RCC	Rental Car Center
RCP	Representative Concentration Pathway
SLR	sea level rise
SMP	Sustainability Management Plan
TCC	Talent, Culture and Capability
TIFIA	Transportation Infrastructure - Finance and Innovation Act
TRB	Transportation Research Board
USACE	United States Army Corps of Engineers
USDOT	United States Department of Transportation
USGBC	United States Green Building Council

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Aviation Security & Public Safety (ASP)

Facilities Management (FMD)

Ground Transportation (GT)

Planning and Environmental Affairs (P&E)

Revenue Generation & Partnership Development (RGP)

Terminal and Tenants Department (Terminal Operations)

Endnotes

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Appendices

APPENDIX A: Inventory



Existing Assets	
Map Label	Asset Name
Airside Facilities	
1	Aboveground Fuel Facility
4	Airport Rescue and Fire Fighting Facility (ARFF)
9	Emergency Manual Arrest System (EMAS)
10	FBO Building Landmark
11	FBO Hanger 1
12	FBO Hanger 2
13	FBO Hanger 3
14	FBO Hanger 4
15	FBO Hanger 5
16	FedEx Admin./Sorting Facilities and Apron
17	Fixed Based Operator (FBO) Apron
18	Gate P-01
19	Gate P-01B
20	Gate P-02
21	Gate P-04B
22	Gate P-08
23	Gate P-13
24	Gate P-18A
25	Gate P-18B
26	Gate P-24
27	Gate P-25
28	Gate P-30
29	Gate VSR01
30	Gate VSR02
31	Gate P-14
32	Glide Slope Antenna (GSA)
35	Northside Boneyard
41	Waste Sorting/Compacting Facilities
42	Remain Overnight Parking (RON)
43	Runway Visual Range (RWY 27 end)
44	Runway Visual Range (RWY 9 end)
75	Localizer Antenna RWY 9
76	Localizer Antenna RWY 27
77	Airport Shuttle Storage Area
78	Central Receiving and Distribution Center (CRDC)
79	Approach Lighting System (RWY 9)
80	DME Antenna (Runway 27)
81	AOA Fence
82	Air Traffic Control Tower
83	Fuel Farm Administration Buildings
94	Terminal 2 FIS Expansion
97	Existing Triturator
99	Automate Surface Observation System (ASOS)
106	DME Antenna (RWY 9)
107	Localizer Transmitter Building
108	Airport Administration Office (former Commuter Terminal)
G-1	Generator 1
G-2	Generator 2
G-3	Generator 3
G-4	Generator 4
G-5	Generator 5
G-16	Generator 16
G-17	Generator 17
G-18	Generator 18
G-19	Generator 19
Landside Facilities	
8	Electric Vault
33	Maintenance Storage Area
38	Pump Station
39	Rental Car Center (RCC) Shuttle Parking
40	RCC Parking
84	Rental Car Center (RCC)
85	Wind Tunnel
86	World Trade Center
87	USO/PMO
88	Switchgear Building
90	HVAC CUP
95	FMD Offices
96	Terminal 1
100	Economy Lot Solar Array
101	NTC Solar Array
G-8	Generator 8
G-9	Generator 9

Existing Assets (cont.)	
Map Label	Asset Name
G-10	Generator 10
G-11	Generator 11
G-12	Generator 12
G-13	Generator 13
G-14	Generator 14
G-15	Generator 15
Tenant Facilities	
3	Air Freight Terminal
5	DHL Admin./Sorting Facilities
6	DHL Apron/Parking
70	UPS Admin./Sorting Facilities and Apron
91	American Airlines Maintenance Facility
98	ASIG Maintenance Facility
109	Airport Cargo Administration Building
Transportation	
2	Admiral Boland Way
7	Economy Lot
34	McCain Road
36	Pacific Highway
37	North Harbor Drive
45	Sassafras St
46	Spruance at McCain
47	Taxi Holding Lot
71	Vehicle Service Road (VSR)
72	Washington St
73	West Laurel St
74	Terminal Link Rd
92	Palm St
93	Terminal 2 Parking Plaza
Runways and Taxiways	
48	Taxiway B
49	Taxiway B1
50	Taxiway B4
51	Taxiway B5
52	Taxiway B6
53	Taxiway B9
54	Taxiway B10
55	Taxiway B8
56	Taxiway B7
57	Taxiway C
58	Taxiway C6
59	Taxiway C5
60	Taxiway C4
61	Taxiway C3
62	Taxiway C2
63	Taxiway C1
64	Taxiway D
65	Taxiway F
66	Taxiway H
67	Taxiway J
68	Terminal 2W
69	Terminal 2E
Least Tern Nesting Habitat	
102	Least Tern Habitat 2
103	Least Tern Habitat 3
104	Least Tern Habitat 4
105	Least Tern Habitat 1
Future Assets	
Map Label	Future Asset Name
A	Future Automated Surface Observation System (ASOS)
B	Future: Air Cargo Facilities
C	Future: On Airport Access Road
D	Future: West Fuel Rack
E	Future: Facilities Management Dept. Campus
F	Future: Airline Support Facilities (South)
G	Future: Solid Waste Facility
H	Future: Runway Visual Range (RWY 27 end)
I	Future: Terminal 1
J	Future: Triturator
K	Future: Remote Passenger Processing Center
L	Future: Terminal 1 Parking
M	Future: RON Parking
N	Future: Taxiway A
O	Future: Airport Fueling Operations Facility





Legend

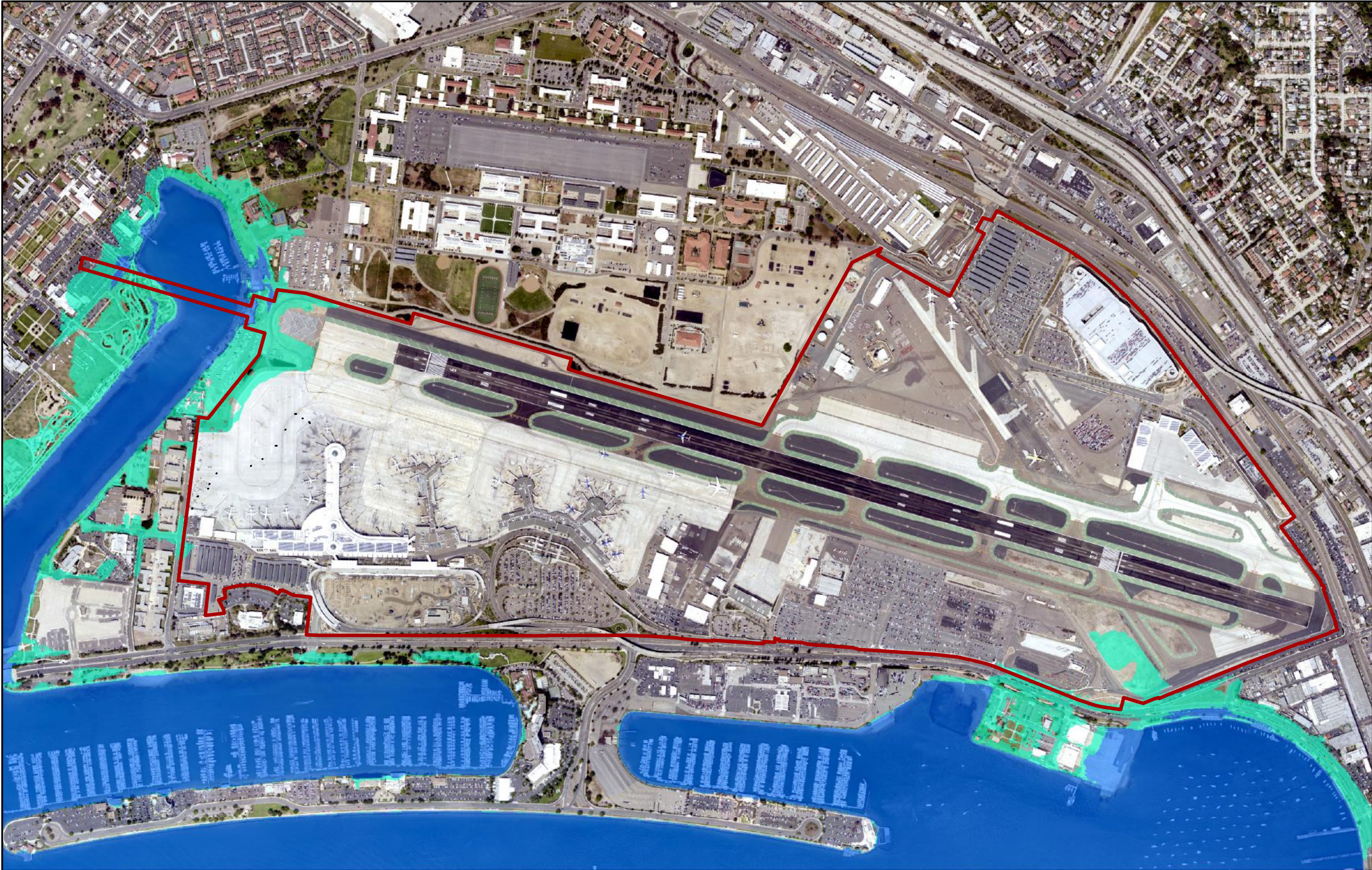
- Airport Boundary
- Maximum High Tide* (Recurring Flooding)
- 100-Year Storm Surge (Rare Flooding)

San Diego International Airport 1.6 ft Sea Level Rise: Year 2050 (5% Probability SLR Meets or Exceeds)



*OCOF denotes this as Average Conditions, which is equivalent to a king tide event, and is expected to occur 1-3 times per year.

Data Sources: Cosmos; San Diego Airport; AECOM; SANDAG & SanGIS.



Legend

- Airport Boundary
- Maximum High Tide* (Recurring Flooding)
- 100-Year Storm Surge (Rare Flooding)

San Diego International Airport
2.5 ft Sea Level Rise: Year 2100
(50% Probability SLR Meets or Exceeds)

0 500 1,000 2,000 Feet

N

*OCOF denotes this as Average Conditions, which is equivalent to a king tide event, and is expected to occur 1-3 times per year. Data Sources: Cosmos; San Diego Airport; AECOM; SANDAG & SanGIS.



Legend

- Airport Boundary
- Maximum High Tide* (Recurring Flooding)
- 100-Year Storm Surge (Rare Flooding)

San Diego International Airport
4.9 ft Sea Level Rise: Year 2100
 (5% Probability SLR Meets or Exceeds)



*OCOF denotes this as Average Conditions, which is equivalent to a king tide event, and is expected to occur 1-3 times per year.

Data Sources: Cosmos; San Diego Airport; AECOM; SANDAG & SanGIS.

APPENDIX C: Detailed Climate Science

Stressor	Mid-Century		End-of-Century		Source	Additional notes	SD, 2050 Is Calling ¹
	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5			
Precipitation Annual precipitation	9.8” (2035-2064)	9.5” (2035-2064)	9.5” (2070-2099)	10.2” (2070-2099)	Cal-Adapt, 2018	1970-1999: 10.7”	16% fewer rainy days; 8% more rainfall during the biggest rainstorms
Annual wet days ² & max daily prec.	77 days; 1.5”	72 days; 1.5”	75 days; 1.6”	70 days; 1.7”	ICLEI Hazard Mitigation Plan report, 2014	1970-1999: 85 days; 1.5” SAN Drainage Study assumes precipitation patterns do not change between now and year 2050.	
Heat Annual days of extreme heat	7 days (2035-2064)	10 days (2035-2064)	10 days (2070-2099)	26 days (2070-2099)	Cal-Adapt, 2018	1970-1999: 4 days	Average temperature will be 4.8 degrees F above a 1985 baseline
Maximum duration of heat waves by year	2.7 days (2035-2064)	3.5 days (2035-2064)	3.9 days(2070-2090)	6.4 days (2070-2099)	Cal-Adapt, 2018	1970-1999: 2.1 days	
SLR³	Data not available from sources chosen	0.9-2.8’ (2050)	Data not available from sources chosen	2.6-10.2’ (2100)	Ocean Protection Council, 2018	Sea level rise is relative to the year 2000 SAN Drainage Study evaluated 24” SLR for year 2050 with 5-yr, 10-yr, 50-yr, 100-yr storm with 24hr precipitation	5-24”, with 24” representing a combination of SLR + high tide and storm surge
Wildfire Annual mean hectares burned	8,044 hectares (2035-2064)	7,949 hectares (2035-2064)	7,891 hectares (2070-2099)	7,527 hectares (2070-2099)	Cal-Adapt, 2018	1970-1999: 7,297 annual mean hectares Variables chosen: Central (medium) population growth scenario; the region chosen is the Integrated Water Management Region for San Diego since poor visibility from wildfires in the region are likely more pressing for SAN than wildfires in its immediate vicinity.	Cedar (2003) and Witch Creek (2007) fires caused over \$4.5 billion in damages.
Other: Wind (related to storm events)	No information to suggest increased intensity of storm events						
Fog	No clear information on changes to fog patterns						
Other impacts							
Water Supply (related to increased temp and changes in precipitation)	20% reduction by 2050 (based on snowpack reductions in San Diego water sources)				ICLEI Hazard Mitigation Plan report, 2014		

¹ It should be noted that the methodologies and sources underpinning the projections in this report are not stated.
² A wet day is defined as any day with 1 mm or more of precipitation.
³ It should be noted that the OPC guidance document does not use RCP 4.5 but rather RCP 2.6. Therefore, the values provided in the cell for 2100 and RCP 4.5 actually relate to 2100 and RCP 2.6. Please see the full table of projections below, as well as tables representing what the Port of San Diego is currently using in its SLR adaptation study.

