
PULGAS CREEK WATERSHED CLIMATE CHANGE DRAFT MEMORANDUM

RE: City of San Carlos Pulgas Creek Watershed – DRAFT Climate Change Memorandum

Date: July 12, 2024

To: Grace Le, P.E./City of San Carlos

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1. Introduction

The City of San Carlos (City) is highly vulnerable to the effects of climate change including rising sea levels, shallow groundwater rising, and increased precipitation intensity. Most specifically the lower portion of the City along the bayshore is most prone to flooding and coastal erosion increasing the risk to life, safety, and critical infrastructure. The San Mateo County's Sea Level Rise Vulnerability Assessment (San Mateo County, 2018) was finalized in 2018, highlighting San Mateo County as the most vulnerable county in California to sea level rise in terms of property value at risk. Modeling results from the vulnerability assessment showed potential flooding of the 1% (100 - Year FEMA Base Flood Elevation) plus 6.6 feet of sea level rise for a high-end scenario (Figure 1).

In 2019, the San Mateo County Board of Supervisors approved a Sea Level Rise Policy (SLR Policy) for County-Owned Assets. The SLR Policy requires that sea level rise is considered in all County-Owned and operated assets, design, construction projects, leases, and property acquisitions and dispositions. These projects must also consider local and regional sea level rise adaptation and flood mitigation projects that could reduce impacts on County-owned assets prior to developing plans to modify existing facilities. Acquisitions that are exempt from this policy: tax default properties; property condemned by the County for roads, sewers, and utilities; right of way, public utility easements; conservation easements; and public service easements. This policy does not apply to private development or development by other public entities.

In addition to the SLR policy, the San Mateo County Flood and Sea Level Rise Resiliency District (OneShoreline) began operating in 2020. OneShoreline is an independent government agency that addresses the design and building process to combat sea level rise, working with cities and developers to build resiliency through planning and coordinating efforts for multijurisdictional flood mitigation projects.

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The SLR Policy and OneShoreline serve to coordinate countywide efforts for a solution to implement adaptive measures and policies to combat climate change. Utilizing the SLR Policy and OneShoreline efforts, this memorandum serves as a roadmap to implement existing policy recommendations to address sea level rise, shallow groundwater, and increased precipitation intensity and frequency.

2. Future Conditions

San Carlos is also expected to experience many impacts of climate changes such as sea level rise, droughts, extreme heat, inland flooding, landslide and debris flow, severe storms, and wildfires, groundwater level rise. Although all effects of climate change will impact the watershed, some of the key future conditions that will impact the watershed are sea level rise, severe storms, and groundwater level rise. The impacts of climate change can cause more frequent landslides, flooding, and even impact water quality.

Sea Level Rise

Higher temperatures also cause ocean water levels to rise, causing further rising sea levels along the bayshore. This is a gradual process that can take place over the span of years or decades. Eventually, sea level may increase enough to permanently flood low-lying areas in the eastern part of San Carlos or just adjacent to San Carlos. Many of the tidal marshes in eastern San Carlos are also expected to convert to another habitat type, a process called “downshifting,” which will lead to different plant and animal species, and some features of wetlands may be altered or lost. The rise in sea levels can also result in larger flooding and would make the shoreline more susceptible to flooding even during normal rain conditions.

With sea level rise, the flooding risk will start to impact infrastructure that impacts not only San Carlos, but also the regionally, such as Highway 101, the San Carlos Airport, and the Silicon Valley Clean Water Wastewater Treatment Plant (SVCWWTP) in Redwood City that are all within low-lying areas of the San Francisco Bay. Flooding of major infrastructure could cause many disruptions to the community, including temporary closures of roads and businesses. Although the SVCWWTP is located within Redwood City, it is infrastructure that treats all of San Carlos’ sanitary sewer. The SVCWWTP is highly vulnerable to the impacts of sea level rise due to most of the components being at or below seal level. If there was a failure of the levee system that currently protects SVCWWTP, there could be major consequences, especially since there is no other facility that treats untreated wastewater in the service area.

Precipitation Intensity and Frequency

During recent years, California has experienced a series of dry years followed by the wettest weeks on record. San Mateo County was severely impacted by two atmospheric river storms that occurred between 2022 and 2023 and brought 75% of all precipitation for the year, resulting in major flooding. Future storm intensity and frequency are likely to become more common in the future, causing more frequent flooding events, especially in more low-lying areas in combination with the tides from the San Francisco Bay.

In the past years, flooding was mostly observed in the lower portion of San Carlos. In the most recent flooding years, the City has experienced floods in the upper portion towards the western hills comprising of parks and less developed spaces. Based on a comparison of flood events to hourly precipitation intensity data from the California Data Exchange Center (CDEC) station, the Pulgas Creek Watershed appears to be at risk of flooding for storm intensities at approximately 0.75 inches per hour. Climate change can affect the intensity and frequency of precipitation. The potential impacts of more severe and more frequent storms include soil erosion leading to more frequent landslides and an increase in sedimentation due to heavy precipitation. The increase in



Sea Level Rise Vulnerability Assessment, <i>County of San Mateo</i>	The County of San Mateo developed a baseline Sea Level Rise Risk Assessment of County-owned and operated assets and leased facilities.
San Mateo County Sea Level Rise Project Database, <i>County of San Mateo</i>	The county will develop and maintain a database to track major existing and planned sea level rise adaptation projects along the San Mateo County Bay and coast shorelines. The database will include a project overview, area covered, and proposed elevation. The database will be updated on an annual basis. The database will be used to inform the initial assessments at all County owned and operated assets and for new projects as they are developed. This will ensure that any site-based adaptation options within the Monitoring and Adaptation Plans will be designed with regional shoreline approaches considered. The County will collaborate with regional collaboratives or agencies to ensure the accuracy of the information in the database.
Map of Future Conditions, <i>OneShoreline</i>	OneShoreline has developed an interactive online map to accompany the OneShoreline Planning Policy Guidance document. The map illustrates the Bay Protection Standard and the proposed boundaries of the Overlay Districts for sea level rise and shallow groundwater rise recommended by OneShoreline.

Using the tools and resources above, the City should transition to climate-adaptive and prepared facilities by assessing new projects, monitoring existing facilities, tracking progress, and finding opportunities for restoration.

Adoption of a Sea Level Rise District

As climate changes and sea levels rise, San Carlos will likely experience more instances of flooding. It is crucial to identify the sea level rise area in San Carlos and ensure that the residents, businesses, and critical infrastructure are protected. By identifying the sea level rise area in San Carlos, the City can assess existing and new projects in the sea level rise area and further monitor sea level rise impacts to each location. This plan recommends that the City consider developing and adopting a Sea Level Rise Overlay District (SLR District) or Zone with associated land use regulations for site planning and minimum construction elevations that support appropriate mitigation and adaption in response to sea level rise.

Policies with the associated District or Zone could include:

- SLR District boundaries and map



sedimentation can lead to reducing capacity in storm drains or even blocking drainage systems, causing flooding, not only in the low-lying areas of San Carlos, but also in the upper watershed.

When precipitation-related flooding occurs at the same time as high tides, flooding can be more extreme since storm drain infrastructure and creeks would likely be at full capacity. Sea level rise will only elevate the risk of these type of events occurring.

Groundwater Level Rise

Shallow groundwater levels are predicted to rise, creating numerous potential impacts on the community, including buoyancy, seepage, infiltration, liquefaction, corrosion, and contaminant mobilization hazards. Initial studies identify shallow groundwater rise as one of the most consequential impacts of sea level rise. The best available science indicates that low-lying communities located inland from the Bay could experience flooding impacts from rising shallow groundwater long before sea level rise overtops the Bay shoreline. Even prior to experiencing flood impacts from rising shallow groundwater, rising groundwater levels will put existing infrastructure at risk, including increased infiltration into storm drain and sewer pipes, destabilizing foundations, and flooding within basements or other below-grade structures.

Groundwater level rise could contribute to contaminant mobilization. As groundwater levels rise within contaminated sites, there is an increased risk that contaminants from the site could be released and conveyed within groundwater. The contaminant mobilization can also impact how the mitigation and risk management of a contaminated site may perform, posing a risk to the surrounding environment.

3. Recommendations

To address future climate change, policies, standards, and guidelines will need to be created. Consistent with the County of San Mateo and OneShoreline goals, recommendations were developed to:

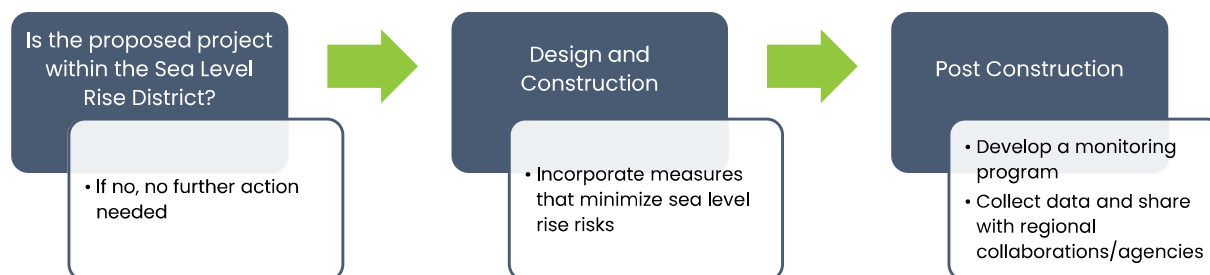
- Protect new and/or substantial construction from future conditions by incorporating climate science into land use planning, development review process, and policy change.
- Protect existing critical facilities and public infrastructure from future conditions.
- Prioritize natural-based infrastructure to the greatest extent feasible when adapting to future conditions.
- Develop regionally coordinated sea level adaptation measures and programs with regional stakeholders.

Infrastructure Evaluation

To implement the goals, OneShoreline has developed a number of resources and tools to address sea level rise concerns. The City is encouraged to utilize the tools and resources below when developing new infrastructure projects or evaluating existing infrastructure and facilities.

Tool Name	Description
Sea Level Rise Mapping Tool, <i>County of San Mateo</i>	San Mateo County established a GIS-based sea level rise map layer for use by departments in determining sea level rise inundation areas during the design process. The GIS map layer can be found in the County website and will be updated as needed.

- Development standards including floor elevation, floodproofing critical equipment, buffer zones from the San Francisco Bay Shoreline and creeks
- Additional Requirements for shoreline barriers
- Increasing the required amount of stormwater retention on-site
- Requiring fees to fund the restoration of creeks



As part of the SLR District, the City should utilize the boundaries to assess existing and new projects in the sea level rise area and continue to monitor the impacts of sea level rise in each location. All new projects should be screened using the SLR District boundaries and map to determine whether a project falls within the sea level rise inundation area as outlined in Figure 1. The first step would be a preliminary assessment to include initial consultation on sea level rise risks and potential protection provided by existing flood mitigation projects. Should the project lie outside the outlined inundation area, the assessment can stop here.

Once determined that the project or infrastructure lies within the inundation area, the City may want to increase the scale of new facilities for locations that are at high risk and sensitive or if the building is a critical facility that must maintain operations and access during flood events. It is also critical for developers and landowners to provide adequate space for future infrastructure development and the land rights to use that space to build resilience in communities. Additionally, new facility projects funded by the City shall be sited, designed, constructed, and adaptively managed to minimize sea level rise risks over the life of the project.

For existing facilities and infrastructure within the SLR District, it is recommended that continual monitoring occurs by an oversight department. The oversight department should work to establish thresholds and triggers for monitoring purposes. In the event of subsequent flooding, the oversight department should closely monitor to find the facilities and/or infrastructure that are being affected the most by such events. Data collected from monitoring the performance of existing facilities can help inform the City which facilities need to be prioritized and upgraded to adapt to SLR.

Ongoing capital projects located in areas of risk from sea level rise beyond what will be protected through local or regional planned sea level rise adaptation projects will incorporate an assessment of sea level rise risk and development of monitoring and adaptation strategies as needed.

As part of the Sea Level Rise Overlay District, OneShoreline recommended two different elevation standards in response to sea level rise: Sea Level Rise (SLR)- Base Flood Elevation (BFE) and the Bay Protection Standard. The

SLR-BFE is the recommended lowest floor elevation for a building located within the Sea Level Rise Overlay District. The SLR-BFE is three feet above the project site's BFE and can be found using the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map (FIRM) at the time of project application.

The Bay Protection Standard is the minimum, post-settlement elevation required at the top of any shoreline along the San Francisco Bay Shoreline. The Bay Protection Standard is based on the Base Flood Elevation (BFE) and adding a 6-foot buffer to accommodate for an increase in hazards as sea levels rise. The Bay Protection Standard will vary depending on the location of interest. The Coastal BFE can be found on the FEMA and is based on the Zone VE elevations where available; otherwise, Zone AE elevations can be used.

In addition to adopting a Sea Level Rise Overlay District, it is recommended that the City continue to participate in and develop countywide strategies to update development standards and ordinances for at-risk areas. The City should also continue to collect relevant information and should share it with the regional collaboratives and/or agencies responsible for implementing sea level rise or flood mitigation projects.

Adoption of a Shallow Groundwater Rise Overlay District

As climate changes and sea levels rise, groundwater is also anticipated to also rise. Groundwater rise can create numerous potential impacts on the community. Groundwater rise can contribute to inland flooding in low-lying coastal communities. It is necessary to identify the groundwater rise in San Carlos and ensure that the residents, businesses, and critical infrastructure are protected. This plan recommends that the City consider developing and adopting a Shallow Groundwater Rise Overlay District or Zone with associated land use regulations for site planning and standards that support appropriate mitigation and adaption in response to shallow groundwater. Policies with the associated District or Zone could include:

- Assessment of the project's vulnerability to shallow groundwater rise
- Incorporation of project measures that monitor and mitigate shallow groundwater impacts

The City should adopt a Shallow Groundwater Rise Overlay District and develop a policy that includes:

- Shallow Groundwater Overlay boundaries and map (Figure 2)
- Development standards to address future groundwater conditions, contaminated sites, liquefaction, below-grade structures and utilities, and roadway subgrades
- Requirement of additional performance standards such as geotechnical data collection, topographic data collection, vulnerability assessment and mitigation and real estate disclosure of hazards.

One requirement that the City could implement within the Shallow Groundwater Rise District, is to have developments install permanent monitoring wells onsite, especially if the site has known contaminated soils. As part of their development agreement, the owners would be required to monitor groundwater levels and test for levels of contamination. The City could utilize the information for city-wide purposes as well as ensure that owner-led mitigation efforts continue if groundwater rises or contamination levels change.

The policy should be consistent with OneShoreline Planning Policy Guidance. It is also recommended that the City should continue to participate in and develop countywide strategies to update development standards and ordinances for at-risk areas of shallow groundwater rise. The City should also continue to collect relevant information and should share it with the regional collaboratives and/or agencies as standards are being developed for shallow groundwater rise areas.

FEMA CRS Study

San Carlos participates in the FEMA Community Rating System (CRS). CRS is a voluntary incentive program that recognizes and encourages community floodplain management practices that exceed the requirements of the National Flood Insurance Program (NFIP). CRS credits community efforts to surpass the minimum requirements and awards reduced flood insurance premiums for the community's property owners. San Carlos should continue to participate in CRS and study the full extent of the program's benefits, which reduce flood insurance premiums and can help save lives and property when a flood occurs. The goals of the CRS are to

- (1) reduce and avoid flooding damage to insurable property,
- (2) strengthen and support the insurance aspects of the NFIP, and
- (3) foster comprehensive floodplain management.

Through CRS, flood insurance premium discounts can range from 5% to 45% and are discounted in increments of 5%. CRS rates communities based on the amount of credit points received, ranging anywhere between 0 to 4,500+ credit points. Class 10 is a community not participating and receives no discount up to the highest community rating. Class 1 community receives a 45% premium discount. San Carlos has participated in CRS since 2013 and is currently a Class 9 community, with a total of 717 credit points resulting in a 5% premium discount. In order for San Carlos to elevate to a Class 8 community, San Carlos will need to gain an additional 283 credit points. As a Class 8 community, San Carlos would obtain a 10% premium discount.

San Carlos can increase CRS credits through 19 creditable activities that can be organized under four categories

- (1) public information,
- (2) mapping and regulations,
- (3) flood damage reduction, and
- (4) warning and response.

CRS provides opportunities to exceed the minimum requirements of NFIP, which could lead to further flood insurance premium rate discounts. Looking at the Mapping and Regulations category, it includes five subcategories that a community could earn credit, including:

- (1) Flood Hazard Mapping
- (2) Open Space Preservation
- (3) Higher Regulatory Standards
- (4) Flood Data Maintenance
- (5) Stormwater Management

If credits are not already earned in these categories, the City could look into creating policies related to Stormwater Management. The Stormwater Management category includes stormwater management regulations (SMR) that allow for a maximum of 380 credits. The SMR includes policies related to:

- Size of Development (SZ): Credit is based on the minimum size of the area that is required to comply with stormwater management standards.
- Design Storms (DS): Credit is based on what design storm the community is using in the regulations.

- Low-Impact Development (LID): Credit is provided only if the community's stormwater management ordinance requires the use of LID.
- Public Maintenance (PUB): Credit is provided when the owners of all new facilities are required to allow the community to inspect stormwater management as necessary and perform the required maintenance.

In addition to the SMR, there is also a Watershed Master Plan (WMP) element that allows a community to earn a maximum of 315 credit points. The WMP credit is earned if the community implements the stormwater management regulations through an adopted watershed master plan. To receive credit points, the WMP must, at a minimum, address future development within the watershed and the impact of flows during a 100-year event. Credit is also provided for a WMP that

- evaluate future conditions and long-duration storms,
- impact of sea level rise and climate change,
- identify the wetlands and natural areas,
- address the protection of natural channels, and
- provide a dedicated funding source for implementing the plan.

This plan recommends that San Carlos conduct a study to understand the cost-benefit of implementing policies that surpass NFIP to improve the CRS score resulting in reduced flood fees. The study should investigate CRS policy recommendations, in all 19 creditable activities, to understand the associated CRS credit that allow for premium discounts. In addition, the study should help guide and establish policies that will continue to help prepare the community for future flood events.

Opportunities for Restoration

Public parks and open spaces typically present opportunities for the restoration of natural ecological systems or processes. Restoring natural ecological systems is an option to reduce vulnerability to climate change-related hazards while increasing the long-term adaptive capacity of coastal and inland areas. These open spaces could be tidal marshes, parks, rain gardens, and urban tree canopies and can include implementing projects such as revegetation. However, it also includes engineered systems and practices that use or mimic natural processes to conserve ecosystem values and functions, such as Low Impact Designs (LID) and detention basins. Further discussion of proposed capital improvement projects in public parks and open spaces can be found in the Flood Mitigation Evaluation Memorandum (WRA, 2024).

4. Conclusion

In order to combat the future climate change impacts, the City should consider implementing more than one of the proposed solutions to provide the best opportunities for the City in the future. Impacts of climate change, such as sea level rise, rise of groundwater levels, and increased precipitation frequency and intensity will need to be addressed not only by the City, but also with the neighboring cities and County of San Mateo. To address climate change, collaboration with adjacent cities and agencies is necessary and the City should continue to collect relevant information and should share it with the regional collaboratives and/or agencies responsible for implementing flood mitigation projects.

5. References



City of San Carlos. (2021). Climate Mitigation and Adaptation Plan.

County of San Mateo. (2018). Sea Level Rise Policy for County-Owned Assets.

Community Rating System. FEMA.gov. (2024). <https://www.fema.gov/floodplain-management/community-rating-system>

OneShoreline. (2023). Planning Policy Guidance to Protect and Enhance Bay Shoreline Areas of San Mateo County

WRA, Inc. (2024). Flood Mitigation Evaluation Memorandum.



FIGURES

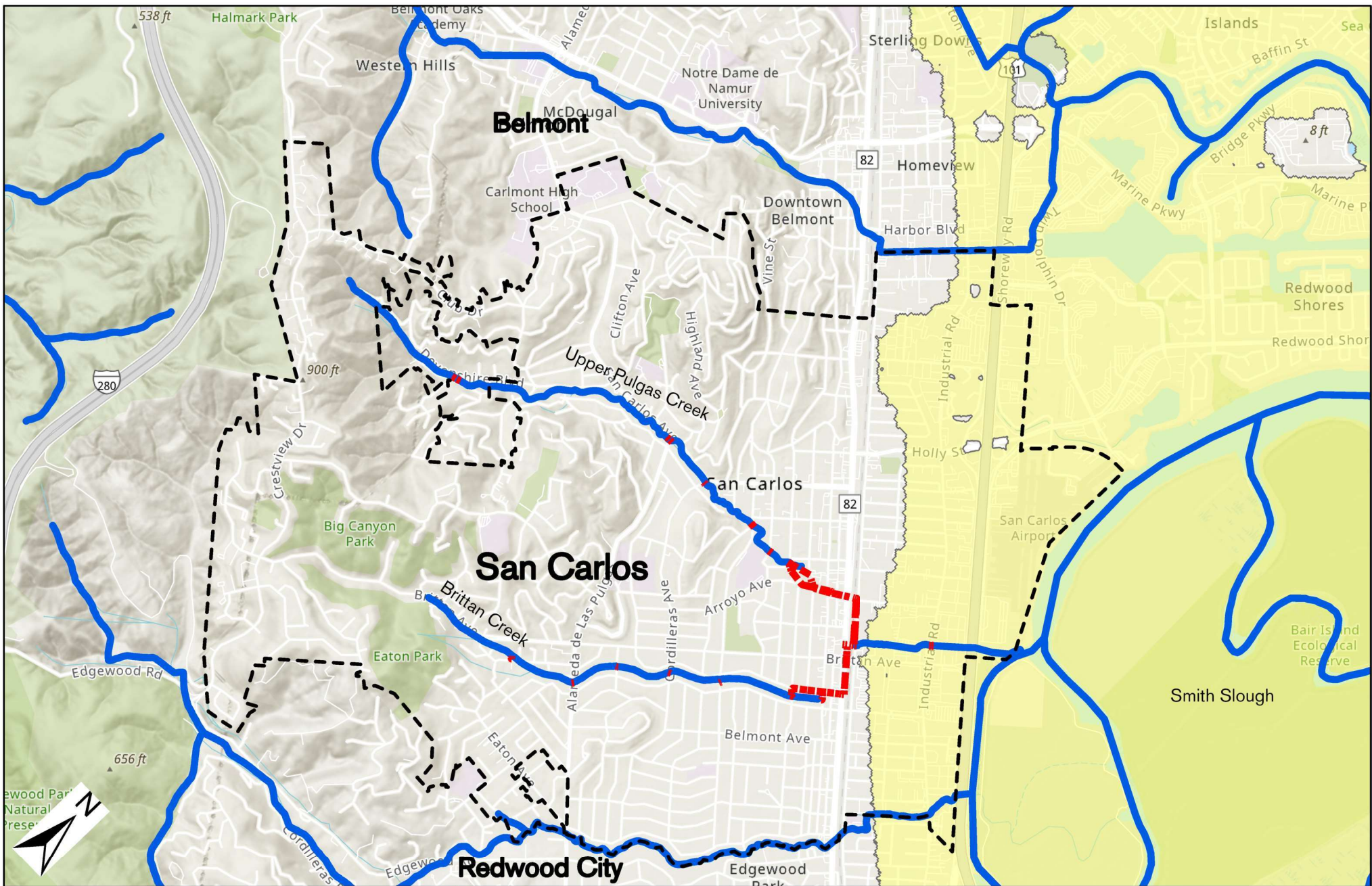


Figure 1
Sea Level Rise District Overlay
San Carlos

Legend

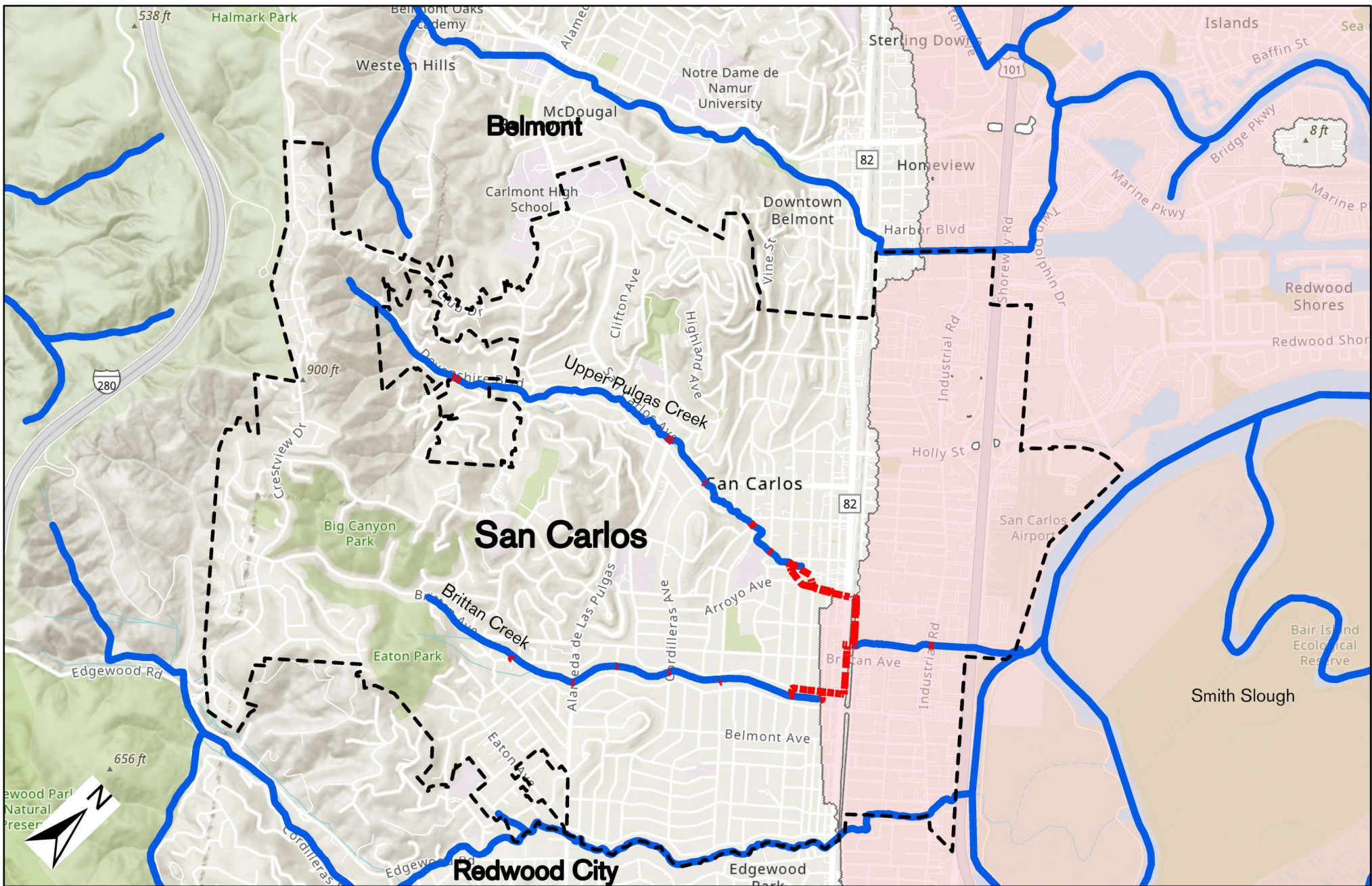
- San Carlos City Limit
- Sea Level Rise
- Streams
- Closed Creek Channel



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Figure 2
Shallow Groundwater Rise District Overlay
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Legend

- San Carlos City Limit
- Streams
- Closed Creek Channel
- Shallow Groundwater Rise