C/CAG

CITY/COUNTY ASSOCIATION OF GOVERNMENTS
OF SAN MATEO COUNTY

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Millbrae ▪ Pacifica ▪ Portola Valley ▪ Redwood City ▪ San Bruno ▪ San Carlos ▪ San Mateo ▪ San Mateo County ▪ South San Francisco ▪ Woodside

STORMWATER (NPDES) COMMITTEE AGENDA

2:30 PM, Thursday, May 21, 2020

On March 17, 2020, the Governor issued Executive Order N-29-20 suspending certain provisions of the Ralph M. Brown Act in order to allow for local legislative bodies to conduct their meetings telephonically or by other electronic means. Pursuant to the Shelter-in-Place Orders issued by the San Mateo County Health Officer and the Governor, and the CDC's social distancing guidelines, which discourage large public gatherings, C/CAG meetings will be conducted via remote conferencing. Members of the public may observe or participate in the meeting remotely via one of the options below.

Join by Zoom: https://us02web.zoom.us/j/87220365321?pwd=clFNNDlGcDBWbTNscU5qVXhFZmFHZz09
Meeting ID: 872 2036 5321

Join by Phone: 1 (669) 900-6833
Meeting ID: 872 2036 5321

Persons who wish to address the C/CAG Board on an item to be considered at this meeting, or on items not on this agenda, are asked to submit written comments to rbogert@smcgov.org. Oral public comments will also be accepted during the meeting through Zoom. Please see instructions for written and spoken public comments at the end of this agenda.

1.	Public comment on items not on the Agenda (presentations limited to three minutes).	Breault	No materials
2.	Stormwater Issues from May C/CAG Board meeting: • Approve Reso 20-21authorizing application of funds for a California Resilience Challenge grant administered by the Area Business Council for $97,671 to develop six schoolyard greening concepts under C/CAG's proposed Resilient San Carlos Schoolyards Project and further authorizing the C/CAG Executive Director to negotiate and execute a grant agreement and other documentation for receiving the funds.	Fabry	No materials
3.	ACTION – Review and approve April 16, 2020 Stormwater Committee minutes	Fabry	Pages 1-5
4.	INFORMATION – Announcements on stormwater issues • COVID Response Letter to Regional Water Board • Funding Opportunities • Regional Projects Update • Other	Fabry	Verbal, no materials
5.	INFORMATION – Receive an update on C/CAG's Sustainable Streets Master Plan.	Fabry	7-46
6.	INFORMATION – Receive update on budget assumptions for the Fiscal Year 2020-21 Countywide Water Pollution Prevention Program budget.	Fabry	47
7.	Regional Board Report	Mumley	No Materials
8.	Executive Director's Report	Wong	No Materials
9.	Member Reports	All	No Materials
10.	Adjourn		

PUBLIC NOTICING: All notices of C/CAG regular Board meetings, standing committee meetings, and special meetings will be posted at the San Mateo County Transit District Office, 1250 San Carlos Ave., San Carlos, CA, and on C/CAG's website at: http://www.ccag.ca.gov.

PUBLIC RECORDS: Public records that relate to any item on the open session agenda for a regular Board meeting, standing committee meeting, or special meeting are available for public inspection. Those public records that are distributed less than 72 hours prior to a regular Board meeting are available for public inspection at the same time they are distributed to all members, or a majority of the members, of the Board. The Board has designated the City/County Association of Governments of San Mateo County (C/CAG), located at 555 County Center, 5th Floor, Redwood City, CA 94063, for the purpose of making public records available for inspection. Such public records are also available on C/CAG's website at: http://www.ccag.ca.gov. Please note that C/CAG's office is temporarily closed to the public; please contact Mima Guilles at (650) 599-1406 to arrange for inspection of public records.

PUBLIC PARTICIPATION DURING VIDEOCONFERENCE MEETINGS: Persons with disabilities who require auxiliary aids or services to participate in this meeting should contact Mima Guilles at (650) 599-1406, five working days prior to the meeting date.

Written comments should be emailed in advance of the meeting. Please read the following instructions carefully:

1. Your written comment should be emailed to rbogert@smcgov.org.
2. Your email should include the specific agenda item on which you are commenting or note that your comment concerns an item that is not on the agenda.
3. Members of the public are limited to one comment per agenda item.
4. The length of the emailed comment should be commensurate with the two minutes customarily allowed for verbal comments, which is approximately 250-300 words.
5. If your emailed comment is received at least 2 hours prior to the meeting, it will be provided to the C/CAG Committee members, made publicly available on the C/CAG website along with the agenda, and read aloud by C/CAG staff during the meeting. We cannot guarantee that emails received less than 2 hours before the meeting will be read during the meeting, but such emails will be included in the administrative record of the meeting.

Oral comments will be accepted during the meeting through Zoom. Please read the following instructions carefully:

1. The Stormwater Committee meeting may be accessed through Zoom at the online location indicated at the top of this agenda.
2. You may download the Zoom client or connect to the meeting using an internet browser. If using your browser, make sure you are using a current, up-to-date browser: Chrome 30+, Firefox 27+, Microsoft Edge 12+, Safari 7+. Certain functionality may be disabled in older browsers including Internet Explorer.
3. You will be asked to enter an email address and name. We request that you identify yourself by your name as this will be visible online and will be used to notify you that it is your turn to speak.
4. When C/CAG Staff or the Committee Chair/Vice-Chair call for the item on which you wish to speak, click on "raise hand." C/CAG staff will activate and unmute speakers in turn. Speakers will be notified shortly before they are called on to speak.
5. When called, please limit your remarks to the time allotted.

If you have any questions about this agenda, please contact C/CAG staff:

Program Manager: Matthew Fabry (650) 599-1419
Administrative Assistant: Mima Guilles (650) 599-1406

C/CAG AGENDA REPORT

Date: May 21, 2020

To: Stormwater Committee

From: Matthew Fabry, Program Manager

Subject: Review and approve April 16, 2020 Stormwater Committee meeting minutes.

(For further information or questions contact Matthew Fabry at 650 599-1419)

RECOMMENDATION

That the Committee review and approve April 16, 2020 Stormwater Committee meeting minutes, as drafted.

DISCUSSION

N/A.

ATTACHMENTS

1. Draft April 16, 2020 Minutes

STORMWATER COMMITTEE
Regular Meeting
Thursday, April 16, 2020
2:30 p.m.

DRAFT Meeting Minutes

The Stormwater Committee met remotely via Zoom, per C/CAG's shelter-in-place policy and consistent with state and county directives to manage COVID-19. Attendance at the meeting is shown on the attached roster. In addition to the Committee members, also in attendance were Matt Fabry (C/CAG Program Manager), Reid Bogert (C/CAG staff), Sandy Wong (C/CAG Executive Director), Mikaela Hiatt (C/CAG staff), Jennifer Lee (City of Burlingame), Rachel Krai and Scott Durbin (Lotus Water), Steve Carter (Paradigm Environmental), Sarah Scheidt (City of San Mateo), Chris Sommers (EOA), Kim Springer, Susan Wright, and John Allan (County of San Mateo), Jon Konnan (EOA), Jill Bicknell (EOA). Chair Breault called the meeting to order at 2:40 p.m.

1. Public comment: None

2. Stormwater Issues from C/CAG Board Meetings: Highlighted the October appointment of Peter Brown, Public Works Director from the City of Belmont, and Andrew Yang, Senior Civil Engineer from the City of Millbrae, to the Stormwater Committee.

3. ACTION – Approval of the draft minutes from the September 19, 2019 and November 21, 2019 Stormwater Committee meetings. Motion: member Murtuza, second: member Machida. Approved (14:0:2).

4. INFORMATION – The following items were covered in announcements:

- New website – Matt Fabry announced the newly designed www.flowstobay.org website and toured the basic structure and new layout, emphasizing new features, including the Data & Resources section and the Green Infrastructure Design Guide.
- Solicitations – Fabry announced several funding solicitations:
  - EPA Water Quality Improvement Fund - $5.9 million in federal funds with a one to one match requirement, with proposals due May 13.
  - CNRA Urban Flood Protection and Urban Greening Grant Programs – the California Natural Resources Agency has two pots of funding available with eligible projects including stormwater capture; however, both solicitations are on hold due to COVID-19.
  - Prop 1 Stormwater Grant Round 2 – Jill Bicknell mentioned the second round of Prop 1 Stormwater Grant funds, with a solicitation open now and proposals due July 2. A webinar on the funds will be hosted on May 12 at 2 p.m. Fabry will circulated information to the Stormwater Committee.
- BASAMAA – Fabry gave a status update on the Bay Area Stormwater Management Agencies Association, stating the organization's intention to dissolve its non-profit status and establish a new collaboration model via a Memorandum of Understanding (which is currently in draft form). The BASMAA Board of Directors will be discussing input on the draft MOU at its next Board meeting on Thursday, April 23. The plan now is to dissolve the organization and transition to an MOU model by the end of the calendar year at the latest.

- Report of Waste Discharge – Fabry discussed the Report of Waste Discharge (ROWD) requirements per the MRP to submit documentation on behalf of the San Mateo County permittees of all work completed in the current permit term as part of the process for application under the reissuance of the permit. The ROWD is due 180 days prior to the expiration of the current permit (which is July 4, 2020), and SMCWPPP will be submitting the ROWD with support from EOA.
- Regional Stormwater Capture Projects – Fabry briefed the committee on the $3 million awarded to C/CAG by the state to develop regional project concepts and advance regional stormwater collaboration. Updates included agreement by the California Natural Resources Agency to enter into separate funding agreements with the project sponsors (rather than having C/CAG enter into sub-agreements with the cities developing preliminary designs); C/CAG and the County area developing a joint Request for Proposals for developing designs for the San Bruno and Redwood City projects, as well as for the associated work to identify new project opportunities and project concepts. Belmont and the Flood and Sea Level Rise Resiliency District have been awarded additional funds from the Department of Water Resources to do creek restoration on Belmont Creek adjacent to the proposed stormwater capture project at Twin Pines Park. To better align these connected projects and the available funds, Belmont will be issuing a separate RFP process.

5. INFORMATION – Receive an update on developing the PCBs and Mercury in San Mateo County Stormwater Runoff: Control Measures Plan and Reasonable Assurance Analysis..

Jon Konnan presented the overview and timeline for developing the SMCWPPP PCBs (polychlorinated biphenyls)/Mercury Control Measures Plan on behalf of San Mateo County permittees, per provision C.12.d of the Municipal Regional Permit. The Control Measures Plan is intended to demonstrate reasonable assurance toward meeting the water quality goals for PCBs and mercury TMDLs (Total Maximum Daily Loads) for the San Francisco Bay by 2028 and 2030, respectively. The plan must identify all "technically and economically feasible" controls, along with an implementation schedule and cost evaluation. The report is due with the September 2020 Annual Reports. A key assumption of the analysis is that due to the proposed reduced baseline loading presented in the SMCWPPP green infrastructure Reasonable Assurance Analysis (RAA) and associated pollutant modeling, the load reduction benefits of control measures needs to be scaled commensurately. The plan will integrate the RAA modeling for green infrastructure in the county with other source control measures to determine the existing level of PCBs and mercury controls, associated costs and level of pollutant reduction. The analysis will then identify all additional load reductions that can be reasonably achieved via source controls by 2028/2030. Any remaining gap between the project load reduction and the required load reduction for San Mateo permittees (based on population) will likely be assumed to be made up by additional green infrastructure. Finally, the plan will include an evaluation of different scenarios for achieving the TMDL waste load allocations with an optimal scenario selected as a recommendation for the permittees. Importantly, the Control Measures Plan will provide a demonstration of the technically and economically feasible controls within the given timeline of the TMDLs, which may be helpful in making a case for time extension if needed. The plan will also provide the basis for further advancement of countywide stormwater goals, including a regional funding initiative and pursing grant funds for project implementation. Staff will circulate a draft report in June, bring another presentation to the Stormwater Committee in July with the second draft report, followed by a workshop in August and a third draft for review. The final report will be submitted September 2020 with Annual Reports.

Committee members discussed the need for better understanding the potential scope of impact of implementing the Control Measures Plan and what level of commitment is being made.

6. INFORMATION – Received update on Municipal Regional Permit reissuance process and schedule.

Fabry provided an update on the negotiation process for the Municipal Regional Permit 3.0. The MRP 3.0 Steering Committee is meeting on an ongoing basis to address proposed modifications and areas of disagreement on permit provisions, based on discussions at the various workgroups (Trash, GI/C.3, C.8, C.11/12, Firefighting Flows, Homelessness). Fabry and lead staff from EOA provided updates from the workgroup meetings and recent Steering Committee meetings. Areas of significant disagreement remain on some provisions, including regulated projects thresholds/exemptions, special projects, and roads for C.3 requirements; source control credits, creek cleanups/direct discharge programs, managing trash on properties connected to the MS4, full trash capture equivalency, and timeline for achieving "no adverse impact" from trash via storm drains for C.10; and issues surrounding homelessness impacts on stormwater quality and planned cost reporting requirements.

The following schedule presents the timeline for reissuance:

- MRP 3.0 Workgroups continue meeting to discuss issues through mid- to late-summer 2020
- Draft language in July/August 2020
- Administrative Draft issued in September 2020
- Formal Tentative Order released in December 2020 with 45 day comment period
- Regional Water Board Workshop on Tentative Order February 2021
- Regional Water Board considers adopting the Tentative Order at April 2021 meeting
- Effective date for MPR 3.0 planned for July 1, 2021

Members of the SMCWPPP Stormwater Committee Ad-hoc Workgroup continue to participate in the Steering Committee meetings.

7. ACTION – Reviewed and approved plan for notification letter to Regional Water Quality Control Board regarding COVID-19 implications on compliance activities.

Fabry shared the statement from the State Water Resources Control Board issued March 20, 2020 regarding compliance with water quality permits during COVID-19 response, stating that compliance with these permits is considered an "essential function," and the Water Board's request for permittees to notify Regional Water Boards immediately of any requirement that cannot be timely met due to the COVID-19 response. Fabry shared the California Stormwater Quality Association (CASQA) COVID-19 guidance for responding to water boards and also a draft C/CAG notification letter to the San Francisco Regional Water Quality Control Board in response to the State Water Board's request. The draft notification was based on notifications from other countywide stormwater programs in the Bay Area, including the Alameda Countywide Clean Water Program and Santa Clara Valley Urban Runoff Pollution Prevention Program. Fabry also referenced two attachments that these two programs included in their respective notifications. The Committee discussed options for sending a letter to Regional Water Board now followed by a list or table of specific compliance issues, vs. waiting to provide a more detailed response in a couple weeks after receiving more input from the Committee and other stormwater representatives. The Committee agreed to send a notification letter in the next day or two, followed by a general list of potential compliance issues, similar to what the Santa Clara program has done, given the uncertainty about how the next few months will proceed along different lines of compliance under the Municipal Regional Permit. C/CAG staff will send the draft letter after minor revisions and will solicit input from the Committee on the list of compliance issues. The Ad-hoc Workgroup will provide input on the final letter to be submitted with the list of compliance issues in about two weeks. The Committee agreed there should be some communications with Regional Water Board staff in the meantime to confirm the proposed approach and to address a proposed approach to addressing any outstanding compliance issues for the fiscal year in the Annual Reports.

A motion to approve process to submit a notification to the Regional Water Board in the next day or two, followed by a more detailed letter and list of compliance issues in two weeks. Motion: member Murtuza, second: member Ovadia. Approved (16:0:0).

8. INFORMATION—Received update and provide feedback on development of the Fiscal Year 2020-21 Countywide Water Pollution Prevention Program budget.

Fabry presented the draft Fiscal Year 2020-21 Countywide Water Pollution Prevention Program budget. Fabry noted the starting balance is estimated to be higher than previous years and the program has maintained its $500,000 in reserved funds for a countywide funding initiative. Fabry shared there is approximately $400,000 in unallocated balance estimated at this time. It was also noted that due to the COVID-19 situation and likely reduced revenues from property taxes and vehicle registration fees, it is uncertain whether the actual starting balance will be maintained. There are also uncertainties about the structure of BASMAA and associated costs for administration and any potential regional projects. The goal from the program perspective is maintain a high balance going into MRP 3.0 and focus on meeting compliance requirements in the near term. C/CAG staff will work with the Ad-hoc Workgroup and the Stormwater Committee to further refine the budget and scopes of work in April and May, and will bring the draft budget to the C/CAG Board at its May 14 meeting followed by planned adoption at its June 11 meeting.

9. ACTION—Nominate and elect Chair and Vice-Chair.

Chair Breault announced the need to fill the Vice Chair position for the Stormwater Committee due to the existing Vice Chair's (Afshin Oskoui) transition to City Manager for the City of Belmont. Chair Breault's recommendation was to solicit nominations for both Chair and Vice Chair.

Committee member Murtuza made a motion to nominate Chair Breault to continue as Chair of the Stormwater Committee. Motion: Murtuza, second: member Ovadia. Approved (16:0:0).

Committee member Ovadia made a motion to self-nominate as Vice Chair of the Stormwater Committee. Motion: member Ovadia, second: Chair Breault. Approved (16:0:0).

10. Regional Board Report: None.

11. Executive Director's Report: Executive Director, Sandy Wong, mentioned appreciation of Chair Breault's leadership of the Stormwater Committee since its inception, and also noted appreciation of C/CAG staff for maintaining the stormwater program during the COVID-19 response.

10. Member Reports: None.
Chair Breault adjourned the meeting at 4:08 p.m.

2019-20 Stormwater Committee Attendance														
Agency	**Representative**	**Position**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**
Atherton	Robert Ovadia	Public Works Director		X	X		X					X		
Belmont	Peter Brown	Public Works Director		X	X		X					X		
Brisbane	Randy Breault	Public Works Director/City Engineer		X	X		X					X		
Burlingame	Syed Murtuza	Public Works Director		O			O					X		
Colma	Brad Donohue	Director of Public Works and Planning	C	X	X	C	X	C	C	C	C	X		
Daly City	Richard Chiu	Public Works Director	A	X	X	A	X	A	A	A	A	X		
East Palo Alto	Kamal Fallaha	City Engineer	N			N		N	N	N	N			
Foster City	Norm Dorais	Public Works Director	C	X	X	C		C	C	C	C	X		
Half Moon Bay	Maziar Bozorginia	City Engineer	E	X		E		E	E	E	E			
Hillsborough	Paul Willis	Public Works Director	L	X	X	L		L	L	L	L			
Menlo Park	Nikki Nagaya	Public Works Director	E	X	X	E	X	E	E	E	E	X		
Millbrae	Andrew Yang	Senior Engineer	D			D		D	D	D	D	X		
Pacifica	Sam Bautista	Public Works Director/City Engineer			O							X		
Portola Valley	Howard Young	Public Works Director		X								X		
Redwood City	Saber Sarwary	Supervising Civil Engineer			O									
San Bruno	Jimmy Tan	City Engineer		X	X							X		
San Carlos	Steven Machida	Public Works Director		X	X		X					X		
San Mateo	Brad Underwood	Public Works Director		X	X		X					X		
South San Francisco	Eunejune Kim	Public Works Director												
Woodside	Sean Rose	Public Works Director										X		
San Mateo County	Jim Porter	Public Works Director		X	X		X					X		
Regional Water Quality Control Board	Tom Mumley	Assistant Executive Officer												

"X" - Committee Member Attended
"O" - Other Jurisdictional Representative Attended

C/CAG AGENDA REPORT

Date: May 21, 2020

To: Stormwater Committee

From: Matthew Fabry, Program Manager

Subject: Receive an update on C/CAG's Sustainable Streets Master Plan.

(For further information or questions contact Matthew Fabry at mfabry@smcgov.org)

RECOMMENDATION

Receive an update on C/CAG's Sustainable Streets Master Plan.

BACKGROUND/DISCUSSION

C/CAG was awarded a $986,300 Adaptation Planning Grant by Caltrans to develop a Countywide Sustainable Streets Master Plan (SSMP) that prioritizes street segments throughout the county for integrating green stormwater infrastructure with other planned investments and community priorities. The project includes the following key tasks:

- Community Engagement
- Climate Adaptation Risk Analysis on Local Transportation Network
- High-Resolution Data Analysis and Fine-Scale Drainage Delineation
- Prioritization of Sustainable Streets Opportunities and Development of Master Plan
- Project Concepts
- Web-based Sustainable Streets Project Implementation Mapping and Tracking Tool

The project is intended to evaluate precipitation-based climate change impacts for managing runoff from the roadway network and prioritize opportunities for integrating green stormwater infrastructure to help adapt the roadway network and downstream infrastructure. The Master Plan will prioritize specific roadway segments for integration of green infrastructure in five-, 10-, and 20-year time horizons and will include up to 10 project concepts. The project uses LiDAR data to develop high-resolution drainage mapping throughout the county and will create a web-based mapping and tracking tool to document progress over time in managing stormwater volumes. The work products will directly support C/CAG member agencies' Green Infrastructure Planning efforts required under the Municipal Regional Permit.

Due to limited time at the April 16, 2020 Committee meeting, staff were unable to present this item at the time of the meeting. Staff will provide an update on the project, focusing on project prioritization and modeling precipitation-based climate change impacts on runoff throughout the county. The draft climate change modeling report is attached – staff will detail timing for member agency review and comment.

ATTACHMENTS

1. Draft Climate Adaptation Risk Analysis for the San Mateo Countywide Sustainable Streets Master Plan

To:	Matt Fabry – City/County Association of Governments of San Mateo County
From:	Steve Carter; John Riverson – Paradigm Environmental
Date:	May 18, 2020
Re:	Climate Adaptation Risk Analysis for the San Mateo Countywide Sustainable Streets Master Plan

The San Mateo Countywide Sustainable Streets Master Plan (SSMP) is a collaborative effort between Caltrans and the 21 member agencies of the City/County Association of Governments of San Mateo County (C/CAG) to prioritize locations for implementation of sustainable street designs. While providing multiple community benefits, these sustainable street projects will also include the integration of green infrastructure (GI) within rights-of-way to capture, infiltrate, and/or treat stormwater runoff. An additional objective of the SSMP is to assess the impact of climate change on the stormwater runoff from county roadways and to evaluate the ability for GI to improve the resiliency of the roadway network in the face of climate uncertainty. As many global climate models predict the occurrence of larger and more frequent rainfall events, increased flooding on roadways will likely become a reality. Increased frequency of flooding has the potential to adversely impact local infrastructure and may disproportionately affect vulnerable communities who may rely on walking, biking, and public transit. This analysis quantifies the effect of future climate scenarios on stormwater runoff from county roads by utilizing the most relevant climate research and models for the region.

The analysis was conducted using a countywide watershed and stormwater management modeling system that was previously developed for a study led by C/CAG for a Reasonable Assurance Analysis (RAA) supporting development of GI Plans for each municipality within the county to demonstrate compliance with the Municipal Regional Stormwater Permit (MRP) (SMCWPPP 2020a and 2020b). The objective of the RAA was to determine the amount of GI necessary to meet water quality improvement goals by 2040 while minimizing overall lifecycle costs. The modeling system integrated insights from decades of local research, monitoring, and modeling conducted by several agencies.

This memorandum describes the hydrologic modeling analysis used to assess climate change scenarios, the impact on county roadways, and the capability of GI to offset the predicted increases in stormwater runoff from county roadways.

1 QUANTIFICATION OF CLIMATE CHANGE-RELATED PRECIPITATION IMPACTS

This section describes (1) the watershed modeling system and the model parameterization for representing current-state hydrology, (2) the development of local design storm hyetographs based on historical rainfall to serve as meteorological boundary conditions for modeling flood events, (3) the climate models used to create meteorological boundary conditions for future climate scenarios, and (4) the modeled impact of climate change on countywide stormwater runoff.

1.1 Watershed Model

The current-state hydrology was modeled using the Loading Simulation Program in C++ (LSPC) model (Shen et al. 2004) component of the watershed and stormwater management modeling system developed by C/CAG for the RAA (SMCWPPP 2020a). This LSPC model is regionally calibrated and provides dynamic (hourly) simulation of hydrology and pollutant transport processes within each watershed in the county. Figure 1-1 shows a map of the subwatersheds modeled in LSPC; however, the hydrologic boundaries of the calibrated watershed areas sometimes extended outside of county lines. The LSPC model from the RAA is available for all subwatersheds in the county. However, in this analysis, the distinction between subwatersheds that drain to the Pacific Ocean and the San Francisco Bay is made because the stormwater capture model (discussed in Section 2) only assesses GI benefits on the bayside. This is because the RAA targets are based on PCBs (polychlorinated biphenyls) and mercury reductions required for stormwater runoff to the Bay only. Oceanside, bayside, and countywide averages are reported in this memorandum to summarize results over these distinct regions; however, all precipitation, runoff, and stormwater capture estimates in the analysis were first simulated at the subwatershed-scale.

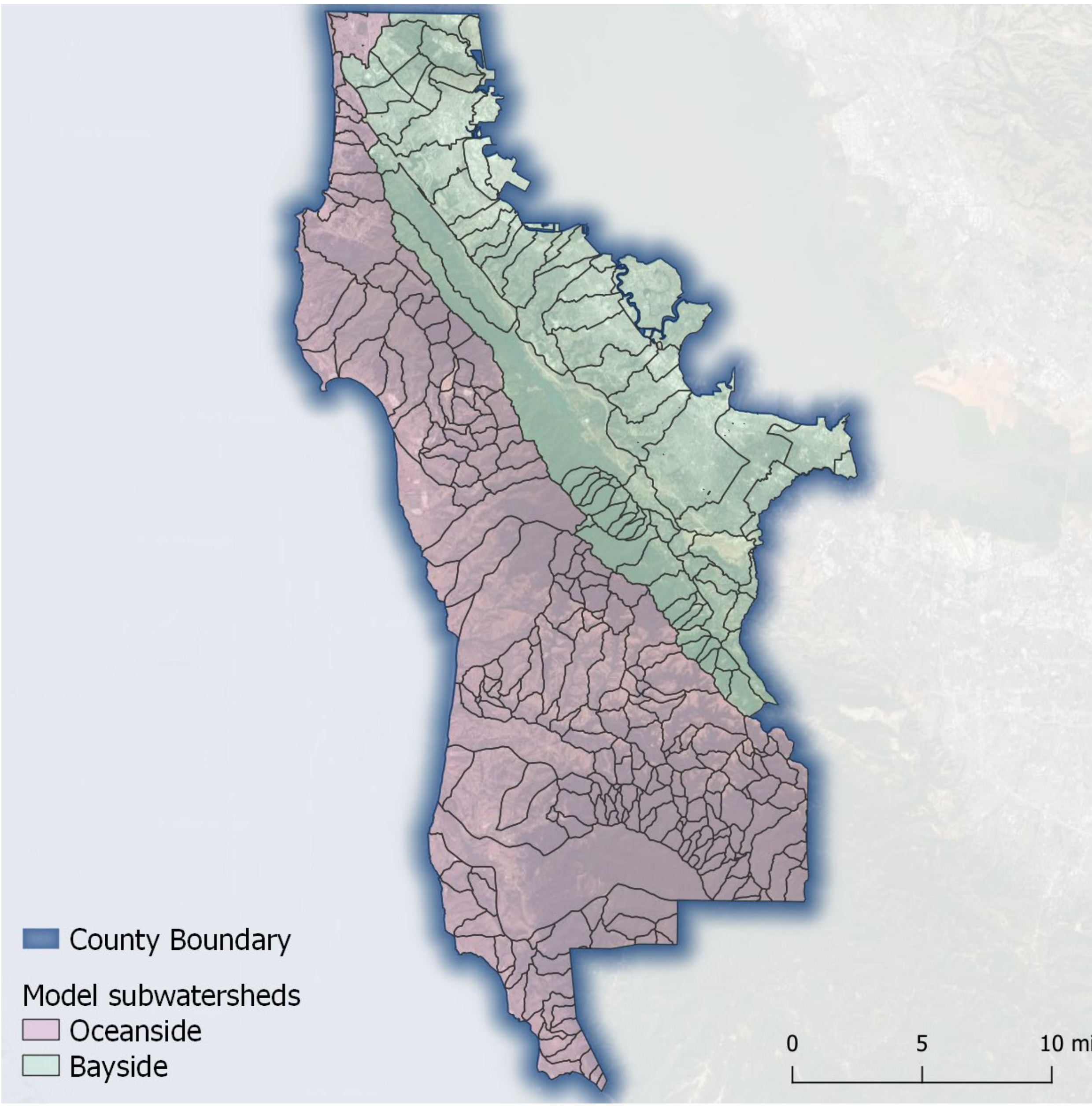


Figure 1-1. LSPC model subwatersheds.

The model was built using datasets that describe land, meteorological, and hydrological characteristics of the subwatersheds. A Hydrologic Response Unit (HRU) is the smallest modeling unit in LSPC and represents the unique combination of physical characteristics including land use/land cover, soil type, and slope (see Figure 2). Table 1-1 lists and describes the data sources used to represent HRUs in the model. Figure 1-3 conceptually illustrates the intersection of the various layers described in Table 1-1 and summarizes the final HRU area distribution for the county. The parameters associated with HRUs are collectively used to simulate aggregated hydrologic and water quality responses which are then routed to each of the subwatersheds.

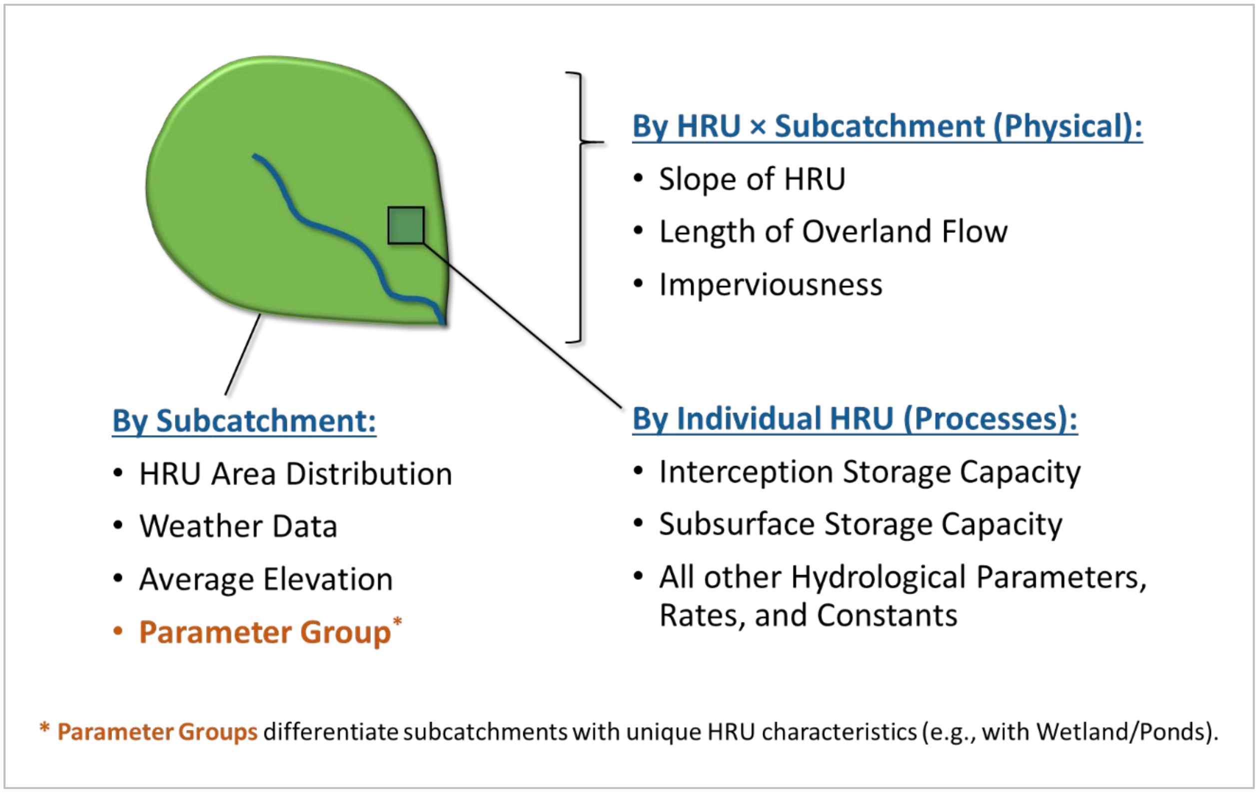
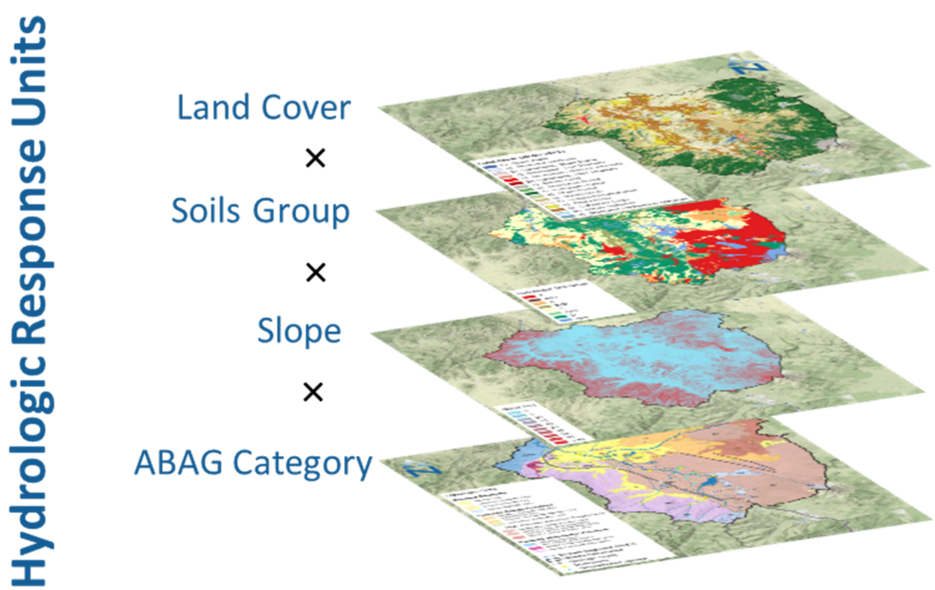


Figure 1-2. Conceptual organization of model parameters within LSPC.

Table 1-1. Data used for HRU analysis

GIS Layer	Description	Source
Land Cover	Polygon layer – contains vegetation type (if any).	National Land Cover Database
Soil Type	Polygon layer – contains soil type.	United States Department of Agriculture
Slope	Raster layer - contains slope information.	Generated from DEM
ABAG Category	Land use classification – contains land use as classified by ABAG.	Association of Bay Area Governments



Group	Description	Percent of Area (by Group)		
		Ocean	Bayside	Countywide
Land Cover	Developed	11.8%	66.5%	32.8%
	Forest	61.2%	27.0%	48.1%
	Shrub/Grass	27.0%	6.4%	19.1%
Soil Type	A	0.7%	0.0%	0.5%
	B	22.6%	1.1%	14.4%
	C	59.4%	63.1%	60.8%
	D	15.5%	15.0%	15.3%
	Impervious	1.8%	20.8%	9.1%
Slope	Low	33.7%	76.5%	50.1%
	Med	66.3%	23.5%	49.9%
ABAG Category	Open	93.4%	41.8%	73.6%
	New Urban	2.1%	3.4%	2.6%
	New Industrial	0.0%	0.6%	0.2%
	Old Industrial	0.0%	2.1%	0.8%
	Old Residential	2.4%	29.3%	12.7%
	Old Urban	1.9%	21.2%	9.3%
	Source Areas	0.2%	1.5%	0.7%
Countywide		**31%**	**19%**	**50%**

Figure 1-3. Conceptual intersection of HRU layers and the summary table of HRU distribution in San Mateo County.

1.2 Design Storms

The modeled baseline scenario for the RAA was a continuous simulation of runoff volume for water year 2002 (10/1/2001 – 9/30/2002), an average annual hydraulic condition identified in the *Bay Area Reasonable Assurance Analysis Guidance Document* (BASMAA 2017). However, because many climate models predict that high-intensity rain events will occur at increased frequency in the future, design storms typically used in flood planning were considered a more appropriate basis for assessing future climate scenarios than an average annual condition. The analyzed recurrence intervals include 2, 5, 10, 25, 50, and 100 years. For example, a 100-year 6-hour storm refers to a rainfall event with a duration of 6 hours and of a size that occurs only once every 100 years (1% chance of occurring any given year).

The design storm precipitation timeseries used in the analysis were determined by applying a 6-hour temporal distribution (unit precipitation timeseries) to storm depths associated with the recurrence intervals. The percentage of the total storm depth occurring at each time step is the same for the timeseries of all storm sizes. The temporal distribution and storm depths were both developed by a regional precipitation frequency analysis conducted by the Santa Clara Valley Water District (SCVWD 2016). The storm depths and temporal distribution were based on local historical rainfall data in the counties of San Mateo, Alameda, and Santa Clara. While this study produced distributions and storm depths for several durations up to 72 hours, a 6-hour event was considered more conservative for runoff estimation because it represents a higher intensity storm. Additionally, a separate study (Rastogi et al. 2017) examining the effects of climate change on precipitation for 6-hour through 72-hour events found that there was the least variance between simulated and conventional precipitation estimation methods for the 6-hour duration, suggesting greater confidence in 6-hour storm depths.

Figure 1-4 presents probability distributions for the cumulative percentage of precipitation to fall over a 6-hour event. The median distribution (50%), prominently featured in the graph below, was selected for use in the model because it is the most representative distribution for all storms. Essentially, 50% of observed storm events in the region were found to produce at least the reported cumulative rainfall percentage at each timestep. For example, in the figure below, at least 65% of precipitation occurs by the third hour in 50% (median) of observed storms. Figure 1-5 graphs the unit precipitation timeseries based on the median distribution used to calculate the various storm precipitation timeseries.

Time (hours)	Distributions of Cumulative Percent of Precipitation by Probability of Occurence								
	90%	80%	70%	60%	50%	40%	30%	20%	10%
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.5	13.33	15.83	17.50	19.17	20.83	21.67	23.33	25.83	30.00
1.0	20.67	24.33	27.00	29.00	31.00	33.33	35.33	39.67	46.67
1.5	29.50	33.00	35.50	37.50	39.50	42.00	44.50	49.50	57.00
2.0	39.33	42.67	44.67	46.67	48.67	51.00	54.33	59.00	65.67
2.5	47.83	51.67	53.50	55.50	57.50	60.50	64.33	68.33	74.00
3.0	57.00	60.00	61.00	63.00	65.00	68.00	71.00	75.00	79.00
3.5	65.33	67.50	69.33	71.33	73.33	76.33	78.50	81.67	86.50
4.0	73.00	74.33	76.33	78.33	79.67	82.00	84.00	86.33	90.67
4.5	79.50	81.00	83.00	84.50	85.50	87.50	89.50	91.00	94.50
5.0	86.00	87.33	89.00	90.00	91.00	92.67	94.00	95.00	97.33
5.5	93.33	93.33	94.17	95.00	95.83	96.67	96.67	97.50	98.33
6.0	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

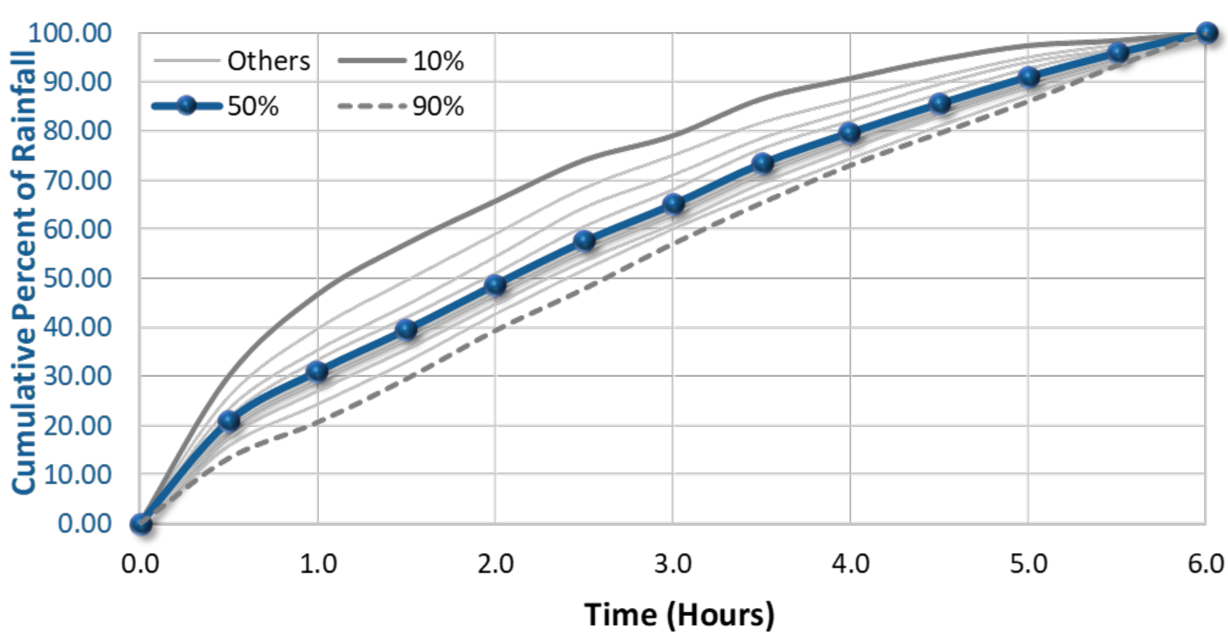


Figure 1-4. Distributions for 6-hour (2nd Quartile) storm events (SCVWD 2016).

Time (hours)	Incremental % of Precipitation
0	0.00%
0.5	20.83%
1	10.17%
1.5	8.50%
2	9.17%
2.5	8.83%
3	7.50%
3.5	8.33%
4	6.33%
4.5	5.83%
5	5.50%
5.5	4.83%
6	4.17%
6.5	0.00%

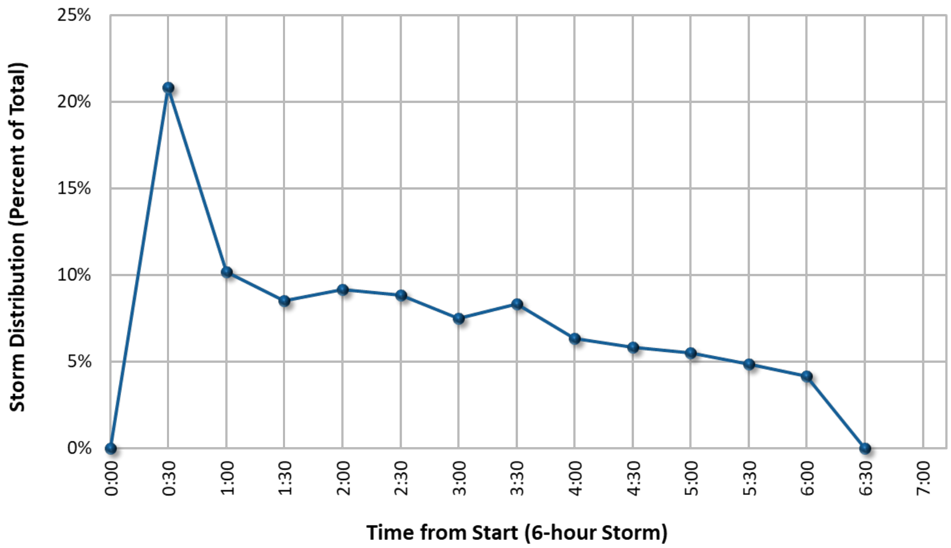


Figure 1-5. Unit precipitation timeseries for median distribution (SCVWD 2016).

Gridded products (~1,500-foot resolution), based on observed historical values from the SCVWD precipitation study, were used to determine 6-hour storm depths. Figure 1-6 shows an example of the SCVWD gridded dataset for a 10-year, 6-hour event across the county. A similar gridded dataset exists for each recurrence interval (2, 5, 10, 25, 50, 100-year). The average 6-hour storm depth was calculated for each subwatershed and applied to the temporal distribution to create a unique precipitation timeseries for each subwatershed. The resulting precipitation timeseries were used as the meteorological boundary conditions in the model to simulate associated runoff in each subwatershed. Table 1-2 summarizes the 6-hour storm depths for each recurrence interval as a countywide area-weighted average. Maps of precipitation depths by subwatershed are provided in Appendix A. The historical storm depths are used for comparisons to the future climate change scenarios described in Section 1.3.

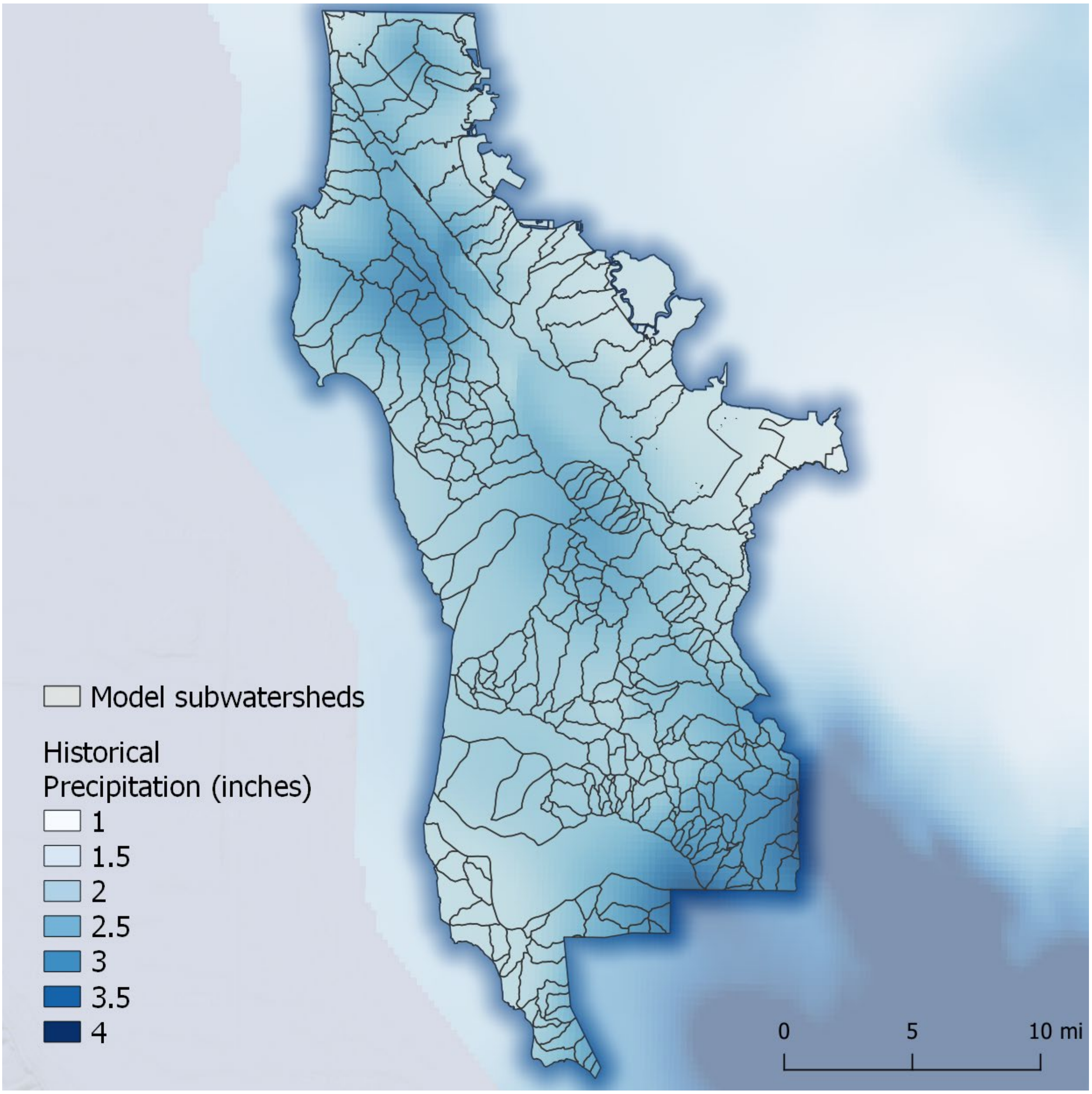


Figure 1-6. Historical 10-year, 6-hour storm depths across San Mateo County (SCVWD 2016).

Table 1-2. Average precipitation depths for 6-hour storm events across San Mateo County

Scenario	6-hour Storm Size (in.) by Recurrence Interval						
	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr
Historical	1.69	2.09	2.39	2.79	3.10	3.40	3.70

1.3 Climate Change Impacts

This section describes the global climate models selected to develop the future climate scenarios and the associated projected storm sizes.

1.3.1 Global Climate Models

For this analysis, an ensemble of 20 climate change projections (i.e., 10 models × 2 future pathways) from Cal-Adapt was considered. Cal-Adapt synthesizes climate change projections and research from California's scientific community and is developed by the Geospatial Innovation Facility at the University of California, Berkeley, with funding and advisory oversight by the California Energy Commission. The projections are from two future projection scenarios, or Representative Concentration Pathways (RCPs) 4.5 and 8.5, for 10 global climate models (GCMs) as recommended by the Climate Change Technical Advisory Group. The two selected RCPs are best- and worst-case projections of future carbon emissions. RCP 8.5 represents a scenario in which carbon emissions continue to climb at historical rates, whereas the RCP 4.5 predicts a stabilization of carbon emissions by 2040 (IIASA 2009). Although these are estimated future trajectories, comparisons to actual emissions levels at the time of the IIASA study suggest that observed emissions have been outpacing the RCP 8.5 scenario (Figure 1-7).

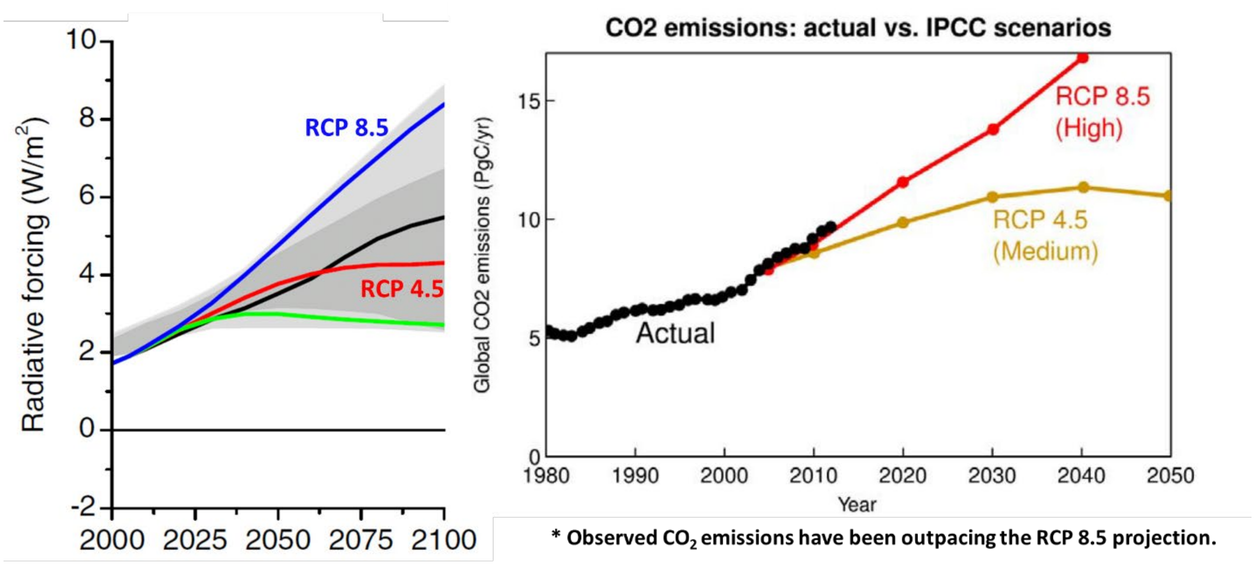


Figure 1-7. Selected Representative Concentration Pathways for climate change analysis (IIASA 2009).

Table 1-3. Description of global climate model scenarios

Global Climate Model		Description
Scenario	Historical Baseline (SCVWD 2016)	Precipitation frequency estimates based on a total of 45 rain gauges in San Mateo County, with periods of record ranging from 1850 to 2016.
	RCP 4.5 *Stabilization*	Radiative forcing level stabilizes at 4.5 W/m^2 before 2100 by employment of a range of technologies and strategies for reducing greenhouse gas emissions.
	RCP 8.5 *Business-as-Usual*	Radiative forcing level reaches 8.5 W/m^2 before 2100 as greenhouse gas emissions continue to rise on the current trajectory.
Model	ACCESS1-0	One of 10 models selected by California's Climate Action Team
	CanESM2	One of 10 models selected by California's Climate Action Team
	CCSM4[1]	Priority model representing Average[5] scenario
	CESM1-BGC	One of 10 models selected by California's Climate Action Team
	CMCC-CMS	One of 10 models selected by California's Climate Action Team
	CNRM-CM5[2]	Priority model representing Cool/Wet[5] scenario
	GFDL-CM3[3]	Priority model representing Warm/Dry[5] scenario
	HadGEM2-CC[4]	Priority model most dissimilar to other three priority models[5]
	HadGEM2-ES	One of 10 models selected by California's Climate Action Team
	MIROC5	One of 10 models selected by California's Climate Action Team

1: Cal-Adapt, National Science Foundation, US Department of Energy, US National Center for Atmospheric Research
2: Cal-Adapt, Centre National de Recherches Meteorologiques
3: Cal-Adapt, NOAA Geophysical Fluid Dynamics Laboratory
4: Cal-Adapt, United Kingdom Meteorological Office
5: California Energy Commission

1.3.2 Projected Storm Sizes

For each climate projection, 6-hour storm precipitation timeseries were generated. The climate models are downscaled at a 7-kilometer resolution, resulting in 32 grids across the county. For each grid, the daily timeseries for a modeled historical (1950-2005) and future (2006-2100) period were retrieved from each GCM. Storm depths based on the simulated historical and future periods were calculated using the daily timeseries from the GCMs. The ratio of simulated future to historical storm depth was calculated for each of the 32 grids (see example in Figure 1-8) and averaged across each subwatershed in the model. These ratios are then applied to the SCVWD historical precipitation timeseries based on observed data (described in Section 1.2) to determine the future timeseries. Ratio grids were developed for each set of GCM, RCP, and recurrence interval. Table 1-4 summarizes the projected storm sizes by climate change scenario averaged across the county. Additionally, the mean and median rainfall depth for all ten GCMs for RCP 4.5, RCP 8.5, and all climate futures were calculated. Projected future storms that exceed the greater historical storm sizes (e.g., future 50-year storm exceeds historical 100-year storm) are highlighted in red to illustrate the extreme conditions anticipated with climate change scenarios. Projected future storms that fall below the historical equivalent storm size are highlighted in blue (e.g., future 50-year storm is less than the historical 50-year storm).

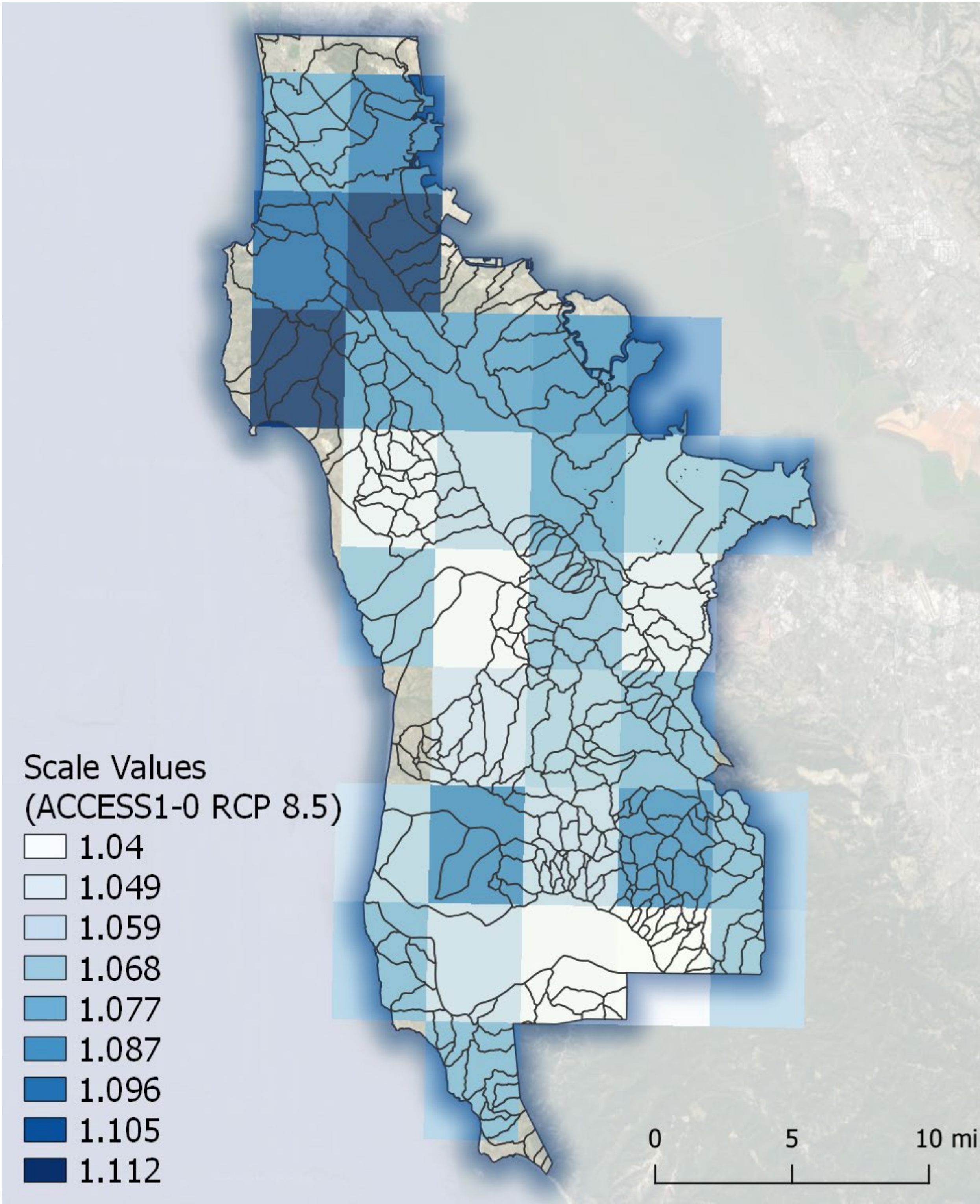


Figure 1-8. Example ratios of future to historical precipitation for GCM ACCESS1-0, RCP 8.5 for a 10-year, 6-hour storm.

Table 1-4. Summary of design storm sizes by climate change scenario averaged across San Mateo County

Climate Change		6-hour Storm Size (in.) by Recurrence Interval					
Scenario	Model	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Current (Historical)		1.69	2.09	2.39	2.79	3.10	3.40
All	Median (All)	1.84	2.33	2.71	3.28	3.77	4.29
	Mean (All)	1.87	2.40	2.82	3.41	3.89	4.41
RCP 4.5	Median (4.5)	1.81	2.27	2.61	3.10	3.52	3.97
	Mean (4.5)	1.84	2.34	2.73	3.27	3.71	4.18
	ACCESS1-0	1.84	2.27	2.62	3.14	3.57	4.03
	CanESM2	1.96	2.59	3.07	3.75	4.30	4.88
	CCSM4	1.78	2.26	2.58	2.97	3.24	3.48
	CESM1-BGC	1.93	2.42	2.87	3.57	4.22	4.95
	CMCC-CMS	1.91	2.39	2.71	3.09	3.35	3.59
	CNRM-CM5	2.20	2.96	3.56	4.40	5.10	5.84
	GFDL-CM3	1.75	2.11	2.38	2.76	3.06	3.37
	HadGEM2-CC	1.66	2.17	2.56	3.08	3.49	3.92
	HadGEM2-ES	1.70	2.09	2.46	3.03	3.56	4.15
	MIROC5	1.66	2.11	2.44	2.88	3.22	3.56
RCP 8.5	Median (8.5)	1.87	2.39	2.86	3.58	4.16	4.78
	Mean (8.5)	1.91	2.47	2.92	3.55	4.08	4.64
	ACCESS1-0	1.82	2.27	2.68	3.32	3.90	4.56
	CanESM2	2.14	2.91	3.53	4.39	5.11	5.88
	CCSM4	1.84	2.31	2.65	3.07	3.40	3.71
	CESM1-BGC	2.02	2.54	3.02	3.74	4.38	5.10
	CMCC-CMS	2.02	2.71	3.20	3.82	4.28	4.73
	CNRM-CM5	2.23	3.05	3.70	4.65	5.44	6.31
	GFDL-CM3	1.75	2.17	2.47	2.84	3.12	3.38
	HadGEM2-CC	1.80	2.38	2.87	3.59	4.23	4.93
	HadGEM2-ES	1.89	2.38	2.84	3.56	4.22	4.97
	MIROC5	1.56	1.94	2.20	2.49	2.70	2.88

[1] Historical 200-year, 6-hour rainfall depth is 3.70 inches.
Dark Red = Exceeds two or more higher historical storm sizes or the 200-year, 6-hour storm
Light Red = Exceeds next highest historical storm size
Blue = Below equivalent historical storm size

To assess the impact of climate change on historical runoff and the benefit of GI on climate resiliency of county roads, a single representative future climate scenario was selected for the remainder of the analysis. The median of all 10 GCMs for RCP 8.5 was selected for all subsequent comparisons between historical and a future climate change scenario, and the benefits of GI to mitigate the impacts of climate change. RCP 8.5 represents a conservative estimate of future carbon emissions, while the median of the 10 GCMs blends the output of all modeled futures including hot/dry and cool/wet scenarios.

Figure 1-9 provides a summary of the impact of climate change on the 6-hour design storm depths for the median RCP 8.5 scenario across model subwatersheds. The figure shows box-and-whisker plots where each observation in the sample is the storm depth for a unique combination of subwatershed and GCM. Note, this differs from Table 1-4, which shows countywide area-weighted averages (the values between Table 1-4 and Figure 1-9 cannot be directly compared). A few notable conclusions from the figure include:

- The percent increase in storm depth from the historical median to future (RCP 8.5) median ranges from 17 to 42 percent across storm sizes.
- Storm depths for the 50-year and 100-year storms exceed the median historical 200-year storm in over 50% (median) of subwatershed/GCM combinations.
- For some subwatershed/GCM combinations, the median historical 200-year storm is exceeded as frequently as every 5 years.

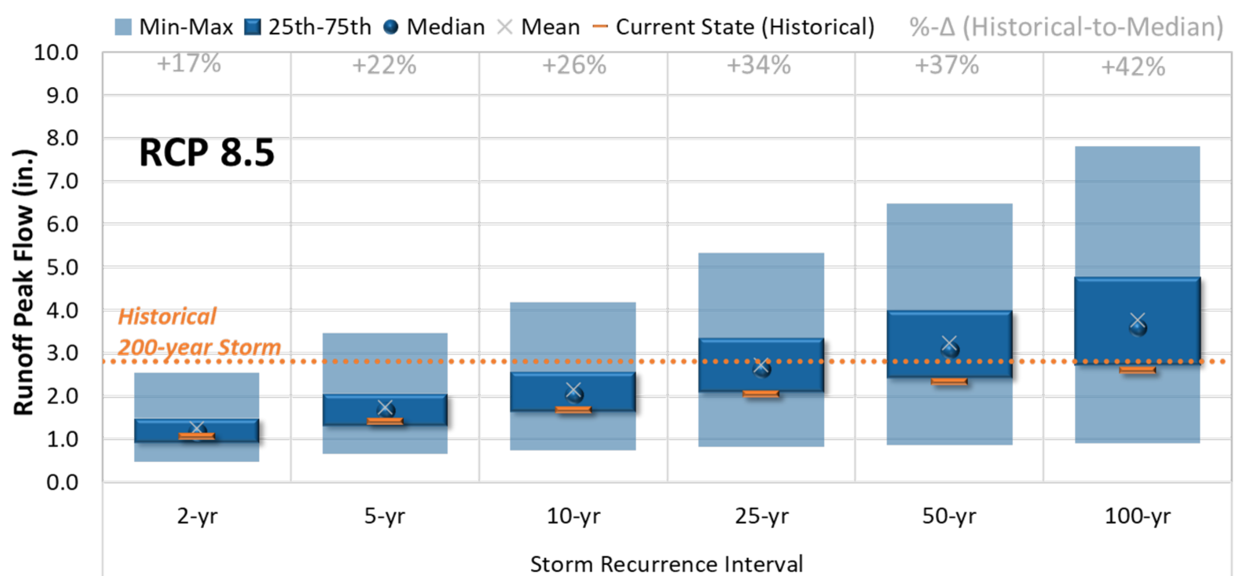


Figure 1-9. Range of projected climate impact across model subwatersheds on 6-hour storm depths for median RCP 8.5.

1.4 Projected Impact to Runoff

The current and future climate change scenarios discussed in Section 1.3 were used to model the stormwater runoff for all design storms. This section summarizes the model results and compares the runoff from historical and future (median RCP 8.5) scenarios from all land area across the county and the roadway network only.

1.4.1 Countywide Impact

The impact of climate change to runoff from all land area countywide is summarized in Table 1-6, in terms of depth in inches. Maps of increased runoff by subwatershed are provided in Appendix B. Countywide, percent increase in runoff ranges from 15% (2-year) to 50% (100-year). The precipitation storm depths in Table 1-5 produce the runoff depths in Table 1-6. The difference between the values in the two tables represent losses due to infiltration, evaporation, interception, and depression storage.

Table 1-5. Projected climate impact on cumulative subwatershed precipitation depth

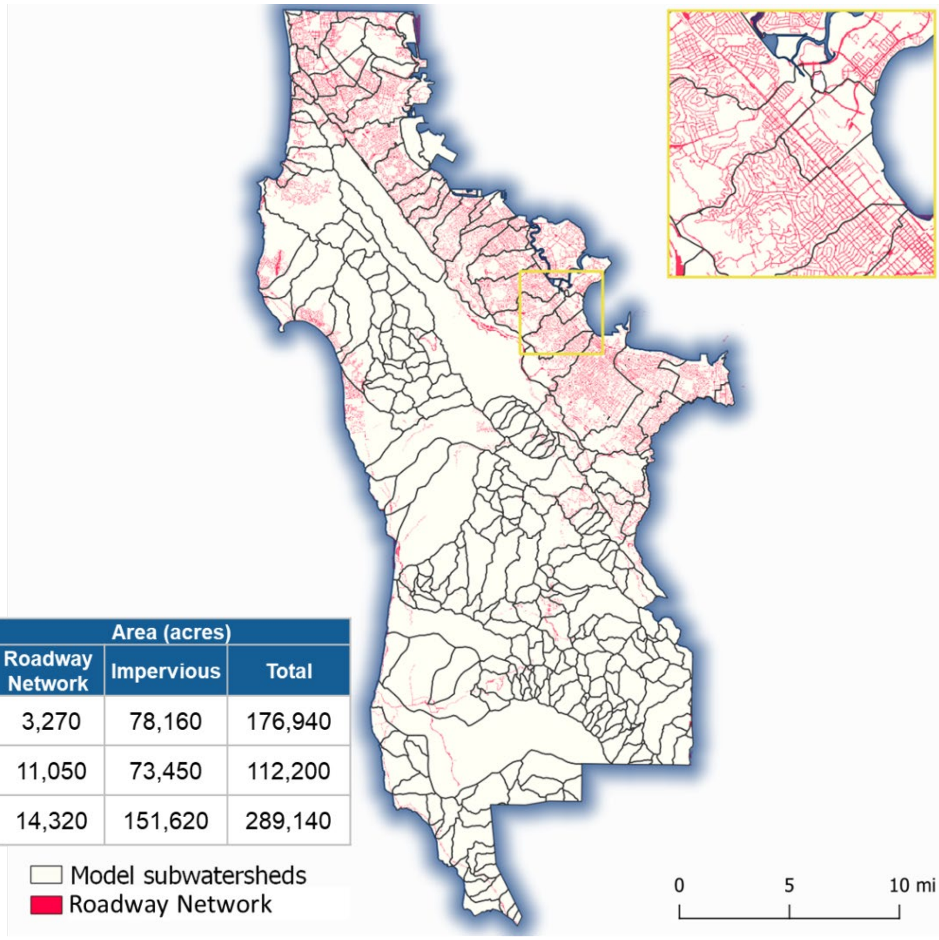
Region	Scenario	6-hour Precipitation Depth (in.) by Return Period					
		2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Ocean	Historical	1.76	2.18	2.49	2.91	3.24	3.56
	Median (RCP 8.5)	1.96	2.51	3.00	3.76	4.38	5.03
Bayside	Historical	1.58	1.96	2.23	2.60	2.88	3.15
	Median (RCP 8.5)	1.73	2.20	2.63	3.28	3.81	4.38
Countywide	Historical	1.69	2.09	2.39	2.79	3.10	3.40
	Median (RCP 8.5)	1.87	2.39	2.86	3.58	4.16	4.78

Table 1-6. Projected climate impact on cumulative subwatershed runoff depth

Region	Scenario	6-hour Runoff Depth (in.) by Return Period					
		2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Ocean	Historical	1.13	1.50	1.79	2.17	2.47	2.77
	Median (RCP 8.5)	1.31	1.80	2.25	2.97	3.56	4.18
	Percent Change	*15%*	*20%*	*26%*	*37%*	*44%*	*51%*
Bayside	Historical	0.97	1.30	1.56	1.90	2.17	2.44
	Median (RCP 8.5)	1.10	1.53	1.94	2.56	3.07	3.62
	Percent Change	*14%*	*17%*	*24%*	*34%*	*41%*	*49%*
Countywide	Historical	1.07	1.43	1.70	2.07	2.36	2.64
	Median (RCP 8.5)	1.23	1.70	2.13	2.81	3.37	3.97
	Percent Change	*15%*	*19%*	*25%*	*36%*	*43%*	*50%*

1.4.2 Roadway Impact

Because the roads were not explicitly delineated in the land use dataset used to develop the HRUs for the LSPC model, a methodology was devised to estimate the amount of runoff generated from the countywide roadway network. The area of the roadway network was estimated from GIS analysis that identified secondary roads from street centerlines and estimated street width using the outline of the rights-of-way (San Mateo County GIS Enterprise Data). This area is conservatively assumed to be 100% impervious. This likely includes sidewalks, gutters, landscape strips, and other road-adjacent land cover, and therefore represents a more conservative estimate of runoff depth from roadways alone. Figure 1-10 is a map of the resulting layer used to estimate the roadway network area. Runoff from the roadway network was estimated by conducting a model run with the estimated area of the roads only and zeroing out all other land uses. The impact of climate change to road runoff is summarized in Table 1-7, in terms of runoff depth in inches. Countywide, percent increase in road runoff ranges from 11% (2-year) to 40% (100-year).



Region	Area (acres)		
	Roadway Network	Impervious	Total
Ocean	3,270	78,160	176,940
Bayside	11,050	73,450	112,200
County wide	14,320	151,620	289,140

Figure 1-10. Layer used to estimate total area from the roadway network.

Table 1-7. Projected climate impact on cumulative runoff volume from the roadway network

Region	Scenario	6-hour Runoff Depth (in.) by Return Period					
		2-yr	5-yr	10-yr [1]	25-yr	50-yr	100-yr
Ocean	Historical	0.030	0.037	0.043	0.050	0.055	0.061
	Median (RCP 8.5)	0.033	0.043	0.051	0.065	0.077	0.089
	Percent Change	*12%*	*15%*	*21%*	*30%*	*38%*	*46%*
Bayside	Historical	0.144	0.180	0.206	0.241	0.268	0.295
	Median (RCP 8.5)	0.158	0.203	0.244	0.306	0.355	0.409
	Percent Change	*10%*	*13%*	*18%*	*27%*	*32%*	*39%*
Countywide	Historical	0.074	0.092	0.106	0.124	0.138	0.151
	Median (RCP 8.5)	0.081	0.104	0.126	0.158	0.184	0.212
	Percent Change	*11%*	*14%*	*19%*	*28%*	*34%*	*41%*

[1] There is approximately 20% increase in runoff from the roadway network for the 10-year storm. Storm drain systems in the county are typically sized for the 10-year storm.

2 QUANTIFICATION OF STORMWATER CAPTURE BENEFITS

This section describes the stormwater capture model used to estimate the performance of GI under the various combinations of design storms and climate scenarios, the estimated volume capture for the 6-hour storm events if the GI implementation scenario defined in the RAA is implemented, and the methodology for extrapolating the benefit of GI on the roadway network.

2.1 Stormwater Capture Model

The effectiveness of potential GI solutions was modeled using the System for Urban Stormwater Treatment and Analysis Integration (SUSTAIN) component of the C/CAG watershed and stormwater management modeling system developed for the RAA (SMCWPPP 2020b). Developed by the U.S. Environmental Protection Agency's (EPA) Office of Research and Development, SUSTAIN was primarily designed as a decision-support system for the selection and placement of GI projects at strategic locations in urban watersheds. It includes a process-based continuous simulation module for representing hydraulic and pollutant transport routing through various types of GI projects. The cost-benefit optimization model in SUSTAIN incorporates dynamic, user-specified project unit-cost functions to quantify the implementation costs associated with various types of GI projects (USEPA 2009, Riverson et al. 2014). The cost-benefit optimization model can be run iteratively to generate cost-effectiveness curves representing different combinations of projects within subwatersheds and/or across jurisdictional boundaries.

LSPC was used to simulate hydrology and runoff boundary conditions from each model subwatershed (Section 1), while SUSTAIN was used to simulate GI hydraulic processes and reductions of runoff volumes from the GI implementation scenario (meeting the 2040 water quality goals) identified in the RAA. Because GI planning efforts in San Mateo County are driven by PCBs and mercury reduction requirements to the San Francisco Bay, the RAA did not model GI in subwatersheds draining to the ocean. Thus, the assessment of GI's ability to improve climate resiliency of the roadway network is focused on the bayside subwatersheds and are based on scenarios focused on achieving 2040 water quality outcomes, not climate resilience in 2100. Although the results only reflect bayside conditions, the findings validate that GI can have a meaningful impact on the climate resiliency of the roadway network and can be extrapolated elsewhere in the county.

2.2 GI Benefit to Bayside Subwatersheds

The RAA identified a cost-optimal suite of GI projects that will meet the requirements of the MRP by 2040. This implementation scenario included: (1) existing facilities consisting primarily of new and redevelopment since 2005 that have been mandated to incorporate GI, (2) MRP-required GI for projected future new and redevelopment areas by 2040, (3) five large regional projects that provide opportunities for stormwater capture, infiltration, and treatment from multiple jurisdictions, (4) identified opportunities for green streets, and (5) other GI projects that are yet to be determined. Because the MRP only regulates stormwater runoff to the Bay, the implementation scenario only applies to bayside subwatersheds. This implementation scenario was modeled in SUSTAIN using the design storms described in Section 1.2 to stress-test the impact of climate change on the GI's effectiveness in reducing stormwater runoff from bayside subwatersheds. The RAA reported GI "capacities" in acre-feet within each model subwatershed and municipal jurisdiction, which represent the cumulative available stormwater storage volume for the hundreds of individual GI projects determined to provide cost-effective pollutant reductions to meet MRP goals by 2040. Table 2-1 provides a summary of the combined capacities for each GI project type. The GI capacities summarized in Table 2-1 were used to model stormwater capture for the historical storm events and the storm events associated with median of all 10 GCMs for RCP 8.5.

Table 2-1. Modeled green infrastructure capacities for bayside subwatersheds

Modeled Green Infrastructure Capacity (acre-feet)					
Total Capacity	Existing Projects	Future New & Redevelopment	Regional Projects (Identified)	Green Streets	Other GI Projects (TBD)
385.3	72.1	115.8	73.6	112.1	11.8

For comparison to the total GI capacity, the total runoff from all land uses on the bayside for each storm size is reported in Table 2-2.

Table 2-2. Runoff volume in acre-feet from bayside subwatersheds

Scenario	6-hour Runoff Volume (ac-ft) by Recurrence Interval					
	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Bayside Historical	8,767	11,784	14,121	17,230	19,645	22,039
Bayside Median (RCP 8.5)	9,966	13,816	17,515	23,175	27,740	32,775

Table 2-3 shows the modeled effectiveness of GI in offsetting the impact of climate change on runoff from all land uses (i.e., difference in runoff between median RCP 8.5 and historical) on the bayside. GI offsets runoff increases by as much as 29.9% for the 2-year (more frequent) storm, and reduces for larger and less frequent storm events with 3.3% for the 100-year storm. Figure 2-1 further illustrates that GI may be a considerable benefit to climate resiliency by offsetting runoff increase, especially for the smaller, more frequent storm events. Recall that the GI scenario from the RAA was designed to attain pollutant reduction goals set by the MRP by 2040, and were not planned to maximize climate change impact offsets. If more GI is implemented beyond goals set by the MRP, the results below indicate that greater offsets of climate change impacts will likely be realized. It is also important to note that these calculations consider runoff from areas from the bayside that are both treated and untreated by GI. As a result, GI is expected to capture a greater percentage of the storm runoff in the areas directly treated by GI.

Table 2-3. Runoff captured by GI in the bayside subwatersheds

Climate Change		6-hour Runoff Depth (in.) by Return Period					
Model	**Implementation Scenario**	**2-yr**	**5-yr**	**10-yr**	**25-yr**	**50-yr**	**100-yr**
Runoff Depth Captured by GI		0.040					
Historical	Runoff Depth	0.97	1.30	1.56	1.90	2.17	2.44
	% Capture	4.1%	3.0%	2.5%	2.1%	1.8%	1.6%
Median (RCP 8.5)	Runoff Depth	1.10	1.53	1.94	2.56	3.07	3.62
	% Capture	3.6%	2.6%	2.0%	1.5%	1.3%	1.1%
Runoff Increase		***0.133***	***0.225***	***0.375***	***0.657***	***0.895***	***1.19***
GI offsets the impact of climate change by		***29.9%***	***17.6%***	***10.5%***	***6.0%***	***4.4%***	***3.3%***

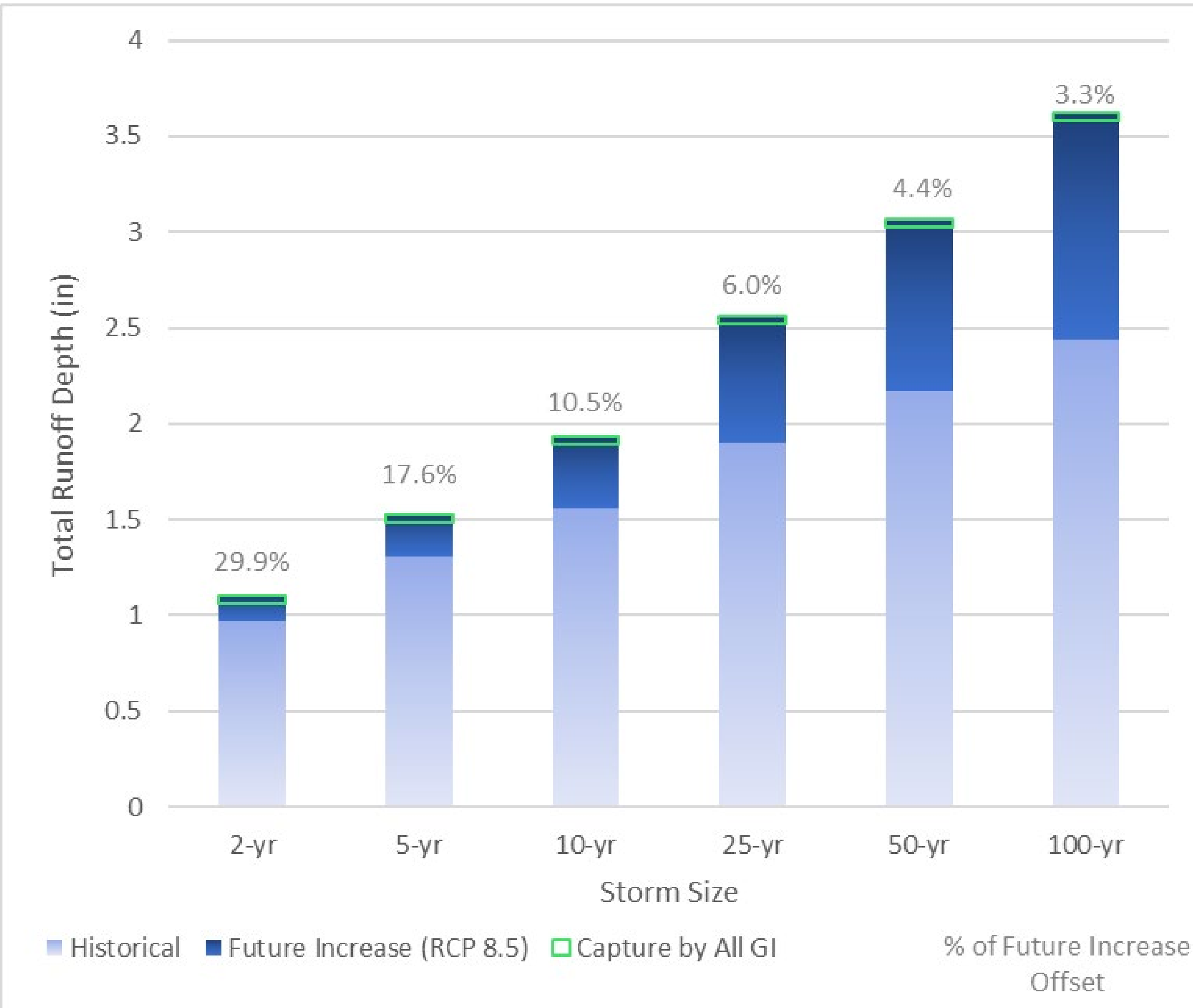


Figure 2-1. GI effectiveness in mitigating runoff increases due to climate change.

2.3 GI Benefit to the Roadway Network

Runoff from the roadway network is primarily treated through distributed practices in the rights-of-way. In order to estimate the benefit Sustainable Streets may have on reducing road runoff, stormwater capture was quantified for a scenario with only green streets identified in the RAA. Green streets are essentially the stormwater capture component of Sustainable Streets, which integrate stormwater capture and multi-modal transportation elements. Table 2-4 summarizes the road runoff in the bayside subwatersheds under historical and future conditions, and the runoff capture from the roadway network by green streets. Figure 2-2 further illustrates the benefit of green streets to offset increases in road runoff due to climate change. Green streets are projected to completely offset the road runoff increases for the 2-year storm on the bayside. Green streets are also estimated to offset the increase in road runoff during a 10-year storm, the typical design criteria for storm drain systems in the county, by as much as 39.5 percent on the bayside. These estimates include runoff from all bayside roads, both treated and untreated by green streets. It is likely that when considering runoff from only roads treated by green streets, the percent of storm runoff captured along those roads will be even higher. This demonstrates that GI may provide significant benefits for climate resiliency for county roads, especially at the smaller range of storm sizes.

Table 2-4. Estimated volume capture from the roadway network by distributed GI

Climate Change		6-hour Runoff Depth (in.) by Return Period					
Model	**Implementation Scenario**	**2-yr**	**5-yr**	**10-yr**	**25-yr**	**50-yr**	**100-yr**
Road Runoff Depth Captured by Green Streets		0.015					
Historical	Road Runoff Depth	0.144	0.180	0.206	0.241	0.268	0.295
	% Capture	10.4%	8.3%	7.3%	6.2%	5.6%	5.1%
Median (RCP 8.5)	Road Runoff Depth	0.158	0.203	0.244	0.306	0.355	0.409
	% Capture	9.5%	7.4%	6.1%	4.9%	4.2%	3.7%
Road Runoff Increase		***0.0146***	***0.023***	***0.038***	***0.065***	***0.086***	***0.114***
Green streets offset the impact of climate change by		***102.4%***	***62.6%***	***39.5%***	***23.2%***	***17.3%***	***13.1%***

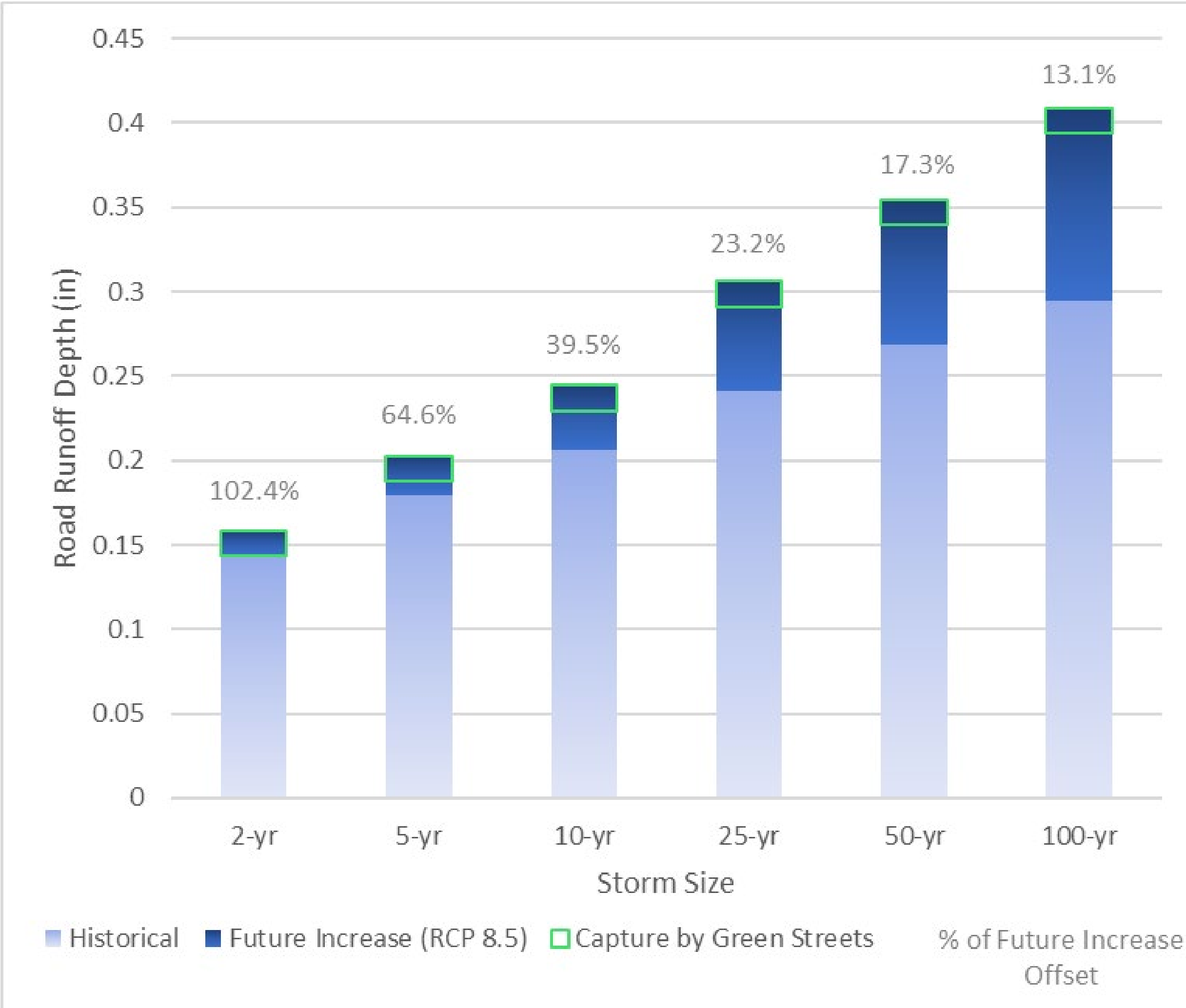


Figure 2-2. Green street effectiveness in mitigating road runoff increases due to climate change.

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APPENDIX A: PRECIPITATION DEPTH MAPS

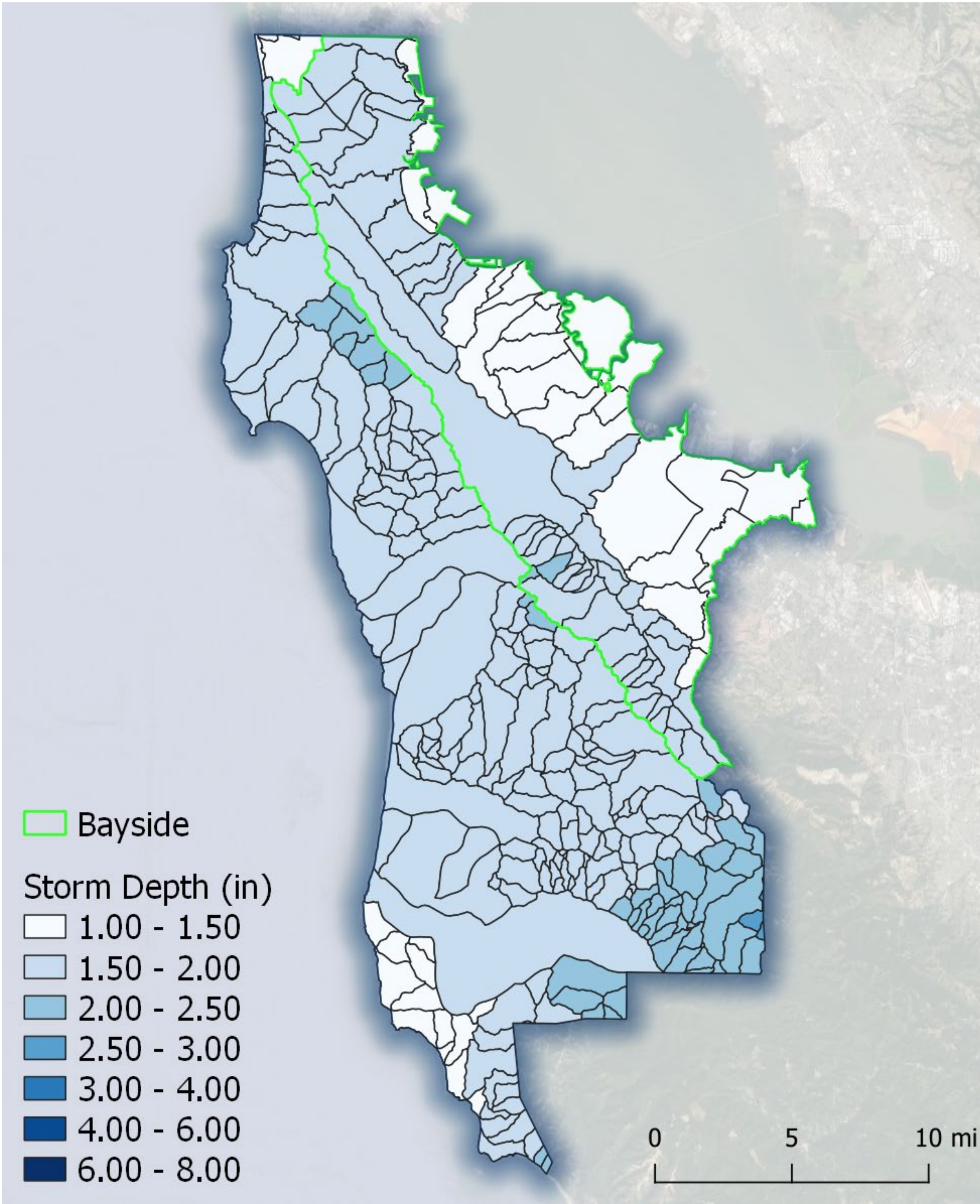

Figure A-1. Historical storm depths for the 2-year, 6-hour storm.

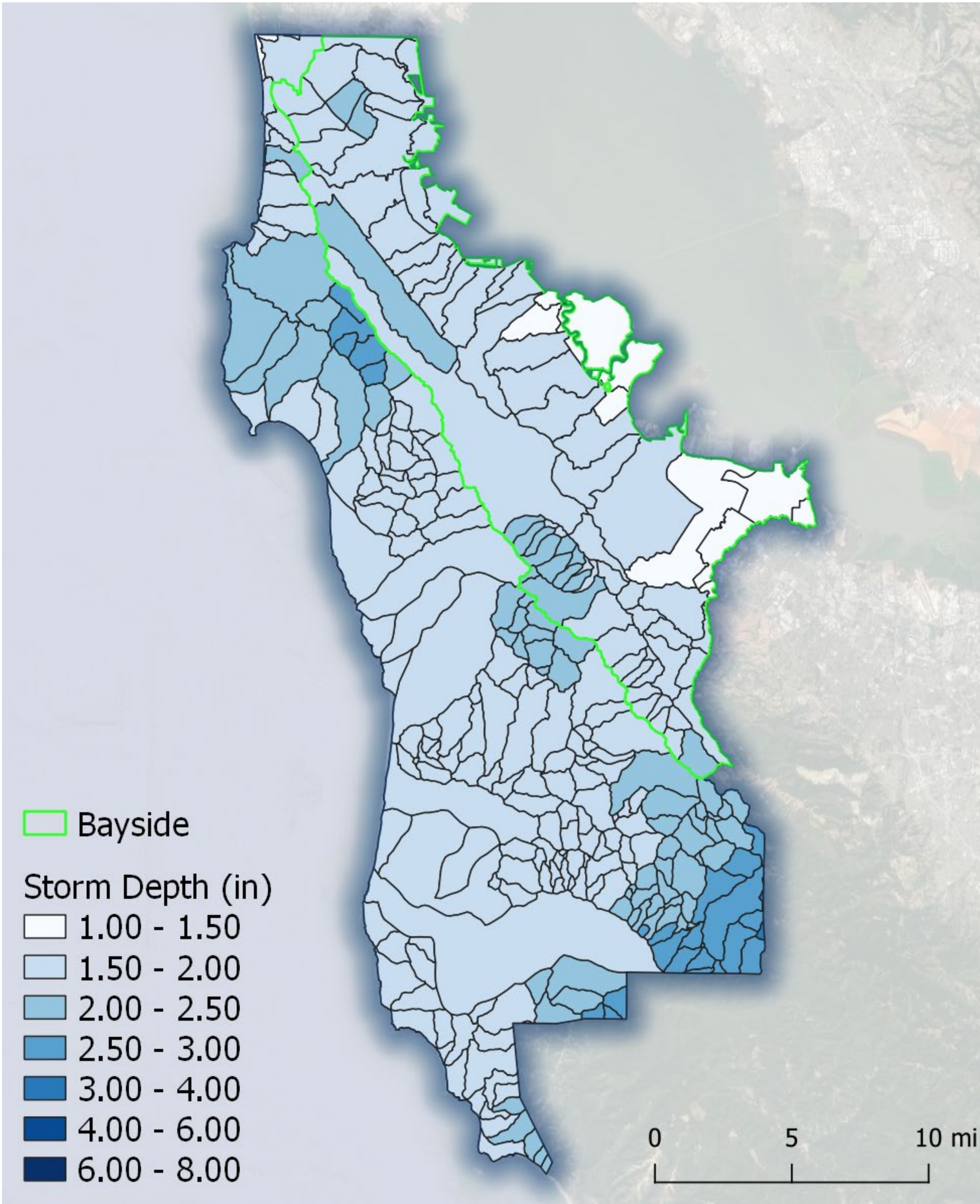

Figure A-2. Future (median RCP 8.5) storm depths for the 2-year, 6-hour storm.

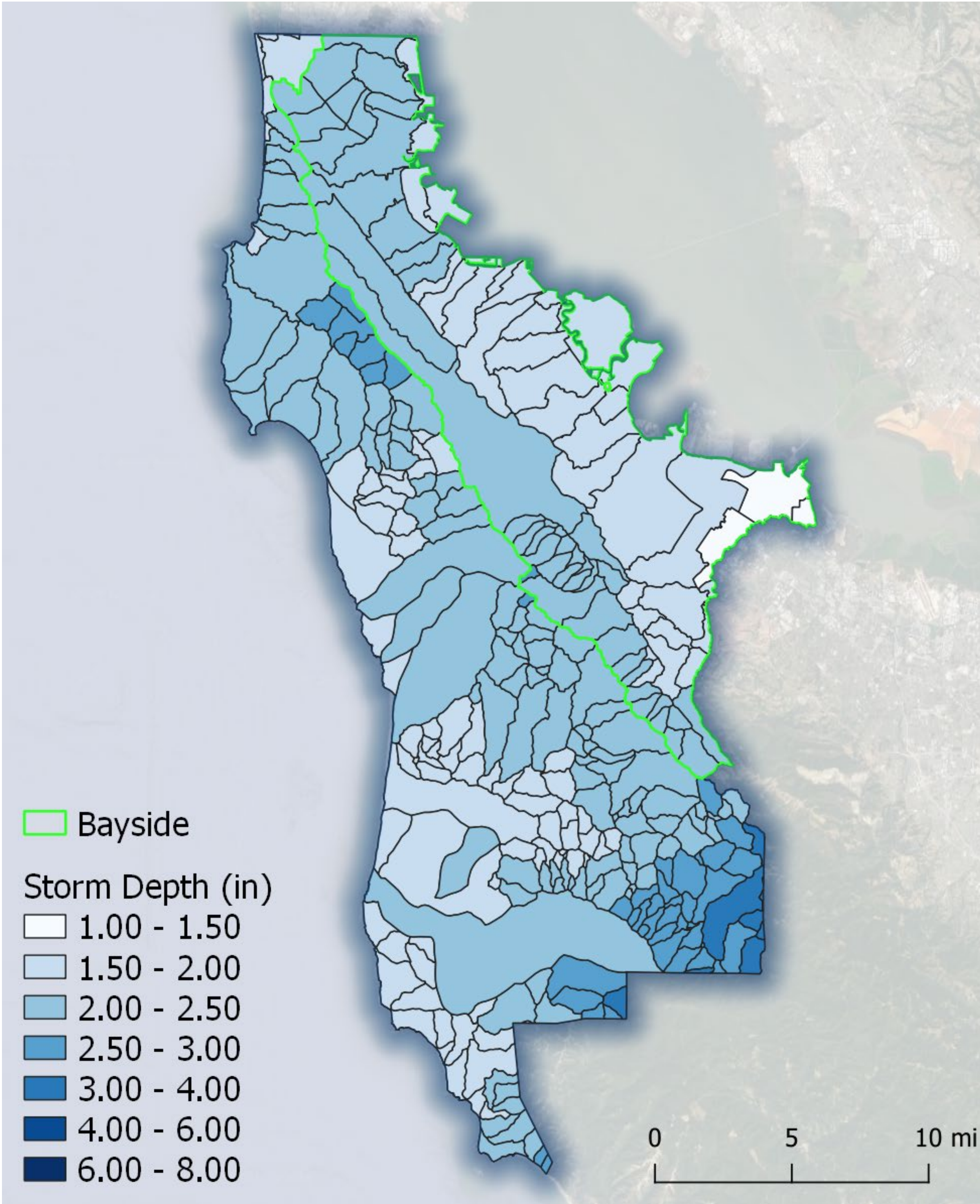

Figure A-3. Historical storm depths for the 5-year, 6-hour storm.

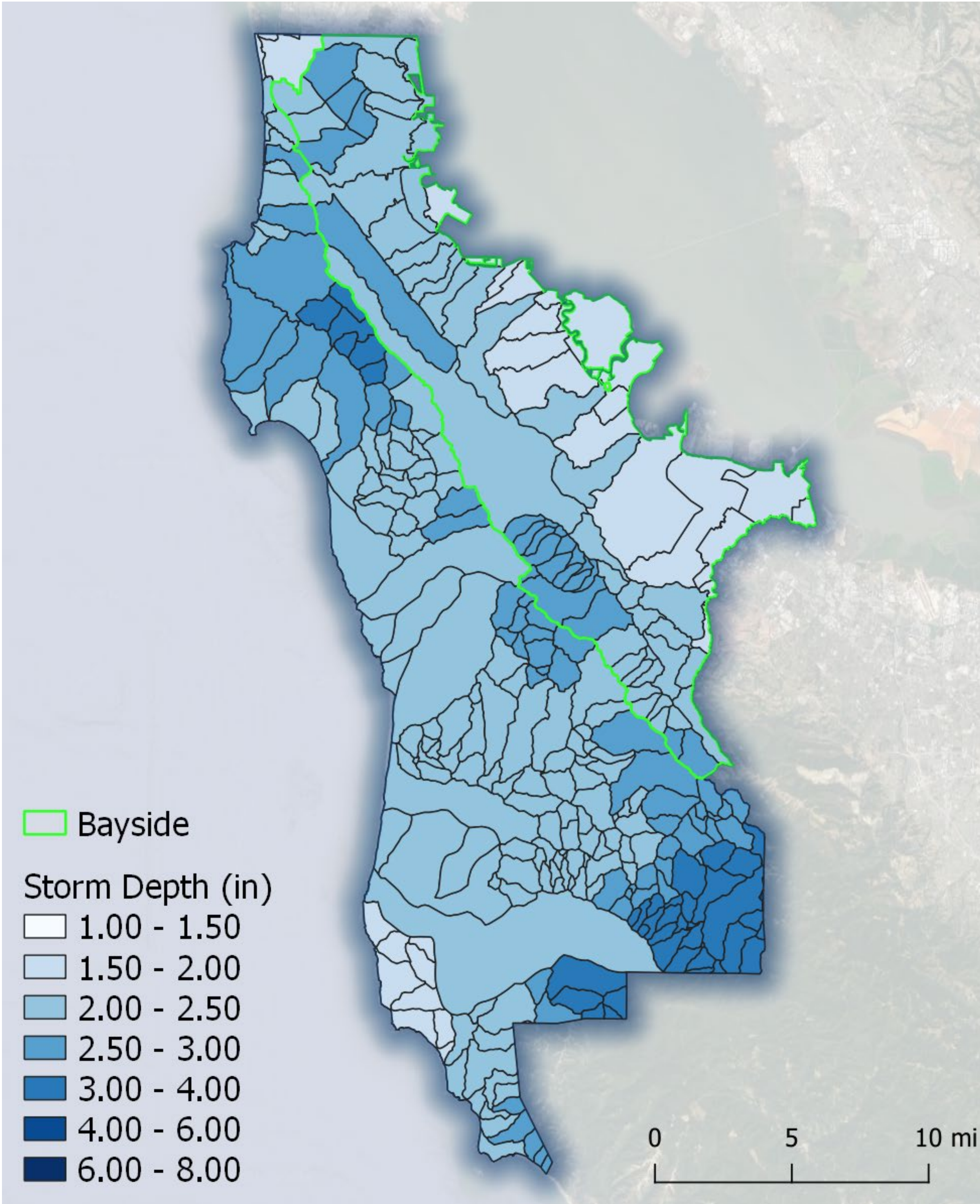

Figure A-4. Future (median RCP 8.5) storm depths for the 5-year, 6-hour storm.

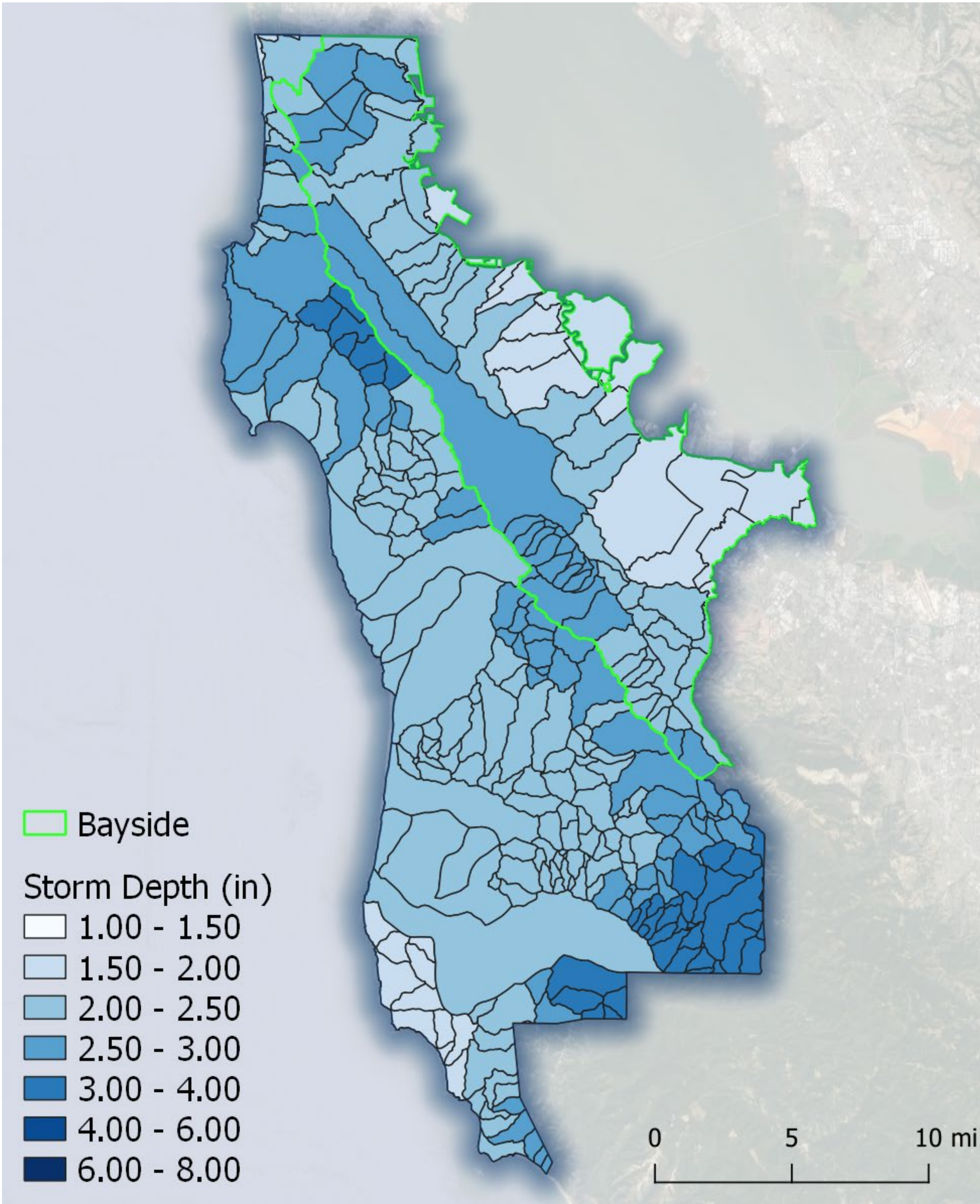

Figure A-5. Historical storm depths for the 10-year, 6-hour storm.

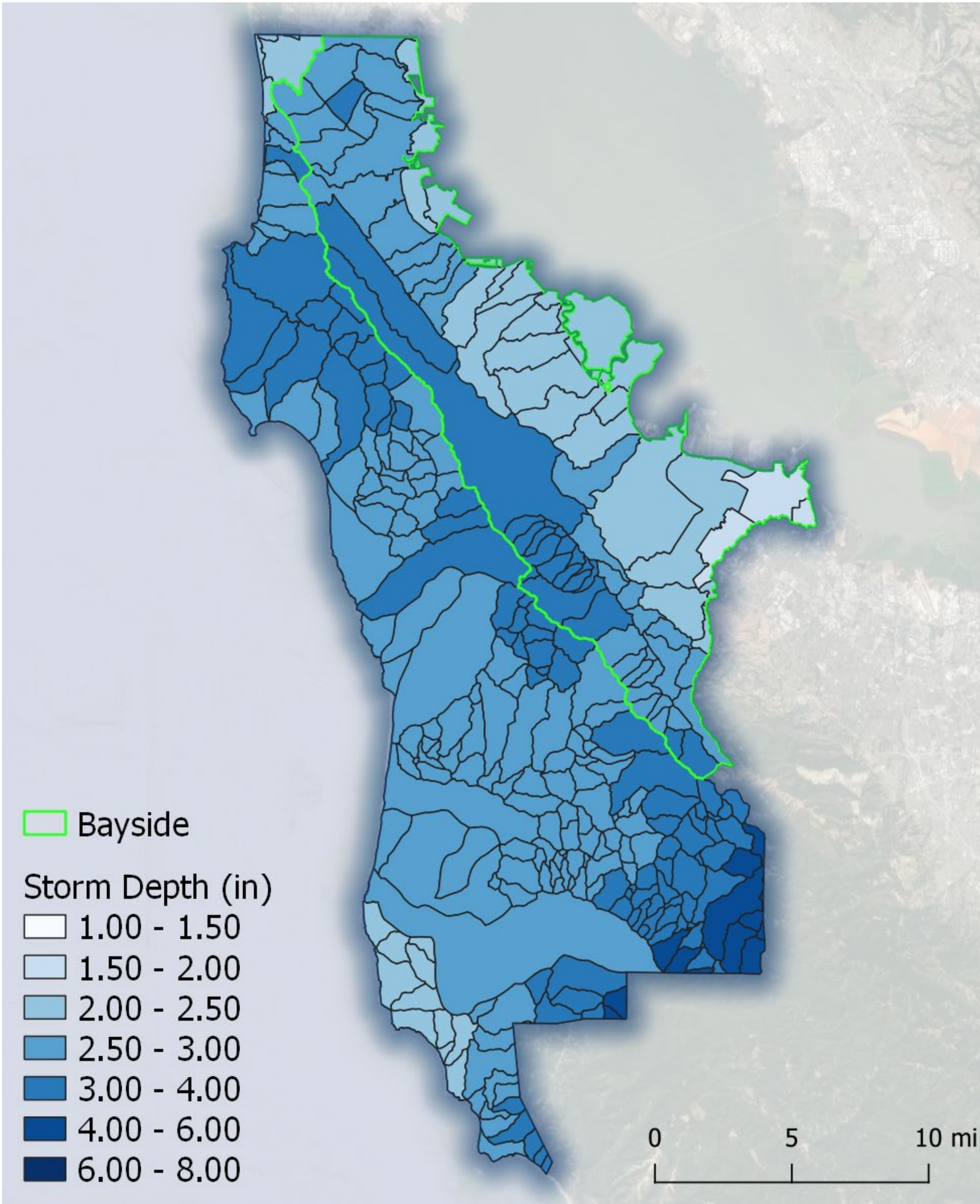

Figure A-6. Future (median RCP 8.5) storm depths for the 10-year, 6-hour storm.

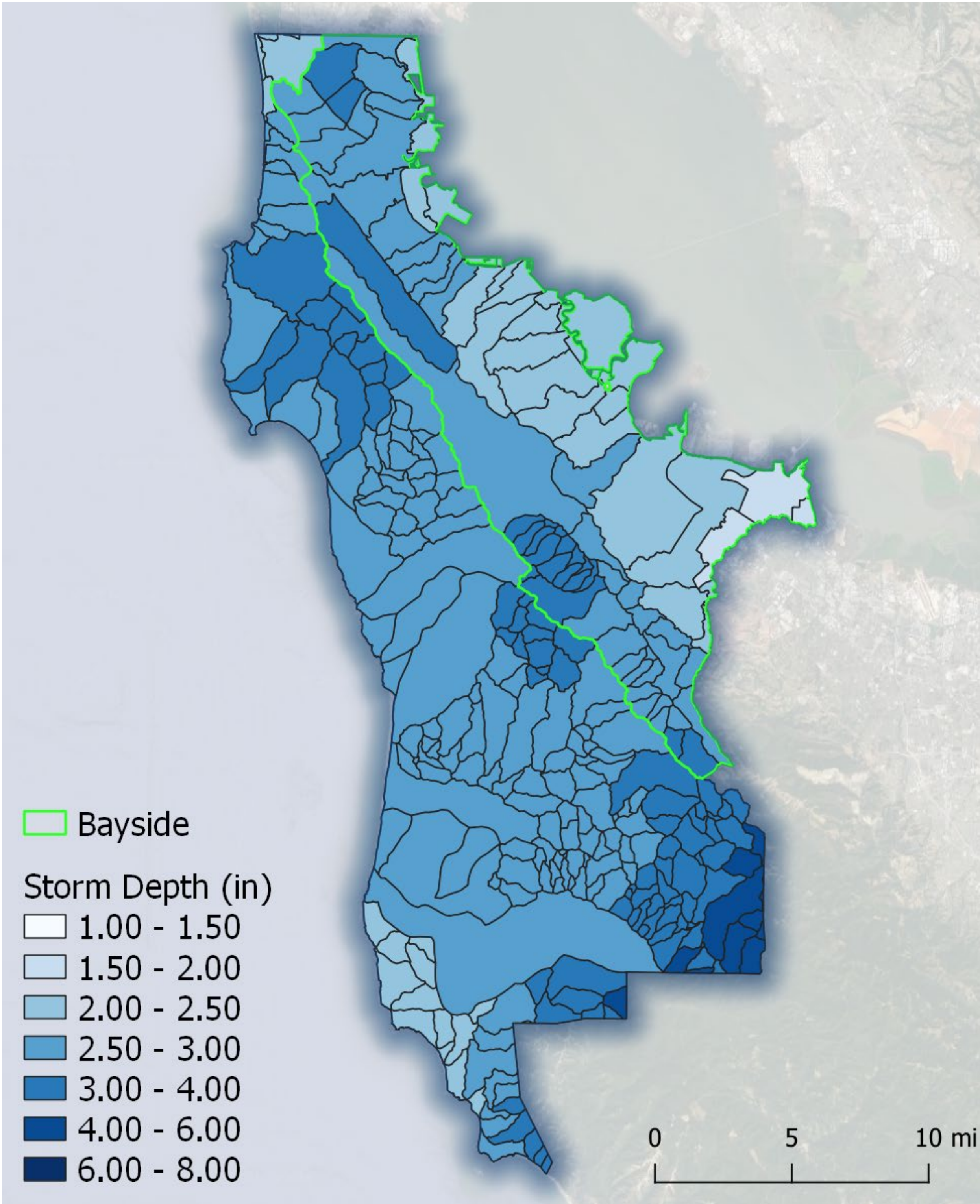

Figure A-7. Historical storm depths for the 25-year, 6-hour storm.

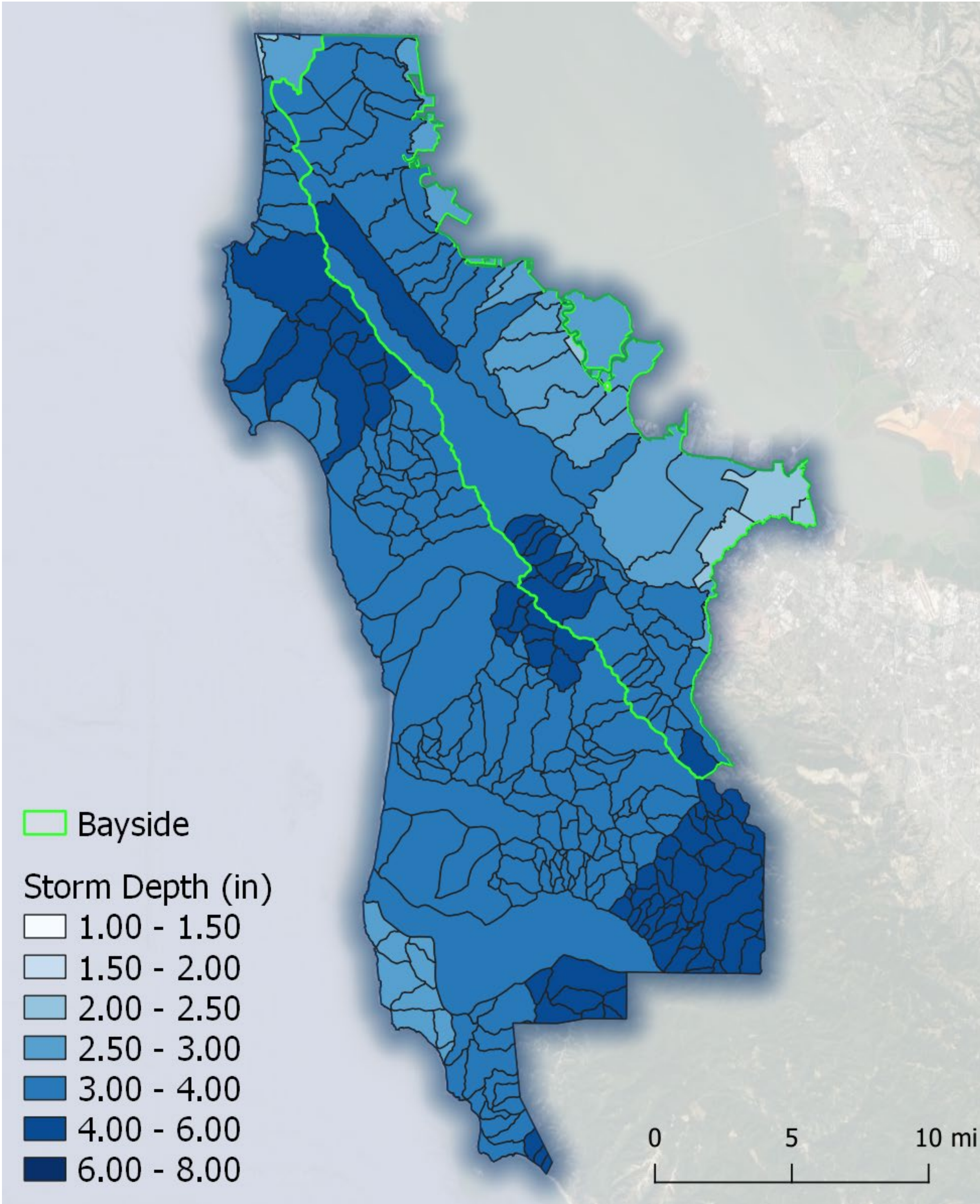

Figure A-8. Future (median RCP 8.5) storm depths for the 25-year, 6-hour storm.

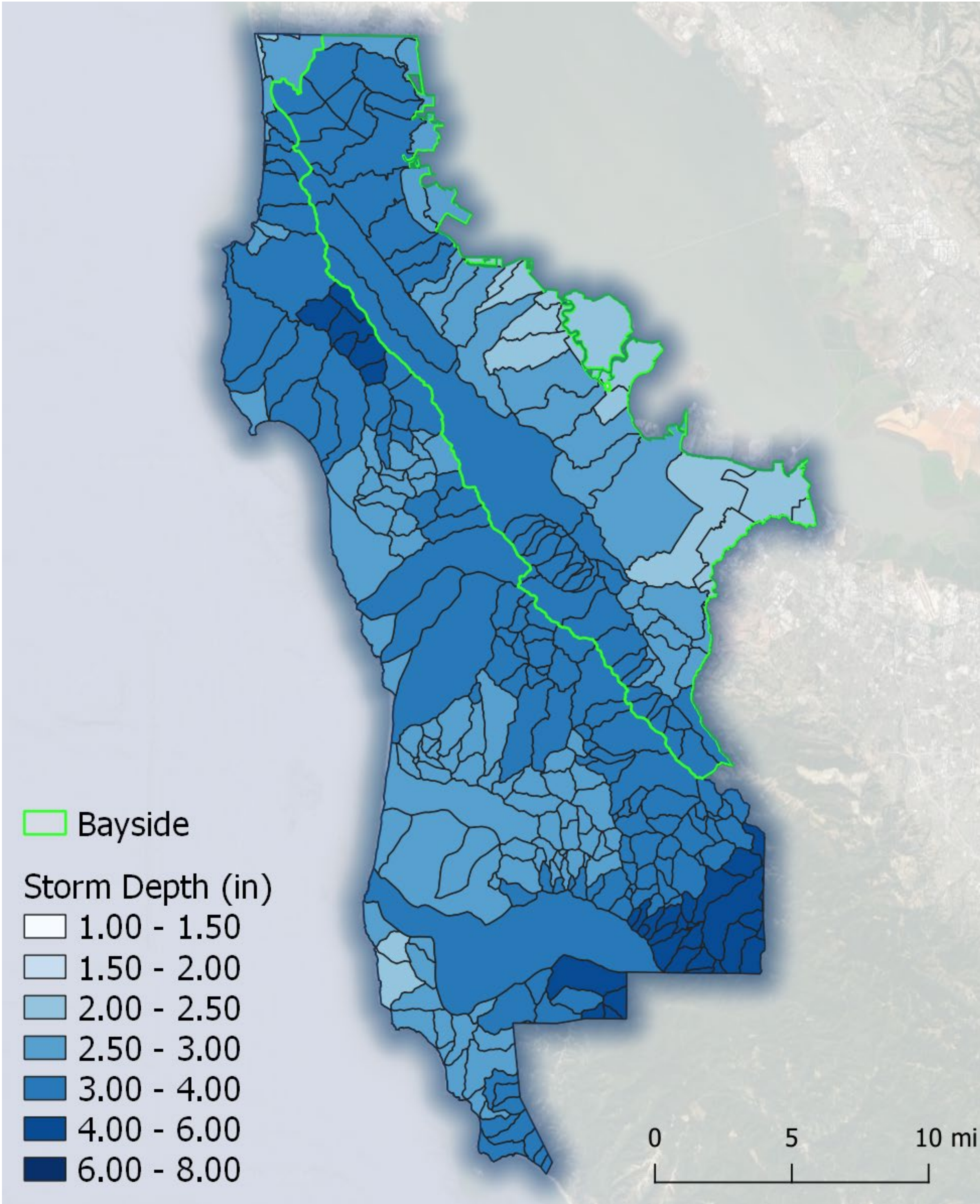

Figure A-9. Historical storm depths for the 50-year, 6-hour storm.

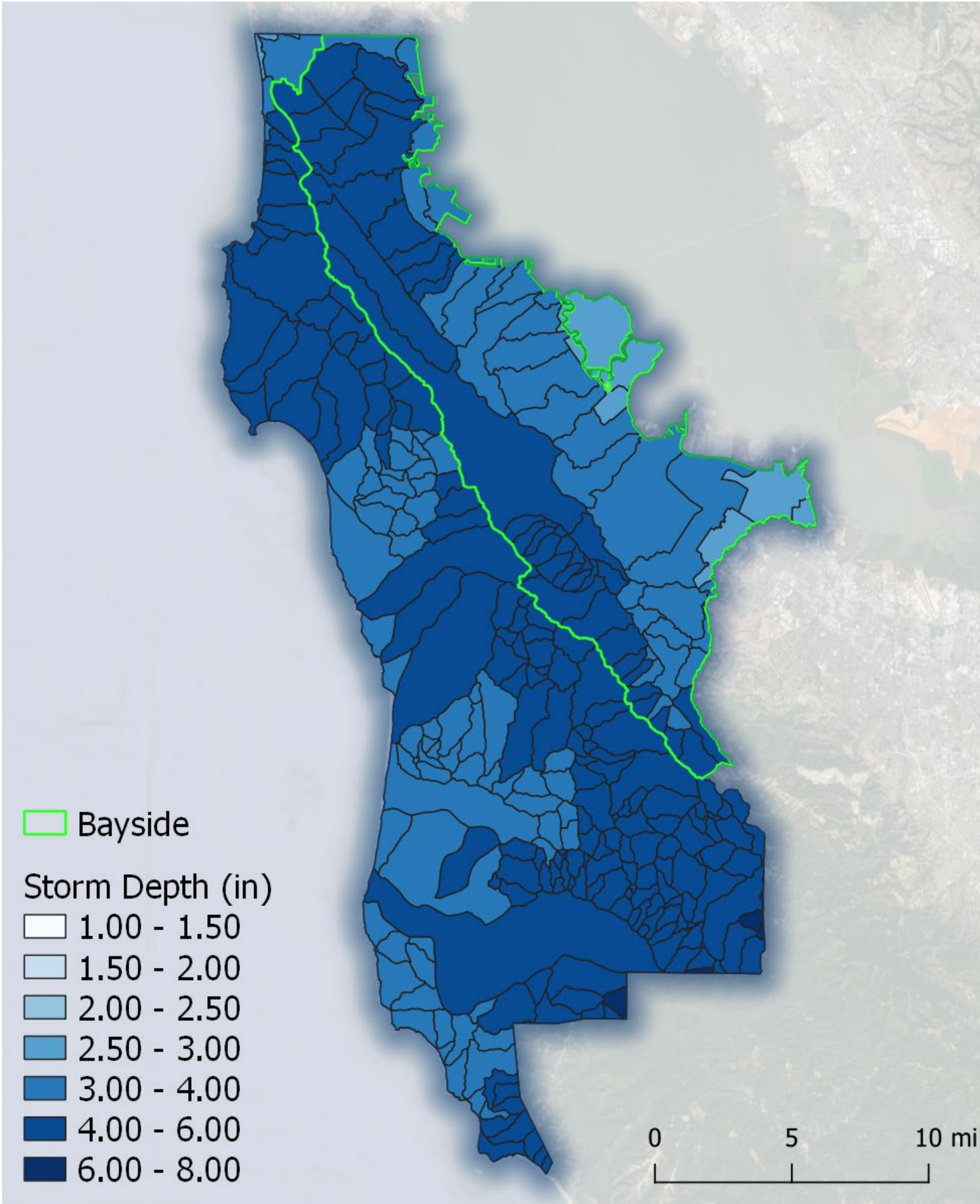

Figure A-10. Future (median RCP 8.5) storm depths for the 50-year, 6-hour storm.

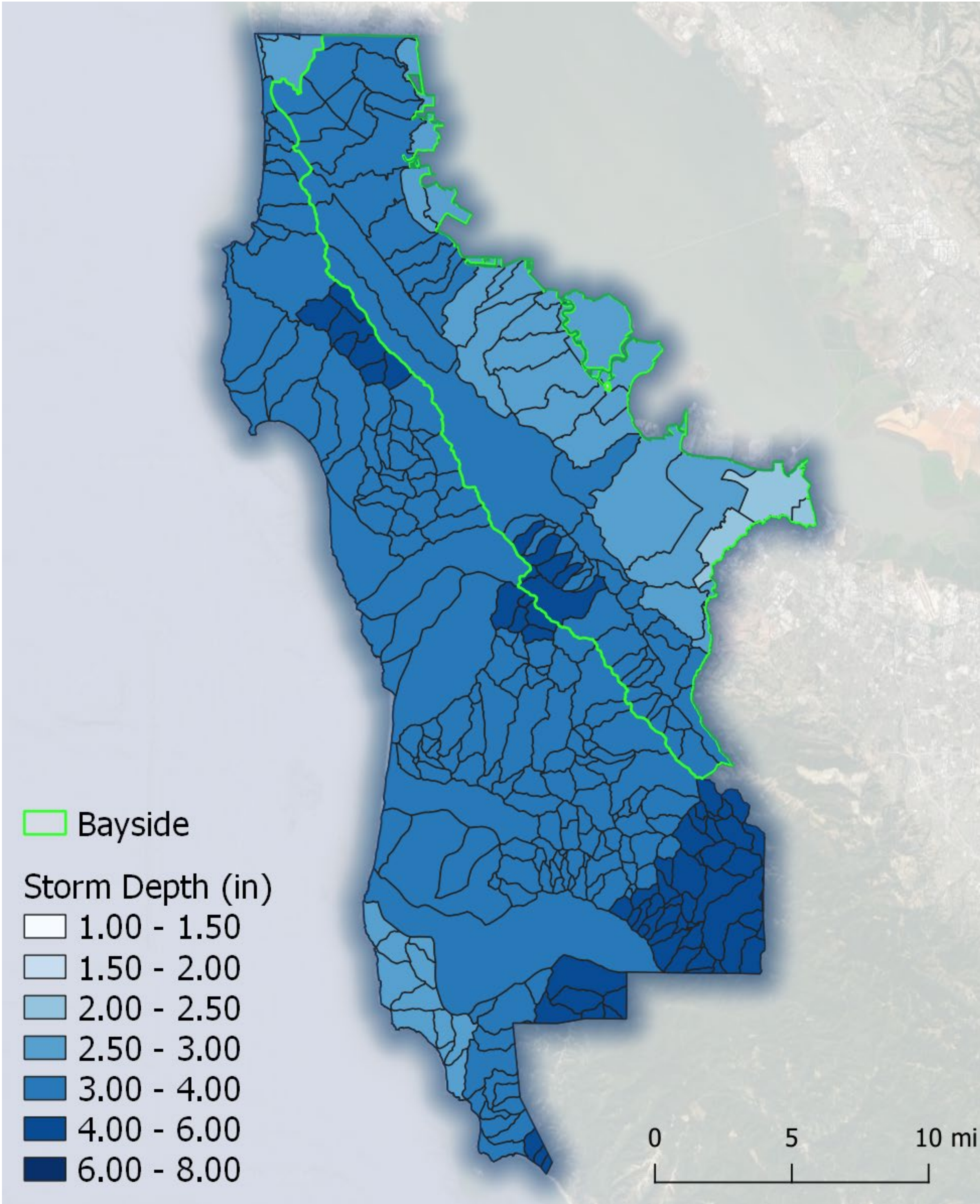

Figure A-11. Historical storm depths for the 100-year, 6-hour storm.

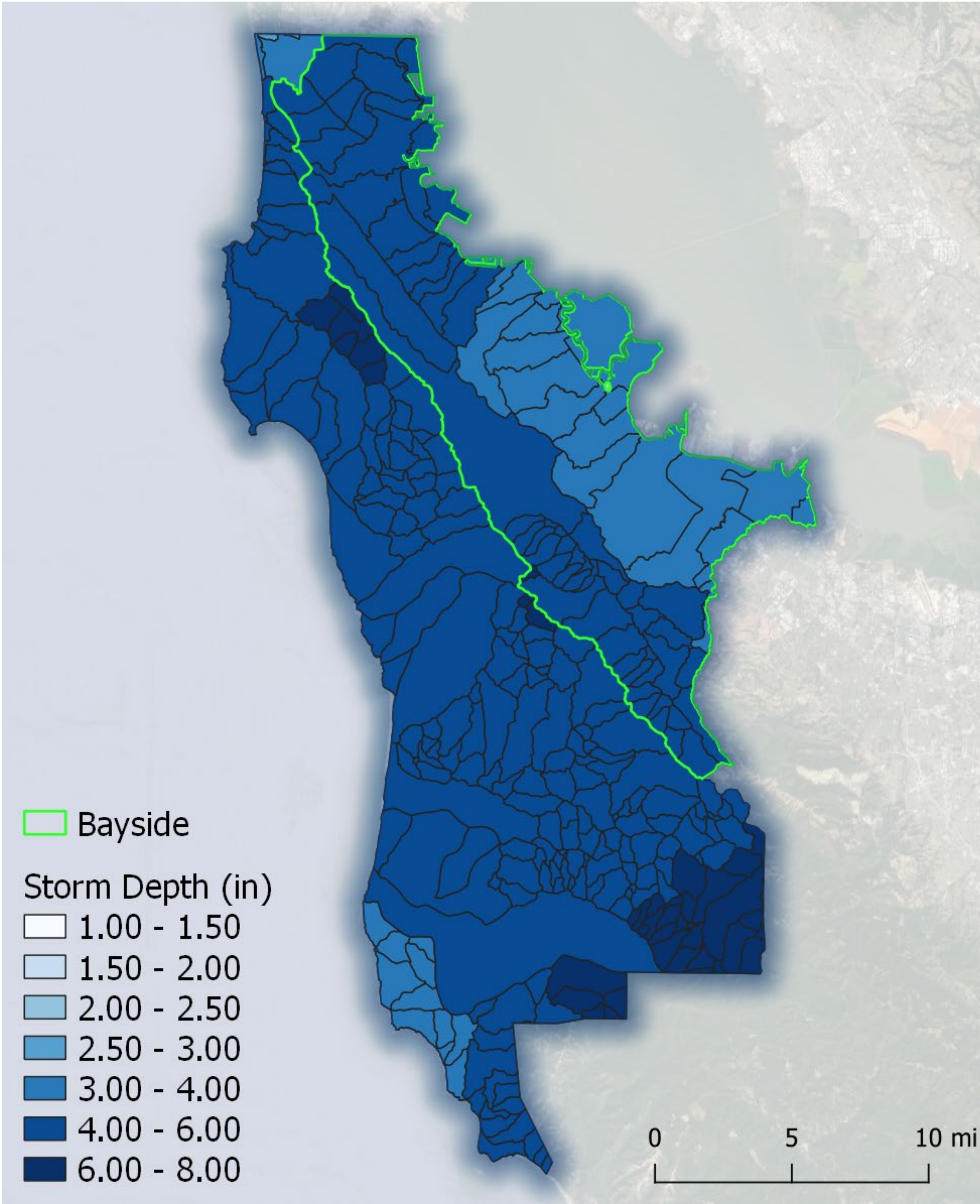

Figure A-12. Future (median RCP 8.5) storm depths for the 100-year, 6-hour storm.

APPENDIX B: RUNOFF INCREASE MAPS

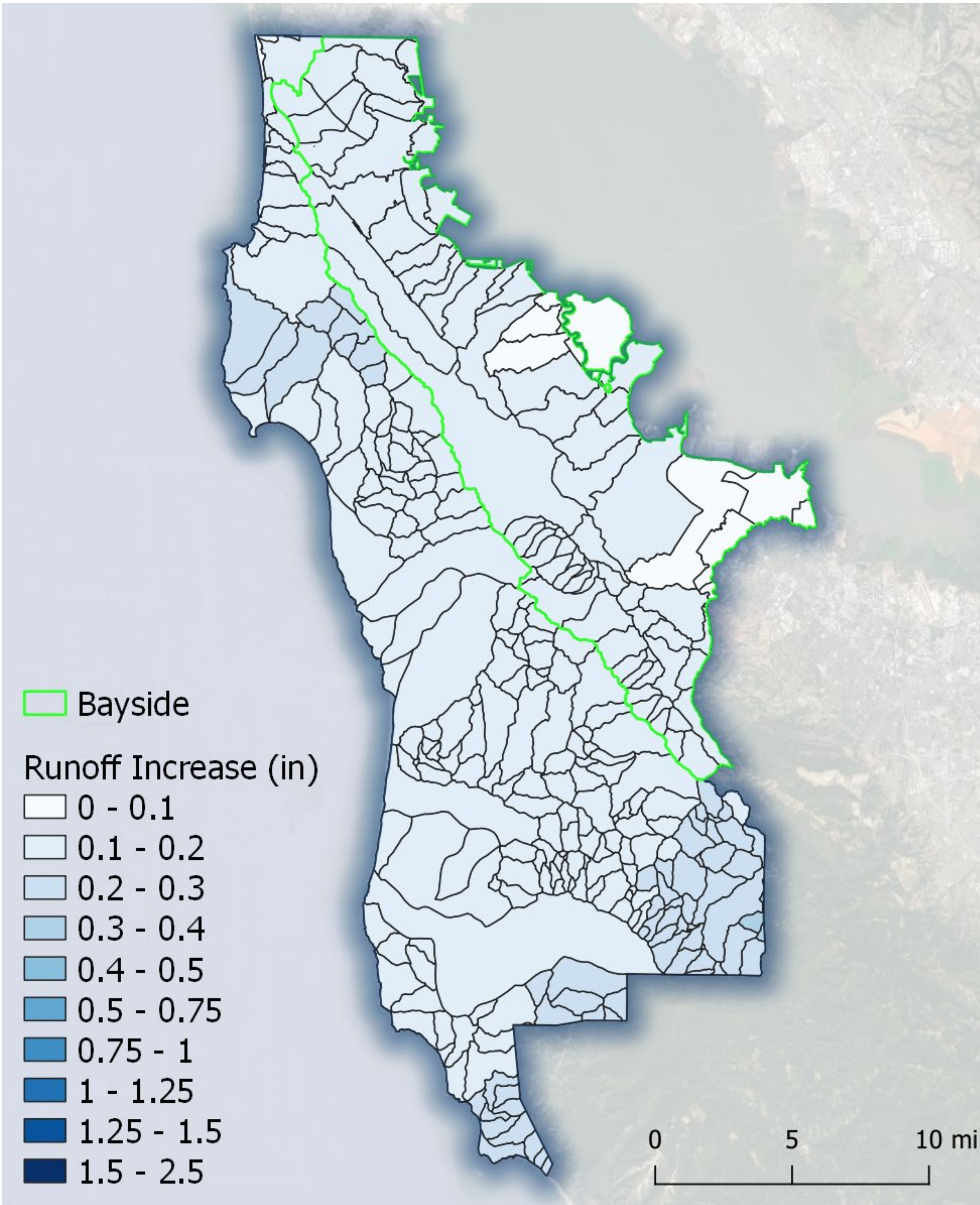

Figure B-1. Increase in runoff due to climate change (median RCP 8.5) for the 2-year, 6-hour storm.

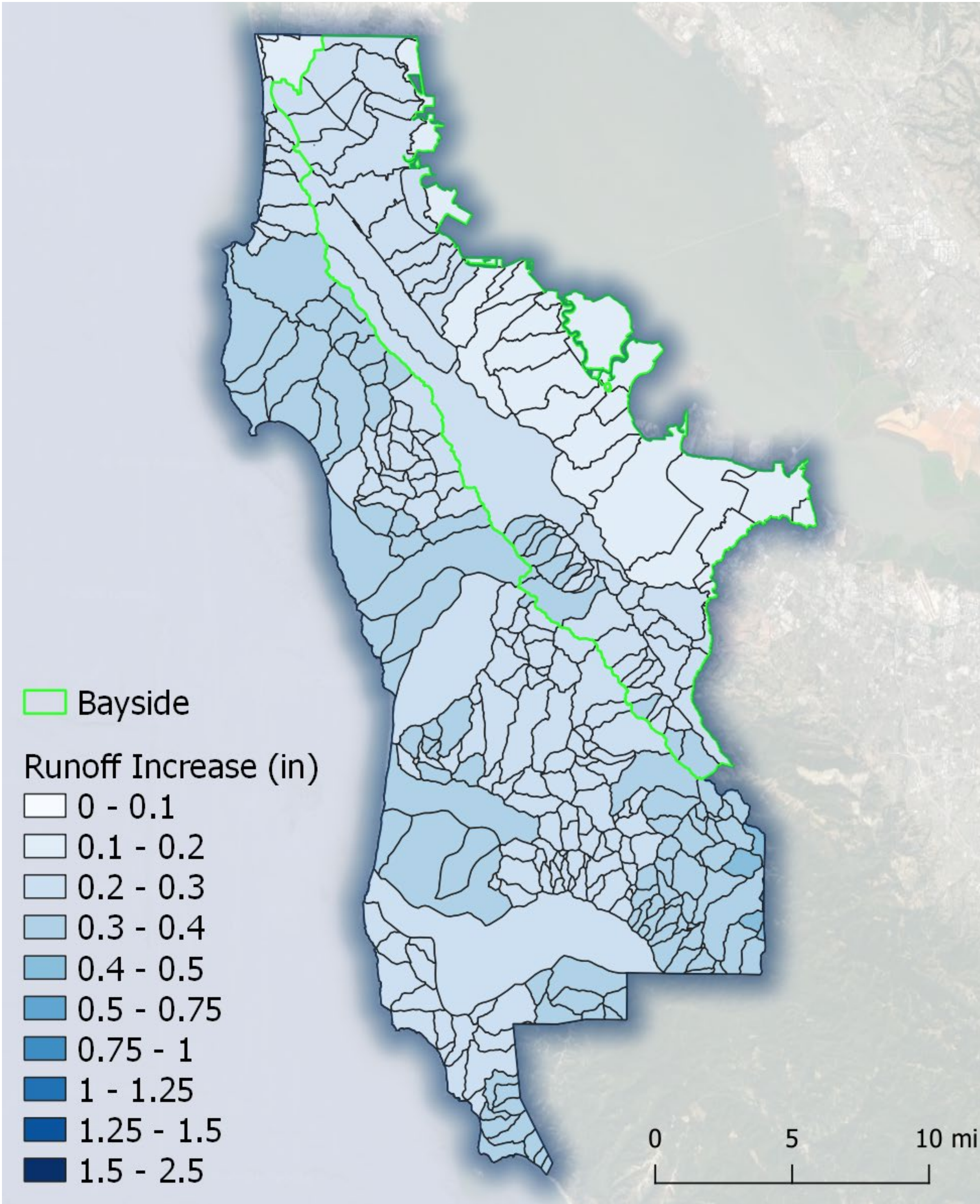

Figure B-2. Increase in runoff due to climate change (median RCP 8.5) for the 5-year, 6-hour storm.

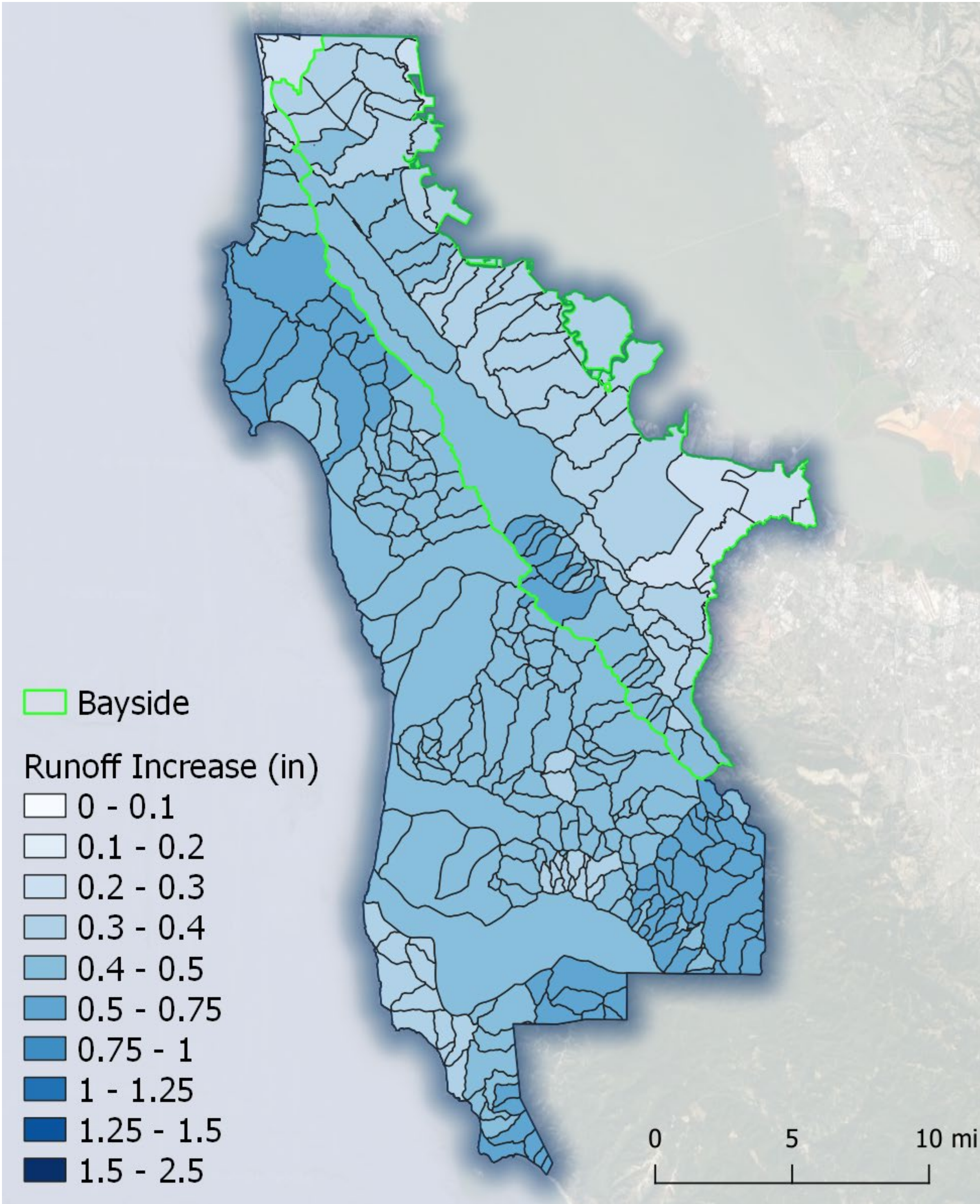

Figure B-3. Increase in runoff due to climate change (median RCP 8.5) for the 10-year, 6-hour storm.

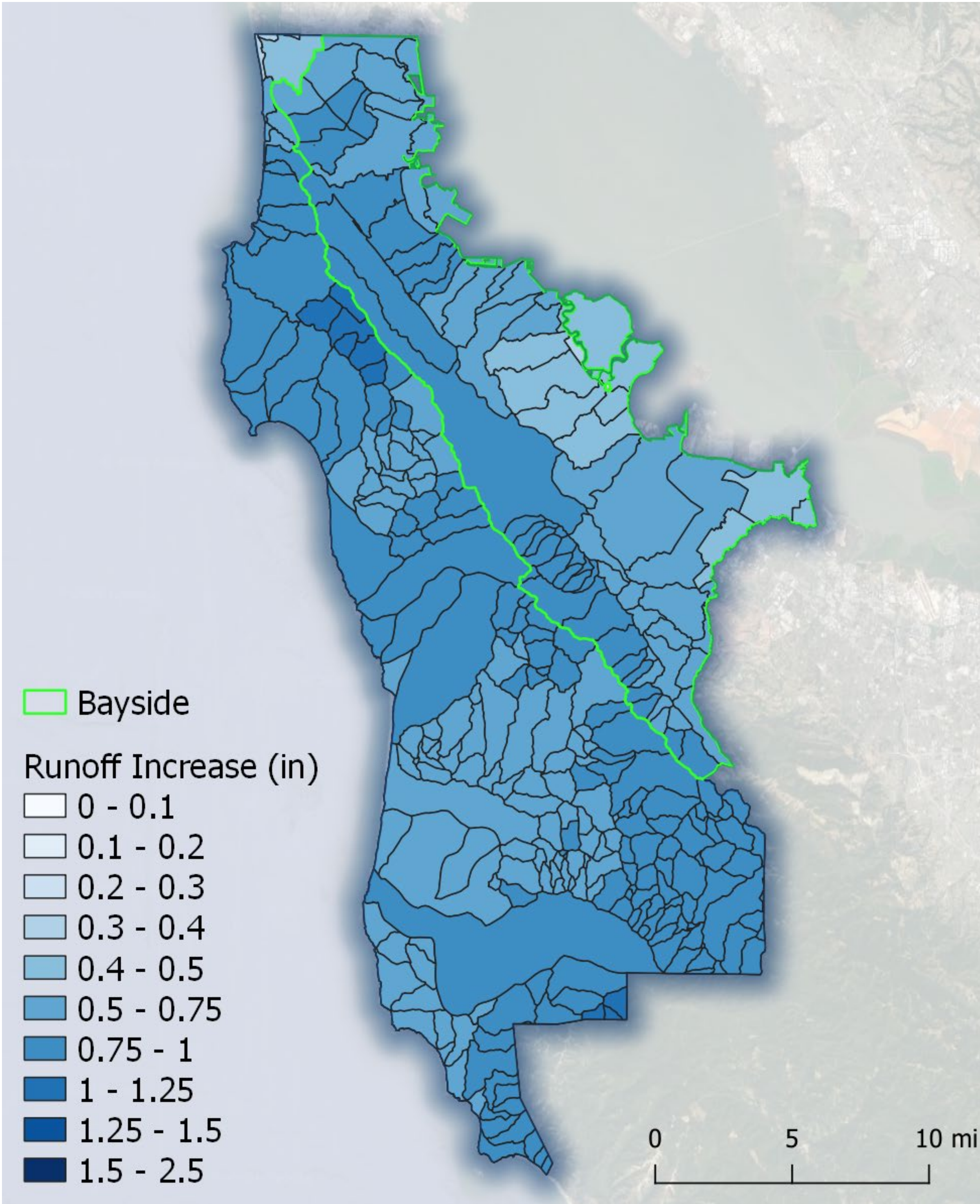

Figure B-4. Increase in runoff due to climate change (median RCP 8.5) for the 25-year, 6-hour storm.

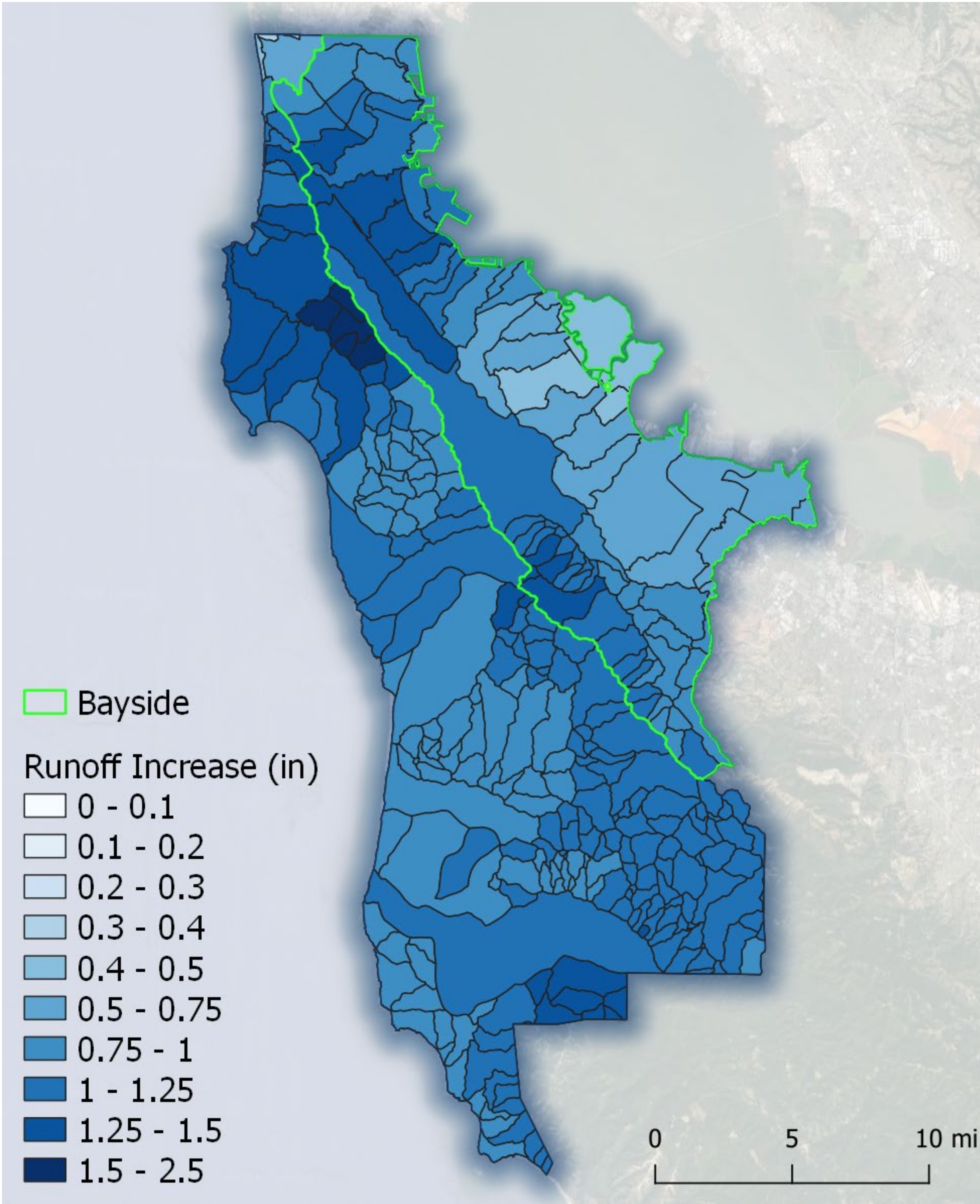

Figure B-5. Increase in runoff due to climate change (median RCP 8.5) for the 50-year, 6-hour storm.

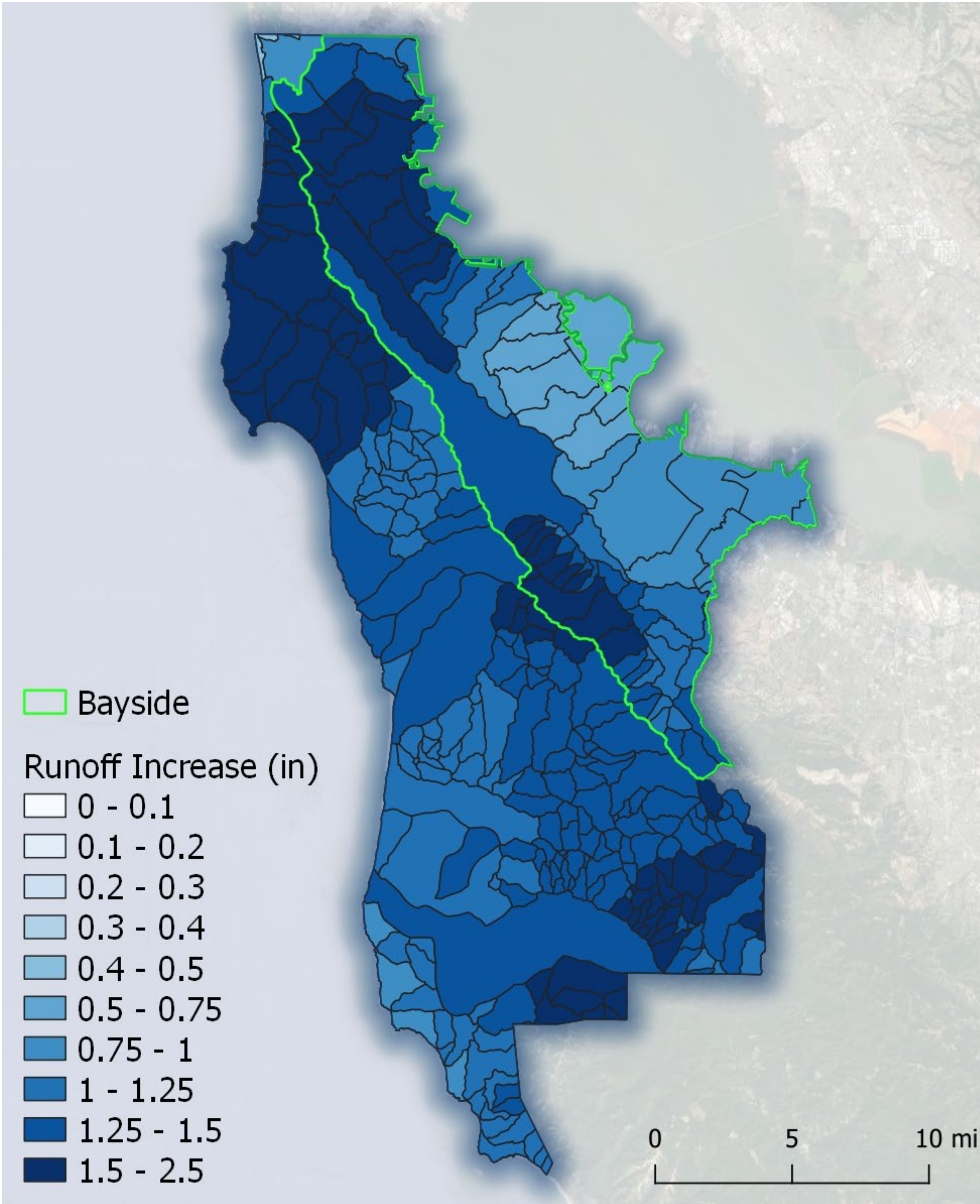

Figure B-6. Increase in runoff due to climate change (median RCP 8.5) for the 100-year, 6-hour storm.

C/CAG AGENDA REPORT

Date: May 21, 2020

To: Stormwater Committee

From: Matthew Fabry, Program Manager

Subject: Receive update on changes in budget assumptions for the Fiscal Year 2020-21 Countywide Water Pollution Prevention Program budget.

(For further information or questions contact Matthew Fabry at 650 599-1419)

RECOMMENDATION

That the Committee receive update on changes in budget assumptions for the Fiscal Year 2020-21 Countywide Water Pollution Prevention Program budget.

DISCUSSION

Staff is developing the Fiscal Year 2020-21 Countywide Program budget and will provide a summary of changes to budget assumptions after the last Committee meeting in preparation for the overall Fiscal Year 2020-21 C/CAG budget approval by the C/CAG Board of Directors at its June meeting.

ATTACHMENTS

None