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WATER POLLUTION PREVENTION PROGRAM

Advancing Regional-Scale Stormwater Management in San Mateo County:

Regional Collaborative Program Framework White Paper – FINAL

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WATER POLLUTION PREVENTION PROGRAM

Clean Water. Healthy Community.

A Program of the City/County Association of Governments of San Mateo County (C/CAG)

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Introduction

The City/County Association of Governments of San Mateo County (C/CAG) is investigating methods for advancing regional-scale stormwater management within San Mateo County (County) to cost-effectively meet Municipal Regional Stormwater Permit requirements to improve stormwater quality. C/CAG, the County, OneShoreline, consultants, and non-governmental organizations (NGOs) studied different aspects of this topic.

Background

This work built on the *Stormwater Resource Plan for San Mateo County* (SRP), which C/CAG completed in 2017 (San Mateo Countywide Water Pollution Prevention Program [SMCWPPP], 2017), and the *PCBs and Mercury Total Maximum Daily Load (TMDL) Control Measure Implementation Plan and Reasonable Assurance Analysis (RAA) for San Mateo County,* completed in 2020 (TMDL Control Measure Plan; SMCWPPP, 2020b). C/CAG found that more drainage areas could be treated with a collaborative, regional-scale stormwater management approach through these projects. Regional-scale stormwater management is defined in this White Paper to include large-scale regional stormwater capture projects, programmatic implementation of parcel-based stormwater capture projects, green streets, and Countywide initiatives such as the rain barrel/cistern/rain garden rebate and incentive programs. C/CAG sought additional studies to advance regional-scale stormwater management, and along the County received two separate grants to fund the work. C/CAG also established a Technical Advisory Committee (TAC) to advance regional-scale stormwater management.

Drivers and Objectives

C/CAG developed drivers and objectives for a Countywide Regional Collaborative Program to answer the question: ***What*** *can be better addressed and achieved through regional-scale stormwater management?*

The terms “drivers” and “objectives” are defined as follows:

- ***Drivers:*** The fundamental issues that provide the impetus for managing stormwater on a regional scale.
- ***Objectives:*** The desired outcomes from addressing the identified stormwater management drivers on a regional scale.

The key drivers for regional-scale stormwater management include:

1. Limited resources,
2. Existing stormwater infrastructure deficiencies,
3. Water quality regulations and protection,
4. Climate resiliency,
5. Beneficial use of stormwater, and
6. Equity and community engagement.

The objectives of regional-scale stormwater management to meet those drivers include:

1. More efficiently use limited resources.
2. Support improvements to and/or alleviate strain on existing stormwater infrastructure.
3. Cost-effectively comply with water quality regulatory requirements.
4. Consider and, where appropriate, design for projected future impacts resulting from climate change.
5. Supplement County water supply portfolio with stormwater where feasible.
6. Site and design projects to equitably serve and protect communities.
7. Consider local community benefits and concerns in project implementation.
8. Maximize other benefits, where possible.

Business Case

C/CAG developed a Business Case to address the key drivers and regional-scale stormwater management objectives. The Business Case focuses on ***Why*** *jurisdictions across the County should collaborate to address stormwater management drivers and objectives.*

The Business Case provides a planning level cost-benefit analysis and qualitative assessment to demonstrate why regional-scale stormwater management may offer cost efficiencies and added benefits to jurisdictions. The Business Case compares two stormwater capture project implementation "scenarios:"

- Scenario 1 is a Jurisdiction-by-Jurisdiction scenario under which stormwater management is addressed through jurisdiction-specific approaches.
- Scenario 2 is a Regional Collaborative scenario under which regional-scale stormwater management is optimized to achieve identified drivers and objectives.

The Business Case demonstrates that local jurisdictions could achieve cost savings and other multiple benefits through the Regional Collaborative scenario for many of the objectives.

Regional Collaborative Program

C/CAG developed a Regional Collaborative Program Framework to describe ***How*** *County jurisdictions can collaborate regionally.* The Regional Collaborative Program includes the following two options:

1. Market-based framework, and
2. Memoranda of Understanding (MOU)-based and market-based combined framework.

The TAC identified the second option, the MOU and market-based approach, as the preferred Regional Collaborative Program for further development. An MOU approach could be used in the near term and serve as an interim program. A larger-scale market-based program is being further explored, developed, and could potentially be rolled out if warranted upon further analysis and coordination with relevant stakeholders.

Regional Collaborative Program Components

Developing an alternative compliance exchange program such as the proposed County Regional Collaborative Program requires consideration of several Program components. Program components described in this White Paper include Regional Collaborative Projects; Regional Collaborative Program Units of Exchange; Funding and Financing Methods; and Community-Based Public-Private-Partnership.

Regional Collaborative Projects may include regional-scale stormwater capture projects and regional-scale implementation of beneficial and cost-effective distributed stormwater capture projects. As part of the overall Advancing Regional-Scale Stormwater Management Project, C/CAG's existing screening and prioritization of public parcels for regional stormwater capture opportunities was refined, and five new regional project concepts are being developed. Additionally, Regional Collaborative Projects are already underway in the county.

C/CAG has identified "volume managed" as the preferred base unit for the Regional Collaborative Program. An appropriate market-based unit (or "unit of exchange") must also relate to the compliance requirement that the prospective buyer is trying to meet. "Acres greened" is a unit that could be used to comply with the local stormwater permit (the San Francisco Bay Regional Water Quality Control Board Municipal Regional Stormwater National Pollutant Discharge Elimination System Permit or MRP). At this time, acres greened units are recommended for the initial MOU-based approach.

This study included an initial legal and accounting analysis of potential funding and financing options available to C/CAG and other Regional Collaborative Program participants. Participants could use the identified funding and financing options for distributed stormwater capture projects and regional stormwater capture projects. In the Regional Collaborative Program context, participants would use the funding and financing options to implement (and potentially maintain) the Regional Collaborative Projects.

Regional Collaborative Program Considerations and Next Steps

The Orange Memorial Park regional stormwater capture project is currently under construction in South San Francisco. It could serve as a pilot project for the interim MOU-based Regional Collaborative Program.

Key considerations for implementing a successful Regional Collaborative Program include clear goals; consistent, defined units of exchange; transparency for and buy-in from affected stakeholders; and simple, clear agreements recognized by regulators.

To further develop the Regional Collaborative Program for the County, C/CAG should consider several decisions and additional studies, such as creating a Regional Collaborative Program Committee, identifying a process for conducting a legal review, and further developing Program components.

1 INTRODUCTION

The City/County Association of Governments of San Mateo County (C/CAG) is investigating methods for advancing regional-scale stormwater management within San Mateo County (County) to cost-effectively meet Municipal Regional Stormwater Permit requirements to improve stormwater quality. C/CAG, the County, OneShoreline, consultants, and non-governmental organizations (NGOs) carried out four sub-projects to explore different aspects of this topic. The four sub-projects included:

- Drivers, Objectives, Business Case, and Regional Collaborative Program Framework development, completed by Geosyntec Consultants, Inc. (Geosyntec).
- Identification, prioritization, analysis, and concepts of regional stormwater capture project opportunities conducted by Craftwater Engineering (Craftwater).
- Assessing the Feasibility of Stormwater Credit Trading in the County, an analysis by Corona Environmental Consulting (Corona Environmental) and American Rivers.
- Funding and Financing Countywide Green Stormwater Infrastructure Investments, completed by WaterNow Alliance (WaterNow).

These four sub-projects are intended to inform the county's strategy for a Regional Collaborative Program that can promote and advance regional-scale stormwater management, as shown in the graphic above. C/CAG member agencies, the San Mateo County Flood and Sea Level Rise Resiliency District (One Shoreline), and other potential stakeholders would work together to manage stormwater through the Regional Collaborative Program.

1.1 White Paper Organization

This White Paper describes the objectives and outcomes of the four sub-projects and the recommended next steps for developing a Regional Collaborative Program in the County. This White Paper is organized as follows:

- Section 2 provides background for the C/CAG effort to advance regional-scale stormwater management in the County.
- Section 3 describes the Drivers and Objectives for regional-scale stormwater management in the County.

- Section 4 summarizes the outcomes of the Business Case for regional-scale stormwater management, which utilized modeling results from the regional project prioritization effort.
- Section 5 describes the development of a Regional Collaborative Program Framework for the County.
- Section 6 outlines key components of a Regional Collaborative Program.
- Section 7 provides considerations and next steps for further developing a Regional Collaborative Program for the County.

2 BACKGROUND

2.1 Previous Findings and Objectives for Regional-Scale Stormwater Management

C/CAG completed the *Stormwater Resource Plan for San Mateo County* (SRP) in 2017 (San Mateo Countywide Water Pollution Prevention Program [SMCWPPP], 2017) and the *PCBs and Mercury Total Maximum Daily Load (TMDL) Control Measure Implementation Plan and Reasonable Assurance Analysis (RAA) for San Mateo County* in 2020 (TMDL Control Measure Plan; SMCWPPP, 2020b). These plans examined three scales of stormwater capture projects:

- Green Streets – Stormwater facilities constructed in the right-of-way (ROW) to capture and treat roadway and adjacent parcel runoff that drains to the street.
- Parcel-Based Stormwater Capture Projects – Stormwater facilities constructed on a parcel to capture and treat runoff generated from that parcel.
- Regional Stormwater Capture Projects – Stormwater facilities that capture and treat runoff from a larger drainage area than just the parcel(s) where the facility is located. These facilities often treat runoff directed to the facility from an adjacent storm drain or channel.

Looking at the three scales of stormwater capture projects listed above, C/CAG found that more drainage area could be treated with a collaborative, regional-scale stormwater management approach. Regional-scale stormwater management is defined in this White Paper to include large-scale regional stormwater capture projects, programmatic implementation of parcel-based stormwater capture projects, green streets, and countywide initiatives such as the rain barrel/cistern/rain garden rebate and incentive programs (the latter three are collectively referred to as "distributed" stormwater capture projects). Such an approach allows for strategic implementation of multi-benefit regional stormwater capture projects, typically costing less on a per-acre treated basis than distributed stormwater capture projects (see Section 4 for cost discussion), along with flexible implementation of distributed stormwater capture projects.

Following these findings from previous Countywide work products, C/CAG sought additional studies to advance regional-scale stormwater management. C/CAG and the County received two separate grants to further these studies[1]:

- California Natural Resources Agency (CNRA) funds granted to C/CAG for prioritizing additional opportunity sites and developing regional stormwater capture project concepts; and
- United States Environmental Protection Agency (USEPA) funds, granted to the County of San Mateo through USEPA Region 9's Water Quality Improvement Fund for San Francisco Bay to develop regional stormwater capture project concepts.

2.2 Technical Advisory Committee

C/CAG established a Technical Advisory Committee (TAC) to provide input on developing the drivers and objectives, Business Case, and Regional Collaborative Program Framework. The TAC also reviewed and provided input on work products developed by Craftwater, Corona Environmental and American Rivers, and WaterNow. The TAC included individuals from C/CAG member agencies, affected or interested water-related entities in the County, and consultants and NGO representatives working on the four identified sub-projects. The TAC consisted of the following members:

- Reid Bogert, C/CAG
- Matt Fabry, C/CAG
- Makena Wong, San Mateo County Flood and Sea Level Rise Resiliency District
- Robert Ovadia, Town of Atherton
- Randy Breault, City of Brisbane
- Paul Willis, Town of Hillsborough
- John Allan, County of San Mateo
- Susan Wright, County of San Mateo
- Bianca Liu, City of South San Francisco
- Matthew Ruble, City of South San Francisco
- Tom Francis, Bay Area Water Supply and Conservation Agency
- Eric Hansen, Silicon Valley Clean Water
- Kim Hackett, Silicon Valley Clean Water
- Zachary Rokeach, San Francisco Bay Regional Water Quality Control Board

[1] C/CAG received $2.97M from the state to advance regional projects. C/CAG worked with Redwood City, San Bruno, and Belmont to help fund design efforts and worked with the County and OneShoreline to develop a joint Request for Proposals (RFP) with the remaining state funds and a portion of the County's WQIF money to complete the Advancing Regional-Scale Stormwater Capture Project in San Mateo County Project.

- Caroline Koch, WaterNow Alliance
- Jeff Odefey, American Rivers
- Janet Clements, Corona Environmental
- Merrill Taylor, Craftwater
- Kelly Havens, Geosyntec
- Lisa Austin, Geosyntec
- Mark Kieser, Kieser & Associates

3 DRIVERS AND OBJECTIVES

Drivers and objectives for a Countywide Regional Collaborative Program were developed to answer the question: ***What*** *can be better addressed and achieved through regional-scale stormwater management?*

The terms "drivers" and "objectives" are defined as follows for the Project:

- ***Drivers:*** The fundamental issues that provide the impetus for managing stormwater on a regional scale.
- ***Objectives:*** The desired outcomes from addressing the identified stormwater management drivers on a regional scale.

As part of the development of drivers and objectives, an overall project vision was developed to describe the envisioned path to achieve the objectives:

- ***Vision:*** Cost-effectively implement multi-benefit stormwater infrastructure solutions that collectively minimize localized flooding; improve water quality; increase resiliency to climate change impacts; utilize stormwater as a resource; address regulatory requirements; and serve communities equitably, both locally and regionally.

To develop the drivers and objectives, Geosyntec reviewed existing plans produced by the County of San Mateo, C/CAG member agencies, and other County-based and regional entities that are relevant to stormwater management planning, implementation, and/or the resulting benefits. Several foundational factors related to or benefitted by regional-scale stormwater management were identified through this review and were used to develop preliminary drivers and objectives. A preliminary list of drivers and associated objectives were presented to the TAC for consideration. The TAC provided input on how to revise the preliminary drivers to develop compelling key drivers for managing stormwater on a regional scale. The Project TAC also provided input on associated objectives developed for the key drivers. The resulting key drivers for regional-scale stormwater management identified through this effort are provided below. See Appendix A for further discussion of all drivers and objectives.

1. **Limited Resources** – Many municipalities have extremely limited or no dedicated funds for stormwater-related services. This is related to how state law (i.e., Proposition 218 and State Bill 231 amending Proposition 218) is interpreted for non-balloted fees. See section 6.3 for further discussion.

2. **Existing Stormwater Infrastructure Deficiencies** – Likely due to limited funding, C/CAG member agencies that have developed storm drain master plans in the past two decades have identified high priority deficiencies in existing storm drain infrastructure, resulting in localized flooding and other issues. Hundreds of millions of dollars (low-end estimate) are needed to address these issues, representing a funding need of at least two orders of magnitude higher than current dedicated stormwater revenue available to C/CAG's member agencies can provide.

3. **Water Quality Regulations and Protection –** C/CAG member agencies are subject to the San Francisco Bay Regional Water Quality Control Board (Water Board) Municipal Regional Stormwater National Pollutant Discharge Elimination System (NPDES) Permit (MRP; Order R2-2015-0049 and future orders), which implements TMDLs for impaired water bodies in the MRP area. Based on preliminary efforts towards advancing a countywide funding initiative in 2014, C/CAG projected a funding gap to comply with trash and polychlorinated biphenyls (PCBs)/mercury requirements under MRP 2.0 of $36M/year, which does not include existing infrastructure upgrade cost projections at that time (C/CAG, 2014). Additionally, C/CAG projected in the TMDL Control Measure Plan that county municipalities may collectively need to invest between $760 million and $1.14 billion in capital improvement funds (on top of storm drain infrastructure investments) over several decades to comply with these requirements.

4. **Climate Resiliency –** The County may experience multiple impacts from climate change. The County has identified specific flooding impacts in the Sea Level Rise Vulnerability Assessment for coastal flooding (San Mateo County Office of Sustainability, 2018) and the Sustainable Streets Master Plan due to more extreme events (C/CAG, 2021), and declared a state of emergency in 2019 (San Mateo County Board of Supervisors, 2019). In 2019, the San Mateo County Flood and Sea Level Rise Resiliency District (referred to as OneShoreline) was formed from the pre-existing San Mateo County Flood Control District to take on additional responsibility for mitigating the impacts of climate change related to sea level rise, coastal erosion, flooding, and regional-scale stormwater issues throughout the County. Additional potential challenges include increasing water stress resulting from prolonged drought or reduced snowpack and increased urban heat impacts.

5. **Beneficial Use of Stormwater –** In addition to needs relating to future water stress and drought year supply shortfalls, there is also a desire to use stormwater as a beneficial resource throughout the County. The primary beneficial use of focus is water supply, including smaller scale capture and use of non-potable water to augment potable use, recharge to groundwater basins, or diversion of stormwater to supplement recycled water production. This is supported by state law and can provide community benefits and support overall water resiliency (State of California, 2018). The Bay Area Water Supply and Conservation Agency (BAWSCA) *Long-Term Reliable Water Supply Strategy* (BAWSCA, 2015) also identifies rainwater harvesting as a strategy for increasing local supply.

6. **Equity and Community Engagement -** In California, disadvantaged and vulnerable communities may be disproportionately burdened by pollution, socioeconomic and health impacts, flooding, and potential climate change impacts. The County of San Mateo's Board of Supervisors has recently increased the focus on equity in County decision-

making (County of San Mateo Board of Supervisors, 2020a and 2020b). In addition to serving and protecting communities equitably, community engagement is also an important aspect of a successful regional-scale stormwater management approach to ensure an equitable process in planning and decision-making.

The objectives of regional-scale stormwater management developed to meet those drivers included:

1. More efficiently use limited resources.
2. Support improvements to and/or alleviate strain on existing stormwater infrastructure.
3. Cost-effectively comply with water quality regulatory requirements.
4. Consider and, where appropriate, design for projected future impacts resulting from climate change.
5. Supplement County water supply portfolio with stormwater where feasible.
6. Site and design projects to equitably serve and protect communities.
7. Consider local community benefits and concerns in project implementation.
8. Maximize other benefits, where possible.

A summary of how the objectives could address the various key drivers is shown in Figure 1. As shown, many of the identified objectives could address multiple key drivers.

Figure 1: Drivers and Objectives

A report was developed describing the identification of the drivers and objectives and more details about each: *Advancing Regional-Scale Stormwater Management in San Mateo County: Drivers and Objectives*. This report is provided as Appendix A of this White Paper. Objectives were also referenced in the development of work products for the other related Advancing Regional-Scale Stormwater Management sub-projects. Additional discussion of how drivers and objectives were used for the development of the Business Case and the Regional Collaborative Framework is included in the following sections.

4 BUSINESS CASE FOR REGIONAL COLLABORATION

4.1 Business Case Objective

A Business Case was developed after establishing the key drivers and developing regional-scale stormwater management objectives. The Business Case was focused on: ***Why*** *jurisdictions across the County should collaborate to address stormwater management drivers and objectives.*

The Business Case provides a planning level cost-benefit analysis and qualitative assessment to demonstrate why a regional-scale stormwater management approach may provide cost efficiencies and added benefits to jurisdictions collaborating regionally to meet regulatory requirements for stormwater quality and to achieve other regional benefits. A summary of the Business Case is provided in this White Paper and the detailed analysis is included in Appendix B.

4.2 Business Case Methodology

To develop the Business Case, analyses were conducted to compare metrics and other evaluation factors for two stormwater capture project implementation "scenarios:"

- Scenario 1: Jurisdiction-by-Jurisdiction scenario under which stormwater management is addressed through jurisdiction-specific approaches.
- Scenario 2: Regional Collaborative scenario under which regional-scale stormwater management is used to achieve identified drivers and objectives.

The Jurisdiction-by-Jurisdiction scenario was represented by existing studies and plans, including the *Countywide Reasonable Assurance Analysis* (Countywide RAA) (SMCWPPP, 2020a) and the *Sustainable Streets Master Plan* (SSMP; C/CAG, 2021), available *Storm Drain Master Plan* (SDMP) and *Green Infrastructure Plan* (GI Plan) information, and the BAWSCA *Long-Term Reliable Water Supply Strategy* (BAWSCA, 2015).

The Regional Collaborative scenario was examined using outputs from parallel analyses from this project that evaluated opportunities for regional stormwater capture projects countywide. This effort builds from the prior regional project identification and multi-benefit metrics-based analysis conducted as part of the San Mateo County *Stormwater Resource Plan* (SMCWPPP, 2017).

The objectives described in Section 3 and Appendix A of this White Paper were translated to quantitative and qualitative metrics for comparison for the Business Case. The metrics, or evaluation factors, that have been used to compare the benefits associated with each scenario for the identified objectives are provided in Table 1.

4.2.1 Regional Stormwater Capture Project Identification and Prioritization

Building on prior work done by C/CAG in the San Mateo County SRP, Craftwater conducted a regional stormwater capture project identification and prioritization exercise to identify locations for stormwater capture facilities that could provide benefits in line with the objectives. As a result of their analysis, 74 potential regional facility locations and the associated proposed facility types were identified (see Appendix C for map of locations). This prioritized suite of potential facilities was modeled by Craftwater to estimate metrics for each facility associated

with the identified project objectives (Appendix C). These metrics were used to represent the Regional Collaborative Scenario in the Business Case and are summarized in Table 1.

Additional details regarding Craftwater's methods and results are provided in the *County of San Mateo Advancing Regional Stormwater Capture Projects Project Opportunities Analysis Memo* (provided as Appendix C). These results are considered generally representative of the Regional Collaborative scenario. Further refinement of the identified regional project opportunities based on project feasibility is ongoing, and additional, more detailed modeling will be conducted for the five projects that are ultimately recommended through the evaluation process and site visit analyses and proceed to concept designs through Craftwater's scope.

4.2.2 Acres Greened

"Acres greened" was used as the base unit for analyses relating to water quality cost-benefit in the Business Case. For this Business Case, acres greened are defined as the areas draining to stormwater capture facilities that meet the requirements of MRP Provision C.3.c (Low Impact Development), which requires that Regulated Projects "*treat 100% of the amount of runoff identified in Provision C.3.d in LID treatment measures,*" defined per C.3.c.(2)(c)(i) as "*harvesting and use, infiltration, evapotranspiration, and biotreatment.*" These types of facilities are also referred to as green stormwater infrastructure (GSI) in this White Paper.

MRP Provision C.3.d provides numeric volume and flow-based sizing criteria for stormwater treatment systems for Regulated Projects. The sizing standard assumed for this analysis is the "*Combination Flow and Volume Design Basis*" defined per C.3.d.i.(3) as "*treatment systems that use a combination of flow and volume capacity shall be sized to treat at least 80 percent of the total runoff over the life of the project, using local rainfall data.*" MRP Provision C.3.e outlines alternative options for compliance with these requirements. The MRP 3.0 Tentative Order (which completed public review in advance of reissuance in 2022) would require permittees to meet numeric GSI retrofit requirements through Provision C.3.j. Provision C.3.j indicates that GSI constructed to meet numeric retrofit requirements must comply with Provision C.3.c and Provision C.3.d. Therefore, standards for acres greened for Regulated Projects to meet on-site treatment requirements (or Provision C.3.e alternative compliance) are equivalent[2] to the standards for acres greened required to be retrofitted by each permittee in the next MRP permit term. Additional work may be needed to define acres greened for regional projects that do not meet the C.3.d numeric sizing criteria. When not calculated through project-specific modeling and analysis, the Business Case calculated acres greened as the percent of the average annual runoff volume captured, multiplied by the tributary impervious drainage area.

For the acres greened evaluation conducted for the Business Case, this study assumed that regional projects analyzed by Craftwater (which have been preliminarily sized and analyzed for the metrics summarized in Table 1, but not designed) would meet these standards, or equivalent standards accepted by the Water Board through their required approval or permit amendment process. Therefore, the findings of this study operate on the assumption that the acres greened achieved by planned or implemented regional in the County are based on the portion of average annual runoff captured by those sites. See Appendix B for details.

[2] Equivalent on the basis of allowable control measure types and sizing requirements for facilities installed. The areas draining to and treated by these facilities comprise the acres greened.

Table 1: Metrics Corresponding with Identified Project Objectives

Objective	Jurisdiction-by-Jurisdiction Scenario[1]	Regional Collaborative Scenario
	Proposed Metrics/Evaluation Factors	**Proposed Metrics/Evaluation Factors**
More Efficiently Use **Limited Resources**	• Costs (Capital and O&M)	• Costs (Capital and O&M)
Support Improvements to Alleviate Strain on **Existing Stormwater Infrastructure**	• SDMP upgrades to address localized flooding (qualitative evaluation)	• Peak flow reduction • Flood event management
Cost Effectively Comply with **Water Quality** Regulatory Requirements	• PCBs and mercury load reduction • Acres "greened" or treated • Volume managed	• PCBs and mercury load reduction • Acres "greened" or treated • Volume managed
Consider and, Where Appropriate, Design for Projected Future Impacts Resulting from **Climate Change**	• Green Stormwater Infrastructure Climate Change Offset per the SSMP (C/CAG, 2021)	• Regional Projects needed to achieve volume managed by green streets modeled for SSMP (C/CAG, 2021)
Supplement County **Water Supply** Portfolio with Stormwater, Where Feasible	• Estimated stormwater volume reclaimed (captured through rainwater harvesting programs)	• Volume recharged (where feasible) and reclaimed and associated cost benefit
Consider Local **Community Benefits** and Concerns in Project Implementation	• Qualitative Evaluation	• Parks and public facilities identified as potential regional project location
Site and Design Projects to **Equitably** Serve and Protect Communities	• Qualitative Evaluation	• Quantify number of potential projects located in DACs
Maximize **Other Benefits**, Where Possible	• Qualitative Evaluation	• Qualitative Evaluation

Notes: DACs = Disadvantaged Communities; O&M = operations and maintenance

[1]Given the retrospective nature of the use of prior analyses and plans, not all objectives under the "Jurisdiction-by-Jurisdiction" scenario have corresponding metrics to those developed through new modeling results for the Regional Collaborative scenario.

4.2.3 Regional Stormwater Capture Project Case Studies

Regional stormwater capture projects within San Mateo County identified in the SRP and subsequent efforts are currently in varying stages of implementation. Studies and designs for these regional stormwater capture projects (which range from concept to final design) were referenced in the Business Case as additional inputs for the analysis. The three projects summarized in the Business Case include:

- **Orange Memorial Park, South San Francisco** – This project, currently under construction, will divert flow from Colma Creek for water quality treatment, beneficial reuse, and local flood reduction. The project includes a large grit/trash removal chamber, a cistern accompanied by an advanced filtration and disinfection system, and infiltration gallery (City of South San Francisco and Lotus Water, 2021).
- **Red Morton Park, Redwood City** – The project, currently in design, would divert runoff from the existing adjacent reinforced concrete box culvert (Jefferson Branch Drain) to a subsurface storage facility located within Red Morton Park. The project is proposed to include some non-potable reuse and flow-through water quality treatment (City of Redwood City, 2021).
- **Caltrans Right-of-Way at I-280 and I-380 Interchange** – The project, currently in preliminary analysis and initial project oversite phase with California Department of Transportation (Caltrans), is proposed to include a subsurface infiltration gallery located in Caltrans right-of-way at the I-280 and I-380 interchange in San Bruno (SMCWPPP, 2020a).

Estimated benefits associated with these projects were incorporated into the analysis conducted for the Business Case. See Appendix B for additional details. In addition to the regional stormwater capture projects listed above, a fourth project (Twin Pines Park in Belmont) is also moving forward into the design phase. This project is being advanced in association with a creek restoration project and was not included in the Business Case analysis due to a separate timeline.

4.3 Results

Results of the Business Case demonstrate cost savings and other multiple benefits could be provided through the Regional Collaborative scenario for many of the examined objectives. A summary of the Business Case findings is provided in Table 2. Green boxes represent those objectives for which the Regional Collaborative approach was found to provide higher overall cost-benefit as compared to the Jurisdiction-by-Jurisdiction approach. Yellow boxes represent those objectives for which the Regional Collaborative approach was found to provide approximately equivalent cost-benefit as compared to the Jurisdiction-by-Jurisdiction approach and/or a higher cost-benefit is difficult to quantify due to data availability and uncertainty on a site-by-site basis.

Table 2: Summary of Business Case Findings

Objective		Jurisdiction-by-Jurisdiction Scenario	Regional Collaborative Scenario
More Efficiently Use **Limited Resources**		Distributed GSI facilities design and construction costs are about $165,000 per acre greened for parcel-based facilities and $230,000 to $302,000 per acre greened for green streets. O&M costs are estimated to scale with capital costs (e.g., 4% of capital costs estimated in Geosyntec, 2018).	***Average cost savings of approximately 60% to 75% per acre greened*** Regional stormwater capture project design and construction costs are estimated at approximately $69,000 per acre greened. Individual regional facility O&M may be quite high but are expected to be lower per acre greened.
Support Improvements to Alleviate Strain on **Existing Stormwater Infrastructure**		SDMP Findings: Substantial grey storm drain infrastructure upgrades are needed to alleviate flooding concerns throughout member agency jurisdictions (see Section 3.2 for summary of completed SDMPs).	***Additional opportunities for projects to provide flooding alleviation*** Regional projects may be able to provide some management of flooding through retention and detention of smaller flood peak flows, potentially allowing for avoidance of some infrastructure capacity upgrades. The Regional Collaborative Scenario provides more options with siting and facility or treatment train type to alleviate flooding.
Cost Effectively Comply with **Water Quality** Regulatory Requirements	PCBs[1]	RAA Scenario Results: Investment in green streets to achieve 30 grams of PCBs load reduction results in an average cost per gram removed of $8.4 million to $10.8 million (per analysis of SMCWPPP, 2020a).	***Estimated cost savings of 75% to 95+% to achieve equivalent PCBs load reduction through GSI as RAA scenario[1]*** Cost to achieve 30 grams of PCBs removal using top prioritized regional projects is estimated to range from $120,000 per gram to $1.9 million per gram with an average of $1.0 million per gram.
	Acres greened[1]	RAA Scenario Results: A total of 1,122 acres greened would be required to meet the PCBs load reduction through GSI by 2040 goal. This would require 385 acre-foot capacity in 196 subwatersheds within 20-member agency jurisdictions (per analysis of SMCWPPP, 2020a).	***Estimated cost savings of approximately 70% to 75% to provide equivalent acres greened as RAA scenario, along with reduced ongoing inspection costs[1]*** Approximately 3-5 regional stormwater capture projects could achieve 1,122 acres greened, reducing implementation and inspection costs.
	Trash	Distributed GSI typically provides full trash capture.	Regional projects should be designed to provide trash management for a large drainage area where feasible (*roughly equivalent to jurisdiction-by-jurisdiction scenario based on available data and analysis*).

Objective	Jurisdiction-by-Jurisdiction Scenario	Regional Collaborative Scenario
Consider and, Where Appropriate, Design for Projected Future Impacts Resulting from **Climate Change**	Green Streets required to achieve the PCBs load reduction through GSI by 2040 goal[2] could achieve a localized offset of climate impacts for smaller return storms (see SSMP, C/CAG, 2021).	***Estimated cost savings of 60% to 70% for equivalent climate change impact offset*** Regional projects can provide equivalent volume management to the modeled jurisdiction-by-jurisdiction scenario in approximately 70% of the capacity and with cost savings of 60% to 70%.
Supplement County **Water Supply** Portfolio with Stormwater, Where Feasible	Stormwater capture could be achieved through rainwater harvesting programs at a cost of $2,900 to $4,800 per acre-foot (BAWSCA, 2015).	***Opportunities for water supply to offset project costs*** Water supply can be provided as an additional benefit for feasible projects through capture and use or recharge (where feasible) and may provide potable water offset or avoidance of other water supply at a cost offset.
Consider Local **Community Benefits** and Concerns in Project Implementation	Distributed facilities can provide distributed community benefits including heat island cooling, habitat through facility plant palettes, safety features, and public education.	In addition to providing many of the benefits that distributed facilities can, regional facilities could provide enhanced amenities in park locations. Six of the regional stormwater capture project opportunities identified are proposed to be located in an existing park, and eleven of them are proposed to be located in undeveloped parcel with the potential to be converted to a park *(qualitative analysis, equivalent or better to jurisdiction-by-jurisdiction based on assessment)*.
Site and Design Projects to **Equitably** Serve and Protect Communities	Distributed facilities can provide distributed community benefits including heat island cooling, habitat through facility plant palettes, safety features, and public education.	Many of the regional stormwater capture project opportunities are located within ½ mile of an identified vulnerable community. Regional projects may be able to provide enhanced implementation of GSI in vulnerable communities *(qualitative analysis, equivalent or better to jurisdiction-by-jurisdiction based on assessment)*.
Maximize **Other Benefits**, Where Possible	Distributed facilities can provide distributed community benefits including heat island cooling, habitat through facility plant palettes, safety features, hydrology benefits for smaller storms, and public education.	Regional stormwater capture project opportunities can the distributed facility benefits listed and provide other benefits including but not limited to sediment management and reduction of erosive flows *(qualitative analysis, equivalent or better to jurisdiction-by-jurisdiction based on assessment)*.

Notes: [1] The RAA scenario (i.e., the existing results available for comparison for the Business Case) focused on the PCBs load reduction through GSI by 2040 goal, a goal required under the current MRP ("2.0"). This specific requirement is changing per the MRP 3.0 Tentative Order; however, substantial PCBs load reduction via GSI facilities is still expected to be needed to meet TMDL goals. The Regional Collaborative Scenario findings are considered representative of an approach that includes targeted siting of larger facilities to reduce PCBs load.

[2] The RAA scenario was modeled for the SSMP and was thus used to represent the "Jurisdiction-by-Jurisdiction" Scenario.

5 REGIONAL COLLABORATIVE PROGRAM DEVELOPMENT

A Regional Collaborative Program Framework was developed to describe: ***How*** *County jurisdictions can collaborate regionally.* The Framework was developed using output from all four sub-projects. Two options for a Regional Collaborative Program were developed:

1. Market-based framework, and
2. Memoranda of Understanding (MOU)-based and market-based combined framework.

A summary of high-level considerations for both options is provided in the following sections.

5.1 Market-Based Approaches

5.1.1 Overview and Background of Market-Based Approaches

Market-based or market-like alternative compliance programs typically have a foundational regulatory driver for participation (i.e., requiring environmental protection, mitigation, or improvement), and a basis for participant cost-savings through cost-effective environmental improvements. A classic market-based alternative compliance approach for pollution reduction in the water sector is water quality trading. In a water quality trading program, water quality benefits generated through control measures can be traded among identified eligible regulated dischargers within the same trading area to meet permit requirements. Water quality trading programs have emerged to provide cost-effective pollutant reductions for regulated dischargers (as buyers) from off-site sources (as sellers).

Since the introduction of water quality trading, emerging market-based programs in the United States have used many of the core principles and structure of water quality trading programs with a focus on water quality benefits outside of the traditionally traded pollutants such as sediment and nutrients. Water quality trading systems have typically been utilized to achieve a formal load reduction cap on permit-regulated, discharged pollutants in a defined watershed. In contrast, other exchange and offset programs have been developed to have more flexible applications than water quality trading, such as their use in meeting new development and urban growth stormwater requirements. These programs also provide a pathway for exchanging nontraditional water benefits that may otherwise be limited by the 2003 USEPA Water Quality Trading Policy (USEPA, 2003). Such flexibility is embraced in a 2019 USEPA Memorandum updating USEPA's perspectives on the 2003 policy (USEPA, 2019). Permittees in Contra Costa County are currently attempting to develop a regional alternative compliance program for stormwater and developed a comprehensive literature review that provides a detailed overview of varying program types (City of San Pablo, 2020). This White Paper focuses on considerations relevant for the Countywide approach. This White Paper also refers to "market-based exchange" programs; these should be considered equivalent to trading programs.

5.1.2 Key Considerations for Market-Based Approaches

Understanding demand for alternative compliance is a key consideration when investing in program development. As regulatory requirements typically drive demand for these approaches, a clear understanding of the compliance timeline and potential future changes to compliance requirements is needed. Additionally, it is recommended that direct input from potential buyers be sought during development. When more complex programs with high initial investments have

been developed without certainty around demand and compliance timelines, these have sat unused. The Electric Power Research Institute (EPRI) spent more than a decade attempting to develop a multi-state water quality trading program for nutrients in the Ohio River Basin (EPRI, 2021). Three states, Ohio, Indiana, and Kentucky (with only Ohio having trading regulations), participated in a pilot program effort and signed a resolution that recognizes water quality trading as a compliance mechanism for Wastewater Treatment Plants (WWTPs), who may voluntarily purchase credits from agricultural sellers across state boundaries (EPRI, 2012). As adoption of state water quality standards for nutrients has languished across the basin, demand by WWTP buyers has not materialized. Notably, the EPRI pilot project spent millions of dollars on watershed modeling tools and an elaborate registry to have only a handful of projects register credits (from grant-funded efforts), and no compliance purchases.

Even if demand is known, highly complex programs can fail when program development is drawn out over years. Exchange opportunities may wane as potential participants look to more traditional approaches to comply with regulations. Examples of this include:

- In 2002, the Michigan Department of Environmental Quality (DEQ) approved administrative rules for a water quality trading program, but ultimately these were considered too complex by users and regulators alike. These rules went unused and were ultimately rescinded in 2013 (Kieser & Associates, LLC [K&A], 2016).
- In the late 1990s, the Lower Boise River Trading Program focused on a multi-year, multi-partner demonstration effort funded by EPA to trade phosphorus load reductions from agriculture for WWTP alternative compliance (Ross & Associates Environmental Consulting, Ltd, 2000). Multiple iterations with different parties were developed and formalized since the initial investigation. In early 2021, Idaho formally adopted water quality trading legislation through "An Act Relating to Water Quality; Amending Chapter 36, Title 39, Idaho Code, by the Addition of a New Section 3903640, Idaho Code, to Provide for Water Quality Innovation and Pollutant Trading." There has been no formal compliance trading in Idaho to date in over two and one-half decades of program development (IDEQ, 2016).

These examples point to the importance of launching a simple program[3] where demand is understood in a timely manner, even if a larger or more complex market-based exchange program is envisioned for the future. Programs that considered demand and compliance timelines, and limited required investment accordingly are summarized below:

- The state of Montana established a simple trading policy that allows alternative compliance but places the onus on buyers to achieve compliance through trading. A 2012 Nutrient Trading Policy was developed in advance of nutrient standards that were ultimately established in 2015 (Montana Department of Environmental Quality, 2012). The DEQ commissioned an assessment of potential WWTP demand under the compliance timelines (K&A et al., 2016) and identified that the use of credit trading was likely to be very limited. This led the state to limit additional investments in developing a trading program, leaving buyers and sellers to otherwise address policy requirements

[3] Any program would require sanctioning or acceptance by regulators after completing the required approval processes (e.g., public comment, permit amendment, Board and/or Executive Officer approval).

without elaborate and expensive state-developed trading infrastructure that would likely go unused.

- Iowa Department of Natural Resources (DNR) adopted a similar credit exchange (trading-like) program strategy (Marshall, 2020) as Montana whereby compliance trading needs were not projected to materialize for at least two five-year permit cycles (K&A, 2020). Under the nutrient reduction exchange in Iowa, buyers and sellers use a national environmental trading registry developed by the United States Army Corps of Engineers (USACE), the Regulatory In-lieu Fee and Bank Information Tracking System (RIBITS), adapted for Iowa's program (USACE, 2021). For these compliance applications, the state simply performs a completeness review of standard information required of all trades that are posted on the registry. There were no other infrastructure investments for this program that Iowa DNR saw as necessary for managing this alternative compliance program with likely limited participation.

Fundamentally, these various program examples illustrate the value of understanding the key long-term regulatory driver(s), the likely demand (including pricing considerations), and the applicable timeframe when assessing the scope for a market-based approach. In many cases, a simpler exchange program (sanctioned by Regulators) can be launched with minimal investment and using existing infrastructure and tools to facilitate program participation as a more complex market-based exchange program is assessed and developed.

5.2 Feasibility of Stormwater Treatment Credit Trading for San Mateo County

5.2.1 Main Driver and Potential Structure

As another sub-project under this effort, Corona Environmental Consulting and American Rivers examined the potential for a stormwater credit trading marketplace and whether and how a program could be incorporated into the Regional Collaborative Program Framework. The full analysis is provided in Appendix D. The primary driver for project-level post-construction stormwater management in San Mateo County was identified to be MRP Provision C.3.b (Regulated Projects) (as well as additional, more stringent standards required by some municipalities). This current Provision affects new development and redevelopment projects that create or replace 10,000 square feet or more of impervious area (although some land use categories trigger the threshold at 5,000 square feet). Regulated projects must include stormwater treatment facilities consistent with MRP Provision C.3.c (Low Impact Development) and be sized to meet numeric sizing requirements in MRP Provision C.3.d (Numeric Sizing Criteria for Stormwater Treatment Systems).

Post-construction stormwater credit[4] trading was defined in the study as a voluntary alternative compliance strategy that allows developers and property owners who are subject to MRP Provision C.3.b to meet those requirements by purchasing stormwater treatment credits generated by the installation of GSI projects located off-site. Any trading program in the County would be tied to MRP Provision C.3.e requirements and the Countywide guidelines for meeting these standards.

[4] Stormwater credits are referred to as "units of exchange" elsewhere in this White Paper.

Three sources of stormwater treatment credits were explored:

- Property owners not subject to Provision C.3.b who voluntarily implement GSI retrofit projects on their property (non-Regulated Projects).
- Regulated Projects that provide additional storage capacity and/or manage additional (i.e., non-Regulated) impervious area through MRP compliant GSI facilities.
- Public projects, including those identified in the County's Sustainable Streets Master Plan, and current and future regional stormwater capture projects.

Developers have had the option of using MRP Provision C.3.e, Alternative Compliance, but this option has rarely been used in San Mateo County, likely because (a) the MRP standards can typically be met on-site and there is flexibility in achieving standards that go beyond the MRP requirements (e.g., drainage requirements); and (b) the available off-site alternative compliance options are not always economically attractive. Available off-site alternative compliance options currently entail individual negotiations with jurisdictions in which developments are located and require implementation of or payment for potentially costlier off-site alternatives. With these current conditions, Corona Environmental and American Rivers concluded that in the absence of technical[5] or economic incentives to seek off-site compliance options, developers would see little benefit in a credit trading program.

Corona Environmental and American Rivers noted that these conditions could change with the MRP reissuance, as currently some property owners in the County can take advantage of special allowances for Special Projects and "non-LID treatment credits," which make on-site stormwater compliance easier. Based on the language in the MRP 3.0 Tentative Order, these provisions may be removed or altered, which could increase demand for off-site/alternative compliance.

Corona Environmental and American Rivers concluded that a credit trading market based solely on private parcel-based GSI as the source of stormwater treatment credits may not currently be feasible. The possibility of also using regional stormwater capture projects (including those identified as part of the Advancing Regional-Scale Stormwater Management Project) and potentially, other public projects, as sources of credits for multiple buyers creates a potential opportunity for a different type of market or program. Buyers may include developers seeking to meet post-construction management standards or others seeking to meet related standards. Such a system may function more like a mitigation bank or "wholesale market" than a credit exchange marketplace.

5.2.2 Supply and Demand for Stormwater Treatment Credits

Corona Environmental and American Rivers analyzed the potential demand for stormwater treatment credits from new and redevelopment sites based on the regulatory, economic, and technical factors that influence the need or desire for off-site compliance. Additionally, the potential supply to a credit bank/exchange that could be generated from private parcel-based GSI projects was examined. The analysis factored in the presence of credits created by both private "suppliers" (i.e., private parcel-based GSI projects located in high priority areas for stormwater

[5] Technical incentives may include the removal of requirements to assess physical feasibility of on-site GSI prior to identifying off-site GSI alternatives to meet compliance needs.

management) and public agencies (i.e., credits generated by current and future regional and green street projects) and the resulting influence on credit price and supply volume.

The result of Corona Environmental and American Rivers' analysis supports the conclusion that there is likely enough supply and demand to support a stormwater treatment credit wholesale market exchange program if it is incorporated into a broader countywide or regional program. The presence of large amounts of credits created by the regional projects skews the price of credits downward because those projects are considerably less expensive to install and maintain on a cost per greened acre basis (compared to private parcel-based GSI projects). As a result, off-site compliance becomes more cost-effective for developers. The intention of this approach would be to provide flexibility for implementation and cost-benefits for buyers, while achieving water quality goals related to specific pollutants and watershed priorities.

This type of model would incentivize more private parcel-based projects in areas of high priority for stormwater management (including those areas that will not be managed by proposed regional projects) because developers of such projects would have a guaranteed buyer (i.e., the associated credits would be purchased and added to the overall pool of credits). Municipalities could also potentially participate in the wholesale market exchange program to meet MRP Provision C.3.b alternative compliance and/or tentative C.3.j numeric retrofit targets or provide compliance for Regulated Projects (including roadway projects potentially regulated in MRP 3).

Corona Environmental and American Rivers examined potential areas for supply and demand sites as part of their analysis. Approximately 340 acres were identified to potentially serve as a source of demand for stormwater treatment credits over the next 20 years based on locations of high priority for new development and redevelopment. Additionally, over 3,500 acres of public and private parcels were identified as high priority sites for distributed parcel-based non-Regulated Projects to generate stormwater treatment credit supply. See Appendix D for more details on the methodology used to identify supply and demand acreage.

Corona Environmental and American Rivers analysis also provided suggested additional analyses to further develop the wholesale market model for the Regional Collaborative Program. These are referenced in Section 6 relating to key components of the Program as well as in Section 7.3, describing next steps.

5.3 Memoranda of Understanding Approaches

5.3.1 Overview and Background of MOU Exchange Programs

When there is significant need for water quality improvements, a demanding compliance timeline, and substantial costs associated with traditional compliance, pilot or interim programs can provide a roadmap towards more formal, institutionalized market-based programs. Alternative legal instruments like MOUs can be used to allow exchanges that are recognized by regulatory agencies as acceptable for compliance. There are relevant national program examples that allow trading of nutrients under MOUs or similar instruments, such as resolutions.

One recent example of such a program was developed by the Great Lakes Commission, which piloted a multi-state water quality trading program for phosphorus in Lake Erie from 2016 to 2018. Dubbed the "Erie P Market," the program focused on interstate trading between municipal point sources, such as WWTPs, and agriculture to address Western Lake Erie Basin water quality impairments due to phosphorus loading. In December of 2017, environmental and agricultural

agencies in Michigan, Ohio, and Indiana signed an MOU which denoted a mutual agreement to the "Erie P Market Framework" (Great Lakes Commission, 2017a and Great Lakes Commission, 2017b). Only the state of Ohio had water quality trading regulations at the time of the framework agreement (which remains the case as of this writing). The framework otherwise guides all trading conditions and allows for interstate trades. It was envisioned as a compliance alternative that would evolve and serve as the basis for state-adopted trading rules or guidance.

5.3.2 Key Considerations for an MOU Exchange Program Approach

A primary element for MOUs or resolutions that establish interim program options is long-term acceptance by regulatory agency(ies). MOUs or resolutions should be consistent with current permit requirements or accepted by the regulatory agencies through typical approval or amendment processes. Program participants, particularly permittee buyers, need assurances that the purchase of units of exchange will be formally recognized by the agencies. For private sector buyers (if/when included in an MOU approach), there may be expectations that project (i.e., units of exchange) investments will be a one-time purchase to permanently address compliance obligations. Satisfying this interest by this latter set of buyers may be difficult with an alternative legal instrument utilized to accommodate early exchanges or a finite pilot program timeline. This may inherently limit pilot program participation. Unit sellers under an interim legal instrument will likely require some form of "backstop" for capital costs and/or ongoing O&M (i.e., to cover costs for undersold units of exchange) if a full program does not materialize. Stormwater exchange programs differ in these regards from traditional water quality trading programs where other NPDES buyers can satisfy shorter-term, temporary compliance needs within 5-year permit cycles, and sellers such as farmers may only need to meet contract obligations for 1-5 years of credit generation. GSI stormwater retrofits require much higher costs for installation and long-term O&M (in perpetuity in most cases).

Other key needs suggested for developing MOUs and other alternative legal instruments include:

- An identified MOU administrator or administrative body;
- Broad understanding among stakeholders that the interim program would be the pre-cursor to a fully-developed market-based exchange program in the future;
- Regulator acceptance of the interim program as consistent with the language of the current permit (i.e., MRP), along with:
    - Assurances to sellers that interim program units of exchange are acceptable for compliance, and
    - Consideration for how interim program units of exchange purchased and used for compliance will be recognized under a future fully developed program;
- Program-defined types of control measures and required sizing, such that there will be implicit water quality benefits when capturing stormwater flows and that compliance will be achieved through the control measures (Section 6.1);
- Interim program conditions and constraints, including conditions on pricing for units of exchange, recognizing these may not be subject to change during the acknowledged interim program timeline and associated interim permit cycles; and

- Coordination, outreach, agreement, and acceptance among entities participating in the MOU exchange program.

Additional suggested next steps specific to a potential MOU exchange program approach for the County are provided in Section 7.3.

5.4 Development of Regional Collaborative Program Framework

Regional Collaborative Program Framework flow charts were developed to describe, at a high level, how a Regional Collaborative Program could operate for a market-based approach and an MOU-based approach. These options were presented to the TAC for input, along with an example of how the proposed Framework would operate, using an example application for the Orange Memorial Park regional project (this example is provided in Section 7.1). Following discussion, the TAC identified the Program Framework option that includes both the MOU approach and the market-based approach as the preferred Regional Collaborative Program to be developed further. An MOU approach could be used in the near term and serve as an interim Program as a larger scale market-based program is being further explored, developed, and potentially rolled out if warranted upon further analysis and coordination with relevant stakeholders.

For the Countywide Regional Collaborative Program, an initial MOU could be developed consistent with the requirements of the adopted MRP 3.0. Based on the Tentative Order language, the MOU could be an internal mechanism to cost-share across the county to meet Provision C.3.j requirements or could be used within the bounds of Provision C.3.e (alternative compliance) as a payment agreement instrument for Regulated Projects that meet the requirements of that Provision. While discussions with the Water Board should be ongoing, such an approach should not require an official permit amendment or approval process. A larger market-based program, which would be expected to allow more flexibility than the Tentative Order permit language to maximize opportunities and benefits achieved, would require an MRP amendment process or be addressed through a future permit reissuance. Based on the MRP 3.0 Tentative Order, a permit amendment process entails submittal of a program proposal that describes key identified program components. The amendment would require a public review process and Water Board approval.

Flow charts for the proposed Regional Collaborative Program Framework are provided in Figures 2 through 4. The Program would promote investment in Regional Collaborative Projects (the Program infrastructure). Regional Collaborative Projects provide multiple benefits that could be translated into units of exchange. For the initial MOU based program, these units of exchange would be cost-shared by MOU participants as established through program agreements (Figure 2). As the market-based program is rolled out, units of exchange could also be purchased by other buyers (Figure 3). The resulting purchases or ongoing payments would be dedicated to a Capital and Administrative Fund, which would fund infrastructure capital investments and Program administration, as well as an O&M Fund, which would fund ongoing O&M of Program infrastructure. If a market-based program is fully developed, the initial units of exchange shared through MOUs would be retired and the Program would only operate in a market-based framework. There may be a period where both the MOU program and the market-based program are operating. Additional Regional Collaborative Program components shown in Figures 2-4 include:

- Program Investment (i.e., funding and financing), which provides initial capital for constructing Regional Collaborative Projects. Currently, entities within the county have applied for and received state grant funds to invest in some regional stormwater capture projects. Longer-term sources of investment are discussed in Section 6.3.
- Regional Collaborative Projects consist of regional and distributed stormwater capture projects that would comprise the Regional Collaborative Program infrastructure. These are discussed further in Section 6.1.
- Units of Exchange, also referred to as credits, are the saleable metrics generated by Regional Collaborative Projects that buyers or MOU participants would purchase or cost-share to meet their compliance requirements. Some of these units are assumed to be "Reserve Benefits" required for either the regional project funding source or to achieve overall Program goals (e.g., net environmental benefit). Any units of exchange associated with Reserve Benefits could not be exchanged. See Section 6.2.
- MOU Participants are those participants, likely municipalities, who would choose to participate in the interim agreement-based Regional Collaborative Program. Additional details on the role and suggested next steps for MOU Participants are included in Section 7.
- Buyers are the participants who may participate in the future market-based exchange Program, which may be developed and rolled out over multiple years. Potential buyers were identified by Corona Environmental and American Rivers, and additional studies are needed to further define these parties, as described in Section 7.
- The Regional Collaborative Capital and Administrative Fund would pool capital funds from buyer purchases and MOU cost-sharing agreements. This could fund administration of the Program, reimburse capital expenses, as well as fund capital investments in Regional Collaborative Projects and/or payments for capital financing.
- The Regional Collaborative O&M Fund would pool O&M payments (ideally ongoing) from buyers and MOU participants to fund ongoing O&M of the Regional Collaborative Projects.
- Other Programmatic Sources of Funding, if materialized, could fund portions of the capital or O&M requirements of the Regional Collaborative Program in the future. Some options for the sources of this funding are discussed in Section 6.4.

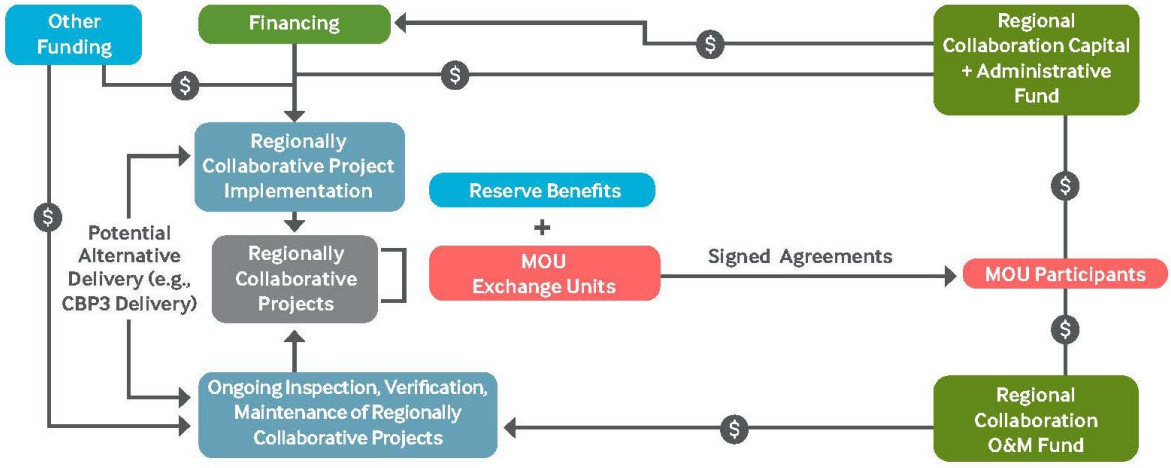

Figure 2: Proposed Regional Collaborative Program - Interim MOU-Based Framework

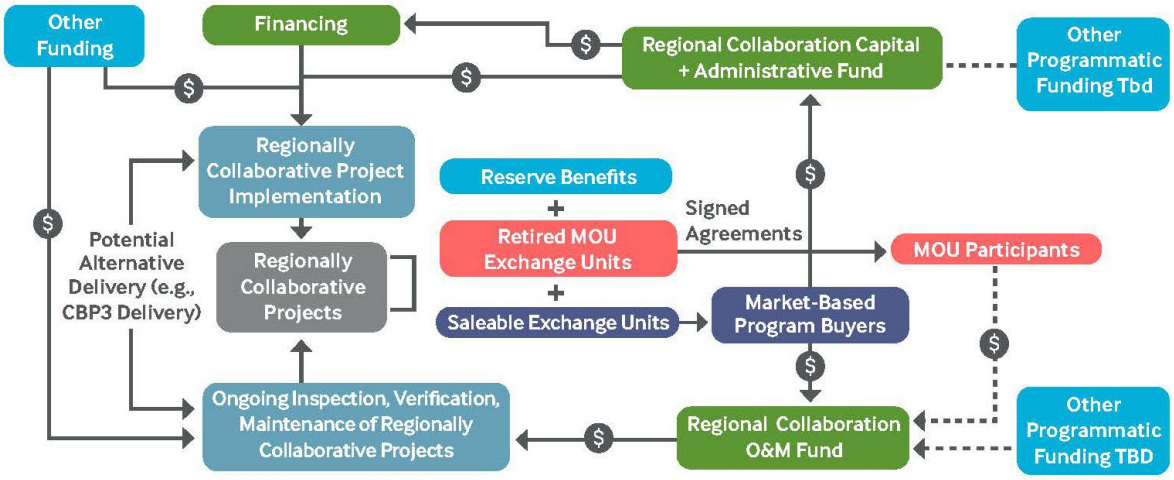

Figure 3: Proposed Regional Collaborative Program – Fully Operational Market-Based Program

The Program Administrator is yet to be identified but could be C/CAG or another existing or future Countywide entity. The Program Administrator could administer all aspects of the Program through Program staff or could utilize mechanisms such as community-based public-private partnerships (CBP3s) to administer aspects of the Program (with permittee oversight). This approach is further described in Section 6.4.

6 REGIONAL COLLABORATIVE PROGRAM COMPONENTS

Development of an alternative compliance exchange program such as the proposed Countywide Regional Collaborative Program requires consideration of several Program components. Discussion of some of these components is provided in the following subsections, including

credit-generating projects, units of exchange, funding and financing, and community-based public-private partnership approaches. Additional components that are not addressed in detail but require consideration include Program legal basis, eligible participants, Program geographic boundaries, Program limitations, Program Administrator, Program unit of exchange cost setting, unit of exchange timeframes, and Program tracking. Some of these are addressed in Section 7.3.

6.1 Regional Collaborative Projects

Regional Collaborative Projects may include both regional-scale stormwater capture projects as well as regional-scale implementation of beneficial and/or cost-effective distributed stormwater capture projects. As part of the overall Advancing Regional-Scale Stormwater Management Project, Craftwater led an effort to further refine C/CAG's existing screening and prioritization of public parcels for regional stormwater capture opportunities. Additionally, Corona Environmental and American Rivers identified parcel-based stormwater capture opportunities that may be beneficial for parcel-based exchange.

Regional Collaborative Projects provide multiple benefits that correspond to the overall objectives identified as part of the Project. Through these multiple benefits, the Regional Collaborative Projects will generate the Program Units of Exchange that are sold or cost-shared through the Regional Collaborative Program. Additional discussion about Units of Exchange is provided in Section 6.2.

Regional Collaborative Projects are already underway in the county as summarized in Section 4.2.3. Additionally, Craftwater is tasked with developing five new regional project concepts for priority projects resulting from their analyses that will help achieve the above objectives and drivers and can kick-start funding efforts for design and construction.

6.2 Regional Collaborative Program Units of Exchange

C/CAG has identified "volume managed" as the preferred base unit for the Regional Collaborative Program. The benefit of this base unit is that it can correspond to multiple benefits, which may be attractive to multiple different buyers, and it can be used to calculate other relevant metrics for units of exchange. To that end, volume managed may need to be converted to an appropriate market-based unit that is relevant for prospective buyers for different potential units of exchange, which may vary based on the phase of the program and the participating entities. An appropriate market-based unit (or "unit of exchange") must relate to the compliance requirement that the prospective buyer is trying to meet. For example, as described in Section 4.2.2, acres greened, which is a unit that could be used to meet MRP Provision C.3.b (or C.3.e alternative compliance) or C.3.j compliance, must be generated by specific control measure types that are consistent with MRP Provision C.3.c and sized consistent with the requirements of MRP Provision C.3.d. Not all volume managed units would meet the more specific required characteristics of an acres greened" unit of exchange depending on the control measure type and sizing of the Regional Collaborative Project generating the units of exchange.

Potential units of exchange that could be derived from the "volume managed" base units are shown in Figure 3 below. Pollutant load reduction units are not included in Figure 3 as the 2003 USEPA Water Quality Trading Policy discouraged the trading of bioaccumulative toxics. Though a 2019 USEPA memorandum (USEPA, 2019) supported additional flexibility with market-based water quality trading applications, the memorandum was silent on trading

bioaccumulative toxics noted in the 2003 policy document (USEPA, 2003). The 2019 memorandum did, however, encourage consideration of new trading applications to achieve "meaningful pollutant reductions" and mechanisms to provide long-term regulatory certainty and modernized regulatory programs. PCBs, which are regulated by TMDL and would likely be the pollutant load reduction unit of exchange, fall into the category of bioaccumulative toxics. An additional legal review may find that there are means to exchange PCBs load reduction within the context of the 2003 USEPA Water Quality Trading Policy or more recent policies; however, at this time, acres greened units are recommended for the initial MOU based approach to the Regional Collaborative Program instead as a water quality unit of exchange. Acres greened would require further definition for the Regional Collaborative Program to demonstrate that these units of exchange are consistent with the compliance requirements of the MRP.

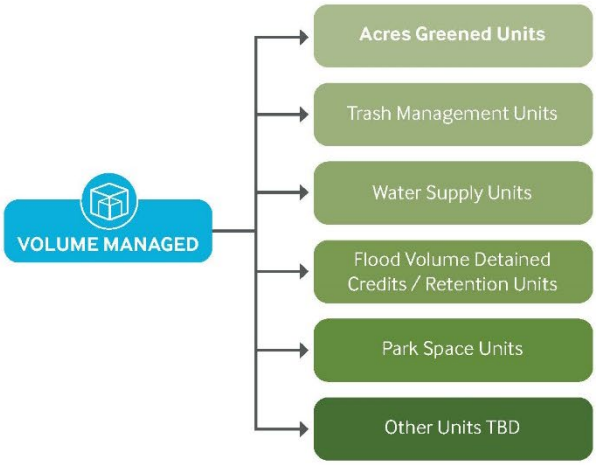

Figure 4: Potential Units of Exchange Derived from Volume Managed

When multiple units of exchange are included in a Program (which could be the case with sufficient regulatory or monetary incentives for different stakeholders that would benefit from Regional Collaborative Projects, in the case of this proposed program), the Program can become difficult to administer and track. Calculations would be required to convert the base unit of Volume Managed into each unit of exchange for sale through the Program. For each unit of exchange, the "baseline," or benefit amount that cannot be exchanged away, should be established. The baseline may vary by Regional Collaborative Project based on the specifics of the implementation and design of the projects. Additionally, rules should be established regarding whether or not different units of exchange could be "stacked," (i.e., selling two different units of exchange from the same single unit of volume managed). One example of stacking would be selling units of exchange associated with infiltration to one buyer for water quality compliance and selling the same infiltrated volume as water supply units to a separate buyer. The complexities of the rules and unit translations must be very clearly defined and tracked to maintain confidence in the Program.

In all cases, units of exchange should not be introduced into the Regional Collaborative Program unless it is known that demand for those units of exchange exists. At this time, as described by Corona Environmental and American Rivers, demand for acres greened units of exchange is expected based on the requirements of the MRP. However, demand for the other potential units of exchange is unknown and should be explored in further stages of Program development.

6.3 Funding and Financing the Regional Collaborative Program

WaterNow conducted an initial legal and accounting analysis of the potential funding and financing options available to C/CAG and other Regional Collaborative Program participants to advance regional-scale stormwater management (see Appendix E for the full analysis). Funding and financing options could be used for both distributed stormwater capture projects and regional stormwater capture projects. In the context of the Regional Collaborative Program, the funding and financing options would be used to invest in implementing (and potentially maintaining) the Program infrastructure – Regional Collaborative Projects. While the options discussed are potential funding and financing pathways, there are considerable challenges in securing many of these, and currently, there is insufficient funding to implement Regional Collaborative Projects on a countywide scale.

6.3.1 Hypothetical Spending Plan

WaterNow developed a hypothetical spending plan for a large-scale GSI implementation program built over a 20-year timeframe, intended to be representative of the investments needed for the proposed Regional Collaborative Program. The hypothetical spending plan entails investments in 10 regional-scale projects over a 20-year period, and an annual investment of $1.5 million in parcel-scale projects each year for 20 years. Based on assumptions established by WaterNow, C/CAG, and other study partners, this was assumed to cost $250 million over 20 years (see Appendix E for details). The identified funding and financing options were intended to theorize pathways for sufficient coverage of the hypothetical spending plan.

6.3.2 Potential Funding Options

WaterNow identified a mix of potential funding sources that may be available to C/CAG and its member agencies (as well as regional partners) to fund countywide regional and distributed stormwater capture projects. The four potential funding options explored include: (1) non-balloted stormwater fee, (2) enhanced infrastructure financing district, (3) water rates, and (4) sewer rates. Based on the findings of the analysis, there is potential for each of these funding options to be used for the Regional Collaborative Program infrastructure investments. A summary of each funding option is included below, and additional detail is provided in Appendix E.

6.3.2.1 Non-balloted Stormwater Fee

A non-balloted stormwater fee does not require voter approval and follows the guidance of State Bill (SB) 231 (Hertzberg). Proposition 218 establishes requirements for voter-approved fees and allows some fees without voter approval, namely "sewer services" and "water services." SB 231 amended Proposition 218 to include fees for collection, treatment, or disposal of "…surface or storm waters" to fees not requiring voter approval. C/CAG member agencies, C/CAG, and Special Districts such as OneShoreline may be eligible to adopt a non-balloted stormwater fee per Proposition 218 and the SB 231 amendment (State of California, 2017).

A non-balloted stormwater fee would be a novel fee that could be charged on a per parcel basis or per square foot of parcel basis (similar to Los Angeles County's Measure W parcel tax) and generate revenue for stormwater capture infrastructure capital improvements, operations and maintenance, and changes in cost over time. Though there are large potential benefits to this approach, challenges are expected, notably from the Howard Jarvis Taxpayers Association, and the use of SB 231 for stormwater is untested in the California courts.

6.3.2.2 Enhanced Infrastructure Financing District

An Enhanced Infrastructure Financing District (EIFD) is a mechanism authorized by the California Legislature in 2014 to enable local governments and agencies to leverage increases in property taxes. EIFDs may be established by city councils or county boards of supervisors through a process that includes an initial resolution, preparation of an infrastructure financing plan, and a public adoption hearing. Following adoption, the EIFD becomes a separate entity from the city or county that established it.

Regional and distributed stormwater capture projects are believed to fall within several of the categories of eligible projects to be funded through an EIFD. Based on preliminary analysis by C/CAG staff, WaterNow estimated that an EIFD for San Mateo County collecting a 1% tax increment from participating entities could generate up to $61 million over 20 years. This option would require consideration of the challenges of allocating County resources that are already overextended.

6.3.2.3 Water Rates

WaterNow examined water rates as a potential pathway to co-fund capital investments and ongoing operations and maintenance of stormwater capture facility infrastructure. There are three types of water rates that may be available to co-fund countywide GSI investments of all scales: (1) rates collected by a municipally owned water provider, (2) rates collected by a Special District that provides drinking water, and (3) rates collected by privately owned water systems. Each of these are governed by different public and/or private bodies that may have the authority or ability to use rates to co-fund stormwater capture project infrastructure. For example, Municipal, County, or Special District water rates must meet the requirements of Proposition 218. This would only be applicable to stormwater capture projects that provide water supply and offset potable water use benefits could support the use of water rates for stormwater capture project infrastructure capital investments or operations and maintenance.

6.3.2.4 Sewer Rates

Sewer rates may also potentially be used to co-fund capital investments and ongoing operations and maintenance of stormwater capture facility infrastructure. Municipal, County, or Special District sewer district rates must meet the requirements of Proposition 218. Privately owned sewer provider rate setting is governed by the California Public Utilities Commission and there may be less flexibility in how the rate may be used. Funding would be limited to stormwater capture projects can provide direct benefits to sewer systems by: keeping stormwater out of sewers and preventing sewer overflows or backups into buildings; (with adequate upstream storage) providing influent to reduced inflows caused by water conversation measures; or allowing for increased opportunities for water recycling. These benefits may support the use of sewer rates to co-fund both capital investments and ongoing operation and maintenance of regional-scale and parcel-scale facilities.

6.3.3 Potential Financing Options

In addition to exploring funding opportunities, WaterNow described a debt-financing approach that could allow for payment of capital investments for the regional and distributed stormwater capture facilities and fully leverage the potential funding options. The financing options examined included: (1) revenue bonds; (2) State Revolving Fund loans; and (3) Water Infrastructure Finance and Innovation Act (WIFIA) loans. WaterNow's preliminary legal analysis finds that there is potential for each of these options to be used to finance countywide

GSI investments in both regional- and parcel-scale facilities. Based on the findings of the analysis, there is potential for each of these financing options to be used for the Regional Collaborative Program infrastructure investments. A summary of each financing option explored is included below and additional detail is provided in Appendix E.

6.3.3.1 Revenue Bonds

Municipal revenue bonds may be issued by a local government to raise funds for public capital projects secured by a specific revenue source. The bonds provide up-front capital that is paid back over the life of the bond through the identified revenues. WaterNow explored traditional revenue bonds, green and climate bonds, and environmental impact bonds as potential bond financing approaches.

General law cities in San Mateo County and/or the County can use state statute to identify their legal authorities to debt-finance stormwater capture projects and determine whether there are limitations on bond proceeds that could impact the use of bonds for these investments. In addition, Joint Powers Authorities, Special Districts, and EIFDs each have separately authorized, standalone authority to issue revenue bonds for specific uses, which in many cases can likely be extended to stormwater capture projects. In all cases, in addition to establishing and identifying stable revenue sources, certain procedural requirements must be followed before issuing revenue bonds.

6.3.3.2 Clean Water State Revolving Fund Loans

The Clean Water Act established state revolving funds (SRFs) to assist communities with upfront cash to build water infrastructure. USEPA allocates SRF funding, which the states must match at 20%, and the states administer their programs according to state-specific eligibility criteria. The primary purpose of California's Clean Water State Revolving Fund (CWSRF) is to provide financing for eligible projects to restore and maintain water quality in the state. The California program also seeks to reduce the effects of climate change and promote sustainable use of water resources for future generations.

Borrowers eligible for SRF loans include, but are not limited to any city, town, district, or other public body created under state law. There are defined authorized uses for CWSRF that could likely include investment in stormwater capture projects that augment water supplies. The CWSRF has not been used often for stormwater capture project investments, though one project on the CWSRF fundable list for 2021/2022 - the City of San Diego's South Mission Beach Storm Drain Improvements and Green Infrastructure project – does include GSI.

6.3.3.3 Water Infrastructure Finance and Innovation Act

The WIFIA was enacted in 2014 to accelerate investment in local water and wastewater infrastructure. This program is separate from but implemented in coordination with the SRF programs to provide subsidized financing for large dollar-value projects. As local governmental entities, C/CAG and/or its members are eligible entities for WIFIA loans. Special districts in San Mateo County, such as OneShoreline, are likely also eligible. Additionally, eligible entities can submit joint loan applications for a bundle of projects. WIFIA loans have specific conditions and requirements regarding project sizes, percent of costs covered, loan terms, and repayment. Stormwater capture projects are expected to meet WIFIA program project eligibility requirements.

6.4 Community-Based Public-Private-Partnership

Incorporating different programmatic delivery models into the Regional Collaborative Program Framework can provide additional benefits, including a reduction in overall GSI project costs, increased speed and efficiency in the implementation of the projects, and an opportunity to obtain additional socioeconomic and community-based benefits as a byproduct (i.e., through additional program-specific requirements). Programmatic delivery models can reduce overhead burden by streamlining procurement and management.

Alternative delivery models include public private partnerships (P3s); design, build, maintain (DBM); and similar pay-for-performance models. Using these methods, the project owner (i.e., the Regional Collaborative Program) contracts with a single entity that is accountable for all aspects of the project(s) throughout the lifecycle, which reduces risk for the project owner. A unique P3 model developed specifically for stormwater implementation is called a CBP3. It was developed by the USEPA and has been quite effective in reducing the cost and delivery time of GSI while providing other benefits to the local community, like increased local participation of small and disadvantaged businesses, increased participation of local resident workforce, mentor protégé programs to train and build up small and disadvantaged businesses, and the equitable distribution of program benefits to all sectors of the community.

C/CAG is currently working with the National Municipal Stormwater Alliance (NMSA) to receive template request for information (RFI)/RFP documents for a CBP3 type program that could be proposed in San Mateo County. This delivery approach could allow for a plan and an approach for broad-scale, community-based implementation with pay for performance attributes and ability to ensure proper O&M for the Regional Collaborative Program.

7 REGIONAL COLLABORATIVE PROGRAM CONSIDERATIONS AND NEXT STEPS

7.1 Orange Memorial Park Regional Stormwater Capture Project

The Orange Memorial Park Regional Stormwater Capture Project is currently under construction in South San Francisco and would be the first project to potentially be exchanged or cost-shared through a regional collaborative approach (i.e., MOU-based approach) for compliance purposes. Based on calculations performed by South San Francisco and their consultant, the project could provide the following benefits (City of South San Francisco and Lotus Water, 2021):

- Water quality treatment of 2,468 acres of equivalent area and 969 acres of equivalent impervious area (per City of South San Francisco and Lotus Water, 2021);
- 640 acre-feet of water diverted and treated annually, of which a portion is infiltrated, and a portion is captured and used for irrigation;
- 424 acres greened (based on the portion of diverted water infiltrated and captured/used);
- 15 million gallons of potable water offset per year ($140,000 annually in water savings);
- 240 acre-feet of groundwater recharge annually;
- 10 grams of PCBs removed annually; and

- 30 grams of mercury removed annually.

Based on the discussion provided in Section 6.2, the most likely units that could be attractive for exchange are the acres greened units; however, there is the potential that other units of exchange could be available in later stages of Program development (e.g., trash, water supply).

Since the Orange Memorial Park Regional Stormwater Capture Project requires O&M investment from Regional Collaborative Program participants immediately (as soon as 2022), the units of exchange generated from the Project would be exchanged under the interim Regional Collaborative Program, which is proposed to be an MOU-based structure.

Using an MOU-based structure, participating entities would sign cost-sharing agreements to receive some portion of acres greened units that they could identify in their MRP Annual Reports compliant with the MRP (i.e., for MRP Provision C.3.j retrofit requirements or consistent with MRP Provision C.3.e). In addition to other terms of participation, it is recommended that the cost-sharing agreements include both an up-front payment for the capital cost of the units as well as a separate payment for O&M associated with the acres greened unit. While the O&M payment could be up-front, an ongoing O&M payment is preferable as regional stormwater capture projects are currently assumed to operate in perpetuity. The MOU agreements could be established with a defined timeline of 10 years, with cost adjustments on a more frequent basis, to account for the potential that O&M payments be covered through other programmatic funding sources in the future or to be modified with potentially lower costs after initial years of operations. The caveat is that if other programmatic funding sources do not materialize, MOU participants could be required to continue to pay for ongoing O&M past the 10-year interim Program period. The payment amount for both the up-front capital costs of the acres greened unit, as well as the one-time or ongoing O&M payment, should be established through a cost study. The cost study should identify the capital and Program costs the up-front capital payment would cover as well as the costs the O&M payment would cover.

Because the Orange Memorial Park Regional Stormwater Capture Project is unique in both its implementation timing and funding source, the Orange Memorial Park units that are shared under the MOU agreement will likely be specifically identified as separate and different from units of exchange that are generated from future Regional Collaborative Projects. For the Orange Memorial Park project, the up-front capital payment and the O&M payment would be calculated and negotiated specific to the project. This will be a different pricing process from what could be expected for units of exchange generated from future Regional Collaborative Projects.

Ongoing negotiations between the capital funder (Caltrans), the sponsor municipality South San Francisco (SSF), and Water Board staff, with support from the countywide stormwater program, will be needed to define how units of exchange will be allocated for the Orange Memorial Park project. Given it is the first of its kind, it will provide the basis for advancing future agreement based-projects for cost-sharing and exchange among municipalities operating under the MRP.

7.2 Regional Collaborative Program Considerations

Other key considerations for implementing a Regional Collaborative Program are provided below:

- Clear and narrow goals (which can be expanded/refined with time) provide for easier initial Program development.
- Consistent, specifically defined units of exchange must be established for accountability.
- Transparency for and buy-in from affected stakeholders should be prioritized to maximize program participation from buyers and sellers. This includes the need to have substantial interagency collaboration and coordination, especially for the interim Program launch, and a robust reporting and tracking system.
- Simple, clear, agreements (recognized and/or approved by regulators) are typically preferred by program participants.
- To incentivize early program participation, levels of buy-in upfront (or for pilot participation) could be discounted as compared to those who participate later in Program development.

7.3 Recommended Next Steps

To further develop the Regional Collaborative Program for the County, several decisions and additional studies should be considered. For all actions taken to further the Regional Collaborative Program, the defined Program objectives should be considered, particularly for those objectives that are more difficult to quantify: "site and design projects to equitably serve and protect communities" and "consider local community benefits and concerns in project implementation". Suggested next steps are summarized below:

Next Step	Applicable to MOU Program or Market-Based Program?	Potential Time Frame to complete
Develop a Regional Collaborative Program Committee that will guide development and decisions for the near-term MOU Program and longer-term market-based program.	Both	FY 22/23
Identify a process for conducting legal review of the proposed Regional Collaborative Program, assumptions, and components as it is being developed.	Both	FY 22/23
Establish the entity that will serve as the Program Administrator or identify a process for identifying this entity.	Both	FY 22/23
Establish guidelines for the interim MOU Program, including the units of exchange, eligible participants, cost basis for units of exchange, and exchange boundaries allowable under the interim Program (which may be different than the fully operating Program).	MOU	FY 22/23
Develop a roadmap to evolve the interim MOU Program to a full market-based exchange Program and establish the type of market-based Program desired.	Both	FY 22/23+
Establish and develop a tracking system to track Projects, units generated, units exchanged, buyers, and ongoing O&M of Projects.	Market-Based	FY 22/23+
Identify eligible participants for the market-based Program, including unit generators (i.e., those who can construct stormwater capture facilities and sell the generated units of exchange) and buyers.	Market-Based	FY 23/24+

Next Step	Applicable to MOU Program or Market-Based Program?	Potential Time Frame to complete
Expand on demand projections conducted by Corona Environmental and American Rivers for identified eligible participants. It is suggested that a more in-depth study that entails interviews, surveys, updated development projections, or other forms of outreach to the development community be conducted to better estimate potential demand for acres greened units of exchange to meet MRP C.3 compliance requirements. Additionally, it is suggested that studies entailing both quantitative assessment and outreach be conducted to examine potential demand for other units of exchange. Outreach or discussions with municipalities to gauge interest in participation for acres greened and other units of exchange should also be conducted.	Market-Based	FY 23/24+
Continue to identify, prioritize, and develop concepts for potential Regional Collaborative Projects to inform potential benefits and units of exchange that may be generated.	Market-Based	FY 23/24+
Continue to examine funding, financing, and alternative delivery approaches for the Regional Collaborative Program. Consider the potential for alternative delivery approaches to include further identification and implementation of Regional Collaborative Projects (versus investing in this further upfront).	Market-Based	FY 23/24+
Define the units of exchange to be included in the Program and develop needed baselines, calculations, control measure requirements, timeframes, and certification and verification requirements corresponding to those units.	Market-Based	FY 23/24+
Using demand projections as a basis, establish Program exchange boundaries and other geographic limits.	Market-Based	FY 23/24+
Develop agreements needed to participate in the Program. Agreements should be developed for both the interim MOU Program and the full market-based exchange Program.	Market-Based	FY 23/24+
Identify whether O&M payments will be upfront or ongoing, and if ongoing, the mechanism to charge these payments.	Market-Based	FY 23/24+
Conduct cost studies to set amounts and frequency for units of exchange and O&M payments for the market-based Program.	Market-Based	FY 24/25+

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APPENDIX A

Advancing Regional-Scale Stormwater Management in San Mateo County: Drivers and Objectives

MAY 2021

SAN MATEO COUNTYWIDE

WATER POLLUTION PREVENTION PROGRAM

Advancing Regional-Scale Stormwater Management in San Mateo County:

Drivers and Objectives

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WATER POLLUTION PREVENTION PROGRAM

Clean Water. Healthy Community.

A Program of the City/County Association of Governments of San Mateo County (C/CAG)

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1. INTRODUCTION

Geosyntec Consultants, Inc. (Geosyntec) is assisting the City/County Association of Governments of San Mateo County (C/CAG) with a project focusing on advancing regional-scale stormwater management in San Mateo County (County) through a countywide collaborative approach (the Project).

The Project involves a multi-stage process to identify:

1. **What** can be addressed and achieved through regional-scale stormwater management, by defining key drivers and objectives for the County;
2. **Why** jurisdictions across the County should collaborate to address stormwater management drivers and objectives, through development of a business case; and
3. **How** County jurisdictions can collaborate regionally, by establishing a collaboration framework.

The focus of the Project is advancing implementation of multi-benefit regional-scale stormwater management projects, though the regional collaboration framework developed is expected to include programmatic applications for smaller scale distributed green stormwater infrastructure (GSI). It is intended that C/CAG member agencies, the San Mateo County Flood and Sea Level Rise Resiliency District (FSLRRD), and other potential stakeholders would jointly collaborate to manage stormwater through the regional collaboration framework.

In parallel with this Project, C/CAG and the County of San Mateo are working with Craftwater Engineering (Craftwater) to identify and prioritize potential multi-benefit regional stormwater capture opportunity locations and concepts for projects that can achieve the drivers and objectives identified herein. With consideration of the drivers and objectives, Geosyntec will work collaboratively with Craftwater to develop the approach for the business case demonstration, and Craftwater will conduct modeling and analyses to develop quantitative output to support the business case. C/CAG is receiving additional pro-bono support from American Rivers/Corona Environmental Consultants and WaterNow Alliance to 1) evaluate the feasibility of creating a stormwater credit trading market; and 2) develop meaningful funding and financing approaches for varying scales of stormwater management that can achieve objectives identified herein. The analyses conducted through the pro-bono support will build from this Project, and the final products will be incorporated into regional collaboration framework deliverables as attachments.

This report summarizes key drivers and objectives for managing stormwater on a regional scale throughout the County, and includes the following sections:

- Section 2 defines “drivers” and “objectives” for the purposes of the Project,
- Section 3 describes the process used to identify drivers and objectives,
- Section 4 identifies drivers for regional-scale stormwater management,
- Section 5 describes objectives to meet the identified drivers, and
- Section 6 summarizes next steps for the Project.

2. DEFINITIONS

This report identifies key drivers for managing stormwater on a regional scale and identifies objectives associated with those key drivers. Regional-scale stormwater management is defined as planning and implementation of multi-benefit regional and sub-regional stormwater capture facilities that may serve one or multiple jurisdictions, as well as regional-scale implementation of smaller-scale distributed facilities countywide. For the purposes of this report, "regional" facilities serve neighborhoods or large portions of neighborhoods, while "sub-regional" facilities refer to approximately block-scale facilities. "Distributed" facilities provide parcel-scale or right-of-way segment-scale treatment.

The terms "drivers" and "objectives" are defined as follows for the purposes of the Project:

- ***Drivers:*** The fundamental issues that provide impetus for managing stormwater on a regional scale.
- ***Objectives:*** The desired outcomes from addressing the identified stormwater management drivers on a regional scale.

The following overall "vision" statement describes the envisioned path to achieve the objectives identified in this report:

- ***Vision:*** Cost-effectively implement multi-benefit stormwater infrastructure solutions that collectively minimize localized flooding; improve water quality; increase resiliency to climate change impacts; utilize stormwater as a resource; address regulatory requirements; and serve communities equitably, both locally and regionally.

3. PROCESS TO IDENTIFY DRIVERS AND OBJECTIVES

Geosyntec reviewed existing plans produced by County of San Mateo, C/CAG member agencies, and other County-based and regional entities that are relevant to stormwater management planning, implementation, and/or resultant benefits. Several foundational factors related to or benefitted by regional-scale stormwater management were identified through review of the plans and were used to develop preliminary drivers and objectives for consideration. These factors include: the presence of water quality regulations, stormwater infrastructure deficiencies, existing and future flooding issues, climate change impacts, water supply needs, community benefits and engagement, and equity considerations. The preliminary drivers identified in these plans are compiled in Attachment A.

A preliminary list of drivers and associated objectives were presented to the Project Technical Advisory Committee (TAC) for consideration at the first of three TAC meetings on January 22, 2021. The Project TAC provided input on how to revise the preliminary drivers to the key drivers that are most compelling for managing stormwater on a regional scale. The Project TAC also considered the associated objectives of the revised drivers, the prioritization of the drivers and objectives, and the overall Project vision. Input from the Project TAC was used refine the drivers, which are summarized in Section 4 of this report. Objectives relating to the drivers are provided in Section 5 of this report.

4. REGIONAL-SCALE STORMWATER MANAGEMENT DRIVERS

Based on input from the Project TAC, the key drivers for managing stormwater on a regional scale in the County are:

1. Limited Resources
2. Existing Stormwater Infrastructure Deficiencies
3. Water Quality Regulations and Protection
4. Climate Resiliency
5. Beneficial Use of Stormwater
6. Equity and Community Engagement

These drivers are described as follows.

4.1 Driver 1: Limited Resources

There are currently limited resources available to address many of the fundamental stormwater needs in the County. This limitation primarily arises from stormwater fees that are lower than what is needed (and limited general fund monies to supplement) to maintain permittee stormwater infrastructure, and meet compliance requirements of the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) Municipal Regional Stormwater National Pollutant Discharge Elimination System (NPDES) Permit (MRP; Order R2-2015-0049), especially with respect to achieving stormwater treatment and GSI requirements (SFBRWQCB, 2015). In 2020, C/CAG projected San Mateo County municipalities may collectively need to invest between $760 million and $1.14 billion in capital improvement funds over the course of several decades to comply with mandated GSI requirements and additional publicly funded GSI needed to achieved mercury and polychlorinated biphenyls (PCBs) load reductions established in the Total Maximum Daily Loads (TMDLs) for these pollutants in the San Francisco Bay (San Mateo Countywide Water Pollution Prevention Program [SMCWPPP], 2020a). Further, it is typical for the cost to comply to increase during each permit term, putting an increased strain on limited resources every five years (also see Section 4.3). There are additionally limitations with the funding structure of the FSLRRD, which is currently dependent on municipal entities (i.e., cities and towns and the County of San Mateo) contributing funding and is additionally challenged by entities that face difficulties funding projects with limited or no benefits within their jurisdictional boundaries. These funding constraints are coincident with a need for increased investment in infrastructure to provide resiliency and adaptation as the County is confronted with the current and future impacts of a changing climate.

As an example of existing stormwater funding challenges, the City of San Mateo is conducting a Stormwater Funding Analysis to evaluate the current and future funding need to operate the City's stormwater program. Using the City's current basic operations costs, estimates for additional operational and compliance needs, and future capital costs based on the Capital Improvement Program funded and unfunded projects budgets and a 2018 Marina Lagoon Dredging Analysis, the draft report estimates that the City's overall stormwater funding need ranges from $68 to $139 million amortized over 30 years to meet basic operations, regulatory compliance and capital improvements. (City of San Mateo, 2021b). To achieve this funding goal,

the City would need to propose a significant new stormwater utility fee or propose an alternative means to a long-term revenue stream. City of San Bruno provides another example, with 2014 stormwater fees ranging from $2 to $4 per 1,000 square feet for parcels, depending on land use, resulting in an average of about $500,000 to $600,000 collected by the City's Stormwater Fund each year. Collections support operational work and occasional small improvement projects, with an annual surplus of typically less than $100,000. The SDMP states that the City would need to revise its storm drainage fee structure or find other funding sources to fund the proposed SDMP Capital Improvement Program (CIP) of over $20 million for Priority 1 and 2 projects (City of San Bruno, 2014). San Bruno initiated a Proposition 218 property-related fee balloting process in early 2021 to increase stormwater fees from $46 for a single-family residence to $154; results of the balloting were not available at the time this report was finalized.

Many of C/CAG's member agencies have developed storm drain master plans. The following table summarizes the costs identified in those plans for necessary infrastructure improvements, broken down by high, medium, and low priority projects, where available, along with dedicated stormwater fee revenue, if any. It is important to note that many of these master plans were completed five or more years ago, and listed costs are not escalated to current dollars. In addition, many member agencies do not have storm drain master plans, or they were not available for review for the purposes of this report.

Table 1: Summary of Storm Drain Master Plan Costs and Dedicated Revenue

	Date of Study	Storm Drain Master Plan Cost (total)	High Priority Projects	Med Priority Projects	Low Priority Projects	Dedicated Annual Revenue
Atherton	2015	$45	$18	$24	$3	$0.000
Belmont	2009	$57	$13	$13	$31	$0.300
Brisbane	2003	$20	$15	$3	$2	$0.055
East Palo Alto	2014	$39	$31	$5	$3	$0.125
Hillsborough	2015	$58	$26	$14	$18	$0.030
Menlo Park	2003	$39	$23	$16		$0.335
Millbrae	2018	$42	$3	$30	$9	$0.240
Pacifica	2012	$11	$9	$2		$0.178
San Bruno	2014	$26	$19		$7	$0.575
San Carlos	2017	$56	$43	$13		$0.435
San Mateo (City)	2004	$57	$33	$16	$8	$0.000
South San Francisco	2016	$54	$23	$27	$4	$0.425
Total		**$504**	**$256**	**$163**	**$85**	**$3**

Note: All values in $ millions

A significant impediment to increasing municipal stormwater fees is Proposition 218, a state constitutional amendment that restricts local government's ability to impose property-related fees without voter approval. Proposition 218 exempts "sewer" fees and taxes from its provisions, but court decisions have interpreted the meaning of "sewer" to preclude stormwater within its definition. As a result, it has been difficult for counties and local municipalities to gain voters or property owners support for tax proposals to fund stormwater infrastructure improvements or

stormwater capture, urban runoff treatment programs and projects to comply with municipal separate stormwater system (MS4) requirements. Contra Costa County tried to get property owner approval for an increased stormwater fee and failed in 2012,[1] though some cities in southern California have been successful. The City of San Bruno initiated a Proposition 218 property-related fee process to increase their stormwater fee from $46 to approximately $154 annually for a typical single-family home (City of San Bruno, 2021b). Faced with similar funding challenges, the City of San Mateo has commissioned a study to investigate the potential to create a stormwater utility and needed next steps (City of San Mateo, 2021b).

C/CAG initiated a similar effort to pursue a property owner-balloted countywide stormwater fee in 2014, including opinion research and evaluation of funding needs, but ultimately did not go forward with the initiative. The needs analysis indicated an annual shortfall to comply with the MRP of approximately $25 million. This takes into account approximately $10 million in dedicated stormwater revenue throughout the County, both for C/CAG's stormwater program (approximately $2.2 million) and roughly half of the 21 agencies that have pre-Proposition 218 fees in place, as well as the local share of vehicle registration revenue that can be used for water pollution prevention efforts (see below). It is important to note that the needs analysis was performed during the first five-year term of the MRP, which is now moving toward its third term with increased cost implications associated with GSI implementation and additional pollutant load reduction requirements. Costs to maintain and repair stormwater systems and for compliance with MRP requirements have risen significantly since that analysis was completed.

Senate Bill (SB) 231, signed into law in 2017, is intended to provide guidance to the courts in their interpretation of "sewer" in the context of Proposition 218 (State of California, 2017). SB 231 clarifies the definition of sewer includes storm sewers and therefore stormwater property related fees would be subject to the same voter approval exemptions as sanitary sewer fees. Taxpayer advocacy groups disagree with this clarification and are likely to challenge in court any agency that attempts to impose a new or increased stormwater property-related fee without a balloting process; hence, no jurisdiction to date has attempted this approach to increasing stormwater revenues.

4.2 Driver 2: Existing Stormwater Infrastructure Deficiencies

There are existing deficiencies in many C/CAG member agency storm drainage systems as a result of age and limited resources to address these issues. Deficiencies are identified in SDMPs produced by many of the member agencies. In many SDMPs, deficiencies are ranked in terms of severity, with some deficiencies classified as, for example: indicative of "imminent failure" that could "affect a dwelling structure, damage… property…, cause roadway failure or traffic disruption" (Town of Hillsborough, 2015); areas that "continually flood and cause damage and/or pose a threat to safety" (City of South San Francisco, 2016); or "hav[ing] a large area of flooding where the 10-year maximum flood depth is greater than 12-inches" (City of Half Moon Bay, 2016).

[1] See article titled, "Water fee defeat starts email rant" from The Mercury News, 2012. Notably, the article claims, "Nowhere in the [ballot initiative's] voluminous backup reports did analysts answer a homeowner's most basic question: How much money will my city receive from this fee, and how will it spend it?"

All the SDMPs reviewed by Geosyntec identified major improvement projects to maintain and improve existing infrastructure to address minor to severe flooding issues resulting from undersized, aging, or otherwise deficient storm drain infrastructure. The multi-year schedule and hundreds of millions of dollars needed to mitigate just the severe/high priority issues (e.g., more than 14 years and $26 Million for the Town of Hillsborough high priority improvements; over $23 Million to address Priority 1 deficiencies for South San Francisco; and $56 Million to address identified CIP projects and Tier 2 projects for the City of San Carlos) are indicative of the funding challenges for stormwater management overall (see Table 1 and Driver 1).

4.3 Driver 3: Water Quality

The Clean Water Act (CWA) requires MS4 discharges to be permitted under the NPDES permit program. In addition, the CWA requires the States to adopt water quality standards for receiving water bodies. Water quality standards consist of designated beneficial uses for a receiving water body (e.g., wildlife habitat, agricultural supply, fishing, etc.), along with water quality criteria necessary to support those uses. All San Mateo County MS4s discharge into regulated receiving water bodies.

4.3.1 Impaired Water Bodies and Total Maximum Daily Loads

When designated beneficial uses of a receiving water body are being compromised by water quality, Section 303(d) of the CWA requires identifying and listing that water body as "impaired". Once a water body has been deemed impaired, a total maximum daily load (TMDL) must be developed for the impairing pollutant(s). A TMDL is an estimate of the total load of pollutants from point, non-point, and natural sources that a water body may receive without exceeding applicable water quality standards (with a "factor of safety" included). Once established, the TMDL allocates the loads among current and future pollutant sources to the water body. Table 2 lists the water quality impairments for water bodies in San Mateo County as reported in the Final 2014/2016 California Integrated Report (CWA Section 303(d) List/ 305(b) Report) (State Water Resources Control Board [SWRCB], 2021a).

The SFBRWQCB oversees protection of water quality in the San Francisco Bay Area. The San Francisco Bay Basin Plan (SFBRWQCB, 2017), the water quality control planning document for the San Francisco Bay Region, identifies beneficial uses for waterbodies in the region. The Basin Plan classifies water quality attainment strategies, including specific TMDLs and enhancement plans that help to maintain water quality standards.

Table 2: Summary of 303(d) Listings for San Mateo County

Waterbody	Impaired Pollutants
River and Stream	
Butano Creek	Sedimentation/Siltation
Colma Creek	Trash
Pescadero Creek	Sedimentation/Siltation
Pomponio Creek	Indicator Bacteria
San Francisquito Creek	Diazinon
	Sedimentation/Siltation
	Trash
San Gregorio Creek	Indicator Bacteria

Table 2: Summary of 303(d) Listings for San Mateo County

Waterbody	Impaired Pollutants
	Sedimentation/Siltation
San Mateo Creek	Diazinon
	Trash
San Mateo Creek, Lower	Toxicity
San Pedro Creek	Indicator Bacteria
San Vicente Creek	Indicator Bacteria
Coastal and Bay Shoreline	
Aquatic Park (Marina Lagoon, San Mateo County)	Indicator Bacteria
Lakeshore Park Beach (Marina Lagoon, San Mateo County)	Indicator Bacteria
Kiteboard Beach (San Francisco Bay, Lower)	Indicator Bacteria
Oyster Point Marina (San Francisco Bay, Lower)	Indicator Bacteria
Pacific Ocean at Pacifica State/Linda Mar Beach	Indicator Bacteria
Pacific Ocean at Pillar Point	Mercury
Pacific Ocean at Pillar Point Beach	Indicator Bacteria
Pacific Ocean at Venice Beach	Indicator Bacteria
Lake and Reservoir	
Lower Crystal Springs Reservoir	Mercury
Pilarcitos Lake	Mercury
Bay and Harbor	
San Francisco Bay, Lower	Chlordane
	Dichlorodiphenyltrichloroethane (DDT)
	Dieldrin
	Dioxin compounds, including (2,3,7,8-TCDD)
	Furan Compounds
	Invasive Species
	Mercury
	Polychlorinated biphenyls (PCBs)
	Polychlorinated biphenyls (PCBs) dioxin-like
	Trash
San Francisco Bay, South	Chlordane
	Dichlorodiphenyltrichloroethane (DDT)
	Dieldrin
	Dioxin compounds, including (2,3,7,8-TCDD)
	Furan Compounds
	Invasive Species
	Mercury
	Polychlorinated biphenyls (PCBs)
	Polychlorinated biphenyls (PCBs) dioxin-like
	Selenium

TMDLs have been developed for watersheds throughout San Mateo County. Completed TMDLs include:

- Sediment for Pescadero Creek and Butano Creek;
- Diazinon and pesticide-related toxicity for San Francisco Bay area urban creeks, including Laurel Creek, San Francisquito Creek, and San Mateo Creek in San Mateo County;
- Bacteria for San Pedro Creek, Pacifica State Beach, and Marina Lagoon (Aquatic Park and Lakeshore Park Beach); and
- Mercury and PCBs for San Francisco Bay.

TMDLs under development in San Mateo County include:

- Sediment for San Francisquito Creek and San Gregorio Creek;
- Bacteria for Pillar Point Harbor and Venice Beach on the Pacific Ocean; and
- Bacteria for Kiteboard Beach and Oyster Point Beach on San Francisco Bay.

A Water Quality Improvement Plan has also been developed for San Vincente Creek and was adopted by the SFBRWQCB in 2016 (SFBRWQCB, 2016). For municipal stormwater discharges in the Bay area, TMDLs are implemented through requirements in the Municipal Regional Permit (MRP).

4.3.2 Municipal Regional Permit

C/CAG member agencies are subject to the requirements of the MRP, which was issued first issued in 2009, reissued in 2015, and is currently being revised for its third five-year term, with the expected effective date of July 1, 2022 (herein called "MRP 3.0"). The MRP applies to 79 large, medium, and small municipalities (cities, towns, and counties) and flood control agencies (collectively referred to as Permittees) throughout the San Francisco Bay Area, including all C/CAG member agencies.

The MRP regulates discharges to receiving waters in various ways including Provision C.3., which details specific requirements for new development and significant redevelopment projects, including selection, sizing, and design criteria for low impact development (LID), treatment control, and hydromodification control BMPs. Provision C.3 also requires the development of long-term Green Stormwater Infrastructure (GSI) Plans to address pollutants in stormwater discharges. The MRP states:

> *"Over the long term, the Plan is intended to describe how the Permittees will shift their impervious surfaces and storm drain infrastructure from gray, or traditional storm drain infrastructure where runoff flows directly into the storm drain and then the receiving water, to green—that is, to a more-resilient, sustainable system that slows runoff by dispersing it to vegetated areas, harvests and uses runoff, promotes infiltration and evapotranspiration, and uses bioretention and other green infrastructure practices to clean stormwater runoff."*

In addition to Provision C.3, trash controls (Provision C.10) and mercury (Provision C.11) and PCBs (Provision C.12) controls are included in the MRP. The SFBRWQCB has indicated that MRP 3.0 will require implementation of the Permittees' GSI Plans, including a GSI retrofit target to be achieved during the next permit term (2022 – 2027), potentially requiring over 100

acres to be retrofit countywide. In addition, specific provisions to address approved TMDLs that are not included in the current MRP will be incorporated into MRP 3.0. These new provisions will require specific controls for bacteria and sediment in the drainage areas of water bodies impaired for these pollutants (Table 2). While the Quality Improvement Plan for San Vincente Creek Water and a section of the Pacific Ocean at James V. Fitzgerald Marine Reserve was approved under the current MRP, an additional new provision is expected in MRP 3.0 to address discharges to the County's Area of Special Biological Significance (ASBS) within Fitzgerald Marine Reserve. In addition to those described, there are other provisions within the MRP that address other sources of stormwater pollution.

MRP Provisions C.11 and C.12 requires Permittees to develop a Reasonable Assurance Analysis (RAA) that quantitatively demonstrates that proposed GSI control measures will result in sufficient load reductions of PCBs and mercury to meet the municipal stormwater wasteload allocations (WLAs) for the San Francisco Bay PCBs and mercury TMDLs. C/CAG's SMCWPPP developed an RAA study that quantifies baseline hydrology and loadings of PCBs and mercury loads to San Francisco Bay, and evaluates the benefits of proposed GSI projects to reduce these loads through the capture, infiltration, and/or treatment of stormwater. The RAA was also used to predict the most cost-effective GSI implementation plan for each municipal jurisdiction and sub-watershed throughout the County and set implementation goals for the amount of stormwater volumes to be managed and impervious area to be retrofitted to serve as metrics for implementation tracking (SMCWPPP, 2020b). The new MRP requirements in the permit to be reissued in 2022 are expected to result in increased costs for implementation and long-term operations and maintenance, above and beyond what was anticipated in the 2014 C/CAG funding needs analysis (i.e., increased costs above $25M per year).

4.4 Driver 4: Climate Resiliency

The climate crisis is projected to cause impacts to all facets of water and stormwater systems in the 21st century (and beyond), including stormwater management, flood management, water quality, water supply, and drainage systems. California's Fourth Climate Change Assessment (2018) identified dozens of current and future impacts caused by climate change, including an already observed increase in annual maximum temperature of 1.7°F in the San Francisco Bay Area , more intense large winter storms, decreased snowpack in the Sierra Nevada and moisture deficits throughout the state, and a median sea level rise of at least 2.4 feet and potentially as much as 10 feet by 2100 (Ackerly et al., 2018). The County of San Mateo has identified specific flooding impacts to the County in the Sea Level Rise Vulnerability Assessment for coastal flooding (San Mateo County Office of Sustainability, 2018) and in the Sustainable Streets Master Plan for watershed flooding impacts (C/CAG, 2020). As a result of the current and projected impacts resulting from climate change, the San Mateo County Board of Supervisors declared a Climate Emergency in the County (San Mateo County Board of Supervisors, 2019). The Emergency Declaration demands accelerated actions on the climate crisis, calls on local and regional partners to collaborate to address climate change, and emphasizes the importance of protecting vulnerable communities by focusing on equitable climate solutions.

Key precipitation related effects of climate change that will likely impact existing stormwater drainage systems include projected increases in less frequent, larger storm events, which countywide downscaled climate modeling has shown could cause up to a 20% increase in the 10-year, 6-hour storm size and up to a 40% increase in the 100-year, 6-hour storm size per the

climate analysis conducted in the Sustainable Streets Master Plan (C/CAG, 2020). Storm drains in residential neighborhoods are typically designed for the 10-year, 24-hour event, with larger storm drains sized for a range of storm sizes from the 25-year, 24-hour event to the 100-year, 24-hour event. The projected increases expected for design events under climate change indicate that already deficient storm drain infrastructure is likely to become increasingly strained with larger and/or more frequent large events in the future, with potential for increased flooding and associated damage.

Per AB 825, the San Mateo County FSLRRD powers include controlling floodwater and stormwater, as well as addressing and protecting against the impacts of sea level rise and coastal erosion (State of California, 2019). The purpose of the act establishing the district includes allowing for more comprehensive management of the floodwater and stormwater; conserving waters for beneficial purposes when practical; and protecting infrastructure, life, and property from floodwater and stormwater.

In addition to flooding concerns, increased water stress is projected for much of the state with changes to climate, largely relating to expected declines in snowpack. Additionally, future increases in temperature, regardless of changes (increases or decreases) in total precipitation, are likely to cause longer and deeper California droughts (Ackerly et al., 2018). Many water supply agencies and districts in the County are members of the Bay Area Water Supply and Conservation Agency (BAWSCA) (16 member agencies within the County) and rely upon the San Francisco Regional Water System for supply. Eighty-five percent of the regional system water comes from Sierra Nevada snowmelt (BAWSCA, 2021). Changes to snowmelt could cause reliability impacts to current water supplies. There are areas of the County that also rely on groundwater as all or part of their water supply source. In the meantime, population is projected to continue to grow in the County, resulting in additional water demand (BAWSCA, 2015). The total population of the BAWSCA member agency service areas is projected to grow from 1.8 million in 2015 to 2.2 million by 2040, reflecting a 25% increase (BAWSCA, 2015). The San Francisco Public Utilities Commission (SFPUC) is in the process of developing a Long Term Vulnerability Assessment and Adaptation Plan for their Water Enterprise through the Water Research Foundation to explore the impact of climate change on water supply for the agencies reliant on the Regional Water System, with the plan due in 2021 (SFPUC, 2021). The importance of using stormwater as a potential source for augmenting water supplies is included under Driver 5 in the next section.

Additional impacts of climate change that could impact urban areas include changing temperature and weather patterns. Such changes are projected to result in additional heat stress and may create challenges for maintaining certain vegetation.

4.5 Driver 5: Beneficial Use of Stormwater

In addition to needs relating to future water stress and drought year supply shortfalls, there is also a desire to use stormwater as a beneficial resource throughout the County. The primary beneficial use under consideration is water supply, including smaller scale capture and use of non-potable water to augment potable use, recharge to groundwater basins, or divert stormwater to supplement recycled water production. Use of stormwater for water supply is supported by California Water Conservation Legislation (AB 1668 and SB 606) signed into law in 2018 (State of California, 2018), which provides a road map for actions to be taken by the California Department of Water Resources (DWR) and the SWRCB to: (1) use water more wisely; (2)

eliminate water waste; (3) strengthen local drought resilience; and (4) improve agricultural water use efficiency and drought planning (DWR and SWRCB, 2018).

BAWSCA identified in their 2015 Long-Term Reliable Water Strategy (Strategy) a forecasted supply shortfall of up to 43 million gallons per day (mgd) in future drought years (year 2040, of a total estimated demand of 284 mgd). To address the drought year shortfalls, BAWSCA has identified a number of actions, including supporting local water supply projects. Local water supply projects identified in the Strategy include recycled water, groundwater recharge, and desalination projects, along with local stormwater capture and reuse projects. Notably, while the Strategy estimated a potential yield from rainwater harvesting (i.e., rain barrels) of 210 acre-feet per year (AFY) to 680 AFY, the Strategy stated that "reliable information on the potential yield of BAWSCA service area wide implementation of stormwater capture projects is not currently available due to the lack of projects in the region." As a result, larger stormwater capture projects are not included in the portfolio of projects summarized by the Strategy to make up for the drought year shortfall and rainwater capture makes up only 0.5 mgd of the projects identified to cover the shortfall (BAWSCA, 2015).

There are currently initiatives at the state level to increase use of recycled water, including the Recycled Water Policy. The Recycled Water Policy (SWRCB Resolution No. 2018-0057) encourages the safe use of recycled water from wastewater sources (SWRCB, 2018). Four of the 10 publicly operated treatment works (POTWs) in the County utilize recycled water or have plans to. These POTWs include City of Pacifica Wastewater Treatment Plant (WWTP), North San Mateo County Sanitation District, Palo Alto Regional Water Quality Control Plan, and Silicon Valley Clean Water. Based on initial research, two of the four POTWs have current recycled water programs and/or plans to expand services. The other two POTWs do not appear to have advanced treatment, which is needed for recycled water systems. A list of POTW status relating to recycled water capabilities is provided as Attachment B. In addition to potentially supplementing recycled water operations, stormwater management upstream may provide other benefits to POTWs, including reductions in peak flows during wet weather.

There are community-based reasons for potentially advancing beneficial use of stormwater as well. Per AB-825, the FLSSRD has powers that include planning and implementing facilities for public recreation incidental to projects that provide flood control drainage and water conservation. Projects that provide community amenities are potentially more likely to have community support and interest (see Driver 6) and may have additional opportunities for grant funding (see Driver 1).

4.6 Driver 6: Equity and Community Engagement

In California, disadvantaged and vulnerable communities have been disproportionately burdened by pollution, socioeconomic and health impacts, flooding, and potential climate change impacts. The San Francisco Bay Conservation and Development Commission (BCDC) includes in their community vulnerability mapping tool a description of these disproportionate effects on communities of color (BCDC, 2021):

> *"Discriminatory policies implemented across all levels of government intentionally and unintentionally caused generations of communities of color to face persistent poverty; poor public health; inadequate public services; disproportionate exposure to polluted air, water, and soil; and under-representation in policy-making."*

With respect to the increased vulnerability to climate change impacts based on existing social conditions, several demographic factors, including age, race/ethnicity, language, education, income, housing vulnerability and access to vehicles, have been identified as potentially influencing how well communities are able prepare for, respond to and recover from climatic events such as sea level rise in San Mateo County (San Mateo County Office of Sustainability, 2018).

Multiple metrics have been used to identify vulnerable communities in the County (Exhibit 1). Some of these indicators include:

- CalEnviroScreen was developed to identify California's most pollution-burdened and vulnerable communities using a quantitative method. Census tracts identified as in the top 25% of most pollutant-burdened in the state per CalEnviroScreen are defined as disadvantaged under Senate Bill 535 (State of California, 2012; CalEPA, 2017).
- The San Francisco Bay Restoration Authority identifies an "economically disadvantaged community" (EDC) as a community with a median household income less than 80% of the area median income (San Francisco Bay Restoration Authority, 2019).
- The Metropolitan Transportation Commission's (MTC) communities of concern include tracts with four of more disadvantage factors as defined in the Plan Bay Area methodology (MTC and Association of Bay Area Governments, 2017).
- The San Mateo County Community Vulnerability Index, which "combines standardized values of seven separate indicators collected from the United States Census Bureau's American Community Survey to illustrate combined indicators of poverty" (San Mateo County, 2021). This was derived from the County's Climate Adaptation Planning work under Climate Ready SMC (https://climatereadysmc.org/), which addresses multiple climate hazards (flooding, sea level rise, extreme heat, fire).

Several of these key vulnerable community indicators were compiled as part of C/CAG's Sustainable Streets Master Plan. Exhibit 1 of this report displays the map of vulnerable communities created for the Sustainable Streets Master Plan (C/CAG, 2020). As defined in the Sustainable Streets Master Plan, "vulnerable and disadvantaged communities are those that are considered the most burdened by health, economic, and environmental factors." The Sustainable Streets Master Plan compiled datasets include the: (1) Median Household Income (MHI) based Disadvantaged Communities (DACs) dataset from the U.S. Census American Community Survey data; (2) Cal EnviroScreen DAC dataset; (3) economically disadvantaged communities dataset from the San Francisco Bay Restoration Authority; (4) MTC's Communities of Concern dataset; and (5) top tier of the San Mateo County Community Vulnerability Index.

The California Governor's Office of Planning and Research (OPR) includes a definition of social equity in the 2017 General Plan Guidelines from the National Academy of Public Administration (OPR, 2017):

> *"The fair, just, and equitable management of all institutions serving the public directly or by contract; the fair, just and equitable distribution of public services and*

> *implementation of public policy; and the commitment to promote fairness, justice, and equity in the formation of public policy."*

Chapter 4 of the California State General Plan Guidelines was updated in 2020 to expand considerations of environmental justice, an important component of equity, and to describe in further detail SB 1000, which requires that environmental justice be considered in land use planning. The 2020 General Plan Guidelines Chapter 4 update includes a focus on ensuring equitable access and connections to public services and community amenities, such as community centers, libraries, public transit, parks and recreation facilities, and safe drinking water and wastewater services, as well as active transportation infrastructure, flood control and water drainage, and facilities and programs to improve disaster preparedness and recovery capacity (OPR, 2020).

Following feedback from public outreach efforts, BCDC approved an amendment to the Bay Plan[2] to include environmental justice and social equity policies, acknowledging that impacts of pollution, flooding, and climate change are impacting and will affect disadvantaged communities differently (BCDC, 2021). This focus on equity considerations is consistent with other initiatives in the state and the County.

The County of San Mateo's Board of Supervisors has recently increased the focus on equity in County decision making. The Board adopted a resolution authorizing an "Agreement with Social Progress Imperative for Research, Data Analysis, and Consulting Services in Connection with the Integration of Equity Factors into the County's Decision-Making Processes" in March 2020 (Resolution 20-089; County of San Mateo Board of Supervisors, 2020a), in addition to resolutions condemning racism (Resolution 20-584; County of San Mateo Board of Supervisors, 2020b) and supporting the Black Lives Matter movement (Resolution 20-394; County of San Mateo Board of Supervisors, 2020c).

In developing C/CAG's Sustainable Street Master Plan, the need for addressing equity and the disproportionate impacts of climate change on historically underserved communities in the County was recognized early on as an important criterion for project opportunity evaluation and builds on other recent climate adaptation planning efforts, including the San Mateo County Sea Level Rise Vulnerability Assessment and Climate Ready San Mateo County Initiative and associated community-based climate resiliency projects. To this end, the opportunity prioritization methodology included metrics for prioritizing project opportunities based on a composite of community vulnerability indices, drawing on existing state, regional and countywide data layers defining disadvantaged communities.

In addition to serving and protecting communities equitably, community engagement is also an important driver for a successful regional collaboration approach. Regional stormwater projects have stalled or failed when there has not been adequate community support for their implementation. A recent example of this includes a stormwater capture project conceptualized at Holbrook-Palmer Park in the Town of Atherton. There was significant public opposition to the project being at the Town's only park, with "residents and park users said that the construction

[2] San Francisco Bay Plan, https://www.bcdc.ca.gov/plans/sfbay_plan.html.

process could be too disruptive and the facility would be out of place in the park." [3] As a result, the project was relocated to be beneath the athletic fields at a nearby college and preliminary design and environmental review were performed, but ultimately, the project was abandoned by the college. Adequate community engagement and education, especially with communities characterized by existing social vulnerabilities, on the importance of stormwater management, particularly with respect to addressing the effects of climate change, can increase the likelihood of community support for projects and programs. Community understanding of the need for and importance of managing stormwater – whether addressing water quality mandates, preventing flooding and protecting life and property (now and into the future), or using stormwater beneficially as a resource instead of treating as a waste – is essential for ultimately securing the necessary resources.

Regional stormwater management may result in benefits for which equity issues should be considered. For example, regional stormwater projects can create new or improved recreational facilities, such as new playing fields atop an underground retention facility. The downstream benefits of such a project may benefit some communities more than others, or more directly than the community in which the facility is sited. Decisions around the siting and resultant benefits of such facilities should be viewed through and equity lens. Additionally, programmatic mechanisms implemented at a regional scale can provide increased socioeconomic community benefits including workforce training and development opportunities and job creation, particularly in the "green jobs" sector.

5. OBJECTIVES TO MEET DRIVERS

Objectives, or the preferred outcomes of managing stormwater on a regional scale, are described in this section. Many objectives relate to several of the drivers identified in Section 4. The driver(s) relevant for each objective is included in each subsection. Stormwater capture projects implemented through regional-scale stormwater management should be identified, prioritized, and designed to maximize the number of objectives that are addressed. Metrics that represent these objectives will be developed as part of the business case analyses.

5.1 Objective 1: More Efficiently Use Limited Resources

The primary objective of managing stormwater on a regional scale is to use limited municipal resources more efficiently and effectively. This includes reducing fiscal impacts to individual municipalities, achieving economies of scale through funding of larger projects and implementing these projects in the locations (and within a collaborative framework) that provide the most benefits (e.g., capturing larger quantities of water, reducing flood flows, treating larger scale pollutant loads, and providing other benefits). This also includes a focus on planning and implementing multi-scale (i.e., regional, as well as street and parcel-scale) and multi-benefit projects that together have a higher potential of meeting the requirements of various state and federal grants and therefore increasing opportunity to augment limited existing resources through these funding sources. One example of this would be the State's Integrated Regional Water

[3] "Atherton takes first steps toward moving site of water capture project." The Almanac. September 24, 2018. https://www.almanacnews.com/news/2018/09/24/atherton-takes-first-steps-toward-moving-site-of-water-capture-project

Management (IRWM) approach to distributing water resource funding throughout the state through grant programs (SWRCB, 2021b). ***(Relates to Driver 1)***

5.2 Objective 2: Support Improvements to and/or Alleviate Strain on Existing Stormwater Infrastructure

Identify and prioritize stormwater capture opportunities that can minimize existing storm drain deficiencies or their impacts, as identified in Permittee SDMPs. A major challenge for the C/CAG member agencies is implementation of needed repairs, replacement and upgrades for existing storm drain infrastructure. Many severe storm drain issues may be best managed by upgrades to existing "grey" infrastructure, (i.e., storm drainage pipes, pump stations, detention facilities, or other infrastructure). However, some storm drain capacity issues can be at least partially addressed by regional large-scale and/or distributed stormwater capture projects and GSI, which can reduce or slow runoff while providing other benefits. More frequent flooding events can be minimized through implementation of GSI, which provides localized detention of stormwater (and retention/infiltration where feasible) during lower return frequency storm events and can help to reduce peak flows to the storm drain system. Additionally, even moderate to more severe storm drain deficiencies could potentially be served by diverting runoff to larger regional stormwater capture facilities or managing rainwater where it falls with street and parcel-scale GSI, where feasible. *(Relates to Driver 2 and Driver 1)*

5.3 Objective 3: Cost Effectively Comply with Water Quality Regulatory Requirements

Implementation of large-scale stormwater capture facilities that can allow permittees to cost-efficiently meet water quality regulatory requirements. In addition to programmatic needs relating to enforcing and complying with MRP requirements, the RAA Report found that high levels of investment in structural stormwater controls are needed to meet the PCBs TMDL target across the County. However, the RAA Report demonstrated substantial modeled cost savings (~35%) in meeting TMDL targets with implementation at a countywide scale instead of each jurisdiction having to implement an individual distributed GSI system to achieve a proportionate share of water quality improvement (SMCWPPP, 2020a). If additional regional projects are identified and optimized for load reduction potential, these savings could potentially be increased due to less need for small-scale, distributed GSI facilities on public rights-of-way or parcels. Based on a review of statewide GSI design and construction cost data, the unit cost for regional treatment is significantly less than the unit cost for distributed GSI or green street projects (Geosyntec, 2018). There are added cost benefits relating to inspection and maintenance efficiencies with centralized facilities in comparison to distributed GSI. Countywide implementation of strategic distributed scale stormwater management systems may also provide similar benefits but result in increased inspection and maintenance requirements.

In addition to the MRP compliance needs relating to GSI and PCBs load reductions, there are additional requirements, such as Provision C.3 (new development/redevelopment) and Provision C.10 (trash control), that may require additional investment in water quality control measures, and new requirements expected in MRP 3.0 as described in Driver 3. Maximizing the water quality benefits provided by any given facility implemented through regional-scale stormwater management (i.e., regional stormwater capture facilities as well as strategically placed distributed GSI), can allow for efficiencies in meeting these requirements. Additional MRP provisions that

address other sources of stormwater pollution that could also be beneficially addressed through regional-scale SW management. ***(Relates to Driver 3 and Driver 1)***

5.4 Objective 4: Consider and, Where Appropriate, Design for Projected Future Impacts Resulting from Climate Change

Site and design stormwater capture facilities to avoid future climate impacts and/or to help mitigate future climate impacts. These impacts include flooding from sea level rise or upland floods, heat stress, and water stress. For example, stormwater capture projects should not be sited in locations where there is a strong likelihood of inundation from sea level rise in the future (unless specifically designed to be inundated) or where rising groundwater levels due to sea level rise will limit infiltration capacity or infringe upon the necessary depth separation for groundwater protection. Facilities should be sited and designed to alleviate future impacts from climate change to the extent feasible, providing that other high priority objectives are met through the same facilities or other stormwater capture facilities. Siting considerations relating to climate change resiliency could include, for example: locating a facility where it could serve to detain peak flows projected to be higher in the future; siting in locations upstream of areas that are anticipated to have compound effects of sea level rise and increased runoff; siting a facility where it could provide increased water supply through recharge, detention, and/or diversion (also see Objective 5); or siting sub-regional facilities or integrated distributed GSI and large-scale projects where there are projections of increased heat stress.

If a facility is sited such that it could serve to mitigate some of these climate impacts, it must also be designed appropriately in consideration of those projected changes. A facility sited to cool urban heat islands should include vegetation that maximizes shade and/or cooling through evapotranspiration. Similarly, a facility sited to detain increasing peak flows should be designed with an outfall structure or other features that can manage these peaks. Importantly, climate projections range widely and where facilities are designed to mitigate increased peak flow, there should also be consideration of the range of potential future outcomes for precipitation to minimize the potential for unintended consequences. ***(Relates to Driver 2, Driver 4 and Driver 5)***

5.5 Objective 5: Supplement County Water Supply Portfolio with Stormwater Where Feasible

Where economically and physically feasible, use stormwater capture projects to supplement the County Water Supply Portfolio. Examine opportunities for using regional-scale stormwater management to supplement water supply through groundwater recharge, capture, treatment, and use, larger-scale detention and diversion to treatment plants to supplement recycled water operations and opportunities for using distributed parcel-scale GSI to offset potable water use with rainwater capture and onsite use. Facilities sited for water supply should also be designed specifically to provide those water supply benefits, for example, to infiltrate optimally for recharge or use an active controlled outfall to divert water to a recycled water treatment facility when the timing is optimal or, for distributed parcel-scale facilities, integrate stormwater capture as a source of water supply in water supply planning.

A key objective of the BAWSCA Long-Term Reliable Water Supply Strategy includes identifying and evaluating water supply management projects that could be developed to meet drought year demands, during which supply shortfalls could be experienced. Stormwater capture

and use is identified as a potential water supply project under consideration, but BAWSCA identified only a small proportion of the projected drought shortfall to be made up by rainwater capture (i.e., rain barrels) in their Strategy (BAWSCA, 2015). There could be the opportunity to increase the stormwater portion of water supply portfolios in the County (depending on the groundwater basin) even during drought years with innovative stormwater capture and groundwater recharge projects.

The economics of stormwater use as water supply vary widely depending on a number of factors, and include storage, treatment, and conveyance considerations. Based on a study by Diringer et al. (2020), recharge to groundwater provides the most cost-efficient solution due to the smaller storage requirements as compared to detention facilities, and centralized capture systems are substantially less expensive than decentralized facilities.

According to Cooley et al. (2019), the levelized cost of stormwater capture and use for water supply is less expensive than non-potable reuse, indirect potable reuse, and seawater desalination. However, some Peninsula and South Bay POTW facilities that have recycled water operations are currently not considering supplementing operations with stormwater supply. This is largely related to the fact that stormwater has lower concentrations of pollutants and does not require the same level of treatment as wastewater (thus potentially a waste of energy to treat similarly to wastewater), and that stormwater quantity is unpredictable and would not arrive at the POTW at a steady flow rate without substantial storage (City of San Mateo, 2021a; Santa Clara Valley Water District, 2021).

An example of a regional-scale stormwater management project that will supplement county water supplies is the Orange Memorial Park water capture facility in South San Francisco, that began construction in March 2021. The $15 million project will divert flow from the hardened Colma Creek channel within Orange Memorial Park, and, after providing initial treatment to remove pollutants, will direct water either to an infiltration gallery for groundwater recharge or to an onsite treatment and disinfection facility for subsequent irrigation of Orange Memorial Park and adjacent park facilities. The project is expected to infiltrate 240 acre-feet of water annually into the Westside Groundwater Basin, which is actively used for water supply purposes, and offset 15 million gallons annually in potable water usage for irrigation purposes.

It is possible that the economics of stormwater capture and use as water supply will become more favorable as state water conservation initiatives are enacted and effects of climate change are increasingly felt. If so, the objective to use regional stormwater capture facilities to expand the water supply portfolio may become a higher priority in the coming years. Furthermore, while recognizing the cost-efficiencies of more centralized options for beneficial reuse of stormwater, there is also the potential to leverage existing programs to capture and reuse stormwater at a site or parcel scale, including the rain barrel rebate partnership between BAWSCA and C/CAG, or local policy changes related to new or redevelopment project onsite water usage. ***(Relates to Driver 4 and Driver 5)***

5.6 Objective 6: Site and Design Projects to Equitably Serve and Protect Communities

Site and design facilities to equitably serve and protect communities, particularly disadvantaged communities and socially vulnerable communities. Consistent with OPR's General Plan Guidelines, communities across the County should have equitable access to

services, amenities, resiliency, and benefits provided through stormwater capture facilities. Equitable access should consider racial, socio-economic, and health factors. Additionally, as feasible, facilities could be sited and designed to increase amenities or resiliency in communities to provide more equitable distribution of these benefits more generally. Communities identified as disadvantaged or socially vulnerable should be of focus when considering equitable implementation of regional stormwater capture facilities of all scales (Figure 1). As possible, communities that may be expected to be disproportionately impacted by climate change and/or poor water quality should be of focus when considering how climate resiliency benefits can be incorporated into the suite of regional/sub-regional stormwater capture projects and distributed GSI implemented through regional-scale stormwater management. Additionally, the intersection of climate change impacts and other related environmental issues needs to be better considered and anticipated (e.g., impacted water supplies or water contamination from nearby industrial facilities). Similarly, if public amenities can be incorporated into regional stormwater capture projects, equitable implementation of these amenities should be of priority. The mobilization and demolition cost and effort needed for implementing a regional stormwater capture project could be used to benefit other community projects that may not have sufficient funding for full implementation. A programmatic approach to regional-scale distributed parcel-scale GSI facilities could provide opportunities to equitably engage community members disproportionately impacted by localized flooding. These approaches, e.g., parcel-scale rainwater harvesting systems, which should consider the economic means of the participants, may allow installation of multi-benefit projects that can partially mitigate these impacts while also helping to reduce individual's cost of potable water use. ***(Relates to Driver 6 and Driver 5)***

5.7 Objective 7: Consider Local Community Benefits and Concerns in Project Implementation

Educate and engage residents regarding stormwater management needs, stormwater capture facilities, and associated benefits to maximize the potential for community support. A key success factor for implementation of regional-scale stormwater management through a range of stormwater capture facility sizes is support from the local community. Inadequate education and outreach to the local community can stymie projects simply because residents are unaware of the benefits of stormwater management or view short-term impacts of constructing a project as outweighing the long-term benefits, especially if those benefits are primarily experienced in downstream communities. The residents of San Mateo County have elected federal and state officials with a focus on environmental issues (i.e., see California League of Conservation Voters Scorecard). Therefore, presumably an understanding of the environmental benefits of stormwater capture could increase overall support for facility implementation. Additionally, if a stormwater fee increase is ultimately brought to property owners or the voters, this education and understanding may increase the likelihood of success (as well as support for the potential renewal of C/CAG's Measure M vehicle registration fee in 2035). A programmatic approach to regional-scale distributed parcel-scale GSI may offer additional community engagement opportunities. These facilities can be built on residential and commercial properties in partnership with the property owners and can be highly visible to the larger community. This type of direct engagement can also build support for larger-scale projects.

Additionally, if other benefits can be maximized through facility implementation (see, for example, those listed in Objective 8), those benefits can be designed with consideration of the needs and desires of the local community. If the local community is aware of the environmental

benefits and has a chance to weigh in on other additional community benefits provided by a stormwater capture facility, there is increased potential for support from nearby residents. Additional benefits can be provided programmatically in the process of project implementation, such as through including contractual requirements for workforce training and development and job creation as part of a regional-scale facility implementation approach. ***(Relates to Driver 6 and Driver 1)***

5.8 Objective 8: Maximize Other Benefits, Where Possible

Regional-scale implementation of stormwater capture projects should entail siting and designing facilities to maximize additional benefits provided. Facilities implemented through a regional-scale approach should be designed to maximize other potential benefits, including but not limited to:

1. Integrating waterways into communities (opportunities for wetlands, stream restoration, or creek daylighting that can be integrated into regional stormwater capture facilities);
2. Community amenities (including trails, parks, etc.);
3. Habitat (use of native plants, design to maximize ecosystem benefits);
4. Safety/Health/Active Transportation (green space for urban health and reduction of heat island, GSI as a buffer feature in multi-modal transportation design, GSI as part of a larger project to encourage walking or biking); and
5. Education (siting and signage selected with consideration of public education benefits, GSI facility tours).
6. Reducing sediment loads to tidally influenced drainages that require ongoing dredging.

Relating to community amenities, the FSLRRD has authority to implement projects that provide recreational benefits. The incorporation of community amenities into or through stormwater capture project implementation can also encourage public buy-in to projects in their communities (see Objective 7). ***(Relates to Driver 5 and Driver 6)***

6. SUMMARY AND NEXT STEPS

6.1 Identification of Projects to Meet Objectives

As described in Section 3, the vision for managing stormwater on a regional scale is to:

- Cost-effectively implement multi-benefit stormwater infrastructure solutions that collectively improve water quality; increase resiliency to climate change impacts; mitigate localized flooding; utilize stormwater as a resource; and serve communities equitably, both locally and regionally.

A next step in meeting this vision is to identify potential multi-benefit regional stormwater capture project locations and designs of varying scales that could address the objectives of managing stormwater on a regional scale. A number of plans reviewed as part of the development of this report include relevant information that can be used to identify and prioritize

multi-benefit stormwater capture projects, such as deficient storm drain infrastructure identified in storm drain master plans, high priority water quality facilities included in member agency GSI Plans, facility locations incorporated into RAA output, projects identified through the County Stormwater Resource Plan (SMCWPPP, 2017), and potential resiliency solutions identified in San Francisco Estuary Institute's Adaptation Atlas (Beagle et al., 2019).

Importantly, Driver 1, limited resources, relates to a number of regional-scale stormwater management approach objectives. As described in Sections 4.1 and 4.2, there is currently not enough funding to upgrade deficient infrastructure in many jurisdictions, let alone meet all eight objectives summarized in Section 5. As such, prioritization of identified stormwater capture projects may be difficult if choices must be made between meeting different objectives in any given facility. Additionally, identified facilities may preferentially alleviate impacts in the jurisdiction(s) in which they are located and/or adjacent to. This tension is something that will need to be considered as stormwater capture projects of varying scales are identified and the regional-scale stormwater management approach is developed further.

A visual of how the drivers and objectives interact is shown in Figure 1, below.

Figure 1: Drivers and Objectives

6.2 Project Next Steps

The existing plans described in Section 6.1 can be used as input to the list of regional stormwater capture projects identified to meet the objectives described in this report and shown in Figure 1. Craftwater will be incorporating the analyses summarized in existing plans, along with the findings of this report, into the identification and prioritization of feasible regional stormwater capture projects to be implemented through a regional-scale stormwater management approach.

With consideration of the drivers and objectives, Geosyntec and Craftwater will develop the approach for the business case demonstration, beginning with the development of metrics that can be used to quantitatively assess the potential for a suite of stormwater capture facilities to meet objectives. Craftwater will conduct modeling and analyses to develop quantitative output to support the business case. This may include estimates of facility performance in terms of water quality benefits, including load reduction, peak flow reduction, and other quantitative metrics.

Geosyntec will work collaboratively with Craftwater to evaluate the output of this analysis alongside comparative benefits achieved from smaller-scale distributed facilities. It is anticipated that planning-scale cost analyses will be conducted for both sets of potential projects to demonstrate the potential economic benefits of siting regional stormwater capture facilities where they can optimally meet the objectives. The results of these analyses will be summarized in the Project Business Case Memorandum.

The Business Case Memorandum will be presented to the Project TAC and C/CAG member agencies to obtain input. These considerations will be used to develop a draft regional collaboration framework that will be summarized in a final white paper as part of the Project.

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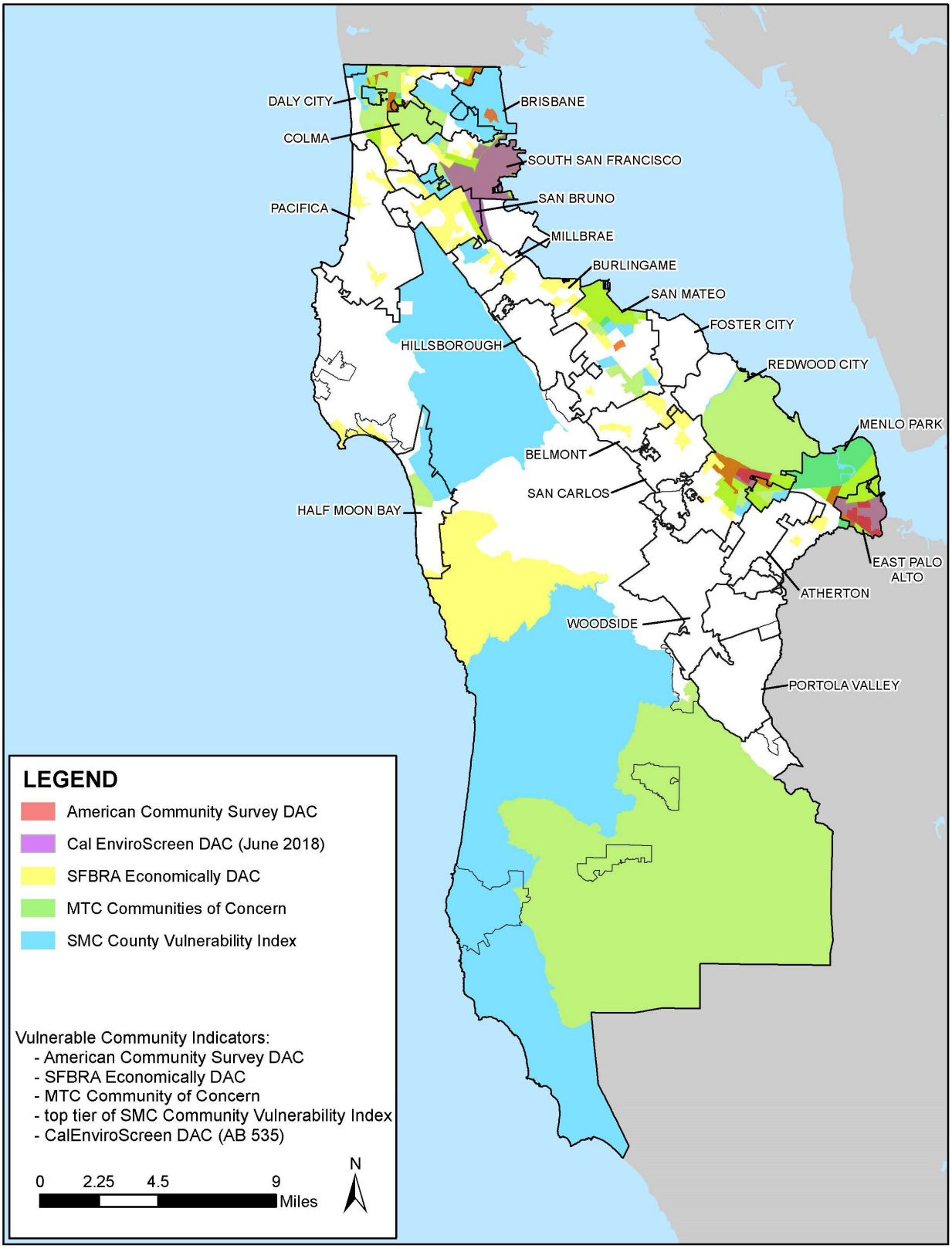
EXHIBIT 1
Vulnerable Communities



Note: Map was prepared by Lotus Water Engineering for the San Mateo Countywide Sustainable Streets Master Plan (C/CAG, 2020).

San Mateo County
Vulnerable Community Indicators

C/CAG Advancing Regional Stormwater Capture Projects: Drivers and Objectives

Geosyntec consultants

CWR0650	February 2021

Exhibit 1

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ATTACHMENT A

Drivers Matrix

Advancing Regional Stormwater Capture Projects: Drivers and Objectives
Attachment A: Maxtrix of Drivers
City/County Association of Governments of San Mateo County

Agency	Title	Year	Report Category	Driver 1: Limited Resources	Driver 2: Existing Stormwater Infrastructure Deficiencies	Driver 3: Water Quality	Driver 4: Climate Resiliency	Driver 5: Beneficial Use of Stormwater	Driver 6: Equity and Community Engagement
SFBRWQCB	Municipal Regional Stormwater NPDES Permit (MRP)	2015	Permit			X			
SFBRWQCB	San Francisco Bay Mercury TMDL	2008	TMDL			X			
SFBRWQCB	San Francisco Bay PCBs TMDL Project	2010	TMDL			X			
SFBRWQCB	Pescadero and Butano Creeks Watershed Sediment TMDL	2018	TMDL			X			
SFBRWQCB	San Vicente Creek and Fitzgerald Marine Reserve Fecal Indicator Bacteria Project	2016	TMDL			X			
SFBRWQCB	Pillar Point Harbor and Venice Beach Bacteria TMDL (Open for Public Comment)	2020	TMDL			X			
SFBRWQCB	San Francisquito Creek Sediment TMDL		TMDL			X			
SFBRWQCB	San Gregorio Creek Sediment TMDL		TMDL			X			
SFBRWQCB	Kiteboard Beach and Oyster Point Beach Bacteria TMDL		TMDL			X			
SFBRWQCB	San Pedro Creek and Pacifica State Beach Bacteria TMDL	2012	TMDL			X			
SFBRWQCB	San Francisco Bay Beaches Bacteria	2016	TMDL			X			
San Francisquito Creek Joint Powers Authority	Website	2020	Flood Management		X		X		
San Mateo County	Climate Adaptation Risk Analysis for the San Mateo Countywide Sustainable Streets Master Plan, Sustainable Streets Master Plan	2020 (DRAFT)	Climate Change Adaptation		X		X	X	X
San Mateo County	SMC Energy and Water Strategy for 2025	2020 (DRAFT)	Water Supply Management		X		X	X	X
BAWSCA	Long-Term Reliable Water Supply Strategy (Risk Assessment)	2015	Water Supply Management					X	
FSLRRD	FSLRRD BOS Presentation, December	2020	Climate Change Adaptation		X		X	X	X
SFEI	SFEI SF Bay Shoreline Adaptation Atlas	2019	Climate Change Adaptation		X		X	X	X
San Mateo County	County of San Mateo Sea Level Rise Vulnerability Assessment	2018	Climate Change Adaptation		X		X	X	X
Coastside County Water District	Coastside County Urban Water Management Plan	2016	Groundwater	X				X	
San Mateo County	San Mateo Plain GW Basin Assessment	2018	Groundwater					X	
City of San Bruno/Daly City	South Westside Basin GWMP	2012	Groundwater					X	
California's Groundwater Bulletin	Half Moon Bay Terrace (Coastside) GWMP		Groundwater					X	
San Mateo County	SMC Hazard Mitigation Plan	2016	Climate Change Adaptation		X			X	
San Mateo County	Stormwater Resource Plan for San Mateo County	2017	Stormwater Resource Plan		X		X	X	X
SMCWPPP	San Mateo County-Wide Reasonable Assurance Analysis Addressing PCBs and Mercury	2020	TMDL/MRP Compliance			X	X	X	
San Mateo County	Climate Ready Viewer	2020	Climate Change Adaptation		X		X		
Silicon Valley Clean Water	Solids Management	2021	Sustainability				X		
San Mateo County	Groundwater Information	2020	Groundwater					X	
San Mateo County Board of Supervisors	FLSSRD CEO Len Materman's presentation to the San Mateo County Board of Supervisors	2020	Presentation				X		X
Atherton	Green Infrastructure Plan	2019	GSI Plan			X	X	X	X
Belmont	Green Infrastructure Plan	2019	GSI Plan			X	X	X	X
Brisbane	Green Infrastructure Plan	2020	GSI Plan			X	X	X	X
Burlingame	Green Infrastructure Plan	2019	GSI Plan			X	X	X	X
Colma	Green Infrastructure Plan	2019	GSI Plan			X	X	X	X
Daly City	Green Infrastructure Plan	2019	GSI Plan			X	X	X	X
East Palo Alto	Green Infrastructure Plan	2019	GSI Plan			X	X	X	X
Foster City	Green Infrastructure Plan	2019	GSI Plan			X	X	X	X

Agency	Title	Year	Report Category	Driver 1: Limited Resources	Driver 2: Existing Stormwater Infrastructure Deficiencies	Driver 3: Water Quality	Driver 4: Climate Resiliency	Driver 5: Beneficial Use of Stormwater	Driver 6: Equity and Community Engagement
Half Moon Bay	Green Infrastructure Plan	2019	GSI Plan			X	X	X	X
Hillsborough	Green Infrastructure Plan	2019	GSI Plan			X	X	X	X
Menlo Park	Green Infrastructure Plan	2019	GSI Plan			X	X	X	X
Millbrae	Green Infrastructure Plan	2019	GSI Plan			X	X	X	X
Pacifica	Green Infrastructure Plan	2019	GSI Plan			X	X	X	X
Portola Valley	Green Infrastructure Plan	2019	GSI Plan			X	X	X	X
Redwood City	Green Infrastructure Plan	2019	GSI Plan			X	X	X	X
San Bruno	Green Infrastructure Plan	2019	GSI Plan			X	X	X	X
San Carlos	Green Infrastructure Plan	2019	GSI Plan			X	X	X	X
San Mateo, City	Green Infrastructure Plan	2019	GSI Plan			X	X	X	X
San Mateo County	Green Infrastructure Plan	2019	GSI Plan			X	X	X	X
South San Francisco	Green Infrastructure Plan	2019	GSI Plan			X	X	X	X
Woodside	Green Infrastructure Plan	2019	GSI Plan			X	X	X	X
Atherton	Climate Action Plan	2016	Climate Action Plan				X	X	X
Belmont	City of Belmont 2017 Climate Action Plan	2017	Climate Action Plan				X	X	X
Brisbane	City of Brisbane Climate Action Plan	2015	Climate Action Plan				X	X	X
Burlingame	City of Burlingame 2030 Climate Action Plan	2019	Climate Action Plan				X	X	
Colma	Town of Colma Climate Action Plan	2013	Climate Action Plan				X	X	X
Daly City	Daly City's Green Vision, A Climage Action Plan for 2011 - 2020 and Beyond	2005	Climate Action Plan				X	X	X
East Palo Alto	City of East Palo Alto Final Climate Action Plan	2011	Climate Action Plan				X	X	
Foster City	Foster City Climate Action Plan	2015	Climate Action Plan		X		X	X	X
Hillsborough	Town of Hillsborough	2010	Climate Action Plan				X	X	
Menlo Park	2030 Climate Action Plan	2020	Climate Action Plan				X	X	X
Millbrae	City of Millbrae Final Climate Action Plan	2020	Climate Action Plan				X	X	X
Pacifica	City of Pacifica Climate Action Plan	2014	Climate Action Plan				X	X	X
Redwood City	Climate Action Plan City of Redwood City	2020	Climate Action Plan				X	X	X
San Bruno	City of San Bruno Climate Action Plan	2012	Climate Action Plan				X	X	
San Carlos	City of San Carlos Climate Action Plan	2009	Climate Action Plan				X		X
San Mateo, City	City of San Mateo 2020 Climate Action Plan	2020	Climate Action Plan				X	X	X
San Mateo County	San Mateo County Energy Efficiency Climate Action Plan	2013	Climate Action Plan				X	X	X
San Mateo County	County of San Mateo Government Operations Climate Action Plan	2012	Climate Action Plan				X	X	
South San Francisco	City of South San Francisco Climate Action Plan	2014	Climate Action Plan				X	X	
Woodside	Town of Woodside Climate Action Plan	2015	Climate Action Plan				X	X	X
C/CAG	RICAPS Climate Action Plan Template	2020	Climate Action Plan				X	X	X
Atherton	Town of Atherton Townwide Drainage Study Update	2015	Storm Drain Master Plan	X	X	X			
Belmont	Belmont-Wide Storm Drainage Study	2009	Storm Drain Master Plan	X	X	X			
Brisbane	Storm Drainage Master Plan	2003	Storm Drain Master Plan	X	X	X			
East Palo Alto	City of East Palo Alto Storm Drain Master Plan	2014	Storm Drain Master Plan	X	X	X			
Half Moon Bay	Half Moon Bay Storm Drain Master Plan Update	2016	Storm Drain Master Plan	X	X				
Hillsborough	Hillsborough Storm Drain Master Plan	2015	Storm Drain Master Plan	X	X	X			
Menlo Park	City-Wide Storm Drainage Study	2003	Storm Drain Master Plan	X	X				
Millbrae	City of Milbrae Storm Drain Master Plan	2018	Storm Drain Master Plan	X	X	X			
Pacifica	City of Pacifica Storm Drainage System Master Plan	2012	Storm Drain Master Plan	X	X				
San Bruno	City of San Bruno Storm Drain Master Plan	2014	Storm Drain Master Plan	X	X	X			
San Carlos	City of San Carlos Storm Drain System Master Plan	2017	Storm Drain Master Plan	X	X				
San Mateo, City	Storm Drain Master Plan San Mateo, California	2004	Storm Drain Master Plan	X	X				
South San Francisco	City of South San Francisco Storm Drain Master Plan	2016	Storm Drain Master Plan	X	X	X			

ATTACHMENT B

Summary of POTWs serving San Mateo County

Advancing Regional Stormwater Capture Projects: Drivers and Objectives
Attachment B: Summary of County POTWs
City/County Association of Governments of San Mateo County

Publically Owned Treatment Works	C/CAG Agencies Served by the POTW	Treatment Level	Recycled Water Information
City & County of San Francisco, Southeast	Brisbane	Secondary[1]	
City of Burlingame Wastewater Treatment Plant	Burlingame	Secondary[1]	
City of Millbrae Water Pollution Control Plant	Millbrae	Secondary[1]	
City of Pacifica Wastewater Treatment Plant	Pacifica	Advanced Secondary[2]	The Calera Creek Water Recycling Plant can treat 4 million gallons of sewage per day (up to 20 MGD during storm events). Recycled water is used to irrigate local fields around the City of Pacifica. (City of Pacifica, 2021)
City of San Mateo Waste Water Treatment Plant	Foster City San Mateo Town of Hillsborough	Advanced Secondary[2]	Currently working on the design for the recycled water component of the POTW Expansion project. The project will produce Title 22 / Recycled Water effluent. Since they are not the water purveyor in the area, however, they don't have plans to distribute the recycled water. Foster City owns 25% of the facility and they are interested in developing plans for future recycled water needs (they are both a water purveyor and sewer agency). The effort would require additional treatment to the Title 22 effluent being produced (reverse osmosis due to salinity levels) and a distribution system for their City. With respect to stormwater, the City doesn't have plans for use. (City of San Mateo, 2021)
North San Mateo County Sanitation District	Daly City Colma South San Francisco	Tertiary[3]	*"In 2004, as part of a partnership between the SFPUC and the City of Daly City, recycled water was made available to Lake Merced Golf Club, the Olympic Club Golf Course, and the San Francisco Golf Club by adding a tertiary level of treatment at the North San Mateo County Sanitation District (a subsidiary of the City of Daly City) Wastewater Treatment Plant located in Daly City, and by installing a distribution system from the treatment plant to these respective golf courses. Recycled water currently accounts for about 80% of the irrigation at these locations. This has markedly decreased the demand on local groundwater in the vicinity of Lake Merced.* *In 2012, the Harding Park and Fleming golf courses began irrigating with recycled water also supplied by the North San Mateo County Sanitation District in Daly City."(From SFPUC: https://sfwater.org/index.aspx?page=862)* The Daly City recycled water expansion project is designed to meet the annual demand of the irrigation customers of about 1,060 AFY and the peak daily demand of 2.3 mgd (BAWSCA, 2015).
Palo Alto Regional Water Quality Control Plant	East Palo Alto Menlo Park	Advanced Secondary[2]	The City of Palo Alto's Regional Water Quality Control Plant generates approximately one million gallons of high quality recycled water each day. Recycled water is available for permitted users. (City of Palo Alto, 2021)

Publically Owned Treatment Works	C/CAG Agencies Served by the POTW	Treatment Level	Recycled Water Information
Sewer Authority Mid-Coastside	Half Moon Bay	Secondary[1]	
Silicon Valley Clean Water (SVCW)	Atherton Belmont East Palo Alto Menlo Park Portola Valley Redwood City San Carlos Woodside	Advanced Secondary[2]	SVCW is a Joint Powers of Authority serving Belmont, Redwood City, San Carlos, and the West Bay Sanitary District. POTW has advanced treatment and is providing recycled water to the community through the Redwood City's Public Works department. Recycled water is used for landscaping, agriculture and industrial applications. There is a process to provide permanent recycled water connections for approved uses. The recycled water yields are significant greater than the identified regional demand (BAWSCA, 2015).
South San Francisco Water Quality Control Plant	Colma San Bruno South San Francisco	Secondary[1]	POTW also provides declorination for Millbrae and Burlingame

Notes:

[1]Secondary treatment standards are established technology based requirements by EPA for municipal wastewater treatment plants. The standards are reflected in terms of five-day BOD, TSS removal, and pH.

[2]Advanced secondary treatment includes, at a minimum, filtration.

[3]Tertiary treatment includes additional chemical or physcial treatment of wastewater so that it can be used as recycled water for non-potable irrigation and industrial purposes.

Primary Source: POTWs in the SF Bay Region
https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/planningtmdls/basinplan/web/tab/tab_4-08.pdf

APPENDIX B

Advancing Regional-Scale Stormwater Management in San Mateo County: Business Case Technical Memorandum

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FINAL Memorandum

Date:	November 22, 2021
To:	Matt Fabry, P.E., and Reid Bogert, City/County Association of Governments of San Mateo County
From:	Kelly Havens, P.E., Senior Engineer, Lisa Austin, P.E., Principal, Lisa Welsh, Ph.D., Scientist, Troy Hunt, P.E., Senior Principal, and Yuecheng Liu, Senior Staff Engineer
Subject:	Advancing Regional Stormwater Capture Projects: Business Case for Regional Collaboration Geosyntec Project Number: CWR0650

1. INTRODUCTION

Geosyntec Consultants, Inc. (Geosyntec) is assisting the City/County Association of Governments of San Mateo County (C/CAG) with a project focusing on advancing regional stormwater capture projects in San Mateo County (County) through a regionally collaborative approach (the Project). An overview of the Project objectives was provided in the *Advancing Regional Stormwater Capture Projects: Drivers and Objectives Report* (Drivers and Objectives Report) (C/CAG, 2021a). The Drivers and Objectives Report described what could be addressed and achieved through regional-scale stormwater management (i.e., key objectives associated with identified drivers).

This memorandum describes the Business Case for regional collaboration. The Business Case provides a planning level cost-benefit analysis and qualitative assessment to demonstrate why a regional-scale stormwater management approach may provide cost efficiencies and added benefits to jurisdictions collaborating regionally to meet regulatory requirements for stormwater quality and to achieve other regional benefits. This memorandum is organized as follows:

- Section 2 provides an overview of the approach used to conduct the Business Case and a summary of the regional stormwater capture projects, including those previously identified in other efforts and additional potential opportunities, which are referenced in this comparative Business Case analysis.
- Section 3 presents the Business Case comparison by objective between a jurisdiction-by-jurisdiction approach and regional collaborative approach.
- Section 4 provides the Business Case summary.

2. BUSINESS CASE APPROACH

2.1 Drivers and Objectives

The Drivers and Objectives Report describes the key Project drivers, defined as the fundamental issues that provide impetus for managing stormwater on a regional scale, and objectives, defined as the desired outcomes from addressing the identified stormwater management drivers on a regional scale (C/CAG, 2021a). A summary of the identified drivers and objectives and how they interact is provided in Figure 1.

Figure 1: Drivers and Objectives

2.2 Analyses Methodology

Analyses have been conducted to compare metrics and other evaluation factors for two stormwater capture project implementation "scenarios:"

1. Scenario 1: Jurisdiction-by-Jurisdiction scenario under which stormwater management is addressed through jurisdiction-specific approaches.
2. Scenario 2: Regional Collaborative scenario under which regional-scale stormwater management is optimized to achieve identified drivers and objectives.

The Jurisdiction-by-Jurisdiction scenario is represented by existing studies and plans, including the *Countywide Reasonable Assurance Analysis* (Countywide RAA) (San Mateo County Water Pollution Prevention Program [SMCWPPP], 2020a) and the *Sustainable Streets Master Plan* (SSMP; C/CAG, 2021b), available *Storm Drain Master Plan* (SDMP) and *Green Infrastructure Plan* (GI Plan) information, and the Bay Area Water Supply and Conservation Agency (BAWSCA) *Long-Term Reliable Water Supply Strategy* (BAWSCA, 2015). The Regional Collaborative scenario was examined using outputs from analyses conducted for the Project by Craftwater Engineering (Craftwater), which has evaluated opportunities for regional stormwater capture projects countywide, building from the regional capture project identification and multi-benefit metrics-based analysis conducted as part of the San Mateo County *Stormwater Resource Plan* (SRP; SMCWPPP, 2017).

2.3 Objective-Based Metrics and Evaluation Factors

The metrics, or evaluation factors, that have been used to compare the benefits associated with each scenario for the identified objectives are provided in Table 1. Given the retrospective nature of the use of prior analyses and plans, not all objectives under the "Jurisdiction-by-Jurisdiction" scenario have corresponding metrics to those developed through new modeling results for the Regional Collaborative scenario.

Table 1: Metrics Corresponding with Identified Project Objectives

Objective	Jurisdiction-by-Jurisdiction Scenario		Regional Collaborative Scenario
	Proposed Metrics/Evaluation Factors	**Source**	**Proposed Metrics/Evaluation Factors** (*all developed through the Project*)
More Efficiently Use **Limited Resources**	• Costs (Capital and O&M)	• See Attachment A • Countywide RAA	• Costs (Capital and O&M)
Support Improvements to Alleviate Strain on **Existing Stormwater Infrastructure**	• SDMP upgrades to address localized flooding (qualitative evaluation)	• C/CAG Member Agencies SDMPs	• Peak flow reduction • Flood event management
Cost Effectively Comply with **Water Quality** Regulatory Requirements	• PCBs load reduction • Acres "greened" or treated • Volume Managed	• Countywide RAA • C/CAG Member Agency GI Plans	• PCBs load reduction • Acres "greened" or treated • Volume managed
Supplement County **Water Supply** Portfolio with Stormwater, Where Feasible	• Estimated stormwater capture through rainwater harvesting programs	• BAWSCA Long-Term Reliable Water Supply Strategy	• Volume recharged (where feasible) and reclaimed and associated cost benefit
Consider and, Where Appropriate, Design for Projected Future Impacts Resulting from **Climate Change**	• Green Stormwater Infrastructure Climate Change Offset per the Sustainable Streets Master Plan (C/CAG, 2021)	• SSMP	• Regional capture projects needed to achieve volume managed by green streets modeled for Sustainable Streets Master Plan (C/CAG, 2021)
Consider Local **Community Benefits** and Concerns in Project Implementation	• Qualitative Evaluation	• --	• Parks and public facilities identified as potential regional capture project location
Site and Design Projects to **Equitably** Serve and Protect Communities	• Qualitative Evaluation	• --	• Quantify number of potential projects located in DACs
Maximize **Other Benefits**, Where Possible	• Qualitative Evaluation	• --	• Qualitative Evaluation

Notes: DACs = Disadvantaged Communities; O&M = operations and maintenance; PCBs = polychlorinated biphenyls

2.4 Acres Greened

This Business Case examines the benefits of stormwater capture projects for a number of different metrics. Acres greened was used as the base metric for analyses relating to water quality cost-benefit. For this Business Case, acres greened are produced from stormwater capture facilities that meet the requirements of MRP Provision C.3.c (Low Impact Development), which requires that Regulated Projects "*treat 100% of the amount of runoff identified in Provision C.3.d in LID treatment measures,*" defined per C.3.c.(2)(c)(i) as "*harvesting and use, infiltration, evapotranspiration, and biotreatment.*" These types of facilities are also referred to as green stormwater infrastructure (GSI) in this Business Case.

MRP Provision C.3.d provides numeric volume and flow-based sizing criteria for stormwater treatment systems. The allowable sizing standard assumed for this Business Case analysis is the "*Combination Flow and Volume Design Basis*" defined per C.3.d.i.(3) as "*treatment systems that use a combination of flow and volume capacity shall be sized to treat at least 80 percent of the total runoff over the life of the project, using local rainfall data.*" The MRP Tentative Order also requires that GSI built to meet permittee numeric retrofit requirements of Provision C.3.j shall comply with Provision C.3.c and Provision C.3.d.

GSI includes infiltration, capture and use, biofiltration/biotreatment (through a non-proprietary biofilter), and diversion to sanitary sewer (for treatment and reuse). Other stormwater quality treatment measures that do not currently meet the MRP Provision C.3.c definition include large detention facilities that do not infiltrate, non-vegetated media filters, proprietary biotreatment facilities, and full trash capture devices. Notably, some locations in California allow for proprietary biofilters to be considered GSI; for example, the Los Angeles Regional Water Quality Control Board has issued approvals of proprietary biofilters under their Alternative Biofiltration Specification (LARWQCB, 2021).

These facilities that do not meet the MRP Provision C.3.c definition provide substantial other water quality benefits, including reduction of trash (required per Provision C.10 of the MRP), sediment, and other pollutants, and can provide additional multiple benefits when included in a treatment train. They can be used to meet load reductions for PCBs and mercury Total Maximum Daily Loads (TMDLs) for the San Francisco Bay, detain flood flows, and provide additional community amenities. It may be possible to demonstrate that these facilities can provide equivalent water quality and other benefits to the MRP Provision C.3.c defined facilities types when implemented at a regional scale with specific design parameters.

2.5 Prioritized Regional Stormwater Capture Project Opportunities

Craftwater conducted a regional stormwater facility identification and cost optimization exercise to identify facilities that could provide benefits in line with the objectives. As a result of their analysis, 74 potential regional facility locations and the associated proposed facility types were identified. It was assumed that regional stormwater capture projects analyzed by Craftwater would be designed to meet MRP Provision C.3.c standards or equivalent standards negotiated

with the SFBRWQCB such that they would provide acres greened for the portion of average annual runoff captured. The regional stormwater capture project opportunities were modeled by Craftwater to estimate for each facility (per Craftwater, 2021b):

1. A cost-optimized storage volume.
2. Resulting average annual volume managed (i.e., captured).
3. Total PCBs load reduced annually.
4. "Acres greened," calculated as the percent of the average annual runoff volume captured by the facility, multiplied by the tributary impervious drainage area.[1]
5. Peak flow reduction and volume capture for the 10-year, 24-hour event.
6. Potential water supply benefit, based on infiltration feasibility (100% of captured volume assumed to be available as water supply) or potential to divert to the sanitary sewer for treatment at a publicly owned treatment works (POTW) recycled water facility for reuse (33% of captured volume assumed to be available as water supply).
7. Planning level cost estimates.
8. Potential aggregate area of medium, high, or very high trash generation areas in project drainage area and aggregate area of Caltrans area in project drainage area.

Additional details regarding Craftwater's methods and results are provided in the County of San Mateo Advancing Regional Stormwater Capture Projects Project Opportunities Analysis Memo (Craftwater, 2021b). The results of Craftwater's analysis were transmitted to Geosyntec through delivery of spreadsheets and other data (Craftwater, 2021a). These results were used to define the Regional Collaborative scenario for the Business Case and are referenced as such in Section 3. These results are considered generally representative of the Regional Collaborative scenario but are still preliminary. Further refinement of the identified regional stormwater capture project opportunities is ongoing, and additional, more detailed modeling, will be conducted for those projects that are ultimately recommended through the evaluation process.

2.6 Regional Stormwater Capture Project Case Studies

Regional stormwater capture projects within San Mateo County identified in the SRP and subsequent efforts are currently in varying stages of implementation. Studies and designs for these regional stormwater capture projects (which are currently in varying stages ranging from concept to final design) are referenced in this Business Case as additional inputs for the analysis.

[1] For this memorandum, this calculation is how "acres greened" are assumed for regional stormwater capture projects achieving less than 80% capture. For individual facilities, the calculation of "acres greened" may require further discussion with the SFBRWQCB and/or additional hydrologic and water quality modeling in later stages of design to demonstrate equivalency. This also assumes that these projects provide Provision C.3.c compliant treatment or are otherwise accepted as compliant with Provision C.3.c by the SFBRWQCB.

This section describes those regional stormwater capture projects and the output of analyses completed thus far.

Three regional stormwater capture projects were identified in the San Mateo County *Stormwater Resource Plan* (SRP; SMCWPPP, 2017). Of these, Orange Memorial Park in South San Francisco is moving forward to construction and is summarized herein. The other two regional stormwater capture projects are not included in this Business Case. One opportunity (Holbrook-Palmer Park in Atherton) has since been determined not to be feasible, and the concept for the other project (Twin Pines Park, Belmont) has changed substantially from the SRP. Since the SRP, two additional regional stormwater capture project concepts were identified and are also moving forward into design and construction phases; these two projects are included in this Business Case. The three projects summarized include:

- **Orange Memorial Park, South San Francisco** – This project, currently under construction, will divert flow from Colma Creek for treatment, beneficial reuse, and local flood reduction. The project includes a large grit/trash removal chamber, a cistern accompanied by an advanced filtration and disinfection system, and infiltration gallery (City of South San Francisco and Lotus Water, 2021).
- **Red Morton Park, Redwood City** – The project, currently in design, would divert runoff from the existing adjacent reinforced concrete box (Jefferson Branch Drain) to a subsurface storage facility located within Red Morton Park. The project is proposed to include some non-potable reuse and flow-through water quality treatment (City of Redwood City, 2021).
- **Caltrans Right-of-Way at I-280 and I-380 Interchange** – The project, currently in preliminary design, is proposed to include a subsurface infiltration gallery located in Caltrans right-of-way at the I-280 and I-380 interchange in San Bruno (SMCWPPP, 2020a).

A summary of the three regional stormwater capture projects is provided in Table 2, including: the total tributary drainage area and impervious portion of the drainage area; the storage volume; the facility cost; and the source of information for the facility. A summary of the potential benefits achieved through the projects, as provided in existing reports and documents, is included in Table 3. Table 3 includes: the facility volume managed; the percent capture; the "equivalent" drainage area (i.e., portion of the total drainage area multiplied by the facility percent capture) and equivalent impervious drainage area; the estimated annual PCBs load reduced; the "acres greened" (i.e., portion of drainage area assumed treated by GSI-equivalent treatment); and the estimated annual water supply benefit provided.

Similar to the prioritized regional stormwater capture projects, when capture is less than 80% average annual runoff volume, equivalent acres greened were calculated as the percent capture of the average annual runoff volume by C.3.c compliant treatment measures (or others deemed equivalent per the SFBRWQCB) multiplied by the impervious drainage area.

Table 2: Summary of Previously Identified Regional Projects at Varying Stages of Implementation in San Mateo County

Regional Project	Implementation Stage	Total Tributary Drainage Area (acres)	Total Impervious Tributary Drainage Area (acres)	Total Tributary Average Annual Runoff (ac-ft/yr)	Design Alternative	Storage Volume (ac-ft)	Estimated Capital Cost	Estimated O&M Cost	Source
Orange Memorial Park, South San Francisco	Under Construction	6,577	2,565	4,000	n/a	0.6 (cistern) 4.9 (infiltration gallery)	$15.5 million	$500,000 for first year[1]	City of South San Francisco and Lotus Water (2021)
Red Morton Park, Redwood City[2]	Preliminary Design Alternatives	1,682	409	529	Project Alternative 1 - 85th Percentile Alternative	9.5	$12.2 to $14.9 million[3]	$151,670 per year	City of Redwood City (2021)
					Project Alternative 2 - Single Field Maximization	23.5	$28.2 to $31.5 million[3]		
Caltrans I-280 @ I-380, San Bruno	Concept Design	942	254	n/a	n/a	21	$19.6 million	n/a	SMCWPPP (2020a)

[1] Obtained per e-mail communication with South San Francisco (2021).
[2] A third option is being considered that would include 30 acre-feet of storage and cost $35.6 to $38.9 million. This option entails a two-phase approach that would extend the project footprint of Project Alternative 1 or 2 to include another facility under an adjacent field.
[3] Cost estimate range for gravity diversion and pump diversion, respectively.
ac-ft/yr = acre-feet per year
ac-ft = acre-feet

Table 3: Identified San Mateo County Regional Projects – Benefits Estimated

Regional Project	Design Alternative	Volume Managed (GSI and non-GSI) (ac-ft/yr)	Equivalent Impervious Tributary Drainage Area (GSI and non-GSI) (acres)	Estimated PCBs Load Reduction (g/year)	Percent Average Annual Runoff Captured Through GSI Equivalent Treatment	Acres Greened (acres)	Cost per Acre Greened ($/acre)	Water Supply (ac-ft/yr)	Source
Orange Memorial Park, South San Francisco	n/a	640	969	10	7%	424[1]	$37,000	240 (groundwater recharge) + 40 (irrigation)	City of South San Francisco and Lotus Water (2021)
Red Morton Park, Redwood City	Project Alternative 1 - 85th Percentile Alternative	310	240	6.2	59%	140[2]	$106,000[2]	11.6	City of Redwood City (2021)
	Project Alternative 2 - Single Field Maximization	374	289	7.8	71%	204[2]	$154,000[2]	11.6	
Caltrans I-280 @ I-380, San Bruno[3]	n/a	226	254	8	100%	254	$77,000	Potential to irrigate adjacent parks and cemetery. Infiltration feasibility to be determined.	SMCWPPP (2020a)

[1] Acres greened calculated for Orange Memorial Park was based on assumption that 44% of the equivalent impervious tributary drainage (969 acres, provided by City of South San Francisco and Lotus Water, 2021) was treated with GSI-equivalent facilities (i.e., 16% watershed runoff diverted in total, 7% of watershed runoff treated through GSI-equivalent treatment).

[2] Acres greened and unit cost assumes that the Red Morton Park project design will be considered compliant with Provision C.3.c by the SFBRWQCB.

[3] The Caltrans I-280 @ I-380 project was assumed to provide 80% capture (i.e., capture of the 85th percentile, 24-hour storm event) through infiltration.

g/year = grams per year

3. BUSINESS CASE COMPARISON BY OBJECTIVE

This section provides the details of the Business Case. Metrics corresponding with objectives are compared for the Jurisdiction-by-Jurisdiction scenario and the Regional Collaborative scenario. The input for the Jurisdiction-by-Jurisdiction scenario has been compiled from various existing reports and resources, cited herein. The information for the Regional Collaborative scenario has been compiled from the identified San Mateo County regional projects (Table 2 and Table 3) and the results from the regional stormwater capture project opportunities modeling conducted by Craftwater.

3.1 More Efficiently Use Limited Resources

A key challenge for C/CAG member agencies is limited resources, specifically dedicated funding, for storm drain infrastructure and stormwater quality needs. Efficient use of limited resources can make the dollars that are available go farther. One way to use resources efficiently is to construct facilities that achieve multiple objectives and cost less than other options. To examine this, costs used for this Business Case analysis have been compiled from existing and new sources. These include cost estimates included in the *PCBs and Mercury Total Maximum Daily Load (TMDL) Control Measure Implementation Plan and RAA for San Mateo County* (TMDL Control Measure Plan; SMCWPPP, 2020b); statistical analyses of available GSI cost data conducted by Geosyntec in 2018 to examine costs of GSI at varying scales and additional data points from Southern California (Geosyntec, 2018); estimated costs for identified San Mateo County regional projects at varying stages of implementation (Table 2); San Mateo County Integrated Safe Routes to School and Green Infrastructure Project costs (C/CAG, 2021c); and the regional stormwater capture project opportunities planning level cost output (Craftwater, 2021a). A summary of the costs from each of these sources is provided in Attachment A. The capital and operations and maintenance (O&M) cost estimates used in this Business Case are summarized in the following sections.

3.1.1 Capital Costs Used in Analysis

The costs used in the analysis and the justification for using these costs are provided in Table 4 and discussed below.

Table 4: Unit Capital Costs Assumed for Business Case

Facility Type	Cost or Range	Unit	Sources
Parcel-based or "Other GSI"	$165,000	Cost per acre greened	TMDL Control Measure Plan, escalated to 2021 dollars
Green Streets	$230,000 - $301,000	Cost per acre greened[1]	TMDL Control Measure Plan, escalated to 2021 dollars, San Mateo County Integrating Safe Routes to School, and Green Infrastructure Project costs
Regional Projects	$37,000 - $154,000	Cost per acre greened	Most Recent San Mateo County Regional Project Information, see Table 3
	Average $69,000	Cost per acre greened	Craftwater Analysis (see Attachment A of this memo)

[1] Included as "cost per acre treated" in the TMDL Control Measure Plan. This is assumed treated per the MRP Volume Hydraulic Design Basis or Flow Hydraulic Design Basis and therefore equivalent to "cost per acre greened" for the purposes of this Business Case.

- **Parcel-based or "Other GSI"** – when parcel-based or "Other GSI" costs are identified, the parcel-based average cost per treated acre identified in the TMDL Control Measure Plan, escalated to 2021 dollars, is used for consistency with that Plan (see Attachment A). This is applied as cost per acre greened in this analysis.
- **Green Streets** – Local San Mateo County Integrated Safe Routes to School and Green Infrastructure Project cost data (average of $301,000 per impervious acre treated) is reflective of current implementation costs (a summary of this data is provided in Attachment A). However, a cost range is provided to allow for the potential for cost efficiencies over time and for consistency with the cost identified in the TMDL Control Measure Plan, escalated to 2021 dollars (see Attachment A). This is applied as cost per acre greened in this analysis.
- **Regional Projects** – Regional project costs used in the Business Case are those estimated by the regional stormwater capture project opportunities analysis where those potential facilities are referenced; or the estimated costs of San Mateo County regional projects, where those identified facilities are referenced, scaled based on the benefit provided. See Attachment A for a statistical summary of Craftwater model-estimated optimized regional project costs; the average cost per acre greened is provided in Table 4 for reference. Estimated costs associated with San Mateo Regional Projects moving forward in design and construction are summarized in Table 2.

Comparing the optimized regional project cost (an average of $69,000 per acre greened) to costs associated with parcel-based facilities and green streets projects, regional projects are generally significantly less expensive to implement on a per acre greened basis. As shown in Table 4, the cost per acre greened or regional projects is approximately 40% of the cost of parcel-based facilities and approximately 25% to 30% of the unit cost of green street projects.

3.1.2 Operations and Maintenance Costs

In addition to capital costs savings, O&M cost savings should also be realized through the use of regional projects. O&M costs used in this Business Case are summarized in Table 5. Estimated O&M costs for the identified San Mateo County regional projects are included in Table 2. Although regional projects can have greater facility-specific O&M costs, cumulative O&M costs on a countywide scale should be less because fewer projects would be implemented for the same overall benefit. Regional collaboration approaches would allow for pooling of maintenance funds for regional facilities to allow for additional efficiencies and consistency (also see Section 4.1).

TMDL Control Measure Plan Costs

The TMDL Control Measure Plan referenced Geosyntec's 2018 suggested O&M cost of approximately 4% of the capital cost of these facilities on an annual basis (SMCWPPP, 2017). The resulting annual O&M costs used in the TMDL Control Measure Plan are summarized in Table 5 and have been escalated to 2021 costs.

Table 5: TMDL Control Measure Referenced O&M Costs

Control Measure	2021 Dollars	Units	Source
GI - Private/Parcel-based Redevelopment	$6,610	$ per acre greened per year	Geosyntec 2018
GI - Public Right of Way Retrofits (Green Streets)	$9,200	$ per acre greened per year	Geosyntec 2018
GI - Regional Projects	$4,360	$ per acre greened per year	Geosyntec 2018

The 4% of capital costs value assumption for O&M is consistent with the assumed O&M for the Orange Memorial Park project, which is estimated to have a first year O&M cost of $500,000 (City of South San Francisco, 2021) or a little more than 3% of capital costs. The Red Morton Park Preliminary Design Report indicates an O&M cost of $151,670 per year, which is approximately 1% or less of the capital costs, depending on design alternative (City of Redwood City. 2021).

3.2 Support Improvements to Alleviate Strain on Existing Stormwater Infrastructure

As summarized in the Drivers and Objectives Report, storm drain infrastructure improvements costing hundreds of millions of dollars have been identified as needed to alleviate flooding and capacity issues with existing storm drains. The following table summarizes the costs identified in

available plans for necessary infrastructure improvements, broken down by high, medium, and low priority projects, where available, along with dedicated stormwater fee revenue, if any[2].

Table 6: Summary of Storm Drain Master Plan Costs and Dedicated Revenue

	Date of Study	Storm Drain Master Plan Cost (total) [1,2]	High Priority Projects[1,2]	Med Priority Projects[1,2]	Low Priority Projects[1,2]	Dedicated Annual Revenue[1]
Atherton	2015	$45	$18	$24	$3	$0.000
Belmont	2009	$57	$13	$13	$31	$0.300
Brisbane	2003	$20	$15	$3	$2	$0.055
Burlingame	2009	$39	$20	$10	$9	$1.500
East Palo Alto	2014	$39	$31	$5	$3	$0.125
Hillsborough	2015	$58	$26	$14	$18	$0.030
Menlo Park	2003	$39	$23	$16		$0.335
Millbrae	2018	$42	$3	$30	$9	$0.240
Pacifica	2012	$11	$9	$2		$0.178
San Bruno	2014	$26	$19		$7	$0.575
San Carlos	2017	$56	$43	$13		$0.435
San Mateo (City)	2004	$57	$33	$16	$8	$0.000
South San Francisco	2016	$54	$23	$27	$4	$0.425
Total		**$543**	**$276**	**$173**	**$94**	**$4**

[1] All values in $ millions.

[2] Values are reflective of individual Storm Drain Master Plan year.

Multi-benefit regional stormwater capture projects can be designed with adaptive diversion intakes to capture portions of smaller flood events, including the shaving of peak flows if capacity is available. When these regional projects are upstream of needed storm drain improvements, such as those identified in SDMPs across the County, they may be able to reduce the investment needed for downstream infrastructure improvements. Many of the identified regional capture projects are estimated to provide some level of peak flow reduction and volume capture for the 10-year, 24-hour flood event (Craftwater, 2021a).

All 74 regional stormwater capture project opportunities are estimated to manage runoff during the 10-year, 24-hour storm event. Per Craftwater (2021a), the regional stormwater capture projects are estimated to manage between 3% and 100% of the 10-year, 24-hour storm event. In addition, 39 of the regional stormwater capture project opportunities are estimated to reduce 10-

[2] Many of these master plans were completed five or more years ago, and listed costs are not escalated to current dollars. In addition, many member agencies do not have storm drain master plans, or they were not available for review for the purposes of this report.

year, 24-hour peak flows, with reductions ranging from 0.03 to 58.5 cubic feet per second (cfs), managing <1% to 68% of the peak flow.[3] The large range is reflective of the relationship between the drainage area and the available area for the facility footprint. Facility footprints were cost-optimized per Craftwater's analysis and can achieve less peak flow reduction when they are smaller in comparison to the tributary drainage area. Facilities that can manage a significant portion of 10-year, 24-hour peak flow could alleviate some downstream flooding during these storm events.

The cost offset of this benefit cannot be quantified for the regional stormwater capture project opportunities, as the flood management benefits would be modeled individually for each project during their respective design phases, and the resulting downstream storm drain benefits identified at that time. However, flood flow management could be considered an additional benefit on top of the other benefits achieved through the implementation cost of the facility (i.e., pollutant load reduction, acres greened, and water supply). As described in the following section, the estimated benefits of the Regional Stormwater Capture Project at I-280/I-380 demonstrate how these cost offsets could be realized.

3.2.1 Regional Project Case Study

One example of an identified San Mateo regional project that is anticipated to provide SDMP cost offset is the Regional Stormwater Capture Project at I-280/I-380, located in the City of San Bruno. In the San Bruno SDMP (City of San Bruno, 2014), the City of San Bruno identified two potential improvements to alleviate flooding along 7th Avenue: a detention basin in Crestmoor Canyon costing an estimated $2.9 million or approximately one mile of storm drain improvements downstream of Crestmoor Canyon in the vicinity of I-380 between I-280 and CA-82 (El Camino Real), entailing upgrades of undersized pipes in the area. The estimated cost of the storm drain improvements was $10.9 million in 2014 dollars (City of San Bruno, 2014). Preliminarily, it is thought that the regional stormwater capture project, just downstream of Crestmoor Canyon, in addition to providing other water quality and possible water supply benefits, could provide some upstream detention to reduce some of the downstream impacts.

3.3 Cost Effectively Comply with Water Quality Regulatory Requirements

As described in the Drivers and Objectives Report, C/CAG member agencies are subject to the MRP as well as TMDLs for PCBs and mercury for the San Francisco Bay (Bay), for Bay-draining jurisdictions; and sediment and bacteria for certain Pacific Ocean-draining creeks and adjacent lagoons and beaches. There is also a Diazinon and Pesticide-Related Toxicity TMDL for San Francisco Bay Urban Creeks, however, this is primarily addressed through outreach and source control. PCBs TMDL load reduction goals, acres greened, and trash reductions are discussed in this section.

[3] In some cases, the regional projects treat (i.e., manage) runoff for the 10-year, 24-hour event, but discharge the runoff relatively quickly, hence the peak flow is not managed. This is why the volume managed may look much higher than the peak flow reduction.

3.3.1 PCBs TMDL Load Reduction

Bay-draining portions of San Mateo County are subject to the San Francisco Bay PCBs TMDL. A total PCBs load reduction of 1.5 kilograms per year (kg/year) is required to be achieved in urban stormwater discharges from Bay-draining San Mateo County permittees by 2030, per the TMDL Control Measure Plan (SMCWPPP, 2020b). The MRP (Provisions C.11 and C.12) required Permittees to develop an RAA that quantitatively demonstrates that the proposed control measures will result in sufficient load reductions of PCBs and mercury to meet the municipal stormwater wasteload allocations (WLAs) for the San Francisco Bay, as well as reduce a certain portion of PCBs load by 2040 through GSI. Actions required to achieve the PCBs TMDL WLAs were analyzed and summarized in the TMDL Control Measure Plan (SMCWPPP, 2020b).

PCBs Load Reduction Through GSI by 2040 Goal

A portion of the overall load reduction required to achieve the PCBs WLA should be addressed through GSI. For San Mateo County, 230 g/year should be reduced through GSI by 2040, as described in the TMDL Control Measure Plan (see Figure 4-1). After accounting for existing projects and future redevelopment, it was estimated that an additional 96 g/year of PCBs should be reduced through GSI or other treatment projects by 2040 at a minimum in San Mateo County. Some portion of this was assumed to be reduced through regional stormwater capture projects that are already moving forward in the County (summarized in Section 2.6). Notably, the PCBs load estimated to be reduced through regional stormwater capture projects in the RAA included projects that have been revised, are no longer moving forward, or otherwise have reduced GSI capacity. Further analysis would require assumptions made in the RAA to be adjusted to reflect the latest status of the regional stormwater capture projects.

Per the RAA, the remaining PCBs load that should be reduced through green streets by 2040 is approximately 25-30 g/year (i.e., after accounting for load reductions through existing projects, future redevelopment, and concept-level load reductions for the five regional projects assumed in the RAA. This was assumed to be 30 g/year for this Business Case to be conservative (SMCWPPP, 2020b; see Figure 4-1 for load reduction breakdown). The RAA looked at cohesive sediment reduction to estimate GSI treatment needs and calculated the needed capacity of green streets and other GSI projects for two implementation scenarios to achieve the PCBs load reduction through GSI by 2040 goal: (1) a proportional jurisdiction-based approach and (2) a countywide approach. The required green streets capacities estimated by the RAA are summarized in Table 7 below. Also estimated in Table 7 is the extrapolated acres greened, based on the average acres treated per acre feet GSI capacity provided in Table 9-1 of the RAA (SMCWPPP, 2020a), along with the total estimated cost of the GSI facilities.

Table 7: Estimated Cost of Additional Green Streets and Other GSI Required to Achieve PCBs Load Reduction Through GSI by 2040 Goal

RAA Scenario Modeled	Green Streets Capacity Required (ac-ft)	Additional GSI Capacity Required (ac-ft)	Acres Greened per acre-feet capacity[1] (acres/ac-ft)	Total Equivalent Acres Greened[1] (acres)	Total Estimated Cost of Required GSI[2] ($)
Jurisdiction-Based Green Streets	112.1	11.8	9.1	1,122	$251 million – $324 million
Countywide Green Streets	93.9	4.3	9.4	927	$209 million – $272 million

[1] Calculated based on the total treated impervious acres and the total GSI facility capacity provided in Table 9-1 of the RAA.
[2] Calculated using the range of average cost per impervious acre treated provided in Table 4.

For comparative purposes, this analysis will focus on the 30 g/year identified as required to be achieved through GSI by the TMDL Control Plan and analyzed through the RAA. The regional stormwater capture project opportunities modeling results demonstrate that approximately 30 g/year could be achieved with far fewer regional facilities and at a considerably lower cost than the jurisdiction-by-jurisdiction approach analyzed in the RAA. Of the top 12 Bay-side prioritized regional stormwater capture project opportunities from the 74 identified, 10 are estimated to achieve more than 11 g/year of PCBs load reduction each (Craftwater, 2021a). If three of these top prioritized facilities were ultimately implemented, they would likely provide sufficient pollutant load reduction to meet the 30 g/year PCBs load reduction needed. A summary of the costs to achieve the 30 g/year through the Jurisdiction-Based scenario and the Regional Collaborative scenario is provided in Table 8.

Table 8: Cost per gram of PCBs Reduced by Scenario

RAA Scenario Modeled	Total Estimated Cost to Achieve 30 g/year PCBs load Reduction[1]		Cost per gram PCBs reduced[1]	
	Low	High	Low	High
Jurisdiction-Based through GSI by 2040 in RAA	$251 million	$324 million	$8.4 million	$10.8 million
Regional Collaborative	$5.4 million	$59.1 million	$121,000[2]	$2.0 million

[1] Per cost range analyzed, see Table 4.
[2] Cost per gram removed based on most efficient modeled regional project, a single project which is estimated to remove 45 grams per PCBs per year at a cost of $5.4 million.

Implementation of the Regional Collaborative approach is estimated to cost 75% to 95% less than the jurisdiction-based approach to achieve the same load reduction. The cost per gram per

year calculations account only for the water quality associated benefits and does not account for the value of other benefits being achieved through these regional facilities.

TMDL Wasteload Allocation (WLA)

Beyond the MRP-required PCBs load reduction through GSI by 2040 goal, the TMDL WLA must also be achieved. San Mateo County has an estimated required load reduction of 1.5 kg/year to meet its WLA of 0.2 kg/year. The TMDL Control Measure Plan estimated the total PCBs load reductions achieved through source control measures, full trash capture systems, and GSI planned to be implemented as part of new and redevelopment projects. Based on the estimates included in the TMDL Control Measure Plan, additional load reduction would be required beyond these measures to achieve the WLA (approximately 950 grams per the TMDL Control Measure Plan), and requires additional measures to address. The estimated load reduction achieved through source controls and development projects, along with the proposed control measures to meet the WLA is shown in Figure 4-2 from the TMDL Control Measure Plan (SMCWPPP, 2020b).

PCBs and Mercury TMDL Control Measure Implementation Plan and RAA for San Mateo County

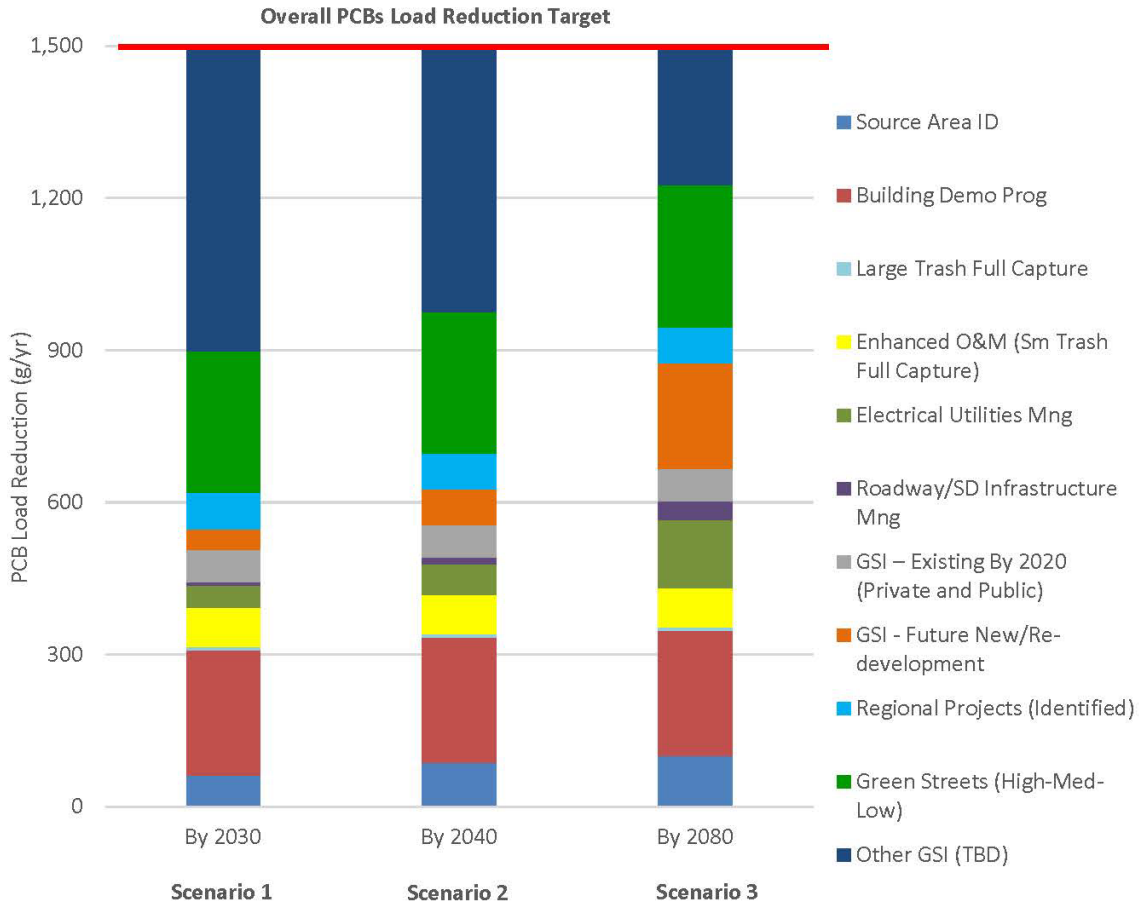

Figure 4-2. Scenarios for combinations of control measures projected to achieve San Mateo County PCBs TMDL load reduction target (i.e., 1.5 kg/yr) by 2030, 2040 and 2080.

Figure 1: Scenarios for PCBs Reducing Control Measures from SMCWPPP (2020b)

The load reduction proposed to be achieved by identified regional projects, green streets, and other GSI (to be determined) is inclusive of the PCBs load reduction through GSI by 2040 goal. In the control measure plan, the additional public GSI required to achieve the load reduction by 2030, 2040, and 2080, along with the costs, was estimated. A summary of the TMDL Control Plan findings is provided in Table 9.

Table 9: Estimated TMDL GSI Implementation Needs from TMDL Control Plan (SMCWPPP, 2020b)

Year	Area Treated (acres)	PCBs Loads Reduced (g/year)	Capital Cost (total)	Capital Cost per Gram	Annual Ongoing O&M Cost
2030	8,341	0.95	$1.14 billion	$1.2 million	$46 million
2040	7,930	0.87	$1.1 billion	$1.3 million	$44 million
2080	4563	0.62	$760 million	$1.2 million	$30 million

The PCBs load reduction efficiency must be very high to achieve these targets, in both PCBs reduced per acre treated as well as cost per gram of PCBs removed. A number of the regional stormwater capture project opportunities identified could provide this level of PCBs removal efficiency.

3.3.2 Acres Greened

The RAA output identified projects with a total of 385 ac-ft capacity in 196 subwatersheds within 20-member agency jurisdictions to achieve the required PCBs load reduction through GSI by 2040 goal. These 385 ac-ft capacity projects will capture 4,493 ac-ft of stormwater runoff per year on average. Of that, 124 ac-ft is required in green streets and other GSI, or a total of 1,122 acres greened. As summarized in Table 7, this is estimated to cost $251 million – $324 million.

When examining the top 14 prioritized projects identified, the average acres greened per facility is approximately 320 acres (assuming that GSI-equivalent treatment is provided) (Craftwater, 2021a). To achieve equivalent to 1,122 acres greened, implementation of approximately three to five of the 74 regional stormwater capture project opportunities would be needed. Using the average cost per acre treated of $69,000, implementation would cost approximately $77 million, a cost savings of 70% – 75%. In addition to providing equivalent capture of stormwater runoff in many fewer facilities (allowing for cost efficiencies for capital and O&M costs), the regional stormwater capture project opportunities are estimated to provide additional benefits.

Regional Project Case Study

The Orange Memorial Park project, currently under construction, is estimated to provide trash and sediment capture and treatment to an equivalent impervious treatment area of 969 acres and GSI-equivalent treatment (i.e., acres greened) for 424 acres of those impervious acres via capture and non-potable reuse or infiltration. With a total project cost of $15.5 million, the cost per acre greened is estimated to be $37,000 (for capital costs only). This calculation does not isolate the costs associated with the portion of runoff just receiving sediment and trash capture; the true cost per acre greened is likely lower when considering the costs associated with that treatment separately. Notably, O&M costs for the project are projected to be quite high for an individual facility ($500,000 per year), but estimated at approximately 3% of the capital facility cost. These O&M costs are quite low per acre greened ($1,179 per acre greened), lower than the average O&M cost included in Table 5.

3.3.3 Trash Capture

Trash management is a requirement per Provision C.10 of the MRP, which requires substantial trash load reductions. Where visual inspections demonstrate that full trash management systems must be installed, these facilities must meet requirements for screening (i.e., trapping of particles retained by a 5-millimeter mesh screen) and design sizing (i.e., the 1-year, 1-hour storm event peak flow rate). GSI facilities, including bioretention, capture and use systems, and infiltration facilities, are considered certified multi-benefit trash treatment systems by the State Water Resources Control Board (2019). This means that most to all of the GSI implemented in San Mateo County would be considered full trash capture. However, regional projects could provide additional trash reduction benefits through less expensive non-GSI portions of the treatment train. The Regional Collaborative scenario examined the medium, high, and very high trash-generating areas in the project watersheds, and additionally examined the area owned by Caltrans in each project watershed. As Caltrans has programs for partnerships with local municipalities to reduce trash from Caltrans-owned area, these projects could provide a funding pathway. A summary of the trash-generating area and Caltrans area within projects identified as the most-downstream in the analysis is provided in Table 10.

Table 10: Potential Acreage of Trash Benefit through Regional Stormwater Capture Project Opportunities

Project Drainage Areas	Number of Regional Stormwater Capture Project Opportunities with Identified Area in Drainage Area[1]	Average Area in Project Drainage Area (acres)
Medium, High, and Very High Trash-Generating Area	22	299
Caltrans-Owned Area[2]	37	195

[1] Represents most-downstream identified project opportunities only to avoid bias of averages from double counting.
[2] Represents overall ROW, not just high-trash generating areas.

Regional Project Case Study
The Orange Memorial Park project, currently under construction, includes sediment and debris capture and treatment to an equivalent impervious treatment area of 969 acres. Additionally, Caltrans is receiving 68 acres of full trash capture credit toward trash reduction compliance for the project[4].

3.4 Supplement County Water Supply Portfolio with Stormwater, Where Feasible

The BAWSCA Long-Term Reliable Water Supply Strategy identified that up to 680 ac-ft of supply could be achieved through rainwater harvesting in the BAWSCA service area

[4] The equivalent 1-year, 1-hour trash capture design storm is not fully captured by the project, hence the lower full trash capture credit.

(BAWSCA, 2015). The rainwater harvesting program represents an important incentive program that also acts as public education. The costs of the water supply achieved through the rainwater harvesting program are estimated by BAWSCA to range from $2,900/ac-ft to $4,800/ac-ft using an equipment life of 15 years and other assumptions.

Alternative water supply from stormwater could potentially be achieved at greater volumes through regional stormwater capture projects. Two pathways to supply—infiltration and sanitary diversion (i.e., diverting stormwater runoff to sanitary sewer for conveyance to publicly owned treatment works for treatment and reuse) — were modeled through the regional stormwater capture project opportunity analysis. Because stormwater capture for direct use requires demand calculations, which take place at later stages of design, stormwater capture and use water supply benefits were not modeled.

Of the 74 regional stormwater capture project opportunities identified, a total of 46 were identified as having potential water supply benefits through infiltration or sanitary diversions. The average water supply benefit provided through the most-downstream regional stormwater capture project opportunity for each of these supply pathways (i.e., considering that some regional stormwater capture project opportunities overlap) is provided in Table 11. As these facilities are primarily constructed to provide water quality benefits and often water supply infrastructure is a small additional cost, monetization of water supply provided could be considered cost savings realized through implementing these facilities.

Potential economic benefit can be estimated by examining the potential savings associated with using captured stormwater to replace other water supply sources. The modeling does not easily demonstrate the potential for capture and use of stormwater, which is a local water supply pathway for all 74 regional stormwater capture project opportunities if non-potable demand is present. Captured stormwater could be used for irrigation and other non-potable local uses and replace other water supply, providing a cost offset. Where captured stormwater is replacing potable water supply, savings can be very high (see Section 3.4.1 for the Orange Memorial Park example). Given modeling limitations, as well as differences in potable (and non-potable, e.g., recycled) water rates, the cost-benefit associated captured and locally used stormwater as a water supply source could not be quantified.

For illustrative purposes, the cost benefit of captured stormwater replacing other water supply is quantified for another potential source – water transfers. The water purchase cost of a water transfer is explored in BAWSCA's *Bay Area Water Supply and Conservation Agency Long-Term Reliable Water Supply Strategy, Phase II* (BAWSCA, 2015). Water supply provided through regional stormwater capture facilities could avoid or reduce the need for a water transfer and therefore provide a monetary benefit. The base cost of a water transfer per BAWSCA (2015) is $50 - $350 per ac-ft in 2015 dollars. When East Bay Municipal Utilities District (EBMUD) wheeling costs, pump station and other operation costs, transmission pipeline fee, and San Francisco Public Utilities Commission (SFPUC) Wholesale Revenue Requirement are incorporated, the full cost of a water transfer, estimated at $935 - $1725 per ac-ft in 2015 dollars (BAWSCA, 2015). For conservatism, the base cost of $50 - $350 per ac-ft is considered as the

cost benefit for water supply provided through regional stormwater capture projects, allowing that there would likely be pumping, conveyance, and treatment costs associated with the stormwater alternative supply that may not fully offset. If some of these additional transmission costs could also be avoided by capturing alternative supply locally, the water supply cost savings realized could be higher per ac-ft. The results of this exercise are provided in Table 11.

Table 11: Estimated Potential Water Supply Provided by Regional Stormwater Capture Project Opportunities

Water Supply Pathway	Number of Facilities Identified	Average Water Captured for Supply (average) (ac-ft/year)	Average Facility Water Supply Annual Cost Savings Based on Avoidance of Water Transfer[1]	
			Low (Avoids Water Purchase at $50/ac-ft)	High (Avoids Water Purchase at $350/ac-ft
Infiltration	11	118	$6,000	$41,000
Sanitary Diversion[2]	35	297	$15,000	$104,000

[1] Cost savings includes offset of water purchase only, i.e., does not include cost of EBMUD wheeling costs, pump station and other operation costs, transmission pipeline fee, and SFPUC Wholesale Revenue Requirement. Cost offset could be higher if treatment and pumping/conveyance costs are lower than other cost aspects of water transfer. Cost kept in 2015 dollars for calculation in table. Cost rounded to nearest $1,000.
[2] Sanitary diversion is currently not used in the County and POTWs with recycled water operations may not be open to this source of water supply.

The ability to provide sanitary diversion for these projects will require additional coordination and acceptance by local POTWs with recycled water operations (see Drivers and Objectives Report for additional information on these POTWs). Currently, many of the potential facilities are sited in areas with high underlying groundwater, hence the limited number of facilities that could provide infiltration benefit. However, if the local groundwater elevation was lowered due to increased use of groundwater, there could potentially be adequate separation to the groundwater table to allow for safe infiltration through these facilities.

3.4.1 Regional Project Case Studies

Water reuse is an important component of the Orange Memorial Park project, where approximately 15 million gallons (46 ac-ft) of potable water will be offset each year, resulting in an estimated savings of $140,000 annually. Captured stormwater will be used to irrigate Orange Memorial Park, including the recreation fields, picnic area, and sculpture garden, as well as the adjacent Centennial Way Trail and Sister Cities Park.

In addition to irrigation benefits, the project overlies the Westside Groundwater Basin and an estimated 240 ac-ft of groundwater will be recharged annually. Since the Westside Basin is a water supply source for the California Water Service and SFPUC, the project has the potential to reduce the need and use of imported water. There may be potential for monetization of groundwater recharge.

Multi-benefits from the Red Morton Park project in Redwood City also include water reuse. The project concept includes the capture and use of stormwater for on-site irrigation as well as for toilet flushing in the park bathrooms. In addition, a fountain and surface recirculation has been proposed to provide aesthetic, habitat, and educational benefits as well as a means to keep water moving through the subsurface storage unit and prevent public health issues with standing water.

Groundwater infiltration at Red Morton Park was initially thought to be possible, but further investigation has shown that it is currently is infeasible largely due to the high underlying groundwater (currently at 10 feet below ground surface [ENGEO, 2021]). Prior to the use of imported water from the Hetch-Hetchy Reservoir in the 1960s, the underlying groundwater basin (San Mateo Plain) was used for water supply (EKI, 2018). At the time of use, it is possible that water supplies were drawn down below sustainable levels (i.e., up to 90 feet in some places [EKI, 2018]). It is possible that a managed aquifer recharge program with groundwater extraction for local potable or non-potable use could balance the depth of the aquifer and allow for safe infiltration of stormwater to the basin, providing that geotechnical conditions support infiltration. Based on the geotechnical examination of the site, Red Morton Park is underlain by expansive clay, so infiltration still may not be feasible even with lower groundwater elevations (ENGEO, 2021).

Irrigation of neighboring parks (e.g., Commodore Park) and the Golden Gate National Cemetery is also being considered as part of the Regional Stormwater Capture Project at I-280/I-380 in San Bruno.

3.5 Consider and, Where Appropriate, Design for Projected Future Impacts Resulting from Climate Change

As part of the SSMP, Green Streets projects identified for the PCBs load reduced through GSI by 2040 RAA scenario (proportional by jurisdiction scenario) were modeled for 6-hour storm events corresponding to specific return frequencies. Historical 6-hour storm events and predicted larger 6-hour storm events (adjusted to account for climate change[5]) were modeled. Based on the analyses conducted for the RAA and the SSMP, an estimated watershed depth of 0.015 inches (135 ac-ft volume managed) can be captured by the identified green streets projects for the 2040 green streets implementation scenario at a countywide scale (C/CAG, 2021b; Craftwater, 2021a; SMCWPPP, 2020a).

Craftwater conducted an analysis to examine prioritized regional stormwater capture project opportunities in the Bayside communities that could achieve equivalent volume capture to the green streets identified for the RAA scenario. The analysis assumed that capture and management of equivalent volume within the Bayside communities by regional projects could provide equivalent offset of increased precipitation to that demonstrated in the Sustainable Streets Master Plan (Craftwater, 2021a). This assumption would also require that the runoff be

[5] Climate change scenarios modeled included a Representative Concentration Pathway (RCP) 8.5 scenario to year 2070.

adequately conveyed to the regional facilities (i.e., capacity constraints in the storm drain network upstream of a regional facility could impact the ability of the facility to capture the increased volume).

The results of this analysis demonstrated that equivalent volume could be managed in a smaller total combined storage capacity[6] and for lower cost. A summary of the comparison is provided in Table 12.

Table 12: Comparison of Estimated Regional Stormwater Capture Project Capacity and Cost Required for Equivalent Climate Change Offset to Green Streets Analyzed by SSMP

Scenario Modeled	Capacity Required (acre-feet)	Impervious Acres Treated (acres)	Total Estimated Cost of Required GSI ($)
Jurisdiction-Based through GSI by 2040 from RAA[1]	112.1	1,122	$251 million – $324 million
Regional Collaborative	79.4	4,594	$95.2 million

[1] See Table 7.

In addition to providing offset for increases in larger return frequency storm events, the regional facilities provide other multiple benefits related to mitigation of climate change impacts. These include some management of larger flood events, including the 10-year, 24-hour storm peak flow, and water supply resiliency.

3.6 Consider Local Community Benefits and Concerns in Project Implementation

Jurisdiction-by-jurisdiction implementation of green streets and other distributed GSI can provide benefits to adjacent communities, including heat island cooling and habitat through facility plant palettes, safety features, and public education. Green streets distributed throughout the County could provide wide coverage of such benefits.

Regional projects could also provide enhanced amenities for certain locations. Existing park locations or undeveloped parcels present opportunities to provide community amenities through park improvements as part of planning and installation. Six of the regional stormwater capture project opportunities are at existing parks, and 11 of them are proposed to be located in undeveloped parcels with the potential to be converted to a park.

3.6.1 Regional Project Case Studies

The regional projects moving forward at Orange Memorial Park and Red Morton Park provide examples of the community amenities that can be provided through these projects when implemented at a park location. At Orange Memorial Park, associated improvements include

[6] The smaller storage capacity results from a faster regional stormwater capture facility drawdown rate for some of the facilities.

new artificial turf fields, scoreboards, and other features. At Red Morton Park, a recirculation stream feature is also proposed.

3.7 Site and Design Projects to Equitably Serve and Protect Communities

As described in the previous section, jurisdiction-by-jurisdiction implementation of green streets and other distributed GSI can provide benefits to adjacent communities. Implementation of GSI facilities in vulnerable communities and disadvantaged communities can sometimes face specific challenges, including but not limited to: lack of adequate public outreach, which can be especially true in multilingual communities; and limited ability to site projects on the street due to community transportation and parking needs.

Regional projects implemented through a regional collaboration program could provide solutions to some of these concerns, including the ability for a larger, more focused public outreach budget, siting of facilities on parcels where they do not take up community parking spots, and fiscal benefits (also see Section 4.1).

The regional stormwater capture project opportunities identified are also located within or near a number of the vulnerable communities identified as part of the SSMP (C/CAG, 2021b). Three of the vulnerable community datasets sited in the SSMP were investigated as part of the regional stormwater capture project opportunities modeling. Of the 74 projects, 43 of them would be located within ½ mile of a Metropolitan Transportation Commission (MTC) Community of Concern; 17 would be located within ½ mile of an American Community Survey Disadvantaged Community (DAC); and 71 would be located within ½ mile of a San Francisco Bay Restoration Authority (SFBRA) Economic DAC. Sixteen projects would be located within ½ mile of communities identified by all three datasets. See Table 13 for this summary.

Table 13: Regional Stormwater Project Opportunities Located within ½ Mile of San Mateo County Vulnerable Communities

Vulnerable Community Dataset	Number of Identified Regional Stormwater Capture Project Opportunties within ½ Mile of Communities
MTC Communities of Concern	43
American Community Survey DACs	17
SFBRA Economic DACs	71
Located within ½ mile of DAC identified by all three datasets	16

Many of the MTC Communities of Concern, as well as vulnerable communities identified in the other datasets, are directly adjacent to flood-prone streams or located within the 100-year Federal Emergency Management Act Flood Plain, which may be at greater risk of flooding with projected climate change impacts. Twenty-three of the regional stormwater capture project

opportunities located within ½ mile of an MTC Community of Concern could provide some mitigation of the 10-year, 24-hour storm peak flow tributary to the facility, and nine could provide peak flow reductions greater than 25%, based on modeling results. These estimated peak flow reductions could provide some alleviation of flooding in these vulnerable communities.

Additional benefits to vulnerable communities provided by these facilities include coincident amenities, such as park, playfield, parking lot, and other infrastructure upgrades made as part of the implementation of regional projects, water supply benefits, including offset of nearby potable demand, and, for certain facility types, evapotranspiration-caused cooling effects due to installed vegetation.

3.8 Maximize Other Benefits, Where Possible

In addition to the benefits described in the previous sections, additional benefits are provided through these facilities. Regional projects that capture and retain or detain a portion of larger stormwater flows can also alleviate erosive flows in channels where this is a concern. Another example is sediment management, which has been the primary focus of the Orange Memorial Park project, for example. The regional project case studies are predicted to remove a considerable amount of sediment from the drainage area (e.g., approximately 100 tons/year at Orange Memorial Park and 112 tons/year at Red Morton Park, for the single field project alternative). Removal of sediment provides removal of entrained pollutants from downstream receiving water bodies, hence water quality benefits, and it can also provide added benefits due to the removal of the sediment itself. For example, the Orange Memorial Park project captures sediment that would have otherwise been discharged to San Francisco Bay via Colma Creek. Ongoing maintenance of Colma Creek includes dredging at multiple locations (SMCFSLRRD, 2021). The capture of this sediment could potentially reduce downstream dredging costs.

Beneficial reuse of this captured sediment is a possibility, though the sediment would require robust quality checks of physical and chemical characteristics[7] and the process is complicated regulatorily. Additional sediment is critically needed to protect Bay Area baylands and increase their resiliency. SFEI published *Sediment for Survival: A Strategy for the Resiliency of Bay Wetlands in the Lower San Francisco Estuary* in 2021, which estimates that many hundreds of million metric tons of sediment are needed to maintain tidal marshes and tidal flats in the Bay, which protect property and infrastructure and provide crucial habitat (Dusterhoff et al, 2021). A significant portion of this sediment is needed before the year 2050 based on sea level rise projections.

4. SUMMARY OF BUSINESS CASE

In general, the regional stormwater capture project opportunities implemented through the Regional Collaborative approach would cost less as compared to the Jurisdiction-by-Jurisdiction

[7] Including examination of pollutant concentrations on sediment, which must be lower than regulatory thresholds.

approach to achieve similar benefits. The cost savings achieved through the regional stormwater capture project opportunities are estimated to range from 60% to 90+% of the capital cost depending on the benefit, and could provide additional cost offsets (e.g., monetization of water supply), depending on the specific objective. These regional facilities also provide increased opportunity for multiple benefits to be achieved by the same project, such as water supply and/or flood reduction benefits in addition to water quality and climate resiliency benefits.

Additional savings may be achieved through the Regional Collaborative approach by enabling streamlining of procurement, environmental review and outreach processes, construction, inspection, and operations and maintenance. The ability to leverage stormwater investment region-wide can also allow for programmatic approaches that can incorporate additional feature such as local workforce training and development.

A summary of the Business Case for all of the objectives is provided in Table 14 below. Project delivery considerations are described in section 4.1.

Table 14: Summary of Business Case

Objective		Jurisdiction-by-Jurisdiction Scenario	Regional Collaborative Scenario
More Efficiently Use **Limited Resources**		Distributed GSI facilities cost about $165,000 per acre greened for parcel-based facilities and $230,000 to $302,000 per acre greened for green streets. O&M costs are estimated to scale with capital costs (e.g., 4% of capital costs estimated in Geosyntec, 2018).	***Average cost savings of approximately 60% to 75% per acre greened*** Regional stormwater capture projects are estimated to cost approximately $69,000 per acre greened. Individual regional facility O&M may be quite high but are expected to be lower per acre greened.
Support Improvements to Alleviate Strain on **Existing Stormwater Infrastructure**		SDMP Findings: Substantial grey storm drain infrastructure upgrades are needed to alleviate flooding concerns throughout member agency jurisdictions (see Section 3.2 for summary of completed SDMPs).	***Additional opportunities for projects to provide flooding alleviation*** Regional projects may be able to provide some management of flooding through retention and detention of smaller flood peak flows, potentially allowing for avoidance of some infrastructure capacity upgrades. The Regional Collaborative Scenario provides more options with siting and facility or treatment train type to alleviate flooding.
Cost Effectively Comply with **Water Quality** Regulatory Requirements	PCBs	RAA Scenario Results: Investment in green streets to achieve 30 grams of PCBs load reduction results in an average cost per gram removed of $8.4 million to $10.8 million (per analysis of SMCWPPP, 2020a).	***Estimated cost savings of 75% to 95+% to achieve equivalent PCBs load reduction through GSI as RAA scenario***[1] Cost to achieve 30 grams of PCBs removal using top prioritized regional projects is estimated to range from $120,000 per gram to $1.9 million per gram with an average of $1.0 million per gram.
	Acres greened	RAA Scenario Results: A total of 1,122 acres greened would be required to meet the PCBs load reduction through GSI by 2040 goal. This would require 385 ac-ft capacity in 196 subwatersheds within 20-member agency jurisdictions (per analysis of SMCWPPP, 2020a).	***Estimated cost savings of approximately 70% to 75% to provide equivalent acres greened as RAA scenario, along with reduced ongoing inspection costs***[1] Approximately 3-5 regional stormwater capture projects could achieve 1,122 acres greened, reducing implementation and inspection costs.
	Trash	Distributed GSI typically provides full trash capture.	Regional projects can be designed to provide trash management for a large drainage area (*roughly equivalent to jurisdiction-by-jurisdiction scenario based on available data and analysis*).

Objective	Jurisdiction-by-Jurisdiction Scenario	Regional Collaborative Scenario
Supplement County **Water Supply** Portfolio with Stormwater, Where Feasible	Stormwater capture could be achieved through rainwater harvesting programs at a cost of $2,900 to $4,800 per ac-ft (BAWSCA, 2015).	***Opportunities for water supply to offset project costs*** Water supply can be provided as an additional benefit for feasible projects through capture and use or recharge (where feasible), and provide potable water offset or avoidance of other water supply at a cost offset.
Consider and, Where Appropriate, Design for Projected Future Impacts Resulting from **Climate Change**	Green Streets required to achieve the PCBs load reduction through GSI by 2040 goal[2] could achieve offset of climate impacts for smaller return storms (see SSMP, C/CAG, 2021b).	***Estimated cost savings of 60% to 70% for equivalent climate change impact offset*** Regional projects can provide equivalent volume management to the modeled jurisdiction-by-jurisdiction scenario in approximately 70% of the capacity and with cost savings of 60% to 70%.
Consider Local **Community Benefits** and Concerns in Project Implementation	Distributed facilities can provide distributed community benefits including heat island cooling, habitat through facility plant palettes, safety features, and public education.	In addition to providing many of the benefits that distributed facilities can, regional facilities could provide enhanced amenities in park locations. Six of the regional stormwater capture project opportunities identified are proposed to be located in an existing park, and eleven of them are proposed to be located in undeveloped parcel with the potential to be converted to a park *(qualitative analysis, equivalent or better to jurisdiction-by-jurisdiction based on assessment)*.
Site and Design Projects to **Equitably** Serve and Protect Communities	Distributed facilities can provide distributed community benefits including heat island cooling, habitat through facility plant palettes, safety features, and public education.	Many of the regional stormwater capture project opportunities are located within ½ mile of an identified vulnerable community. Regional projects may be able to provide enhanced implementation of GSI in vulnerable communities *(qualitative analysis, equivalent or better to jurisdiction-by-jurisdiction based on assessment)*.
Maximize **Other Benefits**, Where Possible	Distributed facilities can provide distributed community benefits including heat island cooling, habitat through facility plant palettes, safety features, and public education.	Regional stormwater capture project opportunities can provide other benefits including but not limited to sediment management and reduction of erosive flows *(qualitative analysis, equivalent or better to jurisdiction-by-jurisdiction based on assessment)*.

[1] The RAA scenario focused on the PCBs load reduction through GSI by 2040 goal, a goal required under the current MRP. This specific requirement is changing per the MRP Tentative Order; however, substantial PCBs load reduction via GSI facilities is still expected to be needed to meet TMDL goals. The Regional Collaborative Scenario findings are considered representative of an approach that includes targeted siting of larger facilities to reduce PCBs load.
[2] The RAA scenario was modeled for the SSMP and was thus used to represent the "Jurisdiction-by-Jurisdiction" Scenario compared against.

4.1 Other Cost Efficiencies and Benefits of Regional Collaboration

Stormwater facilities, specifically GSI, are by their nature small, varied, and geographically dispersed, which has traditionally caused them to be planned, designed, and constructed individually. This is true in San Mateo County where multiple jurisdictions are individually planning, designing, and constructing their own GSI projects often within a shared watershed. Implementing small GSI on a project-by-project basis makes these projects even less cost effective because of the amount of overhead required to procure and manage multiple engineering and construction firms for project implementation and permitting. This project-by-project mentality has constricted innovation within the stormwater industry and has promoted the inefficiencies inherent in a piecemealed delivery approach.

The logical approach to lowering the cost and increasing the speed of GSI implementation is to consolidate the projects into fewer, larger, regional facilities located in the best geographic locations regardless of jurisdiction and to consolidate and streamline the procurement and management of the work. Much of this document focuses on the technical and environmental advantages of consolidating the projects into fewer, larger regional projects and the reduction of costs associated with this approach. However, incorporating different programmatic delivery models will provide additional benefits, including a reduction in overall GSI project costs, increased speed and efficiency in the implementation of the projects, and an opportunity to obtain additional socioeconomic and community-based benefits as a byproduct.

The most efficient way to implement GSI is to combine as many efficient practices as possible together, including locating projects in the areas that will provide the most environmental benefit, configuring the projects as large as possible, an using a delivery model that reduces overhead burden by streamlining procurement and management.

4.1.1 Alternative Delivery

Several alternative delivery models are available, and each provides advantages worth considering. Design build and its variations relieve some of the overhead burdens by providing a single point of responsibility for the implementation of a single project. This contributes to a more efficient delivery, but as mentioned previously GSI is best suited to a full programmatic delivery model that manages the implementation of GSI in a holistic way. This approach aggregates piecemealed projects into a performance-based, investable solution that achieves broader community and economic value. It achieves goals faster, in part, by stacking the efficiencies gained through private sector flexibility in project selection and aggregation, contractor procurement, economies of scale, and other similar tactics. The relatively small, individual efficiencies, when combined, create substantial time and cost savings.

These alternative delivery models include public private partnerships (P3s); design, build, maintain (DBM); and similar pay-for-performance models. Using these methods, the project owner contracts with a single entity that is accountable for all aspects of the project throughout the lifecycle, which reduces risk for the project owner. A unique P3 model developed

specifically for stormwater implementation is called a Community-Based Public Private Partnership (CBP3). It was developed by the United States Environmental Protection Agency and has been quite effective in reducing the cost and delivery time of GSI while providing other benefits to the local community, like increased local participation of small and disadvantaged businesses, increased participation of local resident workforce, mentor protégé programs to train and build up small and disadvantaged businesses, and the equitable distribution of program benefits to all sectors of the community.

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ATTACHMENT A: COST DATA AND INPUTS

1. CAPITAL COSTS

Capital cost data examined to develop this Business Case is summarized in the following sections. The assumed cost per acre greened and/or treated applied to the Business Case is described therein.

1.1 GSI Statistical Cost Analysis Conducted by Geosyntec

Geosyntec conducted a comprehensive statistical cost analysis in 2018 using available GSI implementation cost data throughout the state. The results of that analysis, escalated to 2021 dollars, are provided in Table A-1.

Table A-1: Statistical Summary of Unit Capital Cost for GSI Project Categories (Geosyntec, 2018) Escalated to 2021 Dollars

Project Category	No. of Projects (n)	Unit Capital Cost ($/acre treated) in 2021 Dollars[1]					
		Minimum	25th-percentile	Median	75th-percentile	Maximum	Mean
Green Street	19	$27,000	$76,000	$148,000	$288,000	$1,393,000	$230,000
Distributed (i.e., Parcel-Based) GSI	21	$17,000	$97,000	$131,000	$190,000	$449,000	$165,000
Regional Stormwater Control	11	$16,000	$27,000	$66,000	$137,000	$461,000	$109,000

[1] Units have been rounded to the nearest $1,000. Cost data includes design and construction costs.

The escalated cost statistics provided in Table A-1 are used as a benchmark for the other cost estimates referenced throughout the Business Case.

1.2 TMDL Control Measure Plan Costs

The TMDL Control Measure Plan referenced Geosyntec's 2018 cost statistics as well as other cost analyses conducted as part of the accompanying RAA and the San Mateo County Stormwater Resource Plan (SMCWPPP, 2017). The costs used in the TMDL Control Measure Plan are summarized in Table A-2 and have been escalated to 2021 costs where applicable.

Table A-2: TMDL Control Measure Referenced Costs

Control Measure	Unit of Implementation	2018 Dollars	2021 Dollars	Units	Source
GI - Private/Parcel-based Redevelopment	Acres greened	$153,000	$165,000	$/acre	Average value for parcel-based (distributed GI) from Geosyntec, 2018
GI - Public Right of Way Retrofits (Green Streets)	Acres greened	$213,000	$230,000	$/acre	Geosyntec, 2018
GI - Regional Projects	Acres greened	$101,000	$109,000	$/acre	Geosyntec, 2018

1.3 San Mateo County Regional Projects

The costs associated with the San Mateo County regional projects, currently at varying phases of implementation, are provided in Table A-3 below, for comparison.

Table A-3: Summary of Cost per Acre Greened for Identified San Mateo County Regional Projects

Regional Project	Design Alternative	Total Cost	Acres Greened (acre)	Cost per Acre Greened ($/acre)
Orange Memorial Park, South San Francisco	n/a	$15.5 million	421	$37,000
Red Morton Park, Redwood City	Project Alternative 1 - 85th Percentile Alternative	$14.9 million	140[1]	$106,000[1]
	Project Alternative 2 - Single Field Maximization	$31.5 million	204[1]	$154,000[1]
Caltrans I-280 @ I-380, San Bruno	n/a	$19.6 million	254	$77,000

[1] Acres greened and unit cost assumes that the Red Morton Park project design will be considered compliant with Provision C.3.c by the SFBRWQCB.

1.4 Regional Stormwater Capture Project Opportunities

Planning-level costs were developed for the regional stormwater capture projects identified as part of the regional stormwater capture project opportunity analysis. These proposed regional projects were modeled to optimize the water quality and other benefits given the facility location, drainage area, and other factors (Craftwater, 2021a). As such, many of these projects do not capture 80% of average annual runoff (i.e., the Volume Hydraulic Design Basis as defined in MRP Provision C.3.d) if the site is either too space constrained or it would be uneconomical to do so.

Using the acres greened calculation for these regional stormwater capture project opportunities, the cost per acre greened was calculated for the 74 project opportunities. As described in Section

2.4, acres greened also require treatment through MRP Provision C.3.c compliant measures. For the unit costs provided in Table A-4, it was assumed that regional stormwater capture projects analyzed by Craftwater would be designed to meet MRP Provision C.3.c standards or equivalent standards negotiated with the SFBRWQCB such that they would provide acres greened for the portion of average annual runoff captured

Table A-4: Statistical Summary of Craftwater Planning-Level Costs for Regional Projects

Project Category	No. of Modeled Projects (n)	Unit Capital Cost ($/acre greened), Planning Estimates					
		Minimum	25th percentile	Median	75th percentile	Maximum	Mean
Regional Stormwater Capture Project Opportunities	74	$13,000	$36,000	$59,000	$79,000	$328,000	$69,000

[1] Units have been rounded to the nearest $1,000. Cost data includes planning level costs.

The statistical spread varies somewhat from the updated empirically derived regional stormwater cost statistics (Table 4), especially in the higher cost range, but overall the costs are very similar to the empirically based costs findings. The lower costs for the 75th percentile, maximum, and mean unit costs as compared to the actual cost data statistics are likely due to the cost-optimized nature of these modeled facilities. This unit cost check allows for confidence in using these planning level regional stormwater capture project opportunities cost values for the Business Case analysis.

1.5 San Mateo County Integrated Safe Routes to School Green Infrastructure Project Costs

C/CAG compiled GSI costs for eight Integrated Safe Routes to School and Green Infrastructure projects completed to date (of ten total projects). The green streets GSI typically consisted of bulbouts or linear planters in the street and were constructed within eight member agency jurisdictions in the County. A statistical summary of the unit cost (cost per acre treated) is provided in Table A-5.

Table A-5: Unit Cost statistics for San Mateo County Safe Routes to School Projects GSI

Project Category	No. of Modeled Projects (n)	Unit Capital Cost ($/acre), Planning Estimates					
		Minimum	25th percentile	Median	75th percentile	Maximum	Mean
GI - Public Right of Way Retrofits (Green Streets)	8	$85,000	$124,000	$189,000	$487,000	$632,000	$301,000

When compared to the green streets statistics compiled by Geosyntec (Table A-1), these facilities are more expensive to implement – with both the median and mean unit costs approximately 30% higher than the statistical results (escalated to 2021 dollars). This increased cost of green streets implementation in the San Francisco Bay Area is consistent with green streets costs compiled in other counties. This is a relatively small data set, but provides recent local implementation costs, so will be used as a cost input for this Business Case.

APPENDIX C

County of San Mateo Advancing Regional Stormwater Capture Projects: Project Opportunities Analysis Memorandum

County of San Mateo

Advancing Regional Stormwater Capture Projects

Project Opportunities Analysis Memo FINAL

26 January 2022

PRESENTED TO

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
ac-ft	acre-feet
ABAG	Association of Bay Area Governments
BMP	Best Management Practice
C/CAG	City/County Association of Governments of San Mateo County
cfs	cubic feet per second
DEM	Digital elevation model
ft	feet
hr	hour
HSG	Hydrologic soil group
MRP	Municipal Regional Permit
MS4	Municipal Separate Storm Sewer System
PCB	Polychlorinated biphenyls
POC	Pollutant of Concern
RAA	Reasonable Assurance Analysis
ROW	Right-of-Way
SMC	San Mateo County
SRP	Stormwater Resource Plan
SSURGO	Soil Survey Geographic Database
TMDL	Total Maximum Daily Loads

1.0 BACKGROUND & CONTEXT

The following provides introduction to the Project and rationale for the need to advance the best opportunities for regional stormwater capture across San Mateo County.

1.1 OVERVIEW

To address the requirements of the Municipal Regional Permit (MRP), the City/County Association of Governments of San Mateo County (C/CAG) and member agencies are collaborating to determine the most impactful and effective ways possible to capture stormwater and improve water quality across managed watersheds across their jurisdictional boundaries. The MRP, a Phase I municipal stormwater permit, was issued by the San Francisco Regional Water Quality Control Board and includes compliance requirements by Permittees to address regional TMDLs (Total Maximum Daily Loads) for mercury and PCBs (polychlorinated biphenyls) as part of the San Francisco Bay Basin Plan. To provide required pollutant reductions and contribute to other regional watershed management goals (flood management, green infrastructure, water reuse, etc.), C/CAG has taken a progressive approach to achieve compliance with the MRP in a cost-efficient manner, while promoting multi-benefit projects with a heavy focus on leveraging collaboration and funding sources. The approach has undertaken several large-scale planning efforts to date with the goals of modeling watersheds, planning strategies, and quantifying needs to provide a sound determination of how member agencies can collectively work together to develop solutions that will both meet regulatory compliance requirements and provide multi-benefit infrastructure solutions in a cost-effective manner. The approach is a multi-scaled approach that provides site development guidance, green street instruction, and regional scale opportunities identification. The focus of this analysis is on regional-scale stormwater capture projects and identifying opportunities/watershed areas that can support regional-scale programmatic implementation of green infrastructure at a distributed scale. Previous planning efforts have begun to identify how this might be carried out, but there is a need to further advance this analysis to determine the best potential opportunities across San Mateo County where these program ideals can be realized.

1.2 ADVANCING REGIONAL STORMWATER CAPTURE PROJECTS

Highly distributed green infrastructure has been shown to be an effective stormwater management practice in many instances, and while it is an important component of new development, it can be difficult and expensive to fully implement in previously developed areas which require extensive retrofits. Because of this and increasingly stringent water quality requirements, regional stormwater capture projects have been shown to be a more cost-effective alternative in highly developed areas, with more focused and centralized capture and treatment of stormwater at strategic locations. Furthermore, the areas where PCBs have historically accumulated (i.e. old industrial land use areas) tend to not be the most effective and efficient locations for implementing distributed green infrastructure. The Stormwater Resources Plan watershed-based opportunities analysis began to identify feasible locations for regional stormwater capture projects, but there is a need to identify more potential opportunities, provide further detail for project potential, and develop a more focused feasibility and prioritization assessment of these opportunities so that C/CAG can ensure that County-wide efforts are pursuing the most cost-effective and impactful projects moving forward. Additionally, it is necessary for potential project identification to incorporate an assessment of technical feasibility and multi-benefit evaluation that will provide C/CAG assurance that identified opportunities can be effectively engineered and that they will contribute to a broad range of watershed goals in addition to the water quality benefits that they can impart. The result of this analysis contained herein will provide a strong list of the best regional stormwater capture projects across the County, vetted through focused engineering feasibility and project potential metrics, that will provide the best options for C/CAG to further pursue for refined engineering feasibility and design studies moving forward.

1.3 REGIONAL-SCALE FRAMEWORK

The identification and conceptualization of the regional stormwater capture projects is one part of the multi-pronged approach to manage stormwater within San Mateo County. The larger effort's goal is to catalyze countywide collaboration on regional-scale stormwater management to address key drivers, create a framework under which that collaboration can take place, prioritize and conceptualize opportunities for regional-scale stormwater management, and explore innovative funding and financing approaches. The effort is broken into four interrelated project components:

1) Building the business case for regional-scale stormwater management
    a. Establishes the 'What, Why, and How' regional-scale management should be performed. Includes development of drivers and objectives, benefits realized by collaborating, and how collaboration could function across jurisdictional boundaries.
2) Prioritizing and conceptualizing regional-scale stormwater management opportunities
    a. Creates an identification and prioritization framework to find and rank the best regional opportunities. Concept designs for the top identified locations serve to move towards finding funding opportunities.
3) Credit trading marketplace analysis
    a. Evaluates the opportunity to allow private developers or member agencies to buy and sell stormwater management credits to increase overall stormwater management project implementation per the drivers and objectives established.
4) Innovative funding and financing analysis – a
    a. Pursues innovative funding and financing options for various scales of stormwater management.

This technical report focuses on the identification and prioritization frameworks to help find the top project concepts that will be field evaluated and conceptualized in a future task. Ultimately, these projects will be incorporated into the Stormwater Resources Plan to provide a comprehensive plan for the region.

2.0 PROJECT IDENTIFICATION & FEASIBILITY EVALUATION

The following section summarizes the methodology and datasets used to identify potential regional stormwater capture project opportunities and characterize them to focus further feasibility assessment and engineering evaluation to determine a narrowed roster of the top opportunities for full modeling evaluation.

All parcels within the County were considered as possible candidate sites and entered the site feasibility analysis. Initial screening narrowed the potential list to approximately 300 parcels where a project could reasonable be completed. The 300 projects were reviewed by a design engineer who performed aerial imagery and street view analysis of the sites to provide an initial thought on project complexity and provided an assessment of not feasible, significant constraints, and minimal constraints. The projects identified as having minimal constraints equated to 74 project sites that were then parameterized for prioritization. The priority modeling provided a ranking of each project relative to the drivers and objectives (see the Drivers and Objectives memorandum) where the highest-ranking ones across multiple objectives were selected for further evaluation. **Figure 2-1** provides a brief overview of the identification and prioritization process followed.

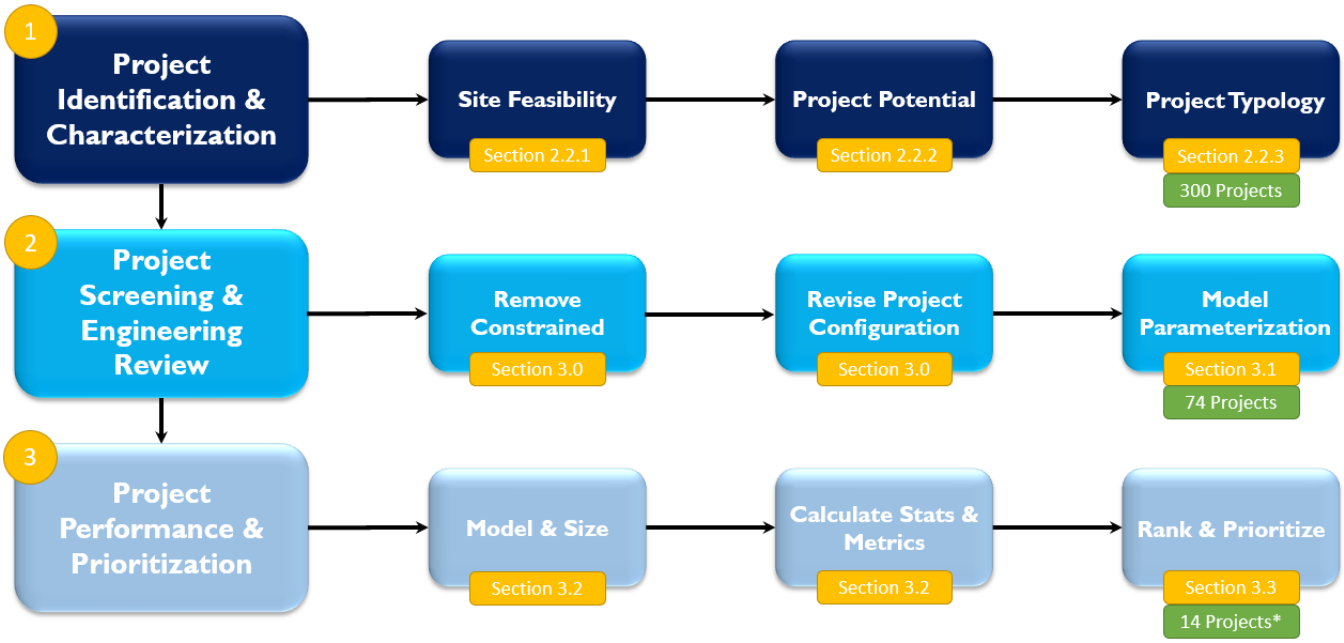

Figure 2-1. Regional project identification and prioritization process flow chart. *14 projects evaluated by the jurisdictions. Ten (10) projects will be ultimately selected for field visits and five (5) for project concepts.

2.1 PROJECT IDENTIFICATION AND CHARACTERIZATION

In the first step of project identification, the goal is to evaluate the applicability of feasible regional scale stormwater capture projects based on the site feasibility, project potential, and project typology. High-resolution geospatial analysis was used to identify regional stormwater capture project opportunities across San Mateo County and characterize these opportunities to serve as a basis for further engineering analysis, project performance quantification, and prioritization that will narrow the list of potential opportunities to a short list of the most impactful and cost-effective projects that C/CAG can pursue. A variety of spatial datasets were provided by C/CAG and member agencies for these purposes, and this data was integrated with engineering feasibility assessment analysis to develop the most realistic determination of project potential possible at a County-wide

scale. The methodology used in this analysis is detailed below across three key project assessment criteria, and specific datasets utilized for these purposes are summarized in **Table 2-1**.

Project opportunities were identified across San Mateo County and characterized along the following three assessment criteria to provide context to focus the efforts of engineering feasibility analysis on the projects with the greatest chance of success.

Project Site Feasibility

A regional stormwater capture project can be engineered and built almost anywhere using brute force and human ingenuity given sufficient funding, but the most cost-effective projects capitalize on locations that are the most amenable to construction and the incorporation of stormwater projects within current site conditions. Preliminary feasibility screening was performed to identify potential project sites that avoid building footprints, existing utility infrastructure, and fault zones and that each site has constructable areas with a moderate ground slope that can be readily built upon. Provided datasets were used to screen out areas where these conditions would not be amenable to project implementation (see **Table 2-1** for greater screening detail). The results of this analysis (feasible project area) were summarized at the County parcel level. Because publicly owned parcels offer much fewer barriers to project implementation than do private parcels, these have been prioritized in this analysis for advancing the best options found. However, the full project characterization analysis has been carried out for all parcels countywide (public or private) to (1) assist in the credit market feasibility analysis to identify optimal locations for implementing projects on public/private sites to determine future demand/supply for credit trading and (2) possible future public-private partnerships for top project opportunities on these lands in the future. In addition to the defined public parcels, key areas of right-of-way (ROW) have been assessed for potential project opportunities as well because of their public nature and potential to incorporate stormwater capture with other maintenance and construction activities. These have been identified where major roadway corridors are crossed by existing storm drains to assess the ROW locations with the greatest potential for stormwater capture.

Project Capture Potential

With nearly 4,500 public parcels identified in San Mateo County, it is not possible to provide an in-depth engineering analysis for project opportunities at each of these individual sites. Ranking these sites based on their potential to capture stormwater provides a preliminary list of project opportunities that can be assessed in order of rank to narrow the list of projects to a manageable number for more in-depth modeling assessment. The potential for a project opportunity to capture stormwater is rooted in (1) available space to construct the project and (2) access to an appreciable amount of stormwater runoff via diversion from existing storm drains. The former

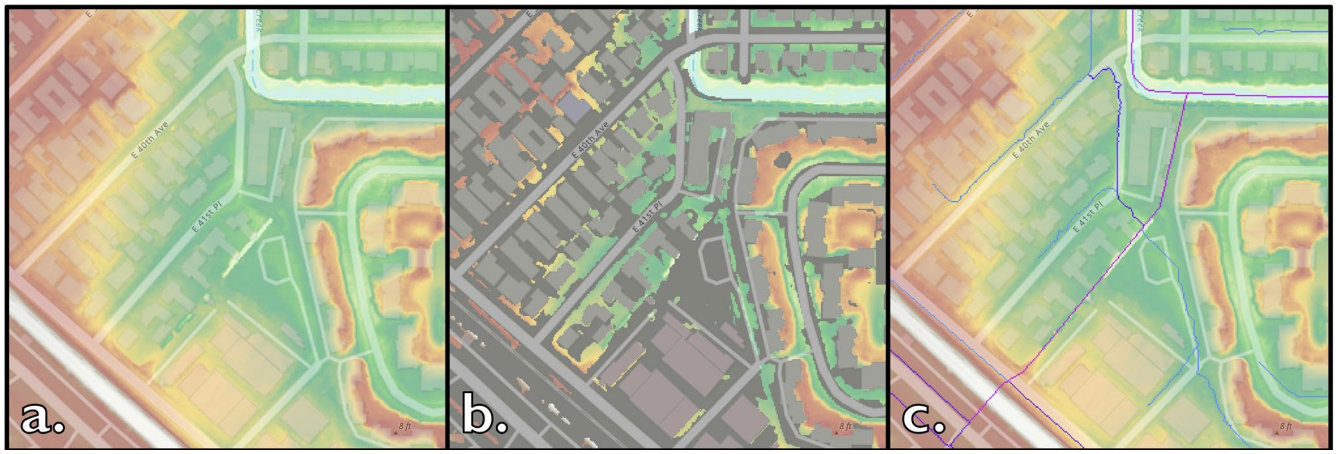

Figure 2-2. Combining DEM-based drainage patterns (a) with impervious surface data (b) and storm drain lines (c) to be used to assess project potential.

has been assessed based on the results of the Project Site Feasibility Analysis. The latter has been assessed using high-resolution drainage mapping and elevation analysis.

The drainage mapping analysis integrates digital elevation models (DEMs; **Figure 2-2a**), storm drain inventories, automated drainage area delineation, and proximity analysis to identify feasible diversion points for runoff from the storm drain network to each potential project location and the associated drainage area that would be treated by capturing this runoff. Once the drainage area for each project is identified using the DEM and storm drain network in conjunction, it is further assessed to quantify the magnitude of impervious surfaces within the drainage to gauge potential project performance (**Figure 2-2b** shows how elevation and impervious surfaces interact to forge runoff accumulation paths in **Figure 2-2c**). While overall drainage area is a good indicator of potential runoff to a site, the impervious drainage area provides an even better indicator of not only runoff magnitude but also potential pollutant loading. Impervious surfaces are often associated with higher runoff volumes and pollutant loads because runoff transmitted across them is mostly concentrated and carries with it all accumulated pollutants that result from land use, human activity, and the collective ambient conditions of pollutant deposition. The results of these two project opportunity metrics (feasible space and treatable impervious area) were combined in a balanced ranking (geometric mean) to focus the engineering analysis wherein the top potential opportunities are individually screened using "engineering eyes" and accompanying project characterization data to provide a more refined feasibility assessment to determine which projects move on to the modeling and prioritization analysis.

Project Typology Evaluation

A variety of categorical evaluative factors are useful in the engineering analysis to determine the potential options that may or may not be viable at any given location and the potential for success of any given project opportunity. These factors are typically categorical in nature and/or binary measures of project specific conditions (yes/no; presence/absence). These types of data may not apply to all potential BMP types, but they can be used to select among multiple BMP types at a given site or exclude certain options that may not be feasible. Because of this, these data do not necessarily define the potential performance of a project opportunity at any given site. Rather, these evaluative factors help focus the engineering analysis of potential options at a given site (e.g. open field versus parking lot, a deep versus shallow water table, relatively constrained footprint versus larger footprint) and provide guidance as to what might be the best BMP type to pursue once detailed site analysis is performed. Details of the evaluative factors that were used in the full analysis are found in **Table 2-1**, and maps of how these factors vary across the County are provided in Section 2.2.3. These factors have been used in the engineering analysis as

well as further project opportunity evaluation for the top projects to select among a variety of desired BMP types for the County.

2.2 MULTI-DRIVERS SCREENING CRITERIA DATA & METHODS

The second step in the identification process is the screening using readily available datasets from countywide sources and previous studies. The goal of the screening is to further refine the list of regional project opportunities from several thousand to a number that can reasonable be evaluated by engineering eyes in an aerial evaluation and to further evaluate the opportunities based on the full set of objectives in the Drivers and Objectives Report. The following approach and data were used to conduct the geospatial analysis of opportunities that help maximize the benefit of these projects. The table below summarizes metrics, datasets, and classification details used to identify, screen, rank, and evaluate the full roster of County-wide project opportunities and narrow this list down to a focused group of the best opportunities to undergo full modeling analysis for prioritization. Key maps follow to demonstrate how these criteria varied across the County, and all final characterization will be included in the geospatial project database.

Table 2-1. Summary of geospatial datasets used in project opportunity characterization.

Assessment Criteria	Metric/Constraint	Data Source	Classification	Notes
Site Feasibility	Building Footprints	C/CAG Impervious Surface Data	Footprint + 20' buffer	Building footprint plus offsets screened out for BMP feasibility
	Utility Conflicts	C/CAG and Member Agency Utility Data	Asset + 4' buffer	Utility avoidance keeps costs lower and minimizes delays; screened out for BMP feasibility
	Constructable Slope	C/CAG 2017 1m DEM	15% Grade Breakpoint	Slopes ≤ 15% more easy to construct upon; any areas with higher slopes screened out for BMP feasibility
	Fault Hazards	ABAG Fault Hazards	Presence/Absence	Higher probability of failure; areas screened out for BMP feasibility
Potential Stormwater / Hydrology Performance	Drainage Patterns	DEM Analysis	DEM-based Flowpath	Indicate surface runoff pathways
	Storm Drain Diversions	C/CAG and Member Agency Utility Data	Drains ≥ 24 in. Diameter	Identify potential project drainage area rom storm drain diversion point to BMP via GIS analysis of subsurface runoff pathways forming drainage areas in conjunction with surface runoff pathways
	Impervious Drainage Area	DEM Analysis	DEM-based Flowpath	Assessed at project diversion points; indicate greater runoff volume with heavier pollutant loading
Project Typology Evaluative Factors	Hydrologic Soil Group	Soil Survey Geographic Database (SSURGO)	A = 1, B = 2, C = 3, D = 4	High (HSG A) to Low (HSG D) infiltration potential
	Soil Liquefaction Potential	C/CAG Stormwater Resource Plan (SRP) Datasets	Presence/Absence	May raise costs for infiltrative BMPs
	Aquifer Recharge Potential	C/CAG SRP Datasets	Presence/Absence	Areas where infiltration has been prioritized
	Sewer Discharge Potential	C/CAG and Member Agency Utility Data	Within 200' of Sanitary Sewer for potential discharge	Full water quality treatment and water supply provisioning
	Pervious Footprint Area	C/CAG Impervious Surface Data	Portion of Feasible Space designated Pervious	Lower cost to construct BMP in existing pervious areas
	Flooding Risk	C/CAG SRP Datasets	Within Floodprone Watershed (Yes/No)	Flood management contributions of higher priority
	SMC Water Pollution Prevention (WPP) Trash Generation Capture Potential	SMC WPP Trash Generation Designation Dataset	Upstream area with Medium/High/Very High Trash Generation designation	Centralized projects can provide significant capture of upstream trash
	Potential CALTRANS Trash Capture Opportunities	Catchment areas with substantial CALTRANS ROW coverage.	Upstream drainage area coinciding with CALTRANS ROW areas	Projects in these catchments can offer multi-benefits and collaborative potential

2.2.1 Project Site Feasibility Screening

The goal of the project opportunity feasibility screening was to both identify parcels in San Mateo County where regional stormwater capture projects could be implemented and provide an upper estimate of the potential footprint for a BMP at these sites. This screening involved elimination of areas with discernible conditions that would make construction of a BMP difficult, costly, or infeasible. Note that potential opportunities identified as feasible at this stage are only vetted based on this analysis and any opportunity identified herein could become infeasible as more detailed site assessment is conducted. The screening process used is displayed in **Figure 2-2**, demonstrating the key screening criteria used to define the County-wide feasible project space to be further evaluated for project potential and suitability. This process started by eliminating building footprints, buffered to 20' to allow adequate setback for construction (**Figure 2-3a**). Subsequently, utility conflicts were eliminated as well where data was available, buffered to 4' for storm drains (**Figure 2-3b**) and sanitary sewer lines (**Figure 2-3c**). Ground slope was considered, eliminating areas where the local slope exceeded a 15% grade (**Figure 2-3d**). Finally, fault hazard areas were eliminated from consideration for BMPs due to the higher risk of failure for infrastructure in these areas of the County (not shown in the figure). The result of these screening criteria is shown in the focus area in **Figure 2-3e** (green areas) and is displayed for the full County in **Figure 2-4**. Parcel ownership was also accounted for in the feasibility screening, separating parcels by ownership based on tax status and known public owner agencies. These are highlighted in both **Figure 2-3f** (light blue overlay) and county-wide in **Figure 2-4**.

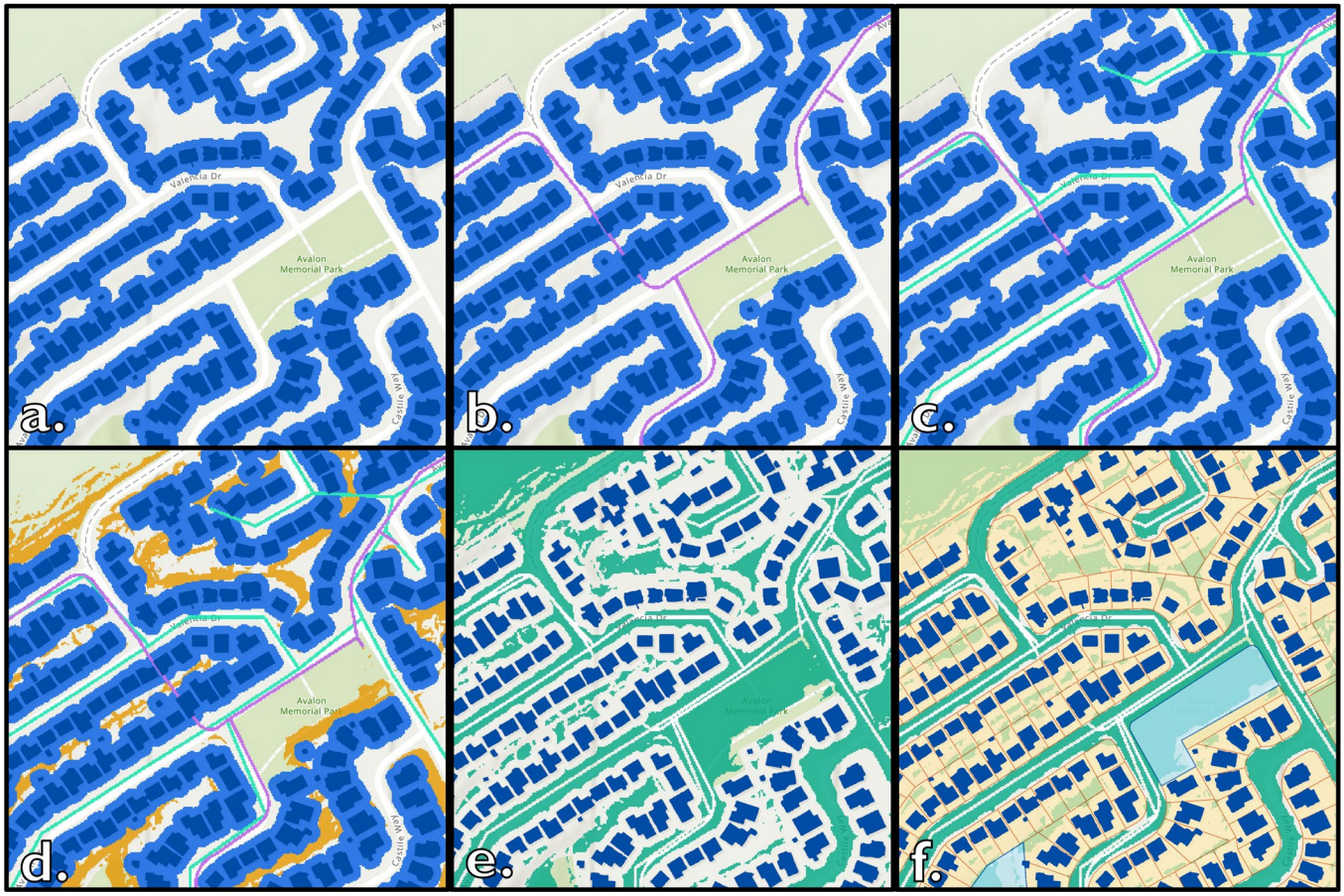

Figure 2-3. Progression of feasibility assessment used to determine potential space where a regional stormwater capture project could be readily built. (a) Buildings are buffered, (b) storm drains are embedded, (c) sewer lines and other utilities mapped, (d) slopes are overlaid, (e) remote sensing of open areas, and (f) possible areas for implementation shown in blue.

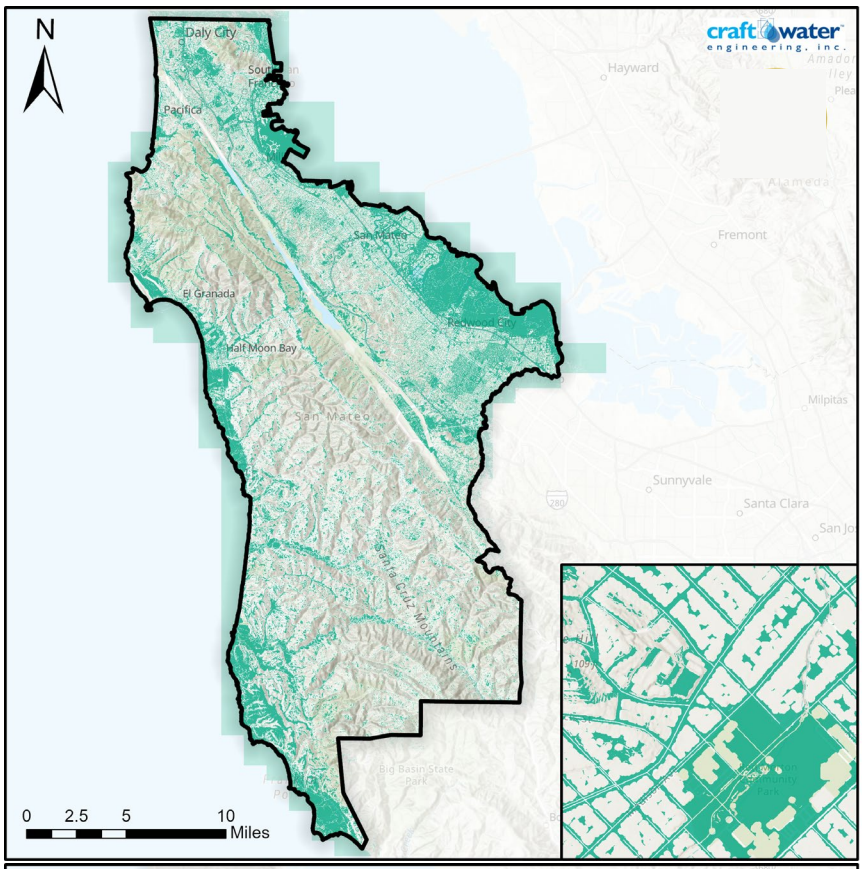

Figure 2-4. Feasible BMP project space across San Mateo County. Identifies parcels and parkway spaces.

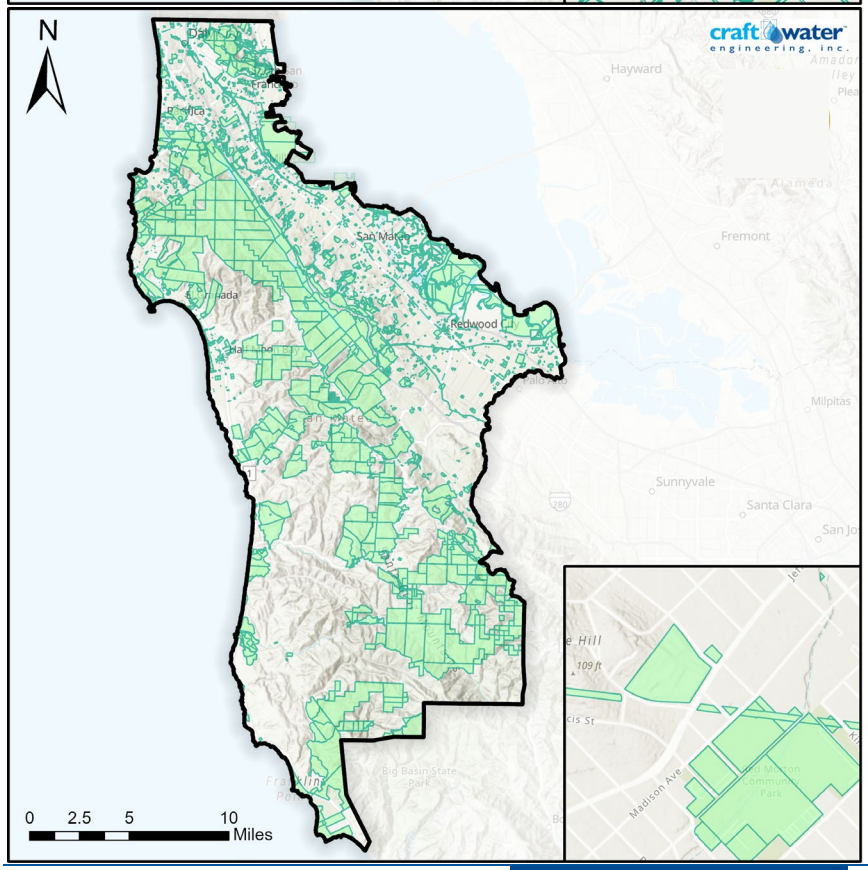

Figure 2-5. Public parcels across San Mateo County.

2.2.2 Project Capture Potential Analysis

As mentioned before, the potential for a given project opportunity to capture stormwater is related to a balance between the available space to construct a BMP and access to runoff from a large drainage area via diversion from the storm drain network to the BMP. Because water quality benefits are such an integral component of stormwater capture success, BMPs that capture runoff from a large area of impervious surfaces typically capture the greatest runoff volumes carrying the highest pollutant loads. These two ideals (feasible space and impervious drainage area) form the basis of estimating the potential performance at identified project sites. These data were assessed County-wide and cross-referenced with project opportunities to provide a ranked list of potential projects and focus more in-depth engineering analysis to identify the top projects across San Mateo County. A subset of this data is highlighted in **Figure 2-6**.

Drainage area assessment and proximity analysis were combined with potential project locations to identify the maximum divertible impervious drainage area to the project site, constrained by feasible diversion line lengths of approximately 1000 feet. This metric was combined with feasible project space at each site to form a balanced ranking which provided a roadmap for further engineering analysis to focus on the locations with the greatest stormwater capture potential across the County.

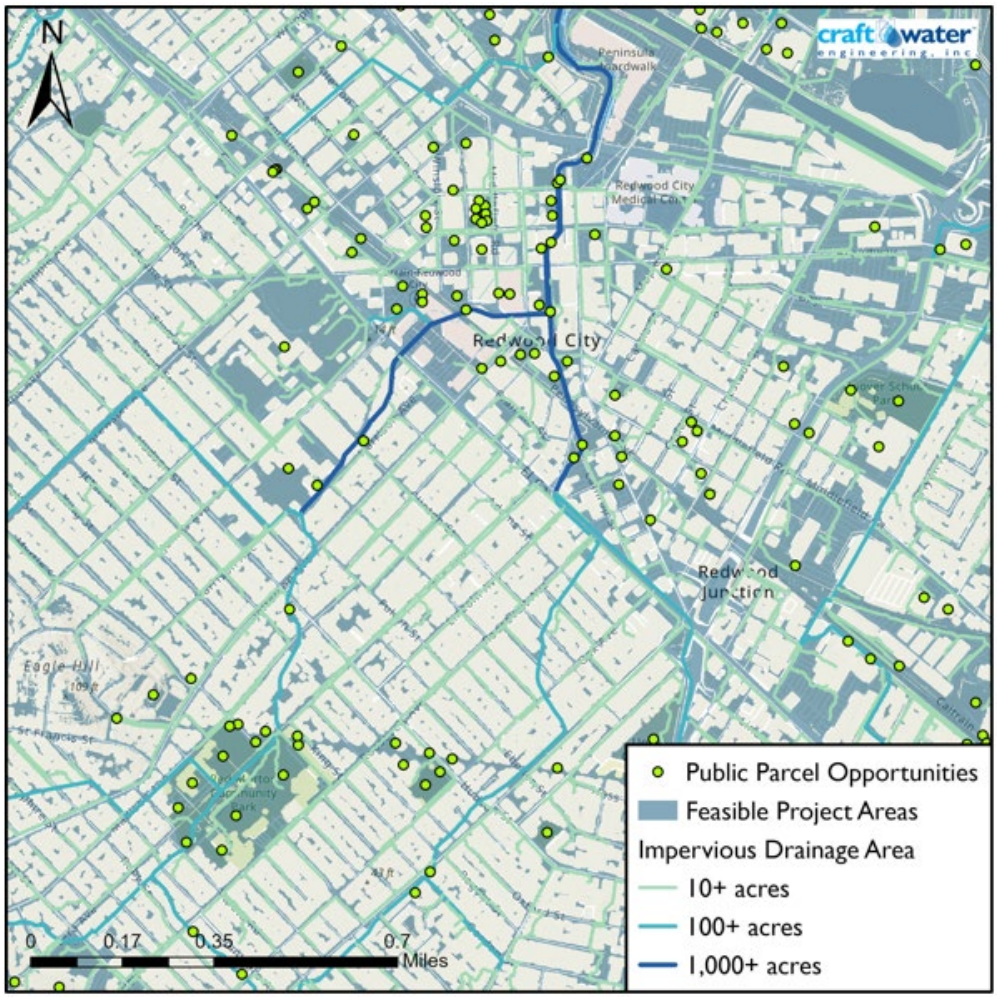

Figure 2-6. Estimating project potential with feasible space and upstream impervious drainage area.

2.2.3 Project Typology Evaluation

The following figures highlight datasets used to provide evaluative criteria to aid in project opportunity engineering analyses and assist in optimal BMP typology and options definitions for potential sites.

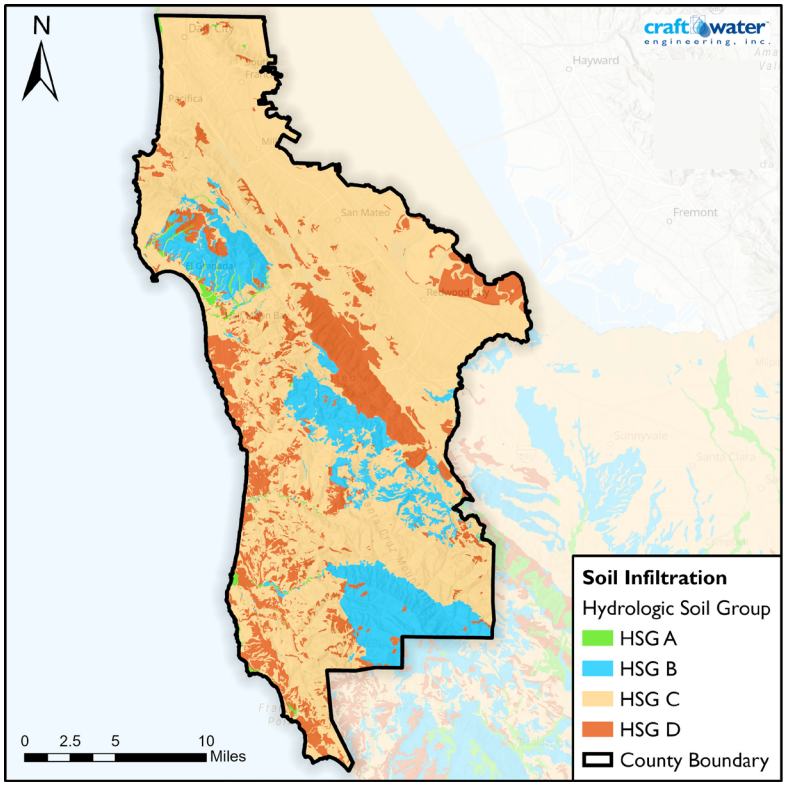

Figure 2-7. Soil hydrologic soil groups per SSURGO. Indicative of infiltration potential.

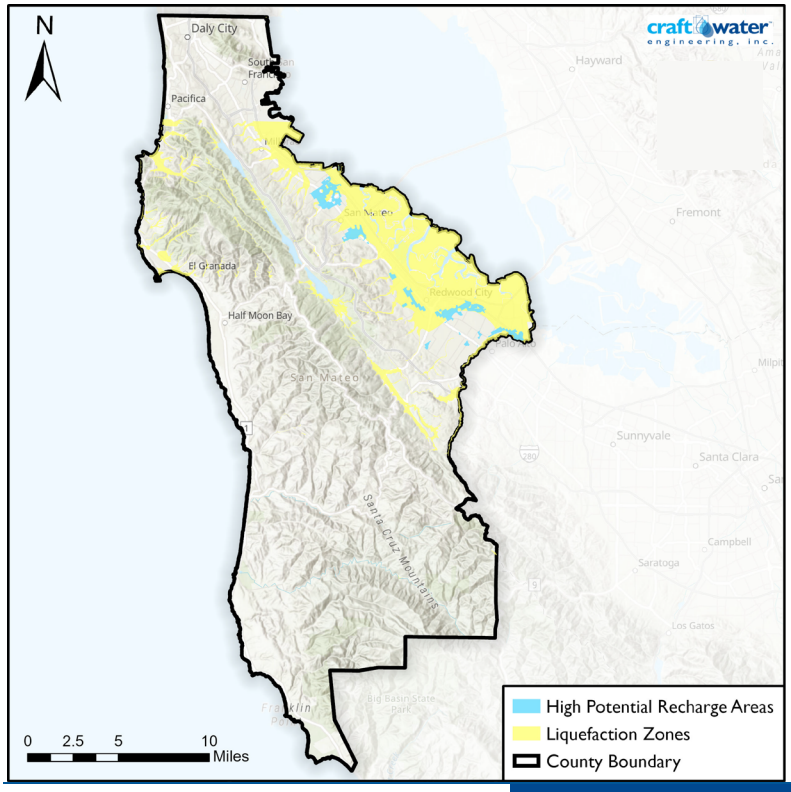

Figure 2-8. High potential recharge areas and liquefaction zones.

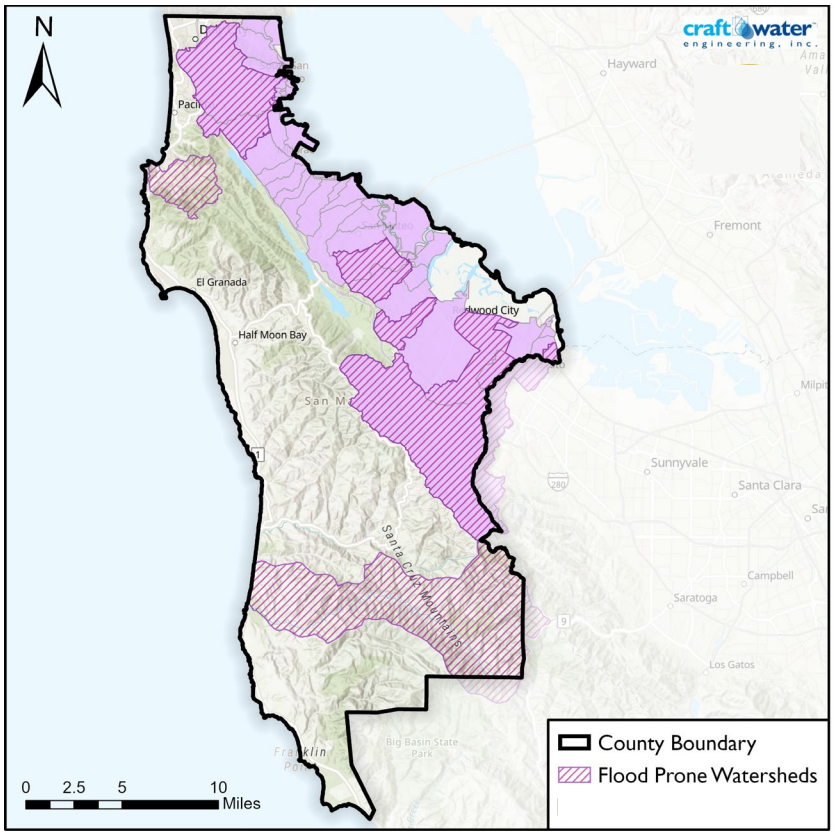

Figure 2-9. Watersheds with known flooding issues per the SRP.

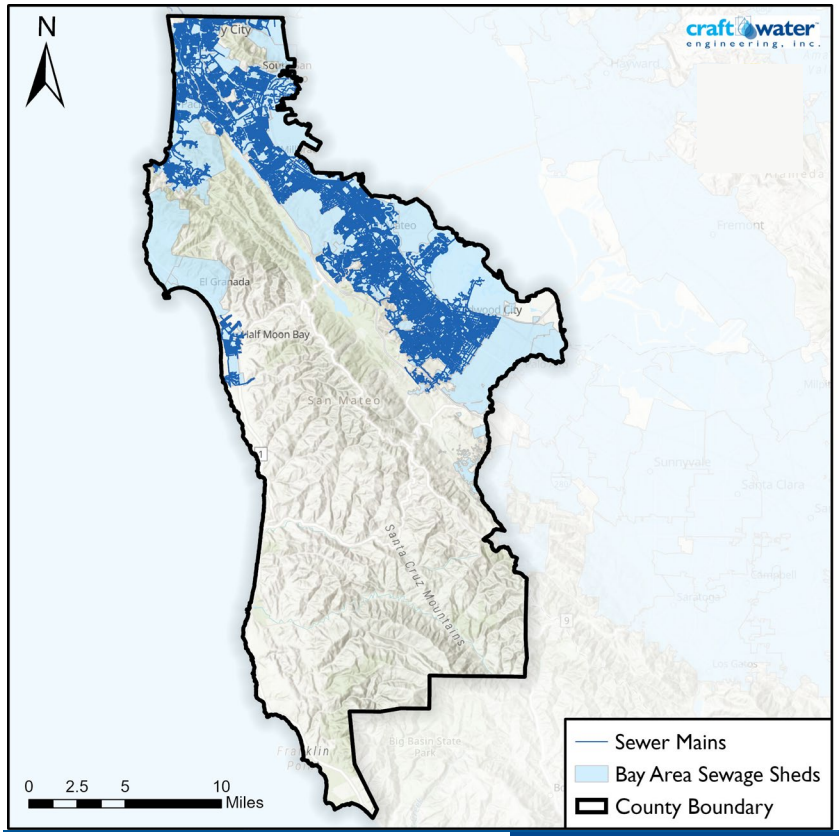

Figure 2-10. Locations of known sewer mains.

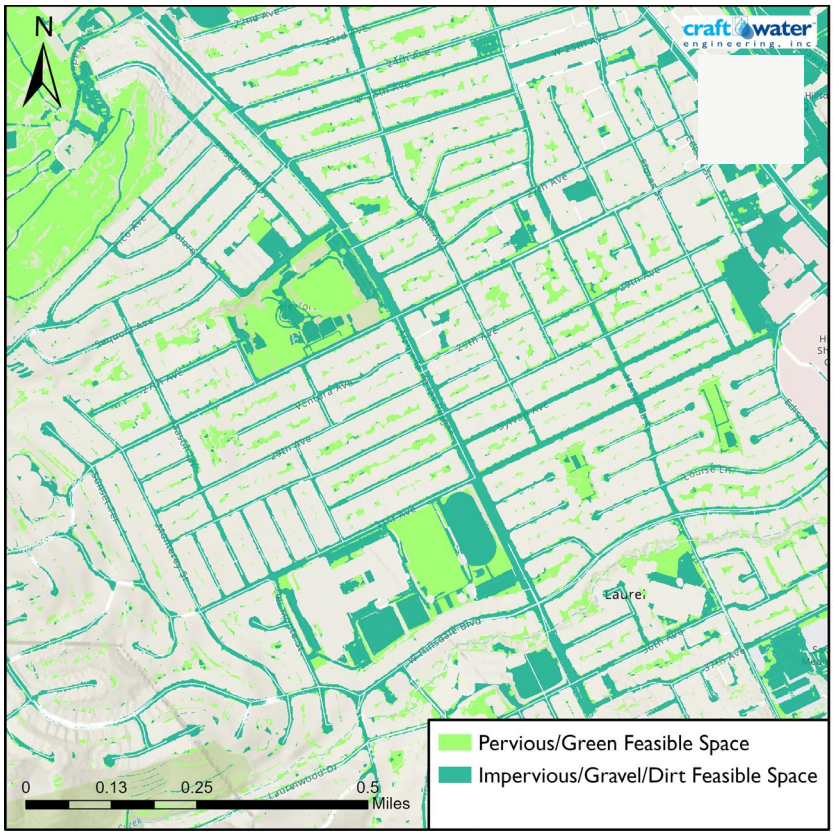

Figure 2-11. Pervious vs impervious area.

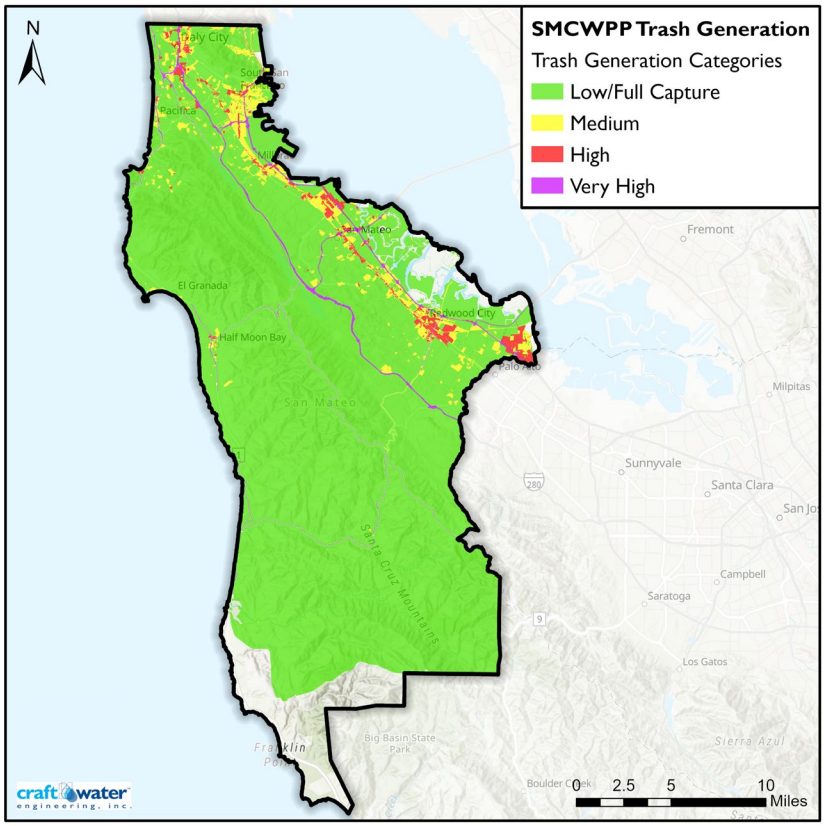

Figure 2-12. SMC WPP Trash Generation dataset. Category descriptions available within the SMC WPP Trash Generation Report

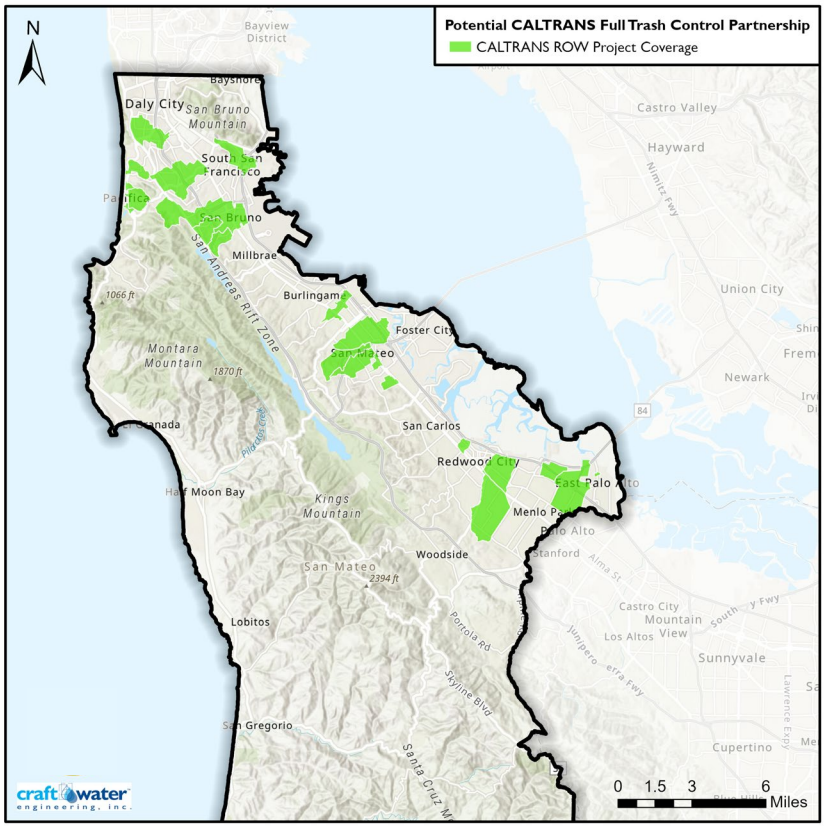

Figure 2-13. CALTRANS Full Trash Capture opportunity drainages. Areas highlighted are of highest priority to Caltrans and illustrates where they desire to have a project area treat.

3.0 PROJECT PERFORMANCE & PRIORITIZATION

Detailed engineering analysis was conducted for approximately 300 of the top opportunities resulting from the previous analysis. These opportunities were narrowed to a field of 74 feasible regional projects that passed the engineering analysis as viable project opportunities. With the potential opportunities for regional stormwater capture projects narrowed through the project identification and evaluation analyses, more detailed quantification of potential project performance of these 74 opportunities was performed. For each of the project opportunities in the narrowed list, drainage areas were delineated to provide an even more detailed assessment of project performance focusing on the BMP menu and performance metrics developed between the Project Team and C/CAG (see **Figure 3-1**). To accurately quantify these metrics, an integrated assessment using long-term hydrology and water quality modeling, BMP sizing and configuration optimization, and balanced project prioritization was utilized. Details for this methodology are summarized below.

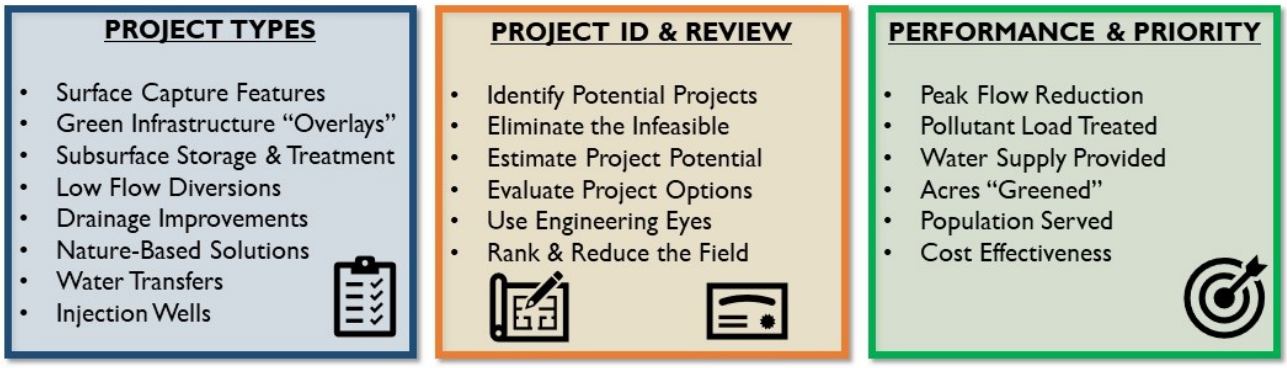

Figure 3-1. Summary of screening approach and performance metrics to be used in project opportunity prioritization.

3.1 PROJECT TYPES

Characterizing the type of practice that is suitable for each of the identified potential project areas is the first step in determining the potential project performance and subsequent prioritization. For purposes of this study, the regional projects are first divided into two categories: surface and subsurface. Both surface and subsurface projects can utilize infiltration or filtration methodologies for treatment pending geotechnical investigations for infiltration rates, depth to groundwater, and soil contamination. As a part of this analysis, the infiltrative practices were only assigned to areas identified as potential groundwater recharge regions. Below describes typical surface and subsurface practices considered in the performance modeling. The project type can be changed or updated based on site-specific conditions observed during more in-depth evaluations.

3.1.1 Subsurface Practices

Subsurface galleries are underground storage reservoirs that temporarily store and then infiltrate and/or filter stormwater runoff. The subsurface units allow for siting water quality/water supply projects where surface space is limited or where alternate surface uses are desired (i.e. athletic fields and/or parking). Infiltrative practices percolate captured runoff through openings along the bottom of the unit and into the subgrade and subsoils. If site conditions do not allow for infiltration, water is filtered through a media or cartridge system and directed back to the stormwater conveyance system. Alternatively, captured runoff can be directed to local sanitary sewer systems for treatment pending capacity and feasible proximity. For purposes of this analysis, any already

developed parcels that identified as a possible opportunity were assigned a subsurface facility and potential discharge method (infiltration/filtration/sewer discharge) were assigned where feasible. Since filtration is feasible anywhere for subsurface practices, it was assigned lowest priority in designation. Infiltration was assigned highest priority given its nature-mimicking hydrologic benefits.

Subsurface systems can be precast concrete structures or poured-in-place solutions depending on the desires of the municipality. Precast units typically have shorter install times and allow for modular installation while poured-in-place can reduce overall project costs and generally results in lower construction traffic. There are multiple modular precast concrete systems available including the following example systems; StormPrism by Precon, StormTrap, StormCapture by Oldcastle, and Jensen StormVault. All subsurface systems are designed to maximize storage space while meeting or exceeding HS-20 traffic loading thus providing sufficient strength to support covering soils and resist buoyancy. An example subsurface system is shown in **Figure 3-2**.

Figure 3-2. Example subsurface regional practices.

3.1.2 Surface Practices

Surface treatment facilities are basins that store and then infiltrate and/or filter stormwater runoff. These practices can contain a permanent pool of water (i.e. treatment wetland) or only contain water during wet-weather events (i.e. extended detention ponds). Both systems can be designed as an infiltration or filtration facility depending on the geotechnical conditions. Surface practices require open space and for purposes of this analysis, only areas that are currently undeveloped were considered for surface practices. An example surface system is shown in **Figure 3-3**.

Figure 3-3. Example surface regional practices.

3.2 PROJECT PERFORMANCE MODELING

Initial estimates for potential project performance were assessed using long-term baseline hydrology and water quality modeling from the C/CAG's previous Reasonable Assurance Analysis (RAA) conducted to determine overall County needs for BMP implementation to meet the requirements of the TMDLs (C/CAG 2020). This model provided a drainage-specific 10-year timeseries (WY2006-2015) to be used in BMP modeling and optimization at each site. With this timeseries at each location, a range of BMP options, sizes, and configurations were modeled across engineering-feasible and site-specific ranges to assess the potential performance at the site by quantifying expected PCB load reductions. Planning level cost functions were applied to encapsulate differences in each of these modeled options with relative differences in overall project cost, and these were paired with BMP performance results to identify the optimal BMP size and configuration to deliver cost-effective benefits at any given location.

BMP performance for each opportunity was assessed in isolation as if each opportunity would manage stormwater on its own. However, it is known that BMPs in overlapping drainages can be impacted when additional BMPs are placed upstream. Full evaluation of BMPs in so-called "nested" drainage areas is complex and can be highly variable depending on the mix of BMPs, their sizes, placement, and other factors. Final performance of BMPs with nested drainages is dependent upon a defined system of projects due to their interdependent capture and treatment, so any change in system-defining variables (# of BMPs, size of BMPs, specific BMPs included) will shift the overall performance of the system of BMPs. Because BMP selection is often guided by decisions concerning a variety of other factors external to BMP capture potential alone, it is best to focus on defining the most impactful BMP opportunities available and selecting them across several different non-nested drainage areas wherein regional treatment can be distributed over the County's many isolated drainages to maximize capture with the most impactful projects over the greatest area of need.

3.3 FINAL PROJECT PRIORITIZATION AND RANKING

The final step in the identification and prioritization is relating the performance to the Drivers and Objectives Memo that outlines the categories and metrics of interest. Modeling results provided values for metrics that were utilized to make an initial prioritization of project opportunities and present the County with a solid list of the top candidates from the field of 74 that would offer the most well-rounded impact to their current stormwater program. Regional BMPs that have already advanced in conceptualization and design throughout the County were included in the analysis to provide a point of comparison for any new opportunities selected. However, these BMPs were not included in the prioritization selection, and any opportunities located close to these existing concepts were deemphasized. Tabulated metrics (**Table 3-1**) were assessed for all 74 candidate opportunities, and each was ranked to show how each project performed for each compared to other project opportunities.

Rankings for each metric were used to select several top tier opportunities to potentially advance to further conceptualization. To identify these top candidates, water quality rankings were first assessed. Moving down the list of the best performers, projects were included or not based on the balance of their water quality ranking in comparison to their other multi-benefits that might be provided. Additionally, projects were selected in a way to distribute top opportunities geographically across the County, among distinct watersheds to provide treatment of different drainages, as well as among BMP typologies to provide C/CAG a variety of concepts to explore their options in regional capture with. Using rankings allowed for flexible, engineering-focused comparisons to be made amongst metrics and in relation to other potential projects as opposed to assigning a final score with arbitrary weighting to each project opportunity. This approach provides flexibility to the decision-making process, a basis for comparison among project alternatives across different sets of criteria and allows the County to revisit project opportunities in the future and compare these metrics for further decision-making down the line as more projects become implemented and the next crop of options is being sought. Following **Table 3-1** are several maps that highlight the rankings for key values to demonstrate how they vary among projects and across the County.

Table 3-1. Summary of BMP project opportunity performance metrics.

CATEGORY	METRIC	DESCRIPTION	UNITS
Community Benefits	Walkable Population	Estimated 2010 population within ½ mile walkable radius to project	people
	Project Community Benefit	Designates project is on Park or School parcel; "NEW" indicates undeveloped parcel with potential to convert to Park; "NO" indicates limited community benefit from site	na
Flood Management	Peak Flow Reduction	Reduction in peak flow for 10 Year, 24 Hour storm event	cfs
	Flood Volume Reduction	Volume captured for 10 Year, 24 Hour storm event	ac-ft/yr
Water Quality	Water Quality Reduction	Average annual reduction in PCBs for the drainage area	g/yr
	“Greened” Acres	Proxy of impervious area "treated" from drainage area by the project	acres
	Volume Managed	Average annual runoff volume captured by project for treatment	ac-ft/yr
Water Supply	Volume Used	Average annual water volume utilized/supplied; assumed full for infiltration, 33% for sewer discharge (which is typically limited to discharge in off-peak hours of ~ 10pm – 6am, or $^1/_3$ of the day), and 0 for other options which return water to drains	ac-ft/yr
	Demand Offset	Demand of regional offset; based on 680 ac-ft/yr demand for stormwater harvesting projected for regional projects supply (BAWSCA 2015)	percentage
Trash Capture	SMCWPP Trash Capture	Potential area treated with Medium/High/Very High trash generation designation from the SMCWPP baseline	acres
	CALTRANS Opportunity Full Capture	Potential area treated coinciding with CALTRANS Full Capture opportunity drainage areas.	acres

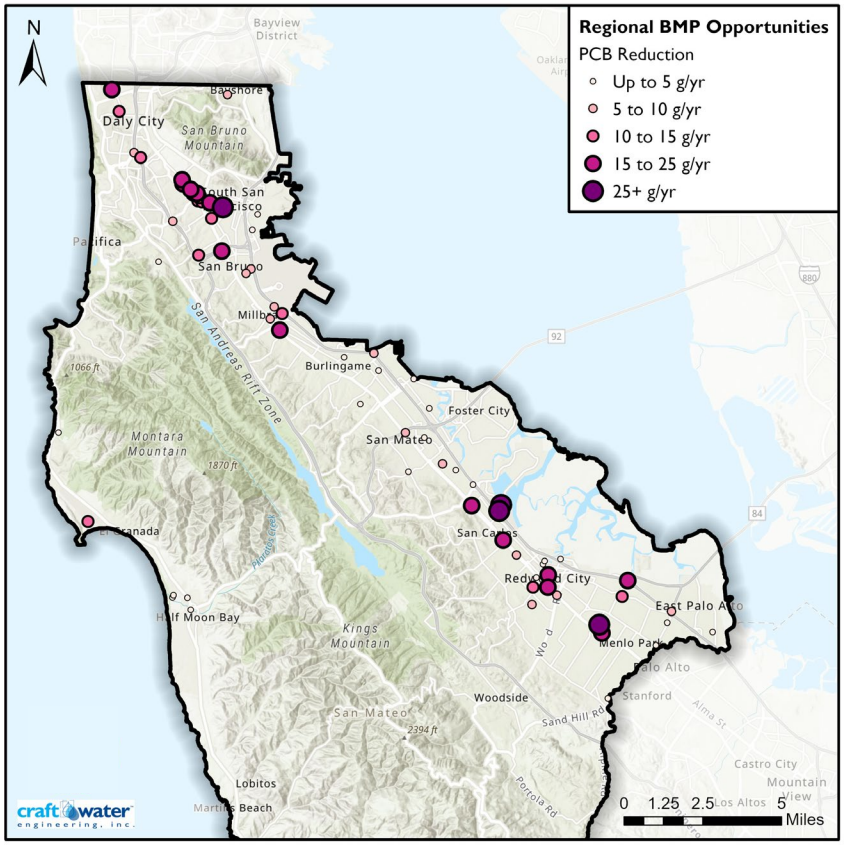

Figure 3-4. PCB Reduction across candidate opportunities.

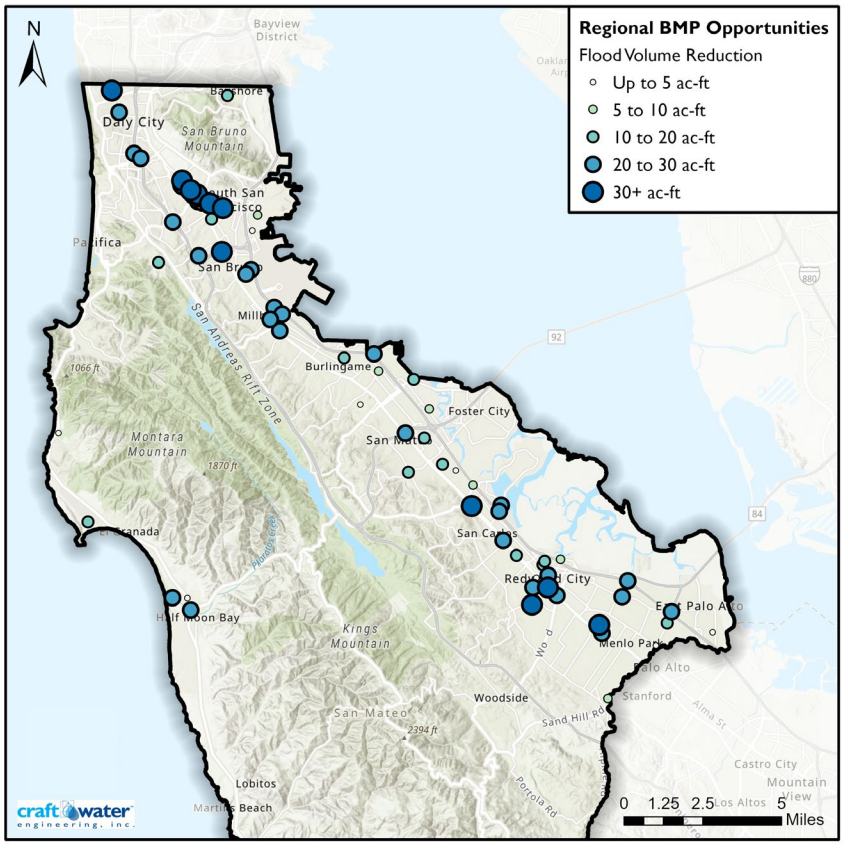

Figure 3-5. Flood volume managed by candidate opportunities.

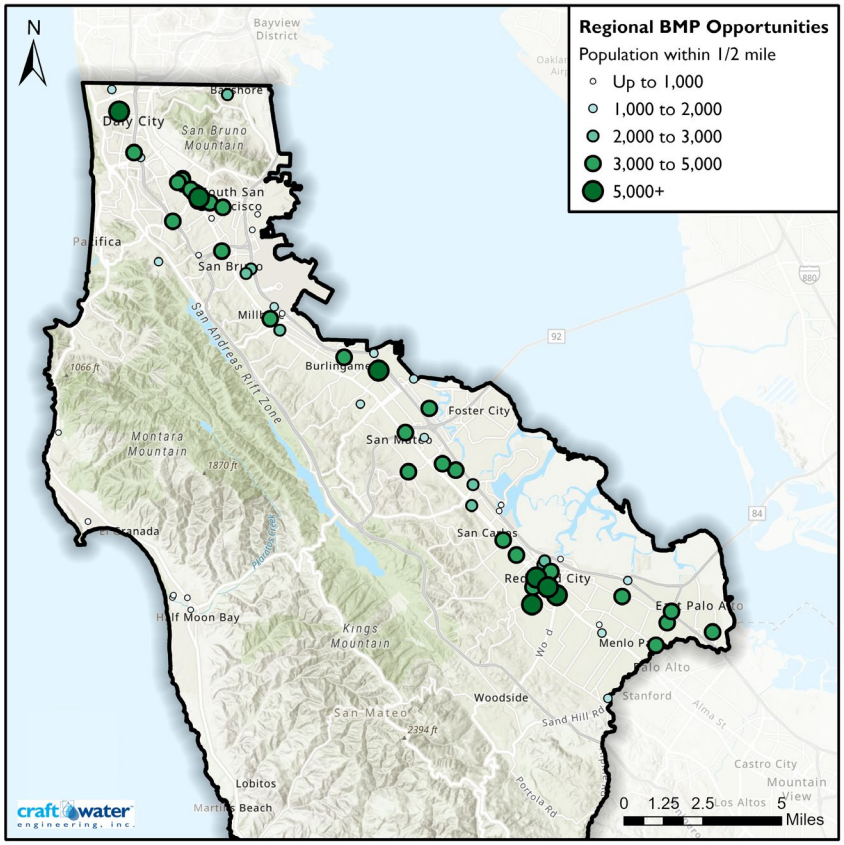

Figure 3-6. Population benefited by candidate opportunities.

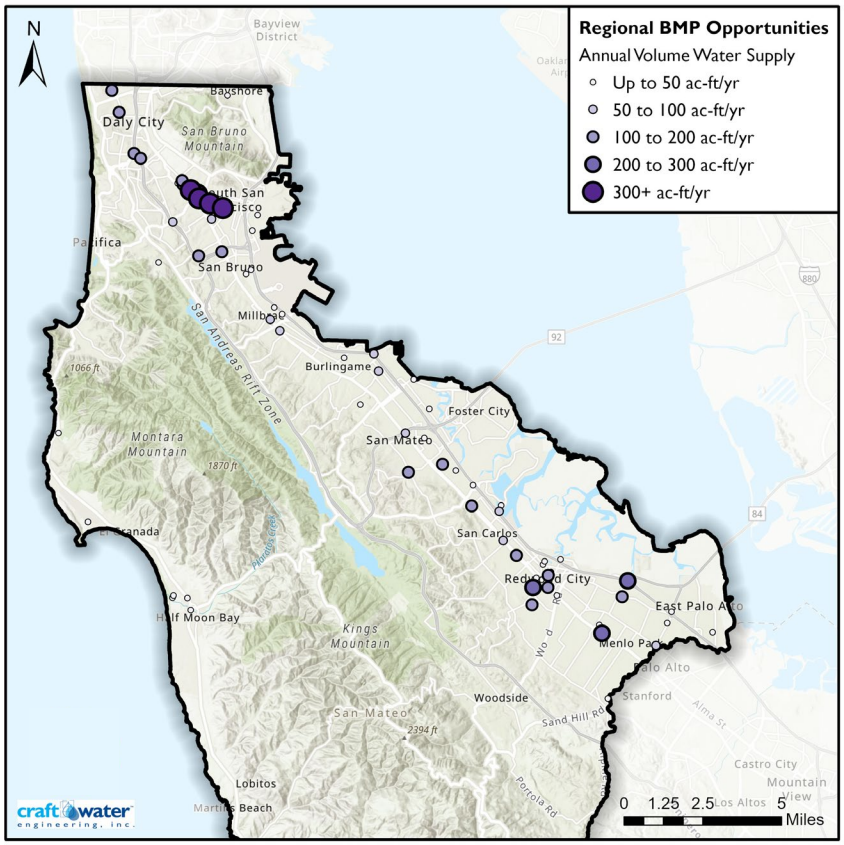

Figure 3-7. Potential water supply for candidate opportunities.

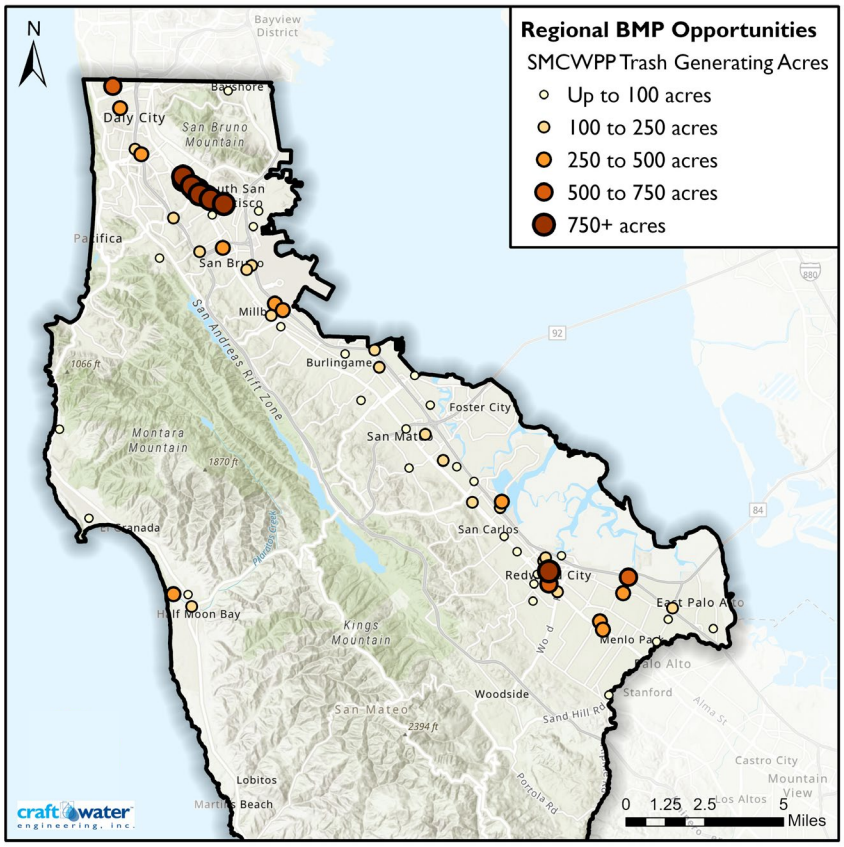

Figure 3-8. Potential trash capture for candidate opportunities drainage areas.

4.0 TOP PROJECT OPPORTUNITIES

The analysis of candidate opportunity metrics and performance focused the BMP opportunity list to a group of 14 top tier projects (**Figure 4-1**) that will provide the most impactful and cost-effective options for the County to pursue further in study and design. These different projects were chosen with a focus on performance metrics but also with an eye on (1) distributing projects among diverse drainage areas to provide options across County watersheds, (2) sensitivity to protecting the performance of previously planned projects currently in construction or design, and (3) providing a range of BMP types to develop a range of options for the County to utilize in building out their stormwater management portfolio. Discussion with the C/CAG member agencies and project TAC will follow and will determine which of the top opportunities will be advanced to more detailed concepts following review of this report.

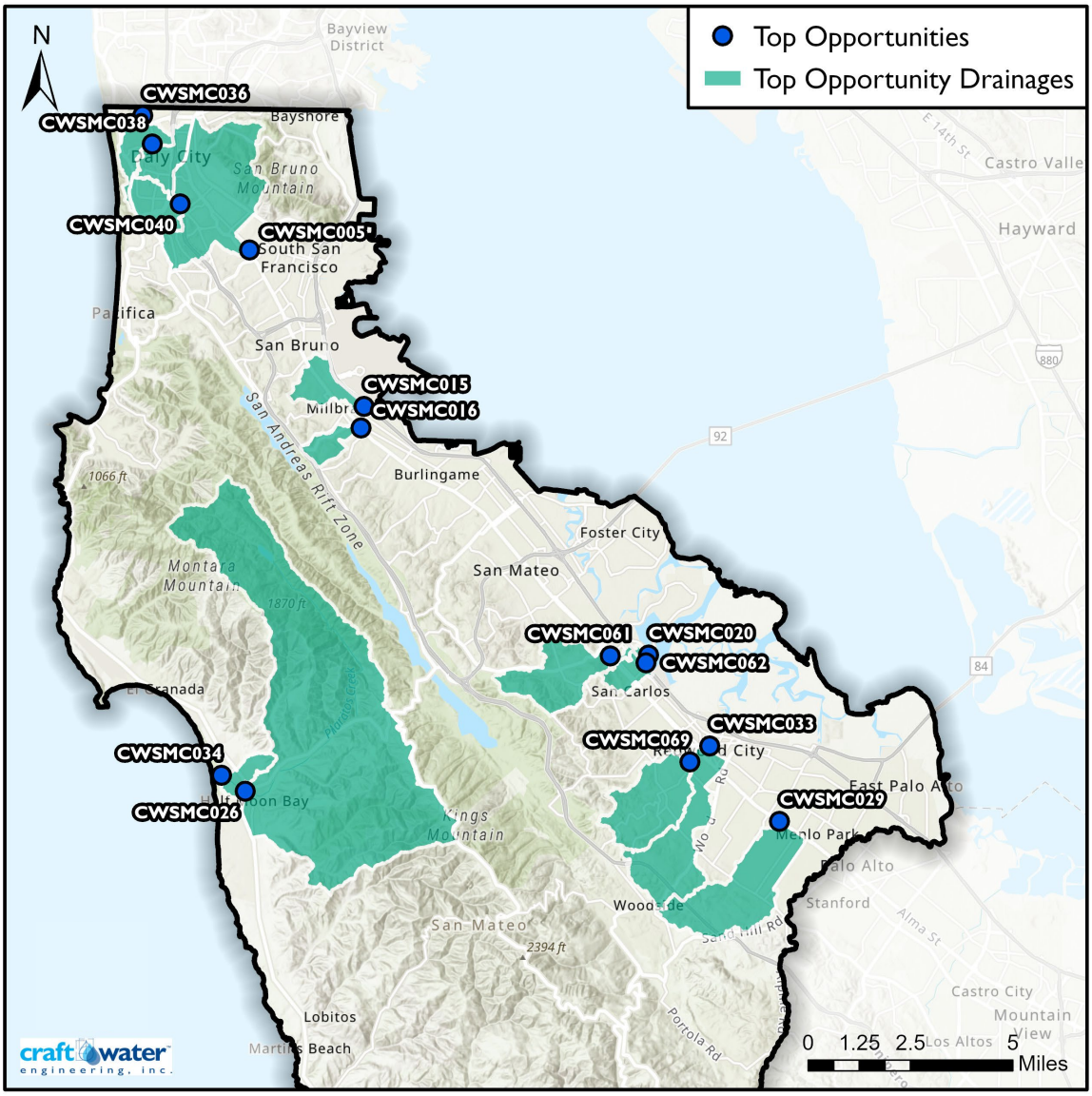

Figure 4-1. Top priority opportunities for regional BMPs in San Mateo County.

5.0 REFERENCES

Bay Area Water Supply & Conservation Agency (BAWSCA), 2015. *Long-Term Reliable Water Supply Strategy Strategy Phase II Final Report.* February 2015.

C/CAG, 2020. *San Mateo County-Wide Reasonable Assurance Analysis Addressing PCBs and Mercury: Phase I Baseline Modeling Report*. September 2020.

C/CAG, 2017. *San Mateo County Stormwater Resource Plan*. February 2017.

C/CAG, 2021. *San Mateo Countywide Sustainable Streets Master Plan*. January 2021.

Geosyntec Consultants, 2021. *Advancing Regional Stormwater Capture Projects: Business Case for Regional Collaboration – DRAFT MEMORANDUM.* August 2021.

APPENDIX A: PROJECT OPPORTUNITY DATABASE

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CATEGORY	ATTRIBUTE	DESCRIPTION and NOTES	UNITS
Project Baseline	CWID	Craftwater Project ID	na
	FULLDA_AC	Full Upstream Drainage Area to project diversion point	acres
	IMPDA_AC	Impervious Area in project drainage area	acres
	IMPDA_PCT	Percentage of drainage area impervious	percentage
	BASE_RUN_af	Baseline Runoff to project diversion point	ac-ft/yr
	BASE_PCB_g	Baseline PCBs to project diversion point	g/yr
	10YR_PEAK_cfs	Peak Flowrate for 10 Year, 24 Hour storm event to project diversion point	cfs
	10YR_VOL_af	Runoff Volume for 10 Year, 24 Hour storm event to project diversion point	ac-ft/yr
Project Attributes	DIV_CFS	Preliminary Project Diversion Rate	cfs
	STOR_ACFT	Preliminary Project Storage Volume	ac-ft/yr
	BMPTYPE	Type of BMP	na
	TREATMENT	Type of BMP treatment recommended	na
	PLANCOST	Planning Level Cost Estimate	$ dollars
Community Benefits	WLKBL_POP	Estimated 2010 population within 1/2 mile walkable radius to project	people
	PARKS_REC	Designates project is on Park or School parcel; "NEW" indicates undeveloped parcel with potential to convert to Park; "NO" indicates limited community benefit from site	na
Flood Management	PEAK_RDX	Reduction in peak flow for 10 Year, 24 Hour storm event	cfs
	VOL_RDX	Volume captured for 10 Year, 24 Hour storm event	ac-ft/yr
Water Quality Benefit	PCB_RDX	Average annual reduction in PCBs for the drainage area	g/yr
	GREEN_ACRES	Proxy of impervious area "treated" from drainage area by the project	acres
	VOL_MAN	Average annual runoff volume captured by project for treatment	ac-ft/yr
Water Supply	VOL_USE	Average annual water volume utilized/supplied; assumed full for infiltration, 33% for sewer discharge, and 0 for other options which return water to drains	ac-ft/yr
	DEM_OFFSET	Demand of regional offset; based on 680 ac-ft/yr demand for stormwater harvesting via other capture initiatives	percentage
Trash Capture	SMCWPP_TRASH	Aggregate area of Medium/High/Very High trash generation areas in project drainage area from the SMCWPP Trash Generation designations	acres
	CALOPPS_TRASH	Aggregate of drainage covered by potential CALTRANS trash capture opportunities	acres

CWID	DA_AC	IMPDA_AC	IMPDA_PCT	BASE_RUN_af	BASE_PCB_g	10YR_PEAK_cfs	10YR_VOL_af	DIV_CFS	STOR_ACFT	BMPTYPE	TREATMENT	PLANCOST
CWSMC001	322.23	144.35	44.80%	212.02	10.64	94	35.77	50	6.2	Subsurface Vault	Infiltration	$8,900,000
CWSMC002	1154.17	436.74	37.84%	519.46	19.36	307	99.78	80	16.5	Subsurface Vault	Infiltration	$21,400,000
CWSMC003	4578.7	1717.13	37.50%	1327.71	28.40	543	163.16	80	18	Subsurface Vault	Filtration/Sewer	$23,200,000
CWSMC004	423.97	164.57	38.82%	255.99	5.60	110	37.16	50	6.6	Subsurface Vault	Filtration/Sewer	$9,300,000
CWSMC005	4682.47	1784.88	38.12%	2824.00	61.80	1209	409.94	80	20	Wetland/Detention	Wetland/Filtration	$25,600,000
CWSMC006	5111.42	1952.77	38.20%	3084.05	67.49	1320	447.69	70	17.5	Subsurface Vault	Filtration/Sewer	$22,500,000
CWSMC007	6711.06	2728.64	40.66%	3708.36	103.77	2353	707.27	50	8	Wetland/Detention	Wetland/Filtration	$4,300,000
CWSMC008	1449.81	677.78	46.75%	801.50	22.43	508	152.86	70	14	Subsurface Vault	Filtration/Sewer	$18,300,000
CWSMC009	1589.68	553.23	34.80%	528.66	9.70	321	119.26	60	23.5	Subsurface Vault	Filtration/Sewer	$31,600,000
CWSMC010	1452.26	679.49	46.79%	802.26	22.45	509	153.01	80	13	Wetland/Detention	Wetland/Filtration	$6,500,000
CWSMC011	1723.04	408.43	23.70%	605.37	15.01	242	78.51	20	0.7	Modular Wetland	Filtration	$1,700,000
CWSMC012	89.44	79.29	88.65%	59.63	2.99	26	10.06	30	2.3	Subsurface Vault	Filtration/Sewer	$4,100,000
CWSMC013	32.4	27.51	84.91%	19.88	1.00	9	3.35	20	0.7	Modular Wetland	Filtration	$1,700,000
CWSMC014	703.52	376.3	53.49%	342.04	11.26	161	65.64	80	11.5	Wetland/Detention	Wetland/Filtration	$5,800,000
CWSMC015	787.92	411.79	52.26%	383.47	12.62	181	73.59	80	13.2	Wetland/Detention	Wetland/Filtration	$6,500,000
CWSMC016	475.37	189.83	39.93%	284.89	19.13	176	54.72	60	10.6	Subsurface Vault	Filtration/Sewer	$14,200,000
CWSMC017	177.72	101	56.83%	70.60	2.62	59	17.52	20	1.6	Subsurface Vault	Filtration/Sewer	$3,200,000
CWSMC018	159.46	30.92	19.39%	137.51	1.40	17	7.60	20	0.6	Subsurface Vault	Infiltration	$1,000,000
CWSMC019	584.89	204.44	34.95%	253.04	9.82	165	56.47	80	9.6	Subsurface Vault	Filtration/Sewer	$13,100,000
CWSMC020	563.08	360.92	64.10%	299.17	56.15	254	89.58	70	10.6	Wetland/Detention	Wetland/Filtration	$5,400,000
CWSMC021	776.05	283.42	36.52%	322.16	20.15	185	60.00	60	9	Subsurface Vault	Filtration/Sewer	$12,300,000
CWSMC022	245.05	137.71	56.20%	90.33	2.62	49	18.26	40	4.8	Subsurface Vault	Filtration/Sewer	$7,100,000
CWSMC023	4506.59	1054.12	23.39%	1060.00	68.69	796	301.62	70	21.5	Subsurface Vault	Infiltration	$26,300,000
CWSMC024	3838.55	838.01	21.83%	902.81	58.50	678	256.89	60	18.5	Subsurface Vault	Infiltration	$22,700,000
CWSMC025	1278.46	476.2	37.25%	474.23	13.76	258	95.86	50	14.2	Wetland/Detention	Wetland/Filtration	$7,000,000
CWSMC026	17352.11	648.21	3.74%	4918.27	7.53	269	112.73	50	9.4	Wetland/Detention	Wetland/Filtration	$4,900,000
CWSMC027	267.6	85.58	31.98%	69.35	4.48	67	19.20	40	3.2	Subsurface Vault	Filtration	$5,200,000
CWSMC028	2979.77	697.01	23.39%	701.29	45.44	527	199.55	60	21.5	Subsurface Vault	Filtration	$27,300,000
CWSMC029	2891.96	650.96	22.51%	679.80	44.05	511	193.43	60	21.5	Subsurface Vault	Infiltration	$26,300,000
CWSMC030	242.87	86.5	35.62%	101.17	1.63	18	9.38	20	4.2	Subsurface Vault	Filtration	$6,300,000
CWSMC031	246.14	157.65	64.05%	106.36	4.13	69	23.73	40	3.7	Subsurface Vault	Filtration/Sewer	$5,800,000
CWSMC032	34.71	17.42	50.19%	10.21	0.32	8	2.85	20	0.4	Bioretention	Filtration	$1,300,000
CWSMC033	5951.65	2113.52	35.51%	2210.23	64.14	1201	446.79	60	14.6	Subsurface Vault	Filtration/Sewer	$19,000,000
CWSMC034	17807.65	765.47	4.30%	5048.39	7.73	276	115.71	50	8	Wetland/Detention	Wetland/Filtration	$4,300,000
CWSMC035	393.51	48.2	12.25%	109.29	0.17	6	2.51	20	0.7	Wetland/Detention	Wetland/Filtration	$1,200,000
CWSMC036	1463.63	863.55	59.00%	1064.78	31.04	624	184.50	90	26	Subsurface Vault	Filtration/Sewer	$32,800,000
CWSMC037	193.54	82.18	42.46%	114.70	6.62	77	23.10	40	4	Subsurface Vault	Filtration/Sewer	$6,200,000
CWSMC038	759.12	471.56	62.12%	551.43	16.07	323	95.55	70	13.5	Subsurface Vault	Infiltration	$17,700,000
CWSMC039	481.19	244.43	50.80%	421.40	10.22	181	56.49	50	9.2	Subsurface Vault	Infiltration	$12,500,000
CWSMC040	764.24	389.32	50.94%	668.70	16.21	287	89.65	60	11	Subsurface Vault	Infiltration	$14,700,000
CWSMC041	397.55	57.51	14.47%	115.38	2.47	47	14.18	40	13	Subsurface Vault	Filtration/Sewer	$17,000,000
CWSMC042	4576.48	1715.52	37.49%	1327.03	28.39	542	163.08	90	22.5	Subsurface Vault	Filtration/Sewer	$28,600,000
CWSMC043	29.57	15.63	52.86%	21.52	0.43	8	2.77	20	0.6	Modular Wetland	Filtration	$1,600,000
CWSMC044	4639.95	1756.28	37.85%	2799.62	61.26	1198	406.40	90	26	Subsurface Vault	Infiltration	$32,800,000
CWSMC045	5145	1976.6	38.42%	3104.36	67.93	1329	450.64	50	9.4	Subsurface Vault	Filtration/Sewer	$12,700,000
CWSMC046	6802.07	2780.93	40.88%	4103.94	89.81	1756	595.74	90	26	Subsurface Vault	Infiltration	$32,800,000
CWSMC047	7177.41	3002.5	41.83%	4757.10	238.76	2112	802.69	80	28.8	Subsurface Vault	Infiltration	$36,100,000
CWSMC048	610.99	276.8	45.30%	337.95	9.46	214	64.46	60	11	Subsurface Vault	Filtration/Sewer	$14,700,000

CWSMC049	532.94	209.58	39.33%	239.34	8.92	141	45.98	40	8.5	Wetland/Detention	Wetland/Filtration	$4,500,000
CWSMC050	991.53	341.56	34.45%	445.81	16.62	263	85.64	60	14.2	Subsurface Vault	Infiltration	$18,500,000
CWSMC051	263.56	66.36	25.18%	118.36	4.41	70	22.74	30	4.4	Wetland/Detention	Wetland/Filtration	$2,700,000
CWSMC052	530.41	208.95	39.39%	238.03	8.87	141	45.72	40	8.4	Wetland/Detention	Wetland/Filtration	$4,500,000
CWSMC053	434.64	198.53	45.68%	211.57	6.96	100	40.60	30	7.2	Subsurface Vault	Filtration/Sewer	$9,900,000
CWSMC054	520.32	271.16	52.11%	248.22	9.07	211	62.42	50	8.4	Subsurface Vault	Filtration/Sewer	$11,500,000
CWSMC055	344.6	185.19	53.74%	136.73	5.07	115	33.94	30	5.2	Subsurface Vault	Infiltration	$6,500,000
CWSMC056	73.01	46.2	63.28%	40.37	1.72	25	9.20	20	0.8	Modular Wetland	Filtration	$1,800,000
CWSMC057	298.4	52.55	17.61%	158.14	0.45	9	3.44	50	16.5	Wetland/Detention	Wetland/Filtration	$8,000,000
CWSMC058	1676.15	553.83	33.04%	493.64	15.43	382	137.63	60	17.2	Subsurface Vault	Infiltration	$21,100,000
CWSMC059	1427.66	404.52	28.33%	420.44	13.15	326	117.22	50	13.8	Subsurface Vault	Infiltration	$17,000,000
CWSMC060	93.66	51.42	54.90%	27.24	0.85	21	7.59	20	0.6	Modular Wetland	Filtration	$1,600,000
CWSMC061	1831.69	548.64	29.95%	648.29	25.54	323	115.20	60	18	Subsurface Vault	Filtration/Sewer	$23,100,000
CWSMC062	447.91	274.67	61.32%	237.99	44.66	202	71.26	50	12.8	Subsurface Vault	Filtration/Sewer	$16,800,000
CWSMC063	531.78	121.79	22.90%	273.69	17.69	70	22.02	40	6	Subsurface Vault	Filtration	$8,600,000
CWSMC064	2173.94	422.31	19.43%	823.65	25.16	222	86.45	50	14.4	Subsurface Vault	Infiltration	$17,700,000
CWSMC065	115.37	88.99	77.13%	42.34	1.23	23	8.56	20	0.8	Modular Wetland	Filtration	$1,800,000
CWSMC066	281.08	166.22	59.14%	104.44	3.03	57	21.11	30	4.5	Subsurface Vault	Filtration/Sewer	$6,700,000
CWSMC067	20.04	15.94	79.54%	8.47	0.25	5	1.71	10	0.5	Modular Wetland	Filtration	$1,500,000
CWSMC068	199.68	100.15	50.16%	73.39	2.13	40	14.84	20	1.5	Subsurface Vault	Infiltration	$2,000,000
CWSMC069	2077.36	771.66	37.15%	770.62	22.36	419	155.78	70	25	Subsurface Vault	Infiltration	$30,500,000
CWSMC070	3472.76	1091.24	31.42%	1290.01	37.43	701	260.77	80	23	Subsurface Vault	Filtration/Sewer	$29,200,000
CWSMC071	258.63	46.93	18.15%	72.86	0.11	4	1.67	30	5.5	Subsurface Vault	Filtration/Sewer	$7,900,000
CWSMC072	653.71	242.32	37.07%	169.23	10.93	162	46.85	70	12.2	Subsurface Vault	Filtration	$16,200,000
CWSMC073	39.15	28.31	72.31%	16.47	0.27	3	1.53	10	0.5	Modular Wetland	Filtration	$1,500,000
CWSMC074	264.42	125.78	47.57%	110.58	1.78	20	10.25	30	4.2	Subsurface Vault	Infiltration	$5,300,000

CWID	WLKBL_POP	PARKS_REC	PEAK_RDX	VOL_RDX	PCB_RDX	GREEN_ACRES	VOL_MAN	VOL_USE	DEM_OFFSET	SMCWPP_TRASH	CALOPPS_TRASH
CWSMC001	528	SCHOOL	29.7	19.78	10.06	82.33	183.78	183.78	27.0%	59.83	4.2
CWSMC002	3259	NO	0	30.46	15.17	137.74	364.00	364.00	53.5%	257.82	1061.38
CWSMC003	4813	NO	0	32.25	15.18	188.00	501.29	167.10	24.6%	1223.4	801.62
CWSMC004	4344	NO	27.86	20.38	5.06	84.27	217.10	72.37	10.6%	55.63	3.64
CWSMC005	4161	NEW	0	34.27	18.95	419.67	1100.96	0.00	0.0%	1243.09	814.9
CWSMC006	4867	NO	0	31.77	17.57	427.58	1119.19	373.06	54.9%	1299.96	818.54
CWSMC007	2274	NEW	0	22.25	9.31	185.52	456.28	0.00	0.0%	1592.37	2049
CWSMC008	4659	NO	0	28.25	12.16	191.42	409.45	136.48	20.1%	258.88	1228.31
CWSMC009	6353	PARK	50.56	37.29	7.79	130.13	373.93	124.64	18.3%	37.64	0
CWSMC010	4177	NEW	0	27.25	12.21	189.27	404.52	0.00	0.0%	260.42	1229
CWSMC011	3086	SCHOOL	0	14.55	3.52	44.50	187.73	0.00	0.0%	97.72	0
CWSMC012	357	NO	10.29	9.19	2.96	51.93	58.58	19.53	2.9%	69.19	8.14
CWSMC013	311	NO	0.63	3.32	1.00	16.86	19.85	0.00	0.0%	29.07	0
CWSMC014	1013	PARK	30.96	25.21	9.74	144.42	270.00	0.00	0.0%	327.72	31.35
CWSMC015	636	PARK	32.72	26.92	10.83	155.83	298.17	0.00	0.0%	336.38	31.35
CWSMC016	2892	NO	25.1	24.41	17.25	92.45	231.52	77.17	11.3%	74.23	0
CWSMC017	1972	PARK	4.38	11.83	2.40	36.19	63.68	21.23	3.1%	75.17	0
CWSMC018	1353	SCHOOL	0.03	0.66	0.12	4.19	21.63	21.63	3.2%	0	6.69
CWSMC019	3656	NO	11.33	23.35	8.92	72.76	208.18	69.39	10.2%	60.4	577.6
CWSMC020	837	NEW	0	24.34	44.62	139.36	217.42	0.00	0.0%	278.65	0
CWSMC021	3207	NO	0	22.76	16.10	81.19	222.32	74.11	10.9%	24.41	0
CWSMC022	2867	NEW	30.25	15.24	2.47	46.56	82.86	27.62	4.1%	102.62	36.53
CWSMC023	1675	NO	1.09	23.49	15.43	52.91	226.19	226.19	33.3%	606.46	79.49
CWSMC024	3151	NO	0.93	20.21	13.27	42.39	194.18	194.18	28.6%	407.15	9.81
CWSMC025	7006	NO	0	27.96	9.94	113.27	304.10	0.00	0.0%	174.44	1203.86
CWSMC026	35	NEW	0	23.74	3.89	67.98	1819.86	0.00	0.0%	240.02	0
CWSMC027	3515	NO	22.05	14.03	4.05	19.61	61.30	0.00	0.0%	23.33	256.3
CWSMC028	859	NO	0	35.37	28.19	93.67	400.46	0.00	0.0%	340.56	9.28
CWSMC029	1084	NO	1.08	23.48	15.61	45.87	203.78	203.78	30.0%	312.06	9.28
CWSMC030	1976	SCHOOL	10.21	9.38	1.61	35.75	100.38	0.00	0.0%	33.65	0
CWSMC031	1428	NO	22.68	16.04	3.94	61.61	96.19	32.06	4.7%	101.22	2.11
CWSMC032	4625	PARK	0	2.59	0.32	5.11	10.17	0.00	0.0%	0	0
CWSMC033	4783	NO	0	28.88	15.72	185.46	522.24	174.08	25.6%	874.14	1263.29
CWSMC034	11	NEW	0	22.35	3.82	79.16	1841.47	0.00	0.0%	284.33	0
CWSMC035	31	NEW	0	2.51	0.14	11.69	95.44	0.00	0.0%	6.16	0
CWSMC036	1810	NO	0	40.25	18.21	327.45	554.99	185.00	27.2%	570.16	19.45
CWSMC037	2059	NO	25.5	16.3	6.34	43.64	102.77	34.26	5.0%	47.63	0
CWSMC038	7301	NEW	0	27.6	11.65	220.37	354.75	354.75	52.2%	395.87	19.27
CWSMC039	3409	NO	3.38	23.36	9.11	185.38	364.94	364.94	53.7%	189.44	460.17
CWSMC040	1108	NO	0	25.26	12.27	265.91	521.99	521.99	76.8%	401.6	657.47
CWSMC041	4162	SCHOOL	32.16	13.59	2.29	15.04	103.95	34.65	5.1%	28.71	0
CWSMC042	4434	NO	0	36.75	16.71	201.32	537.05	179.02	26.3%	1221.18	801.62
CWSMC043	4110	NO	0	2.68	0.43	11.31	21.40	0.00	0.0%	10.64	0
CWSMC044	4058	NO	0	40.27	21.57	438.25	1157.82	1157.82	170.3%	1236.83	801.62
CWSMC045	5119	NO	0	23.67	12.50	384.91	1001.89	333.96	49.1%	1318.71	819.56
CWSMC046	4340	PARK	0	40.28	22.22	576.36	1409.75	1409.75	207.3%	1600.83	2050.63

CWSMC047	3405	NO	0	43.07	51.11	541.62	1294.73	1294.73	190.4%	1774.47	2060.32
CWSMC048	3261	NO	0	25.25	7.81	116.92	258.08	86.03	12.7%	121.95	458.77
CWSMC049	2296	NO	25.88	22.27	7.81	76.92	195.59	0.00	0.0%	116.29	460.31
CWSMC050	443	NO	0	28.11	13.05	110.34	320.30	320.30	47.1%	181.1	898.74
CWSMC051	1012	NO	22.16	16.43	4.18	26.86	106.67	0.00	0.0%	28.19	260.43
CWSMC052	2781	NEW	25.35	22.17	7.77	76.63	194.53	0.00	0.0%	116.29	457.78
CWSMC053	3995	NO	22.16	20.64	6.24	81.34	178.08	59.36	8.7%	107.99	0
CWSMC054	1786	NO	0	22.32	7.58	101.81	195.37	65.12	9.6%	180.04	30.21
CWSMC055	6381	SCHOOL	0.26	5.68	2.63	28.44	52.92	52.92	7.8%	232.43	222.05
CWSMC056	3294	SCHOOL	1.84	7.18	1.68	24.77	39.15	0.00	0.0%	6.98	47.03
CWSMC057	134	NEW	0.69	3.44	0.37	26.86	152.51	0.00	0.0%	0.03	0
CWSMC058	4684	SCHOOL	0.86	18.79	6.01	53.66	162.40	162.40	23.9%	142.76	18.39
CWSMC059	3566	SCHOOL	0.69	15.07	4.86	37.47	132.24	132.24	19.4%	67.1	13.16
CWSMC060	2072	NO	0	5.98	0.82	14.30	26.05	0.00	0.0%	24.32	0
CWSMC061	2595	NO	0	31.82	17.37	112.78	376.52	125.51	18.5%	191.38	0.44
CWSMC062	593	NO	14.02	26.51	38.69	118.42	193.12	64.37	9.5%	196.51	0
CWSMC063	167	NO	32.16	18.47	14.37	57.45	250.84	0.00	0.0%	0.05	0
CWSMC064	3302	NO	0.73	15.74	9.49	32.42	166.91	166.91	24.5%	78.94	0.62
CWSMC065	736	NO	1.84	6.82	1.14	30.10	39.03	0.00	0.0%	78.84	7.36
CWSMC066	2036	NO	22.16	15.95	2.79	54.63	92.37	30.79	4.5%	137.8	38.55
CWSMC067	4142	NO	0	1.71	0.25	6.73	8.46	0.00	0.0%	20.04	0
CWSMC068	5017	SCHOOL	0.08	1.64	0.60	8.25	16.45	16.45	2.4%	72.81	0
CWSMC069	3920	SCHOOL	1.26	27.3	10.12	90.09	242.54	242.54	35.7%	60.97	0
CWSMC070	7550	NO	0	37.02	18.22	168.13	535.05	178.35	26.2%	546.3	1224.7
CWSMC071	51	NO	0	1.67	0.10	12.87	70.94	23.65	3.5%	22.79	0
CWSMC072	3324	NO	58.45	25.81	9.55	53.08	143.19	0.00	0.0%	193.48	633.54
CWSMC073	4054	SCHOOL	0	1.53	0.27	11.91	16.47	0.00	0.0%	39.15	0
CWSMC074	3901	NO	7.29	4.58	1.28	37.98	79.84	79.84	11.7%	0.22	0.36

CWID	PEAKRDX_RANK	VOLRDX_RANK	PCBRDX_RANK	GRNAC_RANK	VOLMAN_RANK	VOLUSE_RANK	DEMOFF_RANK	SMCWPP_RANK	CALOPPS_RANK
CWSMC001	8	44	30	33	44	16	16	53	44
CWSMC002	40	13	19	21	22	7	7	25	9
CWSMC003	40	10	18	13	14	20	20	8	14
CWSMC004	9	42	46	32	35	31	31	54	45
CWSMC005	40	9	7	5	7	47	47	6	13
CWSMC006	40	12	10	4	6	5	5	5	12
CWSMC007	40	39	35	14	15	47	47	3	3
CWSMC008	40	15	26	11	16	23	23	24	6
CWSMC009	2	5	40	22	20	26	26	57	50
CWSMC010	40	20	25	12	17	47	47	23	5
CWSMC011	40	54	53	50	43	47	47	43	50
CWSMC012	21	59	54	47	63	45	45	49	41
CWSMC013	36	66	64	64	70	47	47	59	50
CWSMC014	6	26	32	19	27	47	47	19	31
CWSMC015	3	21	28	18	26	47	47	18	31
CWSMC016	13	27	12	30	31	29	29	47	50
CWSMC017	24	57	58	55	61	44	44	46	50
CWSMC018	39	74	73	74	68	43	43	73	43
CWSMC019	20	34	37	39	36	32	32	52	19
CWSMC020	40	28	2	20	34	47	47	22	50
CWSMC021	40	35	14	35	33	30	30	62	50
CWSMC022	7	52	57	48	58	41	41	41	30
CWSMC023	29	31	17	46	32	12	12	11	27
CWSMC024	31	43	21	52	41	14	14	14	38
CWSMC025	40	17	31	25	25	47	47	34	8
CWSMC026	40	29	51	40	2	47	47	26	50
CWSMC027	18	55	49	63	62	47	47	64	25
CWSMC028	40	8	4	29	18	47	47	17	39
CWSMC029	30	32	16	49	37	13	13	20	39
CWSMC030	22	58	61	56	54	47	47	58	50
CWSMC031	14	49	50	41	55	39	39	42	46
CWSMC032	40	68	69	73	73	47	47	73	50
CWSMC033	40	14	15	15	12	19	19	10	4
CWSMC034	40	36	52	36	1	47	47	21	50
CWSMC035	40	69	72	69	56	47	47	69	50
CWSMC036	40	4	9	7	9	15	15	12	34
CWSMC037	11	48	43	51	53	38	38	55	50
CWSMC038	40	18	27	9	23	8	8	16	35
CWSMC039	25	33	36	16	21	6	6	31	21
CWSMC040	40	24	24	8	13	4	4	15	17
CWSMC041	4	56	59	65	52	37	37	60	50
CWSMC042	40	7	13	10	10	17	17	9	14
CWSMC043	40	67	67	70	69	47	47	67	50
CWSMC044	40	3	6	3	5	3	3	7	14
CWSMC045	40	30	23	6	8	9	9	4	11
CWSMC046	40	2	5	1	3	1	1	2	2

CWSMC047	40	1	1	2	4	2	2	1	1
CWSMC048	40	25	39	24	28	27	27	37	22
CWSMC049	10	38	38	37	38	47	47	38	20
CWSMC050	40	16	22	27	24	10	10	32	10
CWSMC051	15	47	48	61	51	47	47	61	24
CWSMC052	12	40	41	38	40	47	47	38	23
CWSMC053	16	41	44	34	45	35	35	40	50
CWSMC054	40	37	42	28	39	33	33	33	33
CWSMC055	37	63	56	59	64	36	36	27	26
CWSMC056	26	60	60	62	65	47	47	68	28
CWSMC057	34	65	68	60	48	47	47	72	50
CWSMC058	32	45	45	44	47	22	22	35	36
CWSMC059	35	53	47	54	50	24	24	50	37
CWSMC060	40	62	65	66	67	47	47	63	50
CWSMC061	40	11	11	26	19	25	25	30	48
CWSMC062	19	22	3	23	42	34	34	28	50
CWSMC063	4	46	20	42	29	47	47	71	50
CWSMC064	33	51	34	57	46	21	21	44	47
CWSMC065	26	61	63	58	66	47	47	45	42
CWSMC066	16	50	55	43	57	40	40	36	29
CWSMC067	40	70	71	72	74	47	47	66	50
CWSMC068	38	72	66	71	72	46	46	48	50
CWSMC069	28	19	29	31	30	11	11	51	50
CWSMC070	40	6	8	17	11	18	18	13	7
CWSMC071	40	71	74	67	60	42	42	65	50
CWSMC072	1	23	33	45	49	47	47	29	18
CWSMC073	40	73	70	68	71	47	47	56	50
CWSMC074	23	64	62	53	59	28	28	70	49

APPENDIX D

Assessing the Feasibility of Stormwater Credit Trading in San Mateo County, CA

Assessing the Feasibility of Stormwater Credit Trading in San Mateo County, CA

An analysis and recommendations for increasing green stormwater infrastructure implementation and operations on public and private property.

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C/CAG City/County Association of Governments of San Mateo County

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Introduction

This memorandum grows out of a year-long partnership between staff from the Stormwater Program within the San Mateo County City and County Association of Governments (C/CAG) and a team of water policy and economic professionals from American Rivers, WaterNow Alliance, and Corona Environmental Consulting (project team). This partnership began in 2020 with the invitation to C/CAG staff to participate in a series of trainings hosted by project team members. These trainings focused on incentive programs to encourage the implementation of green stormwater infrastructure (GSI) on privately owned property and approaches to financing these incentives. The trainings provided a foundation for a more detailed follow up project in which the project team collaborated with C/CAG staff to analyze the potential for establishing a stormwater volume credit trading program within C/CAG's member communities.

The intention of this effort is to provide a very high-level assessment of the factors that could promote, or obstruct, the design and administration of a credit trading program. This analysis also includes an evaluation of whether and how such a program could be integrated into the Regional Collaboration Framework currently being considered by C/CAG and its member agencies for addressing stormwater challenges and complying with the San Francisco Bay Municipal Regional Permit (MRP).

This memorandum summarizes the project team's high-level assessment. It is intended to be informative and exploratory only and does not represent an expression of C/CAG's intention to develop a stormwater credit trading program. This memorandum is organized as follows:

- Section 1 provides a basic introduction to the concept of stormwater credit trading, its application, and potential benefits.
- Section 2 provides an assessment of the feasibility of a credit trading program among C/CAG member communities under existing (and likely future) regulatory conditions and offers some suggestions about how possible alternative regulatory drivers could influence trading program feasibility.
- Section 3 describes the project team's assessment of the potential demand for a stormwater credit trading program in San Mateo County relative to potential supply.
- Section 4 contains an analysis of potential costs for credits compared to costs for on-site compliance and within the context of the Regional Collaboration Framework.
- Section 5 relates the team's conclusions regarding credit trading feasibility and provides recommendations on program structure. The section also identifies additional research and analysis that could be pursued with additional resources to further characterize feasibility in greater detail.

1. Overview of Stormwater Credit Trading

For the purposes of this memo, post-construction stormwater credit trading is a voluntary, alternative compliance strategy that allows developers and property owners who are subject to post construction stormwater management requirements to meet those requirements (or a portion of those

requirements) by purchasing volume-based stormwater credits generated by the installation of GSI projects located off-site.

The credit trading approach may succeed when property owners and developers find that purchasing credits from an off-site provider reduces technical or economic obstacles to a real estate development project. In some cases, buying credits can allow property owners or developers to take advantage of additional buildable area on-site, including surface, rooftop, or underground areas. In other cases, on-site controls may not be feasible due to technical or land use constraints and/or may be very expensive. Purchasing credits can provide a less expensive option for meeting stormwater management obligations compared to on-site compliance or paying an in-lieu payment to the permitting authority (where this option exists.)

In addition to benefits for developers, the goal of a stormwater credit trading program is to provide greater overall water quality/stormwater control benefits relative to an approach that requires all developers to strictly manage stormwater on-site. For example, allowing some portion of retention to be met off-site (while still requiring that some percentage be met onsite when feasible) can result in a greater number of smaller GSI installations which, in comparison to a smaller number of larger stormwater management practices, capture more stormwater per event and can help distribute the environmental, social, and human health co-benefits of GSI throughout a city or watershed.[1] Municipalities can design programs in a way that encourages or incentivizes credit generation in areas where it will result in the greatest overall benefit, rather than simply gaining additional stormwater control where new development and redevelopment happens to be occurring.

Any trading program in San Mateo County would be tied to the minimum post construction stormwater standards reflected in section C.3 of the MRP and the requirements/guidelines for meeting these standards, as expressed in San Mateo County's C.3 Regulated Projects Guide. Some municipalities in the County have stricter standards/higher requirements than outlined in the MRP; these could also be incorporated into a volume-based trading program. While the demand for post-construction stormwater credits would come from property owners/developers seeking to comply with MRP/municipal standards, credits could potentially be generated/supplied from several sources:

- Property owners not subject to post construction stormwater management requirements who voluntarily implement GSI retrofit projects on their property.

- Developers and property owners subject to post construction stormwater management requirements who build GSI projects that provide additional storage capacity and/or manage additional (i.e., non-regulated) impervious area. These developers and property owners can either bank the extra storage capacity they create for use at future development sites or sell them.

- In San Mateo County, the project team is also evaluating the potential for public projects to serve as a source of supply of credits. These projects could include those identified in the

[1] Dougherty, S., R. Hammer, and A. Valderrama. 2016. How to: Stormwater Credit Trading Programs. NRDC Issue Brief 16-01-A. New York: NRDC, Available at https://www.nrdc.org/sites/default/files/stormwater-credit-trading-programs-ib.pdf.

County's Sustainable Streets Master Plan, current and future regional stormwater projects (including those identified in the Regional Collaboration Framework), and other public agency constructed stormwater management features.

Stormwater credit trading was pioneered by the District of Columbia's Department of Energy and Environment (DOEE). DOEE's Stormwater Retention Credit Trading program allows property developers to meet a portion (or in some cases all) of their stormwater retention requirements by purchasing an equivalent volume of stormwater BMP capacity from credit generators (i.e., private property owners or project developers) who build stormwater retention projects located elsewhere in the District. Developers are also allowed to build additional storage capacity (i.e., go above and beyond requirements) and use the associated credits at future development sites. Developers can purchase credits "by-right," meaning they do not have to demonstrate technical constraints/site conditions that prevent them from implementing stormwater controls on-site.

DOEE has carefully designed its program to incentivize stormwater management projects within its MS4 permit area, where distributed GSI projects result in greater water quality benefits compared to projects located in the downtown/combined sewer area.[2] The program provides economically valuable flexibility to developers, particularly in the downtown urban core where buildable area is relatively scarce and valuable. In addition, the distribution of credit generating GSI projects results in improvements in neighborhoods that are not otherwise seeing direct investments from real estate development projects. Other volume-based credit trading programs are being evaluated or are under development in several other jurisdictions, including Grand Rapids, MI, and Cook County, IL.

A key aspect of DOEE's program is that credits are purchased on an annual basis (though multi-year purchases/contracts between buyers and sellers are encouraged). One credit is equal to one gallon of retention capacity per year. Credits are certified by DOEE for three years at a time, which helps to ensure that credit generating projects are continuously maintained. This approach creates flexibility for sellers who may wish to redevelop their property and/or stop selling credits at some point. However, the frequency of credit purchases can increase overall compliance costs (because credits are purchased annually) and creates some uncertainty for credit purchasers. For many developers however, the cost for recurring annual credit purchases is offset by the high opportunity cost of land in D.C., especially in the downtown core.

Stormwater credit trading programs may be structured in different ways; for example, the City of Grand Rapids is contemplating a one-time (upfront) purchase of credits. This provides more certainty for buyers and reduces long-term compliance costs, but also limits flexibility for market participants (i.e., sellers that may want to exit the market).

In both Grand Rapids and DC, an in-lieu fee (ILF) serves as the ceiling price for credits on the market. This works because the cost to the public agency for constructing GSI is typically higher than the cost that private credit generators incur to build the same installations on private property. To sell credits, credit providers must charge less than the ILF charged by the city, otherwise developers would opt to pay the

[2] Special rules also apply to credit demand sites located in the Anacostia Waterfront Development Zone, with the goal of reducing any adverse effects associated with dislocating the development site from the location of the stormwater management project.

ILF. In DC, DOEE has also implemented a purchase guarantee program as a way to encourage credit suppliers to enter the market. Under this program, credit generators can enter into an agreement with DOEE that stipulates DOEE will purchase their credits (at a price slightly below market price) if they can't sell them on the market. Once purchased, DOEE retires those credits. The program serves as a price floor on the market and provides certainty to sellers.

2. Feasibility Considerations for Credit Trading in San Mateo County

As noted earlier, the objective of our analysis is to perform a high-level assessment to evaluate the potential feasibility for post construction stormwater credit trading in San Mateo County. This section provides an overview of general feasibility conditions for credit trading and describes the potential for credit trading under alternative regulatory compliance frameworks.

2.1 General Feasibility Conditions

A key tenant of stormwater credit trading is that it requires regulatory standards for post construction stormwater management that create sufficient demand for off-site compliance. A program may be feasible when development projects are subject to stormwater management standards that are challenging to meet within the footprint of project site. "Challenging" implies that compliance with the management standard may create additional technical costs or difficulties. Examples include on-site retention requirements that necessitate dedication of substantial site area or that may be difficult to achieve with local soil, slope, or land use conditions. Where these conditions impact cost or difficulty of on-site compliance, off-site alternatives become attractive options. The central importance of a stringent management requirement makes it the threshold pre-condition for the feasibility of a credit trading program.

Another necessary pre-condition is that the relevant permit (in this case the MRP) allows for off-site compliance. This condition is met in San Mateo County, as the MRP allows for alternative compliance by-right (although stricter regulations may exist within individual municipalities). However, the draft alternative compliance language in MRP 3.0 requires the use of GSI or low impact development techniques on-site "to the Maximum Extent Practicable" (MEP). This could interpreted as a requirement for developers to conduct a feasibilitiy assessment to demonstrate the need for offsite compliance or as an avenue for implementing alternative "non-LID controls" or flow-through treatment devices. Although this is not necessarily the case; it could also be interprted quite differently, depending on how MEP is defined.

Site-level economic factors also influence the likelihood of trading program success, as well as how it is structured. When the dedication of space within the project footprint for stormwater management needs exceeds the alternative economic value of the area, off-site options become more economically attractive, further increasing the number of potential demand sites and the ability to pay for off-site compliance (i.e., purchase credits).

At the same time, trading requires the possibility that lower cost compliance is possible within a trading geography. Where costs of on-site compliance equal or nearly equal the costs of off-site alternatives, trading becomes less viable. From a municipality's perspective, there must also be enough locations where voluntary stormwater projects can be installed to create credits in a way that optimizes

stormwater management benefits (supply sites), as well as associated co-benefits of GSI projects. This distribution will be governed by, geologic, topographic, and demographic factors.

Finally, the implementation and administration of a credit trading program requires sufficient capacity/resources within the implementing agency (or from a third party). Once established, the program can be integrated into ongoing administration of a post construction stormwater management/MS4 compliance program. However, administrative needs include developing the relevant resources and technology to track credit purchases, certify credit generating projects, incentivize supply (e.g., though a purchase guarantee or other programs, as applicable/needed), and more. This assessment does not include an analysis of program administration needs (or the feasibility of contracting some aspects of program administration to a third-party); however, the project team recommends this as a next step towards implementation.

2.2 Feasibility of Credit Trading under Current Stormwater Management Standards

The primary driver for project-level post construction stormwater management in San Mateo County is MRP provision C.3 (as well as additional, more stringent standards required by some municipalities). This provision affects new real estate development and redevelopment projects that create or replace 10,000 square feet or more of impervious area (although some land use categories trigger the threshold at 5,000 square feet). These projects must "treat the stormwater runoff equal to the volume of annual runoff required to achieve 80 percent or more capture" based on local rainfall data (80 percent capture method).[3] This is approximately equivalent to managing for the 85th percentile storm event, which ranges from 0.29 to 1.20 inches (24-hour rainfall event), depending on location in the County.

Based on the MRP, C/CAG's post-construction stormwater control standards emphasize that new real estate development projects, and certain redevelopment projects, must use one of two approved approaches for managing the stormwater generated within the project site. As mentioned above, one approach is to manage 80% of the volume associated with the annual mean precipitation depth ("the volume-based approach"). Alternatively, developers may opt to use the "flow-based sizing criteria" requiring control of runoff resulting from a precipitation rate of 0.2" per hour. The Countywide Water Pollution Prevention Program has translated this into guidance that the surface area of a biotreatment measure be sized to 4% of the impervious area that drains to it and prefers this approach for sizing GSI projects.[4]

Information available to this project team indicates that, generally, project developers have not had difficulty in meeting either of these standards within their project footprints. This seems to be because the infiltration or other measures required to meet the standard can be effectively incorporated into the project design and footprint with relative ease and at a low cost (or at least relative to off-site compliance options). Were this not to be the case, developers have had the option of using the Alternative Compliance options outlined in MRP Provision C.3.e. Based on information available to the team, this option has rarely been utilized in San Mateo County, likely because (a) the MRP standards are reasonably easy to meet on-site and there is flexibility in achieving standards that go beyond the MRP

[3] Alternative approaches are allowed, however, are less preferred by the Countywide Program. See C.3 Regulated Project Guide at 5.1.2.
[4] C.3 Regulated Projects Guide at 5-7.

requirements (e.g., drainage requirements); and (b) the available off-site alternative compliance options are not economically attractive.[5] In the absence of technical or economic incentives to look for off-site compliance options, developers would see little benefit in a credit trading program.

However, some property owners in the county are able to take advantage of special allowances for Special Projects and "non-LID treatment credits," which reduce on-site management requirements (making it easier to comply onsite). For example, roadway projects and some infill development projects are either exempt from or have reduced LID requirements .These provisions may be removed or altered in the forthcoming updated MRP, which could have the effect of increasing demand for off-site/alternative compliance.

While an updated MRP has yet to be finalized, a Tentative Order has been released that provides insights into future requirements. - While the C.3 treatment measure design standard in the Tentative Order remains unchanged, it proposes to lower the application threshold to projects that create 5,000 square feet of impervious area for all land use categories. The project team's analysis suggests that this will create challenges for some future projects, but probably not in sufficient numbers to support a credit trading program, at least one that emphasizes transactions between private developers (i.e., the model developed in DC).

2.3 Feasibility of Credit Trading under a Regional Collaboration Framework

While a credit trading market based solely on private (mostly) parcel-based GSI as the source of supply may not currently be feasible, the possibility of utilizing the capacity of regional stormwater projects (including those identified in the Regional Collaboration Framework) and potentially, other public projects, as sources of credits for multiple buyers (including developers seeking to meet post construction management standards and other seeking to meet MRP-related standards) creates a potential opportunity for a different type of market or program. Functioning more like a mitigation bank than a credit exchange marketplace, a program of this nature in San Mateo County could incorporate the purchase of private parcel-based GSI projects by the public implementing agency. The credits associated with these private parcel-based projects would be added to an overall pool that would also include credits generated from regional and other public projects. As described in the memo outlining the Regional Collaboration Framework (Geosyntec 2021), the pool of credits would be available for purchase to a range of potential buyers. This could include developers seeking to meet post construction stormwater standards, particularly if the stringency of local/MRP regulatory drivers were to be increased to a level that motivated uptake of the off-site alternative compliance option.

As described in the following sections, the project team's analysis focused on the potential functionality of a credit bank for developers seeking to comply with meeting post construction stormwater management standards. Specifically, the project team analyzed the potential demand for credits from new and redevelopment sites based on the regulatory, economic, and technical factors that influence the need or desire for off-site compliance. For demonstration purposes, the project team assumed a hypothetical stormwater management standard that required on-site retention of the 85th percentile storm. This standard was chosen because it is similar to the current standard except it requires retention (i.e., use of infiltration practices) and prioritizes off-site compliance over the use of flow through treatment when infiltration is not possible on-site. Further, as reflected in the San Mateo County

[5] Personal communications with Matt Fabry and Reid Bogert.

Stormwater Resource Plan, the average rainfall depth associated with the 85th percentile storm (0.57 inches across the County)[6] reflects the expected marginal increase in the 10-year (6-hour) storm event under climate change.[7] Infiltrating this volume will help to protect the existing storm sewer system, which is designed to manage the 10-year storm.

We also examined the potential supply to a credit bank/exchange that could be generated from private parcel-based GSI projects. To examine the economic drivers for a credit exchange program, our analysis factored in the presence of credits created by both private suppliers (i.e., private parcel-based GSI projects located in high priority areas for stormwater management) and public agencies (i.e., credits generated by current and future regional and green street projects) and the resulting influence on credit price and supply volume.

As described in more detail below, the result of this analysis support the conclusion that there is likely enough supply and demand to support a credit bank/exchange program for post construction stormwater management if it is incorporated into a broader regional program. The presence of large amounts of credits created by the regional projects skews the price of credits downward, because those projects are considerably less expensive to install and maintain on a cost/greened acre basis (compared to private parcel based GSI projects). As a result, off-site compliance becomes more cost-effective for developers. This type of model would incentivize more private parcel-based projects in areas of high priority for stormwater management (including those areas that will not be managed by proposed regional projects) because developers of such projects would have a guaranteed buyer (i.e. the associated credits would be purchased and added to the overall pool of credits). This is a key tenant and priority for C/CAG's approach to stormwater management throughout the County. In addition, participation in alternative compliance for numeric retrofit targets or C.3 regulated projects could also help municipalities address the need for funding and resources to ensure ongoing O&M for regional or distributed GSI.

3. Potential Site-Level Supply and Demand for Post Construction Stormwater Credit Trading in San Mateo County

A post construction credit trading/exchange program must have sufficient supply and demand to support robust market activity. The project team's feasibility assessment focused largely on identifying potential demand for credits from future new development and redevelopment sites, as well as the potential supply from private parcel-based GSI projects in high priority areas for stormwater management. The following sections describe the project team's methodology for assessing supply and demand and presents our high-level results.

3.1 Overall Methodology

Using data provided by C/CAG and Craftwater, we first identified opportunity parcels that would serve as high priority for parcel-based GSI credit supply sites. We then estimated the potential demand for credits based on parcel level data and projections for new development and redevelopment by County

[6] See San Mateo Countywide Water Pollution Prevention Program, Stormwater Resource Plan for San Mateo County, February 2017, at Table 2-5.

[7] Personal communication with Matt Fabry, 9/2/21.

Traffic Analysis Zone (TAZ, as developed by CD+A 2017). To assess total supply for a credit "bank," we also included supply from regional projects identified for the Regional Collaboration Framework and planned Green/Sustainable Streets projects. We did not include other public GSI projects (e.g., parcel-based projects) because these were constructed for regulatory compliance purposes. We then estimated the cost of a credit on the market and compared the value of a credit to the cost of on-site compliance.

Geographic data provided by C/CAG served as the basis for this analysis. This data included parcel-level land use, impervious area, projected new/redevelopment by TAZ, as well as sewer-shed and groundwater basin boundary information. Additionally, Craftwater shared GIS data on areas that are flood prone and/or have a high potential for stormwater recharge, and soil infiltration rates. Craftwater also provided information on identified opportunities for regional projects and their associated drainage areas. These data provided criteria to help prioritize supply and demand sites. We focused our analysis on the eastern side (or Bay side) of San Mateo County, as this is the portion of the county that is the focus of certain MRP requirements (e.g., PCB load reductions) and where the majority of existing and proposed development is occurring or is expected to occur.

The first step in our process was to build a database of relevant parcels. We excluded single-family residential parcels, as well as other land uses that are not well suited for GSI installations (see Appendix A for a full list of land use types that were excluded). We identified the impervious area associated with each parcel, as well as the TAZ within which most of the parcel lays. We overlayed parcel data with the criteria data that helped to determine locational attributes of each parcel, including drainage area for the top regional project opportunities, high potential for stormwater recharge, flood zone area, soil drainage type, and areas classified as "old industrial" (which are high priority for stormwater management retrofits/reducing PCBs and other water quality contaminants). This database of parcel level information enabled us to look at parcels that could potentially provide supply of stormwater credits to a market, as well as aggregate parcels that might have a more difficult time meeting stormwater compliance on site and would therefore generate demand for those credits. The parcel-level database is included as an attachment to this memo.

3.2 Identifying High Priority Supply Sites

For a property to be considered a candidate for on-site stormwater management (i.e., serve as a credit generating retrofit site), it must have enough uncontrolled impervious area[8] to generate a sufficiently sized credit generating project. For our analysis, we also assumed that it would be more cost-effective to construct GSI projects on sites with some level of existing pervious area. To identify potential supply sites, we therefore included properties with at least 2,500 square feet of impervious area and that have a ratio of impervious area to total parcel area of 90% or less (i.e., at least 10% of the property would be more readily available for retrofitting stormwater management practices).

Next, we used criteria provided by Craftwater to rank each potential supply parcel's locational attributes that contribute to increased benefit of managing stormwater at that site. Parcels were ranked from 0 – 5

[8] We chose to use impervious area rather than building footprint to identify potential supply sites. This provided a simple and consistent approach across all parcel types. However, it's possible there are sites that are more than 90% impervious that could generate additional supply that we have not captured in this analysis, for example small buildings with large parking lots that could be retrofitted with permeable pavement.

based on the proportion of land in a flood zone, in a high potential for recharge area, in an opportunity drainage area or on poorly draining soil, as well as whether the parcel is classified by C/CAG as old industrial (based on 2019 land use data). All attributes were weighted equally.

If a parcel has poor soil infiltration capabilities or is located in a drainage area of an identified opportunity for a regional public project (including four projects in the planning phases and the top 14 opportunity projects identified by Craftwater), it was discounted based on the proportion of area with those qualities. Poor soil quality makes infiltration of stormwater difficult. The top opportunities for regional public projects are large projects that will manage a significant portion of stormwater in the associated drainage areas, so private commercial retrofits in these areas will not contribute as great a benefit compared to projects located outside of the drainage areas. Parcels with land in an area with high potential of stormwater recharge or in an area prone to flooding were assigned a higher ranking based on the proportion of the property that have those attributes. The old industrial land use classification also improved a parcel's ranking as these sites might be at high risk for PCB loading (or other water quality contaminants) and could therefore benefit from onsite GSI controls.

Our analysis identified close to 9,500 impervious acres that could be managed; of these 3,520 impervious acres are on parcels designated as high priority supply sites. If these parcels were to install GSI-based stormwater management practices, they would offer additional benefits of increased recharge, local flood management, and potentially other benefits. If these sites were to provide stormwater credits to a market or credit bank, they would increase the efficiency of stormwater management across the region due to the accrual of these additional benefits.

3.3 Identifying Potential Demand in Priority Development Areas

To identify total regulated impervious acres that might benefit from off-site compliance, we started with the regulatory requirements outlined in the current MRP. The threshold for on-site management is 5,000 square feet or more of impervious surface for uncovered parking areas, restaurants, auto service facilities and retail gasoline outlets. We note that the Tentative Order proposes to reduce the threshold for C.3 compliance to 5,000 square feet for all new or redevelopment projects. With these two factors in mind, we began our analysis by identifying properties greater than 5,000 square feet in size. This represents the universe of parcels that could potentially trigger stormwater management standards if they were developed/redeveloped.

The demand analysis is complicated by the fact that we do not know how parcels will be redeveloped in the future. For the purposes of this analysis, we assume that redevelopment sites will follow the general pattern of existing land uses by TAZ. Thus, we relied on existing site conditions (e.g., % of sites with lot line to lot line development) to predict future demand from new/redevelopment sites.

For parcels with greater than 90% impervious area, we assume there is little room to effectively implement stormwater management practices that could retain required runoff from all impervious surfaces. We anticipate these sites would have more difficulty implementing on-site retention due to the limited land capacity and the opportunity cost of using land to manage stormwater in high density development zones. Additionally, parcels with more than 50% of their land located on poorly drained soil areas would likely not be able to infiltrate runoff on-site. We estimate at least 3,219 impervious acres of parcels meet these criteria. These parcels constitute potential demand sites (if they were to be redeveloped).

Since MRP requirements only apply to new and redevelopment projects, we needed to filter our results based on whether land was expected to be redeveloped. C/CAG shared data on acres of projected growth of single-family housing, multifamily housing and commercial/industrial by TAZ through 2040. In total, these estimates project that a total of 1,170 acres of commercial and/or multifamily housing will be redeveloped. Since we are concerned with commercial retrofits, we calculated the proportion of multifamily housing and commercial/industrial acres of projected growth relative to total area of each TAZ that is not classified as single family (or any of the other land uses excluded from our analysis). We applied this proportion to the area of identified potential demand parcels based on the TAZ in which the majority of the parcel is located. This generated an approximation of acres of new or redevelopment aggregated by TAZ that might have difficulty meeting stormwater regulations on site. Results of this analysis indicate that approximately 338 acres of development meet the criteria outlined above and might benefit from off-site compliance (approximately 30% of projected redevelopment acres).[9] The location of the projected acres of demand in new and redevelopment is visualized in Figure 1.

3.4 Supply and Demand Analysis

In this high-level analysis, we identified nearly 340 acres that would potentially serve as a source of demand for credits. As shown in Figure 1, that demand is driven by the areas C/CAG has identified as high priority for new and redevelopment over the next 20 years. We also identified over 3,500 acres of high priority supply sites. If GSI were implemented at these supply sites, C/CAG member agencies would see an increase in efficiency in stormwater management through dispersed GSI. This is particularly true if areas being redeveloped are already highly impervious and were not previously subject to stormwater management standards (i.e., there is no net harm from moving stormwater compliance off-site).

Stormwater credit trading can increase efficiency both by allowing flexibility for developers subject to stormwater regulations without sacrificing valuable land assets, and by distributing stormwater infrastructure geographically to areas that offer greater benefits of on-site management. To demonstrate these benefits, Figure 2 shows a high demand TAZ around Redwood City, and high priority supply parcels within the TAZ and the surrounding region. While overlap of potential supply and demand exist in the area just southeast of Redwood City towards North Fair Oaks, there is a high concentration of projected new and redevelopment parcels that might seek compliance off-site in Redwood City center. There is also a pocket of high priority supply parcels just south in Menlo Park.

Potentially, a credit exchange program could encourage developers in Redwood City to pursue off-site compliance, while facilitating their purchase of credits created by distributed GSI in Menlo Park. Figure 3 demonstrates the additional benefits of allowing for off-site compliance. Figure 3(a) shows that the areas of high development that would generate demand are located outside of a flood zone, while the concentration of priority supply sites in Menlo Park could potentially be designed to reduce localized flooding in that area. Additionally, Figure 3(b) shows some sites in Menlo Park as well as a few supply sites to the northwest of Redwood City that are located in areas that have high potential for groundwater recharge if stormwater were to be infiltrated intentionally in these locations.

[9] This estimate may be reduced if there are redevelopment projects that qualify as Special Projects and could more easily achieve compliance on-site with non-LID treament measures, which is allowed in the current MRP.

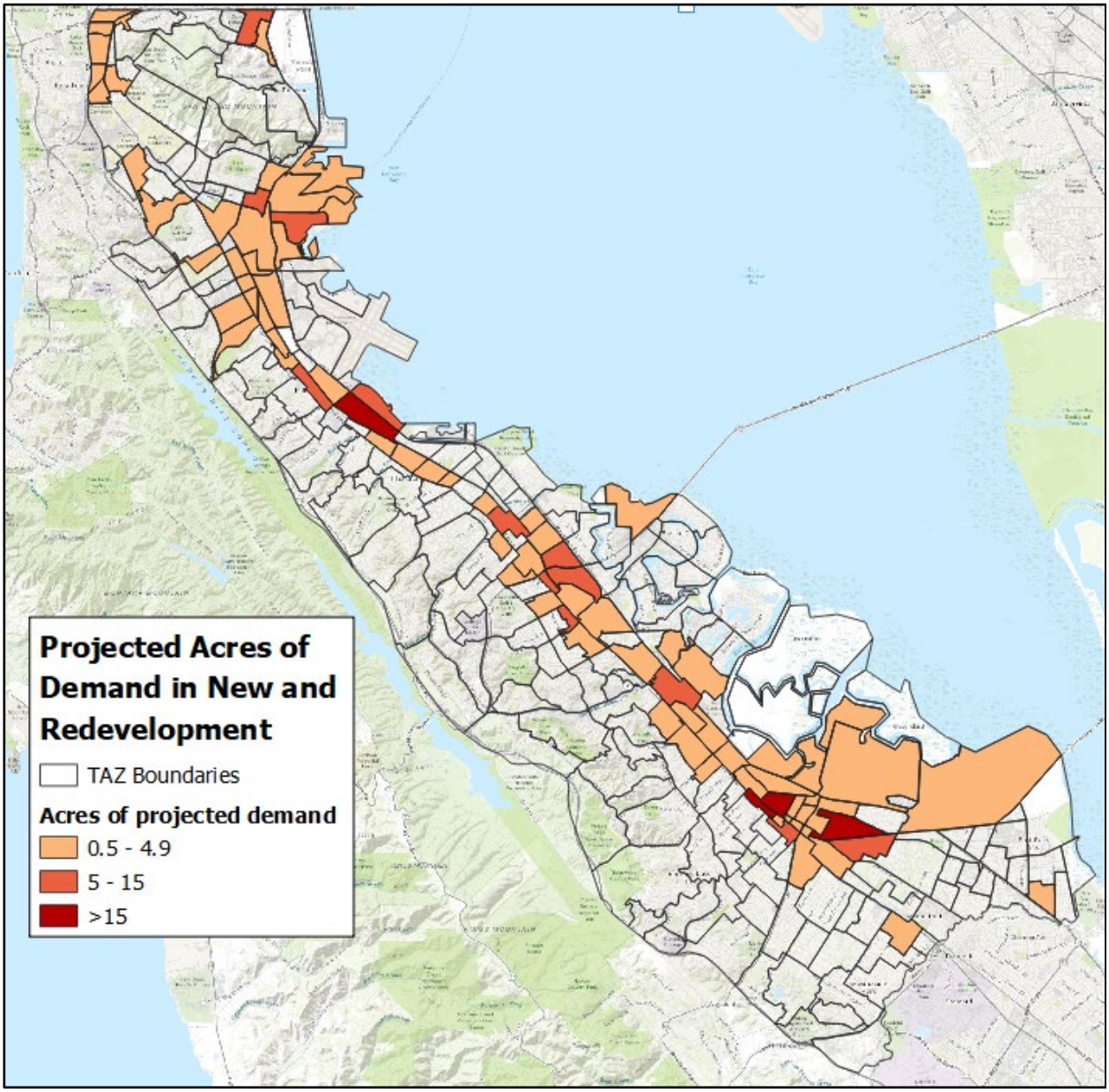


Figure 1. Projected acres of demand in high priority development areas by TAZ

4. Integration into Regional Collaboration Framework

As discussed previously in this report, C/CAG is working to advance the implementation of multi-benefit regional stormwater capture projects and distributed GSI in San Mateo County through a Regional Collaboration Framework to provide more cost-effective implementation of municipal stormwater management, while complying with MRP provisions. Stormwater credit trading could potentially become a component of the Regional Framework, with large scale regional projects, sustainable streets projects, and private parcel GSI serving as a "bank" of supply credits for public and private sector buyers. One challenge we encountered during our analysis was the task of normalizing metrics for measuring

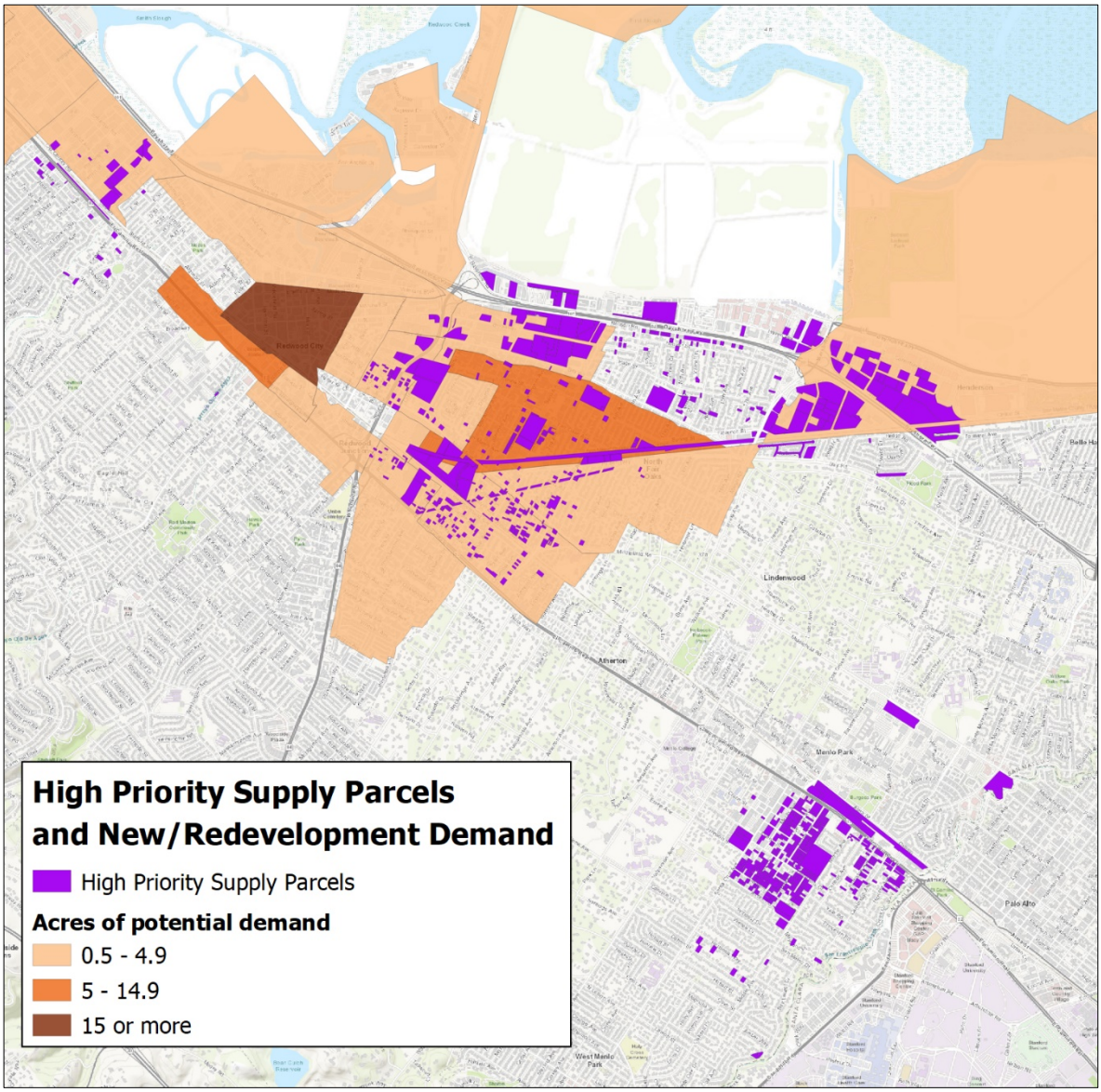
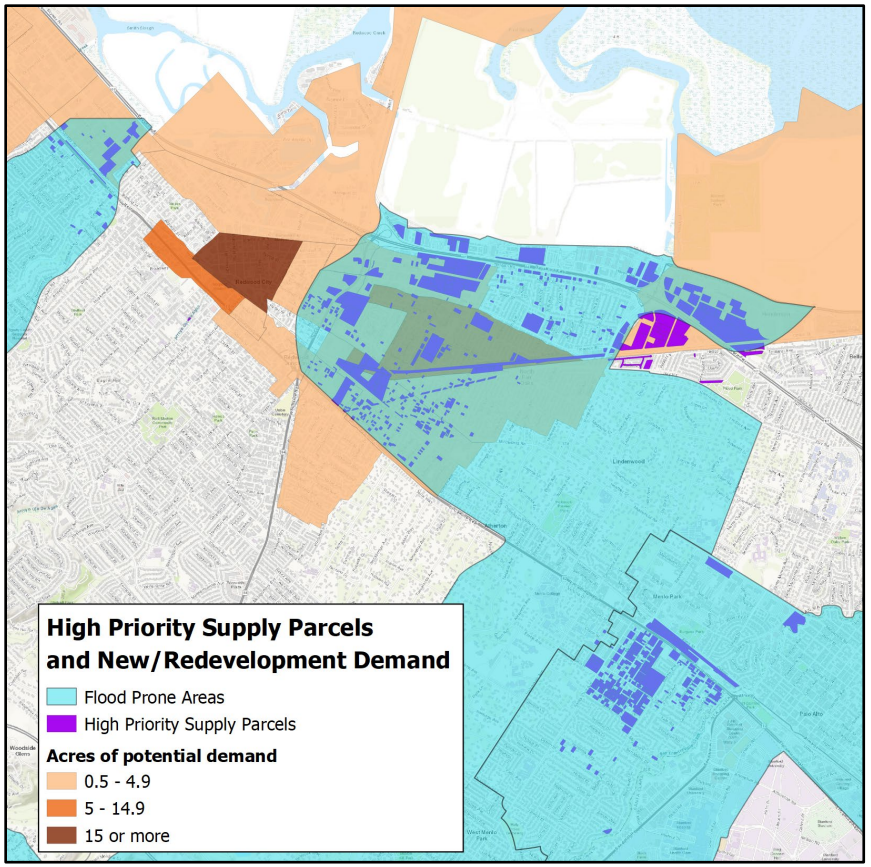
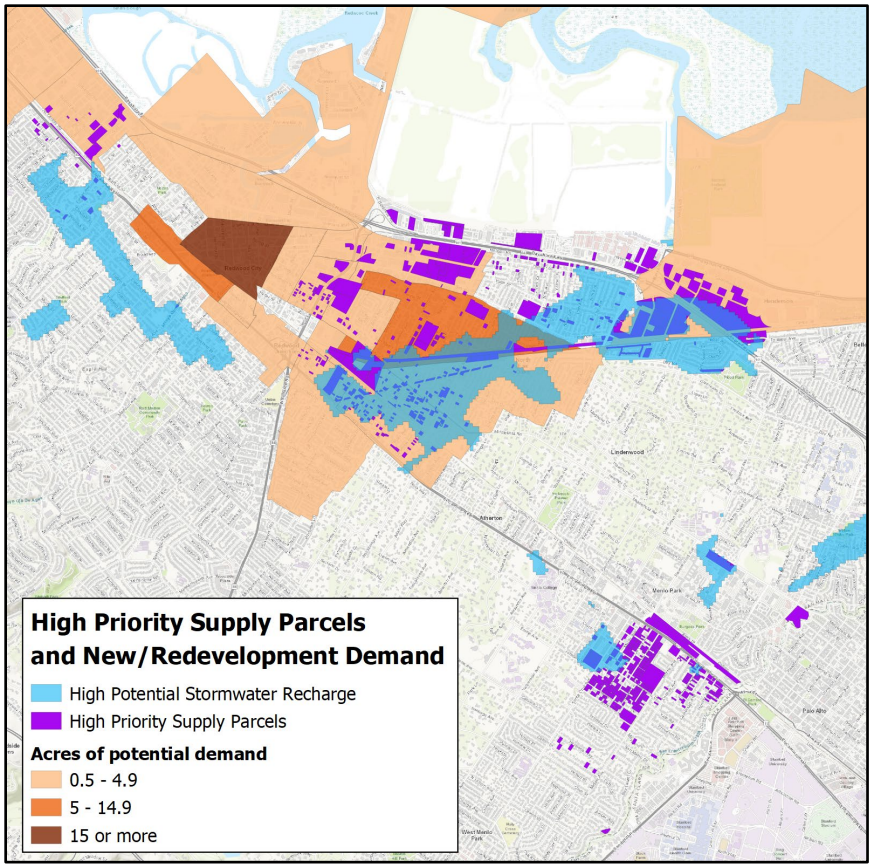


Figure 2. High potential demand in Redwood City TAZ and high priority supply parcels in the surrounding area.

acres of land or volume of stormwater managed by different project types. For consistency, we adopted the definition of a "greened acre" from Geosyntec: *treatment of stormwater runoff through green stormwater infrastructure (GSI) sized per the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) requirements, or "GSI-equivalent" treatment*. There is some ambiguity with the permit's C.3 provisions regarding standards for stormwater management, in part due to the differences in rainfall across the County. To quantify and compare supply, we applied the same stormwater capture volume standard used in the Geosyntec business case (infiltrating runoff from the 85th percentile 24-hour storm runoff event, which averages 0.57 inches across the County).


High Priority Supply Parcels
and New/Redevelopment Demand
Flood Prone Areas
High Priority Supply Parcels
Acres of potential demand
0.5 - 4.9
5 - 14.9
15 or more


High Priority Supply Parcels
and New/Redevelopment Demand
High Potential Stormwater Recharge
High Priority Supply Parcels
Acres of potential demand
0.5 - 4.9
5 - 14.9
15 or more

4.1 Potential sources of public supply

In addition to parcel-based projects, GSI investments made in the public right of way could serve as a supply of stormwater credits. Per discussions with C/CAG, any publicly owned GSI stormwater management project constructed after 2015 and not built to satisfy requirements for a regulated project would be eligible to generate credits that count towards supply or be entered into the "bank" of credits. The sources of potential supply and their associated greened acres and volume of stormwater managed are summarized in Table 1 as follows:

- Public Green Streets projects are relatively small-scale GSI projects that have been constructed in accordance with the Local San Mateo County Integrated Safe Routes to School and Green Infrastructure Project. These projects collectively manage 22.0 greened acres.
- The Sustainable Streets Master Plan Priority Projects have been designed but are not yet constructed. The 11 proposed projects would manage 18.8 greened acres.
- San Mateo County has four regional projects in varying phases of implementation (including Orange Memorial Park, which has been completed). Together, these projects will collectively manage an estimated 692 greened acres.
- Craftwater conducted an optimized regional project analysis and identified 14 high priority large-scale regional projects. These projects have only been evaluated at a high level but could collectively manage the 85th percentile runoff volume from 2,321 acres.

Table 1. Potential publicly owned sources of stormwater credit volume supply (assuming infiltration of 85th percentile storm, rainfall depth average)

Public Projects Supply	Status	Greened Acres	Volume Infiltrated (AF)
Green Streets projects	Constructed	22.0	1.1
SSMP Priority Projects	Planned	18.8	0.9
Regional Projects	Planned/Implemented	692	32.9
Regional Projects	Proposed	2,321	110.2
Total		3,072	145.9

4.2 Potential sources of public demand

In addition to generating a bank of supply credits for cost-effective stormwater management, regional collaboration could also generate additional demand for credits. Public municipalities and other permittees, CalTrans, and potentially even water supply agencies (if projects are infiltrating groundwater) could participate in the market on the purchasing side. Without an extensive survey of forecasted improvement or development plans and/or more information on the technical and economic constraints on achieving future pollutant reduction or greened acreage goals on a jurisdiction-by-jurisdiction basis, it is difficult to estimate the quantity of demand that might be generated by public agencies or other permittees. However, it is helpful to acknowledge that the demand generated by private new and redevelopment projects outlined in the previous section is just one component of total possible demand.

5. Stormwater Volume-Based Credit Cost Analysis

For private developers and public agencies alike, one of the main drivers for exploring alternative compliance is the high cost of managing stormwater on-site. Credit trading can provide an economically favorable avenue for compliance. There are two ways to consider these cost efficiencies. First, in dense areas of new and redevelopment the physical space required to manage stormwater can have a high value for other uses. Accounting for the opportunity cost of using that space for other purposes can make on-site compliance more expensive. Second, if all credits, from large scale public projects to small scale private retrofits, are banked, then purchasing volume-based credits could be less expensive than managing stormwater on-site. The costs of credits are highly dependent on the structure of the market, so the methodology presented here is purely demonstrative in nature and would likely be refined as/if the program moves forward.

We began the cost analysis by gathering regionally specific cost data (where available) for the different types of projects that could serve as a source of supply. The cost data and sources are summarized in Table 2. The costs are difficult to compare side by side since the data available did not offer a breakdown of included expenses. Capital cost and overhead and maintenance (O&M) cost estimates were sourced from the Geosyntec Business Case when possible. The Sustainable Streets Master Plan provided cost estimates for the identified priority projects. Private project costs were calculated from engineering estimates from the project team's previous work as well as grant amounts for GSI capital construction projects from the San Francisco Public Utility Commission. O&M costs were drawn from a combination of Community-enabled Lifecycle Analysis of Stormwater Infrastructure Costs (CLASIC) developed by the Water Research Foundation (2020) and estimates from previous work.

Table 2. Capital and O&M Costs by Project Type

Project Type	Capital cost per greened acre	O&M cost per greened acre	Source
Green Streets projects	$230,000 - $301,000	$9,200	Geosyntec, 2021
SSMP Priority Projects[a]	$1,605,433	$9,200[b]	SSMP, Appendix E, 2021
Implemented Regional Projects	$68,250	$4,360	Geosyntec, 2021
Proposed Regional Projects	$69,000	$4,360	Geosyntec, 2021
Private Projects	$165,000 - $736,201	$1,960 - $6,610	Various

a. The costs for the SSMP projects were obtained from the SSMP (Appendix E). The project team notes that these cost estimates are much higher than the estimates for other projects. This is because these projects include additional components such as bikeways, medians, and pedestrian improvements. A decrease in these costs (e.g., if only stormwater management costs are included) would further reduce potential credit prices. The SSMP did not separately allocate costs across project components.

b. Due to the high cost of the SSMP projects, we assumed the O&M for the stormwater component of the SSMP projects would be the same as reported by Geosyntec 2021 for green street projects (estimated at 4% of the low-end estimate for green street projects).

The value, or price, of a credit will be determined by the costs of installing and maintaining GSI projects. If all supply credits are aggregated and banked, and then credit prices could be set at the weighted/pooled average. Under these circumstances, costs to purchase credits from banked supply could be less expensive for developers than managing stormwater on-site. Understanding an average cost per volume therefore provides insight into what the value of a stormwater volume credit might be

on a market. The methodology for estimating a cost per credit outlined below is demonstrative, as the true cost per credit will depend largely on the mix of credits coming from different supply sources.

The price of a credit will also depend on how a credit trading system is structured: a one-time purchase of credits will be very different than purchasing a "capital" credit up front with an annual fee for maintenance. For example, prices in the stormwater credit trading market in D.C. reflect the annualized capital and O&M costs of the originating projects. Because the program essentially requires property owners to purchase credits every year, it increases the cumulative cost for property developers. Although this cost may be very expensive for private property owners, it is often less than the economic value of the property that can be used for non-stormwater management purposes. Because some portions of San Mateo County have comparable land values, the DOEE market model may be economically feasible. This is not the case in Grand Rapids, MI where the credit trading program (which is currently being designed by project team members and city staff) is structured around a single, up-front purchase that incorporates maintenance costs. This approach reduces overall costs for purchasing project developer while requiring a larger initial investment. This model may be a viable alternative for San Mateo County, recognizing the wide disparity of property values and stormwater management costs across the county.

As shown in Table 3, we used the cost estimates presented above to calculate a cost per cubic foot of stormwater managed by each project type. To calculate a weighted average of capital costs per cubic foot of stormwater managed, we included the total potential supply from public projects (see greened acres managed from Table 1). For potential private credit-generating sites, we assumed that 25% of the potential greened acres identified in the supply analysis would be managed through GSI installations/serve as credit supply sites (880 greened acres from the total 3,500). Based on this methodology, we estimate that the value of a credit could range from $48 - $110 (capital costs only). For O&M the weighted average cost amounts to $1.87 – 2.37. However, the actual credit price would vary based on the way a market is structured and how much supply comes from different sources.

Table 3. Potential sources of stormwater credit supply

Project Type	Capital Cost per Cubic Foot	O&M Cost per Cubic Foot
Green streets projects	$128	$4.45
SSMP priority projects	$776	$4.45
Implemented regional projects	$33	$2.11
Proposed regional projects	$33	$2.11
Private parcel-based projects[a]	$80 - $356	$0.95 - $3.19
Weighted average credit price	$61 - $208	$1.50 – $2.70

a. Low end of the range for private parcel-based projects is $165,000 per greened acre – this is based on the assumption that private property retrofits would be at least as cost-effective as public parcel-based GSI. Although based on the project teams experience private parcel-based projects are often less expensive than public projects. The high-end estimate is $736,201 – this is based on costs for retrofits funded through SFPUC's GSI grant program. Costs do not include profit/ROI for private credit suppliers.

The Reasonable Assurance Analysis (RAA) for San Mateo County (2020) reports the average cost of on-site compliance for redevelopment sites as $153,000 per greened acre, or approximately $74 per CF. This estimate for on-site compliance cost is within the middle of the estimated weighted average price of a stormwater volume credit. However, if the $153,000 reflects an average cost (as reported in the RAA), sites facing technical constraints or site conditions that make it difficult to implement GSI would likely face increased costs. In addition, this estimate does not include the opportunity cost to developers and property owners of having to use limited and valuable space to manage stormwater. Including these costs would make the value of purchasing stormwater credit on the market much more competitive with on-site compliance. Finally, the nature of credit trading will drive project developers to implement projects where they are most cost effective (and to implement the most cost-effective controls). Thus, the average costs of credit-generating retrofits may be much lower than the estimates used in this analysis. At the same time, the regional projects drive the weighted average price downwards; if fewer regional projects are implemented, the average credit price will increase.

6. Summary and Conclusions

6.1 General conclusions of analysis

Our analysis suggests that under more stringent regulatory requirements, and with the inclusion of regional stormwater projects, a credit exchange/banking program may be viable within C/CAG member communities. Under these conditions, there appears to be sufficient demand for off-site compliance. Likewise, the distribution of less densely developed parcels in areas of suitable soils indicates the potential the creation of supply credits from GSI retrofits or redevelopment projects. However, the influence of the regional projects on credit price indicates that an exchange program likely would be more successful if structured as a pooled bank of credits that developers, public agencies, and other permittees could draw upon. In this way, rather than a true credit trading program, private suppliers would essentially receive a direct incentive as a payment for their credits.

6.2 Additional analyses for consideration

While resolving some threshold feasibility questions, the team's analysis left unanswered several more detailed questions about the structure, administration and economic underpinnings of a pooled credit exchange program. In this section, we will provide some additional variables for consideration.

6.2.1 Alternative approaches to forecasting supply

When analyzing supply from private commercial parcels, this report only included potential high priority supply sites that could provide additional stormwater management benefits for locating GSI on-site (e.g. supply sites that were ranked 3 or greater in our simple prioritization methodology). However, our analysis identified a total of close to 9,500 impervious acres that could potentially be retrofitted. This includes supply from neutral sites while still excluding those parcels located in areas with poorly draining soils and/or do not have a significant amount of impervious area to manage.

Another consideration for supply is the concerns for cost-effectiveness of managing stormwater on-site. This broad analysis did not fully consider challenges that different geographies or land use types might have in implementing GSI. It's possible that some high priority supply sites we have identified in this report would not even be feasible due to locational attributes that could not be included in this analysis. A more refined analysis of potential private would likely be necessary and could further inform the

structure of the program (e.g., by identifying areas where additional incentives might be offered to encourage supply development).

6.2.2 Alternative approaches to predicting demand

When considering potential demand, it is likely that the number of new and redevelopment acres identified in this report are an undercount of total potential demand. Municipalities, other permittees, CalTrans and other public entities could increase demand through infrastructure improvement programs. A more thorough examination of potential private commercial demand could also provide additional insight. This analysis was limited to current land use types, so parcels that are un- or underdeveloped (such as vacant lots) are not included in our count of demand acres. As with supply, a more careful look at areas of planned redevelopment by local officials could improve the demand analysis.

6.2.3 Administration of a pooled credit exchange

The pooled credit approach suggested in the team's conclusions will require some form of centralized administration. This analysis did not evaluate whether or not C/CAG is the right entity to provide this administration, or whether there are other options available. For example, it may be appropriate to engage a 3rd party program administrator, or to locate administration within a county agency or special district. The team can suggest that a future analysis consider the range of program administration tasks likely to be required for the development, operation, and support of a pooled credit exchange program. One administrative role is worth drawing particular attention to. A necessary component of a trading or exchange program is the ability to ascertain compliance at the site level. In order to this, C/CAG member agencies must be assured that projects generating credits meet all technical standards (certify credits), that credit purchases meet the required off-site compliance volumes, that purchases of credits are logged to the purchaser in a way that verifies compliance, and that credits are not sold to multiple parties at the same time. All of these factors must be built into a robust credit tracking system and complemented with periodic site inspections. A program administrator must have sufficient financial and staff resources to develop and maintain a tracking system. These resources are, in turn, dependent upon the structure of that system and the degree to which it can leverage or be integrated into existing data management resources.

6.2.4 Trading Geographies and Credit Ratios

Finally, there are many geographic considerations that extend beyond the scope of this work, including the delineation of any potential trading area boundaries within the Bayside portion of the C/CAG member area. Regional authorities should consider the importance of storm sewer-shed boundaries, water quality considerations, groundwater basins, drainage areas and jurisdictional priorities when designing trading zones or regulations of a credit market. Attention to socially equitable distribution of GSI to areas with more vulnerable populations may also be a priority for C/CAG, as well as trading across different land use categories.

6.2.5 Credit Trading Ratios

It is common for alternative stormwater compliance programs to have some form of trading or off-site ratio which requires increased levels of retention or treatment or other "net benefits" for when developers opt for an off-site option. For example, Grand Rapids Michigan's MS4 permit specifies that projects seeking compliance must install (or cause to be installed) 1.5 times the volume needed to meet

compliance minimums. In some high priority watersheds, this ratio increases to 2:1. From a purely market perspective, these requirements increase costs for off-site compliance, perhaps to the point of disincentivizing participation in trading markets or similar programs. Indeed, there does not appear to be compelling evidence that the increased requirements are necessary to achieve water quality or flood control goals. Future refinement of a credit-based approach for San Mateo County should include an evaluation of necessary or desirable ratios, as current and proposed alternative compliance provisions in the MRP require any offsite compliance to achieve a net benefit.

6.2.6 Drainage District and Municipal Standards

This evaluation focused on the post-construction stormwater management requirements imposed by permittees to meet MRP obligations, and does not take into account the effects of local standards. For example, the County of San Mateo has developed a draft drainage manual which proposes prescriptive/runoff management requirements for projects between 750 sq ft and the C.3 threshold (~5,000 sq ft) as well as additional runoff management requirements for C.3 projects. If adopted, both could have the effect of increasing supply and demand within the pooled credit exchange approach.

Likewise, some C/CAG member communities (e.g., Hillsborough and Atherton) have infiltration / retention requirements that are more stringent than MRP requirements for single family home projects. A future analysis should account for such localized standards in forecasting demand and supply, and in establishing protocols for credit purchase and sale. Because the credit trading program would be volume based, there may be a translation factor that could incorporate different standards.

6.2.7 Purchase and payment structure

As indicated in a preceding section, determining the frequency that credits must be purchased, and their duration, has direct implications for not only credit price but also the administration of a pooled credit exchange. A deeper analysis of the economic effects of single vs. multiple purchase requirements will inform C/CAG member agencies' dentification of a scheme that creates a stable, self-sustaining exchange program without creating undue economic hardships on participants.

In addition, in some instances of an expanded credit trading program private project developers may essentially receive a direct incentive (e.g., payment from municipalities) to add supply to the credit bank (in the form of GSI parcel-based projects)). The way this payment is structured also requires some consideration. For example, it could be provided as a set amount per greened acre (similar to how Philadelphia has structured its Greened Acre Retrofit Program). It may be on a reimbursement basis (although this would require additional administration) or through an innovative project delivery model (e.g., community-based partnerships). Additional incentives may also be necessary to further encourage supply in high priority areas.

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APPENDIX E
Funding and Financing Countywide Green Stormwater Infrastructure Investments

Funding and Financing Countywide Green Stormwater Infrastructure Investments

An Exploration of Options for Investing in Regional-Scale and Parcel-Scale GSI throughout San Mateo County

Final
November 15, 2021

Prepared for the City/County Association of Governments of San Mateo County

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Executive Summary

The City/County Association of Governments of San Mateo County (C/CAG) implements the San Mateo Countywide Water Pollution Prevention Program (SMCWPPP) established in 1990 to reduce the pollution carried by stormwater into local creeks, the San Francisco Bay, and the Pacific Ocean in partnership with each incorporated city and town in the county, and the County of San Mateo, which share a common National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System permit. As part of the SMCWPPP implementation, C/CAG is working to advance regional-scale and distributed, parcel-scale green stormwater infrastructure (GSI) projects in San Mateo County by developing a Regional Collaboration Program Framework to describe a countywide stormwater program focused on both potential regional projects and distributed green infrastructure implemented by private sector developers that can provide water quality and resiliency benefits. C/CAG is also working to identify potential funding and financing mechanisms to implement the strategies to be identified in the Regional Collaboration Program Framework.

As part of WaterNow's Tap into Resilience (TiR) initiative, this report details WaterNow's initial legal and accounting analyses of the potential funding and financing options available to C/CAG, its members, and possible regional partners to inform and advance San Mateo County's increased investments in countywide regional-scale green infrastructure as well as parcel-scale green infrastructure. This report also explores a hypothetical spending plan for a large-scale green stormwater infrastructure program in San Mateo County that includes multiple regional-scale and robust investment in distributed, parcel-scale projects built over a 20 year timeline.

Hypothetical Spending Plan: Large-scale GSI Program

To examine what it would take to invest in a large-scale green stormwater infrastructure program that includes multiple regional-scale and robust investment in distributed, parcel-scale projects built over a 20 year timeline in San Mateo County, based on discussions with the project team and available cost estimates, WaterNow developed a hypothetical spending plan representing rough estimates of the cost to build and maintain regional-scale and parcel-scale green infrastructure projects. The full spending plan is available in Appendix A.

The spending plan includes investments in 10 regional-scale projects over a 20-year period, and an annual investment of $1.5 million in parcel-scale projects each year for 20 years. Because the spending plan is a hypothetical example, it is based on several assumptions discussed with the project team, which are:

- Ten region-scale projects were estimated to cost $15 million each. We assumed capital investment in these regional-scale projects would be concentrated in the first ten years of the 20 year plan. Capital costs for regional scale projects total $150 million.
- Parcel-scale capital costs total $28.5 million.
- Maintenance costs were estimated to be 1.5% of the construction costs per year for each major project for a total of $23.6M. In addition, operations costs were increased over time to reflect increases in staff, consultant, and other needs associated with the

growing GSI program. Operations and maintenance for all project types is estimated at $71.1 million during the 20 year timeline of the hypothetical plan.

In sum, the spending plan would cost a total of about $250 million over 20 years. This mix of regional-scale and distributed, parcel-scale projects was chosen as a hypothetical scenario to help theorize how San Mateo County can achieve overall Total Maximum Daily Load (TMDL) goals for PCBs as well as a green acres objective of 6,000 green acres by 2030 with a focus on cost-effective regional projects. While existing and planned GSI projects in the County have put the County on the path towards meeting these goals, additional countywide GSI installations will be needed to achieve the longer-term pollutant reduction goals for the County's population based share of the TMDL.

To fund this type of program, C/CAG will need to establish a mix of potential funding options, as a single funding source is unlikely to generate sufficient revenue to meet program needs. A potentially feasible funding portfolio would include:

- Property-related stormwater fee and/or parcel tax;
- Tax increment revenues;
- Water rates; and
- Wastewater rates.

Achieving the hypothetical spending plan will also require using a debt-financing approach to pay for capital investments in both regional-scale and parcel-scale GSI. For example, issuing three bonds every 5 years during the 20 year period and assuming $10 million in annual revenues would meet the $178.5 million capital needs included in the hypothetical plan. This debt-financing approach would help reduce strain on revenues, i.e., rates, by spreading the costs of the spending plan over a long period of time. In particular, if the spending plan were debt-financed with bonds with repayment terms longer than the 20-year period, the County would have the benefit of repaying $64 million over future years. This extended repayment period would help lessen the impacts of the large-scale program on rates.

This hypothetical mix of regional-scale and distributed, parcel-scale projects was chosen to theorize a possible pathway for funding and financing a large-scale green infrastructure program, and provides a framework for decision making going forward. In that process, decision-makers will need to consider:

1. What is the appropriate level of green infrastructure spending?
2. Is it possible to raise the revenue needed to meet the level of spending?
3. What is the appropriate and feasible mix of revenues?

The Potential Funding and Potential Financing Options sections provide analyses to support decision-makers as they work to answer these questions.

Potential Funding and Potential Financing Options

This report explores four potential funding options available to C/CAG, its members, and potential regional partners to pay for investments in all scales of green stormwater infrastructure: (1) non-balloted stormwater fee; (2) enhanced infrastructure financing district; (3) water rates; and (4) sewer rates. WaterNow's preliminary legal analysis finds that there is potential for each of these options to be used to pay for countywide GSI investments. While accessing one of these funding options alone is unlikely to meet the green infrastructure investment needs of San Mateo County communities, if combined into a portfolio of revenue streams these options may provide a pathway for creating a dedicated source of revenue for long-term stormwater management, including capital investments and ongoing operations and maintenance of those facilities.

To provide information on how these potential funding options can be fully leveraged, this report also explores three potential financing options available to C/CAG, its members, and potential regional partners to finance capital investments in all scales of green stormwater infrastructure: (1) revenue bonds; (2) State Revolving Fund loans; and (3) Water Infrastructure Finance and Innovation Act (WIFIA) loans. WaterNow's preliminary legal analysis finds that there is potential for each of these options to be used to finance countywide GSI investments in both regional- and parcel-scale facilities.

Further, from an accounting perspective, as governmental agencies with governing boards empowered to set rates C/CAG's members can likely meet the requirements for capitalizing investments in GSI with Regulated Operations accounting. Regulated Operations accounting allows public agencies to book the cost of "business-type activities" as assets instead of annual expenses. The Regulated Operations approach is a complete alternative to traditional public agency accounting for capital assets, and, importantly, allows local governments to access municipal bond proceeds and other forms of debt to invest in consumer rebate (and/or direct installation) programs. For example, Los Angeles Department of Water and Power uses municipal bond proceeds to finance consumer rebate programs for a variety of water efficiency and stormwater capture programs, including rebates for water-efficient installations, high-efficiency washing machines, permeable pavement, rain barrels, cisterns, and replacement of turf with low-water landscaping using Regulated Operations accounting.

WaterNow's analysis also finds that using public dollars to invest in GSI on private property would serve public purposes, and would, thus, not run afoul of California's prohibition against the gift of public funds is set out at Article XVI, section 6 of the California Constitution. In California, as in most states, so long as the public funds used for private property investments serves a public purpose, there is no gift of public funds even if private persons benefit from the investment. The public purposes of parcel-scale GSI investments are cited throughout this report, including water quality improvement, urban flooding mitigation, and resilience to the impacts of climate change. Given these extensive public purposes, it is likely that using public rates and bond dollars to pay for parcel-scale GSI located on private property will not be a prohibited gift of public funds even if those projects incidentally benefit the private property owner where they are located.

To implement a large-scale, countywide GSI program, C/CAG and/or its member agencies will likely need to take a portfolio approach to funding and financing, as it is unlikely that any single revenue stream alone will be able to meet programmatic needs. Pursuing this portfolio approach within the countywide setting can be both a challenge and an opportunity. As this report outlines, there are a number of funding and financing options available to C/CAG and/or its member agencies, as well as potential regional partners, to build out this portfolio.

I. Introduction & Overview

The City/County Association of Governments of San Mateo County (C/CAG) implements the San Mateo Countywide Water Pollution Prevention Program (SMCWPPP) that was established in 1990 to reduce the pollution carried by stormwater into local creeks, the San Francisco Bay, and the Pacific Ocean in partnership with each incorporated city and town in the county, and the County of San Mateo, which share a common National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System permit. As part of the SMCWPPP implementation, C/CAG is working to advance regional-scale and distributed, parcel-scale green stormwater infrastructure (GSI)[1] projects in San Mateo County by developing a Regional Collaboration Program Framework to describe a countywide stormwater program focused on both potential regional projects and distributed green infrastructure implemented by private sector developers that can provide water quality and resiliency benefits. C/CAG is also working to identify potential funding and financing mechanisms to implement the strategies to be identified in the Regional Collaboration Program Framework.

As part of WaterNow's Tap into Resilience (TiR) initiative, as detailed below, WaterNow has conducted initial legal and accounting analyses of the potential funding and financing options available to C/CAG, its members, and possible regional partners to inform and advance San Mateo County's increased investments in countywide regional-scale green infrastructure as well as parcel-scale green infrastructure. The identified funding and financing options are informed by WaterNow and C/CAG's discussion on February 23 and March 5 scoping memo, as well as C/CAG's existing funding and financing analysis conducted by SCI Consulting Group.[2] The potential funding and financing options below were also informed by Geosyntec's May 2021 "Advancing Regional Stormwater Capture Projects: Drivers and Objectives" memo to ensure the possible funding and financing options identified can help meet the key drivers and objectives motivating San Mateo County's collaborative, integrated management of stormwater.

In addition, this report explores a hypothetical spending plan for a large-scale green stormwater infrastructure program in San Mateo County that includes multiple regional-scale projects and robust investment in distributed, parcel-scale projects built over a 20 year timeline.

II. Hypothetical Spending Plan: Large-scale GSI Program

To examine what it would take to invest in a large-scale green stormwater infrastructure program that includes multiple regional-scale projects and robust investment in distributed, parcel-scale projects built over a 20 year timeline in San Mateo County, based on discussions with the project team and available cost estimates, WaterNow developed a hypothetical spending plan representing rough estimates of the cost to build and maintain regional-scale and parcel-scale green infrastructure projects. The full spending plan is available in Appendix A. We provide a summary and considerations for future decision-making below.

The spending plan includes investments in 10 regional-scale projects over a 20-year period, and an annual investment of $1.5 million in parcel-scale projects each year for 20 years. This mix of regional-scale and distributed, parcel-scale projects was chosen as a hypothetical scenario to help theorize how San Mateo County can achieve overall Total Maximum Daily Load (TMDL) goals for PCBs as well as a greened acres objective of 6,000 green acres by 2030 with a focus on cost-effective regional projects. While existing and planned GSI projects in the County have put the County on the path towards meeting these goals, additional countywide GSI installations will be needed to achieve the longer-term pollutant reduction goals for the County's population based share of the TMDL.

Because the spending plan is a hypothetical example, it is based on several assumptions discussed with the project team, which are:

- Ten region-scale projects were estimated to cost $15 million each. We assumed capital investment in these regional-scale projects would be concentrated in the first ten years of the 20 year plan. Capital costs for regional scale projects total $150 million.
- Parcel-scale capital costs total $28.5 million.
- Maintenance costs were estimated to be 1.5% of the construction costs per year for each major project for a total of $23.6M. In addition, operations costs were increased over time to reflect increases in staff, consultant, and other needs associated with the growing GSI program. Operations and maintenance for all project types is estimated at $71.1 million during the 20 year timeline of the hypothetical plan.

In sum, the spending plan would cost a total of about $250 million over 20 years.

Next, we considered how these projects could be paid for assuming annual revenues of $10 million. Because there is not yet a dedicated revenue stream identified sufficient to meet these investments the project team chose $10 million in annual revenue as a hypothetical amount for the purposes of this exercise only. The remainder of this report discusses four possible sources of revenue that may be available to fund a GSI spending plan. As shown in the worksheet at Appendix A, using a PayGo—all cash—approach to fund the hypothetical spending plan, costs outpace revenues until the 12th year. Or, in other words, it would not be possible to implement the hypothetical spending plan on an all cash basis.

Alternatively, it would be possible to implement the spending plan using a debt-financing approach to pay for the capital investments. For example, issuing three bonds every 5 years during the 20 year period and assuming $10 million in annual revenues would meet the $178.5 million capital needs included in the hypothetical plan. This debt-financing approach also helps reduce strain on revenues, i.e., rates, by spreading the costs of the spending plan over a long period of time. In particular, if the spending plan were debt-financed with bonds with repayment terms longer than the 20-year period reflected in Appendix A, the County would have the benefit of repaying $64 million over future years. This extended repayment period would help lessen the impacts of the large-scale program on rates.

To fund this type of program, C/CAG will need to establish a portfolio of revenue streams representing a mix of potential funding options, as a single funding source is unlikely to generate sufficient revenue to meet program needs. A potentially feasible funding portfolio would include:

- Property-related stormwater fee and/or parcel tax;
- Tax increment revenues;
- Water rates; and
- Wastewater rates.

As explained in detail below, initial analyses demonstrate that a countywide Enhanced Infrastructure Finance District (EIFD) could generate $61 million in tax increment revenues over 20 years. Assuming a 1% tax increment funding stream from an EIFD, could reduce the revenue needs from other sources from $10 million to $7 million in the first decade of the spending plan, and further reduce the need for other revenues over time as the tax increment grows. In addition, a stormwater credit trading program incentivizing private investment in parcel-scale GSI may provide an additional avenue for C/CAG to bring revenues into its funding portfolio by offsetting the need to pay for parcel-level projects and by potentially becoming a source of revenue if regional projects generate credits saleable in the trading market.[3]

Establishing this portfolio approach, which will require collaboration with its members and regional partners, aligns with the goals and objectives of C/CAG's Regional Collaboration Program Framework as well as the Advancing Regional Stormwater Capture Projects: Business Case for Regional Collaboration.[4]

The spending plan demonstrates a possible pathway for funding and financing a large scale green infrastructure program for San Mateo County, and provides a framework for decision making going forward. In that process, decision-makers will need to consider:

4. What is the appropriate level of green infrastructure spending?
5. Is it possible to raise the revenue needed to meet the level of spending?
6. What is the appropriate and feasible mix of revenues?

The Potential Funding and Potential Financing Options sections below provide analyses to support decision-makers as they work to answer these questions.

III. Potential Funding Options

WaterNow has explored four potential funding options available to C/CAG, its members, and potential regional partners to pay for investments in all scales of green stormwater infrastructure: (1) non-balloted stormwater fee; (2) enhanced infrastructure financing district; (3) water rates; and (4) sewer rates. While accessing one of these funding options alone is unlikely to meet the green infrastructure investment needs of San Mateo County communities, if combined into a portfolio of revenue streams these options may provide a

pathway for creating a dedicated source of revenue for long-term stormwater management, including capital investments and ongoing operations and maintenance of those facilities. And as explained in the Potential Financing Options section, below, these revenues can be further leveraged by debt-financing regional and parcel-scale GSI investments.

Each of the potential funding options is described in detail below.

A. Non-Balloted Stormwater Fee

Establishing a dedicated stormwater fee, separate from existing water and sewer fees, will likely be a key component of any funding portfolio for investing in GSI in San Mateo County. California's Proposition 13 and Proposition 218 (and subsequent ballot measure Proposition 26) have created a complex fabric of legal requirements that local governments must meet before they can impose such a fee.

The following sections provide a summary of the: (1) requirements and/or eligibilities for non-balloted stormwater fees, (2) types of entities that can impose a non-balloted stormwater fee, (3) authorized uses of revenues generated from non-balloted stormwater fees, and (4) types of GSI investments non-balloted stormwater fees can fund.

1. Authority to Establish Non-Balloted Stormwater Fees

C/CAG consultants have previously evaluated the prospect of establishing a voter-approved stormwater fee that meets the requirements of Proposition 218.[5] Those prior evaluations also provide a preliminary analysis of the amendments to the California Government Code implementing Prop 218 enacted in 2017, i.e., SB 231 (Hertzberg), and how those amendments might apply to property-related fees imposed to pay for stormwater services.[6] To build on these existing materials and because establishing a dedicated, separate revenue stream to fund stormwater investments and operations and maintenance is likely an essential element of a funding portfolio, this section outlines the requirements and/or eligibilities that must be satisfied to impose a property-related fee for stormwater services that is not approved by voters and follows the guidance of SB 231. For purposes of this report we refer to such as fee as a "non-balloted stormwater fee."[7]

As an initial matter, we note that establishing a non-balloted stormwater fee would be a novel approach that has not yet been tested by California courts and may be subject to legal challenge. The analysis below provides possible pathways for creating a Prop 218 compliant non-balloted stormwater fee; however, additional legal analysis is needed and we do not offer an opinion on the legality of this approach.

i. What Is a Non-Balloted Stormwater Fee?

The baseline requirement in California is that all property-related fees must be approved by a majority of the owners of the property subject to the fee or by a two-thirds vote of the electorate residing in the affected area.[8] Fees for sewer, water, and refuse collection services are exempt from this voter approval requirement.[9] In the 2002 *City of Salinas* decision, the California Appellate Court found that Salinas's storm drainage fee did not fall within this exception because it was a property-related fee for a property-related service and "sewer services" or "water services" did not include stormwater management. Since this decision, establishing property-related stormwater fees has required voter approval.

However, in response to the *City of Salinas*, via SB 231 (Hertzberg) the California Legislature amended section 53750(k) of the Government Code to legislatively extend the definition of "sewer" to encompass stormwater:

> "Sewer" includes systems, all real estate, fixtures, and personal property owned, controlled, operated, or managed in connection with or to facilitate sewage collection, treatment, or disposition for sanitary or ***drainage*** purposes, including lateral and connecting sewers, interceptors, trunk and outfall lines, sanitary sewage treatment or disposal plants or works, drains, conduits, outlets for surface ***or storm waters***, and any and all other works, property, or structures necessary or convenient for the collection or disposal of sewage, industrial waste, or surface ***or storm waters***. "Sewer system" shall not include a sewer system that merely collects sewage on the property of a single owner.[10]

The Legislature further found and declared that for purposes of interpreting whether Prop 218 exempts fees or charges for sewer services the term "'sewer' should be interpreted to include services necessary to collect, treat, or dispose of sewage, industrial waste, or surface or storm waters, and any entity that collects, treats, or disposes of any of these necessarily provides sewer service."[11]

Thus—while these legislative amendments are not definitive authority and it will be up to the California courts to make the ultimate decision whether "sewer" includes stormwater—it may be possible to make the argument that property-related[12] stormwater fees are exempt from voter-approval requirements on at least two grounds. First, the stormwater fee may be able to avoid voter-approval requirements so long as the fee is imposed for services necessary to collect, treat, or dispose of storm waters. This approach would establish a dedicated, separate stormwater fee to pay for stormwater services. Second, to further make the case that property-related stormwater fees are exempt from voter approval requirements, it's suggested that the local governmental entity establishing the stormwater fee also demonstrate that the stormwater services have a nexus to sewer, water, and/or refuse collection services. Sewer, water, and refuse collection services are the categories of fees that are already exempt from voter approval requirements. Showing that stormwater services funded with a dedicated stormwater fee can also help provide water, sewer, and refuse services may be useful in demonstrating that the dedicated stormwater fee is exempt from

voter-approval requirements, too. As detailed below, regional-scale and distributed, parcel-scale GSI projects can potentially meet these definitions.

ii. Establishing a Non-Balloted Stormwater Fee

While voter approval for property-related stormwater fees necessary to collect, treat, or dispose of storm waters may not be needed, to establish a non-balloted stormwater fee, local agencies must meet certain other procedural requirements as follows:

1. Identify the parcels upon which the fee or charge will be imposed;
2. Calculate the amount of the fee or charge to be imposed;
3. Provide written notice by mail to the recorded owners of each identified parcel of the—
    a. amount of the fee or charge to be imposed
    b. basis for the calculation of the amount
    c. reason for the fee or charge
    d. date, time, and location of a public hearing on the proposed fee or charge.[13]

The agency proposing the fee or charge must conduct a public hearing on the proposed fee not less than 45 days after the mailed notice.[14] The agency must consider all protests against the proposed fee at the hearing, and if a majority of identified parcel owners protest in writing the agency may not impose the fee.[15]

In addition to these procedural requirements, property-related stormwater fees must meet these requirements:

1. Revenues derived from the fee or charge may not exceed the funds required to provide the property related service;
2. Revenues derived from the fee or charge must be used only for the purpose for which the fee or charge was imposed;
3. The amount of a fee or charge imposed may not exceed the proportional cost of the service attributable to the parcel at issue;
4. Service for which the fee or charge is needed must be actually used by, or immediately available to, the property owner being charged; and
5. No fee or charge may be imposed for general governmental services including, but not limited to, police, fire, ambulance or library services, where the service is available to the public at large in substantially the same manner as it is to property owners.[16]

As to the "proportionality" requirement, a property-related fee must bear a reasonable relationship to burden on or benefits to the property from the agency's activity.[17] For dedicated stormwater fees, the proportionality requirement could, for example, be met by establishing a fee based on a parcel's volume of stormwater runoff determined by impervious area or square footage. In addition, the fees imposed must be for the actual services the agency supplies and must be founded on the costs borne by the agency to provide those services.[18] As to immediate availability of services, a "minimum charge imposed on parcels

with connections to a water district's utility systems for the basic cost of providing water or sewer service, regardless of actual use, is a charge for an immediately available property-related water or sewer service …, and consequently does not require ballot approval by affected owners."[19]

Satisfying these requirements and eligibilities allows an agency to impose a new or increased property-related fee.[20]

2. Entities Authorized to Impose Non-Balloted Stormwater Fees

Prop 218 provides that an "agency" may impose fees for property related services. "Agency" means any "county, city, city and county, including a charter city or county, any special district, or any other local or regional governmental entity."[21] "Special district" means "an agency of the state, formed pursuant to general law or a special act, for the local performance of governmental or proprietary functions with limited geographic boundaries including, but not limited to, school districts and redevelopment agencies."[22]

i. C/CAG & C/CAG Members

As cities and a county, C/CAG's members are eligible entities. C/CAG and several C/CAG member cities already collect nominal stormwater fees, including Belmont, Brisbane, Burlingame, Daly City, East Palo Alto, Hillsborough, Menlo Park, Millbrae, Pacifica, San Bruno, San Carlos, and South San Francisco.[23]

In addition, C/CAG would be empowered to adopt a non-balloted stormwater fee as it was formed in 1990 as a joint exercise of powers between San Mateo County and all the cities and towns in San Mateo County.[24]

ii. Special Districts

Special districts in San Mateo, such as the Bay Area Water Supply and Conservation Agency (BAWSCA) and the Flood and Sea Level Rise Resiliency District (FSLRRD), would also be authorized to establish non-balloted stormwater fees. BAWSCA was created by the separate, but parallel, actions of 24 local government agencies in the Bay Area, as authorized by AB 2058, enacted by the California Legislature in 2002 to foster "coordinated planning and implementation of strategies for water supply, water conservation, water recycling, and repair and improvement of the San Francisco regional system,"[25] among other purposes.[1] The

[1] BAWSCA's governing board includes not only representatives from each of the 24 public agencies, but also from Stanford University and the California Water Service Company, both of which are long term wholesale purchasers of water from San Francisco. AB 2058 was the Legislature's response to problems related to the institutional framework in which decisions about regional water issues are made. BAWSCA provides the vehicle for member agencies to work with the San Francisco Public Utilities Commission on an equal basis. As referenced in AB 2058, the intent of the Legislature was to enable

FSLRRD was created by special act of the State to "conserve and reclaim water for present and future use within the district," among other purposes.[26]

3. Authorized Uses of Revenues Generated from Non-Balloted Stormwater Fees

Revenues generated from property-related stormwater fees must only be used for the purposes for which the fee was imposed, as defined in the public notice about the fee or charge.[27] Allowable uses of revenues from fees or charges include:

- capital improvements,
- changes in cost for providing the particular service, and
- costs of operating and maintaining the agency's system.[28]

Given that no agencies have imposed a non-balloted stormwater fees or charges, there are not yet any cases that provide guidance on stormwater-specific allowable uses of the revenues generated from stormwater fees or charges. Generally, however, agencies may not use revenues generated from property-related fees for general governmental services where the service is available to the public at large in substantially the same manner as it is to property owners, e.g. police, fire, ambulances, or library services.[29]

4. Funding GSI Investment with Non-Balloted Stormwater Fees

According to C/CAG's prior consultants:

> As they pertain to [GSI], property-related fees remain a flexible and stout funding source. … The scope of [GSI] is stretching the traditional boundaries of stormwater services, and great care must be taken when crafting a property-related stormwater fee structure. But just as water agencies have embraced conservation efforts and watershed habitat protections, so, too, can stormwater agencies carefully expand into the area of [GSI].[30]

While recognizing this prior analysis and caution, for at least four reasons it may be possible to use revenues from a non-balloted stormwater fee to pay for the currently proposed approach to invest in countywide stormwater management through regional stormwater capture projects and implementation of distributed, parcel-scale GSI.

First, C/CAG and/or its member cities and/or the County could satisfy the requirements of section 6(a) of Article XIII D. The parcels in the County upon which the stormwater fee would be imposed can be identified. The amount of the fee to include costs of green infrastructure

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local governments responsible for water distribution in the three counties to establish a multicounty agency authorized to plan for and acquire supplemental water supplies, to encourage water conservation and use of recycled water on a regional basis, and to assist in the financing of essential repairs and improvements to the San Francisco regional water system, including seismic strengthening.

facilities of all scales can be calculated. And the bases for the calculated amount and the reason for the fee can be provided, including, e.g., to improve water quality, reduce localized flooding, and create resilience to climate change and to meet the terms of the San Francisco Bay Regional Stormwater NPDES Permit, Order No. R2-2015-0049, Permit No. CAS612008 (MS4 Permit).[31]

Second, establishing a non-balloted stormwater fee that will be used to fund GSI investments could likely be designed to meet the proportionality and other requirements of Section 6(b) of Article XIII D. There do not appear to be any insurmountable legal barriers to structuring a non-balloted property-related fee or charge to meet section 6(b) of Article XIII D.[32] Further, a property-related stormwater fee in San Mateo County, or the cities in the County, would be imposed for actual services San Mateo County and the cities in the County, and/or C/CAG, supplies—C/CAG and its member cities and the County are responsible for countywide stormwater management, including for complying with the terms of the MS4 Permit.[33] And green infrastructure is an express part of providing these stormwater management services. The MS4 Permit requires development and implementation of a "Green Infrastructure Plan" for the inclusion of "low impact development drainage design into storm drain infrastructure on public and private lands, including streets, roads, storm drains, parking lots, building roofs, and other storm drain infrastructure elements."[34] A stormwater fee would help fund the implementation of these plans.

Given C/CAG and its members' responsibility to provide stormwater management services including by implementing green infrastructure the costs incurred to meet these responsibilities would serve as the basis for a fee for C/CAG and/or its members to provide stormwater management services, as required by section 6(b) of Article XII D.

Third, to build green infrastructure installations representing large regional-scale facilities and distributed parcel-scale facilities C/CAG and its members would incur capital improvement costs, the cost for providing stormwater management service in San Mateo County would increase due to these new green infrastructure facilities of all scales, and C/CAG and/or its members would incur costs of operating and maintaining these facilities. These are likely allowable uses of revenues from non-balloted stormwater fees or charges.[35] And because this would be a new fee in developing, designing, and noticing a property-related non-balloted stormwater fee or charge in San Mateo County C/CAG and/or its members can expressly cite these uses to make a clear connection between the fee or charge and the purposes for which it will be used.

Finally, with respect to further justifying a non-balloted approach under Prop 218, regional-scale, and distributed, parcel-scale GSI projects provide water, sewer, and trash/refuse services as co-benefits of GSI stormwater management services. GSI can provide water services by offsetting potable water use through rainwater harvesting and use for irrigation or other appropriate non-potable uses and recharging groundwater through infiltration thus replenishing drinking water supplies. It can provide sewer services either by keeping stormwater out of maxed-out sewer systems helping prevent sewer overflows and basement

backups and adding influent to wastewater treatment plants with reduced inflows resulting from conservation allowing improved water quality for effluent discharges or increased opportunities for water recycling. GSI can also be designed to provide refuse collection services by providing pre-treatment for refuse or potentially directing trash and litter carried by stormwater runoff to GSI features such as bioswales or detention basins where it can be collected and kept out of area surface waters. As explained above, fees for sewer, water, and refuse collection are exempt from voter-approval requirements.[36] Because GSI can provide these services there may be a strong argument that property-related fees to fund GSI investments are exempt from voter-approval requirements.

For example, the types of future GSI projects that may be fundable via a non-balloted stormwater fee would be similar to existing programs such as:

- C/CAG's Rain Barrel Rebate Program implemented in partnership with BAWSCA that provides rain barrels to residential customers in San Mateo County to keep polluted stormwater out of area surface waters and allow homeowners to use rainwater for outdoor irrigation;[37] and
- Regional-scale projects such as the Orange Memorial Park Storm Water Capture Project under construction as of 2021 in South San Francisco that diverts flows from Colma Creek for treatment via GSI and reuse for irrigation and groundwater recharge.[38]

While the Rain Barrel rebate program and the Orange Memorial Park project are already funded with other revenues, these projects serve as examples of the types of GSI facilities that a dedicated stormwater fee could pay for in the future, including to help fund ongoing operations and maintenance costs of those future projects.

Orange Memorial Park Stormwater Capture Project,
https://www.ssf.net/government/construction/orange-memorial-park-improvement

Projects eligible to be funded by a non-balloted stormwater fee may also include the potential projects identified by Craftwater Engineers to inform the Regional Collaboration Framework and Business Case for Green Infrastructure Investments. The top 14 projects are estimated to capture 214 acre-feet of stormwater per year, provide 1,365 acre-feet per year in water supply, and cover 5,459 acres for trash removal.

While non-balloted stormwater fees or charges are novel, and GSI for stormwater management is still a growing concept, using property-related taxes to pay for green infrastructure is not unprecedented. In November 2018, Los Angeles County voters passed a

parcel tax commonly referred to as "Measure W" that fund the Los Angeles County Flood Control District's Safe, Clean Water Program.[39] Prior to moving forward with Measure W, the Legislature amended the authorizing legislation for the Los Angeles County Flood Control District to specify that the District has authority to levy a tax to pay the costs and expenses of carrying out projects and programs to increase stormwater capture and reduce stormwater and urban runoff pollution in the District subject to voter approval.[40] The 2.5 cents per square foot parcel tax established by Measure W is assessed on non-exempt properties within the Los Angeles County Flood Control District service area and is based on the amount of stormwater each property generates, measured in terms of impervious area.[41]

The tax revenue generated is now being used to help LA County make much-needed infrastructure investments to manage its water supply through projects that capture rainwater and re-use it onsite or allow it to infiltrate back into the ground as well as its water quality through projects that manage rainwater at or near the site where it falls and prevents it from gathering pollutants. In particular, the tax revenues can be used for "Nature-Based Solutions."[42] As of April 2021, there are at least 89 infrastructure and 29 planning projects being funding with Measure W revenues that include nature-based solutions, including a:

- $5 million full-scale, multi-benefit green street project in Beverley Hills project designed to improve stormwater quality, reduce urban runoff and increase local water supply via capturing stormwater onsite and replacing turf with native landscaping
- $10.6 million multiple-benefits project in Los Angeles to install infiltration planters and pervious concrete (among other measures) to provide water quality and flood management
- $300,000 planning process for green infrastructure retrofits through a natural systems approach focused on community-based design and installation of green infrastructure elements such as pervious paving, landscape infiltration planters, tree wells, bioswales, rain gardens and mulched native plant landscape areas which will provide key ecosystem and community health benefits, on Pasadena Unified School District Campuses.

Additional green infrastructure and multiple benefits projects can be explored here: https://portal.safecleanwaterla.org/scw-reporting/dashboard. Los Angeles County Flood Control District's Safe, Clean Water Program provides a useful example of how a non-balloted property-related stormwater fee or charge might be designed to ensure the revenues can be used to pay for green infrastructure.

As outlined above, C/CAG and/or its members' do appear to have a pathway to crafting a legally sound property-related stormwater fee that could be used to pay for green infrastructure of all scales.

B. Enhanced Infrastructure Financing Districts

An Enhanced Infrastructure Financing District (EIFD) may be an additional mechanism available to C/CAG and/or its members to build a portfolio approach for funding GSI

investments. In 2014, the California Legislature authorized the creation of EIFDs to provide local governments and agencies a mechanism for leveraging increases in property taxes, i.e., property tax increment, from cities, counties, and special districts that agree to contribute those funds.

The following sections provide a summary of the: (1) requirements and/or eligibilities for establishing EIFDs, (2) types of entities that can form EIFDs, (3) authorized uses of tax increment revenues collected by EIFDs, (4) types of GSI investments EIFDs can fund, (5) examples of communities that have created EIFDs, and (6) green infrastructure Drivers and Objectives in San Mateo County EIFDs could potentially meet.

1. Authority to Establish EIFDs

The legislative bodies, i.e., city council or board of supervisors, of cities and counties are authorized to establish EIFDs for the sole purpose of financing public facilities or other projects.[43] To establish an EIFD several procedural requirements must be met, and the California Association for Local Economic Development describes three main steps to initiating the process:

1. An initial meeting of the county board of supervisors or the city council sponsoring the EIFD where the board or council adopts a "Resolution of Intention" to begin the process and forms a Public Financing Authority to govern the EIFD adoption;
2. Preparation of an Infrastructure Financing Plan by the Public Financing Authority that serves as a detailed business plan for carrying out the work of the EIFD that is sent to district landowners and other taxing agencies within the district for review; and
3. The Public Finance Authority holds a public hearing to adopt the Infrastructure Financing Plan and create the EIFD.

Once established, the EIFD becomes a governmental entity separate and distinct from the city or county that established it.

2. Entities Authorized to Create EIFDs

City councils and/or boards of supervisors for California cities and counties are authorized to establish EIFDs.[44] The EIFD then becomes a legally distinct agency created to finance public facilities or other projects.[45] Accordingly, San Mateo County or the cities in San Mateo are authorized to create an EIFD.

The scope of the EIFD may include cities, counties, and special districts that voluntarily agree to be part of the district by contributing agreed-upon property tax increments, but may not include K-12 school districts, community college districts, or county offices of education.[46] "Cities, counties and special districts, which are generally allocated close to half of the property tax of an area, may agree to contribute all or part of their tax increment to the

EIFD."[47] For example, an EIFD for San Mateo County could potentially include the County, the 20 cities and towns in the county, as well as area special districts.

Preliminary analysis by C/CAG staff demonstrates that an EIFD for San Mateo County collecting a 1% tax increment from the participating agencies would generate a total of $61 million over 20 years; WaterNow used this estimated in the hypothetical spending plan detailed above, which demonstrates that with 1% tax increment revenues approximately $7 million in other revenues would be needed to fund (and finance) a $250 million countywide GSI program. Over a 45-year horizon, the EIFD would have an estimated $330 million in total tax increment revenue available to it.[48]

3. Funding GSI with EIFDs

An EIFD may fund any of the following, among others:

1. The purchase, construction, expansion, improvement, seismic retrofit, or rehabilitation of any real or other tangible property with an estimated useful life of 15 years or longer that significantly benefits to the district or the surrounding community;
2. The ongoing or capitalized costs to maintain public capital facilities financed in whole or in part by the district (expect ongoing maintenance may not be financed with bond proceeds);
3. Sewage treatment and water reclamation plants and interceptor pipes;
4. Facilities for the collection and treatment of water for urban uses;
5. Flood control levees and dams, retention basins, and drainage channels;
6. Parks, recreational facilities, and open space;
7. Brownfield restoration and other environmental mitigation;
8. Acquisition, construction, or repair of industrial structures for private use;
9. Projects that implement a sustainable communities strategy, when the State Air Resources Board has accepted a metropolitan planning organization's determination that the sustainable communities strategy or the alternative planning strategy would, if implemented, achieve the greenhouse gas emission reduction targets;
10. Projects that enable communities to adapt to the impacts of climate change, including, but not limited to, higher average temperatures, decreased air and water quality, the spread of infectious and vector-borne diseases, other public health impacts, extreme weather events, sea level rise, flooding, heat waves, wildfires, and drought.[49]

Regional-scale and distributed, parcel-scale GSI projects likely fall within several of these categories of eligible projects, e.g., GSI projects have useful lives of more than 15 years, extend or improve the storm sewer system, and significantly benefit the community, combat the impacts of climate change including increased localized flooding and drought, and can be designed as facilities for the collection and treatment of water for urban uses; thus, it may be possible to fund GSI investments with tax increment revenues from an EIFD. These revenues, however, may not be used to fund the costs of an ongoing operation of GSI facilities.[50]

4. Example EIFD: West Sacramento

In June 2017, West Sacramento created the State's first EIFD to support the City's efforts to to transition many areas of the City from heavy industrial use to mixed-use areas along the City's waterfront, to enhance the City's transportation network, and enhance the quality of public facilities for residents, businesses and visitors. West Sacramento's EIFD is made up of fourteen, non-contiguous subareas encompassing a diversity of land uses including mixed-use riverfront, industrial, and retail across ~4,000 acres, representing 25% of the City. The fourteen subareas are detailed in the table to the right.

Table 1: EIFD No.1 Subareas and Existing Assessed Value

Subarea	Acres	FY 2016/17 Assessed Value ($millions)
Bridge District	190	$123
Riverside	336	$369
Southport Industrial Park	665	$293
Stone Lock	226	$0
Washington	350	$351
The Rivers II	75	$14
Pioneer Bluff	142	$54
Seaway	382	$0
Iron Triangle	134	$54
West End	195	$62
North of Port Industrial	240	$189
Port North Terminal	172	$19
Port of Sac. Indust. Park	881	$575
Riverpoint	157	$214
Total, EIFD No.1	4,144	$2,317

The EIFD will be in place for the full 45-year timeframe allowed by California law, and can potentially capture 100% of the City's share of annual property tax increments from properties within the district. When the EIFD was formed in 2017, the assessed value of EIFD properties in base year FY 2016/17 totaled $2,316,771. From that baseline, it was anticipated that a total of $3.13 billion of tax increment ($1.23 billion in 2017 dollars) would accrue to the EIFD. In any event, the projects to be funded by the EIFD will also be supported by a mix of revenues, including development impact fees, local ballot measure funds, federal and state grants, and other special district funds. And the EIFD plans to issue bonds to further finance projects in West Sacramento.

Projects eligible for EIFD funding include purchase, construction, expansion, improvement, seismic retrofit, or rehabilitation of any real or other tangible property with an estimated useful life of 15 years or longer and are projects of communitywide significance that provide significant benefits to the district or the surrounding community. Specific projects include those consistent with the City's adopted General Plan 2035 and Capital Improvement Plans.

Additional information about West Sacramento's EIFD is available here and here, and the Infrastructure Financing Plan can be found here.

C. Water Rates

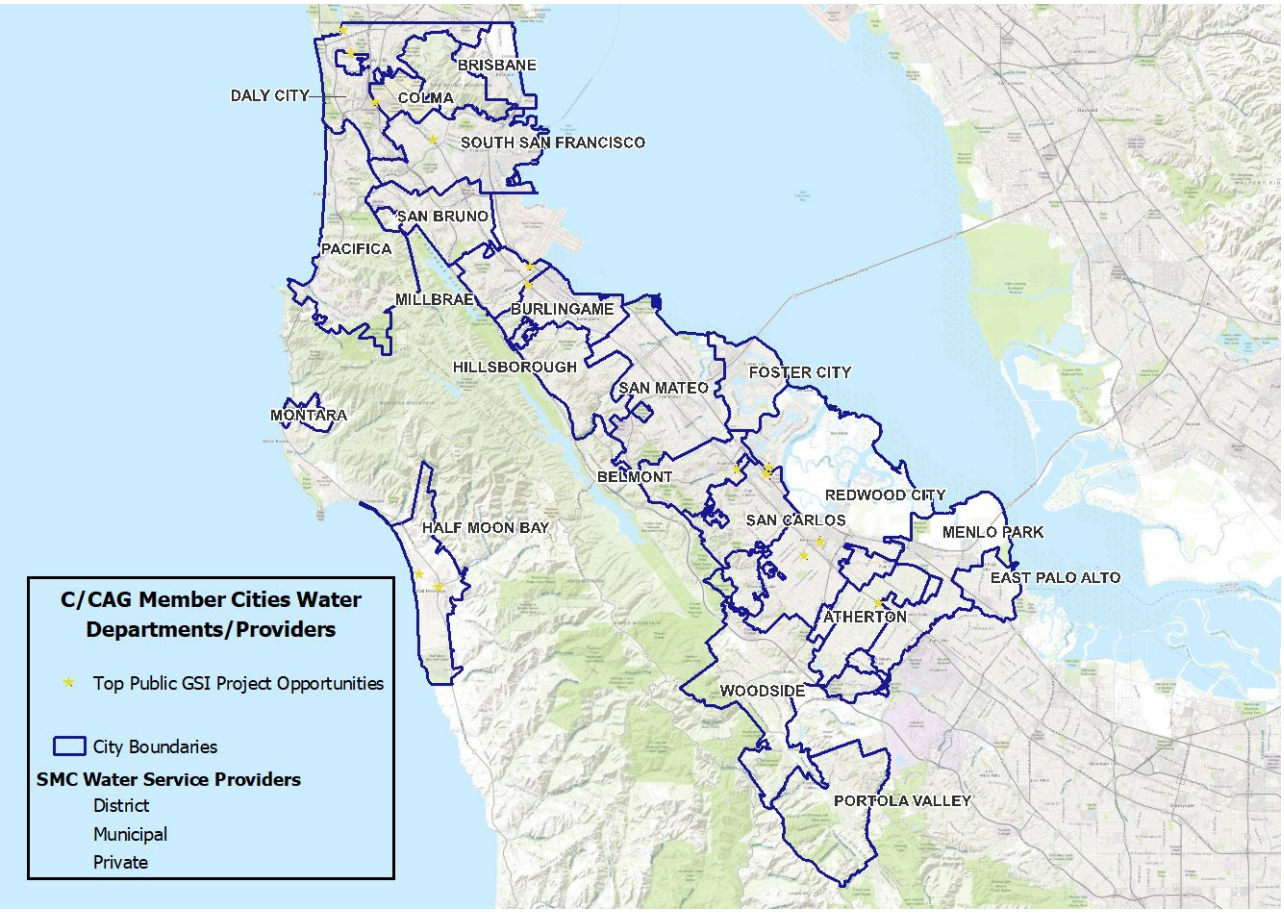
Adding to the options available for a portfolio funding approach, it may be possible to co-fund countywide regional-scale and parcel-scale GSI projects with water rates, which can be used for capital investments as well as ongoing operations and maintenance.

The following sections provide a summary of the: (1) the three types of water providers present in San Mateo County, (2) authorized uses of revenues generated from water rates, (3) types of GSI investments water rates could potentially fund, (4) examples of communities that have used water rates to pay for GSI, and (5) green infrastructure Drivers and Objectives in San Mateo County using water rates to pay for GSI could potentially meet.

1. Authorized Uses of Revenues Generated from Water Rates

There are three types of water rates that may be available to co-fund countywide GSI investments of all scales: (1) rates collected by a municipally owned water provider, (2) rates collected by a special district that provides drinking water, and (3) rates collected by privately owned water systems. As detailed below, whether these rates can be used to help pay for GSI investments depends on the varying degrees of flexibility and legal authorities these different types of water providers have with municipally owned water districts potentially having the most flexibility and privately owned water systems likely having the least. The types of water providers within C/CAG's membership are mapped in Figure 1, below.

Figure 1 – C/CAG Member Cities Water Departments/Providers



i. Municipal Water Providers

Municipally owned and operated water districts authority to collect rates from their customers is governed by Prop 218. As explained above, rates collected for water services are exempt from voter approval requirements; water rates must, however, meet the remaining requirements of Prop 218. This includes the requirements that water rates be used only for the purpose for which the rate was imposed—i.e., water supply—and that the rate not exceed the proportional cost of the service attributable to the property on which the rate is imposed. In addition, local ordinances regulate municipal water districts rates.[51]

Because water rates set by municipally owned and operated water providers are governed by local ordinance there may be flexibilities in the purposes for which these rates may be used, including for GSI as is explored in the next section.

ii. Special Districts

There are several sources of authority to consider when evaluating how special water districts may use their water rates. Special district water providers' rates are governed by Prop 218. They are also governed by the enabling legislation that created the special district. The specific enabling legislation will depend on the particular special district in question.[52] For example, the Coastside County Water District, a special district in San Mateo County that provides water to certain residents in Half Moon Bay and other jurisdictions, was created pursuant to California Water Code sections 30000 et seq.[53] In addition, special water districts authority to collect and use rates for water supplies are governed by the district's regulations, ordinances, and/or resolutions.[54]

Because water rates set by special districts are governed by multiple layers of legal requirements there may be moderate flexibility in the purposes for which these rates may be used. This may nonetheless include the ability to co-fund GSI of all scales, as is explored in the next section.

iii. Privately Owned Water Providers

The authority for privately owned water providers to collect and use water rates is governed by the California Public Utilities Commission.[55] In setting utility rates, the Commission applies two basic factors: 1) the utility's operating expenses or cost of service and 2) a fair return on the utility's investment.[56] In particular, sewer rates for privately owned systems are governed by California Public Utility Code section 727.5.

Because water rates set by privately owned water providers are governed by the California Public Utilities Commission there may be less flexibility in the purposes for which these rates may be used. This may nonetheless include the ability to co-fund GSI of all scales, as is explored in the next section.

2. Co-Funding Green Infrastructure Investment with Water Rates

As detailed above, regional-scale and distributed, parcel-scale GSI projects provide water supply and offset potable water use as co-benefits of GSI stormwater management services. For example, GSI can provide water services by offsetting potable water use through rainwater harvesting and use for irrigation or other appropriate non-potable uses and recharging groundwater through infiltration thus replenishing drinking water supplies. Craftwater Engineers estimates that 14 regional-scale projects that could potentially be implemented in San Mateo County could provide 1,365 acre-feet per year in water supply. (These 14 regional-scale projects were identified in the analysis Craftwater Engineers undertook to identify potential regional-scale stormwater capture projects to inform the Regional Collaboration Framework and Business Case for Green Infrastructure Investments.)

And cities in San Mateo County recognize the water supply benefits of parcel-scale GSI, and co-fund these programs through BAWSCA's Lawn Be Gone rebate program. This turf change out rebate program includes an additional $300 rebate to incentivize installation of rain gardens, which is offered by Brisbane/Guadalupe Valley Municipal Improvement District, Menlo Park, Mid-Peninsula Water District, Millbrae, North Coast County Water District, Redwood City, and San Bruno.[57] Further, BAWSCA's Long-Term Reliable Water Supply Strategy identifies rainwater harvesting and stormwater capture, including the parcel-scale rain barrel program, as strategies for viable local water supply management projects.[58] Per the BAWSCA Strategy, "A preliminary estimate of the potential yield for rainwater harvesting in 2040 in residential units in the BAWSCA service areas ranges from 210 [acre feet per year] AFY to 680 AFY."[59] BAWSCA's Strategy does not estimate the water supply from stormwater capture projects given a lack of reliable data.[60]

These co-benefits of GSI may support the use of water rates to co-fund both capital investments and ongoing operation and maintenance of regional-scale and parcel-scale facilities.

D. Sewer Rates

As with water rates and further adding to the options available for a portfolio funding approach, it may be possible to co-fund countywide regional-scale and parcel-scale GSI projects with sewer rates, which can be used for capital investments as well as ongoing operations and maintenance.[61]

The following sections provide a summary of the: (1) the types of sewer providers present in San Mateo County, (2) authorized uses of revenues generated from sewer rates, (3) types of GSI investments sewer rates could potentially fund, (4) examples of communities that have used water rates to pay for GSI, and (5) green infrastructure Drivers and Objectives in San Mateo County using water rates to pay for GSI could potentially meet.

1. Authorized Uses of Revenues Generated from Sewer Rates

There are four types of sewer rates that may be available to co-fund countywide GSI investments of all scales: (1) rates collected by a municipally owned sewer agencies, (2) rates collected by county sewer districts, (3) rates collected by special districts that provide sewer services, and (4) rates collected by privately owned sewer systems. As detailed below, whether these rates can be used to help pay for GSI investments depends on the varying degrees of flexibility and legal authorities these different types of sewer agencies have with municipally owned agencies potentially having the most flexibility and privately owned systems likely having the least.

i. Municipal Sewer Agencies

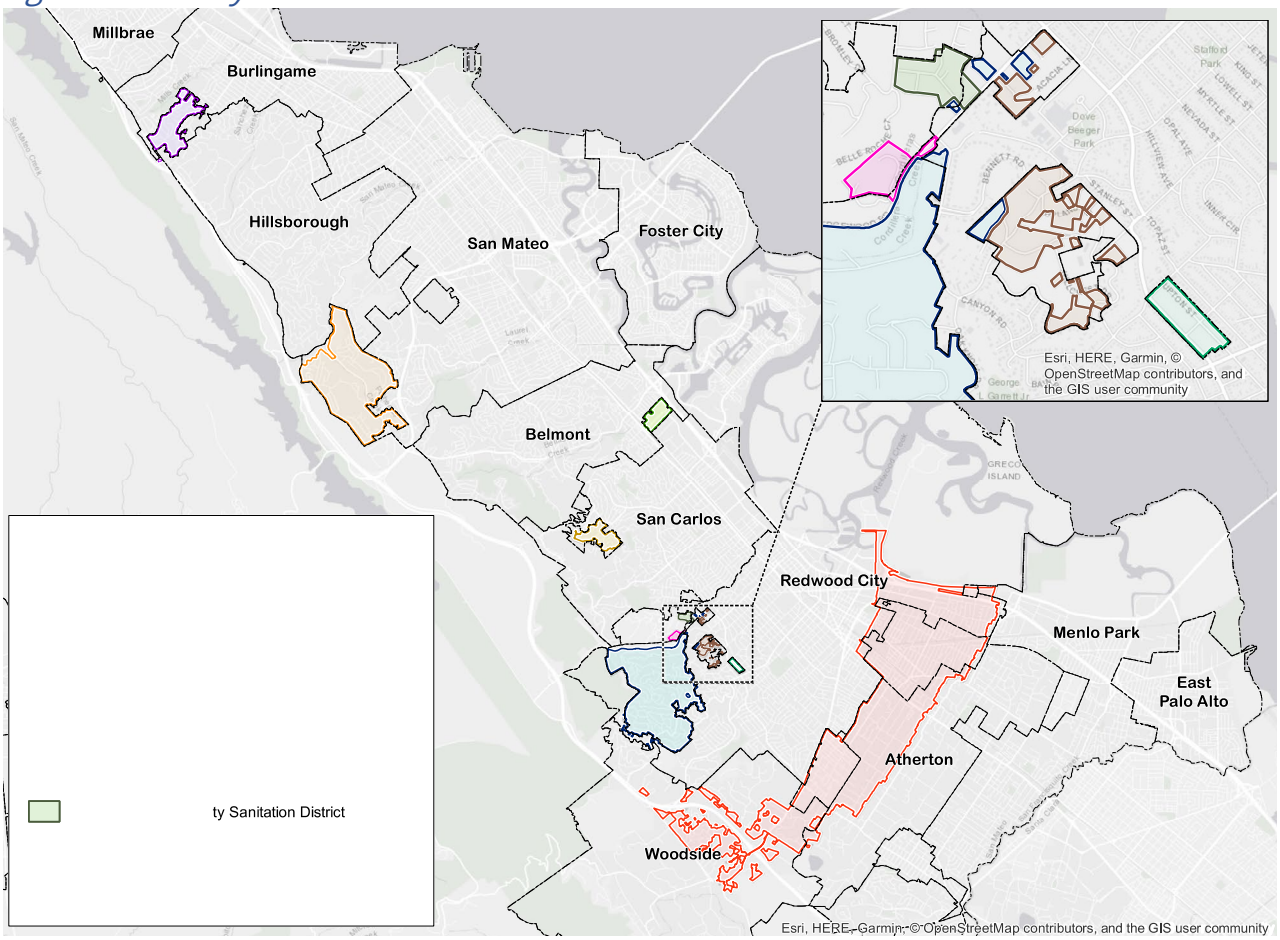
Municipally owned and operated sewer agencies' authority to collect rates from their customers is governed by Prop 218. As explained above, rates collected for sewer services are exempt from voter approval requirements; sewer rates must, however, meet the remaining requirements of Prop 218. This includes the requirements that sewer rates be used only for the purpose for which the rate was imposed—i.e., collecting and disposal of sewage—and that the rate not exceed the proportional cost of the service attributable to the property on which the rate is imposed. In addition, local ordinances regulate the rates which municipal sewer agencies collect and how those rates are used.[62]

Because sewer rates set by municipally owned and operated sewer agencies are governed by local ordinance there may be flexibilities in the purposes for which these rates may be used, including for GSI as is explored in the next section.

ii. County Districts

Sewer services may also be provided by county-governed districts. Per the San Mateo County San Mateo County Local Agency Formation Commission (LaFCO) there are 10 county-governed sewer districts in San Mateo County, which are shown in Figure 2, below.[63] As with municipal sewer agencies, county-governed systems' authority to collect rates from their customers is governed by Prop 218, as well as county ordinances, resolutions, and other regulations.

Figure 2 – County Administered Sewer and Sanitation Districts



Because sewer rates set by county sewer districts are governed by county ordinance there may be flexibilities in the purposes for which these rates may be used, including for GSI as is explored in the next section.

iii. Special Districts

There are several sources of authority to consider when evaluating how special sewer districts may use their sewer rates. Special district sewer providers' rates are governed by Prop 218. They are also governed by the enabling legislation that created the special district. The specific enabling legislation will depend on the particular special district in question.[64] For example, the Bayshore Sanitary District, a special district in San Mateo County that provides sewer collection and disposal services for portions of serving portions of Daly City and Brisbane, was created pursuant to California Health and Safety Code sections 6400 et seq.[65] In addition, special sewer districts authority to collect and use rates for sewer services are governed by the district's regulations, ordinances, and/or resolutions.[66]

Because sewer rates set by special districts are governed by multiple layers of legal requirements there may be moderate flexibility in the purposes for which these rates may be

used. This may nonetheless include the ability to co-fund GSI of all scales, as is explored in the next section.

iv. Privately Owned Sewer Districts

The authority for privately owned sewer providers to collect and use water sewer is governed by the California Public Utilities Commission.[67] In setting utility rates, the Commission applies two basic factors: 1) the utility's operating expenses or cost of service and 2) a fair return on the utility's investment.[68] In particular, sewer rates for privately owned water providers are governed by California Public Utility Code sections 451-468.

Because sewer rates set by privately owned systems are governed by the California Public Utilities Commission there may be less flexibility in the purposes for which these rates may be used. This may nonetheless include the ability to co-fund GSI of all scales, as is explored in the next section.

2. Co-Funding Green Infrastructure with Sewer Rates

As detailed above, regional-scale and distributed, parcel-scale GSI projects can provide benefits to sewer systems either by keeping stormwater out of maxed-out sewer systems helping prevent sewer overflows and basement backups and adding influent to wastewater treatment plants with reduced inflows resulting from conservation allowing improved water quality for effluent discharges or increased opportunities for water recycling.

Communities in San Mateo County already recognize the benefits of GSI to local sewer systems. For example, the City of San Mateo's Green Infrastructure Plan cites multiple benefits of GSI, and identifies sewer rates as a revenue source for its stormwater program that includes GSI investments.[69]

These co-benefits of GSI may support the use of sewer rates to co-fund both capital investments and ongoing operation and maintenance of regional-scale and parcel-scale facilities.

IV. Potential Financing Options

WaterNow has explored three potential financing options available to C/CAG, its members, and potential regional partners to finance capital investments in all scales of green stormwater infrastructure: (1) revenue bonds; (2) State Revolving Fund loans; and (3) Water Infrastructure Finance and Innovation Act (WIFIA) loans. C/CAG can leverage the revenues detailed above by debt-financing capital investments in regional-scale and distributed, parcel-scale GSI projects.

Each of the potential financing options is described in detail below.

A. Revenue Bonds

There are two types of bonds potentially available to finance countywide regional and parcel-scale GSI: (1) revenue bonds and (2) general obligation bonds. The focus on this report is revenue bonds. There are also several alternative types of municipal financing approaches that might be available; exploration of these alternatives is, however, beyond the scope of this analysis.[70]

Municipal revenue bonds are bonds issued by local governments to raise funds for public capital projects secured by a specific revenue source.[71] These types of bonds provide up-front capital that is paid back over the life of the bond out of specified revenues. Municipal utilities and special districts often have bonding authority as well, which allows them to borrow against expected revenue from ratepayers. In California, revenue bonds can fall within an exception to Constitutional and statutory debt limitations and thus allow the issuing agency to avoid certain voter approval requirements.[72]

In addition to traditional revenue bonds, this type of bond can be issued as green or climate bonds, or environmental impact bonds. These are detailed below.

1. Green & Climate Bonds

Green and climate bonds are essentially identical to the normal bonds that municipalities issue, except that:

- The bonds are labeled as “green” or “climate” by their issuer,
- Proceeds are earmarked for green or climate-change mitigation or adaptation investments, and
- The issuer tracks and reports on the use of proceeds to ensure green compliance.[73]

Green and climate bonds also differ from traditional bonds because they undergo a certification process that attests to the environmental benefits of the bond-financed projects.

2. Environmental Impact Bonds

Environmental impact bonds (EIB) are an innovative financing tool that leverages private investment to support high-impact environmental programs. EIBs use a outcomes-based approach where Environmental, Social, and Governance (ESG) investors provide upfront capital for environmental projects and the beneficiary—e.g., a public entity—repays the investors based on the achievement of the agreed-upon project outcomes. A special kind of municipal bond, an EIB focuses on the delivery of successful environmental outcomes and can include investor payments and penalties attached to the achievement, or non-achievement, of those outcomes.

As detailed below, specific legal and accounting requirements govern the extent to which EIBs can finance distributed GSI. As special kind of municipal revenue bond, to issue an EIB, three key players are needed. First is a government agency or municipality that has a project with specific outcomes, e.g., improved stormwater quality or reduced localized flooding, in mind that needs funding, but may be higher risk because they are innovative strategies making traditional financing approaches out of reach. Second are service providers who can meet the project needs, i.e., contractors to build the intended projects, as well as other stakeholders and beneficiaries of the proposed projects. Third are impact investors who are willing to take on the risk of the particular project not performing as expected and bring down the risks on the public agency. An underwriter then brings these participants together the outcomes-based financing structure, which includes:

- ✓ Establishing performance metrics,
- ✓ Developing the outcomes-based payment structure,
- ✓ Aligning and coordinating partners, and
- ✓ Finding and delivering new sources of capital.

With this model, repayment of the bond depends on the project outcomes. Performance is determined by verified third-party evaluations on whether key stated environmental goals are achieved by bond-financed projects. If the projects perform as expected, the bond would be paid back as planned or as traditional bonds are repaid. If the projects underperform as benchmarked against the established performance metrics, investors may be obligated to repay the bond amount—known as "clawback"—allowing the municipality to assess whether to continue the projects. If the projects overperform, the municipality may agree to pay investors an additional amount over the bond interest and principal payments to incentivize the investors to take on the risk of the innovative projects. This payment structure differentiates EIBs from green and climate bonds. EIBs can qualify as green or climate bonds, however. Performance metrics used in EIBs issued in D.C., Atlanta, and Buffalo to finance investments in green infrastructure—including consumer incentives to encourage distributed GSI on private property in Buffalo—were:

- Volume of stormwater flow reduced,
- Volume of stormwater stored, and
- Impervious area managed.

EIBs also require post-issuance reporting and disclosure of the project outcomes to investors. These disclosures and reporting are more rigorous as compared to green or climate bonds, as they provide the basis for determining whether the finance projects are performing as expected, underperforming, or overperforming and whether the agreed upon payment structures are triggered.

3. Authority to Issue Revenue Bonds

To finance GSI with revenue bonds, utilities must have the express or implied legal authority to issue revenue bonds.[74] In California, a local governmental agency or special district's authority to issue revenue bonds may be derived from state statute or local ordinance. As

detailed below, the source of legal authority to issue revenue bonds depends on the issuing entity. This report is focused on these legal authorities, but we note that there are additional legal questions to consider when issuing bonds in California, including applicable debt limits. Providing detailed analysis of these additional considerations is beyond the scope of WaterNow's report.

i. Charter Cities

The California Constitution authorizes the creation of charter cities and counties.[75] California charter cities and counties look to their local charters to determine their authority to incur debt.[76] Local charters will also govern procedural requirements for issuing revenue bonds, such as voter approval requirements and other administrative steps that must be satisfied.

For example, in June 2018, San Francisco amended its City Charter to make clear that no matter where a project was located, so long as a project furthered the purposes of the utility, the San Francisco Public Utilities Commission would be able to finance the project. As amended, in relevant part, the Charter now specifies:

> the Public Utilities Commission is hereby authorized to issue revenue bonds … for the purpose of reconstructing, replacing, expanding, repairing, or improving water facilities, clean water facilities, power facilities, or combinations of water, clean water, and power facilities … *for any [] lawful purpose* of the water, clean water, or power utilities of the City… .

The SFPUC has interpreted this Charter provision to provide clear authority to debt finance distributed infrastructure along with centralized projects.[77] To determine their legal authority to issue debt to finance regional-scale and parcel-scale GSI, charter cities in C/CAG's membership would look to their own charters for an analogous provision.

ii. General Law Cities & Counties

General law cities, i.e., cities and counties that have not adopted a charter, look to state statute to determine their legal authority to incur debt.[78] State statute will also govern general law cities and counties' procedural requirements for issuing revenue bonds, such as voter approval requirements and other administrative steps that must be satisfied. According to the California Debt and Investment Advisory Commission, "Numerous statutes spread across several California codes give public agencies the power to borrow."[79]

For example, the Revenue Bond Law of 1941,[80] which applies to any city, county, city and county, or any municipal or public corporation or district which is authorized to acquire, construct, own, or operate any enterprise, authorizes "issuance of bonds and the acquisition, construction, or improvement of any enterprise." Improvements to an enterprise that can be financed by a revenue bond under this statute includes "collection, treatment or disposal of sewage, waste or storm water, including drainage."[81] Given the broad scope of this authority,

it may be possible to debt-finance regional-scale and parcel-scale GSI facilities without the need for the entity issuing the debt to own or control the facilities because these GSI facilities improve the storm sewer, water, and wastewater systems, and collect and treat stormwater. The Revenue Bond Law does, however, impose prior voter approval requirements for revenue bonds issued under this authority.[82]

To identify their legal authorities to debt-finance regional- and parcel-scale GSI, general law cities in San Mateo County and/or the County would, thus, look to the authorities outlined in state statute. And when evaluating the scope of those authorities to determine whether they are empowered to use bond proceeds for investments on property they do not own or control—which can be particularly relevant for parcel-scale GSI investments—general law cities may consider whether the statutory authority allows for financing of improvements, extensions, or expansion of the storm sewer system, or water or sewer system, that benefit the system. This type of broad language can help support the use of revenue bond proceeds for GSI on property the financing entity does not control.

iii. Joint Powers Authorities

Joint powers authorities, as independent governmental entities separate from the JPA members, have standalone authority to issue revenue bonds set out in California Government Code sections 6540-6579.5.[83] In particular, JPAs are authorized to issue revenue bonds to finance the cost and expenses of "acquiring or constructing a project" or "conducting a program" for several purposes, including:

- Programs, facilities, rights, properties, and improvements for the management, conservation, reuse, or recycling of water,[84] waste water, or recycled water and other programs and facilities designed to reduce the demand for, or permit or promote the efficient use of, water resources;
- Facilities for the production, storage, transmission, or treatment of water or waste water; and
- A regional or local public park, recreational area, or recreational center, and related all facilities and improvements.[85]

These authorized uses of proceeds from a revenue bond issued by a JPA likely include regional-scale and parcel-scale GSI. These GSI facilities manage stormwater, help conserve drinking water, promote the efficient use of water resources, and can be facilities and improvements related to parks and recreation areas.

As with charter cities and general law cities, JPAs must follow certain procedural requirements prior to issuing revenue bonds and all JPA members must authorize the bond issuance.[86] The specific requirements that apply depend on the type of project to be financed; as relevant to bonds to finance GSI investments procedural steps include adopting an ordinance authorizing the bond and stating that the bond is subject to referendum provisions of section 9142 of the California Elections Code.[87] Revenue bonds issued by JPAs may be a pathway to issuing debt

without prior voter approval. "Revenue bonds are the preferred financing vehicle for enterprise revenue debt when revenue bonds can be issued without voter approval."[88]

iv. Special Districts

Special districts also have independent legal authority to issue revenue bonds, which will be defined by the districts' enabling statutes.

For example, the FSLRRD's enabling law authorizes this special district to issue revenue bonds. In particular, the FSLRRD is authorized to issue revenue bonds pursuant to the Revenue Bond Law of 1941 "except that no election shall be required for revenue bonds authorized by the board for capital projects" undertaken as an exercise of the FSLRRD's powers. As explained above, the Revenue Bond Law of 1941 authorizes "issuance of bonds and the acquisition, construction, or improvement of any enterprise" where improvements include "collection, treatment or disposal of sewage, waste or storm water, including drainage,"[89] which may be sufficiently broad to encompass regional- and parcel-scale GSI.

v. EIFDs

California law also separately authorizes enhanced infrastructure financing districts to issue bonds to finance capital projects to be completed by the district, i.e., tax increment bonds.[90] As detailed above, the types of capital projects that EIFDs can undertake include improvements to property with an estimated useful life of 15 years or longer that significantly benefits the district, facilities for the collection and treatment of water for urban uses, parks and recreational facilities, and projects that enable communities to adapt to the impacts of climate change. These authorized uses of bond proceeds may include regional-scale and parcel-scale GSI.

Via AB 116, effective January 1, 2020, previous voter approval requirements for bonds issued by EIFDs were repealed.[91] With this change in EIFD law, there are no voter approval requirements for an EIFD to issue tax increment bonds. There are, however, procedural requirements EIFDs must meet including adopting a resolution with a description of the facilities or developments to be financed and estimated cost of the facilities or developments, the estimated cost of preparing and issuing the bonds, and the principal amount of the bond issuance, among other requirements.[92]

B. Clean Water State Revolving Fund Loans

The Clean Water Act established state revolving funds (SRFs) to assist communities with upfront cash to build water infrastructure.[93] EPA allocates SRF funding to each state that administers the CWA. The states then contribute an additional 20% to match federal SRF capitalization grants, and also administer the program according to state-specific eligibility criteria. While states establish their own eligibility criteria, the American Recovery Act of 2009,

and subsequent appropriations bills, require all Clean Water SRF programs to use at least 10% of their federal capitalization grant for green infrastructure, water and energy efficiency projects, or other environmentally innovative activities. This requirement is commonly referred to as the Green Project Reserve.

The below sections provide: (1) an overview of California's CWSRF program; (2) an outline of the entities eligible for CWSRF loans; (3) analysis on how SRF loans might be leveraged to pay for regional- and parcel-scale GSI; and (4) examples of Green Project Reserve projects financed by the California CWSRF.

1. Overview: California's CWSRF

The primary purpose of California's CWSRF is to provide financing for eligible projects to restore and maintain water quality in the state.[94] California also seeks to reduce the effects of climate change and promote sustainable use of water resources for future generations through implementation of the CWSRF program.[95]

The California CWSRF, administered by the State Water Resources Control Board Division of Financial Assistance, uses federal capitalization grants, state match funds, loan repayments, bond proceeds and interest earnings to make loans for construction of wastewater treatment facilities, the implementation of nonpoint source water quality control projects, and the development and implementation of estuary enhancement projects.[96] Since it began in 1988 through June 30, 2019, the California CWSRF has executed 838 loans totaling ~$11.2 billion.

2. Entities Eligible for CWSRF Loans

Borrowers eligible for SRF loans include, but are not limited to any city, town, district, or other public body created under state law.[97]

As local governmental entities, C/CAG and/or its members are eligible entities. Special districts in San Mateo County are also eligible. There are no funding minimums or maximums, and interest rates are set at ½ most recent State General Obligation Bond Rate at time of funding approval. As of September 2021, CWSRF interest rates were 1.10%.[98]

3. Leveraging CWSRF Loans for GSI Investment

CWSRF loans can be used to pay for a variety of projects including, but not limited to:

- Construction of publicly-owned stormwater treatment facilities;
- Implementation of nonpoint source projects to address pollution associated with urban areas, among others; and
- Development and implementation of estuary comprehensive conservation and management plans for San Francisco Bay, among others.[99]

In addition, to meet the Green Project Reserve requirements, California follows EPA's 2012 Guidance for Determining Project Eligibility.[100] EPA's guidance specifically cites green infrastructure as categorically eligible project types, including regional- and parcel-scale GSI such as constructed wetlands, permeable pavement, bioretention, green roofs, green streets, urban forestry programs, rainwater harvesting and reuse, and comprehensive retrofit programs designed to keep stormwater discharges out of all types of sewer systems.[101]

Given these authorized uses, there is likely a path for seeking CWSRF loans to finance regional-scale and parcel-scale GSI throughout San Mateo County.

4. Examples of California Green Project Reserve Projects

According to the 2021-2022 CWSRF Intended Use Plan, there are over 20 Green Project Reserve projects on the fundable list for 2021/2022.[102]

Only one project on the 2021/2022 fundable list, however, expressly includes green infrastructure—the City of San Diego's South Mission Beach Storm Drain Improvements and Green Infrastructure project. San Diego's project will implement storm drain improvements to increase conveyance capacity, and mitigate surface ponding conditions within the public right-of-way, and install eight (8) proposed biofiltration or bioretention basins to improve local storm water quality tributary to Mission Bay.[103] San Diego has requested $16.7 million in CWSRF loans for this project.

C. Water Infrastructure Finance and Innovation Act (WIFIA) Loans

The Water Infrastructure Finance and Innovation Act (WIFIA) was enacted in 2014 to accelerate investment in local water and wastewater infrastructure. It supplements the SRF loan programs by providing long-term, low-cost supplemental credit assistance to broad range of borrowers. This program is separate from, but implemented in coordination with, the SRF programs to provide subsidized financing for large dollar-value projects. The WIFIA program offers loans with low, fixed interest rates that are set at loan closing based on the U.S. Treasury rate of similar maturity and flexible financial terms.[104] As of October 2021, EPA has closed 59 WIFIA loans for $11.5 in total financing.

1. Entities Eligible for WIFIA Loans

Borrowers eligible for WIFIA loans include, but are not limited to:

- Local, state, tribal, and federal government entities;
- Partnerships and joint ventures; and
- Corporations and trusts.[105]

As local governmental entities, C/CAG and/or its members are eligible entities. Special districts in San Mateo County are likely also eligible. And eligible entities can submit joint loan applications for a bundle of projects.[106]

In addition, there are certain important program features that borrowers interested in applying for WIFIA funding should consider, including:

- Minimum project size for large communities is $20 million;
- Minimum project size for small communities (population of 25,000 or less) is $5 million;
- WIFIA funds can be used to pay for a maximum of 49% of eligible project costs;
- Total federal assistance may not exceed 80% of eligible project costs;
- The term of the loan may be no more than 35 years following substantial completion of the project;
- Repayment may be deferred for a maximum of 5 years following substantial project completion;
- Projects must be creditworthy and have a dedicated source of revenue.

Further, WIFA loan dollars can be used for development-phase activities such as design and planning as well as construction, reconstruction, rehabilitation, and replacement costs.[107]

2. Leveraging WIFIA Loans for GSI Investments

Borrowers eligible to receive WIFIA funding, including local governmental entities, can use the funds to pay for many types of infrastructure projects, including those aimed at:

- Drought prevention, reduction, or mitigation;
- Aquifer recharge;
- Water reuse; and
- Alternative water sources.[108]

Regional-scale and parcel-scale GSI can likely meet these eligibilities, as GSI projects can serve each of these purposes.

3. Examples

To date, WIFIA has closed 59 loans totaling $11.5 billion in credit assistance to help finance over $24 billion for water infrastructure projects. This includes 23 projects in California for water recycling, flood channel improvements, and wastewater treatment plant improvements.[109] However, to date there have been no WIFIA loans issued to finance investments in GSI.

V. Accounting for GSI

Generally Accepted Accounting Principles (GAAP) that apply to local government and public utilities allow "capital expenditures"—expenditures for fixed or capital assets—to be debt financed. For distributed GSI expenditures to be capital expenditures under GAAP, the expenditure must, among other things, result in the acquisition, improvement or creation of an "asset" of the utility. There are two possible approaches to creating this asset: (1) regulated operations accounting, or (2) standard accounting.

A. Regulated Operations Accounting

Distributed GSI on public property not owned or controlled by the utility and private property may constitute an asset of the utility if the distributed GSI expenditure creates a "regulatory asset" under Governmental Accounting Standards Board (GASB) Statement No. 62.

Doesn't My Utility Need to Control an Asset Before We Can Capitalize the Cost?

Not always—this is the basic difference between GASB Concepts Statement 4 and GASB Statement 62.

Standard accounting for public entities is generally done in conformity with Governmental Accounting Standards Board (GASB) Concept 4 which reflects the GAAP rule that only assets controlled by the entity can be financed with debt, i.e., capitalized.

However, GASB Statement 62 authorizes public agencies to book these expenditures as "regulatory assets" that can be capitalized (see below). Statement 62 accounting does not require that the utility own or control the asset in order to capitalize the cost; the asset is the binding promise to repay the loan, not the items procured or produced with the loan.

GASB Statement 62 allows public agencies to book the cost of "business-type activities" as assets instead of annual expenses—a Regulated Operations accounting approach. These are called "regulatory assets" and can be capitalized by cities and public water utilities. The Regulated Operations approach is a complete alternative to traditional public agency accounting for capital assets. To use Regulated Operations accounting and access debt-financing for distributed GSI, local water providers need to have a governing board that:

- Is empowered to set rates;
- Can set those rates at levels to cover the cost of the specific programs to be financed; and
- Can commit to setting rates in the future to pay for the cost of these programs.

As governmental agencies with governing boards empowered to set rates C/CAG's members can likely meet these requirements.

Electricity utilities have been bond financing distributed energy conservation programs on private properties for many years using GASB 62 accounting. However, this is not an approach that has been widely embraced by the public water resource sector and many

water utility chief financial officers questioned whether it truly could apply to investments in consumer incentives for localized water strategies. Addressing this uncertainty, in May 2018, GASB issued new guidance under GASB 62 making it clear that public water resource agencies are authorized to capitalize investments in localized waters strategies employing consumer rebates and direct installations as "Regulated Operations." The practical implication of this clarification is that utilities can now access municipal bond proceeds to invest in consumer rebate (and/or direct installation) programs. The GASB 62 accounting approach applies to investments made through both municipal revenue and general obligation bonds and can be used when issuing tax-exempt or taxable municipal bonds, as well as other forms of debt.

B. Standard Accounting

Distributed GSI expenditures can also qualify as capital expenditures if the municipality or utility exercises "control" over the asset sufficient to satisfy the requirement of GASB Concepts Statement No. 4—the traditional accounting treatment for debt financing capital assets. As a general matter, control results from the city or utility's ability to determine the nature and manner of use of the investment. Easements or contracts can usually establish the needed level of control. A small but important set of water utilities are finding that they can invest municipal bond proceeds in distributed infrastructure and comply with GASB Concepts Statement No. 4. For example, over the last two decades, the Southern Nevada Water Authority has bond financed more than $250 million (as of 2020) in incentive programs such as private property turf replacements generating approximately 430,000 acre feet in water supply for the Las Vegas region. Similarly, the Milwaukee Metropolitan Sewerage District (MMSD) capitalizes and bond finances GSI investments on property it does not own by requiring recipients of GSI grants to enter into a conservation easement with MMSD. In 2019, MMSD invested $1.9 million in private property GSI. In February 2020, MMSD issued a certified Climate Bond to finance $20 million in "community based" GSI.

C. Examples

Los Angeles Department of Water and Power (LADWP) has been using municipal bond proceeds to finance consumer rebate programs for a variety of water efficiency and stormwater capture programs, including rebates for water-efficient installations, high-efficiency washing machines, permeable pavement, rain barrels, cisterns, and replacement of turf with low-water landscaping using the GASB 62 accounting approach. As of 2020, LADWP reported $160 million in distributed water conservation and stormwater regulatory assets. By using the upfront capital provided by bond sales, LADWP can promote "water use efficiency as a permanent way of life" and work toward achieving the city's long-term conservation goals. Since 2010, LADWP's conservation program has saved roughly 25,000 acre-feet of water per year.

Similarly, Seattle Public Utilities finances its RainWise program[110] with municipal bond proceeds using the GASB 62 regulated operations accounting approach. By investing in these programs at scale, as of September 2020, Seattle has been able to finance GSI

projects that manage 410 million gallons of stormwater per year, bringing the city closer to meeting its goal of managing 700 million gallons of runoff per year with GI by 2025.

A small but important set of water utilities are finding that they can invest municipal bond proceeds in GSI and comply with GASB Concepts Statement No. 4's requirement that the agency "control" the asset to be financed by entering into property liens or contracts with property owners. For example, over the last two decades, the Southern Nevada Water Authority (SNWA) has bond financed more than $250 million (as of 2020) in incentive programs such as private property turf replacements generating approximately 430,000 acre feet in water supply for the Las Vegas region. Similarly, the Milwaukee Metropolitan Sewerage District (MMSD) capitalizes and bond and loan finances GSI investments on property it does not own by requiring recipients of GSI grants to enter into a conservation easement with MMSD. In 2019, MMSD invested $1.9 million in private property GI. In February 2020, MMSD issued a certified Climate Bond to finance $20 million in "community based" GI.

VI. Investments in GSI Serve a Public Purpose

Nearly all states prohibit "gifts" of public funds to private individuals or groups. However, most states have also developed extensive exceptions allowing public funds to be directed to private parties when these funds are deployed for primarily public benefits. These constitutional provisions were adopted in the wake of the public debt crisis of the 1830s—when eight states defaulted on debt incurred to build public infrastructure through private partnerships—nearly every state adopted a constitutional amendment to prohibit the use of public bonds and credit for private projects that do not benefit public interests. Together the amendments have formed the "public purpose" doctrine, which provides that public dollars must be allocated for public purposes and government interests and cannot only be used to aid private persons.

Because of these exceptions state gift prohibitions should not be viewed as barriers to implementing distributed GSI on private property with public capital. Most states allow expenditures that incidentally benefit private interests, as long as they primarily serve and effectuate a public purpose. Some states choose to apply narrow interpretations of terms like "public purpose" and "private benefit" to limit the scope of the prohibition. Other states, however, have not extended an exemption as broadly as others.

In California the prohibition against the gift of public funds is set out at Article XVI, section 6 of the California Constitution.[111] "In determining whether an appropriation of public money is to be considered a gift within the constitutional prohibition, the primary question is whether the funds are to be used for a public or a private purpose."[112] So long as the money serves a public purpose, there is no gift of public funds even if private persons benefit from the investment.[113] Examples of constitutionally valid public purposes include: free school text books, free treatment in county hospitals for the indigent, and flood control.[114]

The public purposes of parcel-scale GSI investments are cited throughout this report, including benefits related to stormwater, water supply, sewer, and refuse management. Given these extensive public purposes, it is likely that using public rates and bond dollars to pay for parcel-scale GSI located on private property will not be a prohibited gift of public funds even if those projects incidentally benefit the private property owner where they are located.[115]

VII. Drivers & Objectives

Pursuing a portfolio approach to funding and financing investments in green infrastructure installations representing large, regional-scale facilities and distributed parcel-scale facilities would be motivated by each of the Drivers[116] identified in C/CAG consultant Geosyntec's May 2021 memo. These Drivers are:

1. Driver 1: Limited Resources
2. Driver 2: Existing Stormwater Infrastructure Deficiencies
3. Driver 3: Water Quality
4. Driver 4: Climate Resiliency
5. Driver 5: Beneficial Use of Stormwater
6. Driver 6: Equity and Community Engagement
7. Driver 7: Compliance with MS4 Permit
8. Driver 8: Environmental Justice.

Geosyntec's memo provides a detailed analyses of each of these Drivers.

Countywide green infrastructure installations representing large, regional-scale facilities and distributed parcel-scale facilities funded via a non-balloted stormwater would advance several Objectives[117] for a regional approach to stormwater management, including:

1. Objective 1: More Efficiently Use Limited Resources
2. Objective 2: Support Improvements to and/or Alleviate Strain on Existing Stormwater Infrastructure
3. Objective 6: Site and Design Projects to Equitably Serve and Protect Communities
4. Objective 7: Consider Local Community Benefits and Concerns in Project Implementation.

Geosyntec's memo provides a detailed analyses of each of these Objectives.

VIII. Conclusion

To implement a large-scale, countywide GSI program, C/CAG and/or its member agencies will likely need to take a portfolio approach to funding and financing, as it is unlikely that any single revenue stream alone will be able to meet programmatic needs. Pursuing this portfolio approach within the countywide setting can be both a challenge and an opportunity. For example, it may not be feasible for a single city within San Mateo County to issue a revenue

bond to finance green infrastructure investments given specific local challenges, e.g., voter approval requirements. However, as detailed above, joint powers authorities may be authorized to issue revenue bonds without prior voter approval. C/CAG and/or its member agencies will, thus, want to consider how a portfolio approach can create flexibilities a single agency approach might not provide.

As this report outlines, there are a number of funding and financing options available to C/CAG and/or its member agencies, as well as potential regional partners, to build out this portfolio approach. Further WaterNow's analysis includes funding and financing options for all scales of GSI, i.e., large, regional-scale projects and smaller parcel-scale facilities. By including the full range of infrastructure options from the outset it may provide C/CAG and its members more flexibility as planners and decision makers move towards a right sized GSI program.

Appendix A – Financing Scenarios Summary Worksheet

San Mateo Stormwater pro forma	yr 1	yr 2	yr 3	yr 4	yr 5	yr 6	yr 7	yr 8	yr 9	yr 10	yr 11	yr 12	yr 13	yr 14	yr 15	yr 16	yr 17	yr 18	yr 19	yr 20	Totals
Desired Spending level																					
Regional project spending	$750,000	$2,250,000	$13,500,000	$13,500,000	$15,000,000	$15,000,000	$15,000,000	$15,000,000	$15,000,000	$15,000,000	$14,250,000	$12,750,000	$1,500,000	$1,500,000							$150,000,000
Parcel sized projects		$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$28,500,000
Total Capital Spending	$750,000	$3,750,000	$15,000,000	$15,000,000	$16,500,000	$16,500,000	$16,500,000	$16,500,000	$16,500,000	$16,500,000	$15,750,000	$14,250,000	$3,000,000	$3,000,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$178,500,000
Operations	$250,000	$900,000	$2,100,000	$2,600,000	$2,600,000	$2,600,000	$2,600,000	$2,600,000	$2,600,000	$2,600,000	$2,600,000	$2,600,000	$2,600,000	$2,600,000	$2,600,000	$2,600,000	$2,600,000	$2,600,000	$2,600,000	$2,600,000	$47,450,000
Maintenance	$0	$0	$0	$0	$0	$225,000	$450,000	$675,000	$900,000	$1,125,000	$1,350,000	$1,575,000	$1,800,000	$2,025,000	$2,250,000	$2,250,000	$2,250,000	$2,250,000	$2,250,000	$2,250,000	$23,625,000
Total Operations and Maintenance	$250,000	$900,000	$2,100,000	$2,600,000	$2,600,000	$2,825,000	$3,050,000	$3,275,000	$3,500,000	$3,725,000	$3,950,000	$4,175,000	$4,400,000	$4,625,000	$4,850,000	$4,850,000	$4,850,000	$4,850,000	$4,850,000	$4,850,000	$71,075,000
Total Desired Spending	**$1,000,000**	**$4,650,000**	**$17,100,000**	**$17,600,000**	**$19,100,000**	**$19,325,000**	**$19,550,000**	**$19,775,000**	**$20,000,000**	**$20,225,000**	**$19,700,000**	**$18,425,000**	**$7,400,000**	**$7,625,000**	**$6,350,000**	**$6,350,000**	**$6,350,000**	**$6,350,000**	**$6,350,000**	**$6,350,000**	**$249,575,000**
Pay/Go funding alternative																					
Parcel Tax																					
Stormwater fees																					
Water/Sewer revenues																					
Grants																					
Total assumed revenue		$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$190,000,000
Tax increment funding*	$ 714,713	$934,074	$1,157,822	$1,386,045	$1,618,833	$1,856,276	$2,098,468	$2,345,504	$2,597,481	$2,854,498	$3,116,654	$3,384,054	$3,656,802	$3,935,005	$4,218,771	$4,508,213	$4,803,444	$5,104,580	$5,411,738	$5,725,040	$61,428,017
Total Revenues	$714,713	$10,934,074	$11,157,822	$11,386,045	$11,618,833	$11,856,276	$12,098,468	$12,345,504	$12,597,481	$12,854,498	$13,116,654	$13,384,054	$13,656,802	$13,935,005	$14,218,771	$14,508,213	$14,803,444	$15,104,580	$15,411,738	$15,725,040	$251,428,017
Short/over Total Revenue less Desired Spending	**($285,287)**	**$6,284,074**	**($5,942,178)**	**($6,213,955)**	**($7,481,167)**	**($7,468,724)**	**($7,451,532)**	**($7,429,496)**	**($7,402,519)**	**($7,370,502)**	**($6,583,346)**	**($5,040,946)**	**$6,256,802**	**$6,310,005**	**$7,868,771**	**$8,158,213**	**$8,453,444**	**$8,754,580**	**$9,061,738**	**$9,375,040**	**$1,853,017**
Debt Funded alternatives																					
Debt Funded Desired Spending level																					
Regional project spending	$750,000	$2,250,000	$13,500,000	$13,500,000	$15,000,000	$15,000,000	$15,000,000	$15,000,000	$15,000,000	$15,000,000	$14,250,000	$12,750,000	$1,500,000	$1,500,000							$150,000,000
Parcel sized projects		$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$28,500,000
Issue Debt in 5 year increments	$51,000,000					$82,500,000					$45,000,000										$178,500,000
Annual debt service 30 year debt 1.5%																					
First issue	$2,200,000	$2,200,000	$2,200,000	$2,200,000	$2,200,000	$2,200,000	$2,200,000	$2,200,000	$2,200,000	$2,200,000	$2,200,000	$2,200,000	$2,200,000	$2,200,000	$2,200,000	$2,200,000	$2,200,000	$2,200,000	$2,200,000	$2,200,000	$44,000,000
Second issue						$3,400,000	$3,400,000	$3,400,000	$3,400,000	$3,400,000	$3,400,000	$3,400,000	$3,400,000	$3,400,000	$3,400,000	$3,400,000	$3,400,000	$3,400,000	$3,400,000	$3,400,000	$51,000,000
Third issue											$1,900,000	$1,900,000	$1,900,000	$1,900,000	$1,900,000	$1,900,000	$1,900,000	$1,900,000	$1,900,000	$1,900,000	$19,000,000
Total debt service	$2,200,000	$2,200,000	$2,200,000	$2,200,000	$2,200,000	$5,600,000	$5,600,000	$5,600,000	$5,600,000	$5,600,000	$7,500,000	$7,500,000	$7,500,000	$7,500,000	$7,500,000	$7,500,000	$7,500,000	$7,500,000	$7,500,000	$7,500,000	$114,000,000
Total Operations and Maintenance	$250,000	$900,000	$2,100,000	$2,600,000	$2,600,000	$2,825,000	$3,050,000	$3,275,000	$3,500,000	$3,725,000	$3,950,000	$4,175,000	$4,400,000	$4,625,000	$4,850,000	$4,850,000	$4,850,000	$4,850,000	$4,850,000	$4,850,000	$71,075,000
Total Desired Spending with Debt	**$2,450,000**	**$3,100,000**	**$4,300,000**	**$4,800,000**	**$4,800,000**	**$8,425,000**	**$8,650,000**	**$8,875,000**	**$9,100,000**	**$9,325,000**	**$11,450,000**	**$11,675,000**	**$11,900,000**	**$12,125,000**	**$12,350,000**	**$12,350,000**	**$12,350,000**	**$12,350,000**	**$12,350,000**	**$12,350,000**	**$185,075,000**
Debt Options																					
1-Assumed revenue of $10 million		$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$10,000,000	$190,000,000
Short/over	($2,450,000)	$6,900,000	$5,700,000	$5,200,000	$5,200,000	$1,575,000	$1,350,000	$1,125,000	$900,000	$675,000	($1,450,000)	($1,675,000)	($1,900,000)	($2,125,000)	($2,350,000)	($2,350,000)	($2,350,000)	($2,350,000)	($2,350,000)	($2,350,000)	$4,925,000
2-Tax increment funding*	$ 714,713	$ 934,074	$ 1,157,822	$ 1,386,045	$ 1,618,833	$ 1,856,276	$ 2,098,468	$ 2,345,504	$ 2,597,481	$ 2,854,498	$ 3,116,654	$ 3,384,054	$ 3,656,802	$ 3,935,005	$ 4,218,771	$ 4,508,213	$ 4,803,444	$ 5,104,580	$ 5,411,738	$ 5,725,040	$61,428,017
Short/over	($1,735,287)	($2,165,926)	($3,142,178)	($3,413,955)	($3,181,167)	($5,568,724)	($6,551,532)	($6,529,496)	($6,502,519)	($6,470,502)	($8,333,346)	($8,290,946)	($8,243,198)	($8,189,995)	($8,131,229)	($7,841,787)	($7,546,556)	($7,245,420)	($6,938,262)	($6,624,960)	($123,646,983)
3-Both Tax increment and $10 M other revenue	$714,713	$10,934,074	$11,157,822	$11,386,045	$11,618,833	$11,856,276	$12,098,468	$12,345,504	$12,597,481	$12,854,498	$13,116,654	$13,384,054	$13,656,802	$13,935,005	$14,218,771	$14,508,213	$14,803,444	$15,104,580	$15,411,738	$15,725,040	$251,428,017
Short/over	($1,735,287)	$7,834,074	$6,857,822	$6,586,045	$6,818,833	$3,431,276	$3,448,468	$3,470,504	$3,497,481	$3,529,498	$1,666,654	$1,709,054	$1,756,802	$1,810,005	$1,868,771	$2,158,213	$2,453,444	$2,754,580	$3,061,738	$3,375,040	$66,353,017
4-Both Tax increment and $7M other revenue	$714,713	$7,934,074	$8,157,822	$8,386,045	$8,618,833	$8,856,276	$9,098,468	$9,345,504	$9,597,481	$9,854,498	$10,116,654	$10,384,054	$10,656,802	$10,935,005	$11,218,771	$11,508,213	$11,803,444	$12,104,580	$12,411,738	$12,725,040	$194,428,017
Short/over	($1,735,287)	$4,834,074	$3,857,822	$3,586,045	$3,818,833	$431,276	$448,468	$470,504	$497,481	$529,498	($1,333,346)	($1,290,946)	($1,243,198)	($1,189,995)	($1,131,229)	($841,787)	($546,556)	($245,420)	$61,738	$375,040	$9,353,017
* Tax increment can only be used for capital																					

Appendix B – Funding & Financing Matrix

Funding/Financing Type	Capital Investments	Ongoing Operation & Maintenance
Non-balloted stormwater fee	✓	✓
Enhanced Infrastructure Financing District	✓	
Water Rates	✓	✓
Sewer Rates	✓	✓
Revenue bonds	✓	
Clean Water SRF Loans	✓	
WIFIA Loans	✓	

Endnotes

[1] GSI practices include green roofs, rain gardens, permeable pavement, trees, cisterns, and other natural approaches that infiltrate, evapotranspirate, or reuse stormwater onsite. For purposes of this report, "regional-scale" GSI includes large installations that capture stormwater runoff from multiple properties and "parcel-scale" refers to GSI facilities that capture stormwater from a single residential, commercial, industrial, or institutional parcel. Together regional-scale and parcel-scale GSI can be implemented to create a countywide GSI program.

[2] https://www.flowstobay.org/wp-content/uploads/2020/03/CCAG-Task-2-Funding-Analysis2014_Final-Draft_0.pdf; https://www.flowstobay.org/wp-content/uploads/2020/03/GIDG-2nd-Edition-2020-03kh-RED.pdf

[3] American Rivers has conducted an analysis of the potential for a stormwater credit trading program in San Mateo County. See their separate report for more details.

[4] The Advancing Regional Stormwater Capture Projects: Business Case for Regional Collaboration was developed by Geosyntec as part of C/CAG's overall Regional Collaboration Framework project.

[5] SCI Consulting Report, 2014; SCI Consulting Report, 2018.

[6] "As stated earlier, water and sewer fees are exempt from the voter approval requirements of Proposition 218. Senate Bill (SB) 231, signed by Governor Brown on October 6, 2017, provides a definition for sewer that includes storm drainage. This clarification would give stormwater management fees the same exemption from the balloting requirement that applies to sewer, water, and refuse collection fees, and would make stormwater property-related fees a non-balloted option – something very attractive to municipalities. Unfortunately, the Howard Jarvis Taxpayers Association, who authored and sponsored Proposition 218, is expected to file a lawsuit against any municipality that adopts a stormwater fee without a ballot proceeding. Therefore, the SB 231 approach must be given a very cautionary recommendation at this time. Any agency considering moving in that direction should consult with other agencies and industry groups to coordinate their efforts in a strategic manner and avoid setting an unfavorable legal precedent." … "Further, Proposition 218 was not sufficiently explicit on the key question of whether stormwater qualifies for the water, sewer, and refuse collection exemption from the voter approval requirement. This issue was settled in 2002 when the appellate court ruled that any new or increased stormwater fee would be required to obtain voter approval. However, SB 231 (2017) attempts to push back on the Salinas decision, and may prove to be the vehicle for putting funding for stormwater services on par with the other water-related services." (SCI Consulting Report, 2018.)

[7] " 'Fee' or 'charge' means any levy other than an ad valorem tax, a special tax, or an assessment, imposed by an agency upon a parcel or upon a person as an incident of property ownership, including a user fee or charge for a property related service. (Cal Const, Art. XIII D § 2(e).)

[8] (*Howard Jarvis Taxpayers Ass'n v. City of Salinas* (2002) 98 Cal.App.4th 1351, 1354 (citing Cal. Const. Art. XIII D § 6(c).)

[9] (*Id.*)

[10] (Cal. Gov. Code § 53750(k) (emphasis added).)

[11] (Cal. Gov. Code § 53751(m).)

[12] This memo is based on the presumption that fees or charges imposed to fund stormwater services in C/CAG's members' jurisdictions will be "property-related fees or charges." A "property-related service" is "a public service having a direct relationship to property ownership." (Cal. Const. Art. XIII D § 2(h).) Analysis whether C/CAG's members could fund stormwater services with fees or charges that are not related to property ownership outside of the meaning of Article XIII D section 2 of the California Constitution is beyond the scope of this memo.

[13] (Cal. Const., art. XIII D, § 6(a)(1).)

[14] (Cal. Const., art. XIII D, § 6(a)(2).)

[15] (Cal. Const., art. XIII D, § 6(a)(2).)

[16] (Cal. Const., art. XIII D, § 6(b).)

[17] (*See Newhall County Water Dist. v. Castaic Lake Water Agency* (2016) 243 Cal.App.4th 1430, 1446.)

[18] (*San Diego County Water Authority v. Metropolitan Water Dist. of Southern California* (2017) 12 Cal.App.5th 1124, 1153 (citing *Newhall County Water Dist. v. Castaic Lake Water Agency* (2016) 243 Cal.App.4th 1430, 1436-1438, 1441, 1442, 1446).)

[19] (*Paland v. Brooktrails Township Community Services Dist. Bd. of Directors* (2009) 179 Cal. App. 4th 1358, 1362.)

[20] (Cal. Const., art. XIII D, § 3(a)(4)); Section 4 of Article XIII D of the California Constitution sets out separate procedures and requirements applicable to "assessments" on parcels which will have a special benefit conferred upon them and upon which an assessment will be imposed. These procedures and requirements are beyond the scope of this memo.

[21] (Cal. Const., art. XIII C, § 1(b).)

[22] (Cal. Const., art. XIII C, § 1(b).)
[23] As of April 2021, C/CAG estimates that these stormwater fees generate $3 million in revenues annually. C/CAG Stormwater Committee, April 18, 2021, Matt Fabry Slides, 17 (2021) https://ccag.ca.gov/wp-content/uploads/2021/04/Fabry_SWCommittee_041521_Presentations.pdf.
[24] Under "common powers" rule governing joint powers authorities, C/CAG has the authority to carry out the powers its members are authorized to carry out individually. (Cal. Gov't Code § 6502; see also *Robings v. Santa Monica Mountains Conservancy* (2010) 188 Cal. App. 4th 952, 962.)
[25] (See Cal. Water Code § 81301(e); see also, generally, Cal. Water Code §§ 81300-81461 (establishing the Bay Area Water Supply and Conservation Agency).)
[26] (AB 825, Sec. 3.)
[27] (Cal. Const., art. XIII D, § 6(b)(2).)
[28] (*See, e.g., Paland v. Brooktrails Township Community Services Dist. Bd. of Directors* (2009) 179 Cal. App. 4th 1358, 1363, 1364.)
[29] (Cal. Const., art. XIII D, § 6(b)(5).)
[30] (SCI Consulting Report, 2018.)
[31] See Geosyntec Drivers & Objectives May 2021 memo for a detailed outline of the Objectives of regional stormwater management via green infrastructure. These Objectives would inform the bases for a non-balloted property-related stormwater fee or charge.
[32] The California Regional Water Quality Control Board San Francisco Bay Region's analysis of Prop 218 is consistent. (See NPDES Permit No. CAS612008, Order No. R2-2022-XXXX, Attachment A, 89-91, https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/stormwater/MRP/Compiled%20Order%20and%20All%20Attachments%20(RS-ACC).pdf.)
[33] (*See San Diego County Water Authority v. Metropolitan Water Dist. of Southern California* (2017) 12 Cal.App.5th 1124, 1153.) In addition, C/CAG implements the Countywide Water Pollution Prevention Program and Stormwater Resource Plan further demonstrating that stormwater management via green infrastructure and other measures are services C/CAG and its members provide.
[34] (MS4 Permit, Section C.3.j.i.)
[35] (*See, e.g., Paland v. Brooktrails Township Community Services Dist. Bd. of Directors* (2009) 179 Cal. App. 4th 1358, 1363, 1364.)
[36] ((*Howard Jarvis Taxpayers Ass'n v. City of Salinas* (2002) 98 Cal.App.4th 1351, 1354 (citing Cal. Const. Art. XIII D § 6(c).)
[37] Rain Barrels & Rebate Program, Flows to Bay, C/CAG, https://www.flowstobay.org/preventing-stormwater-pollution/at-home/rain-barrels-rebate-program/.
[38] Orange Memorial Park Regional Stormwater Capture Project, City Of South San Francisco, https://www.ssf.net/departments/public-works/engineering-division/capital-improvement-program/orange-memorial-park-regional-storm-water-capture-project.
[39] https://safecleanwaterla.org/.
[40] https://safecleanwaterla.org/wp-content/uploads/2019/08/SCW-Board-Letter-Package-CEO-Signed-20180717-Revised-FINAL-SIGNED.pdf.
[41] L.A. Cnty. Code, Title 20, Chpt. 16, §§ 16.08 (tax rate), 16.09 (exemptions).
[42] L.A. Cnty. Code, Title 20, Chpt. 16, §§ 16.03, 16.05. "[A] Project that utilizes natural processes that slow, detain, infiltrate or filter Stormwater or Urban Runoff. These methods may include relying predominantly on soils and vegetation; increasing the permeability of Impermeable Areas; protecting undeveloped mountains and floodplains; creating and restoring riparian habitat and wetlands; creating rain gardens, bioswales, and parkway basins; and enhancing soil through composting, mulching, and planting trees and vegetation, with preference for native species. Nature-Based Solutions may also be designed to provide additional benefits such as sequestering carbon, supporting biodiversity, providing shade, creating and enhancing parks and open space, and improving quality of life for surrounding communities. Nature-Based Solution includes Projects that mimic natural processes, such as green streets, spreading grounds and planted areas with water storage capacity." (L.A. Cnty. Code, Title 20, Chpt. 16, § 16.03.)
[43] (Cal. Gov't Code §§ 53398.51, 53398.59.)
[44] (See Cal. Gov't Code § 53398.51(h).)
[45] (Cal Gov't Code § 53398.51(f).)
[46] (Primer on California's New Tax Increment Financing Tools, Chpt. 2, 8 (2017).)
[47] (Id.)
[48] This hypothetical example is based on historic tax revenue information for the County. Analysis available upon request.
[49] (Cal Gov't Code § 53398.52.)

[50] (Cal. Gov't Code § 53398.52.)
[51] See, e.g., San Bruno Municipal Code, Chpt. 10.14.010, see also, e.g., Brisbane Municipal Code, Chpt. 13.12. Further, while Division 5 of the California Public Utilities Code authorizes municipal corporations to own and operate public utilities, including water utilities, "it is the public entity itself which fixes utility rates pursuant to its independent legislative power. (*American Microsystems, Inc. v. City of Santa Clara* (1982) 137 Cal.App.3d 1037, 1042-1043.)
[52] For example, Division 6 of the California Public Utilities Code authorizes creation of "municipal utility districts"
[53] https://lafco.smcgov.org/coastside-county-water-district
[54] See, e.g., https://www.coastsidewater.org/images/stories/pdfs/Resolution-2020-04-amending-rate-and-fee-schedule.pdf
[55] (*American Microsystems, Inc. v. City of Santa Clara* (1982) 137 Cal.App.3d 1037, 1042.)
[56] (Id.)
[57] https://www.flowstobay.org/preventing-stormwater-pollution/at-home/rain-gardens/
[58] BAWSCA, Long-Term Reliable Water Supply Strategy Phase II Final Report, 4-21 – 4-25 (February 2015), https://bawsca.org/uploads/userfiles/files/BAWSCA_Strategy_Phase_II_Final_Report_Feb_2015.pdf.
[59] BAWSCA, Long-Term Reliable Water Supply Strategy Phase II Final Report, 4-23 (February 2015), https://bawsca.org/uploads/userfiles/files/BAWSCA_Strategy_Phase_II_Final_Report_Feb_2015.pdf.
[60] BAWSCA, Long-Term Reliable Water Supply Strategy Phase II Final Report, 4-24 – 4-25 (February 2015), https://bawsca.org/uploads/userfiles/files/BAWSCA_Strategy_Phase_II_Final_Report_Feb_2015.pdf.
[61] As a general matter, how wastewater utilities approach rates varies widely structures include rates, property taxes, and fees based on parcel-size or amount of water put into the wastewater system. Approaches can also differ within a utility depending on whether a customer has metered or non-metered use or according to the type of property i.e., residential or commercial, being charged. For purposes of this report we use "rate" to include these various structures. Full exploration of the nuances of each of these approaches is, however, beyond the scope of this report.
[62] See, e.g., City of San Mateo Municipal Code § 7.38.060 (Sewer Fees and Charges).
[63] https://lafco.smcgov.org/maps?f%5B0%5D=search_api_multi_aggregation_8%3ASewer/Sanitation&f%5B1%5D=search_api_multi_aggregation_8%3ACounty-governed.
[64] For example, Division 6 of the California Public Utilities Code authorizes creation of "municipal utility districts."
[65] https://lafco.smcgov.org/bayshore-sanitary-district
[66] See, e.g., http://www.bayshoresanitary.com/documents/construction/Bayshore-Sanitary-District-Code-Updated-to-Ord-No-07-5-27-21.pdf
[67] (*American Microsystems, Inc. v. City of Santa Clara* (1982) 137 Cal.App.3d 1037, 1042.)
[68] (Id.)
[69] City of San Mateo, Green Infrastructure Plan, Table 6-3, https://www.cityofsanmateo.org/DocumentCenter/View/78488/City-San-Mateo-GI-Plan-080219_Updated-11-19-2019?bidId=.
[70] See, generally, Spitz & Brennan, Orrick, Herrington & Sutcliffe LLP, Water and Wastewater Projects: Financing with Tax-Exempt Bonds (2012), https://media.orrick.com/Media%20Library/public/files/w/water-and-wastewater-projects-financing-with-tax-exempt-bonds-pdf.pdf; see also California Debt and Investment Advisory Commission, California Debt Financing Guide (June 2021), https://www.treasurer.ca.gov/cdiac/debtpubs/financing-guide.pdf.
[71] WaterNow Alliance, Tap into Resilience Toolkit, *What are My Financing Options, Types of Bonds, Municipal/Revenue Bonds*, available at: https://bit.ly/2ZPMDqK; see also WaterNow Alliance, *Innovation in Action: 21st Century Water Infrastructure Solutions*, available at: https://tapin.waternow.org/resources/innovation-in-action-21st-century-water-infrastructure-solutions.
[72] The California Debt And Investment Advisory Commission, California Debt Financing Guide, 1-4, E-19 (June 2021), https://www.treasurer.ca.gov/cdiac/debtpubs/financing-guide.pdf. Voter approval requirements may still apply depending on the issuing entity and the statutory authority governing the bond issuance.
[73] WaterNow Alliance, Tap into Resilience Toolkit, *What are My Financing Options, Types of Bonds, Green Bonds*, available at: https://bit.ly/2ZPMDqK; see also WaterNow Alliance, Tap into Resilience Toolkit, *How to Issue a Green Muni Bond: The Green Muni Bond Playbook*, available at: https://tapin.waternow.org/resources/how-to-issue-a-green-muni-bond/.
[74] California cities, towns, counties, and other governmental agencies may also be authorized to issue general obligation bonds. Exploration of the legal authorities related to general obligation bonds is beyond the scope of this report.
[75] Cal. Const. art. XI, §§ 3(a), 5.

[76] The California Debt And Investment Advisory Commission, California Debt Financing Guide, i-32 (June 2021), https://www.treasurer.ca.gov/cdiac/debtpubs/financing-guide.pdf. "Charter cities are also subject to general state laws, and all public agencies are subject to the California Constitution." Ibid.
[77] https://sfpuc.sharefile.com/share/view/s5b528d2bb628418599a4aa17006299d7
[78] The California Debt And Investment Advisory Commission, California Debt Financing Guide, i-32 (June 2021), https://www.treasurer.ca.gov/cdiac/debtpubs/financing-guide.pdf.
[79] The California Debt And Investment Advisory Commission, California Debt Financing Guide, 1-3 (June 2021), https://www.treasurer.ca.gov/cdiac/debtpubs/financing-guide.pdf.
[80] Cal. Gov't Code §§ 54300-54700.
[81] Cal. Gov't Code § 54309.
[82] Cal. Gov't Code §§ 54386, 54387.
[83] See, e.g., The California Debt And Investment Advisory Commission, California Debt Financing Guide, 3-60 (June 2021), https://www.treasurer.ca.gov/cdiac/debtpubs/financing-guide.pdf.
[84] The Government Code defines water as: "any system of public improvements intended to provide for the production, storage, supply, treatment, or distribution of water from any source." Cal. Gov't Code § 53750(n).
[85] Cal. Gov't Code § 6546.
[86] See, e.g., Cal. Gov't Code § 6547.
[87] Section 9142 provides that if a county records more than 500,000 votes for governor in the prior election that the bond must be placed on the next ballot for voter approval if at least 5% of the entire votes cast in the county sign a petition seeking referendum on the bond, or if a county records less than 500,000 gubernatorial votes in the prior election and receives a referendum petition from at least 10% of the votes cast then voter approval is required. Section 9142 does not specify by what percent approval is required for the referendum to pass.
[88] The California Debt And Investment Advisory Commission, California Debt Financing Guide, 3-17 (June 2021), https://www.treasurer.ca.gov/cdiac/debtpubs/financing-guide.pdf.
[89] Cal. Gov't Code § 54309.
[90] Cal. Gov't Code § 53398.77.
[91] AB 116 (Ting) (repealing Cal. Gov't Code § 53398.81), https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201920200AB116
[92] Cal. Gov't Code § 53398.77.
[93] Because this report is focused on options for financing distributed GSI discussion of the SRF established under the Safe Drinking Water Act is outside the scope of the report.
[94] California State Water Resources Control Board, Policy for Implementing the Clean Water State Revolving Fund, 1 (December 2019), https://www.waterboards.ca.gov/drinking_water/services/funding/documents/srf/dwsrf_policy/final_policy_1219.pdf.
[95] California State Water Resources Control Board, Policy for Implementing the Clean Water State Revolving Fund, 1 (December 2019), https://www.waterboards.ca.gov/drinking_water/services/funding/documents/srf/dwsrf_policy/final_policy_1219.pdf.
[96] California State Water Resources Control Board, California Clean Water and Drinking Water State Revolving Fund Program Evaluation Report, 2 (December 2020), https://www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/docs/pubs/2019_per.pdf.
[97] https://www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/srf_basics.html.
[98] https://www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/docs/trueinterestcost.pdf.
[99] https://www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/srf_basics.html; see also Cal. Water Code § 13481.
[100] California State Water Resources Control Board, CWSRF Intended Use Plan 2021-2022, 16 (June 2021), https://www.waterboards.ca.gov/water_issues/programs/grants_loans/docs/cwsrf_iup_sfy2021_22_final2.pdf.
[101] https://www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/docs/fy1213/prdcr_implmnt.pdf.
[102] https://www.waterboards.ca.gov/water_issues/programs/grants_loans/docs/cwsrf_iup_sfy2021_22_final2.pdf
[103] https://www.sandiego.gov/sites/default/files/646245_-_storm_drain_improvements_and_green_infrasfructure_report_1.pdf
[104] https://www.epa.gov/sites/default/files/2021-03/documents/wifia_benefits_factsheet.pdf
[105] 33 U.S.C. § 3904; see also, https://www.epa.gov/wifia/what-wifia.
[106] Environmental Protection Agency, WIFIA Program Handbook, 11 (2019), https://tapin.waternow.org/wp-content/uploads/sites/2/2019/11/program_handbook_fy2019_mar_2019.pdf.
[107] 33 U.S.C. § 3906.
[108] 33 U.S.C. § 3905; see also, https://www.epa.gov/wifia/what-wifia.
[109] https://www.epa.gov/wifia/wifia-closed-loans

[110] The RainWise program provides residential customers rebates that cover up to 100% of the costs to install rain barrels and rain gardens to address stormwater runoff and combined sewer overflows. https://www.kingcounty.gov/services/environment/wastewater/cso/rainwise.aspx.

[111] "The Legislature shall have no power to give or to lend, or to authorize the giving or lending, of the credit of the State, or of any county, city and county, city, township or other political corporation or subdivision of the State now existing, or that may be hereafter established, in aid of or to any person, association, or corporation, whether municipal or otherwise, or to pledge the credit thereof, in any manner whatever, for the payment of the liabilities of any individual, association, municipal or other corporation whatever; nor shall it have power to make any gift or authorize the making of any gift, of any public money or thing of value to any individual, municipal or other corporation whatever."

[112] (*County of Los Angeles v. La Fuente* (1942) 20 Cal.2d 870, 876-877.)

[113] (Id.)

[114] (Id.)

[115] Because regional-scale GSI will be located on publicly owned property there is no gift of public funds question at issue with respect to these projects.

[116] Geosyntec has defined "Drivers" as: "The fundamental issues that provide impetus for managing stormwater on a regional scale."

[117] Geosyntec has defined "Objectives" as: "The desired outcomes from addressing the identified stormwater management drivers on a regional scale."