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# Challenges and Opportunities for Climate-Smart Stormwater Management in San Diego

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## Challenges and Opportunities for Climate-Smart Stormwater Management in San Diego

*By Laura Walsh*



**Scripps Institution of Oceanography Capstone Project for the Master's  
in Marine Biodiversity and Conservation Program**

**June 2017**

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## EXECUTIVE SUMMARY

Climate change is affecting stormwater management in San Diego County (San Diego) today and will continue to have major impacts on our region in the future. By 2050, San Diego will experience 16 percent fewer rainy days but 8 percent more rainfall during the biggest rainstorms in an average year (Climate Education Partners 2014). Precipitation models for the time period between 2000 and 2050 indicate an increasingly high degree of variability, which make the San Diego region vulnerable to both flooding and drought (Messner 2011). These forecasts emphasize the need for strong adaptation solutions — San Diego can and should plan for the future by investing in climate-smart stormwater management strategies that make our region more adaptive to coming changes.

Jurisdictions around San Diego are already preparing for changing climate conditions. In 2014, the San Diego Regional Water Quality Control Board (Regional Board) created unique provisions within the regional stormwater permit that provide flexible options for compliance. The County of San Diego issued guidelines to leverage design resources and streamline development of green street projects, and many jurisdictions expanded implementation of green streets. Unique partnerships have been formed to secure financing for stormwater projects, and opportunities for linking stormwater capture projects with recycle and beneficial use<sup>1</sup> strategies are being explored. Champions for creative projects are everywhere, this white paper will link and highlight some of their best ideas.

The purpose of this Gap Analysis is to identify challenges and opportunities for agencies in San Diego to better manage stormwater with climate-smart strategies. In this report, ‘climate-smart’ refers to a stormwater tactic that increases a system’s resiliency to both extreme dry and wet season flows while also enhancing local communities, businesses, and/or natural resources. On a technical level, this includes implementation of green infrastructure, which incorporates the use of natural hydrological systems to manage water and is regarded by the United States Environmental Protection Agency (EPA) as mostly synonymous with Low Impact Development (LID).<sup>2</sup> Climate-smart stormwater management by extension also refers to the tactical linkage of stormwater projects with other climate adaptation and mitigation efforts, like water capture and beneficial use, and greenhouse gas reduction.

‘Key Findings’ of this report are grouped into ‘Challenges’ that prevent climate-smart strategies from being implemented in San Diego, and ‘Opportunities’ where local leadership can and has advanced climate-smart strategies. Unsurprising to many, financing is the biggest challenge. This can be a problem on many levels; for example, green infrastructure projects tend to lack

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<sup>1</sup> This paper uses the term “capture and beneficial use” as opposed to “capture and reuse” to acknowledge that stormwater is not used at all but rather managed, and any attempt to use it for irrigation, potable, or other purposes is a beneficial use.

<sup>2</sup> LID typically refers to project-level tactics whereas green infrastructure may apply on community or even regional scales.

dedicated sources of Operation and Maintenance (O&M) funding, without which they cannot properly function. Stormwater fees collected from property owners throughout the county are either non-existent or crippling low in most cities. Furthermore, the innovative financing tools that could potentially relieve some of these issues typically require eligible projects to be designed, quantified, and valued in advance, which translates to high upfront investment from agencies. These financing challenges require special solutions that are addressed in the Opportunities section of Key Findings.

Other challenges noted in this report may be related to capacity or exist in large part because climate-smart opportunities represent a change in business-as-usual strategies and consequentially induce growing pains. These issues can and should be addressed by best practices. The 'Opportunities' component of this report identifies regionally applicable best practices and opportunities to further them; in addition to specific opportunities for innovative financing strategies. A general 'moment of opportunity' exists for stormwater innovation in San Diego due to trends such as the increasing availability of educational resources and climate change data, as well as political interest in resiliency and adaptation projects that respond to climate change. San Diego's aggressive greenhouse gas reduction initiatives for instance, can be referenced and applied to stormwater innovation. The region's relatively recent achievement in securing potable water resources through the Pure Water program can similarly be leveraged and linked to ideas for evolving stormwater management. This context, and its impact on major challenges and opportunities, is presented in 'Key Findings.'

This report is not intended for a purely technical or policy-focused audience. Instead, it is meant to provide a comprehensive picture of challenges and opportunities for innovating stormwater management regionally; as gathered through interviews with regional stakeholders involved in design, implementation and regulation. The report concludes with a selection of case studies that were chosen with consideration of key findings, that can serve as models for designing, financing and implementing climate-smart stormwater management in San Diego.

## OBJECTIVES

This report was developed by Laura Walsh, a Masters of Advanced Studies candidate in the Marine Biodiversity and Conservation graduate program at the Scripps Institution of Oceanography (SIO), in collaboration with the San Diego Regional Climate Collaborative (SDRCC). This project was requested by and for SDRCC so they may gain a better understanding of how public agencies in San Diego are currently planning for climate change in their stormwater management strategies, as well as to identify barriers and opportunities for advancing more resilient options with multiple co-benefits to local communities.

This project was designed to meet three objectives. The first was to develop an understanding of how public agencies around the country and specifically in San Diego are currently designing and implementing stormwater projects capable of handling more climate variability; for

example, less frequent but more intense rainfall events and longer periods of drought. In particular, the report focuses on the use of green infrastructure techniques.

The second objective was to identify challenges that agencies in San Diego face when implementing these types of 'climate-smart' stormwater management strategies. Prior SDRCC workshops had already uncovered lack of funding and resources as major challenges and thus were given special consideration. 'Challenges' include barriers to stormwater strategies at all levels of implementation from concept to construction to ongoing maintenance.

The final goal was to address these challenges by identifying Best Practices within San Diego and other regions throughout the United States that could be leveraged to help our region advance sustainable stormwater management strategies. 'Best Practices' include examples where San Diego is addressing certain challenges by applying creative solutions that can be further developed and standardized. The final conclusions of this report are meant to be shared among jurisdictions throughout San Diego County and to serve as a guide for taking advantage of current low hanging opportunities for improving stormwater management.

## METHODOLOGY

A preliminary literature review was conducted to assess the stormwater regulatory environment, with a focus on the history of the complex permitting systems with which public agencies in San Diego must comply. This included an in-depth analysis of the San Diego Region Municipal Separate Storm Sewer System permit (regional MS4 municipal permit) and its recent 2013 amendments.

The bulk of the project time was then dedicated to interviews with local stakeholders. One of the major goals was to take a pulse on current regional interest in climate-smart stormwater management programs through conversations with representatives of public agencies, regulators, private entities and developers, consultants, engineers, and non-profit organizations. Approximately thirty interviews were conducted in total.

Interviewees were asked about their most notable stormwater project experiences and the financial and regulatory incentives they encountered. When relevant, interviewees were asked about the recent amendments to the regional MS4 municipal permit and how these changes may have affected their work. The regional MS4 municipal permit's 'Alternative Compliance' option outlined in this permit was discussed to gauge whether it may play a significant regional role in funding stormwater innovation.

Time was also dedicated to collecting resources and case studies through interviews and to reviewing regional Water Quality Improvement Plans (WQIPs). A number of regionally successful case studies for financing, design and management are presented at the end of this report.

A document created by Re:Focus Partners entitled “Field Guide to CSO+”<sup>3</sup> was utilized about halfway through the interview portion of this project. The field guide includes a short survey meant to be an entry point for communities struggling to take action to address combined sewer overflows (CSOs) or other stormwater management issues. These surveys were brought to four interviews with stormwater staffers, although no staffer felt comfortable answering all the questions as this would require them to answer on behalf of other individuals and departments in their city.

A final spreadsheet was created to record responses from each interview. These takeaways have been analyzed for common themes and messages and grouped into key findings, which have been categorized as Challenges and Opportunities in this paper.

Upon completion, this report was reviewed by Laura Engeman, Director of the San Diego Regional Climate Collaborative; Robert Leiter, former Planning Director of the San Diego Association of Governments; Ellory Monks, Co-Founder of The Atlas Marketplace, Co., Alisa Vladerrama; Senior Policy Analyst for the Water Program at the Natural Resources Defense Council; and Geoff Brosseau, Executive Director of the California Stormwater Quality Association (CASQA).

## BACKGROUND

The idea that stormwater projects can be adaptive and provide many co-benefits is not new. Stormwater managers and technical experts have been privy to LID and green infrastructure techniques since the 1980s, although demand has increased for reasons pertaining to climate change and a more stringent regulatory environment, as outlined below (American Planning Association 2017).

In the 1970s and 80s, stormwater management, flood control, water treatment, and distribution services were set up to be addressed separately within municipalities. This legacy of so-called ‘management siloes’ still persists today, but San Diego is beginning to develop a more holistic and integrated approach to various aspects of water sources, water use, and water treatment (American Planning Association 2017).

This is in large part due to factors associated with climate change. In a recent study conducted by the California Climate Change Center, climate models projected that warming and essentially earlier summer conditions in San Diego will induce hydrological deficit, or drought, more often between now and 2050. Projections for future precipitation patterns in San Diego have mixed results, but one important aspect of all the climate projections is that a high degree of variability of annual precipitation will prevail during the next five decades. These patterns, which probably already sound familiar to San Diegans, will continue to expose the region to

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<sup>3</sup> *Field Guide to CSO+* is a guidebook for municipalities created in 2017 by Re:Focus Partners. It can be found here: [http://www.refocuspartners.com/wp-content/uploads/pdf/170307\\_CSQ\\_FieldGuide\\_DIGITAL.pdf](http://www.refocuspartners.com/wp-content/uploads/pdf/170307_CSQ_FieldGuide_DIGITAL.pdf)



more severe instances of both drought and flooding, and require more adaptive stormwater infrastructure than is currently in place today (Messner 2011).

Meanwhile, an increasing strain on potable water supplies presents an opportunity to better integrate stormwater strategies with other aspects of water management. Demand for water is expected to increase 46% by 2035 while water supplies from San Diego's major sources of water imports (the Sierra Nevada and the Colorado River) will be under more stress from warming temperatures and more extended droughts that reduce snowpack and river flow (Climate Education Partners 2014). New stormwater projects or retrofits have a chance to incorporate more efficient capture and beneficial use methods to help address these issues.

Regulatory pressure and infrastructure needs add to San Diego's need to create cost-effective stormwater management strategies. Like much of California, San Diego already needs to upgrade its aging water infrastructure. In 2015, the City of San Diego released a report detailing its water and sewer infrastructure needs and revealed a gap between needs and available funding of about a billion dollars (Consolidated Multi-Year Capital Planning Report 2015). Additionally, national and regional water quality standards have become more stringent over the past decade. For instance, 2013 amendments to the regional ms4 municipal permit required copermittees (local governments and independent jurisdictions) to develop pollution prevention programs for industrial, commercial and city facilities; a program to detect illegal discharge; and the expansion of year-round sampling programs (Regional MS4 Municipal Permit). These conditions put pressure on Municipal Stormwater to develop cost-effective strategies for infrastructure functionality and compliance.

Many agencies recognize an opportunity to maximize efficiency and reduce costs by implementing multi-faceted projects that contribute to various municipal responsibilities. By affixing stormwater projects to projects that address other important community priorities, cities can create near-term political wins and unlock alternative sources of funding and resources (ReFocus Partners 2016). So-called "integrated" projects achieve multiple benefits at a lower individual cost, and can also foster innovation by encouraging uncommon collaborations.<sup>4</sup> LID Roadway Improvements, also called "green streets" for instance, are not only a useful tool for capturing and treating stormwater, but can enhance public safety, nearby real estate values, alternative transportation options, and general livability in an area. These types of projects may also be able to leverage existing transportation funding to create more benefits for the same price tag that already tends to be reserved for street projects.

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<sup>4</sup> More information on the benefits of integrated infrastructure projects can be found in "Small Cities with Big-City Infrastructure Problems," created by Re:Focus Partners: [http://www.refocuspartners.com/wp-content/uploads/pdf/Build\\_It\\_Green\\_Final\\_Report.pdf](http://www.refocuspartners.com/wp-content/uploads/pdf/Build_It_Green_Final_Report.pdf)



Ongoing updates to local and regional climate change policies reinforce current interest in sustainable stormwater projects<sup>5</sup>. The San Diego International Airport's Watershed Stewardship Plan for instance, integrates a zero stormwater discharge goal with other flood resilience and water conservation priorities.<sup>6</sup> Several cities are also thinking about the energy-water-nexus in mitigation strategies that involve identifying ways to improve both energy and water efficiency, partly because transporting water requires large amounts of energy. The City of Chula Vista, for instance, created a Water Stewardship Plan approved by City Council in 2016 that clearly identifies climate-smart stormwater management as an opportunity to achieve aggressive greenhouse gas reduction goals and enacted several programs to leverage green infrastructure opportunities at city facilities, among other initiatives.

Climate change, regulatory pressures and related political priorities all contribute to an increasing need for climate-smart stormwater projects. Many of these trends are true in other communities, and resources and case studies related to climate-smart infrastructure are becoming more widely available. As jurisdictions throughout San Diego County enact strategies to prepare for climate change, we are reaching an opportune moment to showcase projects, address challenges, and take advantage of opportunities to implement best practices for climate-smart stormwater management strategies.

## KEY FINDINGS

This introduction provides an overview of the interplay between major challenges and opportunities for climate-smart stormwater management in a real-world context.

Because scientific modeling points toward strong precipitation and temperature variability on short time scales, stormwater management projects require adaptive multi-faceted strategies, as opposed to strategies that emphasize one priority function. This can present a planning challenge, especially in a political context where decisions and investments are typically framed by distinct 'pressure points,' like drought or flooding. Despite this challenge, stormwater managers have an opportunity to take a more holistic approach to stormwater management and to create projects that are not only adaptive but provide services to address a broad range of climate change mitigation goals (like reducing greenhouse gas emissions). One instance in which San Diego County has already responded to these circumstances is by implementing green streets. These often address community priorities for assuaging traffic and making areas

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<sup>5</sup>The City of Chula Vista's Watershed Stewardship Plan can be accessed here:  
<https://www.chulavistaca.gov/Home/ShowDocument?id=14439>

<sup>6</sup>The San Diego Airport Authority's Water Stewardship Plan can be accessed here:  
[http://www.san.org/Portals/0/Documents/Environmental/2016\\_0509\\_Water%20Stewardship%20Plan%20Document\\_F2.pdf](http://www.san.org/Portals/0/Documents/Environmental/2016_0509_Water%20Stewardship%20Plan%20Document_F2.pdf)

more pedestrian-friendly, meanwhile also working to reduce flooding, capture, and sometimes use that stormwater for nearby irrigation purposes.

Other major challenges to creative strategies for capturing and recycling stormwater are regional geological deficits: San Diego lacks underground storage basins and permeable soils that allow water to infiltrate into the ground (See Image 1). These conditions make integrating stormwater capture programs with wastewater reuse and recycle programs difficult. In response to this challenge, San Diego is exploring creative options for pumping captured stormwater to potable water reservoirs in the Northeast area of the County (San Diego Chamber of Commerce Stormwater Capture and Reuse Workshop 2017). The County of San Diego is also embarking on a Stormwater Capture Feasibility Study that can potentially uncover other geological opportunities and Best Practices for recycling stormwater. Onsite capture and use methods that do not involve groundwater recharge may also present opportunities for stormwater use.

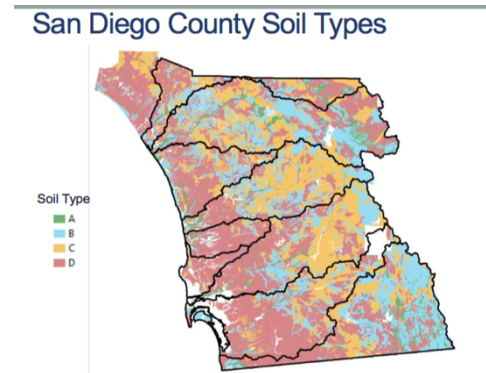


Image 1: San Diego soils are comprised primarily of C and D soils, which correspond to C) sandy clay loam and D) clay loam, silty clay loam, sandy clay, silty clay or clay.

Source: County of San Diego Workshop on Watershed Protection (Gaines 2017)

At the implementation level, financing is the defining challenge that climate-smart projects are up against. Lack of staff resources presents a related but distinct capacity problem for project development and implementation. This report will fully explore financing challenges and opportunities, with lack of committed Operations and Maintenance (O&M) financing presenting an especially tough challenge for sustaining projects. Some jurisdictions are learning how to reserve financing specifically for O&M and are beginning to emphasize life cycle cost accounting practices as a Best Practice. This approach more accurately considers the long-term value of green infrastructure projects, especially given increased climate variability forecasts.

Another way San Diego is inventing creative financing strategies is through the Alternative Compliance provision adopted in the most recent amendment to the regional MS4 municipal permit. Alternative Compliance Programs (ACP) are discussed in the Appendix of this report and may constitute a financing opportunity by providing an option for priority development projects (PDPs) to achieve offsite compliance in lieu of implementing onsite treatment control BMPs. The City of San Diego is currently creating an ACP characterized by a credit trading mechanism. Other specific program characteristics are being discussed, but the groundwork is being laid to ensure that upon development in 2018 it will be one of only a few robust offsite compliance programs in the country. One central area for discussion is how it will manage O&M project costs. In this sense, the challenge of creating a successful ACP also presents a major opportunity to develop a long-term financing mechanism.

As is the case with O&M, other challenges exist simply because climate-smart stormwater projects represent an alternative to the status quo. We do not yet have well-established standards or resources for financing, managing, and collaborating on certain projects. While this presents technical challenges in the short-term, San Diego has a major opportunity to develop best practices for streamlining solutions for the future. San Diego can also leverage the programs and resources that other regions have developed to tackle some of its same challenges. “Field Guide to CSO+” for instance, was created by the consulting firm Re:Focus partners and a landscape architecture team, SCAPE, as part of a collaborative program to help municipalities recognize opportunities for nontraditional financing of stormwater projects. Case studies in the field guide include examples of cities securing stormwater financing based on affordable housing, economic development, and public school needs in various municipalities.

San Diego could leverage this field guide and other resources to establish best practice standards for securing non-traditional sources of financing (See Appendix: Resources). Stormwater managers can uncover similar opportunities by participating in peer-to-peer exchanges like the Green Infrastructure Leadership Exchange, which allows stormwater managers from cities across the country to confer with one another in real time<sup>7</sup>. The Atlas Marketplace similarly offers an interactive digital platform that collects national case studies and can also be used to promote regional projects.<sup>8</sup> By leveraging these resources and gaining a better understanding of challenges and opportunities associated with climate-smart stormwater management, San Diego can take advantage of established means for implementing successful projects and find regional solutions to address tough challenges.

## CHALLENGES

Financing is the primary barrier to climate-smart stormwater management, in part because there are so few options for long-term financing of projects. O&M financing is of most concern, followed by problems associated with the public stormwater fee structure in San Diego. Other challenges presented here can be attributed to the fact that climate-smart strategies are nontraditional and require shifts in design, implementation, and management practices. In the ‘Opportunities’ section of this report, many of these challenges are addressed with the opportunity to formulate standards and other best practices.

### **Financing**

Financing is consistently cited as a barrier to climate-smart stormwater management. Based on project interviews, key regional financing issues include:

- *Operational and Maintenance (O&M) Costs:* As mentioned, ongoing O&M is critical to the proper functioning of a climate-smart project, yet there is currently a lack of major

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<sup>7</sup> The Green Infrastructure Leadership Exchange is a national stormwater practitioner network for municipalities. More information can be found here: <http://giexchange.org>

<sup>8</sup> The Atlas Marketplace collects case studies for financing infrastructure projects and can be found here: <http://www.the-atlas.com>

dedicated sources of financing for projects. For years, lack of sustainable funds for ongoing water quality monitoring has been such a problem that local non-profits like San Diego Coastkeeper have now created supplementary programs to monitor receiving waters throughout the year<sup>9</sup>. The Surfrider Foundation, San Diego Chapter, is also launching a Blue Water Task Force in 2017 in order to provide more frequent water quality monitoring in problem areas<sup>10</sup>.

- Public Stormwater Fee Structure:** Currently homeowners in the City of San Diego are charged 95 cents per month on their water bills for storm drain services; this generates revenue that is a small fraction of the overall cost of basic stormwater services (See Image 2). Some other cities in the region use revenue from a clean water fee, wastewater fee, or related fee to support stormwater services, but this is not considered a long-term sustainable form of financing and does not provide incentive for property owners to reduce runoff from their property. Currently, there are limitations in California state law that have instituted critical barriers to increasing stormwater fees, however recently approved legislation may prove helpful in this area.<sup>11</sup>

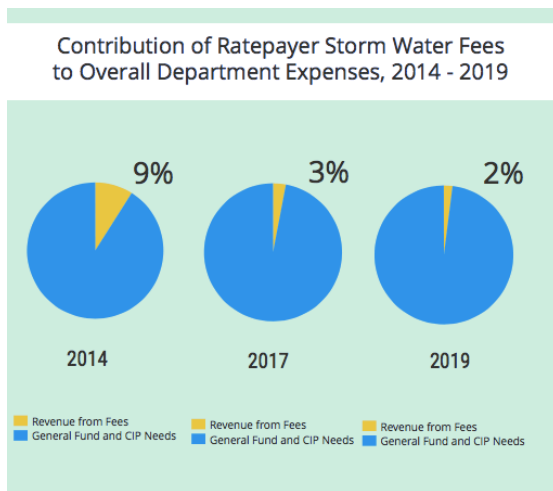


Image 2: Contribution of Ratepayer Stormwater Fees to Overall Department Expenses in 2014, 2017 and 2019. Information based on a constant fee and estimated outlook funding, as calculated by the City of San Diego in its 2013 'Fiscal Impact of New Stormwater Regulations' report.

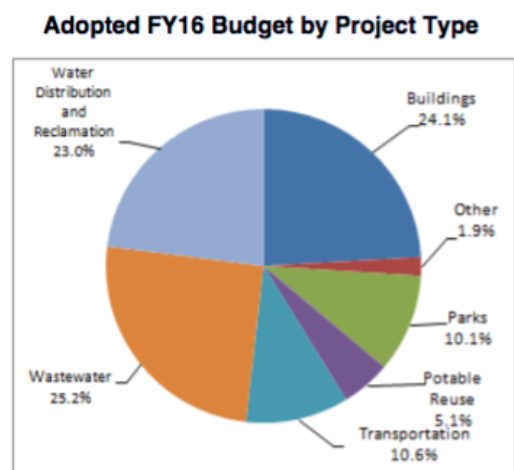


Image 3: City of San Diego Fiscal Year 2016 Adopted General Fund FTE Positions by Department

Source: City of San Diego Fiscal Year 2016 Adopted Budget

<sup>9</sup> San Diego Coastkeeper and a crew of trained volunteers have been collecting surface water quality information since 2011 and now monitor nine of 11 watersheds in the county (San Diego Coastkeeper 2017).

<sup>10</sup> More information can be found at <http://www.surfrider.org/blue-water-task-force/chapter/31>

<sup>11</sup> For more on how state legislation impacts financing of stormwater projects in California, see "Stormwater Funding Barriers and Opportunities" white paper at CASQA's website: <https://www.casqa.org/resources/california-lid-portal>

- *Competition for General Fund Dollars:* Most stormwater departments throughout San Diego County rely significantly on the General Fund to fund and finance stormwater projects. These funds are in high demand for many municipal responsibilities, with a large portion often being spent on public safety, transportation, and other municipal roles [See Image 3].
- *Competition for Grants:* State grants are considered a primary source of funding for any capital improvement project (CIP). California Proposition 1 (Prop 1) is the most recent and largest state grant pertaining directly to stormwater, authorizing \$7.2 billion directly for state water supply projects including stormwater capture. In 2016, Imperial Beach, National City, and the City of Vista all received Round 1 Implementation funding for stormwater projects (California Water Boards 2016) but statewide competition for these grants can be intense. These grants primarily fund design and construction of projects, but provide limited resources for ongoing O&M. These criteria can discourage jurisdictions concerned about long-term maintenance costs and liability from applying.

### **Capacity**

Lack of time, staff, and resources is the second most-often cited barrier to innovative stormwater management. Major resource issues include:

- *Limited Staff:* Most cities (but not all) are not able to add new staff positions dedicated specifically to stormwater management. For some cities in San Diego County, 'stormwater staff' refers to just one person, and he or she must be focused primarily on compliance with stormwater permits. Other typical responsibilities for this staff include procurement negotiation, grant application formulation, project concept and design development, stakeholder communication, project implementation, and project management; with very little time being allocated to workshop innovative ideas.
- *Limited Time to Pursue Grant Applications:* Many grants require that projects be at least partly designed (approximately 10 percent design typically qualifies as 'Conceptual Design' for a project) as a prerequisite for application (The Atlas Marketplace 2016). This creates a barrier for city staff that does not have the funding or capacity to design a project and complete lengthy and time-intensive grant applications.
- *Non-Traditional Supplies:* LID and green infrastructure strategies require materials not traditionally used on CIPs. The City of San Diego for instance, currently ships zeolite, an additive used for its absorptive properties on green street projects, from New Mexico to maintain the functionality of certain bioretention areas (Interview 2017).

- *Regional Geology:* San Diego does not have extensive underground basins to support groundwater recharge. A lack of permeable soils also makes traditional approaches to onsite infiltration and use difficult.

### **Education & Communication**

LID and green infrastructure techniques are still somewhat ‘alternative’ to the status quo of infrastructure planning. Communication and education-related issues include:

- *Limited Knowledge-Sharing:* A lack of available case studies that include specific design and monitoring details makes support-building in communities difficult, and also prevents other municipalities from leveraging lessons learned and best practices happening in the region.
- *Cultural Issues:* Public Works and Engineering departments may have, or are perceived as having, different views and experience with stormwater projects than sustainability officers or other typical ‘climate-smart’ advocates. The former group is often not well integrated with Planning and Parks departments, and is often brought into project planning processes relatively late, although they are still expected to implement and be accountable for the ultimate success of a project. Early collaboration from both parties is critical to successful projects.
- *Other Education Issues:* LID and green infrastructure systems are complex, and associated co-benefits or challenges to implementation are not easily conveyed to the general public. This limits bottom-up political familiarity or interest in these types of projects.
- *Integrated Management Challenges:* Bureaucratic ‘silos’ represent a well-recognized communication challenge in government. This can be particularly complicated in stormwater management because watersheds do not respect jurisdictional boundaries. Creating climate-smart strategies with co-benefits like wastewater conveyance or emissions reductions may require traditionally independent groups to develop more cohesive strategies for working together.
- *Limiting Procurement Practices:* Current procurement practices are not set up to construct and buy green infrastructure. For example, it can be very challenging to write a Request for Proposals (RFP) for a large-scale green infrastructure project because specific modeling, monitoring, and evaluation are essential.

### OPPORTUNITIES

Creative opportunities for long-term financing are considered below, followed by other opportunities to further best practices.

## Financing

Creative financing mechanisms for supporting new stormwater projects are emerging throughout the county. Some opportunities listed below are mentioned because they could be further utilized throughout the region, some originated in other cities and could be considered for application regionally.

- *California Proposition 1 Grants:* Prop 1 grants are the largest direct source of state funding allocated specifically for stormwater projects and still represent a major financing opportunity. The County of San Diego’s Functionally Equivalent Stormwater Resource Plan includes more than 300 proposed projects that could be eligible for remaining Prop 1 funding after early 2017 (San Diego Regional Project Database 2017).

- *Other Public Funding Sources:* Sources of government revenue aside from grants that have been utilized in other cities include General Funds, Special Service Taxes, Permit Fees, Sales Taxes and Calibrated Stormwater Utility Fees. National City’s A Avenue Green Street and Pedestrian Pathway project utilized a wide range of financing mechanisms, including: 67% California Proposition 84 grants, 19% Self-Generation Incentive Program (SGIP) Grants<sup>12</sup>, 8% Library Capital Outlay 4% General Fund, and 3% TransNet Proposition A Fund (See Figure 2).

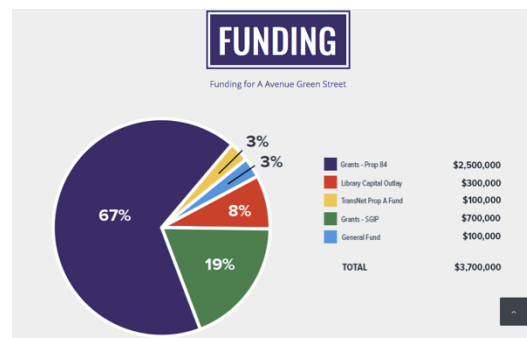


Figure 2: National City A Avenue Funding Sources.

Source: City of National City ‘Projects’ Website.

- *Non-Traditional Grant Opportunities:* Resources and staffing for stormwater projects can be greatly expanded when projects are affixed to other municipal issues. If economic development or affordable housing is the main priority for a given city, grants pertaining to these issues that may afford flexibility for integrated stormwater management tactics should be considered. For instance, a distressed community experiencing chronic flooding that inhibits economic growth and development in the area may be eligible for the \$3 million dollars currently available for construction projects through predevelopment grants from the Economic Development Agency of the federal Department of Commerce. This and other non-traditional Grant Opportunity examples are listed below in Table 2.

## Non-Traditional Stormwater Grant Opportunities for Various Strategic Priorities

<sup>12</sup> The Self-Generation Incentive Program is a California Public Utilities Commission grant that supports existing new and emerging distributed energy resources.



Strategic Priority	Funding Opportunity	Who Should Consider
Economic Development	Predevelopment grants from the Economic Development Agency	“Distressed” communities experiencing chronic flooding that inhibits economic growth and development.
Public Housing	Federal Housing and Urban Development (HUD) grants including the Community Development Block Grant (CDBG) Program, Section 108 Loan Guarantee Program and Sustainable Communities Regional Planning Grants	Communities with flooding issues near major public housing developments
Public Schools	US Green Building Council’s Center for Green School Grants, US Department of Education Grants	Communities with flooding issues seeking to build small-scale green infrastructure projects.

Table 2: Non-Traditional Grant Opportunities for Various Strategic Priorities. Extrapolated From: Field Guide to CSO+ by ReFocus Partners

- **Non-Traditional Project Alignment:** Municipal projects with dedicated sources of funding can often support stormwater retrofits. This is the case with many green streets, which can utilize CIP and transportation project funds. Other less traditional alignments may also be possible. The City of San Diego for instance, recently incorporated multiple green infrastructure elements within a parking lot at the Southeast Family Resource Center<sup>13</sup>.
- **Public Financing Options and Creative Financing Frameworks:** Tools that leverage public funding include municipal project revenue bonds, general obligation bonds, and green bonds. Public-private partnerships are also generating some interest regionally. DC Water, a water utility in Washington D.C., leveraged private partnerships with the Goldman Sachs Urban Investment Group and Calvert Foundation to issue a first-of-its-kind \$25 million Environmental Impact Bond in 2015. The bond was created in response to major CSO challenges from antiquated stormwater infrastructure, and helps DC Water hedge performance risk on a green infrastructure build-out (DC Water is Life 2015).

<sup>13</sup> Details of this project were presented at a Chollas Creek Metals TMDLs Stakeholder Meeting in 2011. <https://www.sandiego.gov/sites/default/files/legacy/stormwater/pdf/2011mtgcountyrunoff.pdf>

- *Legislative Changes to Stormwater Fee Structure:* California Proposition 218 imposed constitutional limits on local officials' ability to impose, increase and extend fees, including property-related fees. These rules do not apply to sewer, water, or refuse collection services, yet the definitions of water and sewer have historically been interpreted to not include stormwater services. Assembly Bill 2403, amended in 2016, clarifies the definition of "water" to include "improvements for producing, storing, supplying, treating, or distributing water from any source" (AB 2403 2016). Senate Bill 231, passed in the California State Assembly in mid 2017, further links the term "sewer" to stormwater management systems. In theory, clarifying these legal definitions could give the cities the right and/or the confidence to raise stormwater fees (SB 231 2017).
- *CalTrans Cooperative Implementation Agreements:* CalTrans is currently financing stormwater projects throughout the state within its Total Maximum Daily Load (TMDL) area. Selection criteria include the type of BMP to be built and number of acres treated. This can be an important source of state funding that applies directly to the built environment (Kontaxis 2017). The City of San Diego is currently using CalTrans fees to support projects affecting the Mission Bay Watershed.
- *Alternative Compliance Program:* ACP presents an opportunity to attract and organize private financing for large-scale stormwater projects. The City of San Diego is currently working on creating a credit trading program to be established by early 2018. The mechanics of the program are still under development and more detail is provided in Appendix A3: Alternative Compliance.

### **Development of Best Practices**

Many opportunities exist to establish Best Practices that confront the challenges cited in this report. The best practice opportunities listed below are not merely hypothetical; they are based on real solutions that could be further developed and standardized.

- *Knowledge-Sharing Within Individual Agencies:* 'Champions,' or professionals who are especially interested in innovating and implementing climate-smart techniques can be the primary drivers of new projects. Some cities, like the City of Lemon Grove, have a single stormwater staffer who is enabled to work with many different departments in order to bridge the communications challenges that are often associated with bureaucratic silos. Other agencies have hired additional staff for this express purpose. The City of Los Angeles, for instance, recently hired a Water Policy Advisor with the specific intention to integrate multiple aspects of water capture and reuse.
- *Knowledge-Sharing Across Agencies:* The creation of organizations or professional positions that exist in order to facilitate communication and leverage resources across agencies presents a major opportunity to break through traditional siloes. The San Diego Regional Climate Collaborative (SDRCC) is a regional network of public

agencies established in 2012 that executes this role in order to help cities plan for climate change. SDRCC Workshops attended by regional stormwater professionals produced the impetus for this report. The California Stormwater Quality Association (CASQA) has also long brought stormwater professionals together through its California Stormwater Quality Task Force (SWQTF) started in 1989. CASQA hosts monthly Board of Directors meetings, bi-monthly Executive Program Committee meetings, quarterly General Membership meetings/webcasts, and its Annual Conference, which drew in a record number of attendees in San Diego in 2016.

- *Leveraging Resources:* Case studies are a major resource that agencies can reference or circulate for others to learn from. Publishing case studies so they are readily and publicly available, as the City of San Diego and National City have done on their city websites<sup>14</sup>, is a best practice that could be replicated in all communities. The County of San Diego also released Green Streets Guidelines specifically to leverage design resources and streamline development of green street projects<sup>15</sup>. Another example of the County of San Diego implementing best practices to leverage community resources is through its Functionally Equivalent Stormwater Resource Plan, which requires all cities to enter potential stormwater projects eligible for Prop 1 funding into a database. The database can be navigated to view project descriptions in various areas, and includes a map that allows users to compare similar projects across jurisdictions throughout the County<sup>16</sup>. Two commonly referenced resource platforms among stormwater practitioners are CASQA's California LID Portal and EPA's Green Infrastructure website<sup>17</sup>.
- *Multi-Stakeholder Management:* Projects with multiple non-profit, public, and even private partners can achieve multiple goals and may have access to more funding opportunities. One way the Regional Board is encouraging agencies to work together is by requiring Water Quality Improvement Plans (WQIPs) to identify problems and solutions for improving water quality in San Diego. WQIPs are created around watersheds, which do not follow jurisdictional boundaries and therefore require stormwater managers from different jurisdictions to work together. Requiring WQIPs can be a first step for agencies to learn how to better communicate to create and achieve watershed management goals. Similarly, many grants require the

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<sup>14</sup> National City 'Green' CIPs can be accessed here: <http://nationalcityprojects.com>

The City of San Diego lists green street pilot projects can be accessed here:

<https://www.sandiego.gov/stormwater/pilot-projects>

<sup>15</sup> The County of San Diego's Green Street Guidelines can be accessed here:

[http://www.sandiegocounty.gov/content/dam/sdc/dpw/WATERSHED\\_PROTECTION\\_PROGRAM/watershedpdf/County\\_BMPDM\\_App\\_K.2.pdf](http://www.sandiegocounty.gov/content/dam/sdc/dpw/WATERSHED_PROTECTION_PROGRAM/watershedpdf/County_BMPDM_App_K.2.pdf)

<sup>16</sup> The San Diego Regional Project Database can be accessed here: <http://irwm.rmcwater.com/sd/login.php>

<sup>17</sup> The California LID Portal can be found here: <https://www.casqa.org/resources/california-lid-portal>. EPA's Green Infrastructure website can be found here: <https://www.epa.gov/green-infrastructure>

development of partnerships as criteria for eligibility. Non-profit organizations may also be a driving force for integration.

- Developing Community or Small-Scale Projects:* Even small scale plans and projects achieve better results when they are integrated with goals of the surrounding community. Planners at a local level can develop best practices for integrating with larger, more holistic plans on the municipal and regional level. When planning to update stormwater tactics in 2016, the University of California San Diego designed their Green Infrastructure Strategy to integrate with the City of San Diego’s and other regional WQIPs and other conservation plans. (See Table 1).

**UCSD Stormwater Integration Strategies**

Scale	Examples	Smart Mobility	Green Infrastructure	Green Buildings
Regional	SANDAG; Regional Water Quality Control Board (RWQCB)	SANDAG RTP; Smart Growth Concept Map	Water Quality Improvement Plans; Multiple Species Conservation Plan	
City	City of San Diego	General Plan / Community Plans; Climate Action Plan	General Plan; Jurisdictional WQIPs; MSCP Subarea Plans	City Plans and Development Regulations; State Requirements
Community	UCSD Campus	LRDP; Campus Climate Action Plan	LRDP; Campus Green Infrastructure Plan	Campus Plans and Regulations; State Requirements
Neighborhood	UCSD Colleges, Activity Centers	Transit-oriented Neighborhoods, Mobility Hubs	EcoParks, Community Gardens, Energy Microgrids	LEED Standards

Table 1: Consultants at the University of California’s (UCSD) urban planning department recommended various types of sustainability projects like Green Infrastructure (Column 4) be aligned with projects at multiple regional levels.

Source: Presentation by Robert Leiter to USP171 class at UCSD, 2017

- Multi-Faceted Projects:* Cities across San Diego are already investing in green streets, which represent one avenue for incorporating natural stormwater systems into traditional infrastructure. In retrofitting 43<sup>rd</sup> Street and Logan Avenue, the City of San Diego chose to add LID retrofits to a well-trafficked area. This illustrates a best practice of making green infrastructure highly visible to support a more climate-smart culture. Another way to support multi-faceted projects is through the creation of green certifications for developers. The City of Oceanside recently launched the Green Oceanside Business Network, which is a voluntary certification program for businesses that want to be recognized as environmental leaders who uphold sustainable practices, including stormwater BMPs.<sup>18</sup>
- Applying Forecasting Data:* Shifting climate trends are creating a need for stormwater management that can handle both extreme dry season flows with high concentrations of pollutants and extreme wet weather flows that may exceed the capacity of traditional pipe systems. The increasing threat of wildfires and drought will also lead to an increase in sediment and soils in runoff that can exacerbate

<sup>18</sup> The City of Oceanside’s Green Business Network can be accessed here: [http://www.ci.oceanside.ca.us/gov/water/services\\_programs/business.asp](http://www.ci.oceanside.ca.us/gov/water/services_programs/business.asp)

stormwater pipe issues. San Diego County has responded to uncertainties regarding precipitation forecasting by requiring all PDPs to mitigate runoff produced from a 24-hour 85<sup>th</sup> percentile storm event. These and other BMP standard and requirements represent a best practice opportunity to encourage more adaptive projects (MS4 Regional Permit).

- *Maintaining Regulatory Compliance:* In recognizing that challenges arise with creating stricter enforcement standards related to the regional permit, the Regional Board adopted the Alternative Compliance provision and an updated BMP design manual. These actions contribute to a best practice of helping to guide agencies and offer more flexibility while still meeting compliance mandates. Another opportunity to ease strain placed on engineers is to develop Regional Standard drawings that include stormwater BMPs. For instance, CASQA is currently working on a project to develop statewide design specifications for treatment controls to be considered "Full Capture Systems."
- *Linking Stormwater Management with Other Strategic Priorities:* Climate Action Plans throughout San Diego are beginning to prioritize water management issues, some even specifically reference stormwater management. As previously mentioned, Chula Vista's Watershed Implementation Plan explicitly outlines opportunities for climate-smart stormwater projects to contribute to greenhouse gas reduction goals outlined in its Climate Action Plan<sup>19</sup>. At the regulatory level, the Regional Board introduced a resolution in February 2017 that provides guided principles for implementing green infrastructure and evolved thinking for linking stormwater management with other priorities to capture and reuse water (California Regional Water Quality Control Board 2017).
- *Preparing Contractors and Suppliers:* Some organizations require contractors and suppliers to obtain certain training pertaining to climate-smart infrastructure. In collaboration with the State Water Resources Control Board and the Office of Water Programs, CASQA administers the Construction General Permit Training Program that qualifies Trainers of Record as well as Qualified SWPPP Developers (QSDs) and Qualified SWPPP Practitioners (QSPs). In early 2018, the Water Environment Federation is expected to rollout a new National Green Infrastructure Certification Program (NGCIP) – an accredited certification program for construction, inspection, and maintenance workers trained in green infrastructure. Owners, employers, and contractors in San Diego could choose to require this certification to ensure employees have adequate knowledge of jobs related to LID and green infrastructure,

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<sup>19</sup> Chula Vista's Watershed Stewardship Plan can be accessed here:  
<https://www.chulavistaca.gov/Home/ShowDocument?id=14439>

as well as the skill and abilities to build, inspect and maintain green infrastructure systems.

- *Creating Large-Scale Integration Strategies:* The County of San Diego is currently conducting a Stormwater Capture Feasibility Study that could reveal capture and beneficial use opportunities. At the same time, the San Diego Regional Chamber of Commerce is hosting a three-part workshop throughout 2017 to investigate capture and beneficial use opportunities while involving developers and other members of the business community in this process. The City of San Diego's creation of an ACP may also ultimately provide a model for offsite compliance programs that could be scaled up to other areas.

## SUMMARY OF KEY FINDINGS

Stormwater management tactics that prepare San Diego for climate change are happening all around San Diego (and have been for decades). Strategies range from increasing commitments to LID tactics to interest in large-scale capture and beneficial use ideas. While there are many impressive examples of climate-smart stormwater projects throughout the County, mainstreaming this approach to water infrastructure is challenging. A paradigm shift where the region considers water resources and services more holistically must take root, and San Diego agencies are grappling with financing, resource, capacity, and legislative constraints that make change difficult. One of the most notable responses to these challenges has been the integration of LID and green infrastructure tactics within other municipal projects — with green streets being an especially popular example in San Diego. Integration with projects pertaining to economic development, public housing, and schools may represent another valuable opportunity for implementing climate-smart stormwater infrastructure and unlocking non-traditional funding sources. Other best practice solutions include the establishment of design guidelines, cross-departmental collaboration, and the use of multiple local and regional funding sources for projects. Strengthened communication amongst many stakeholders; including stormwater practitioners, the public, and academic institutions, will be critical to the expansion of climate-smart stormwater management initiatives. This paper hopes to lay a groundwork for collaboration by outlining current challenges and opportunities that support more efficient and adaptive stormwater infrastructure in San Diego.

## APPENDIX

### A. Case Studies

San Diego has already implemented many ‘climate-smart’ stormwater projects. Since 2003, San Diego has received approximately \$90 million from the state of California for San Diego’s Integrated Regional Water Management (IRWM) grant program in part to help fund 57 priority projects. Below are three case studies of regional climate-smart stormwater management projects that address some of the financial and resource issues presented above.

#### [A1: Four Case Studies Affixing Stormwater Projects to Other Major Municipal Issues](#)

Below, case studies that address major municipal priorities while best practices for design, financing, education and communication are highlighted.

##### **Sweetwater River Park Bioretention Project**

*Jurisdiction:* City of National City

*Type:* Research/Planning

*Project Status:* Ongoing

*Priority Addressed:* Potable Water

Summary: The City of National City received \$1,344,425 in California Proposition 1 funding in December of 2016 to implement a multi-use treatment stormwater project plan. The plan includes green infrastructure elements that provide the dual priority benefits of removing pollutants from runoff that enters the Sweetwater River and helping to infiltrate the local drinking water reservoir. The project encourages passive recreation by promoting public access and expanding bike paths, includes plans to plant 150 trees and native shrubs, and establishes open park space in a densely populated area with a high level of impervious surfaces.

##### **San Diego International Airport Water Stewardship Plan**

*Jurisdiction:* San Diego County Regional Airport Authority

*Type:* Research/Planning

*Project Status:* Ongoing

*Priority Addressed:* 2035 Water and Energy Commitments

Summary: The San Diego County Regional Airport Authority published a Water Stewardship Plan in 2016 that outlines aggressive goals to achieve zero stormwater discharge, eliminate potable water use for non-potable processes and make all critical facilities resilient in a 100-year storm event; all by 2035. Notable projects include the installation of 6 acres of permeable surface since 2013, installation of 12 modular wetland treatment systems in a new parking lot, incorporation of bioswales and other green infrastructure within approximately 60 acres of public parking space, and creation of 2.75 acres of bioretention swales in the new Rental Car Center.



### **Cottonwood Creek Watershed Low Impact Development Retrofit Project**

*Jurisdiction:* City of Encinitas

*Type:* Planning/Construction

*Project Status:* Complete

*Priority Addressed:* Water Quality & Community Education

Summary: The City of Encinitas received \$252,640 of California Proposition 84 funding in 2013 to create an LID plan for the region. The plan identifies and prioritizes potential locations for future LID improvements, with a specific emphasis on locations and modeling scenarios for green streets. It outlines a public outreach plan that includes a long-term pilot demonstration project on a property in a local neighborhood, as well as the creation of LID flyers and a website landing page. The plan helped to develop a training module to provide local professionals and city staff with relevant information about design, implementation and maintenance of LID projects.

### **Spruce Street Channel Improvement Project**

*Jurisdiction:* City of Escondido

*Type:* Planning/Construction

*Project Status:* Complete

*Priority Addressed:* Draining and Vector Control

Summary: The City of Escondido recently completed a channel improvement project originating from neighborhood complaints about the need for maintenance in a concrete channel. Grading variances and sediment deposits within the channel created drainage problems in an area where vector breeding grounds existed near a high number of sensitive receptors. To solve this issue and other flood control, aesthetic, ease of maintenance and water quality issues, the city implemented an engineering design strategy that restored natural creek functions and ensured that drainage accommodates the required storm flow to prevent future flooding. The project also expanded a wetland area and removed non-native plants for earth lined portions of the channel.

### **A2: Green Street and LID Roadway Retrofit Examples**

Integrating climate-smart stormwater techniques into other capital improvement projects can also be a useful way to secure financing and resources. Green streets and other LID Roadway Retrofit options have become a popular mechanism for 'greening' urbanized areas in San Diego. San Diego now has hundreds of examples of LID Roadway retrofits; the small city of Lemon Grove currently has entered 18 conceptual designs onto the IRWM living database for potentially eligible green street projects in 2017. Below is a sample of green street projects either completed as of July 2017.

#### **Mission Avenue**

*Where:* Oceanside

Project description: This complete street in Oceanside reduced Mission Avenue from four lanes to two, and installed many LID features including a vegetated infiltration

basin with a check dam, underdrain, and irrigation. This project was funded by a \$1.5 million ATP grant with a match of \$700k.

### **University Avenue**

*Where:* City of La Mesa

Project description: This project improves bicycle and pedestrian access and incorporates a new plaza between Euclid Avenue and Winona Avenue. Permeable pavers and bioretention soils were incorporated into the design to help capture and reduce excess urban runoff. Open space access and urban forestry are also incorporated into a mini-park as part of the project.

### **Elm Avenue**

*Where:* City of Imperial Beach

Project description: Retrofits on Elm Avenue between Seacoast Drive and 7th Street helped solve a variety of safety problems by widening the sidewalk to accommodate bike and pedestrian traffic, constructing roadway improvements to slow traffic and improve visibility, creating new and improved crosswalks and ramps, and building new vehicle and bus loading/drop-off areas. LID retrofits allowed for necessary upgrades to reduce flooding, and increase community awareness of green infrastructure.

### **A Avenue**

*Where:* City of National City

Project description: A Avenue implements LID infiltration measures to improve water quality of urban runoff entering the storm drain system. Environmentally friendly and educational elements, including interpretative signage and creek-themed art, have been incorporated into the walking path, which is in close proximity to a public library, an elementary school and other highly trafficked areas.

### **Southeast Family Resource Center**

*Where:* City of San Diego

Project description: LID retrofits to existing development improved the surface storage capacity of stormwater surrounding the center. Retrofits include porous pavement with stone reservoirs, as well as parking lot biofilters to help comply with relevant TMDLs.

### **[A3: The Alternative Compliance Program in San Diego](#)**

The Alternative Compliance provision in the regional permit allows for implementation of offsite alternative compliance methods in lieu of meeting structural BMP design standards and/or hydromodification management criteria on specific types of project sites. Onsite treatment control BMPs are still required, though BMPs are not required to meet the onsite retention requirements under this structure.

To implement an offsite ACP, a jurisdiction must first complete an optional Watershed Management Area Analysis (WMAA.) San Diego County stakeholders have collectively funded and provided guidance for development of a regional WMAA, which is currently

being designed as an in lieu fee and credit trading program in the City of San Diego. Mechanisms of the program have not been entirely determined, and many liability and financing issues still need to be resolved. The below chart is a summary of perceived benefits and barriers of a working program. This summary was taken heavily from analysis provided by the San Diego Bay Watershed Management Area Water Quality Improvement Plan, and is subject to change.<sup>20</sup>

### Potential Benefits and Concerns Regarding an Alternative Compliance Program in San Diego

Benefits	Potential Pitfalls
Can provide enhanced pollutant load reduction benefits on a watershed scale	Allows for back-sliding and reduces localized Total Maximum Daily Load requirements
Will encourage more priority development projects	Increased development near watersheds makes water quality more vulnerable
May provide a method for achieving compliance in situations when it may not otherwise be 'possible'	Compliance is 'required' under federal, regional and local regulations
More cost-effective overall	Cost effectiveness may not be equal among stakeholders. Under a public arrangement, an alternative compliance program is not necessarily cheaper for cities.
More effective in overall watershed pollutant removal	Potentially disregards highly localized areas of pollutants and reduces accountability for polluters
Prevailing Concerns	Potential Solutions
The Permit specifies a timing element regarding the amount of time that may lapse between the completion of development project construction and completion of construction for the offsite mitigation.	Programs need to establish assurance that developers will meet that timeline and that the Responsible Party will not be subject to enforcement actions caused by the development applicant's failure.
A program must be established with sufficient staffing to prevent delays in approvals, funding releases, or contract procurement required by the Responsible Party to facilitate implementation of the offsite compliance.	Provisions must be outlined regarding how Copermittees or private applicants will assume responsibility for proportional completions of large and complex projects, including mechanisms or how local jurisdictions will collect and aggregate private development impact fees.
There are public liability risks associated with any public improvements including the offsite BMPs as well as any associated improvements, such as sidewalks and traffic lanes for the alternative compliance site.	Responsible Parties will need to establish measures that prevent additional risk associated with the introduction of Green Infrastructure into public spaces and having a private entity design and construct non-standard designs within public lands and right-of-ways. One measure could include the development of new design standards and standard drawings specific to Green Infrastructure in public spaces.
The obligation to maintain any offsite BMPs is essentially "into perpetuity." Therefore, it will be necessary for responsible parties to have durable mechanisms in place that can assure private development financing of maintenance well into the future. Historically, some mechanisms, such as homeowner associations and maintenance assessment districts, have not always proven to be durable over long periods of time including the possibility of severe downturns in the economy.	Proper maintenance of BMP facilities is essential to provide for the intended BMP function and to prevent health concerns resulting from potential vector issues.

Table 2: Potential Benefits and Concerns Regarding an Alternative Compliance Program in San Diego.  
Source: Created from information provided in the San Diego Bay Watershed Management Area Water Quality Improvement Plan

<sup>20</sup> The San Diego Bay Watershed Management Area Water Quality Improvement Plan can be found here: [http://www.waterboards.ca.gov/rwqcb9/water\\_issues/programs/stormwater/docs/wqip/san\\_diego\\_bay/COMPLETE\\_SDB\\_WMA\\_WQIP.pdf](http://www.waterboards.ca.gov/rwqcb9/water_issues/programs/stormwater/docs/wqip/san_diego_bay/COMPLETE_SDB_WMA_WQIP.pdf)

## B. RESOURCES

Lack of educational resources can be a major barrier to smart stormwater management. Below are a selection of resources for stormwater engineers, managers, champions, other city staff and contractors and suppliers. Materials are organized based on their ability to address specific challenges.

### For Additional Technical Recommendations

- *CASQA California LID Toolbox and Training Courses*: CASQA offers updated courses for inspecting stormwater BMPs weekly throughout the state of California. Their website also features online training on low impact development, as well as a 'toolbox' of case study research that supports the economic benefits of LID.  
<https://www.casqa.org/resources>
- *National Green Infrastructure Certification Program (NGICP)*: NGICP is a certification for suppliers. Owners, employers, and contractors can choose to require this certification to ensure employees have adequate job knowledge, skill and abilities to build, inspect and maintain GI systems, NGICP is designed to meet international best practice standards, and helps establish a career path for skilled GI workers.  
<http://ngicp.org>

### For Peer-to-Peer Mentoring and Exchanges

- *The Green Infrastructure Leadership Exchange*: This is a practitioner network that supports communities seeking to adopt and grow green stormwater infrastructure programs by accelerating peer learning, innovation and implementation. They host 'Shop Talks' through which cities can confer with one another about specific questions in real time, as well as annual 'deep dive' meetings to discuss major trends and topics.  
<http://giexchange.org>
- *San Diego Regional Chamber of Commerce (SDRCC) Stormwater Capture Workshop Series*: SDRCC is hosting a three-part workshop culminating in late 2017 with a collectively created white paper to examine stormwater capture and reuse challenges and opportunities in San Diego. Past workshops featured panelists representing the One Water LA Program and the County of San Diego Watershed Protection Program.  
<http://www.sdchamber.org/event/stormwaterworkshop/>

### For Financing Ideas

- *The Atlas Marketplace*: The Atlas is an online "marketplace and recommendation engine" for environmental technology and infrastructure solutions. Over 250 sustainable, resilient and/or green infrastructure projects and tools from throughout the United States are showcased on its website. These climate adaptive infrastructure solutions can be used to support the new design of similar systems.  
<http://www.the-atlas.com>
- *Field Guide to CSO+* : This less than 20 page field guide by Re:Focus Partners is a digestible tool for unlocking resources for combined sewer overflows, or in many cases general stormwater

management projects. A simple one-page survey can be used to determine city priorities and calibrate relevant funds for stormwater projects.

[http://www.refocuspartners.com/wp-content/uploads/pdf/170307\\_CS0\\_FieldGuide\\_DIGITAL.pdf](http://www.refocuspartners.com/wp-content/uploads/pdf/170307_CS0_FieldGuide_DIGITAL.pdf)

### **For Communications Across Agencies and with Community Members**

- *Project Clean Water*: Project Clean Water was initiated in July 2000 to provide a broad and inclusive forum for exploring water quality issues of regional significance. The online database serves as a clearinghouse for regional documents related to water quality and Water Quality Improvement Plans, which can be a mine of resources for design and strategic case studies if properly navigated.

<http://www.projectcleanwater.org>

- *IRWM Project Database*: This online database serves as a “living” water project list where agencies can add projects that may be eligible for IRWM funding. Projects related to flood control, water supply, stormwater management and other resource categories are included.

<http://irwm.rmcwater.com/sd/master.php>

## REFERENCES

AB-2403 Alcoholism or drug abuse recovery or treatment facilities. California Legislature. 2016.  
[https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160AB2403](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB2403)

American Planning Association. Emerging Trends in Regional Planning (PAS 586) 2016.  
<https://www.nado.org/wp-content/uploads/2017/02/PAS-Report-586.pdf>

California Climate Change Center. Climate Change-related impacts in the San Diego Region by 2050. 2009. <http://www.energy.ca.gov/2009publications/CEC-500-2009-027/CEC-500-2009-027-F.PDF>

California-Nevada Climate Applications Program (CNAP). San Diego Precipitation Page. 2017.  
<http://cirrus.ucsd.edu/~pierce/sdprecip/>

California Regional Water Quality Control Board. Tentative Resolution Addressing Threats to Beneficial Uses from Climate Change. 2017.  
[https://www.waterboards.ca.gov/sandiego/board\\_decisions/tentative\\_orders/docs/R9-2017-0035/tent\\_resolution\\_R9-2017-0035\\_climate\\_change-public-comment-2-2-2017.pdf](https://www.waterboards.ca.gov/sandiego/board_decisions/tentative_orders/docs/R9-2017-0035/tent_resolution_R9-2017-0035_climate_change-public-comment-2-2-2017.pdf)

California Water Boards. Division of Financial Assistance Approval of the Stormwater Grant Program Proposition Round 1 Implementation Funding List. 2017  
[https://www.waterboards.ca.gov/water\\_issues/programs/grants\\_loans/swgp/docs/prop1/prop1\\_swgp\\_imp\\_r1\\_funding\\_list\\_approval.pdf](https://www.waterboards.ca.gov/water_issues/programs/grants_loans/swgp/docs/prop1/prop1_swgp_imp_r1_funding_list_approval.pdf)

Capital Improvement Projects. National City. 2017.  
<http://nationalcityprojects.com>

City of Chula Vista. Water Stewardship Plan. 2017.  
<https://www.chulavistaca.gov/Home/ShowDocument?id=14439>

Clean Water State Revolving Fund, Small Community Grant, and Water Recycling Funding Programs. State Water Resources Control Board. 2016.  
[http://www.waterboards.ca.gov/water\\_issues/programs/grants\\_loans/srf/docs/fy1617/september%202016\\_cwsrf\\_iup\\_update.pdf](http://www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/docs/fy1617/september%202016_cwsrf_iup_update.pdf)

Climate Education Partners. San Diego, 2050 is Calling. 2014.  
<http://catcher.sandiego.edu/items/usd/2050.pdf>

Consolidated Multi-Year Capital Planning Report: City of San Diego Fiscal Year 2016-2020. City of San Diego. 2015. [http://voiceofsandiego.org/wp-content/uploads/2015/01/Infra\\_150121\\_6.pdf](http://voiceofsandiego.org/wp-content/uploads/2015/01/Infra_150121_6.pdf)

Fact Sheet: D.C. Water Environmental Impact Bond. DC Water is Life. 2015.  
<http://www.goldmansachs.com/media-relations/press-releases/current/dc-water-environmental-impact-bond-fact-sheet.pdf>

Field Guide to CSO+. Re:Focus Partners. 2017. [http://www.refocuspartners.com/wp-content/uploads/pdf/170307\\_CSO\\_FieldGuide\\_DIGITAL.pdf](http://www.refocuspartners.com/wp-content/uploads/pdf/170307_CSO_FieldGuide_DIGITAL.pdf)

Fiscal Impact of New Stormwater Regulations. Office of the Independent Budget Analyst for the City of San Diego. 2013. [https://www.sandiego.gov/sites/default/files/13\\_44\\_131011.pdf](https://www.sandiego.gov/sites/default/files/13_44_131011.pdf)

Gaines, Stephanie. "San Diego County Approach to Stormwater Capture." Prepared for Workshop on Drought Vulnerability. 2017 <http://www.nwri-usa.org/pdfs/Gaines.pdf>

Green Business Network. City of Oceanside. 2017.  
[http://www.ci.oceanside.ca.us/gov/water/services\\_programs/business.asp](http://www.ci.oceanside.ca.us/gov/water/services_programs/business.asp)

Kontaxis, Constantine, PE. "CalTrans Statewide TMDLs Cooperative Implementation Agreements." Prepared for Stormwater Finance Forum." 2017.  
[https://www.epa.gov/sites/production/files/2017-05/documents/12\\_oak4\\_3-4\\_kontaxis\\_funding\\_caltrans\\_-\\_cia\\_presentation.pdf](https://www.epa.gov/sites/production/files/2017-05/documents/12_oak4_3-4_kontaxis_funding_caltrans_-_cia_presentation.pdf)

Messner, Steven. "Climate Change-Related Impacts in the San Diego Region by 2050." California Climate Change Center. 2011. <http://www.energy.ca.gov/2009publications/CEC-500-2009-027/CEC-500-2009-027-F.PDF>

Passing the Baton: Taking Resilience from Strategy to Construction and Operation. The Atlas Marketplace. 2016. <https://medium.com/@TheAtlas/passing-the-baton-taking-resilience-from-strategy-to-construction-operation-f41a0b5dd1e5>

Philadelphia's Stormwater Charges. Rworld energy solutions. 2017.  
<http://www.rworldenergy.com/water-conservation/Philadelphia-Stormwater-Charges.shtml>

Priority Development Project SWQMP. County of San Diego. 2016.  
<http://www.sandiegocounty.gov/content/dam/sdc/pds/zoning/formfields/SWQMP-PDP.pdf>

SB-231 Local government: fees and charges. California Legislature. 2017.  
[https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill\\_id=201720180SB231](https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB231)

San Diego Regional Chamber of Commerce (SDRCC) Stormwater Capture Workshop Series. San Diego Chamber of Commerce. 2017.

San Diego Coastkeeper's Water Quality Monitoring Program. San Diego Coastkeeper. 2017.  
<http://www.sdcoastkeeper.org/act/media-center/san-diego-coastkeepers-water-quality-monitoring-program>



San Diego Regional Stormwater Permit. California Regional Water Quality Control Board.  
[http://www.waterboards.ca.gov/sandiego/water\\_issues/programs/stormwater/docs/2015-1118\\_AmendedOrder\\_R9-2013-0001\\_COMPLETE.pdf](http://www.waterboards.ca.gov/sandiego/water_issues/programs/stormwater/docs/2015-1118_AmendedOrder_R9-2013-0001_COMPLETE.pdf)

San Diego Regional Project Database. 2017. <http://irwm.rmewater.com/sd/login.php>

The San Diego Bay Watershed Management Area Water Quality Improvement Plan. San Diego Bay Watershed. 2017.  
[http://www.waterboards.ca.gov/rwqcb9/water\\_issues/programs/stormwater/docs/wqip/san\\_diego\\_bay/COMPLETE\\_SDB\\_WMA\\_WQIP.pdf](http://www.waterboards.ca.gov/rwqcb9/water_issues/programs/stormwater/docs/wqip/san_diego_bay/COMPLETE_SDB_WMA_WQIP.pdf)

Small Cities with Big-City Infrastructure Problems. Re:Focus Partners. 2016  
[http://www.refocuspartners.com/wp-content/uploads/pdf/Build\\_It\\_Green\\_Final\\_Report.pdf](http://www.refocuspartners.com/wp-content/uploads/pdf/Build_It_Green_Final_Report.pdf)

Stormwater Fee Background. Department of Energy & Environment. 2017.  
<https://doee.dc.gov/service/stormwater-fee-background>