DUBLIN
CALIFORNIA

GREEN STORMWATER INFRASTRUCTURE PLAN

City of Dublin

GREEN STORMWATER INFRASTRUCTURE PLAN

Acknowledgements

This Plan has been developed to meet mandates in the Municipal Regional Stormwater National Pollutant Discharge Elimination System Permit, Order No. R2-2015-0049, NPDES Permit No. CAS612008 issued by the San Francisco Bay Regional Water Quality Control Board on November 19, 2015. This Plan was presented to the Dublin City Council on June 18, 2019 and adopted Resolution 65-19 is included at the end of this document.

The following individuals provide substantial input and advice during the development of this Plan:

City Council
David Haubert, Mayor
Melissa Hernandez, Vice-Mayor
Arun Goel, Councilmember
Jean Josey, Councilmember
Shawn Kumagai, Councilmember

City Staff – Key Supporting
Chris Foss, City Manager
Linda Smith, Assistant City Manager
Andrew Russell, Public Works Director
Laurie Sucgang, Assistant Public Works Director/City Engineer
Obaid Khan, Transportation and Operations Manager
Michael Boitnott, Capital Improvement Projects Manager
Dean McDonald, Public Works Maintenance Superintendent

City Staff – Lead and Contact for the Plan
Shannan Young, Environmental Coordinator

Project Consultant - Geosyntec Consultants
Kelly Havens, P.E., Senior Engineer
Lisa Austin, P.E., Principal
Elai M. Fresco, P.E., Senior Staff Engineer
Austin M. Orr, P.E., Engineer

Alameda Countywide Clean Water Program Support
Jim Scanlin, Program Manager
Horizon Water and Environment, LLC
Laura Prickett

Table of Contents

List of Figures

List of Tables

Acronyms and Abbreviations

ACCWP	Alameda Countywide Clean Water Program
BASMAA	Bay Area Stormwater Management Agencies Association
CalTrans	California Department of Transportation
CIP	Capital Improvement Project
EPA	Environmental Protection Agency
FY	Fiscal Year
GI	Green Infrastructure
GIS	Geographic Information System
GSI	Green Stormwater Infrastructure
LID	Low Impact Development
MRP	Municipal Regional Stormwater NPDES Permit
NPDES	National Pollutant Discharge Elimination System Permit
O&M	Operations and Maintenance
PCBs	Polychlorinated Biphenyls
P3s	Public-Private Partnerships
TMDL	Total Maximum Daily Load
Water Board	San Francisco Bay Regional Water Quality Control Board

EXECUTIVE SUMMARY

The purpose of the City of Dublin's (City) Green Infrastructure Plan (referred to hereinafter as the Green Stormwater Infrastructure Plan) is to describe how the City will meet requirements specified in the Municipal Regional Stormwater National Pollutant Discharge Elimination System Permit (MRP), Order No. R2-2015-0049, NPDES Permit No. CAS612008 issued on November 19, 2015. The City is one of 76 co-permittees in the San Francisco Bay Area that are regulated under the MRP. Provision C.3 of the MRP requires Permittees to develop and implement long-term Green Stormwater Infrastructure (GSI) Plans to show how cities will transform their storm drainage system from traditional "gray" stormwater infrastructure which rapidly collects and discharges stormwater to local creeks, to green stormwater infrastructure which slows stormwater flow by directing it to vegetated systems where possible. The MRP requires the GSI Plan to mitigate for the effects of urbanization, in general, on receiving water quality, and also to reduce mercury and polychlorinated biphenyls pollutant loads to San Francisco Bay. In addition to improving water quality, GSI will be designed so that it offers environmental benefits such as improvements to bike and pedestrian safety, reduce localized flooding, provide carbon sequestration opportunities, and mitigate for the urban heat island effect. This GSI Plan demonstrates how the City is meeting MRP requirements and intends to use GSI to enhance the urban environment.

1. INTRODUCTION

1.1 Statement of Purpose

The purpose of this Green Infrastructure Plan (hereinafter referred to as the Green Stormwater Infrastructure Plan) is to guide the identification, implementation, tracking, and reporting of green infrastructure projects within the City of Dublin (City), in accordance with the Municipal Regional Stormwater Permit (MRP), Order No. R2-2015-0049, adopted by the San Francisco Bay Regional Water Quality Control Board on November 15, 2015.

This Green Stormwater Infrastructure (GSI) Plan has been developed to comply with Green Infrastructure Plan requirements in Provision C.3.j of the MRP, which states in part:

> The Plan is intended to serve as an implementation guide and reporting tool during this and subsequent Permit terms to provide reasonable assurance that urban runoff TMDL wasteload allocations (e.g., for the San Francisco Bay mercury and PCBs TMDLs) will be met, and to set goals for reducing, over the long term, the adverse water quality impacts of urbanization and urban runoff on receiving waters. For this Permit term, the Plan is being required, in part, as an alternative to expanding the definition of Regulated Projects prescribed in Provision C.3.b to include all new and redevelopment projects that create or replace 5,000 square feet or more of impervious surface areas and road projects that just replace existing imperious surface area. It also provides a mechanism to establish and implement alternative or in-lieu compliance options for Regulated Projects and to account for and justify Special Projects in accordance with Provision C.3.e.
>
> 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.

The topics discussed in this GSI Plan include:

- MRP requirements
- Green stormwater infrastructure definition and associated benefits
- Explaining how the City identified and mapped potential projects
- A description of the City of Dublin's GSI goals
- GSI Program implementation efforts
- Evaluation of funding and finance opportunities
- Conclusion and next steps

1.2 Municipal Regional Stormwater NPDES Permit

The City of Dublin is a co-permittee of the Municipal Regional Stormwater NPDES Permit (MRP), Order No. R2-2015-0049, adopted by the San Francisco Bay Regional Water Quality Control Board on November 15, 2015. The MRP applies to 76 municipalities and flood control agencies that discharge stormwater to the San Francisco Bay, collectively referred to as Permittees.

A new addition to the MRP in the November 2015 permit reissuance is the requirement for Permittees to develop a Green Stormwater Infrastructure Plan. Permittees are required to use the GSI Plan to guide the identification, implementation, tracking and reporting of GSI projects within each jurisdiction. Both public and private projects are required to be tracked and reported. GSI can be applied at the watershed level, or it can be applied to a parcel or a street. Examples of types of GSI include bioretention areas, pervious pavement, tree well filters, green roofs, tree planting, rainwater capture and use, and tree planting. These examples are described in Section 1.3 of this document.

The MRP has also mandated incorporation of low impact development (LID) practices on both public and private property that meet certain size thresholds ("Regulated Projects") since 2011. LID is a subset of the larger scale (i.e. watershed level) GSI practices that is applied at the site level (see Table 1). LID practices that have been required for Regulated Projects as prescribed in Provision C.3 of the MRP include site design, pollutant source controls, stormwater treatment, and flow control facilities. The most common type of LID stormwater treatment practice installed at projects in Dublin has been bioretention areas, as typified in the bioretention areas installed along Tassajara Road. It is anticipated that bioretention areas will continue to be the most common type of LID/GSI stormwater treatment facilities installed in Dublin.

Bioretention area on west side of Tassajara Road at Rutherford Drive.

☘ Table 1 | **Low Impact Development Compared to Green Stormwater Infrastructure**

Category	Definition	Applies To
Low Impact Development (LID)	The goal is to reduce runoff and mimic a site's predevelopment hydrology. Preserves and recreates natural landscape features. Minimizes imperviousness to create functional and appealing site drainage. Infiltrates, stores, detains, facilitates evapotranspiration and/or biotreats stormwater runoff close to its source. LID is a subset of green stormwater infrastructure applied at the site scale.	MRP Provision C.3 Regulated Projects (public and private).
Green Stormwater Infrastructure (GSI)	Infrastructure that uses vegetation, soils, and natural processes to manage water and create healthier urban environments. At the scale of a city or county, GSI refers to the patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the scale of a neighborhood or site, GSI refers to stormwater management systems that mimic nature by soaking up and storing water.	Any public or private project, above and beyond Provision C.3 Regulated Projects, for which it is feasible to incorporate GSI elements, and for which funding is available to construct and maintain the project. Projects are prioritized based on water quality and other social and environmental benefits.

Both GSI and LID practices are intended to mitigate the impacts of development on the water quality of local creeks and San Francisco Bay. However, GSI requirements are distinct from the LID mandates for Regulated Projects. Regulated Project requirements automatically take effect once certain size thresholds are met. In contrast, there is no size threshold for GSI projects (see Table 2).

☘ Table 2 | **Comparison of C.3 Regulated Projects with Green Stormwater Infrastructure Plan Requirement**

	Impervious Surface Threshold	Requirement
C.3 Regulated Projects	5,000 square feet (Special Land Use – parking lots, restaurants, retail gas outlets, automotive related) 10,000 square feet (all other land uses)	LID Site design, pollutant source controls, and on-site stormwater treatment.
C.3 Regulated Projects	1 acre (all land uses)	LID Site design, pollutant source controls, on-site stormwater treatment, and hydromodification management (flow control).
Green Stormwater Infrastructure projects	No size threshold. Plan required to prioritize projects to demonstrate how Permittees will shift, over time, from gray to green infrastructure.	Site design, stormwater treatment, tree planting, infiltration, capture and use.

The San Francisco Bay Regional Water Quality Control Board (Water Board) included the GSI requirements in the reissuance of the MRP for several reasons:

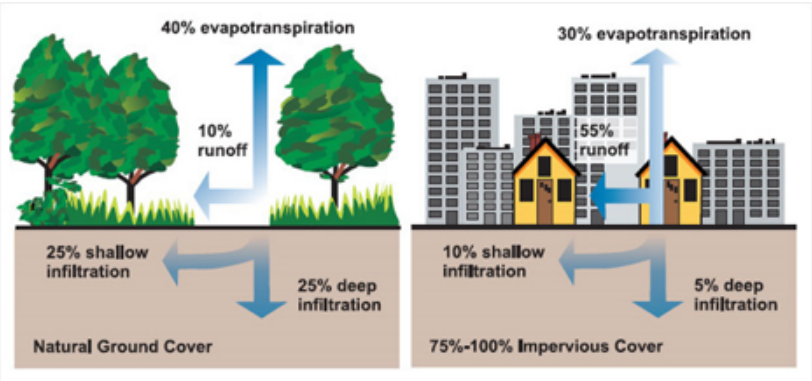
- In lieu of requiring GSI for all road projects that just replace existing impervious surface and as an alternative for lowering the size threshold for Regulated Projects;
- To mitigate for the impacts of urbanization on water quality on local creeks and San Francisco Bay; and
- To demonstrate with reasonable assurance, that urban runoff total maximum daily load (TMDL) wasteload allocations for mercury and polychlorinated biphenyls (PCBs) will be met. For more information on the TMDL wasteload allocation, refer to the Green Infrastructure Framework approved by City Council on June 20, 2017 provided in Appendix A.

A milestone in the development of the GSI Plan was City Council's adoption of Resolution 77-17 establishing a Green Infrastructure Framework on June 20, 2017 (Appendix A). The Green Infrastructure Framework described the environmental issues that are addressed with the development of a GSI Plan as well as funding considerations. The main driver for the GSI Plan is to remove pollutants from stormwater runoff, but GSI can also help alleviate localized flooding, can assist in reducing the urban heat island effect, can enhance carbon sequestration in the urban environment and can be incorporated into the streetscape in the form of bioretention areas next to streets to enhance the bicycle-pedestrian environment. In addition to funding considerations, prioritization of projects which may potentially include GSI will evaluate the multiple benefits that may be achieved to maximize the impact of dollars spent per project. As discussed in Section 5, this MRP requirement is an unfunded mandate and currently there is no dedicated funding stream to design, construct, or maintain these projects and considerable capital will be required to implement this program. Explorations of funding options are underway, and this GSI Plan is a continuation of the Green Infrastructure Framework effort. For a complete list of MRP GSI Plan requirements, please refer to Appendix B.

1.3 Green Stormwater Infrastructure

When land is developed, pervious surfaces such as natural areas or vacant lots which allow water to infiltrate into the soil are converted to impervious surfaces. Impervious surfaces are hard surfaces which prevent water from infiltrating into the soil, causing it to run off instead. The increase in impervious surfaces such as roads and rooftops that are associated with development, increases the speed and volume at which rain or stormwater runs off the land and into the storm drain system since stormwater that otherwise would have infiltrated into the ground can no longer do so (Figure 1). Activities associated with land development such as additional cars on the road or more trash generating activities, cause an increase in pollution deposited on the land which is picked up and washed off impervious surfaces when it rains.

☘ Figure 1 | **Relationship Between Impervious Surfaces and Stormwater Runoff. Source: EPA (2003)**



Green stormwater infrastructure (GSI) is designed to improve stormwater runoff quality prior to discharging it to local creeks and San Francisco Bay. GSI is engineered or man-made infrastructure that is based on natural processes to manage stormwater runoff. In addition to reducing pollutants transported to creeks and San Francisco Bay, GSI systems provide a variety of other benefits. The retention and infiltration of stormwater can reduce localized flooding, reduce flows that may cause erosion in creek channels, decrease downstream flows to mitigate impacts of sea level rise, and recharge groundwater aquifers. Figure 2 depicts how green stormwater infrastructure can retain and infiltrate stormwater runoff. The multiple benefits of GSI are more fully explained in Section 1.4 below.

☘ Figure 2 | **How Green Stormwater Infrastructure Improves Water Quality. Credit, City of Fremont**

Scale of Green Stormwater Infrastructure

Green stormwater infrastructure can be applied at various scales, from a street or a parcel to a larger regional area. Typically, GSI is designed to capture and treat 80 percent of the total stormwater runoff over the life of the project.

- **Green streets.** A green street is designed to redirect roadway runoff from typical gray infrastructure, such as storm drain pipes, to green stormwater infrastructure. The street may be designed such that stormwater runoff flows into vegetated areas or infiltrates into the ground through permeable pavement. An example of a green street retrofit project in Dublin is Golden Gate Drive.

Bioretention area at Golden Gate Drive and St. Patrick Way

- **Parcel-based project.** Parcel-based projects mitigate stormwater impacts by reducing stormwater runoff through capture and use and/or by infiltrating and treating stormwater on-site before it enters the storm drain system. Bioretention areas constructed in parcel-based projects typically capture stormwater runoff from parking lots, rooftops and other impervious surfaces generated on the parcel itself. It is also possible to design a parcel-based GSI facility such that it collects and treats stormwater runoff from impervious surfaces immediately adjacent to the parcel (e.g. stormwater runoff from the adjacent roadway). An example of a parcel-based project in Dublin is Persimmon Place.

Bioretention area at Persimmon Place

- **Regional project.** Regional projects are large-scale stormwater capture and treatment facilities that are intended to collect and treat runoff from a large drainage area. These projects are often the most cost-effective due to multiple benefits achieved and economies of scale. An example of a regional project in Dublin is the Dublin Ranch regional water quality basin.

Dublin Ranch Regional Water Quality Basin

Examples of Green Infrastructure

Bioretention area at Aster Apartments in Dublin

- **Bioretention areas.** Bioretention areas, or rain gardens, function as soil and plant-based filtration devices that remove pollutants through a variety of physical, biological, and chemical processes. These facilities normally consist of a ponding area, organic layer or mulch layer, planting soil, and plants. Bioretention areas are designed to distribute stormwater runoff evenly along a ponding area and slowly infiltrate stormwater into the soil. Bioretention areas have been the most commonly installed type of GSI in Dublin to date. An example of a parcel-based bioretention area in Dublin is provided at Aster Apartments.

Flow-through planter from the National Association of City Transportation Officials

- **Flow-through planters**. Flow-through planters are designed to treat and detain runoff without allowing seepage into the underlying soil. This type of GSI facility is usually constructed with a concrete structural planter wall. Stormwater treatment is achieved through the same mechanisms as bioretention areas except without infiltration. They can be used next to buildings and other locations where soil moisture is a potential concern. Flow-through planters typically receive runoff via downspouts leading from the roofs of adjacent buildings. Flow-through planters typically receive runoff via downspouts leading from the roofs of adjacent buildings, however, they can also be set level with the ground and receive sheet flow. An example of a flow-through planter is provided by the National Association of City Transportation Officials.
- **Tree well filters.** Tree well filters are useful in settings where available space is limited. They may be installed along urban sidewalks, but they are highly adaptable and can be used in most development scenarios. In urban areas, tree well filters can be used in the design of an integrated street landscape – a choice that transforms isolated street trees into stormwater filtration devices. Modular suspended pavement system products, such as Silva Cells, may be used for tree well filter construction and filled with biotreatment soil. An example of a tree well filter may be seen at the Boulevard.

Tree well filter being constructed using Silva Cells at the Boulevard.

Installed tree well filter using Silva Cells at the Boulevard.

- **Pervious pavement.** Pervious pavement includes pervious concrete, porous asphalt, pervious or permeable concrete pavers, permeable interlocking concrete pavement (PICP), and grid pavements such as turf block and grasscrete. Pervious paving is typically used for areas with light vehicle loading and lightly trafficked areas, such as automobile parking areas, but can also be designed to withstand heavier traffic loads. The term pervious paving describes a system comprised of a load-bearing, durable surface constructed over a subbase/base structure typically consisting of compacted, open-graded aggregate rock. The subbase layer temporarily stores stormwater prior to infiltration into the soil or drainage to a controlled outlet. An example of pervious pavement in Dublin is the Grasspave2 parking area at the Wave at Emerald Glen Park.

Grasspave2 installed at The Wave at Emerald Glen Park

Grasspave2

- **Green roofs.** A green roof can be either extensive, with three to seven inches of lightweight substrate and a few types of low-profile, low-maintenance plants, or intensive with a thicker (up to 48-inches) substrate, more varied plantings, and a more garden-like appearance. Green roofs clean the stormwater that lands on the surface of rooftops before it flows to the storm drain system. Both intensive and extensive green roof systems contain layers of protective materials to convey water away from the roof deck. Starting from the bottom up, a waterproof membrane is installed, followed by a root barrier, a layer of insulation (optional), a drainage layer, a filter fabric for fine soils, the engineered growing medium or soil substrate, and the plant material. In addition to improving stormwater quality, green roofs can increase the longevity of roofing membranes, reduce noise and air pollution, help insulate the building, and increase urban biodiversity by providing habitat for wildlife such as butterflies. An example of a green roof can be seen at the West Elm shop in Emeryville.

Green roof at the West Elm store in Emeryville, CA

Large Scale and Commercial Rainwater Capture and Use. Source: The Renewable Energy Hub

- **Rainwater Capture and Use.** Rainwater capture and use systems are engineered to store a specified volume of water with no discharge until this volume is exceeded. Storage facilities that can be used to capture rainwater include above-ground or below-ground cisterns, open storage reservoirs (e.g., ponds and lakes), and various underground storage devices (tanks, vaults, pipes, arch spans, and proprietary storage systems). Rooftop runoff is the stormwater most often collected in capture and use systems because it often contains lower pollutant loads (i.e. is less dirty) than surface runoff from streets or parking lots, and it provides accessible locations for collection. Rainwater

can also be stored under hardscape elements, such as paths and walkways, by using structural plastic storage units, such as RainTank, or other proprietary storage products.

- **Trees.** Trees perform a variety of functions that reduce the amount of stormwater runoff and improve water quality. Leaf canopies intercept and hold rainwater on the leaf surface, preventing it from reaching the ground and becoming stormwater runoff. Root systems create voids in the soil that facilitate stormwater infiltration into the ground. Trees also absorb and transpire large quantities of groundwater, making the soil less saturated, which allows more stormwater to infiltrate. Through the absorption process, trees remove pollutants from stormwater. Tree canopies shade and cool paved areas, reducing the urban heat island effect. Dublin has demonstrated the high value it places on trees by becoming an Arbor Day Foundation Tree City USA Community. Trees are planted throughout the community, as exemplified in the street trees shown here on Rutherford Drive.

Trees along Rutherford Drive

1.4 Benefits of Green Stormwater Infrastructure

Alamo Creek

According to the United States Environmental Protection Agency, green stormwater infrastructure (GSI) is a cost-effective, resilient approach to managing wet weather impacts that provides many community benefits. While single-purpose gray stormwater infrastructure—conventional piped drainage—is designed to move urban stormwater away from the built environment, green stormwater infrastructure infiltrates and treats stormwater at its source while delivering environmental, social, and economic benefits. Some of the benefits of GSI are discussed below.

- **Improved water quality.** As stormwater flows over impervious surfaces such as concrete or asphalt, pollutants that are on those surfaces are picked up and carried to the storm drain system where it flows to local creeks. Green stormwater infrastructure such as bioretention areas naturally removes pollutants from stormwater prior to the stormwater runoff flowing into the storm drain system. How effectively GSI captures a specific pollutant depends on a variety of factors, including whether the pollutant is associated with particles or dissolved in stormwater runoff and how the pollutant responds to the physical, chemical, and microbial action in the facility.
- **Restores aquatic habitat.** As impervious surfaces such as concrete, asphalt, and rooftops are added in a community, stormwater that was

once able to percolate into the ground instead flows much faster to the storm drain system and local creeks, which can erode streambanks and scour streambeds. This causes damage to habitats for fish and other aquatic species. Green infrastructure slows the speed and volume of stormwater flowing to creeks, helping to restore creek health.

- **Mitigate localized flooding.** Green stormwater infrastructure can be installed where localized flooding is a concern. Green stormwater infrastructure is designed to manage the stormwater runoff from small to medium storm events such that the stormwater runoff is held within the GSI facility and slowly discharged to the storm drain system or infiltrated into the ground. An added benefit is that the infiltrated stormwater may be able to recharge groundwater or local creeks.
- **Alleviate Urban Heat Island Effect.** Urban heat islands are created when natural areas are replaced with concrete, buildings, and other impervious surfaces that absorb and retain heat. It is anticipated that climate change will contribute to more frequent, more severe, and longer heat waves during summer months. Planting trees and using green stormwater infrastructure can help reduce the urban heat island effect by providing shade and releasing moisture into the atmosphere.
- **Improve air quality.** Trees and plantings used in GSI facilities remove particulates from the air, helping to improve local air quality.
- **Carbon sequestration.** The plants and soils that are part of GSI facilities can serve to sequester carbon. The main greenhouse gas that contributes to climate change, carbon dioxide, is captured and removed from the atmosphere via tree and plant photosynthesis. Incorporating green stormwater infrastructure is an additional way to add to carbon sequestration opportunities.
- **Enhance the bicycle-pedestrian environment.** GSI facilities can be used to enhance the bicycle environment by providing a buffer between cars and bikes, or the pedestrian environment by shortening the crossing distance at intersections. Bioretention areas may be placed to capture and treat stormwater runoff from roadways or used as bulbouts at intersections. The Amador Valley Boulevard traffic improvement project is an example.

Separated bike lane with bioretention; source unknown.

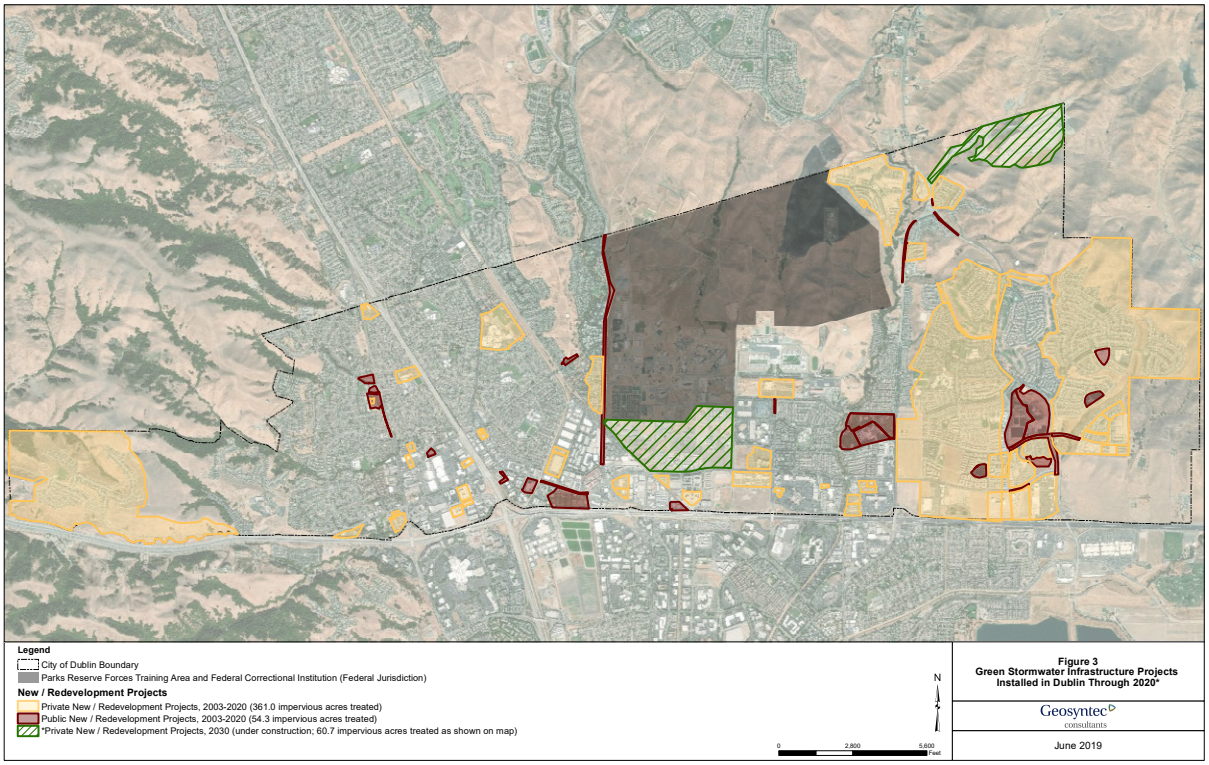
2. PRIORITIZING AND MAPPING POTENTIAL PROJECTS

Provision C.3.j of the MRP requires Permittees to prioritize and map constructed GSI on both public and private property. Public and private GSI is required to be installed at projects to mitigate for the effects of urbanization on water quality, in general, and to reduce mercury and PCBs load reductions to San Francisco Bay, in particular. Permittees are required to target amounts of existing impervious surface to be retrofitted by 2020, 2030 and 2040 to demonstrate that mercury and PCBs load reductions mandates are achieved. To assist with prioritizing and mapping of installed, planned and potential GSI projects, City Staff hired Geosyntec Consultants. The mapping and prioritization work was completed in two phases. The first phase was completed in 2017 prior to the adoption by the City Council of the Green Infrastructure Framework and the second phase was completed in 2019 as part of the GSI Plan development.

2.1 Private GSI Projects

In Phase 1 of the project in 2017, all Regulated Projects (primarily private) that had installed GSI facilities were identified and mapped in an online ArcGIS platform. The ArcGIS platform was developed by the Alameda Countywide Clean Water Program (ACCWP) in cooperation with the Contra Costa Clean Water Program and is the method by which Permittees within those two countywide clean water programs are tracking and mapping Provision C3 Projects. The Regulated Projects with installed GSI, along with known, future Regulated Projects (i.e. Regulated Projects that were in the development review process) were added to the ArcGIS platform as projects that would be completed by 2020. To map potential private projects at the 2030 and 2040 timeframes, the City's General Plan and specific plans were reviewed to identify where development may occur in Dublin. Figure 3 shows the extent of GSI facilities installed at Regulated Projects in Dublin through the 2020 timeframe and Table 3 provides an estimate of the additional amount of impervious surface area that could potentially be managed with GSI through private development through 2040. For a complete description of the methodology used, see the City of Dublin GI Plan Framework Analyses Methodology Memorandum (Memorandum) in Appendix C.

☘ Figure 3 | **Green Stormwater Infrastructure Projects Installed in Dublin Through 2020**



☘ Table 3 | **Estimate of Private Development Retrofit of Impervious Surface Area**

Year	Green Stormwater Infrastructure Treated Area (Impervious Acres)
By 2020	361.0
2021-2030	80.1
2031-2040	24.6

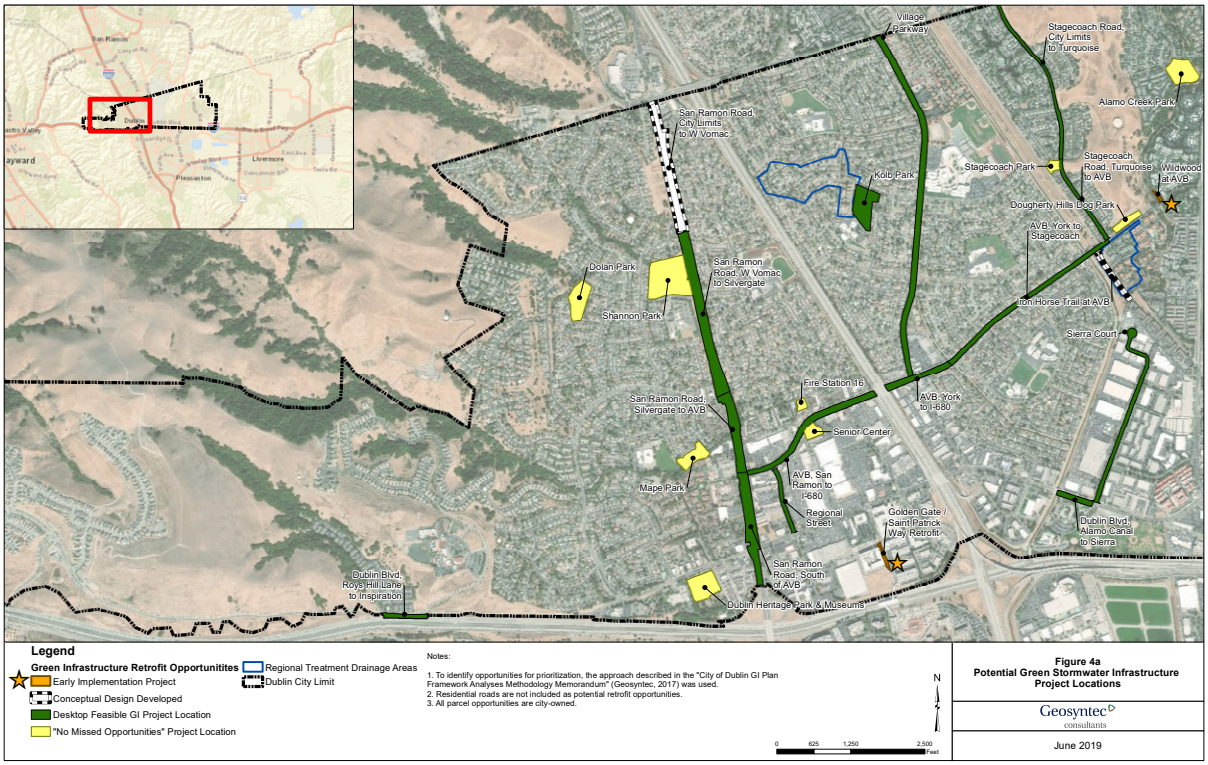
2.2 Public GSI Projects

Phase 1 of the mapping and identification of potential public GSI project locations included developing a GSI opportunity analyses methodology and using that methodology to identify potential opportunities for public retrofit or regional projects. The opportunity analyses methodology used geographic information system (GIS) data to identify public parcels and/or right-of-way where GSI could feasibly be implemented based on technical screening criteria. Opportunities for green street and regional GSI facilities were examined. A GIS analysis was conducted to identify where public parcels overlap with areas that may be physically and hydrologically conducive to GSI implementation. For a complete description of the opportunity analyses and prioritization method, see the Memorandum in Appendix C. Phase I also included mapping of public property that had installed green stormwater infrastructure facilities. These properties are included in Figure 3. The total treated acreage for public projects installed through 2020 is 54.3 acres.

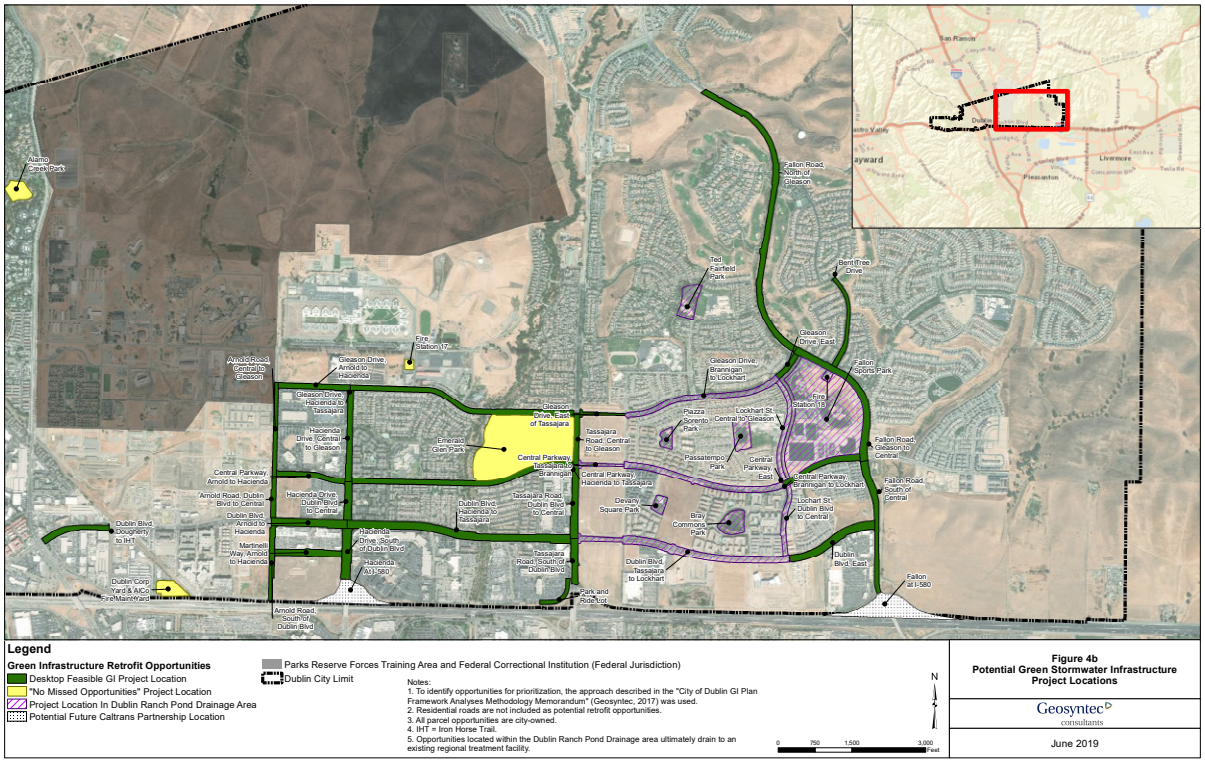
In Phase 2 of the GSI Plan development, the City refined the potential project locations identified in Phase I by completing additional desktop analyses to screen out project locations with observed utility conflicts (i.e. gas, water, sewer) or other incompatibilities (e.g. not enough space to construct GSI). In addition, all city parcels, regardless of size, were included in the Phase 2 analysis. Whereas the original analysis in Phase I was primarily

focused on identifying larger parcels or streets with higher pollutant load reductions and/or potential regional projects, all City owned parcels were included in Phase 2 as a visual reminder to evaluate the feasibility of GSI on any capital improvement project (i.e. "no missed opportunities"). The resulting potential GSI project location maps based on the Phase 1 and Phase 2 work is shown in Figures 4a and 4b.

☘ Figure 4a | **Potential Green Stormwater Project Locations**



☘ Figure 4b | **Potential Green Stormwater Project Locations**



3. GREEN STORMWATER INFRASTRUCTURE GOALS

MRP Provision C.3.j Green Infrastructure Planning and Implementation is an unfunded mandate. However, it requires Permittees to develop a mechanism to prioritize and map areas for potential and planned GSI projects, on both public and private property, that may be implemented by 2020, 2030, and 2040. The timeframes in Provision C.3.j are consistent with the timeframes and requirements in Provision C.11 (Mercury Controls) and Provision C.12 (PCBs Controls) of the MRP. The map of currently installed and planned Regulated Projects through 2020 required by Provision C.3.j is included in Figure 3 of the preceding section. Table 3 in the preceding section shows an estimate of the potential future GSI anticipated to be installed on private Regulated Projects by 2030 and 2040 based on the City's General Plan and Specific Plans. This section of the GSI Plan will describe the City of Dublin's GSI retrofit goals.

3.1 GSI Primary Goals

Goal 1: PCBs and mercury load reduction. Provision C.11 and C.12 of the MRP stipulate that green infrastructure is used to achieve specific PCBs and mercury pollutant loads reductions across the San Francisco Bay Area. Based on preliminary data, it appears that the City of Dublin should meet its share of green stormwater infrastructure load reduction mandates by implementing Provision C.3, New and Redevelopment Standards, of the MRP. If development proceeds as historical trends indicate it should, then Dublin should achieve its 2020 and 2040 population-based GSI PCB and mercury load reduction requirements solely through installation of private GSI.

Goal 2: Mitigate for the impacts of urbanization on water quality. Recognizing that Provision C.3.j of the MRP stipulates that GSI be installed over the long term to mitigate for the impacts of urbanization on water quality in general, and that the GSI plans are intended to demonstrate how Permittees will gradually shift from traditional gray infrastructure to green stormwater infrastructure over time, the City intends to incorporate GSI in its capital improvement projects to the maximum extent practicable and as funding allows. The City recognizes that water quality improvements, as well as complete street benefits such as traffic calming, improved bicycle and pedestrian safety, and increased green space for climate change adaptation are all benefits of GSI.

However, the City cannot commit to specific retrofit projects that are not in the approved capital improvement project (CIP) plan or have no funding for the addition of the GSI. The City's CIP plan and associated budget is completed on a five-year cycle and is approved by City Council. The current CIP project cycle is through 2023. Therefore, the City cannot make targets for the amount of public impervious surface area to be retrofitted by the 2030 or 2040 timeframes. The intention is that it will become the norm to identify and incorporate some form of GSI in City projects to the extent feasible and as funding is available. Staff has made efforts, as described in Section 5, to find sources of GSI funding. As a demonstration of the City's commitment to its GSI Plan, the City has completed the work described in the sections that follow.

3.2 Early Implementation, or "No Missed Opportunities"

Golden Gate Drive Streetscape Enhancement Project. In 2010 the City, in a joint effort with the Bay Area Rapid Transit District (BART), was awarded a grant from the federal Transportation for Livable Communities program administered by the Metropolitan Transportation Commission. The goal of the grant and the project was to enhance pedestrian, bicycle, and public transit connections in the vicinity of the West Dublin BART station. As part of that project, bulbouts were built at intersections, including the addition of a bioretention area at the northwest corner of Golden Gate Drive at Saint Patrick Way. This green street retrofit captures and treats 17,500 square feet of existing impervious surface area.

Bioretention area on Golden Gate Drive and St. Patrick Way

Pedestrian Improvements on Amador Valley Boulevard at Stagecoach Road and Wildwood Road. The Dublin City Council approved a construction contract for this pedestrian safety improvement project on May 7, 2019. Among the improvements being constructed will be a bioretention area in the new bulbout at the corner of Wildwood Road and Amador Valley Boulevard. The bioretention area bulbout will treat 14,300 square feet of existing roadway runoff on Wildwood Road. Construction is expected to be completed by August 2019.

3.3 Potential Project Cost Analysis

Potential project cost analysis, including construction and operations and maintenance (O&M). As part of the project prioritization and mapping effort, the City completed a project cost analysis including design, construction, and 20 years of O&M costs. The cost analysis was completed for the three project types described in Section 1.3 of this plan: green street, parcel-based projects, and regional projects. The cost data that were applied to the projects were compiled from GSI retrofit projects from 21 planned and 28 completed projects from Enhanced Watershed Management Plans that have been constructed in Southern California; six projects from the Bay Area Stormwater Management Agencies Association Clean Watersheds for a Clean Bay Project; and generalized cost per unit acre data provided by the City of Union City. Table 4 provides design and construction costs per unit acre summary statistics based on the completed analysis.

☘ Table 4 | **Design and Construction Cost Per Unit Acre Summary Statistic**

Project Type	Number of Projects Reviewed	Minimum ($/acre treated)	Median ($/acre treated)	Maximum ($/acre treated)	Mean ($/acre treated)
Green Street	8	$34,200	$134,000	$1,180,000	$283,000
Parcel-based project	17	$30,500	$134,000	$384,000	$167,000
Regional project	10	$12,000	$26,400	$64,200	$31,300

Annual O&M Costs are intended to account for activities necessary to maintain the effectiveness of a project that recur on a regular basis, such as routine maintenance on an annual basis of repairs following a large storm event. For the analysis conducted for this project, annual O&M costs do not include replacement or rehabilitation of the GSI facilities. Replacement or rehabilitation is expected to occur approximately every 20 to 30 years. The average O&M cost was calculated according to standard practice, as a percentage of design and construction cost. To validate the standard practice O&M cost factor applied to projects provided in Table 5, O&M annual cost factors were compared to values for projects completed in the City of Tacoma, Washington and the City of Portland, Oregon. These cities have been tracking O&M costs for several years and therefore were able to provide ground-truthing of the standard practice. The O&M dollars reported generally correspond to the standard annual cost factors reported in Table 5 below.

☘ Table 5 | **O&M Annual Cost Factors for GSI Project Types**

Green Stormwater Infrastructure Project Type	O&M Annual Cost Factors (Percent of Capital + Design Costs)
Green Street	3.6%
Parcel-Based Project	1.3%
Regional Stormwater Control	1.3%

For more information on the cost analysis methodology, refer to Appendix D.

3.4 Concept Plan Development

As part the project prioritization and mapping effort, five potential project locations were evaluated in the field for feasibility. The five locations selected for evaluation included:

San Ramon Road between West Vomac and Alcosta Boulevard. This location is in the old urban land classification and the street has high traffic volumes, providing the potential opportunity to capture and treat higher pollutant loads. The project location was selected due to the possibility of managing higher pollutant loads and because there is a landscape rehabilitation project in the City's five-year CIP. A planning level concept plan including four bioretention areas has been developed for this location. Building the bioretention areas as an add-on to the landscape project would significantly increase the scope of the project, but would also provide water quality improvements, stormwater flow control, and contribute to carbon sequestration. No funding has been identified for design, construction, or operation and maintenance of this project. The project concept is provided in Appendix E.

Iron Horse Trail at Amador Valley Boulevard. This location was selected even though the drainage area is new urban/open space and therefore yields relatively low pollutant loads since the City has plans for a linear park to be built adjacent to this location in the future. The site was evaluated to determine if a small, regional green stormwater infrastructure project could be built at the same time as the linear park, saving construction costs while providing stormwater flow control and carbon sequestration opportunities. A planning level concept plan including a pretreatment swale and a bioretention area has been developed for this location. No funding has been identified for design, construction, or operations and maintenance of this project. The project concept is provided in Appendix E.

Village Parkway between Amador Valley Boulevard and Kimball Avenue. This location is in the old urban land classification and the street has high traffic volumes, providing the potential opportunity to capture and

treat higher pollutant loads. Review of this location was superseded by the City's efforts to develop a Downtown Streetscape Master Plan since the team preparing the Downtown Streetscape Master Plan is identifying potential locations that are amenable to adding GSI as part of that process.

Mape Memorial Park. This location was selected for evaluation as a potential collaborative GSI/flood control project with Zone 7 Water Agency. The drainage for this area is from the old urban land classification. The project was deemed infeasible since the park is topographically positioned in such a way that would preclude significant stormwater runoff or inflow to be captured and stored.

Dublin Boulevard between Amador Plaza Road and Hansen Drive. This location is in the old urban land classification and the street has high traffic volumes, providing the potential opportunity to capture and treat higher pollutant loads. The location was deemed infeasible due to narrow sidewalks and medians, as well as a natural gas transmission line that runs directly under the right-of-way.

3.5 Creation of Typical Stormwater Design Details

Starting with the San Francisco Public Utility Commission's typical green infrastructure details, the City modified select details to reflect requirements in MRP Provision C.3 and to address problematic GSI issues identified by Dublin Staff (e.g. adding a pedestrian landing strip when GSI is located adjacent to parallel parking). The typical stormwater details also incorporate inlet components from the City of Portland, Oregon. One of the details, GI-XX, bioretention area with bike lane plan view, was modified from a charette conducted through the Bay Area Stormwater Management Agencies Association Urban Greening Bay Area grant. In total, 12 typical GSI details were developed. The typical details are provided in Appendix F.

3.6 Work with Private Developers

City Staff has been successful working with developers to get GSI construction in the public right-of-way as part of development projects. During the entitlement process, Staff works with developers to identify locations where it is feasible to install GSI and requests that the developer design and construct the GSI facilities. The request is above and beyond what would be required based on Provision C.3.b requirements. For example, Staff worked with the IKEA project team to include GSI on Arnold Road and Martinelli Way. Staff is crafting a formal process to continue working with developers to include GSI in the public right-of-way and anticipates bringing the process forward for City Council consideration in FY2019-20.

3.7 Municipal Regional NPDES Permit General Fund Reserve

In 2015, City Council approved a $2,250,000 MRP General Fund Reserve for development of a GSI Plan and for installation of full trash capture devices. In the FY2018-19 budget, an additional $500,000 was added to the MRP General Fund Reserve for GSI implementation efforts. In relation to GSI work, the funds have been used for the design and construction of the bioretention area in the bulbout that is part of the pedestrian improvements on Amador Valley Boulevard and Wildwood Road and to fund GSI Plan project work.

4. GSI PROGRAM IMPLEMENTATION

This section of the GSI Plan will discuss program implementation elements. Program implementation includes on-going efforts to implement Provision C.3.b New and Redevelopment Standards, as well as new elements to implement requirements in Provisions C.3.j. Green Infrastructure Planning and Implementation, C.11 Mercury Controls, and C.12 Polychlorinated Biphenyls (PCBs) Controls. Program elements discussed will include:

1. Legal mechanisms for implementation
2. Summary of general guidelines and implementation checklists for GSI projects
3. Operations and maintenance, Inspection and Enforcement
4. GSI Requirements in Planning Documents

4.1 Legal Mechanisms for Implementation

As described in Section 1.2, the City of Dublin as a co-permittee of the MRP must require development projects subject to Provision C.3.b to incorporate low impact development green stormwater infrastructure in project designs. Chapter 7.74 of the City's Municipal Code, Stormwater Management and Discharge Control, includes mandates for best management practices for new and redevelopment projects consistent with the MRP. The City's Municipal Code establishes legal authority for the City to require Regulated Projects under Provision C.3.b to comply with MRP requirements. Capital improvement projects that meet the impervious surface threshold limits established in Provision C.3.b must also conform to the sizing and design requirements discussed in Section 4.2 below. Capital improvement projects that do not meet the impervious surface threshold limits established in Provision C.3.b are under the control of the City and will be evaluated on a case-by-case basis to determine if incorporation of GSI into the project design is feasible. The City intends to evaluate its implementation of this GSI Plan and may consider whether additional policies could help facilitate GSI Plan implementation in the future.

4.2 General Guidelines and Implementation Checklists

A summary of general guidelines and implementation checklists for GSI projects is provided in Appendix G to guide Staff in designing a project that has a unified, complete design that implements the range of functions associated with GSI projects. To ensure GSI is appropriately incorporated into projects, Dublin Staff has created processes and checklists to use during the design review process and at construction sign-off. City Staff are also using checklists developed by the Alameda Countywide Clean Water Program (ACCWP) to assist with GSI implementation efforts.

The summary of general guidelines includes:

- Hydraulic-sizing criteria
- Urban forestry considerations
- Bay Friendly Landscape principles

- How to coordinate GSI projects during construction.

Additional information on GSI project design may be found in the Alameda Countywide Clean Water Program (ACCWP) C.3 Technical Guidance Manual.

The checklists developed to date for private development and capital improvement projects include:

- Stormwater management plan content
- Public Works Improvement Plan General Notes
- Stormwater Review Checklist
- Landscape Plan Checklist
- Inspector Final Inspection Checklist
- C.3. Operations and Maintenance Inspection Form
- Worksheet for Identifying Green Infrastructure Potential in Municipal Capital Improvement Program Projects

4.3 Operations and Maintenance, Inspection and Enforcement

As required by MRP Provision C.3, regular inspections occur for all GSI projects at least once every five years. These inspections ensure that installed GSI facilities operate, in perpetuity, as designed. The inspections are completed on both public and private properties and are managed by the City's Environmental Services staff. Private developers are required to enter into a Stormwater Management Maintenance Agreement which is recorded against the property and runs with the land. City inspectors conduct inspections of GSI facilities at critical points during the installation process to verify facilities are being constructed correctly. Prior to project acceptance, final inspections of all GSI facilities are completed.

The transfer of maintenance responsibility for public projects is done at project close out, after the warranty period. The City's Public Works Department is responsible for the maintenance of public facilities. As discussed in Section 5 below, the City of Dublin has no stormwater fee, therefore all maintenance activities are funded by the General Fund.

The operations and maintenance enforcement program is managed by the Environmental Services Division. The enforcement program adheres to the City's Enforcement Response Plan.

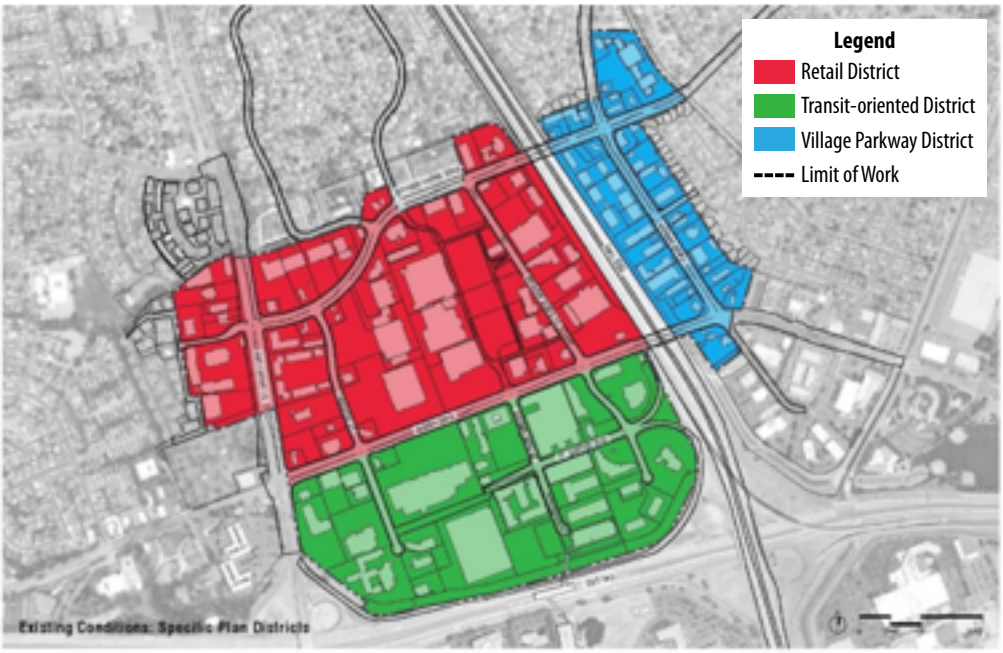
4.4 GSI Requirements in Planning Documents

MRP Provision C.3.j requires that each municipality update relevant planning documents to include GSI. The planning documents that are currently under development in the City of Dublin include the Downtown Dublin Streetscape Master Plan and the update to the Parks and Recreation Master Plan, as described below. City Staff intends to propose updates to Chapter 10, Community Design and Sustainability Element, and Chapter 12, Water Resources Element, of the General Plan to include GSI guidance in FY2019-20 and it is anticipated that GSI will be included in the Bicycle and Pedestrian Master Plan update which is also scheduled to begin in FY2019-20. As other specific plans are updated in the future, green stormwater infrastructure will be included, as appropriate.

Downtown Dublin Streetscape Master Plan

The Downtown Dublin Streetscape Master Plan is in final draft form and includes GSI in the streetscape designs. One of the specifically stated goals in this Master Plan is to "incorporate vegetated "green infrastructure" that moderates micro-climate, creates habitat, and cleanses stormwater to protect the downstream water supply." The area included in this plan is included in Figure 5.

☘ Figure 5 | **Downtown Dublin Streetscape Master Plan Land Area**



Update to the Parks and Recreation Master Plan

The City of Dublin is in the initial stages of an update to its Parks and Recreation Master Plan. The City's Environmental Services staff, which manages implementation of the GSI Plan, has participated in a stakeholder meeting convened by the City's Parks and Community Services Department. It is anticipated that GSI will be included in the update to the Parks and Recreation Master Plan.

5. EVALUATION OF FUNDING OPTIONS

GSI requirements are an unfunded mandate. However, to meet these unfunded provisions of the MRP, the City of Dublin has examined multiple strategies as part of the consideration of potential funding and financing mechanisms to implement prioritized GSI projects. Currently, City of Dublin does not have a general stormwater fee and the MRP has not identified any funding sources for the new GSI regulations. As described in Section 3, GSI and trash capture implementation is funded by the MRP General Fund Reserve. To implement the projects identified through this GSI Plan, additional funding sources would need to be secured.

Research conducted to examine potential additional funding and financing sources thus far has included:

1. Examination of grants that may be applicable to the multi-benefits that stormwater facilities in Dublin can provide;
2. Commissioning of an "Alternative Compliance Handbook";
3. Discussions with Caltrans regarding their mitigation funds, and discussions with other potential public partners;
4. Commissioning of a "Public-Private Partnership White Paper";
5. Consideration of developer agreements or other ordinance that would require frontage improvements for developments in specific regions in the city; and
6. Using Alameda County Measure D funds for Bay Friendly Landscaping.

Details regarding these identified potential implementation methods are provided in the following sections. Documents referenced in this section are included in Appendix H.

Grants

Staff is interested in applying for grants to help implement GSI projects and has conducted an analysis to characterize the specific multi-benefits that could be achieved through GSI projects to identify the grants best matched to potential projects. The list of grants identified through this exercise, which Staff will be tracking, is provided in Appendix H.

Alternative Compliance

The City may consider utilizing alternative compliance strategies to implement potential GSI projects identified through this GSI Plan. The City commissioned the development of an "Alternative Compliance Handbook" in 2018, which provides an overview of the specific studies and administrative topics that could be considered in developing an Alternative Compliance and/or In-Lieu Fee program. To facilitate public GSI construction, an alternative compliance program could be developed such that developers could opt to provide in-lieu fees instead of including on-site green stormwater infrastructure. The in-lieu fees could then be used to construct public GSI projects. The Alternative Compliance Handbook is provided in Appendix H.

The City is also considering Water Quality Trading as a potential avenue for constructing feasible GSI projects. The City has held discussions internally and with local partners regarding the potential for locally regional (i.e., Alameda Creek watershed) or larger regional (i.e., San Francisco Bay-draining communities) Water Quality Trading plans.

Public Partnerships

The City has explored the potential to team with local public partners on individual GSI projects that may be mutually beneficial. For example, Public Works staff has had conversations with Caltrans regarding the potential to implement GSI through Caltrans mitigation programs. In such a partnership, a GSI project could be constructed in the City of Dublin to treat public stormwater runoff equivalent to the volume of runoff generated on adjacent roadways required to be treated by Caltrans. The stormwater quality treatment pond constructed on the northwest corner of San Ramon Road at Silvergate Drive is an example of a Caltrans mitigation program project constructed in Dublin. That project completed construction in 2017.

Public-Private Partnerships

The City has investigated the potential to utilize Public-Private Partnerships (P3s) to implement GSI projects. The City commissioned a White Paper titled "Public-Private-Partnerships (Performance-Based Infrastructure) for Stormwater and MS4 Permit Compliance" to provide an overview of P3s, describe example P3s, and suggest initial steps for developing a P3 program. Stormwater P3s are intended to help communities optimize limited labor resources, meet compliance obligations, and control risk and finances to help build and maintain public infrastructure. The White Paper provided in Appendix H provides more information on Public-Private Partnerships.

Development Agreements/Ordinance

As described in Section 3, the City has worked with developers during the entitlement process on specific projects to have GSI installed in the public right-of-way and is currently working on a plan to formalize a process for working with developers. The process may include a new or updated ordinance to require developers to provide a specified and/or scalable amount of construction and maintenance (and/or funds for these activities) at locations in which it is feasible to implement GSI.

Alameda County Waste Management Authority Measure D Funds

The City has identified "Measure D" funds (the Alameda County Waste Reduction and Recycling Act) as a source of funding for portions of GSI project implementation. In particular, Measure D funds can be used for landscape installations of at least 5,000 square feet (in some cases, 2,500 square feet) when the landscape goes through the Bay-Friendly Landscape rating process. Measure D funds can also be used for maintenance of landscape areas when Bay Friendly Landscape maintenance practices are being used. The City will consider the feasibility of utilizing Bay-Friendly Landscape Practices for all GSI project installations to make use of these funds.

Other Mechanisms

Staff has reviewed other mechanisms of generating funds for GSI implementation, including but not limited to fees, bonds, City MRP General Fund Reserve, and benefit assessment districts. Traditional forms of funding (e.g., General Fund) can be difficult to implement given competing interests for General Fund revenues. The City will continue to consider these and other funding mechanisms as appropriate.

Next Steps for Funding and Financing Options Evaluation

In Fiscal Year 2019-20, staff will further evaluate a selection of GSI funding and financing options summarized in this section. Specifically, it is anticipated that the potential for alternative compliance options and/or public private partnership programs will be analyzed in more depth. Development of one or more of these programs would utilize the steps outlined in the respective documents attached in Appendix H.

6. CONCLUSION AND NEXT STEPS

Green stormwater infrastructure is a powerful tool that the City of Dublin is utilizing to create a healthier, more sustainable urban future. Planning and investing in nature-based green stormwater infrastructure ensures the City is moving toward achieving long-term goals to improve water quality, reduce flooding risks, mitigate climate change impacts, improve the bicycle-pedestrian environment and mitigate the urban heat island effect. However, dedicated funding sources are not available, and the City will need to identify ways to fund GSI projects.

Staff anticipates the next steps in the GSI implementation process will be to continue the work already in process such as finishing a capital improvement project checklist and more fully exploring funding and financing options. In addition, it is anticipated that Chapter 7.74 of the City's Municipal Code, Stormwater Management and Discharge Control, will be updated to provide further guidance and direction on GSI implementation. As described in Section 4.5, City Staff anticipate proposing an update to Elements 10 and 12 of the General Plan as well as the Bicycle-Pedestrian Master Plan in FY2019-20 to stress the importance of GSI as a stormwater strategy in the City of Dublin moving forward. It is likely that the GSI Plan and the maps themselves will require revision in the future as we learn more about how to effectively incorporate and maintain GSI in the City of Dublin. Through an adaptive management process, Staff will periodically review this GSI Plan and make improvements, as necessary.

Appendix A

CITY OF DUBLIN GREEN INFRASTRUCTURE FRAMEWORK

RESOLUTION NO. 77 – 17

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF DUBLIN

****

APPROVING A FRAMEWORK FOR MUNICIPAL REGIONAL STORMWATER NPDES PERMIT GREEN INFRASTRUCTURE PLAN DEVELOPMENT

WHEREAS, the San Francisco Bay Regional Water Quality Control Board adopted the Second Municipal Regional Stormwater NPDES Permit (MRP 2.0) on November 19, 2015 as Order No. R2-2015-0049; and

WHEREAS, the City of Dublin is a permittee under MRP 2.0; and

WHEREAS, Provision C.3.j of MRP 2.0 requires permittees to adopt by June 30, 2017 a framework that describes specific tasks and timeframes for development of a Green Infrastructure Plan; and

WHEREAS, a Green Infrastructure Plan describing how MRP 2.0 permittees intend to include low impact development drainage design into appropriate projects on public and private lands to meet Total Maximum Daily Load (TMDL) wasteload allocations for mercury and polychlorinated biphenyls and to reduce to the Maximum Extent Feasible adverse water quality impacts due to urbanization must be adopted by the City of Dublin City Council by June 30, 2019; and

WHEREAS, the goal of low impact development drainage design is to reduce runoff; minimize land disturbance; minimize directly connected pavement and other impervious cover to the storm drain system; and remove pollutants from urban runoff using methods that employ natural processes of storage, detention, infiltration, evapotranspiration, and filtering of runoff through soil media as described in Provision C.3.c of MRP 2.0; and

WHEREAS, the City of Dublin has demonstrated its commitment to an environmentally sustainable future through its policy goals and actions, including maintaining natural hydrologic systems, and intends to incorporate green infrastructure into projects when doing so will benefit the environment and when a funding source for construction of green infrastructure has been identified; and

WHEREAS, in order to be in compliance with MRP 2.0, a Framework for Green Infrastructure Plan development has been prepared for the City of Dublin.

NOW, THEREFORE, BE IT RESOLVED that the City Council of the City of Dublin hereby adopts the Framework for Green Infrastructure Plan Development, attached hereto as **Exhibit A**, to prepare said Green Infrastructure Plan.

PASSED, APPROVED AND ADOPTED this 20th day of June 2017, by the following vote:

AYES: Councilmembers Biddle, Gupta, Hernandez and Mayor Haubert

NOES:

ABSENT: Councilmember Goel

ABSTAIN:

Mayor

ATTEST:

Deputy City Clerk

Reso No. 77-17, Adopted 6/20/2017, Item No. 4.7 Page 2 of 2

DUBLIN

cleanwater

City of Dublin Framework for Green Infrastructure Plan Development

This Framework for Green Infrastructure Plan Development is organized as follows.

1. Purpose

The purpose of the Green Infrastructure Framework is to describe specific tasks and timeframes for development of the Green Infrastructure Plan required in Provision C.3.j of the re-issued Municipal Regional Stormwater Permit (Regional Water Quality Control Board Order No. R2-2015-0049, adopted on November 19, 2015), which states in part:

> .... The [Green Infrastructure] Plan is intended to serve as an implementation guide and reporting tool during this and subsequent Permit terms to provide reasonable assurance that urban runoff TMDL wasteload allocations (e.g., for the San Francisco Bay mercury and PCBs TMDLs) will be met, and to set goals for reducing, over the long term, the adverse water quality impacts of urbanization and urban runoff on receiving waters. The Plan is intended to describe how 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 to the receiving water, to green....

"Green infrastructure" refers to a sustainable system that: slows runoff by dispersing it to vegetated areas; promotes infiltration and evapotranspiration; provides for stormwater collection and use; and incorporates bioretention and other stormwater treatment methods to clean stormwater runoff and to help mitigate for increased stormwater flows that result from adding impervious surfaces to watersheds. In addition to cleaning stormwater runoff, green infrastructure may be used to alleviate flooding, can assist in reducing the urban heat island effect, and can be incorporated into the streetscape in the form of bioretention areas next to streets to enhance the bicycle-pedestrian environment. The most common types of green infrastructure built in Dublin to date include bioretention areas and vegetated swales.

Permittees under the re-issued Municipal Regional Stormwater Permit (MRP 2.0) are required to incorporate green infrastructure into storm drain design on public and private lands to meet urban runoff total maximum daily load (TMDL) wasteload allocations for mercury and polychlorinated biphenyls (PCBs). Mercury is a natural, ubiquitous pollutant that continues to

be emitted into the environment through burning of fossil fuels, waste incineration and use in gold extraction. Mercury is highly volatile and is released to the atmosphere as a gas which is subsequently deposited on impervious surfaces via air deposition. On the other hand, PCBs are a class of manmade organic pollutants that were manufactured until they were banned in the United States in 1979. Due to their non-flammability, chemical stability, high boiling point and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications. Although no longer commercially produced in the United States, PCBs may be present in products and materials produced before the 1979 PCB ban. The San Francisco Bay Regional Water Quality Control Board (Water Board) has indicated that the most likely pathways for PCB contamination of stormwater include building demolition at old urban, commercial or industrial sites (i.e. pre-1979) when appropriate best management practices are not used, and sediment movement at contaminated sites. The urban runoff wasteload allocation included in the TMDLs for both PCBs and mercury is a region-wide allocation; however, if the PCB and mercury pollutant load reductions are not achieved on a region-wide basis, the default allocation is based on the population of the permittee, not on the actual pollutant load located within each jurisdiction.

Population based TMDL determination poses concerns for the City of Dublin. While Dublin will meet the 2020 wasteload reduction requirements for both mercury and PCBs, Dublin will not be able to meet the 2030 or 2040 wasteload reduction requirements mandated in MRP 2.0 and the TMDL even if green infrastructure were incorporated throughout the city. The reason Dublin will not meet the wasteload reduction requirement is because there are few known locations of PCB contamination within the city, and potentially the City may not be contributing to the current loadings under the population based formula. This also poses a concern for permit non-compliance for Dublin in future re-issuances of the MRP if the population based formula is not addressed and/or if permittees with known PCB contaminated sites are not able to install adequate green infrastructure projects such that region-wide, the stormwater wasteload allocations are met. In contrast, Dublin should be able to meet the 2030 and 2040 wasteload reduction requirement for mercury through the installation of green infrastructure on planned private development projects and public projects anticipated to be constructed during this timeframe.

In addition to the TMDLs drivers, construction of green infrastructure projects is also required to reduce, over the long term, the adverse water quality impacts of urbanization and urban runoff on receiving waters. The Water Board included green infrastructure mandates in Provision C.3.j. of MRP 2.0 in lieu of expanding the definition of a C.3 Regulated project to include all projects that create/replace 5,000 square feet or more of impervious surface area (the current threshold is 10,000 square feet of impervious surface area) and to road projects that only replace existing impervious surface area. Urbanization increases both pollutant load and the volume of flow to local creeks and waterbodies as natural areas are converted to impervious surfaces. Green infrastructure helps to mitigate the environmental impacts of urbanization.

The purpose of the Green Infrastructure Plan required under Provision C.3.j.i.(1) of MRP 2.0 is to guide the identification, implementation, tracking, and reporting of green infrastructure

projects within the City of Dublin. The adoption of the Green Infrastructure Framework is an acknowledgement by the City that it anticipates meeting the intent of MRP 2.0, specifically to reduce pollutant load of Mercury and PCBs to local creeks and San Francisco Bay insofar as pollutants exist within Dublin, to the extent that it can with the funding available. Funding is discussed in more detail in Section 6, Budget.

2. Municipal Stormwater Permit Deadlines

Provision C.3.j.i.(1) of MRP 2.0 requires all permittees, including the City of Dublin, to approve a framework to develop a Green Infrastructure Plan by June 30, 2017. The complete Green Infrastructure Plan must be submitted to the Regional Water Quality Control Board by September 30, 2019.

3. Specific Tasks for Plan Development

Preparation of the Green Infrastructure Plan will require the following specific tasks.

Identify Green Infrastructure Projects

Potential future green infrastructure projects will be identified for inclusion in the Green Infrastructure Plan. This includes documentation of existing proposed plans for private and public development projects that would be subject to MRP 2.0 Provision C.3.b. requirements to include stormwater treatment facilities. Projects subject to MRP 2.0 Provision C.3.b. requirements generally include: 1) new public or private projects that create/replace 10,000 square feet or more of impervious surface area, 2) new road projects that create 10,000 square feet or more of impervious surface, 3) existing road widening projects which include a new travel lane and create/replace 10,000 square feet or more of impervious surface area, and 4) special land use projects (restaurants, automotive service facilities, gas stations, and parking lots) that create/replace 5,000 square feet or more of impervious surface area. The Green Infrastructure Plan will also document the continuing implementation and results of the City of Dublin's process, initiated in Fiscal Year 2015-16, to review planned capital improvement projects that are not subject to Provision C.3.b. stormwater treatment requirements, to identify the potential for incorporating green infrastructure pending identification of funding. Additionally, a tool developed by the Alameda Countywide Clean Water Program (Clean Water Program) will be used to identify, map, and prioritize potential green infrastructure projects that may be included in the Green Infrastructure Plan.

Develop Tracking Procedures

Tools and guidance provided by the Clean Water Program will be used to develop procedures for estimating the pollutant load reduction benefits of green infrastructure projects, and for tracking and reporting on completed projects. The procedures will be described in the Green Infrastructure Plan.

Incorporate Guidelines and Typical Designs

The Green Infrastructure Plan will incorporate guidelines for streetscape and green infrastructure project design and construction, and green infrastructure typical design drawings

and specifications. These will be based on example guidelines, typical design drawings, and specifications provided by the Clean Water Program or other local agencies. The City of Dublin is currently evaluating local design details and is creating typical design details, standard specifications, and procedures as needed.

Update Planning Documents

As required, planning documents, including those listed below, will be reviewed and relevant sections of these documents will be modified, as needed, for implementing green infrastructure in public and private development projects to support the implementation of the Green Infrastructure Plan. If the planning documents are not scheduled to be updated prior to Green Infrastructure Plan development, a schedule for review will be provided in the Green Infrastructure Plan. The review will include the following planning documents:

- General Plan, specific plans, and area plans
- Streetscape Master Plan
- Bicycle and Pedestrian Master Plan
- Commercial Corridor Design Guidelines
- Scarlett Court Design Guidelines
- Pavement rehabilitation work plan
- Parks and Recreation Master Plan

Evaluate Funding Sources

An evaluation of funding sources for both construction and operations and maintenance of potential future public green infrastructure projects will be included in the Green Infrastructure Plan. Guidance provided by the Clean Water Program may be used to develop an in-lieu fee for private development projects that are constrained from fully meeting Provision C.3.b. stormwater treatment measures onsite, as a potential funding source for future public green infrastructure projects. The City may also want to evaluate funding sources such as community-based public private partnerships or other funding strategies. Currently, green infrastructure associated with public projects is paid for through the General Fund. Grant will be pursued for projects when the timing of the project and timing of grant proposals align.

Training and Outreach

Staff will receive training on green infrastructure planning, implementation, design, and maintenance via training sessions facilitated or provided by the Clean Water Program. Updates and opportunities for input on the preparation of the Green Infrastructure Plan will be provided to the City of Dublin City Council and City Manager's Office on a regular basis. Outreach to the development community and the general public, as necessary, will be conducted in coordination with the Clean Water Program.

Compile Green Infrastructure Plan

Documentation of the tasks described above will be compiled into the Green Infrastructure Plan for review and approval by the City of Dublin City Council.

Implement the Green Infrastructure Plan

A resolution, policy, or other legal mechanism will be prepared for adoption prior to beginning implementation of the Green Infrastructure Plan.

Address the Population-Based MRP 2.0 and TMDL Wasteload Allocations

The City of Dublin will coordinate with the Clean Water Program, the Bay Area Stormwater Management Agencies Association and the San Francisco Bay Regional Water Quality Control Board (Water Board) to develop a wasteload allocation formula that is based on actual pollutant loadings rather than the current population based formula.

Submit Plan to the San Francisco Bay Regional Water Quality Control Board

The Plan, and applicable policies or other legal mechanisms for Plan implementation, will be submitted to the Water Board with the City of Dublin's 2019 Annual Report of Stormwater Program Implementation.

4. Timeframe for Plan Development

The schedule for conducting specific tasks is presented below. The Green Infrastructure Plan must be approved by City Council by June 30, 2019 and reported to the Water Board in the Annual Report which is due on September 30 each year.

Schedule of Specific Tasks

Task	FY 2016-17		FY 2017-18				FY 2018-19				FY 2019-20	
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Identify Projects												
Develop Tracking Procedures												
Incorporate Guidelines												
Update Planning Documents												
Evaluate Funding Sources												
Training and Outreach												
Compile Plan												
Adopt Plan												
Submit Plan to Water Board												

5. Staffing Assignments

The Environmental Coordinator in the Public Works Department will direct the preparation of the Green Infrastructure Plan. The Environmental Coordinator will manage consultants hired to assist with the effort and will coordinate with the other City Departments/Divisions that will be

an integral part of the Green Infrastructure Plan development including Planning, Engineering, Maintenance, and the City Attorney Office.

6. Budget

Development of the Green Infrastructure Plan is estimated to cost approximately $250,000 in consultant costs. Staff has initiated planning level work on the Green Infrastructure Plan in order to inform the preparation of the Framework. Additional work will be required to complete the document.

Estimates for design and construction costs of green infrastructure range between $30,000 to $400,000 per treated acre for distributed green infrastructure systems. The cost variation is due to a number of factors such as the location of the project (i.e. if the project is located in a more or less built-out area), the amount of impervious area draining to the green infrastructure facility, and the type of green infrastructure incorporated. The cost for regional facilities is substantially less, ranging between $12,000 - $64,000 per treated acre. The main reason for the price differential comparing distributed facilities to regional facilities is that economies of scale can be achieved with regional facilities. Staff intends to purse options for siting regional facilities in order to manage both construction and on-going operations and maintenance costs.

Estimates for on-going operations and maintenance of green infrastructure facilities range between $1.50/square foot treatment area (not including replacement costs) and up to 6% of construction costs. In addition to on-going, regular operations and maintenance, it is anticipated that green infrastructure may need to be replaced every 10 – 15 years. Replacement costs are anticipated to be much less than construction costs since the infrastructure will already have been built; work required will include removing and replacing vegetation, treatment soil, and underdrain components. The replacement schedule will likely depend on the location of the green infrastructure facility, which will dictate the sediment and pollutant load entering the facility.

The cost estimates provided in this section were derived from local Bay Area municipalities, Southern California municipalities, the City of Portland, the City of Tacoma, WA, and the Environmental Protection Agency.

Summary

The Environmental Coordinator will manage the Green Infrastructure Planning effort required under MRP 2.0 on behalf of the City of Dublin. The City of Dublin will endeavor to construct green infrastructure on public projects where pollutant loads warrant and where funding has been identified. City staff will continue to require private development projects subject to Provision C.3.b of MRP 2.0 to incorporate green infrastructure into applicable projects. City staff will pursue funding options other than the General Fund to assist with Green Infrastructure implementation. The City of Dublin is not committing any funds towards green infrastructure construction with the adoption of this Green Infrastructure Framework; rather, it is committing to initiating the process to complete a Green Infrastructure Plan.

Appendix B

MUNICIPAL REGIONAL STORMWATER NPDES PERMIT GREEN INFRASTRUCTURE PLAN REQUIREMENTS

This Green Infrastructure Plan has been developed to comply with Green Infrastructure Plan requirements in Provision C.3.j of the MRP. Table B-1 links each section of this GSI Plan to the applicable MRP provision.

Table B-1 | **Green Infrastructure Plan Requirements and Applicable MRP Provisions**

GSI Plan Section	Requirement	Applicable MRP Provision
Section 1	Introduction	C.3.j
Section 2	Prioritizing and Mapping Planned and Potential Projects	C.3.j.i.(2)(a) – (c), and C.3.j.i.(2)(j)
Section 2	Approach for Prioritizing and Mapping Projects	C.3.j.i.(2)(a)
Section 2	Summary of Potential Projects	C.3.j.i.(2)(b)
Section 2	Tracking and Mapping Completed Projects	C.3.j.i.(2)(d), and C.3.d.iv.(1)
Section 3	Impervious Surface Retrofit Targets/GSI Goals	C.3.j.i.(2)(c)
Section 3	Workplan for Completing Prioritized Projects	C.3.j.i.(2)(j)
Section 3	Prioritized Projects for Alternative Compliance Program or Early Implementation	C.3.j.i.(2)(j)
Section 4, Appendix G	Summary of General Guidelines for GI Projects	C.3.j.i.(2)(e),C.3.j.i.(2)(f),and C.3.j.i.(2)(g)
Section 4	Relationship to Other Planning Documents	C.3.j.i.(2)(h) and (i)
Section 4	Workplan to Incorporate GI Requirements in Planning Documents	C.3.j.i.(2)(i)
Section 5	Evaluation of Funding Options	C.3.j.i.(2)(k)

CITY OF DUBLIN GI PLAN FRAMEWORK ANALYSES METHODOLOGY MEMORANDUM

Geosyntec consultants

1111 Broadway, 6th Floor
Oakland, California 94607
PH 510.836.3034
FAX 510.836.3036
www.geosyntec.com

Memorandum

Date:	28 February 2017
To:	Shannan Young, City of Dublin
From:	Lisa Austin, Principal; Kelly Havens, Project Engineer; and Austin Orr, Senior Staff Engineer
Subject:	City of Dublin GI Plan Framework Analyses Methodology Memorandum Geosyntec Project Number: WW2298

1. INTRODUCTION

The City of Dublin (City) is required by Municipal Regional Stormwater Permit (MRP)[1] Provision C.3.j to develop a Green Infrastructure (GI) Plan for the inclusion of low impact development drainage design on public and private lands, to be submitted with the 2019 Annual Report. The GI Plan must include a mechanism to prioritize and map areas for potential and planned projects consistent with the timeframes for assessing mercury and PCBs load reductions specified in MRP Provisions C.11 and C.12 (i.e., 2020, 2030, and 2040). The GI Plan must also identify targets for the amount of impervious surface to be retrofit over these timeframes to reduce the adverse impacts of urbanization on water quality and include a work plan identifying how the City will ensure that GI measures are included in future plans, among other requirements. The City must prepare a framework (essentially a scoping document) that describes the specific tasks and timeframes for development of the GI Plan. The GI Plan framework must be approved by the City Council by June 30, 2017.

Geosyntec Consultants (Geosyntec) is assisting the City in conducting preliminary analyses to support the tasks, timeframe, and potential cost implications that will be presented in the framework. These preliminary analyses are intended to inform the level of implementation that may be required as part of the GI Plan for consideration by the City when approving the framework. The modeling and analyses which will occur as part of the development of the GI Plan will refine these preliminary results.

[1] Order No. R2-2015-0049.

The methodology to conduct these analyses is described in this Analyses Methodology Memorandum (Memo). This Memo outlines the methodology will be used to:

1. Calculate the City of Dublin's Required Load Reductions for PCBs and Mercury per the MRP for 2020, 2030, and 2040 (see Table 1);
2. Identify the load reductions already achieved and to be achieved through current, planned, and future redevelopment projects;
3. Estimate the resulting public retrofit area needed to achieve the remaining load reduction not achieved through current, planned, and future redevelopment projects;
4. Identify potential locations and treatment control measures for public retrofit projects; and
5. Prioritize the identified potential public retrofit projects.

To conduct the analyses described herein, Geosyntec previously submitted a Data Needs Request to the City (Attachment 1). Data were provided to Geosyntec on February 10, 2017. The data that will be used for the project analyses described herein and the data sources are summarized in Attachment 2.

The results of these analyses will provide information to be included in the GI Plan framework. The analyses will be conducted in a manner such that they may be used to prepare the City's GI Plan with minor modifications and/or updates.

2. LOAD REDUCTIONS

2.1 TMDL Load Reductions

MRP Provisions C.11 and C.12 require the Permittees to implement programs to address the mercury and PCBs total maximum daily load (TMDL)[2] urban runoff waste load allocations (WLAs). A summary of the Alameda County countywide total TMDL WLA as well as the portion of the Alameda County countywide total WLA required to be addressed during the current MRP term are summarized in Table 1. The portions of the countywide WLA for the TMDL and current MRP term apportioned to the City using a population-based approach are also provided in Table 1. These load reduction targets can be met by any acceptable combination of control measures (i.e., not just GI).

[2] San Francisco Bay and Guadalupe River Watershed Mercury TMDLs (Resolutions R2-2006-0052 and R2-2008-0089) and the San Francisco Bay Region PCBs TMDL (Resolution R2-2008-0012).

Table 1: PCBs and Mercury Load Reduction Performance Criteria for the City of Dublin

Requirement	Date[1]	PCBS (kg/yr)		Mercury (kg/yr)	
		Alameda County Permittees[2,3]	City of Dublin[4]	Alameda County Permittees[2,3]	City of Dublin[4]
TMDL WLA	2028 / 2030	4.45	0.089	19.0	0.380
MRP C.11/C.12	2020	0.94	0.019	*See Note 3*	*See Note 3*

Notes:
1. The mercury TMDL compliance date is 2028 and the PCBs TMDL compliance date is 2030.
2. The 2028/2030 load reduction performance criteria for Alameda County was calculated by subtracting the applicable TMDL WLA from the baseline pollutant load (reported in the TMDL fact sheet) based on relative population in the year 2000.
3. The 2020 PCBs load reduction was obtained from Table 12.1 of the MRP (page 114; note that 2018 criteria was not included). The interim mercury requirement included in the MRP states "The TMDL implementation plan calls for… attainment of an interim loading milestone by February 2018 of 120 kg/yr. The Permittees may comply with any requirement of this provision through a collaborative effort." This 120 kg/yr is not distributed by County in the MRP.
4. The City of Dublin represented 2% of the Alameda County total population in the year 2000, according to census data collected by the California Department of Finance.

2.2 Green Infrastructure Load Reductions

The MRP also includes specific PCBs and mercury load reduction performance criteria for GI control measures by 2020 and 2040. A summary of the Alameda County countywide load reduction performance criteria included in the MRP and the portion of the countywide load reduction apportioned to the City using a population-based approach are provided in Table 2.

Table 2: PCBs and Mercury Load Reduction Performance Criteria for the City of Dublin

Requirement	Date[1]	PCBS (kg/yr)		Mercury (kg/yr)	
		Alameda County Permittees[1]	City of Dublin[2]	Alameda County Permittees[1]	City of Dublin[2]
MRP C.11/C.12	2020	0.037	0.001	0.015	0.0003
MRP C.11/C.12	2040	0.925	0.019	3.125	0.063

Notes:
1. The 2020 and 2040 load reduction performance criteria for GI implementation are stipulated in MRP C.11/C.12 (pgs. 110-111 for mercury, and 117-118 for PCBs).
2. The City of Dublin represented 2% of the Alameda County total population in the year 2000, according to census data collected by the California Department of Finance.

3. CURRENT, PLANNED, AND FUTURE REDEVELOPMENT PROJECT LOAD REDUCTIONS

The project will use accepted modeling tools to quantify expected load reductions achieved by current, planned, and potential future private redevelopment projects ("C.3 projects")

implemented within the City. Current, planned, and future redevelopment projects will be identified and mapped and load reductions will be calculated using the Interim Accounting Methodology (BASMAA, 2016). Details regarding this methodology are included in the following subsections. Geospatial data used for this analysis and subsequent analyses are listed and described in Attachment 2.

3.1 Identification of Current, Planned, and Future Projects

The City will identify current, planned, and future C.3 redevelopment projects and will provide the following information about each project to Geosyntec[3]:

1. Project Type (i.e., "parcel-based", "green street/retrofit", "full trash capture")
2. Public/Private
3. Hydromodification Control
4. Project Name
5. Parcel/APN(s) developed, redeveloped, and/or treated
6. Description of project location
7. Construction Completion Date
8. Project Area (acres)
9. Treatment type (to be) implemented (or no treatment) and the percent of the project area treated by each treatment type (0 – 100%)
10. Hydraulic Sizing Criteria (i.e., MRP standard sizing, smaller, or larger)
11. Whether the project was included in the 2014 Integrated Monitoring Report

Geosyntec will review the City's General Plan and may talk with staff from City departments that may be aware of future development, such as the Transportation Department and the Planning Department, if needed, in order to identify areas of future build-out that are not included in this list of projects.

[3] The Alameda Countywide Clean Water Program will be providing an Excel spreadsheet to be used to gather this information.

3.2 Mapping Development Projects

Following identification of current, planned, and future redevelopment projects to the extent possible given the schedule, the identified projects will be mapped in GIS using the APN number and the City of Dublin parcel land use layer. Project location will be checked using the location description provided by the City. The projects will be classified based on the year project construction was or is predicted to be completed (i.e., construction must be completed before the end of the year for which the load reduction is calculated). Project classification will include three categories:

1. Load reductions achieved by year 2020 (projects completed by June 30, 2020)
2. Load reductions achieved by year 2030
3. Load reductions achieved by year 2040

A map of the projects will identify the parcels developed, redeveloped, and/or treated, and indicate the completion year categorization. The estimated load reduction associated with each project will be provided in an accompanying table and will be calculated as described in the following section.

3.3 Project Load Reduction Calculations

The Interim Accounting Methodology (BASMAA, 2016) establishes the methodology to be used by the Permittees to estimate load reductions during the current MRP permit term (2.0). The Interim Accounting Methodology accounts for loads reduced from source property abatement and other source control measures, as well as implementation of C.3 projects, redevelopment of old industrial and old urban areas, and public retrofit projects.

To calculate the load reduction associated with each project, the identified projects will be geospatially joined with the underlying "baseline" Yield Classification. The PCBs and mercury baseline loads will be calculated for each project by multiplying the area redeveloped and/or treated by the project by the yield associated with the underlying baseline Yield Classification. For parcel-based C.3 projects, the post-project load will be calculated by multiplying the area redeveloped and/or treated by the final Yield Classification (New Urban). For GI retrofit projects, the post-project load will be calculated by applying a 70% reduction factor to the pre-project load. The load reduction will be calculated as the difference between the post-project load and the baseline load.

The load reductions associated with each project will then be summed based on the project year categorization to identify the total load reduction anticipated to be completed by current, planned, and future projects for each of the target years (i.e., 2020, 2030, and 2040).

4. PUBLIC RETROFIT ANALYSIS

4.1 Load Reduction Assessment

The load reductions estimated to be achieved by current, planned, and future redevelopment projects for each of the target years (i.e., 2020, 2030, and 2040) will be subtracted from the required load reductions summarized in Table 1 above. The difference associated with the years 2020 and 2040 will represent the target load reductions for GI public retrofit projects for 2020 and 2040. For 2030, the additional load reduction needed could be achieved by GI retrofit projects and/or other source control measures.

The calculated additional load reductions for 2020 and 2040 will be converted to total retrofit treatment area to identify the acres of impervious area needed to be treated by public projects to meet the load reduction targets. This will be conducted based on the Yield Classifications throughout the City. The acres of each Yield Classification in the total area in the City not associated with a current, planned, or future redevelopment projects will be identified geospatially. Per the Interim Accounting Methodology, a GI project retrofit would result in a 70% reduction in the Yield Classification associated with the area treated. Starting with the Yield Classifications with the highest yield (Old Industrial and Old Urban), the area required to achieve the additional load reduction will be back-calculated assuming a 70% reduction in load for all areas treated. A table of the required acres of each Yield Classification that must be treated to achieve the additional load reduction for 2020 and 2040 will be developed.

For 2030, Geosyntec will work with the City to estimate potential load reductions associated with any source control measures that could be implemented by the City, that reduction will be subtracted from the additional load reduction, and the area required to treat the remaining additional load reduction will be calculated similarly to the area calculation for 2020 and 2040.

4.2 Opportunity Analysis

Geosyntec will conduct an opportunity analysis to identify potential public retrofit projects to treat the required impervious area identified as a result of the analysis conducted per the method described above. Potential projects identified as part of the opportunity analysis will then be prioritized via a prioritization analysis, described in the next section.

The opportunity analysis will utilize GIS data to identify public parcels and/or rights-of-way (ROW) where GI could feasibly be implemented based on technical screening criteria. Opportunities for green streets and parcel-based regional GI facilities will be examined. This will entail a desktop geospatial analysis conducted to identify where public parcels overlap with areas that are physically and hydrologically conducive to GI implementation. The method proposed is a tiered feasibility approach using the available GIS data summarized in Attachment 2. The approach steps are summarized below:

1. Identify all publicly-owned parcels and ROWs not associated with current, planned, and future redevelopment projects. Parcels will include those owned by all municipal agencies, including those owned by the City, along with the fire department, school district, water district, and other local agencies.
2. Screen identified parcels and ROWs for physical constraints which may restrict GI implementation, including:
    - Steep Slopes (estimated using publicly-available topographic data from USGS)
    - 100-year FEMA floodplain boundary
    - Environmentally sensitive areas within 300 feet of the parcel or ROW (i.e., designated wetlands, biologically sensitive areas, etc.)
3. Screen physically feasible regional facility locations for proximity to storm drain (i.e., must be within 500 feet)
4. Screen physically feasible locations with storm drain connections for hydrologic and drainage area characteristics which could limit the efficacy of the GI, including:
    - Very small drainage area
    - Drainage area dominated by open space

    If unavailable, drainage areas will be estimated based on available topographic information and the storm drain network in the vicinity.
5. Identified BMP locations will be screened for infiltration feasibility, which will include examining factors such as:
    - Clay and low-infiltrating soil types
    - Geotechnical hazards (e.g., landslide areas)
    - Seasonal high groundwater elevations within 10 feet of the base of a GI facility
    - Groundwater wells used for drinking water within 100 feet of the parcel

- Locations of septic systems and drain fields within 100 feet of the parcel
- Known underlying soil or groundwater contamination within 100 feet of the parcel (Contamination will be identified based on Geotracker sites; those adjacent to a parcel or ROW will be eliminated)

Potential GI opportunities will be summarized in a table and on a map which will be discussed with the City. Locations that are feasible for implementation of infiltration facilities, based on underlying soil type and the restrictions listed above, will be classified. Information about each identified GI opportunity will be provided, including the drainage area, summary of Yield Classifications in the drainage area, and an estimate of the load reduction resulting from implementation of treatment at the opportunity location. The potential load reduction will be calculated using the Interim Accounting Methodology described in preceding sections and will account for reductions from treatment only.

4.3 Prioritization Analysis

Following submittal of the GI Opportunities table and map to the City, Geosyntec will meet with the City to establish a methodology to prioritize the identified locations. The prioritization approach is anticipated to include, but may not be limited to ranking GI locations based on:

1. Overlap with areas slated for retrofit (e.g., planned transportation or street upgrade projects) or proximity to planned redevelopment projects (e.g., roadways adjacent to planned redevelopment);
2. Presence of higher-yield classifications in the drainage area (i.e., presence of Old Industrial and higher proportions of Old Urban);
3. Total load reduction achieved by the GI project; and/or
4. Planning-level cost estimates.

Geosyntec will conduct a geospatial analysis to identify potential project locations which are co-located with the relevant characteristics listed above and additional characteristics desired by the City. A quantitative metric associated with the ranking characteristic (i.e., percent of location overlapping with retrofit area or percent of drainage area classified as Old Urban) will be calculated for each GI Opportunity and will be used to sort and rank the locations.

The ranked GI project locations will be presented to the City in a sorted table. The total load reduction estimated for each project will be summed cumulatively to identify the projects which might be implemented by 2020 and 2040 to achieve the load reduction performance criteria for

GI in the MRP as well as the total load reduction that might be achievable by the 2028/2030 TMDL compliance date. The projects will be color coded by proposed implementation timeframe and presented on a map along with other distinguishing information.

Final documentation for this project will include an initial screening level feasibility assessment of the identified projects for the various timeframes.

5. POTENTIAL FUTURE CHANGES TO LOAD REDUCTION ACCOUNTING

MRP Provisions C.11.c and C.12.c require the Permittees to prepare a Reasonable Assurance Analysis (RAA) for inclusion in the 2020 Annual Report that quantitatively demonstrates that mercury load reductions of at least 10 kg/yr and PCBs load reductions of at least 3 kg/yr will be achieved by 2040 through implementation of green infrastructure throughout the permit area.

This RAA will do the following:

1. Quantify the relationship between the areal extent of green infrastructure implementation and mercury and PCBs load reductions. This quantification should take into consideration the scale of contamination of the treated area as well as the pollutant removal effectiveness of green infrastructure strategies likely to be implemented.
2. Estimate the amount and characteristics of land area that will be treated by green infrastructure by 2020, 2030, and 2040.
3. Estimate the amount of mercury and PCBs load reductions that will result from green infrastructure implementation by 2020, 2030, and 2040.
4. Quantitatively demonstrate that mercury load reductions of at least 10 kg/yr and PCBs load reductions of at least 3 kg/yr will be realized by 2040 through implementation of green infrastructure projects.
5. Ensure that the calculation methods, models, model inputs, and modeling assumptions used have been validated through a peer review process.

The RAA for Alameda County may result in adjustments to the baseline assumptions in the TMDLs, which may result in a change to the countywide and City load reduction requirements for the 2028/2030 timeframe. As the RAA will not be conducted till after the City's project is complete, the load reductions presented in Table 1 above will be used for the project analyses.

When load reductions are recalculated as part of the RAA analyses, the project implementation schedule identified as part of the prioritization analysis for this project may change, if load

reductions required by 2028/2030 and 2040 decrease as a result of the RAA findings. The GIS data and project information that is developed or compiled as part of this project will be designed to be useful for developing the GI Plan and conducting the RAA, such that only the estimated project load reductions may require future revision.

6. REFERENCES

BASMAA, 2016. Interim Accounting Methodology for TMDL Loads Reduced. Prepared by Geosyntec Consultants and EOA, Inc. 19 September 2016.

* * * * *

Data Request for City of Dublin

PLANNING DOCUMENTS:

- **Future Development Planning Reports**
- **General Plans**
- **Specific Plans**
- **Any available geospatial data associated with figures and maps from the above (geodatabases and shapefiles preferred)**

CAD DETAILS (DWG):

- **GI BMP standard detail file, to be edited to incorporate City of Dublin Standards**

COST INFORMATION (PDF, EXCEL) FOR THE FOLLOWING:

- **Completed GI Construction**
- **Planned GI Construction**

If available, the following spatial datasets are requested from the City of Dublin

SPATIAL DATA LAYERS:

- **From Online GIS Portal (url: https://gis.dublin.ca.gov/Html5Viewer/)**
  - Hazards Group (all)
  - Operations and Maintenance Group (all)
  - Planning Group
    - Development Projects
    - Land Use
    - Planning Areas
    - Specific Plan Areas
    - Zoning Districts
  - Public Works
    - City Services
      - Street Sweeping Zones
  - Utilities
    - Storm Drain Network (all)
  - Basemaps
    - Streets
    - Street Centerlines
    - Property
- **Administrative Datasets**
  - Political boundaries (e.g. council districts, city and neighborhood boundaries)
  - Building Footprints
  - Road center and curb lines
  - Rights-of-Way boundaries (polygons)

- **Elevation Datasets (one or more of the following, based on best available)**
  - LiDAR
  - Digital Elevation Models (DEMs)
  - Contours
- **Land Use Datasets**
  - Parcels with relevant attributes including:
    - Zoning
    - Ownership
    - Whether the parcel pays taxes (to isolate publicly owned parcels)
  - Impervious cover (w/ any attributes such as feature type)
  - Land use/land cover
  - Land use planning datasets (from Portal)
    - General Plans
    - Specific Plans
    - Zoning
- **Environmental Datasets** *(GI siting and sizing)*
  - Streams/Rivers/Waterbodies
  - Watersheds
  - Locally-derived soil/geology/hydrogeology/geotechnical coverages
  - County specific rain gauge locations
  - Depth to groundwater
  - Mapped contaminant plumes or contaminated sites
  - Flood inundation or flood risk areas (FEMA flood zones in Portal)
  - Rainfall isohyetal maps
- **Stormwater/Water Quality Program Datasets**
  - Storm Drains Network (inlets, outfalls, open channels and gravity mains)
  - Catchment/Sub-basin/Drainage Areas to Outfalls if available
  - Trash priority areas
  - Existing or Proposed (e.g. CIP) structural BMPs by type
    - Existing/Planned Flood control facilities
    - Include general BMP class and any photos, if available
  - Areas that have been redeveloped since 2002 and have incorporated green infrastructure (C.3)
    - Include APN, latitude/longitude, narrative description, if available
  - Locations of drinking water treatment facilities (and locations of distribution lines which convey water from source to treatment facility)
- **High Resolution Aerial Imagery**

FORMAT:

Digital Spatial Data Layers would ideally be provided as geo-referenced ArcGIS 10.x shapefiles, geodatabases, or as raster image files (.img). We may be able to convert autocad datasets (.dwg) into ArcGIS 10.x format if they are not available as shapefiles or geodatabases. Tabular datasets cataloging specific features (e.g., lists of existing structural BMPs) can be converted to viable shapefiles if latitude and longitude is included. If Google Earth files (.kmz/ .kml) only are available, we may be able to convert those into ArcGIS 10.x format.

City of Dublin GI Plan Framework Analyses Methodology Memorandum
Attachment 2: Summary of Data to be Used

Table 1. City of Dublin GI Plan Framework Methodology Data Summary Table

Memo Section	Goal	Data	Data Provider	File Name or Feature Class	Description
3. Identify load reductions already achieved through current, planned, and future development projects	Identify existing and planned C.3 projects in the City of Dublin	Project Information (in excel database)	City of Dublin	*In process – Expecting from the City March 8th*	This dataset will include all existing C.3 project sites, all C.3 sites currently under construction, and all future/planned C.3 project sites that are currently known.
	Identify future development areas	Specific plan	City of Dublin	*In process - anticipated from City of Dublin*	Additional future redevelopment projects that can be included based on specific plan or other planning documents.
		Development Projects Completion Date	City of Dublin City of Dublin	DBLN_Development_Projects *In process - anticipated from Project Information deliverable*	
		General Plan	City of Dublin	DBLN_General_Plan_LU	
		Streets	City of Dublin	ALCO_Centerlines_DBLN	Used to identify project boundaries if APN not known.
	Establish baseline load for identified projects	Baseline land use yield categorization	Geosyntec	Landuse_Category.shp	Bay Area yield classifications grouped by EOA as part of the 2014 IMR.
4.1-4.2 Conduct analyses to identify potential locations and treatment control measures for public retrofit projects	Identify all publicly owned parcels and ROWs not associated with current, planned, and future projects.	Assessor database (tax exempt public agencies)	City of Dublin and County Assessor	DBLN_Parcels	Datasets used to identify publicly owned parcels or ROWs which could be retrofit.
		Road ROWs	City of Dublin	*In process - anticipated from City of Dublin*	
		City Owned Properties	City of Dublin	OM_Parcels	
			City of Dublin	DBLN_Parcels	
			Alameda County 2014	geospatial.shp	
			Psomas	PublicParcels	
	BMP Feasibility and Infiltration Feasibility	NRCS SSURGO data for City of Dublin	National Resources Conservation Service Web Soil Survey[1]	soilmu_a_ca609	Datasets used to identify publicly owned parcels feasible

City of Dublin GI Plan Framework Analyses Methodology Memorandum
Attachment 2: Summary of Data to be Used

Memo Section	Goal	Data	Data Provider	File Name or Feature Class	Description
		Environmentally Sensitive Areas	NOAA Office of Response and Restoration[2]	NorthernCaliforniaESI.gdb	for treatment retrofit based on physical characteristics, and classify those feasible for infiltration.
		Groundwater Elevation	Zone 7 Water Agency	*In process - potential to get this data from Zone 7 Water Agency*	
		Landslides and other Geotechnical Hazards	California Department of Conservation[3]	dub_lq, dub_ls	
		Topography - 1/3 acre second DEM raster data	USGS[4]	n38w123, n38w122	
		Floodplain	City of Dublin	FEMA_DFIRM_ZONE	
		Soil/groundwater contamination	Geotracker5	Geotracker_db	
	Siting Feasibility	Storm drain infrastructure	City of Dublin	DBLN_Storm_Drain_Mains	These datasets help identify sites to place bmps.
		Drain inlet infrastructure	City of Dublin	DBLN_Storm_Drain_Structures	
		BMP drainage area	City of Dublin/ Geosyntec	*Estimated by Geosyntec from topography and storm drain infrastructure*	
		Trash Generation Areas	City of Dublin/ Psomas	TrashGenerationAreas	
		Trash Management Areas	City of Dublin/ Psomas	TrashManagementAreas	

1. https://websoilsurvey. sc.egov. usda.gov/App/HomePage.htm
2. http://response.restoration.noaa.gov/maps-and-spatial-data/download-esi-maps-and-gis-data.html
3. http://maps.conservation.ca.gov/cgs/informationwarehouse/index.html?map=regulatorymaps
4. https://viewer.Nationalmap.gov/basic/
5. http://geotracker.waterboards.ca.gov/datadownload

Geosyntec consultants

4. COST ANALYSIS METHODOLOGY (TASK 5 DOCUMENTATION)

4.1 Cost Analysis

This section summarizes the methodology used to estimate the capital costs and annual operations and maintenance costs (O&M) for each of the potential projects identified in the opportunity and prioritization analysis (summarized in Section 3 and provided in Appendix B, i.e., external file [Opportunity Prioritization and Cost Analysis.xlsx])).

4.1.1 Cost Estimation Sources

The opportunity analysis identified five potential Project types, categorized based on the scale of the project and the feasibility of infiltration. For the purposes of the cost analysis, this list was reduced to three categories, as documented in Table 4-1.

Table 4-1: Cost Estimation Category

Potential Project Type	Cost Estimation Category
ROW, Self-Treating without Infiltration	Green Street
ROW, Self-Treating with Infiltration Feasible	Green Street
Parcel, Regional Treatment without Infiltration	Regional Stormwater Control
Parcel, Self-Treating without Infiltration	Distributed Green Infrastructure
Parcel, Self-Treating with Infiltration Feasible	Distributed Green Infrastructure

The cost data that were applied to the City retrofit projects were compiled from retrofit projects from several sources:

- 28 completed projects and 21 planned projects from Enhanced Watershed Management Plans (EWMPs) that have been constructed in Southern California;
- Six projects from the BASMAA Clean Watersheds for a Clean Bay Project (CW4CB) (BASMAA, 2017); and
- Generalized cost per unit acre data provided by Union City.

These sources were processed to determine the capital costs (design and construction) and to estimate recurring annual O&M costs in order to estimate project costs for the planned projects in the City of Dublin. The inputs used to estimate O&M costs were also compared against information from the City of Portland, Oregon, and the City of Tacoma, Washington (see Table 4-5).

Information on facility type and project location were used to group the project data into green street, distributed green infrastructure, and regional stormwater control categories. The following facility types were included in each category:

- Green Streets: Projects built within the right-of-way and include curb cutting and other costs associated with street retrofits. These may include infiltration trenches, bioretention, and infiltration galleries.
- Distributed Green Infrastructure: Biofilters, swales, infiltration strips, and bioretention installed in a parcel to treat runoff generated on that parcel.
- Regional Stormwater Control: Infiltration basins, large storage facilities, and wetlands, installed to treat runoff from a larger drainage area.

4.1.2 Design and Construction Unit Cost Estimates

Information for constructed EWMP projects was collected from various sources, including the Proposition O monthly progress report from August 2016 (Bureau of Engineering Prop O Clean Water Division, 2016) and publicly available online information such as the project fact sheets provided by the City of Los Angeles stormwater program (http://www.lastormwater.org/). EWMP cost data sources also include projects from the Santa Monica Bay Area (Beach Cities EWMP Group, 2015; North Santa Monica Bay Coastal Watersheds EWMP Group, 2016; City of Los Angeles, 2015), and Palos Verdes (Palos Verdes Watershed Management Group, 2015).

The cost information available in the reviewed EWMP references for constructed projects is typically presented in the documentation as one final lump sum value, which may only include construction or may include additional design and planning efforts. Some of the sources reviewed provided unclear documentation of whether the presented costs corresponded to "construction only" or "design and construction." When utilizing these cost data, best professional judgment was used to distribute the design and construction costs when the information provided was unclear. If design costs were not available for a project, an estimate for the design cost was inferred from other projects for which design costs were available. For EWMP projects, the cost of design were calculated to be approximately 30% of the construction cost. For projects with only construction costs, the design and construction cost was calculated as 1.3 x construction cost. If design and construction data was provided these values were not adjusted. Some EWMP Projects summarized in these references were not included in this analysis. This was the case if any of the following were true: a tributary drainage area could not be determined; the project does not fall into one of the Potential Project Types; or project costs could not be broken into components representing O&M, design, and construction.

This cost analysis also includes cost data from six GI projects summarized in the BASMAA CW4CB Project (BASMAA, 2017). For each of the projects used, both the cost of design and the cost of construction were documented.

Additional local cost data were provided via e-mail communication from Union City (Union City, 2017), which reported that their recent green streets projects had obtained a cost per unit acre of treated area of approximately $300,000. Table 4-2 provides summary statistics for all three of the cost data sources combined, and Appendix B provides the compiled cost data (see the "Existing Project Costs Info" tab in the external file [Opportunity Prioritization and Cost Analysis.xlsx]).

Table 4-2: Design and Construction Cost Per Unit Acre Summary Statistics

Project Type	Number of Projects (n)[1]	Minimum ($/ac)	Median ($/ac)	Maximum ($/ac)	Mean ($/ac)
Green Street	8	$34,200	$134,000	$1,180,000	$283,000
Distributed Green Infrastructure	17	$30,500	$134,000	$384,000	$167,000
Regional Stormwater Control	10	$12,000	$26,400	$64,200	$31,300

To apply the capital cost data to new projects, design and construction costs were compared to the treated area for each project. Linear regression equations were developed using plots of treated area versus design and construction cost using project data from the EWMP, CW4CB, and Union City sources. Table 4-3 summarizes the cost formulas developed based on the linear regression plots which predict design and construction cost based on treated area for each of the three project categories.

Table 4-3: Cost Curves for Each Cost Category

Cost Estimation Category	Design and Construction Cost Formula
Green Street	*$114,687 * acres + $36,927*
Distributed Green Infrastructure	*$176,647 * acres + $12,935*
Regional Stormwater Control	*$38,633 * acres*

These formulas were applied to the estimated drainage areas for each identified project to calculate an estimated capital cost for each project. The resulting costs per project are summarized in Appendix B (see "Prioritization Table" tab of the external file [Opportunity Prioritization and Cost Analysis.xlsx]).

4.1.3 Annual O&M Cost Estimates

Annual O&M costs are intended to account for activities necessary to maintain the effectiveness of a project that recur on a regular basis, such as routine maintenance on an annual basis or repairs following a large storm event. For the analysis conducted for this project, annual O&M costs do not include replacement (of portions) or rehabilitation of green infrastructure facilities, which occurs approximately every 20 to 30 years. For the EWMP cost estimations, annual O&M was assumed to be a percentage of the capital construction costs (i.e., design costs were not accounted for in the percentage). Completed project costs for O&M were not available and were estimated based on values for planned projects. In the Beach Cities EWMP (Beach Cities EWMP Group, 2015), annual O&M costs were assumed to be 2% of the capital cost for distributed GI and regional stormwater control facilities and 6% for green streets (USEPA, 2005; Weiss et al., 2007). The activities included in these estimates are listed below.

O&M for distributed GI and regional facilities includes:

- Landscape maintenance;
- Media and gravel replacement when clogged and surface scarification is no longer effective;
- Pest control;
- Sediment and pre-treatment cleanout;
- Cleaning and removal of debris;
- Repairs to inlet/control structures; and
- Pre-treatment cleanup.

O&M for green streets includes:

- Repairs to eroded areas;
- Incremental landscape maintenance;
- Media and gravel replacement when clogged and surface scarification is no longer effective;
- Removal of trash and debris; and
- Removal of aged mulch with installation of a new layer.

The average O&M cost was then calculated as a percentage of design and construction cost. The O&M annual cost factors are reduced when design is included in the implementation cost. As

described in Section 4.1.2, project design was assumed to be 30% of construction costs for EWMP projects when design costs were not provided. The average values for EWMP data were used to calculate O&M cost factors based on combined construction and design costs (capital costs, for the purpose of this analysis). This correction resulted in fixed rates of 3.6% of the construction and design costs for green street projects and 1.3% of the construction and design costs for distributed and regional projects, as summarized in Table 4-4. Annual O&M costs used for this analysis are summarized for planned EWMP projects included in Appendix B (see the "Existing Project Costs Info" tab in the external file [Opportunity Prioritization and Cost Analysis.xlsx]).

Table 4-4: O&M Annual Cost Factors for Each Cost Category

Cost Estimation Category	O&M Annual Cost Factors (Percent of Capital + Design Costs)
Green Street	3.6%
Distributed Green Infrastructure	1.3%
Regional Stormwater Control	1.3%

To validate the O&M cost factor applied to the identified projects provided in Table 4-4, O&M annual cost factors were compared to values for projects completed in the City of Tacoma, Washington (J. Knickerbocker, personal communication, June 1, 2017) and the City of Portland, Oregon (M. Juon, personal communication, May 30, 2017). The City of Portland quantified O&M cost as a function of facility area as opposed to treated area. Local sizing guidance was used to convert the cost per facility area to cost per treated area (City of Portland, 2016). The annual O&M cost factors (as a percent of capital costs) calculated from planned EWMP projects are comparable to the ranges experienced by both City of Tacoma and City of Portland projects.

Table 4-5: Comparison of O&M Cost Estimates to Municipal Sources

Source	BMP Type	Design and Construction/Treated Area ($/acre)		O&M Cost/ Facility Area ($/ft²)	O&M Cost/ Treated Area ($/acre)		O&M Annual Cost Factor (Percent of Capital + Design Costs)
		Low	High		Low	High	
City of Tacoma	Bioretention	$130,000	$400,000		$4,000	$6,000	1.0% - 4.6%
City of Portland	Basin/ Regional[1]	$130,000	$400,000	$1.55	$6,077		1.5% - 4.7%
City of Portland	Planter/Green street[1]	$130,000	$400,000	$1.55	$4,051		1.0% - 3.1%
City of Tacoma	Regional	$4,000			$200		5.0%
EWMP	Green St	$283,000			$10,188		3.6%
EWMP	Distributed GI	$167,000			$2,171		1.3%
EWMP	Regional	$31,300			$407		1.3%

[1] The design and construction costs for these practices were assumed to be the same as the Tacoma data for the purposes of this comparison. Portland's 'basin' and 'planter' information is calculated as the $/sq ft * 43,560 * Sizing Factor to obtain a $/treated acre. Sizing factors of 9% for basins and 6% for planters were used based on the Portland Stormwater Management Manual (City of Portland, 2016).

[2] The Design and Construction costs reported in this table are based on the mean values provided in Table 4-2 and O&M annual cost factors are as reported in Table 4-4.

4.1.4 Total Project Cost Estimation

The total cost of a planned project includes the capital costs and the annual costs over the design life of the project.

$$Total\ Cost = Capital\ Cost + Annualized\ O\&M\ Cost$$

The capital cost, which includes both the design cost and the construction cost, is estimated for a new project based upon its cost estimation category and treatment area using the equations provided in Table 4-3. The annual O&M cost is calculated by multiplying the capital cost by the applicable fixed O&M cost factor from Table 4-4. For the purposes of this analysis, a 20-year design life and a 3% inflation rate were used to calculate the total present value of the annualized O&M costs.

Total project cost estimates are provided in Appendix B (see "Prioritization Table" tab of the external file [Opportunity Prioritization and Cost Analysis.xlsx]) for each of the identified opportunity areas identified in the City.

5. REFERENCES

Alameda Countywide Clean Water Program (ACCWP), 2014. Integrated Monitoring Report Part C: PCB and Mercury Load Reduction. Prepared for ACCWP by Geosyntec. March.

Bay Area Stormwater Management Agencies Association (BASMAA), 2016. Interim Accounting Methodology for TMDL Loads Reduced. Prepared by Geosyntec Consultants and EOA, Inc. 19 September.

BASMAA, 2017. Clean Watersheds for a Clean Bay (CW4CB) Final Report. May. Also available at: http://basmaa.org/Clean-Watersheds-for-a-Clean-Bay-Project/About-the-CW4CB-Project.

Beach Cities EWMP Group, 2015. Draft Enhanced Watershed Management Program (EWMP) for the Beach Cities Watershed Management Area (Santa Monica Bay and Dominguez Channel Watersheds). June.

Bureau of Engineering Prop O Clean Water Division, 2016. Proposition O – Clean Water Bond Program August 2016 Monthly Report. August. http://www.lacitypropo.org/

City of Los Angeles, Los Angeles County Flood Control District, County of Los Angeles, City of Santa Monica, and City of El Segundo, 2015. *Draft Santa Monica Bay Jurisdictional Group 2 and 3 Enhanced Watershed Management Program.* June.

City of Portland, Stormwater Management Manual, 2016. https://www.portlandoregon.gov/bes/64040

Geosyntec, 2017. City of Dublin GI Plan Framework Analyses Methodology Memorandum. Prepared by Geosyntec. 28 February.

North Santa Monica Bay Coastal Watersheds EWMP Group, 2016. Enhanced Watershed Management Program (EWMP) for North Santa Monica Bay Coastal Watersheds. March.

Palos Verdes Watershed Management Group, 2015. Draft Enhanced Watershed Management Program (EWMP) for the Palos Verdes Watershed Management Group.

Union City, 2017. E-mail communication from Thomas Ruark to Shannan Young. 19 April 2017.

United States Environmental Protection Agency (USEPA), 2005. National Management Measures to Control Nonpoint Source Pollution from Urban Areas. EPA-841-B-05-004, U.S. Environmental Protection Agency, Washington, D.C.

Weiss, P.T., J.S. Gulliver, and A.J. Erickson, 2007. Cost and Pollutant Removal of Storm-Water Treatment Practices. Journal of Water Resources Planning and Management, Vol. 133.

Appendix E

POTENTIAL PROJECT CONCEPT PLANS

SAN RAMON ROAD: ALCOSTA BOULEVARD TO WEST VOMAC ROAD BIORETENTION RETROFIT PROJECT

PROJECT CONCEPT

Portions of San Ramon Road were identified as high-priority project opportunities in the green infrastructure retrofit opportunity analysis conducted in April 2017. This project concept focuses on the San Ramon Road retrofit opportunity segment between Alcosta Boulevard and West Vomac Road. The project is not located in a high-trash area, according to on-land visual trash assessments performed by EOA, Inc.

The project would entail installation of four bioretention cells (SR01, SR02, SR03, and SR04) with underdrains along landscaped strips adjacent to the roadway. These facilities would provide treatment of runoff from portions of San Ramon Road. The location and drainage areas of these facilities are shown on Figure SR-1, and a more detailed view is shown on Figure SR-2.

This portion of San Ramon Road is colinear with the historical State Highway 21, and some remnants of the original highway slab may still exist below grade. These slabs may require removal prior to construction of some or all of the bioretention facilities. A summary of the four proposed bioretention facilities is provided:

- Bioretention facility SR01 - located near the southwest corner of the intersection between San Ramon Road and West Vomac Road, in the landscaped strip between San Ramon Road and the bike path. Approximately 70 feet of new storm drain pipe would be required to connect the facility to the existing storm drain system. No trees would need to be relocated to install this facility. A fence is recommended on the western portion of the facility to protect cyclists in the bike lane.
- Bioretention facility SR02 - located near the southeast corner of the intersection between San Ramon Road and West Vomac Road, in the landscaped strip between the pedestrian walkway and the adjacent residential properties. Outflow from the facility would discharge directly to an existing culvert. One tree would need to be relocated to install this facility. A large gas transmission pipeline which runs along San Ramon Road is located in the vicinity of the facility. As sited in the attached figures, the facility is set back 10 feet horizontally from the pipeline; if this is not sufficient, implementation may not be feasible. The pipeline location is based on San Ramon Road as-built plans. The precise location and depth will need to be verified prior to construction.
- Bioretention facility SR03 - located on the western portion of San Ramon in the landscaped strip between the road and bike path. A fence is recommended on the western portion of the facility to protect cyclists in the bike lane. One tree would need to be relocated to install this facility. The facility is located adjacent to an existing storm drain and no additional pipe would be expected to be needed to connect the facility to the storm drain.
- Bioretention facility SR04 - located on the eastern portion of San Ramon Road in the landscaped strip between the pedestrian walkway and the adjacent residential properties. One

tree would need to be relocated to install this facility. The facility is located adjacent to an existing storm drain and no additional pipe would be expected to be needed to connect the facility to the storm drain.

The bioretention facilities have been sized at approximately 2% of impervious tributary area, consistent with continuous modeling results for 80% capture for bioretention with a 6-inch reservoir. Facility areas could be increased to provide additional hydromodification and trash capture benefits, but the density of landscaping in the area would likely necessitate additional tree relocation to accommodate larger facilities.

DESIGN INFORMATION

Drainage Catchment Imperviousness:	95%	
Land Use Yield Category (%):	100% Old Urban	
Facility Type:	Bioretention with underdrains	
Location	**Total Drainage Area (sq-ft)**	**Bioretention Footprint (sq-ft)**
SR01	17,400	340
SR02	23,000	450
SR03	24,300	470
SR04	30,100	580

PROJECT BENEFITS

PCBs Loads Reduced:	TBD
Mercury Loads Reduced:	TBD
Trash Loads Reduced:	N/A, low trash generating area.
Water Supply Benefits:	None anticipated.
Flood Management Benefits:	The project would provide some flood management benefits through peak flow attenuation.
Natural Drainage System Benefits:	None anticipated.
Habitat or Open Space Benefits:	None anticipated.
Community Benefits:	The project would provide an opportunity for educational signage regarding stormwater, green infrastructure, and creek health.

COST ESTIMATE

Item	Quantity	Unit	Unit Price[1]	Cost[1]	Reference
Excavation	240	CY	$ 27.56	$ 6,615.29	*Adjusted Caltrans 2015 Unit Bid Prices*
Clearing & Grubbing	1840	SF	$ 0.16	$ 288.76	*2017 BNI Facilities Manager's Costbook 02230.10*
Soil Disposal	240	CY	$ 31.39	$ 7,532.78	*Engineering Judgement[2]*
Site Grading	205	SY	$ 34.26	$ 7,024.20	*Adjusted 2001 Caltrans BMP Retrofit Pilot*
Erosion control blankets	1840	SF	$ 0.58	$ 1,058.77	*Engineering Judgement[2]*
Class 2 Permeable Rock	70	CY	$ 53.24	$ 3,726.58	*Adjusted Caltrans 2015 Unit Bid Prices 682042*
Bio-Treatment Soil Mix	100	CY	$ 88.67	$ 8,867.24	*Adjusted 2017 Lyngso Garden Biotreatment Soil Mix*
Place Bio-Treatment Soil Mix	205	SY	$ 3.75	$ 767.82	*2017 BNI Facility Manager's Costbook 02910.10*
Mulch	1840	SF	$ 0.52	$ 962.52	*2017 BNI Facility Manager's Costbook 02910.10*
Shrub Material and Installation	368	EA	$ 52.31	$ 19,250.45	*2017 BNI Facility Manager's Costbook 02910.30*
Replacement Tree Material and Installation Cost	3	EA	$ 428.95	$ 1,286.85	*2017 BNI Facility Manager's Costbook 0293.60*
4" Perforated PVC Pipe	160	LF	$ 20.92	$ 3,347.90	*2017 BNI Facility Manager's Costbook, 02630.70*
4" PVC Cleanout w/ Cap	10	LF	$ 20.92	$ 209.24	*2017 BNI Facility Manager's Costbook, 02630.70*
Overflow Riser w/ Grate	4	EA	$ 8,369.76	$ 33,479.04	*Adjusted 2017 Oldcastle Precast 12x12 Swaleguard*
PVC Pipe to Storm Drain	80	LF	$ 10.46	$ 836.98	*2017 BNI Facility Manager's Costbook, 02630.70*
Connection to Existing Storm Drain	4	EA	$ 2,092.44	$ 8,369.76	*Engineering Judgement[2]*
Irrigation system	1840	SF	$ 0.72	$ 1,327.11	*2017 BNI Facility Manager's Costbook, 02810.40*
Curb cut inlet	4	EA	$ 1,046.22	$ 4,184.88	*Engineering Judgement[2]*
Remove and replace irrigation lines	1840	SF	$ 1.31	$ 2,412.52	*Engineering Judgement[2]*
Remove Existing Highway Slab as Needed	1840	SF	$ 8.08	$ 14,874.42	*Adjusted Caltrans 1995 Unit Bid Prices*
Construction Cost Subtotal				**$ 126,423.12**	
Mobilization/Demobilization			10%	$ 12,642.31	*Estimated as a percentage of Construction Cost Subtotal*
			Subtotal 1	*$ 139,065.43*	
Engineering Overhead			20%	$ 27,813.09	*Estimated cost as a percentage of Subtotal 1*
			Subtotal 2	*$ 166,878.52*	
Contingency			30%	$ 50,063.56	*Estimated cost as a percentage of Subtotal 2*
			Subtotal 3	*$ 216,942.07*	
TOTAL COST ESTIMATE				**$ 217,000**	

[1]All costs are in 2018 dollars. Inflation rate calculated from U.S. Department of Labor, Bureau of Labor Statistics.

[2]Cost basis developed as part of Geosyntec work on 2017 Caltrans District 4 Phase I Plan for TMDL Implementation, reviewed by Caltrans. Cost adjusted for inflation.

REFERENCES

BNi® Building News, 2017. Facilities Manager's Costbook. BNI Publications, Inc.

California Department of Transportation (Caltrans), 1995. 1995 Contract Cost Data. Retrieved from: http://sv08data.dot.ca.gov/contractcost/

Caltrans, 2001. Caltrans BMP Retrofit Pilot Program. May. Retrieved from Construction Cost Data Summary: Districts 7 and 11: http://www.dot.ca.gov/hq/env/stormwater/special/newsetup/_pdfs/new_technology/CTSW-RT-01-050/AppendixC/CostRpt05-01.pdf

Caltrans, 2015. 2015 Contract Cost Data. Retrieved from: http://sv08data.dot.ca.gov/contractcost/

EOA, Inc, 2018. Trash Control Status of Land Areas >10,00ft^2 Draining Directly to the MS4.

Lyngso Garden, 2018. Biotreatment soil mix. Retrieved from: https://store.lyngsogarden.com/products/biotreatment-soil-mix-509.html

Oldcastle Infrastructure, 2018. Swalegard® Bioretention Overflow Filter. Retrieved from: https://oldcastleprecast.com/oldcastle_product/12x12-swalegard-overflow-filter/101180/

San Ramon Road - Alcosta to W Vomac Drainage Map

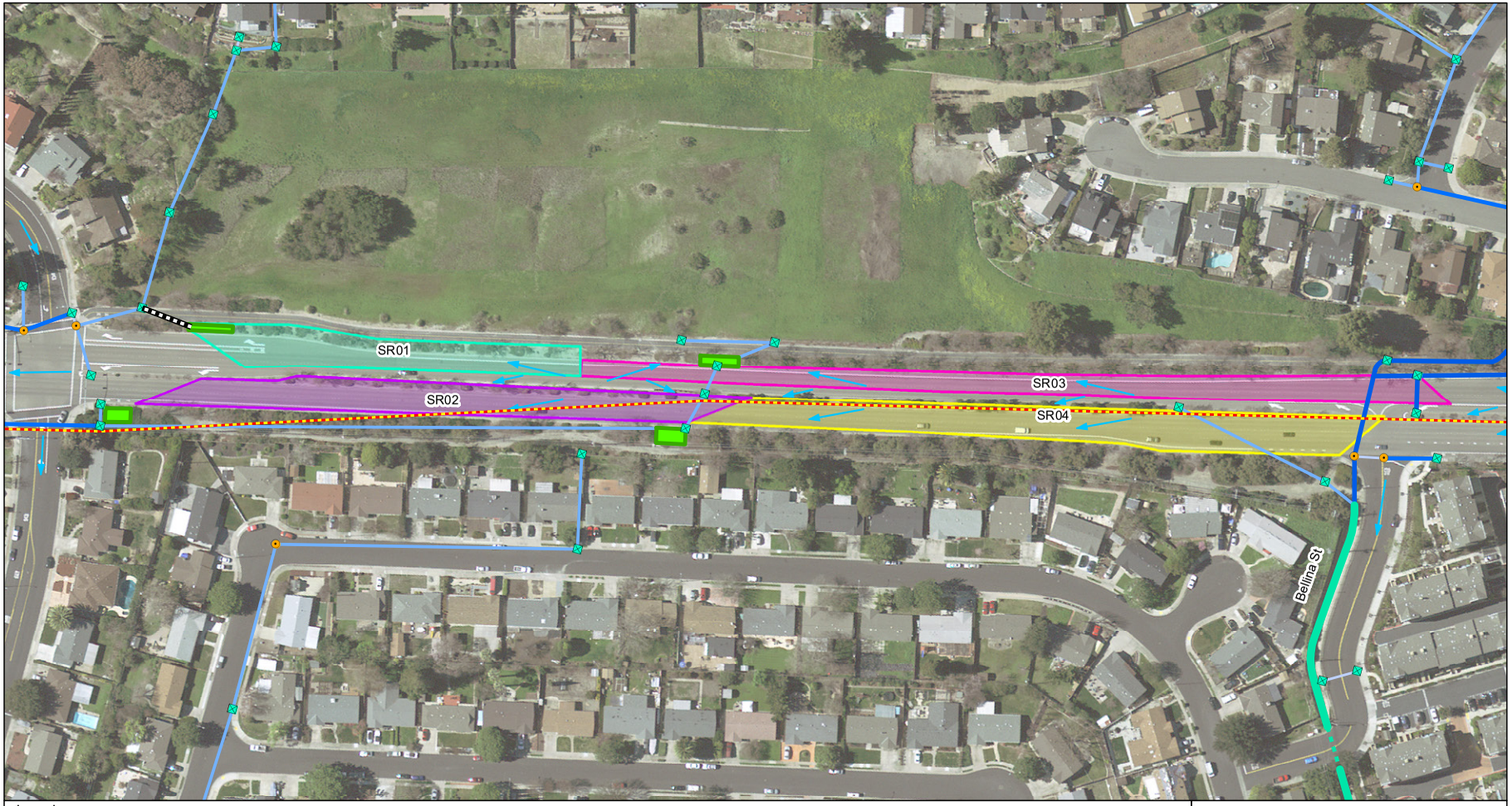
City of Dublin GI Plan / SWRP

Geosyntec consultants

Oakland | September 2018

Figure SR-1

P:\GIS\City of Dublin\Projects\Concept Plans\San Ramon Drainage.mxd 9/7/2018 9:31:36 AM



Legend

Existing Storm Drain Infrastructure
- Catch Basin / Inlet
- Manhole / Junction Box
- Creek / Open Channel
- Culvert
- Surface Flow Direction
- < 12" RCP
- 12 - < 18" RCP
- 18 - < 33" RCP
- >= 33" RCP
- Existing Gas Pipeline

Proposed Control Measures
- Bioretention with Underdrain
- New storm drain pipe

Proposed Drainage Areas
- SR01
- SR02
- SR03
- SR04

N

0 110 Feet

P:\GIS\City of Dublin\Projects\Concept Plans\San Ramon Detail.mxd 9/7/2018 9:33:55 AM

San Ramon Road - Alcosta to W Vomac Detail Map

City of Dublin GI Plan / SWRP

Geosyntec consultants

Oakland | September 2018

Figure SR-2

IRON HORSE TRAIL AT ALAMO CREEK AND SOUTH SAN RAMON CREEK REGIONAL BIORETENTION PROJECT

Note: this project is on hold until the Master Plan has been completed.

PROJECT CONCEPT

There is an existing Iron Horse Nature Park and Open Space Master Plan for the former Union Pacific railroad right-of-way. This area is adjacent to the Iron Horse Trail near the confluence of Alamo Creek and South San Ramon Creek, and has been acquired by the City of Dublin. The Master Plan sites aesthetic and recreation features, including community gardens, a children's natural play area, and flexible open space. The proposed concept would incorporate a bioretention area and pretreatment swale into the Master Plan area to treat surface runoff from adjacent residential areas. A map with the proposed drainage areas and treatment facility location, identified as IH-01 and, is provided as Figure IHT-1, with a more detailed view provided as Figure IHT-2.

Drainage area delineation and facility siting/sizing was based on a preliminary field visit and review of publicly-available aerial imagery, LIDAR elevation data, and City of Dublin storm drain maps. Plan review and field confirmation of drainage area is recommended in future phases of this project.

IH-01 consists of a bioretention area with an underdrain as well as a vegetated swale used for pretreatment. The bioretention area is located in an existing vegetated area at the northwest end of the Iron Horse Trail near the intersection with Amador Valley Blvd. The pretreatment swale is located along an existing vegetated depression/channel, from the proposed bioretention location nearly to Alamo Creek.

The drainage area tributary to the IH-01 facility is approximately 11.5 acres, consisting of 8.8 acres of residential areas and 2.7 acres of open space. The residential areas consist of portions of the Alamo Creek Villas and Heritage Commons developments adjacent to the Iron Horse Trail. Currently these portions of residential area discharge to Alamo Creek through a 24-inch storm drain pipe; approximately 100 feet of proposed new storm drain pipe would direct this runoff into the proposed pretreatment swale and then into the proposed bioretention facility. Additional sheet flow runoff from adjacent open space would also flow into the proposed facilities. Outflow from the facility would discharge into South San Ramon Creek through a retrofit of an existing inlet and storm drain pipe. The existing 150 feet of 15-inch storm drain may need to be upsized.

The bioretention facility is currently sized at approximately 2% of impervious tributary area, consistent with continuous modeling results for 80% capture for bioretention with a 6-inch reservoir. The proposed layout is flexible, however, and the bioretention area could easily be redesigned to be larger or smaller depending on refinement of the drainage area characterization.

The pretreatment swale is sized per the Alameda C.3. technical guidance 0.2 inch-per-hour intensity method (sized for the water quality design flow resulting from rain event with

precipitation intensity of 0.2 inches per hour), with a 10-foot bottom width and 225-foot length, to achieve a residence time of 8 minutes.

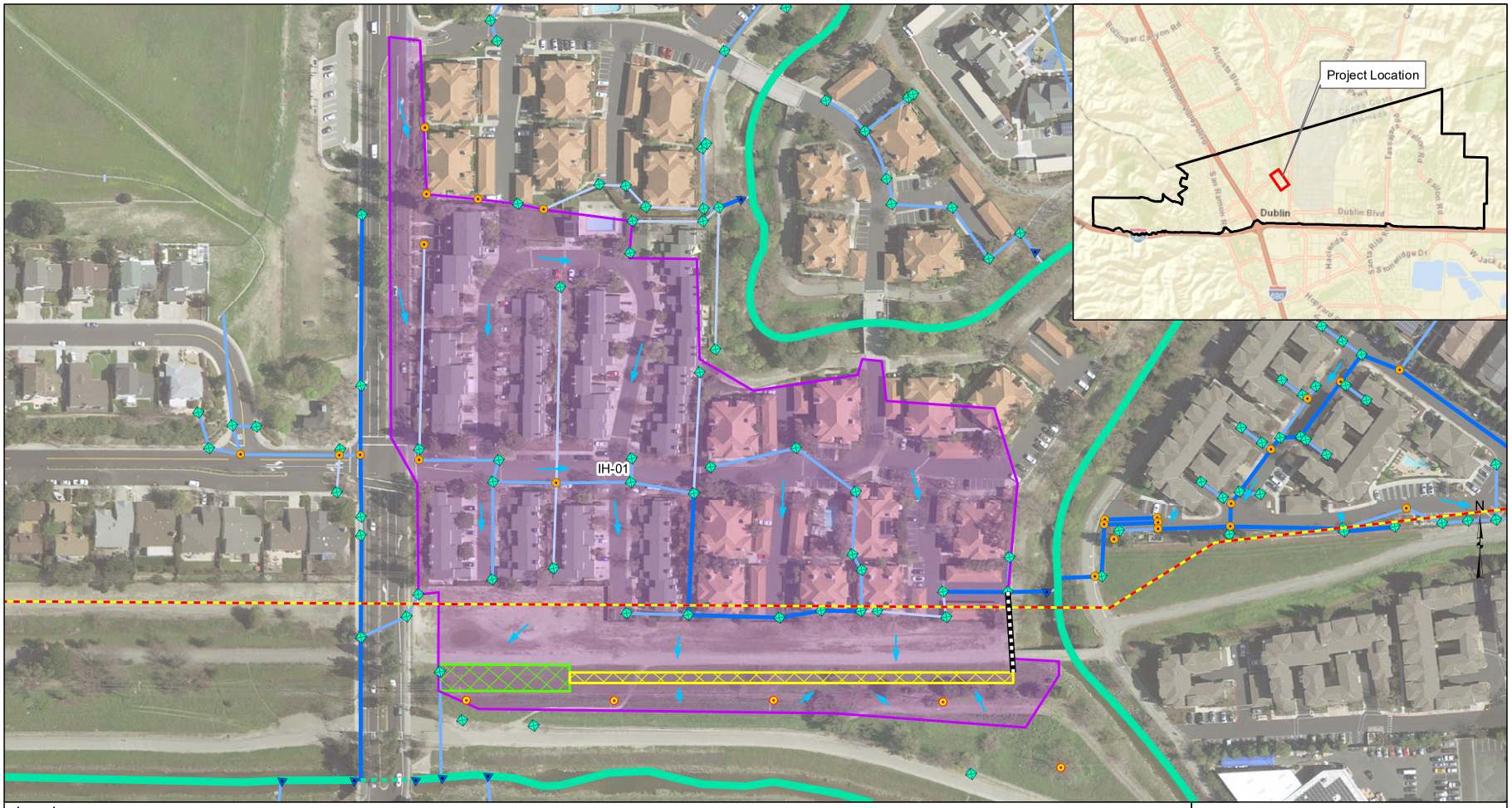
A second treatment facility was considered in the triangular open area east of South San Ramon Creek, but was found to be infeasible due to the location of the existing pipeline.

Design Information

Facility	Total Drainage Area (ac)	Imperviousness (Approximate)	Impervious Drainage Area (ac)	Facility Footprint (sq-ft)	Land Use
IH-01 Bioretention	11.5	65%	7.5	6,700	77% New Urban
IH-01 Swale				6,000	23% Open Space

Cost Estimate

More detailed planning level costs will be developed.


Project Location
Dublin
Dublin Blvd
IH-01
N
Legend
Existing Storm Drain Infrastructure
Catch Basin / Inlet
Manhole / Junction Box
Outfall / Headwall
Creek / Open Channel
Culvert
Surface Flow Direction
< 12" RCP
12 - < 18" RCP
18 - < 33" RCP
>= 33" RCP
Existing Utilities
Pipeline
Utility Pole
Proposed Drainage Areas
IH-01
Proposed Control Measures
Bioretention with Underdrain
Pretreatment Swale
New Storm Drain Pipe
0
130
Feet
Iron Horse Trail Bioretention Concept Drainage Map
City of Dublin GI Plan / SWRP
Geosyntec consultants
Figure
IHT-1
Oakland
September 2018
P:\GIS\City of Dublin\Projects\Concept Plans\Iron Horse Trail Drainage.mxd 9/7/2018 9:40:05 AM

Legend

Existing Storm Drain Infrastructure
- Catch Basin / Inlet
- Manhole / Junction Box
- Outfall / Headwall
- Creek / Open Channel
- Culvert
- Surface Flow Direction

- < 12" RCP
- 12 - < 18" RCP
- 18 - < 33" RCP
- >= 33" RCP

Existing Utilities
- Pipeline
- Utility Pole

Proposed Drainage Areas
- IH-01

Proposed Control Measures
- Bioretention with Underdrain
- Pretreatment Swale
- New Storm Drain Pipe

N

0 75 Feet

Iron Horse Trail Bioretention Concept Detail Map

City of Dublin GI Plan / SWRP

Geosyntec consultants

Oakland | September 2018

Figure IHT-2

P:\GIS\City of Dublin\Projects\Concept Plans\Iron Horse Trail Detail_IH01_only.mxd 9/7/2018 9:40:06 AM

Appendix F
CITY OF DUBLIN TYPICAL STORMWATER DETAILS

Standard specifications and typical design drawings for GSI projects are provided on the following pages, as indicated in Table F-1.

Table F-1 | **CITY OF DUBLIN TYPICAL STORMWATER DETAILS**

Sheet No.	Title of Drawing/Standard Specifications	Notes
GI-1	Bioretention Area Notes	Applies to all details
GI-2A	Bioretention area: Plan view with street parking	Parking lane
GI-2B	Bioretention area: Bulbout plan view	Intersection with sidewalks
GI-2C	Bioretention area street median	—
GI-XX	Bioretention area with bike lane plan view	Bike lane
GI-3A	Bioretention Area: Sloped Sides Cross Section	Sidewalk
GI-3B	Bioretention Area: Vertical Side Wall Cross Section	Parking lane and sidewalk
GI-4	Bioretention Components: Outlet Detail	—
GI-5	Bioretention Components: Edge Treatment Detail	No parking
GI-6A	Bioretention Components: Gutter Curb Cut Inlet Detail	—
GI-6B	Bioretention Components: Trench Drain Curb Cut Inlet Detail	Parking lane and sidewalk
GI-6C	Bioretention Components: Curb Cut At Bulbout Inlet Detail	Intersection with Sidewalks
GI-7	Bioretention Components: Check Dam Detail	Slope requiring check dams

PURPOSE:

PROVISION C.3 OF THE MUNICIPAL REGIONAL STORMWATER NPDES PERMIT (MRP) REQUIRES TREATMENT OF IMPERVIOUS SURFACES USING GREEN INFRASTRUCTURE FOR BOTH PUBLIC AND PRIVATE DEVELOPMENT PROJECTS. BIORETENTION AREAS ARE EXPECTED TO BE THE MOST COMMON GREEN INFRASTRUCTURE APPLICATION IN PUBLIC RIGHT-OF-WAY (ROW). THE PURPOSE OF THE BIORETENTION AREA IS TO IMPROVE WATER QUALITY BY FILTRATION THROUGH THE BIOTREATMENT SOIL AND TO CONTROL RUNOFF PEAK FLOW RATES AND VOLUMES THROUGH STORAGE AND INFILTRATION.

NOTES & GUIDELINES:

1. THE ENGINEER SHALL ADAPT PLAN AND SECTION DRAWINGS TO ADDRESS SITE-SPECIFIC CONDITIONS.
2. BIORETENTION AREA SHALL BE SIZED TO MEET THE REQUIREMENTS OF MRP PROVISION C.3 SIZING.
3. 48 HOUR MAXIMUM FACILITY DRAWDOWN TIME (TIME FOR MAXIMUM SURFACE PONDING TO DRAIN THROUGH THE BIOTREATMENT SOIL AFTER THE END OF A STORM). REFER TO C.3 TECHNICAL GUIDANCE MANUAL (ACCWP) FOR DRAINAGE CONSIDERATIONS.
4. A STORAGE LAYER OF CALTRANS STANDARD CLASS II PERMEABLE MATERIAL IS REQUIRED UNDER THE BIOTREATMENT SOIL. REFER TO C.3 TECHNICAL GUIDANCE MANUAL (ACCWP) FOR SPECIFICATIONS.
5. THE BIORETENTION AREA SLOPE IS TYPICALLY DESIGNED TO MATCH THE LONGITUDINAL SLOPE OF THE ADJACENT ROADWAY/SIDEWALK. THE BOTTOM OF THE BIORETENTION AREA, HOWEVER, SHOULD BE FLAT. CHECK DAMS SHALL BE USED TO TERRACE FACILITIES TO PROVIDE SUFFICIENT PONDING FOR SLOPED INSTALLATIONS. ENGINEER SHALL SPECIFY CHECK DAM HEIGHT AND SPACING. REFER TO DETAIL **GI-7** FOR GUIDANCE ON CHECK DAM DESIGN.
6. DEPENDING ON THE DEPTH OF THE BIORETENTION AREA, ADDITIONAL STRUCTURAL CONSIDERATIONS MAY BE REQUIRED TO ADDRESS HORIZONTAL LOADING. REFER TO DETAIL **GI-5** FOR GUIDANCE ON EDGE TREATMENTS.
7. WHEN FACILITY CONSTRUCTION IMPACTS EXISTING SIDEWALK, ALL SAW CUTS SHALL ADHERE TO CITY OF DUBLIN STANDARDS. SAW CUTS SHALL BE ALONG SCORE LINES OR ALONG CONSTRUCTION JOINTS, AS DETERMINED BY THE CITY ENGINEER, AND ANY DISTURBED SIDEWALK FLAGS SHALL BE REPLACED IN THEIR ENTIRETY.
8. BIORETENTION AREAS IN PUBLIC RIGHT OF WAY SHALL BE DESIGNED WITH AN EMERGENCY OVERFLOW. IN THE EVENT THE BIORETENTION AREA OVERFLOW DRAIN IS OBSTRUCTED OR CLOGGED, THE INUNDATION AREA SHALL BE CONTAINED WITHIN THE STREET AND SHALL NOT BE WITHIN ADJACENT PRIVATE PROPERTIES.
9. BIORETENTION AREA VEGETATION SHALL BE SPECIFIED BY LANDSCAPE DESIGN PROFESSIONAL. SEE C.3 TECHNICAL GUIDANCE MANUAL (ACCWP) FOR PLANT LIST AND VEGETATION GUIDANCE.
10. THE ENGINEER SHALL EVALUATE THE NEED FOR EROSION PROTECTION AT ALL INLET LOCATIONS. ALL COBBLES USED FOR ENERGY DISSIPATION SHALL BE GROUTED.
11. THE PROJECT PLANS SHALL SHOW ALL EXISTING UTILITIES AND INDICATE POTENTIAL UTILITY CROSSINGS OR CONFLICTS.
12. NO UTILITIES, NEW OR EXISTING, SHALL BE LOCATED WITHIN OR BELOW THE BIORETENTION AREA.
13. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES SHALL CONFORM TO CURRENT CITY OF DUBLIN STANDARDS AND OTHER UTILITY PROVIDER REQUIREMENTS.
14. VERTICAL SIDEWALLS EXTENDING INTO EXISTING STORM DRAIN PIPE TRENCH BACKFILL SHALL BE DESIGNED WITH A CONCRETE BACKFILL ACCEPTABLE TO THE CITY ENGINEER.
15. OVERFLOW RISER MUST BE FORMED SUCH THAT IT IS A MINIMUM OF 6" ABOVE THE BOTTOM OF THE SYSTEM INLET, OR AS DESIGNED. PLACE STRUCTURE ADJACENT TO PEDESTRIAN EDGE TO ALLOW FOR MONITORING ACCESS.
16. DETAILS WERE ADAPTED FROM SFPUC GREEN INFRASTRUCTURE TYPICAL DETAILS AND SPECIFICATIONS.
17. DETAILS WERE DEVELOPED BY GEOSYNTEC CONSULTANTS.

ENGINEER CHECKLIST (SHALL SPECIFY, AS APPLICABLE):

- ☐ BIORETENTION AREA WIDTH AND LENGTH
- ☐ DEPTH OF PONDING
- ☐ AMOUNT OF FREEBOARD PROVIDED
- ☐ DEPTH OF BIOTREATMENT SOIL (18" MIN)
- ☐ UNDERDRAIN SPECIFICATIONS AND LOCATION (IF FACILITY IS LINED PLACE UNDERDRAIN AT BOTTOM OF FACILITY)
- ☐ BIORETENTION SURFACE ELEVATION (TOP OF BIOTREATMENT SOIL) AT UPSLOPE AND DOWNSLOPE ENDS OF FACILITY
- ☐ CONTROL POINTS AT EVERY BIORETENTION WALL CORNER AND POINT OF TANGENCY
- ☐ DIMENSIONS AND DISTANCE TO EVERY INLET, OUTLET, CHECK DAM, SIDEWALK NOTCH, ETC.
- ☐ ELEVATIONS OF EVERY INLET, OVERFLOW RISER, STRUCTURE RIM AND INVERT, CHECK DAM, BIORETENTION AREA WALL CORNER, AND SIDEWALK NOTCH
- ☐ TYPE AND DESIGN OF BIORETENTION AREA COMPONENTS (E.G., EDGE TREATMENTS, INLETS/GUTTER MODIFICATIONS, UTILITY CROSSINGS, LINER, AND PLANTING DETAILS)
- ☐ DEPTH AND TYPE OF NON-FLOATING MULCH (3" MIN)

RELATED TECHNICAL GUIDANCE	SOURCE
BIORETENTION: - BIOTREATMENT SOIL MIX - CALTRANS CLASS II PERM LAYER STORAGE - PERFORATED UNDERDRAIN - NON-FLOATING MULCH	C.3 TECHNICAL GUIDANCE MANUAL (ACCWP)

BIORETENTION AREA: NOTES

GREEN INFRASTRUCTURE TYPICAL DETAILS

CITY OF DUBLIN PUBLIC WORKS

SCALE: NOT TO SCALE

DATE: MAY 11, 2018

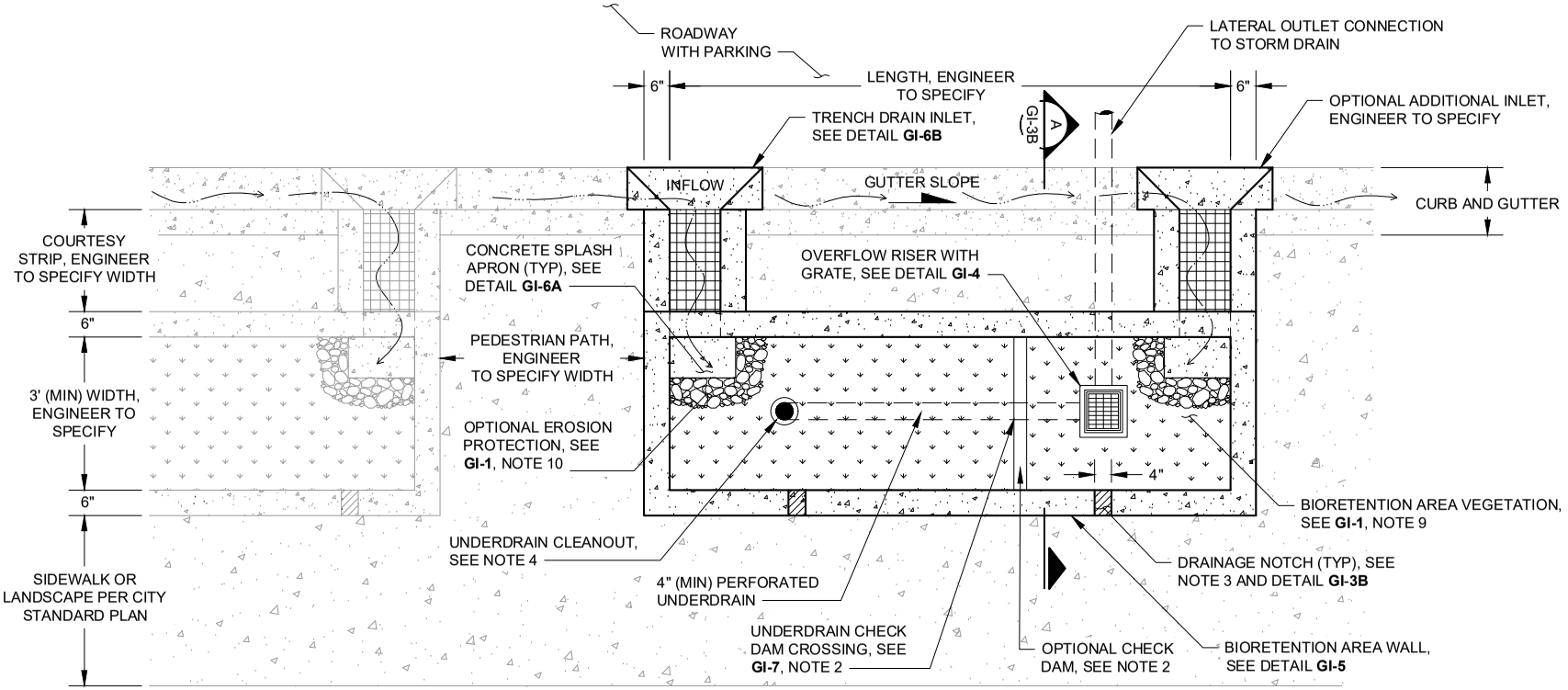
DRAWN BY: K. K.

CHECKED BY: A. R.

APPROVED:

PUBLIC WORKS DIRECTOR

GI-1



NOTES:

1. REFER TO **GI-1** NOTES FOR GUIDELINES AND CHECKLIST.
2. CHECK DAMS SHALL BE SPACED TO PROVIDE PONDING PER SITE SPECIFIC DESIGN (SEE DETAIL **GI-7**).
3. LAY OUT DRAINAGE NOTCHES AS APPLICABLE TO PREVENT PONDING BEHIND BIORETENTION AREA WALL WITH 5' MAXIMUM SPACING BETWEEN NOTCHES.
4. PROVIDE ONE UNDERDRAIN CLEANOUT PER BIORETENTION AREA (MIN). CLEANOUT REQUIRED AT UPSTREAM END AND PIPE ANGLE POINTS EXCEEDING 45 DEGREES. LONGITUDINAL SLOPE OF PIPE SHALL BE 0.5% (MIN).

BIORETENTION AREA: PLAN VIEW WITH STREET PARKING

GREEN INFRASTRUCTURE
TYPICAL DETAILS

CITY OF DUBLIN PUBLIC WORKS

SCALE: NOT TO SCALE

DATE: MAY 11, 2018

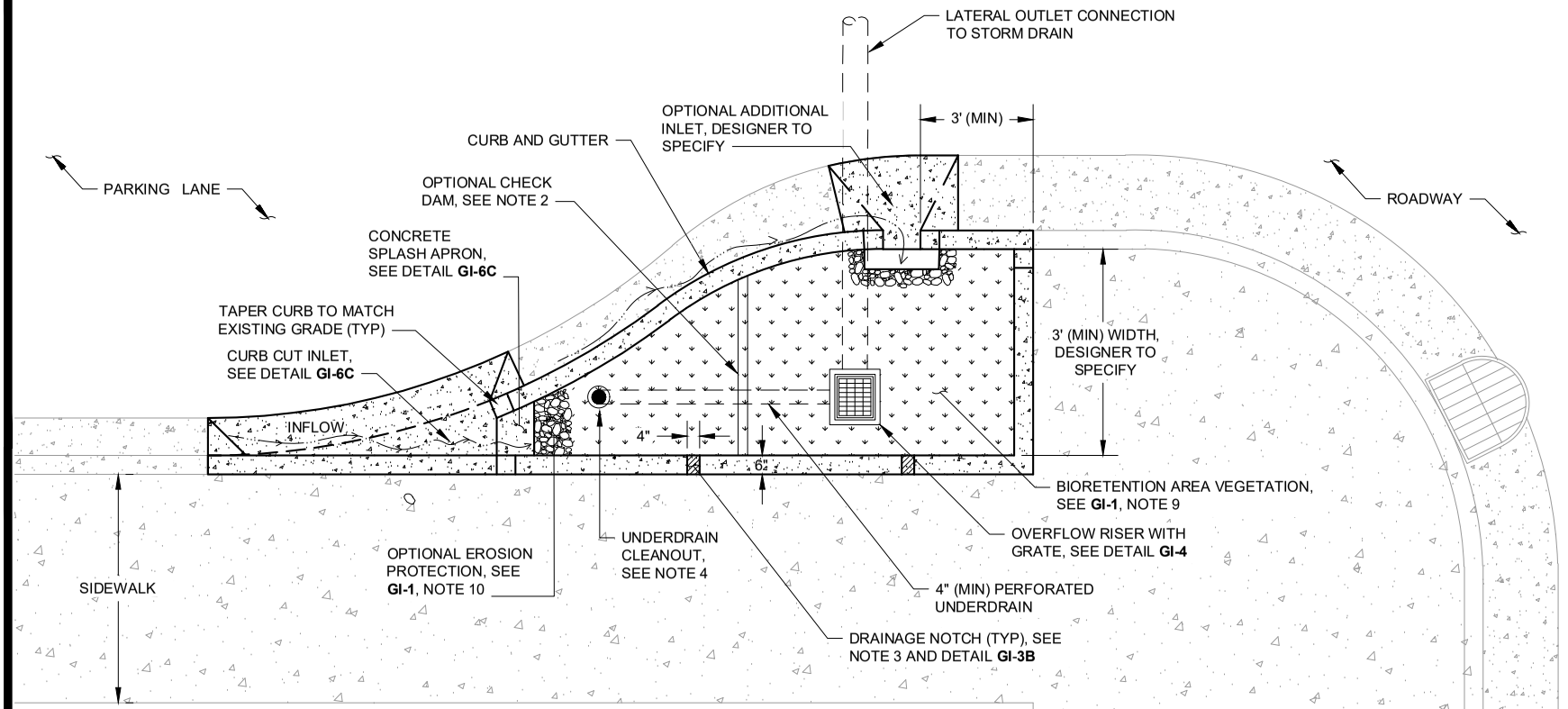
DRAWN BY: K. K.

CHECKED BY: A. R.

APPROVED:

PUBLIC WORKS DIRECTOR

GI-2A



NOTES:

1. REFER TO **GI-1** NOTES FOR GUIDELINES AND CHECKLIST.
2. CHECK DAMS SHALL BE SPACED TO PROVIDE PONDING PER SITE SPECIFIC DESIGN (SEE DETAIL **GI-7**).
3. LAY OUT DRAINAGE NOTCHES TO PREVENT PONDING BEHIND BIORETENTION AREA WALL WITH 5' MAXIMUM SPACING BETWEEN NOTCHES.
4. PROVIDE ONE UNDERDRAIN CLEANOUT PER BIORETENTION AREA (MIN). CLEANOUT REQUIRED AT UPSTREAM END AND PIPE ANGLE POINTS EXCEEDING 45 DEGREES. LONGITUDINAL SLOPE OF PIPE SHALL BE 0.5% (MIN).

BIORETENTION AREA: BULBOUT PLAN VIEW

GREEN INFRASTRUCTURE TYPICAL DETAILS

CITY OF DUBLIN PUBLIC WORKS

SCALE: NOT TO SCALE

DATE: MAY 11, 2018

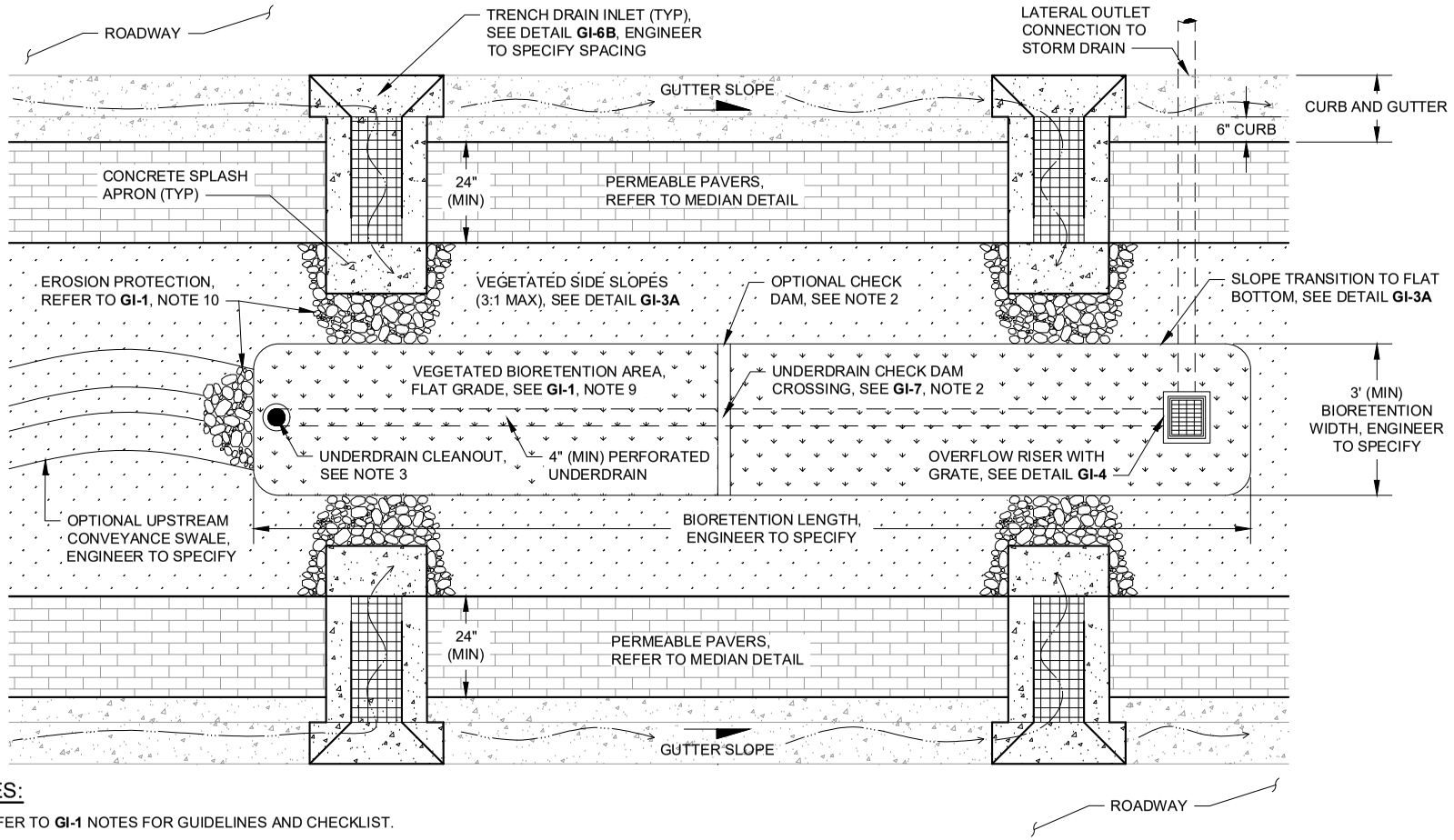
DRAWN BY: K. K.

CHECKED BY: A. R.

APPROVED:

PUBLIC WORKS DIRECTOR

GI-2B



NOTES:

1. REFER TO **GI-1** NOTES FOR GUIDELINES AND CHECKLIST.
2. CHECK DAMS SHALL BE SPACED TO PROVIDE PONDING PER SITE SPECIFIC DESIGN (SEE DETAIL **GI-7**).
3. PROVIDE ONE UNDERDRAIN CLEANOUT PER BIORETENTION AREA (MIN). CLEANOUT REQUIRED AT UPSTREAM END AND PIPE ANGLE POINTS EXCEEDING 45 DEGREES. LONGITUDINAL SLOPE OF PIPE SHALL BE 0.5% (MIN).
4. DESIGNERS TO REFERENCE AASHTO ROADSIDE SAFETY DESIGN REQUIREMENTS AND CONSIDER USE OF MEDIAN BIORETENTION AREAS IN RELATION TO STREET CLASSIFICATION AND STREET SPEEDS.
5. A STORAGE VOLUME SAFETY FACTOR OF 1.5 SHALL BE INCLUDED IN THE DESIGN OF MEDIAN BIORETENTION AREAS TO PREVENT FLOODING.
6. SLOPED SIDES (**GI-3A**) DEPICTED IN PLAN VIEW ABOVE, REFER TO **GI-3B** IF VERTICAL SIDE WALLS ARE USED.

BIORETENTION AREA: STREET MEDIAN

GREEN INFRASTRUCTURE TYPICAL DETAILS

CITY OF DUBLIN PUBLIC WORKS

SCALE: NOT TO SCALE

DATE: MAY 11, 2018

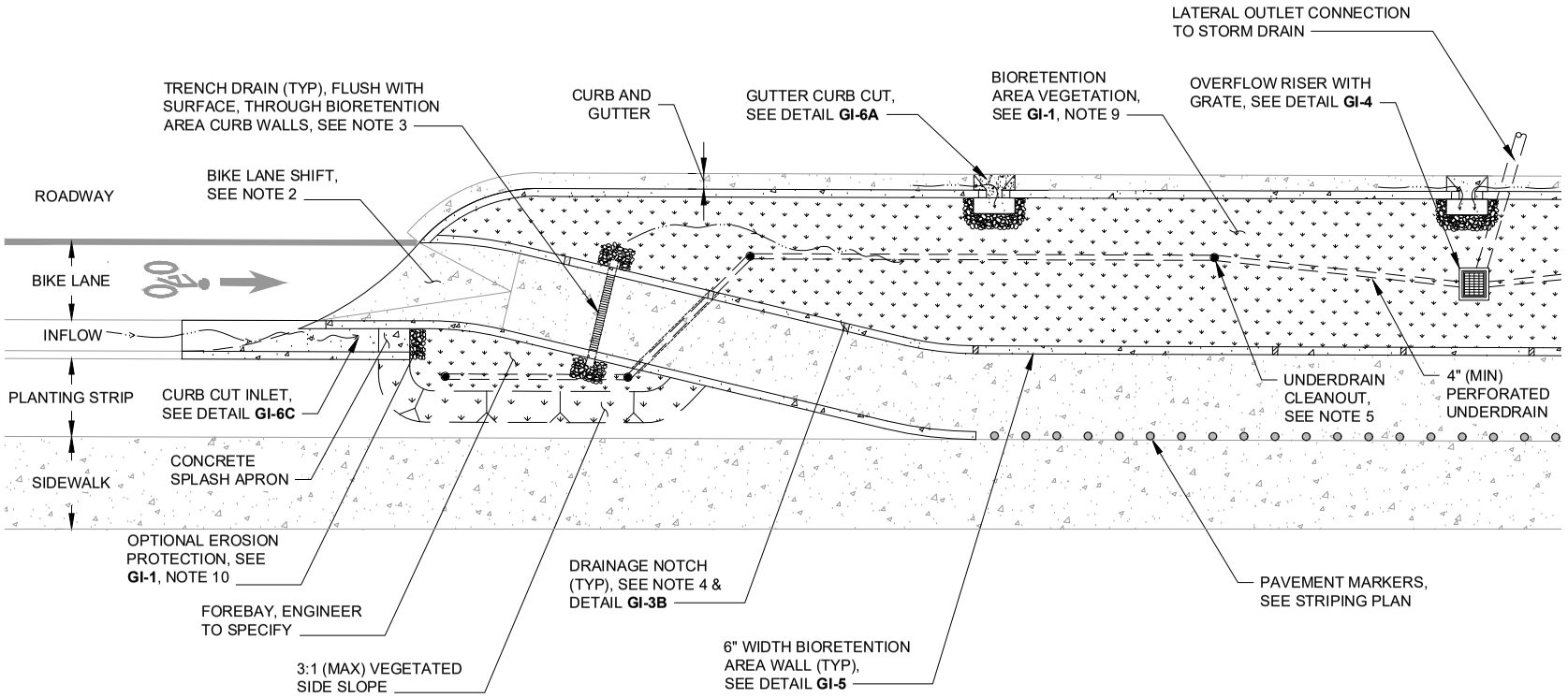
DRAWN BY: K. K.

CHECKED BY: A. R.

APPROVED:

PUBLIC WORKS DIRECTOR

GI-2C



NOTES:

1. REFER TO **GI-1** NOTES FOR GUIDELINES AND CHECKLIST.
2. RAMP BIKE LANE UP ONTO BULBOUT AND SHIFT LANE OVER. MAXIMUM 1:5 HORIZONTAL TRANSITION RATE. TRANSITION GEOMETRY SHALL CONFORM TO CITY OF DUBLIN STANDARDS.
3. HYDRAULIC CONNECTION OF SEPARATED BIORETENTION AREAS PROVIDED BY TRENCH DRAINS. ENGINEER TO SPECIFY, FOLLOWING FLOW AND STRUCTURAL REQUIREMENTS.
4. LAY OUT DRAINAGE NOTCHES AS APPLICABLE TO PREVENT PONDING BEHIND BIORETENTION AREA WALL WITH 5' MAXIMUM SPACING BETWEEN NOTCHES.
5. PROVIDE ONE UNDERDRAIN CLEANOUT PER BIORETENTION AREA (MIN). CLEANOUT REQUIRED AT UPSTREAM END AND PIPE ANGLE POINTS EXCEEDING 45 DEGREES. LONGITUDINAL SLOPE OF PIPE SHALL BE 0.5% (MIN). PIPE SLEEVES REQUIRED FOR UNDERDRAINS TRANSITIONING BETWEEN BIORETENTION AREAS.
6. DRAWING GI-XX MODIFIED FROM THE BASMAA URBAN GREENING BAY AREA TYPICAL GI DETAILS FIGURE C-1.4.

BIORETENTION AREA: WITH BIKE LANE PLAN VIEW

GREEN INFRASTRUCTURE TYPICAL DETAILS

CITY OF DUBLIN PUBLIC WORKS

SCALE: NOT TO SCALE

DATE: MAY 11, 2018

DRAWN BY: K. K.

CHECKED BY: A. R.

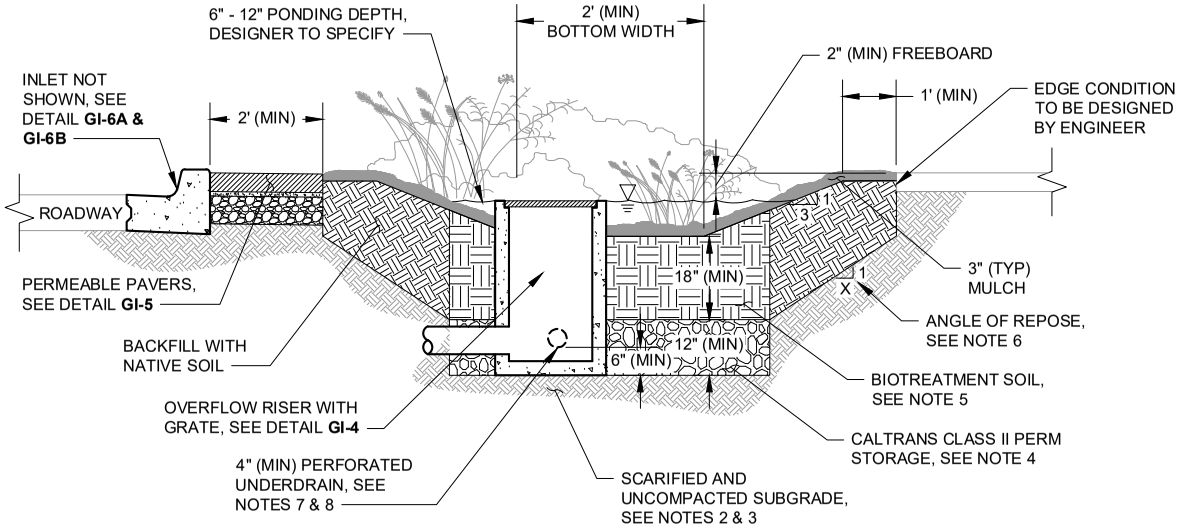
APPROVED:

PUBLIC WORKS DIRECTOR

GI-XX

NOTES:

1. REFER TO **GI-1** NOTES FOR GUIDELINES AND CHECKLIST.
2. AVOID UNNECESSARY COMPACTION OF EXISTING SUBGRADE BELOW AREA.
3. SCARIFY SUBGRADE TO A DEPTH OF 3" (MIN) IMMEDIATELY PRIOR TO PLACEMENT OF CALTRANS CLASS 2 PERMEABLE MATERIAL STORAGE LAYER AND BIOTREATMENT SOIL MATERIALS.
4. AGGREGATE STORAGE LAYER COMPRISED OF 12" MIN CALTRANS CLASS 2 PERMEABLE MATERIAL.
5. REFER TO C.3 TECHNICAL GUIDANCE MANUAL (ACCWP) FOR BIOTREATMENT SOIL MIX SPECIFICATIONS. INSTALL BIOTREATMENT SOIL AT 85% COMPACTION FOLLOWING BASMAA INSTALLATION GUIDANCE.
6. ANGLE OF REPOSE VARIES PER GEOTECHNICAL ENGINEER RECOMMENDATIONS.
7. UNDERDRAIN AND CLEAN OUT PIPE (1 MIN PER FACILITY) REQUIRED, REFER TO C.3 TECHNICAL GUIDANCE MANUAL (ACCWP) FOR DESIGN CONSIDERATIONS. UNDERDRAINS SHOULD BE ELEVATED 6" (MIN) WITHIN THE CALTRANS CLASS 2 PERMEABLE MATERIAL STORAGE LAYER TO PROMOTE INFILTRATION. IN FACILITIES WITH AN IMPERMEABLE LINER, THE UNDERDRAIN SHOULD BE PLACED AT THE BOTTOM OF THE CALTRANS CLASS 2 PERMEABLE MATERIAL STORAGE LAYER.
8. THE UNDERDRAIN IN ALL FACILITIES LOCATED IN THE PUBLIC RIGHT-OF-WAY SHALL BE VIDEO RECORDED AND PROVIDED TO THE CITY FOR REVIEW PRIOR TO PROJECT ACCEPTANCE.



BIORETENTION AREA: SLOPED SIDES CROSS SECTION

GREEN INFRASTRUCTURE TYPICAL DETAILS

CITY OF DUBLIN PUBLIC WORKS

SCALE: NOT TO SCALE

DATE: MAY 11, 2018

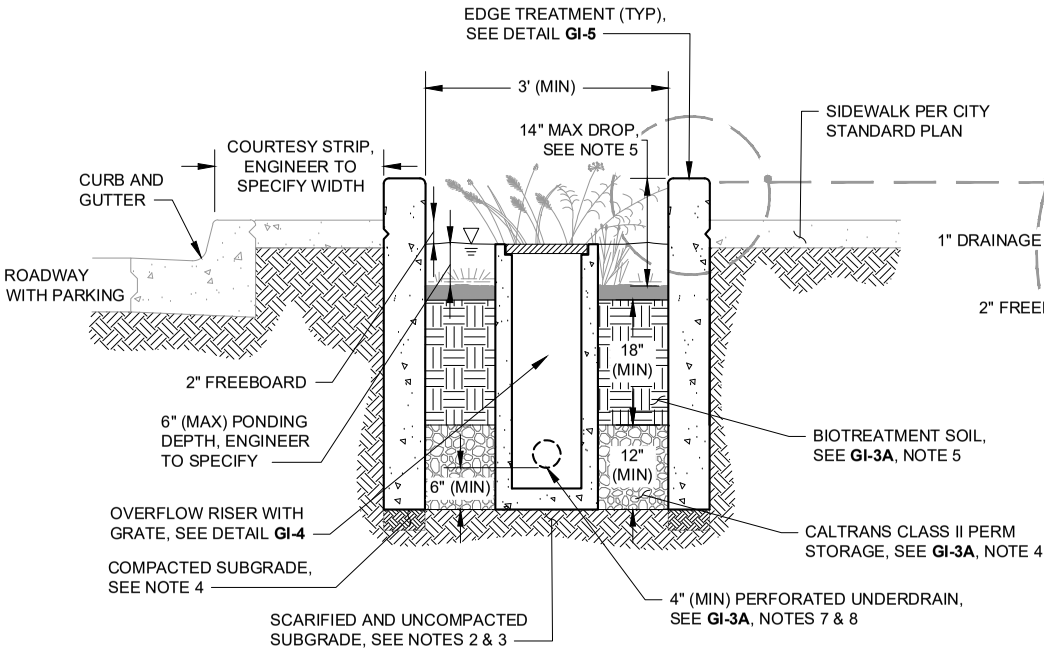
DRAWN BY: K. K.

CHECKED BY: A. R.

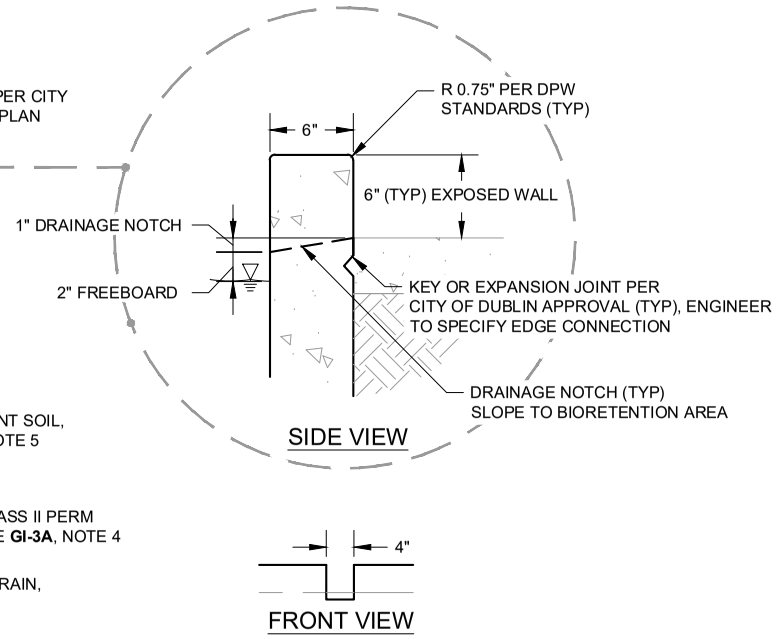
APPROVED:

PUBLIC WORKS DIRECTOR

GI-3A



BIORETENTION AREA WITH VERTICAL SIDE WALLS (A)



DRAINAGE NOTCH DETAIL

NOTES:

1. REFER TO **GI-1** NOTES FOR GUIDELINES AND CHECKLIST.
2. AVOID UNNECESSARY COMPACTION OF EXISTING SUBGRADE BELOW BIORETENTION AREA.
3. SCARIFY SUBGRADE TO A DEPTH OF 3" (MIN) IMMEDIATELY PRIOR TO PLACEMENT OF AGGREGATE STORAGE AND BIOTREATMENT SOIL MATERIAL.
4. FOR STRUCTURAL SUPPORT, SUBGRADE UNDER WALLS ONLY COMPACTED PER ENGINEER SPECIFICATIONS.
5. MAXIMUM DROP FROM TOP OF CURB TO TOP OF BIOTREATMENT SOIL SHALL INCLUDE CONSIDERATIONS FOR BIOTREATMENT SOIL SETTLEMENT. THE DROP IS THE SUM OF PONDING DEPTH (6" TYP), FREEBOARD (2" TYP), AND CURB HEIGHT (6" TYP).

BIORETENTION AREA: VERTICAL SIDE WALL CROSS SECTION

GREEN INFRASTRUCTURE TYPICAL DETAILS

CITY OF DUBLIN PUBLIC WORKS

SCALE: NOT TO SCALE

DATE: MAY 11, 2018

DRAWN BY: K. K.

CHECKED BY: A. R.

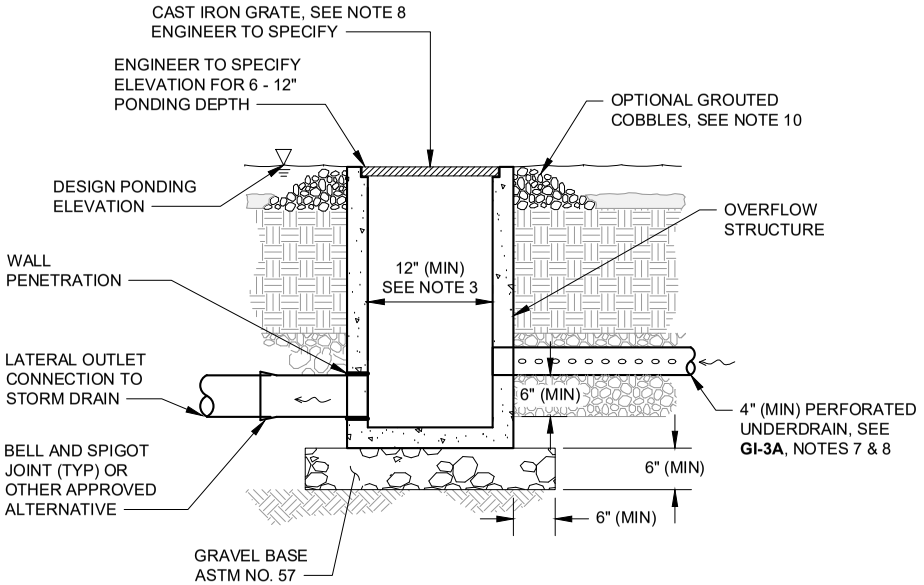
APPROVED:

PUBLIC WORKS DIRECTOR

GI-3B

NOTES:

1. REFER TO **GI-1** NOTES FOR GUIDELINES AND CHECKLIST.
2. ALL MATERIAL AND WORKMANSHIP FOR OVERFLOW STRUCTURES SHALL CONFORM TO CITY OF DUBLIN STANDARDS.
3. DESIGN OVERFLOW WEIR AND OUTLET PIPE TO CONVEY 10-YR, 24-HR STORM FLOW OR DESIGN INLET TO DIVERT FLOWS LARGER THAN THE DESIGN STORM DIRECTLY TO THE STORM DRAIN. LOCATE ALL OVERFLOW PIPES AT AN ELEVATION HIGHER THAN THE STORM SEWER HYDRAULIC GRADE LINE TO PREVENT BACKFLOW INTO THE BIORETENTION FACILITY.
4. STORM DRAIN OUTLET PIPES SHALL BE SIZED TO MEET HYDRAULIC REQUIREMENTS WITH APPROPRIATE COVER DEPTH AND PIPE MATERIAL.
5. PERFORATED UNDERDRAINS WITH CLEANOUT PIPES ARE REQUIRED.
6. MAINTENANCE ACCESS IS REQUIRED FOR ALL OUTLET STRUCTURES AND CLEANOUT FACILITIES. 12" (MIN) CLEARANCE WITHIN OVERFLOW STRUCTURE SHALL BE PROVIDED FOR MAINTENANCE ACCESS.
7. ENGINEER SHALL EVALUATE BUOYANCY OF STRUCTURES FOR SITE SPECIFIC APPLICATION AND SPECIFY THICKENED OR EXTENDED BASE / ANTI-FLOTATION COLLAR, AS NECESSARY.
8. SIZE OF GRATE SHALL MATCH SIZE OF RISER SPECIFIED IN PLANS, SHALL BE REMOVABLE TO PROVIDE MAINTENANCE ACCESS, AND SHALL BE BOLTED IN PLACE OR OUTFITTED WITH APPROVED TAMPER-RESISTANT LOCKING MECHANISM. MAXIMUM GRATE OPENING SHALL BE 2".
9. IF INTERIOR DEPTH OF OVERFLOW STRUCTURE EXCEEDS 5', A PERMANENT BOLTED LADDER AND MINIMUM CLEAR SPACE OF 30" BY 30" SHALL BE PROVIDED FOR MAINTENANCE ACCESS.
10. MINIMUM DIAMETER OF OPTIONAL GROUTED COBBLES SHALL BE LARGER THAN MAXIMUM GRATE OPENING.
11. GROUT ALL PENETRATIONS, CRACKS, SEAMS, AND JOINTS WITH CLASS "C" MORTAR.



BIORETENTION COMPONENTS: OUTLET DETAIL

GREEN INFRASTRUCTURE TYPICAL DETAILS

CITY OF DUBLIN PUBLIC WORKS

SCALE: NOT TO SCALE

DATE: MAY 11, 2018

DRAWN BY: K. K.

CHECKED BY: A. R.

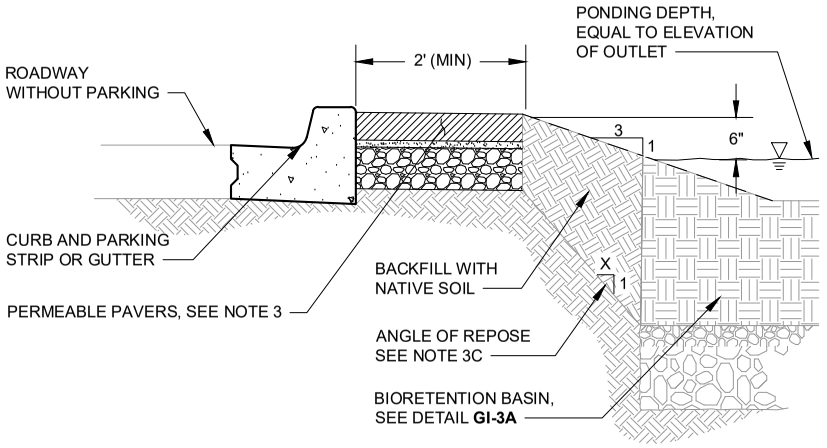
APPROVED:

PUBLIC WORKS DIRECTOR

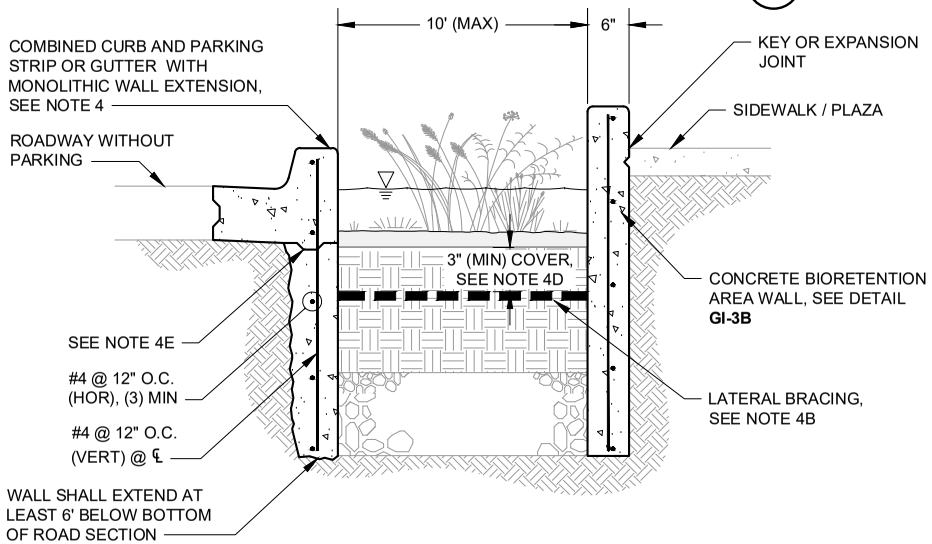
GI-4

NOTES:

1. REFER TO **GI-1** NOTES FOR GUIDELINES AND CHECKLIST.
2. THE ENGINEER SHALL ADAPT EDGE TREATMENT DESIGN TO ADDRESS SITE SPECIFIC CONSTRAINTS TO EFFECTIVELY STABILIZE ADJACENT PAVEMENT AND MINIMIZE LATERAL MOVEMENT OF WATER.
3. STANDARD CURB EDGE (WHEN SPACE AVAILABLE):
   A. PERMEABLE PAVER STRIP (2' MIN WIDTH) REQUIRED IF SPRAY IRRIGATION IS USED TO COMPLY WITH WATER EFFICIENT LANDSCAPE ORDINANCE..
   B. REFER TO CITY OF DUBLIN MEDIAN DETAIL (TBD) FOR PERMEABLE STRIP AND UNDERLYING AGGREGATE SPECIFICATIONS.
   C. ANGLE OF REPOSE VARIES PER GEOTECHNICAL ENGINEERS RECOMMENDATIONS.
4. VERTICAL SIDE WALLS (WHEN SPACE LIMITED):
   A. ALL BIORETENTION AREA WALLS SHALL EXTEND TO BOTTOM OF AGGREGATE STORAGE LAYER OR DEEPER. MINIMUM DEPTHS SHALL BE DESIGNED TO PREVENT LATERAL SEEPAGE INTO THE ADJACENT PAVEMENT SECTION.
   B. FOOTING OR LATERAL BRACING SHALL SHALL BE DESIGNED BY THE ENGINEER TO WITHSTAND ANTICIPATED LOADING ASSUMING NO REACTIVE FORCES FROM THE UNCOMPACTED BIOTREATMENT SOIL.
   C. BIORETENTION AREA WALLS EXTENDING MORE THAN 36" BELOW ADJACENT LOAD-BEARING SURFACE, OR WHEN LOCATED ADJACENT TO PAVERS, SHALL HAVE FOOTING OR LATERAL BRACING. FOOTING OR LATERAL BRACING MAY BE EXCLUDED ONLY IF THE ENGINEER DEMONSTRATES THAT THE PROPOSED WALL DESIGN MEETS LOADING REQUIREMENTS. WALL SHALL NOT ENCROACH INTO TREATMENT AREA.
   D. CONTRACTOR TO PROVIDE 3" MINIMUM COVER OVER ALL LATERAL BRACING FOR PLANT ESTABLISHMENT.
   E. ALL CONSTRUCTION COLD JOINTS SHALL INCORPORATE EPOXY, DOWEL/TIE BAR, KEYWAY, OR WATER STOP.



STANDARD CURB EDGE AT BIORETENTION BASIN (1)



EXTENDED BIORETENTION AREA WALL WITH LATERAL BRACING (2)

BIORETENTION COMPONENTS: EDGE TREATMENT DETAIL

GREEN INFRASTRUCTURE TYPICAL DETAILS

CITY OF DUBLIN PUBLIC WORKS

SCALE: NOT TO SCALE

DATE: MAY 11, 2018

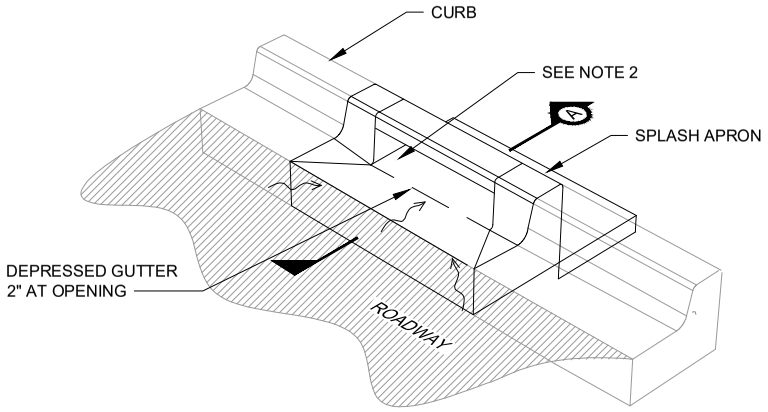
DRAWN BY: K. K.

CHECKED BY: A. R.

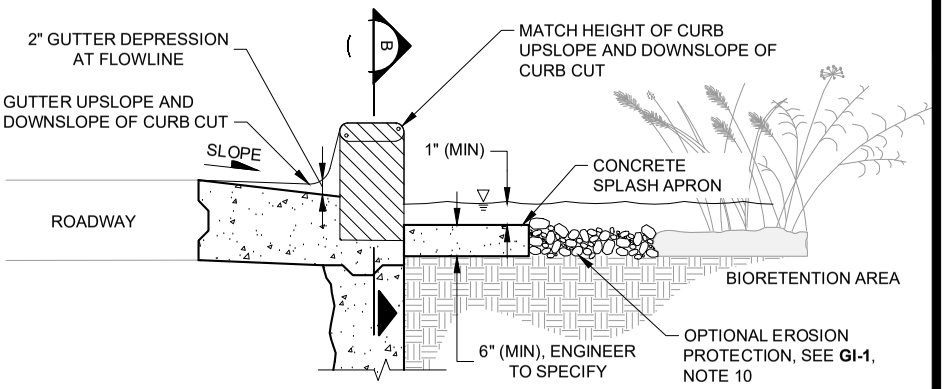
APPROVED:

PUBLIC WORKS DIRECTOR

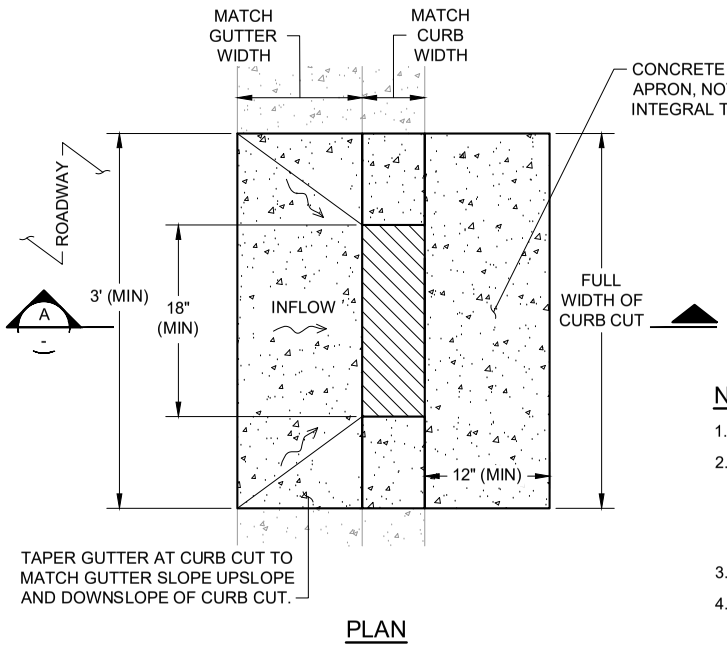
GI-5



ISOMETRIC

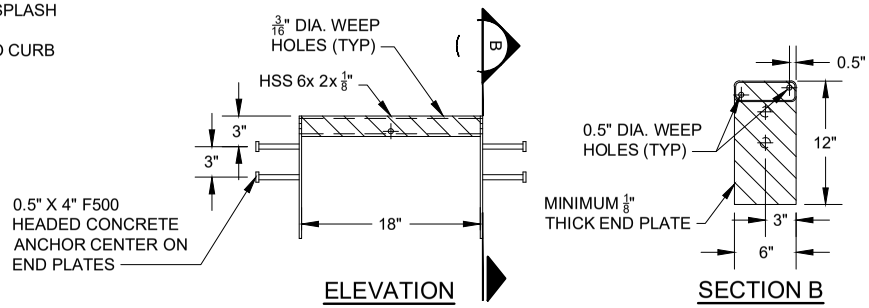


SECTION A



PLAN

METAL INLET ASSEMBLY



ELEVATION

SECTION B

NOTES:

1. REFER TO **GI-1** NOTES FOR GUIDELINES AND CHECKLIST.
2. CURB CUT INLETS SHALL BE ADEQUATELY SIZED, SPACED, AND SLOPED TO MEET HYDRAULIC REQUIREMENTS. THE CURB CUT OPENING WIDTH SHALL BE SIZED BASED ON THE CATCHMENT AREA, LONGITUDINAL SLOPE ALONG THE CURB, AND THE CROSS SLOPE OF THE GUTTER OR ADJACENT PAVEMENT AT THE INLET. SEE SIZING EQUATIONS AND NOMOGRAPHS FOR CURB OPENING INLETS IN THE U.S. DEPARTMENT OF TRANSPORTATION HYDRAULIC ENGINEERING CIRCULAR NO. 27.
3. BOND NEW CURB AND GUTTER TO EXISTING CURB AND GUTTER WITH EPOXY AND DOWEL CONNECTION.
4. METAL INLET ASSEMBLY SHALL BE HOT-DIP GAVANIZED IN ACCORDANCE WITH ASTM A-123.

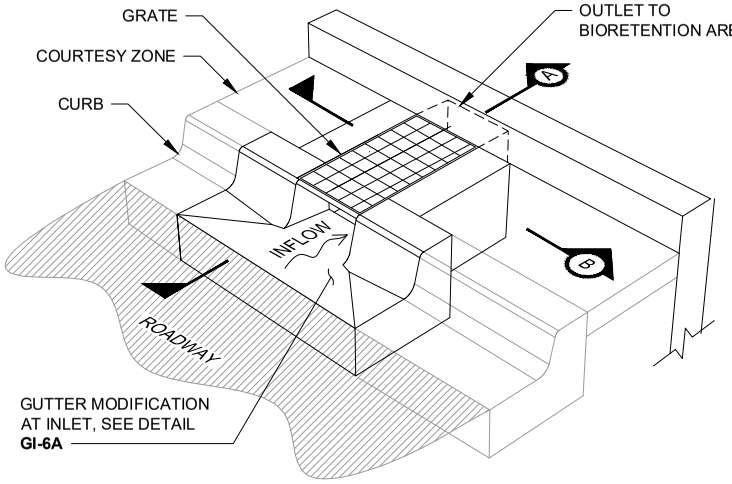
BIORETENTION COMPONENTS: GUTTER CURB CUT INLET DETAIL

GREEN INFRASTRUCTURE TYPICAL DETAILS CITY OF DUBLIN PUBLIC WORKS	SCALE: NOT TO SCALE DATE: MAY 11, 2018 DRAWN BY: K. K. CHECKED BY: A. R.	APPROVED: PUBLIC WORKS DIRECTOR

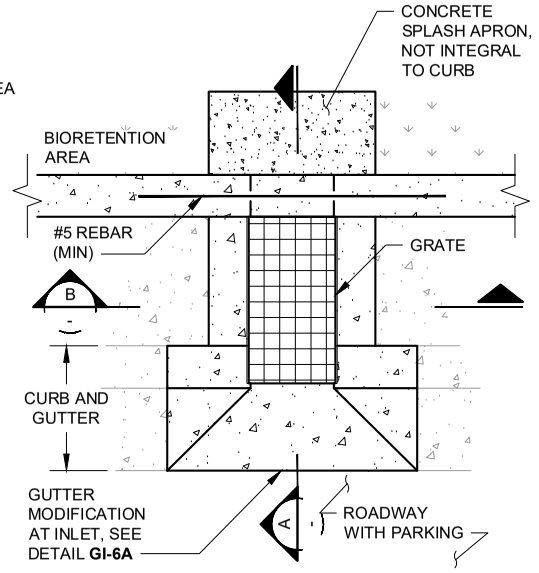
GI-6A

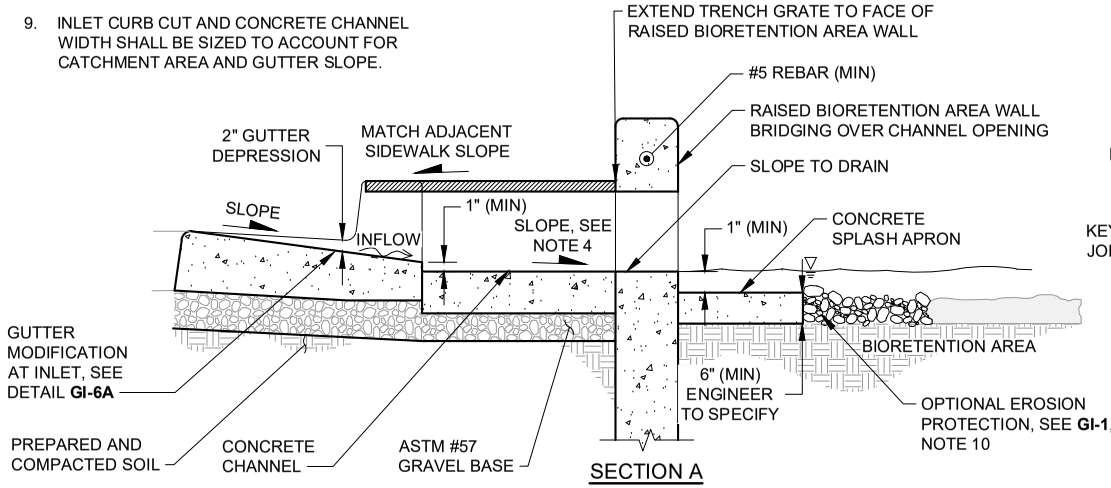
NOTES:

1. REFER TO **GI-1** NOTES FOR GUIDELINES AND CHECKLIST.
2. ALL MATERIAL AND WORKMANSHIP FOR TRENCH DRAIN ASSEMBLY SHALL CONFORM TO CITY OF DUBLIN STANDARDS.
3. TRENCH DRAIN INLETS SHALL BE ADEQUATELY SIZED, SPACED, AND SLOPED TO MEET HYDRAULIC REQUIREMENTS. SEE NOTE 2 DETAIL **GI-6A** FOR REFERENCE.
4. SLOPE TO PROVIDE AT LEAST 1" DROP OVER LENGTH OF CHANNEL OR A MINIMUM OF 2%, WHICHEVER IS LARGER.
5. ALL TRENCH GRATES SHALL BE REMOVABLE, RATED PER THE ANTICIPATED LOADING, AND BOLTED IN PLACE OR OUTFITTED WITH APPROVED TAMPER-RESISTANT LOCKING MECHANISM, FLUSH OR RECESSED IN GRATE.
6. BOND NEW CURB AND GUTTER TO EXISTING CURB AND GUTTER WITH EPOXY AND DOWEL CONNECTION.
7. HORIZONTAL CONTROL JOINTS SHALL BE PROVIDED EVERY 10' (LINEAR), OR PER MANUFACTURER'S RECOMMENDATIONS.
8. APPLY EPOXY BONDING AGENT AT ALL TRENCH DRAIN CONSTRUCTION COLD JOINTS.
9. INLET CURB CUT AND CONCRETE CHANNEL WIDTH SHALL BE SIZED TO ACCOUNT FOR CATCHMENT AREA AND GUTTER SLOPE.

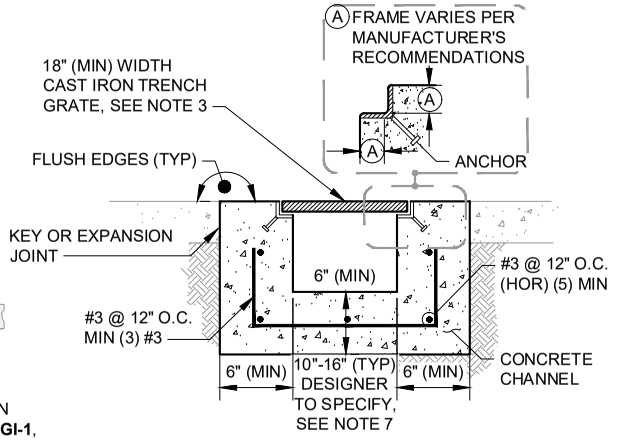


ISOMETRIC





SECTION A



SECTION B

BIORETENTION COMPONENTS: TRENCH DRAIN CURB CUT INLET DETAIL

GREEN INFRASTRUCTURE TYPICAL DETAILS

CITY OF DUBLIN PUBLIC WORKS

SCALE: NOT TO SCALE

DATE: MAY 11, 2018

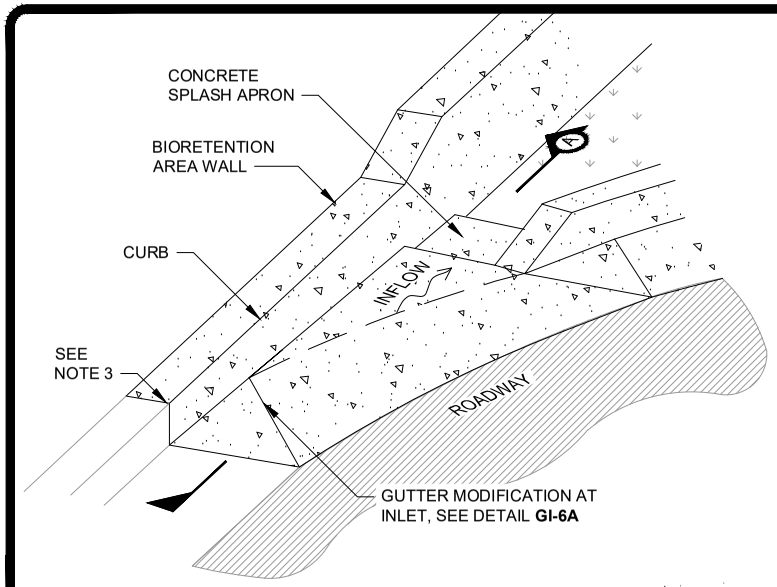
DRAWN BY: K. K.

CHECKED BY: A. R.

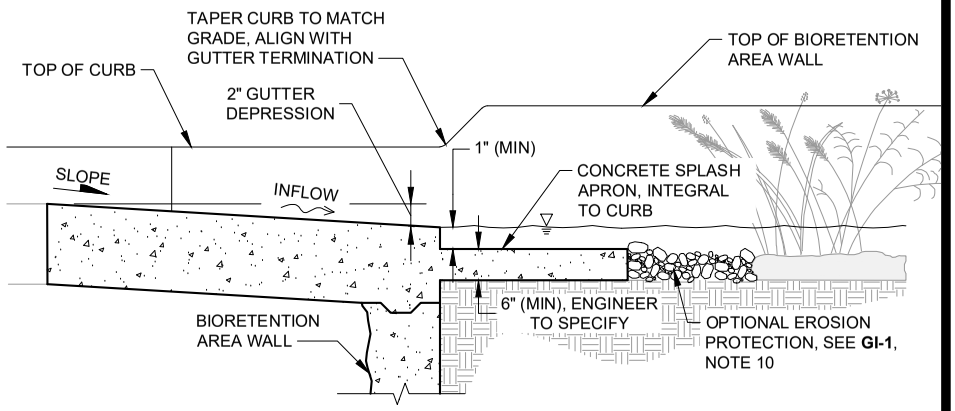
APPROVED:

PUBLIC WORKS DIRECTOR

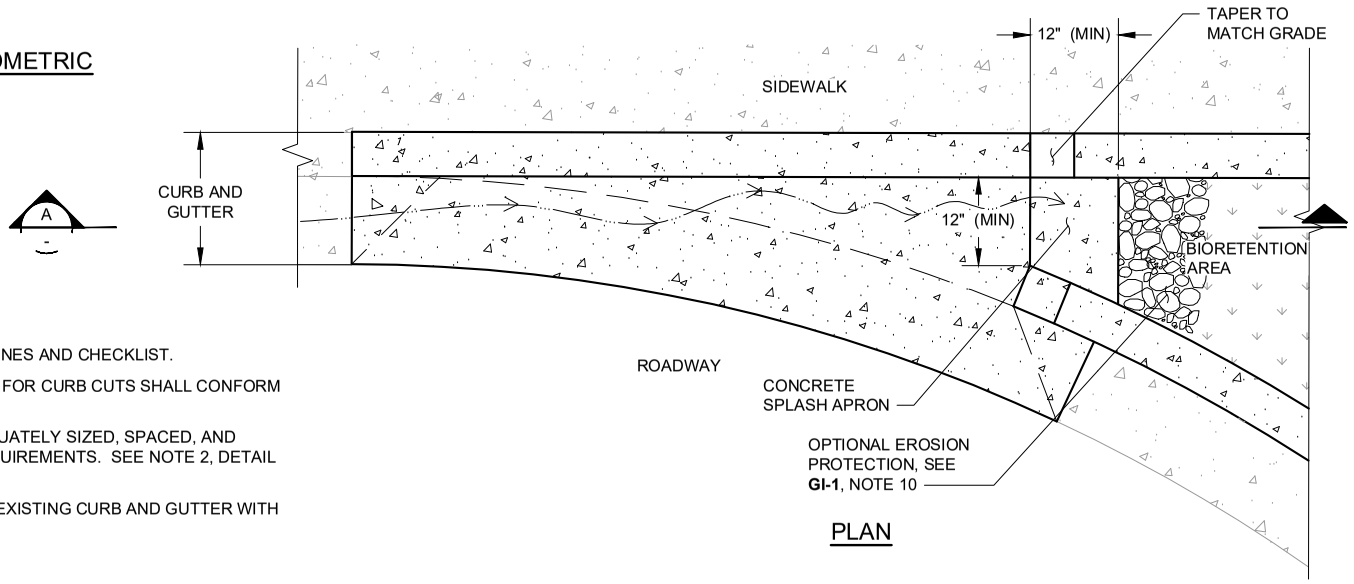
GI-6B



ISOMETRIC



SECTION A



PLAN

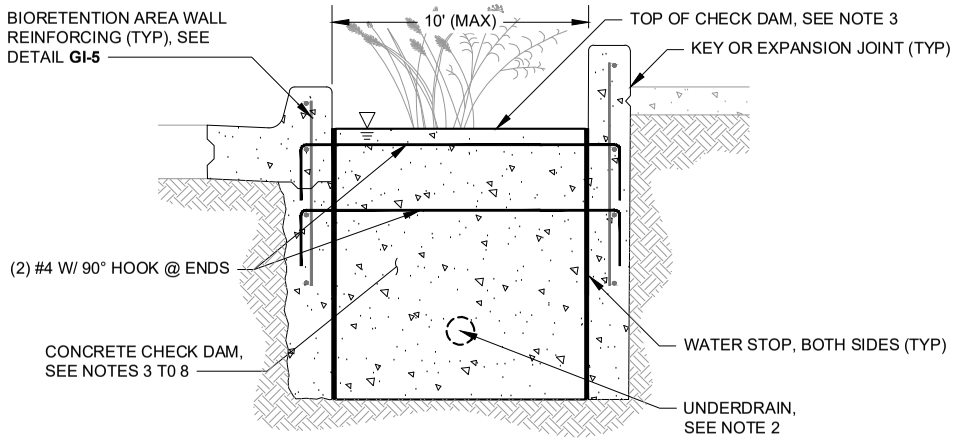
NOTES:

1. REFER TO **GI-1** NOTES FOR GUIDELINES AND CHECKLIST.
2. ALL MATERIAL AND WORKMANSHIP FOR CURB CUTS SHALL CONFORM TO CITY OF DUBLIN STANDARDS.
3. CURB CUT INLETS SHALL BE ADEQUATELY SIZED, SPACED, AND SLOPED TO MEET HYDRAULIC REQUIREMENTS. SEE NOTE 2, DETAIL **GI-6A** FOR REFERENCE.
4. BOND NEW CURB AND GUTTER TO EXISTING CURB AND GUTTER WITH EPOXY AND DOWEL CONNECTION.

BIORETENTION COMPONENTS: CURB CUT AT BULBOUT INLET DETAIL

GREEN INFRASTRUCTURE TYPICAL DETAILS CITY OF DUBLIN PUBLIC WORKS	SCALE: NOT TO SCALE DATE: MAY 11, 2018 DRAWN BY: K. K. CHECKED BY: A. R.	APPROVED: PUBLIC WORKS DIRECTOR

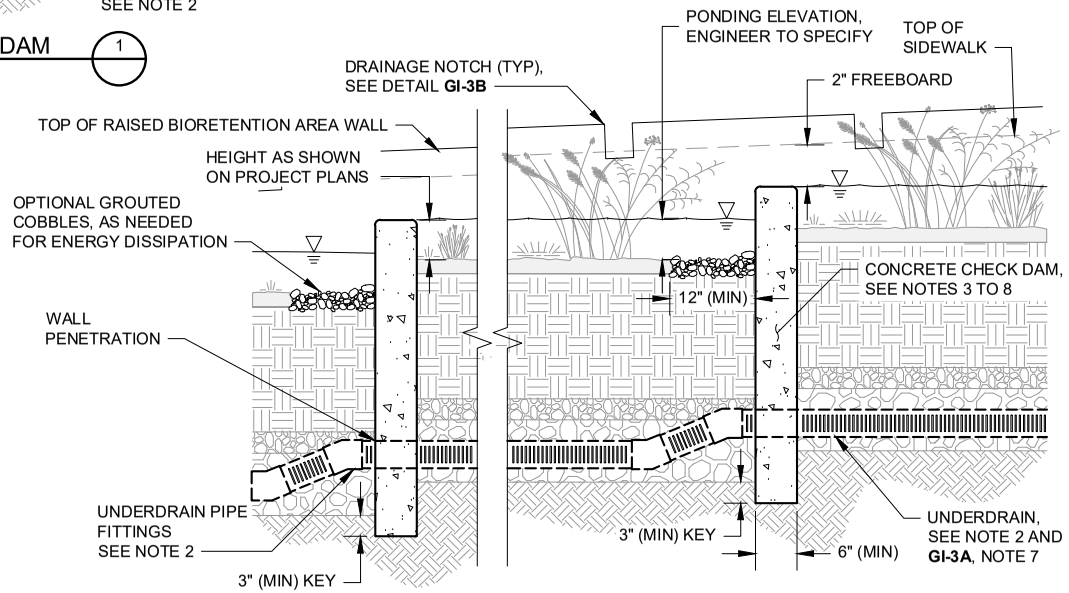
GI-6C



SECTION - CONCRETE CHECK DAM 1

NOTES:

1. REFER TO **GI-1** NOTES FOR GUIDELINES AND CHECKLIST.
2. UNDERDRAIN TO PASS THROUGH CHECK DAM IN NON-PERFORATED HDPE SDR 17 PIPE. PIPE FITTINGS SHALL BE USED TO ACCOMMODATE CHANGES IN GRADE, AS NEEDED.
3. HEIGHT AND SPACING OF CHECK DAMS SHALL BE ESTABLISHED BASED ON THE PONDING DEPTH REQUIRED TO MEET PROJECT HYDROLOGIC PERFORMANCE GOALS AND THE MAXIMUM DESIRED DROP FROM THE SURROUNDING GRADE TO THE FACILITY BOTTOM.
4. ALL MATERIAL AND WORKMANSHIP FOR CHECK DAM ASSEMBLY SHALL CONFORM TO CITY OF DUBLIN STANDARD SPECIFICATIONS.
5. CONCRETE CHECK DAM SHALL BE CONTINUOUS (NO JOINTS) AND REINFORCED WITH #4 BAR, PLACED AT 18" ON CENTER, EACH WAY.
6. CONCRETE CHECK DAM SHALL MEET STRUCTURAL REQUIREMENTS FOR LATERAL BRACING WHEN USED AS LATERAL BRACING. COORDINATE WITH ENGINEER.
7. TOP OF CHECK DAM TO BE LEVEL WITH CREST ELEVATION MATCHING PONDING ELEVATION UNLESS NOTCH SIZED TO CONVEY DESIGN FLOWS PROVIDED.
8. GROUT ALL PENETRATIONS, CRACKS, SEAMS, AND JOINTS WITH CLASS "C" MORTAR.



PROFILE - CONCRETE CHECK DAM 2

BIORETENTION COMPONENTS: CHECK DAM DETAIL

GREEN INFRASTRUCTURE TYPICAL DETAILS

CITY OF DUBLIN PUBLIC WORKS

SCALE: NOT TO SCALE

DATE: MAY 11, 2018

DRAWN BY: K. K.

CHECKED BY: A. R.

APPROVED:

PUBLIC WORKS DIRECTOR

GI-7

Appendix G

GENERAL GUIDELINES AND IMPLEMENTATION CHECKLISTS FOR GSI PROJECTS

G-1 Hydraulic Sizing Requirements

Provision C.3.j.i.(2)(g) of the MRP states that GSI projects are required to meet the treatment and hydromodification management (HM) sizing requirements included in Provisions C.3.c and C.3.d of the MRP. However, an exception to this requirement is provided in Provision C.3.j.i.(2)(g) for street projects that are not Regulated Projects under Provision C.3.b ("non-Regulated Projects"). An alternate sizing approach for non-Regulated constrained street projects has been developed by the Bay Area Stormwater Management Agencies Association and the Water Board has provided verbal approval for the approach. The BASMAA alternate sizing approach guidelines will be available on-line when the approach is formally approved by the Water Board. These guidelines are not intended for use by Regulated Projects as defined in Provision C.3.b of the MRP.

Additional design guidance for GSI facilities, which are also referred to as low impact development (LID) stormwater treatment facilities, is provided in Chapters 5 and 6 of the Alameda Countywide Clean Water Program's C.3 Technical Guidance, which may be downloaded at, www.cleanwaterprogram.org.

G-2 Guidelines Addressing Urban Forestry in Public Right of Way

Increasing the planting of street trees is anticipated to benefit local water quality, air quality, energy efficiency, and property values. GSI projects should incorporate measures to preserve existing street trees and promote the planting of new street trees. The following measures should be incorporated, as appropriate:

- Prioritize the preservation of existing mature trees.
- Replace any mature trees that are removed by the project.
- Maximize the planting of new trees.
- The planting of trees within a GSI facility should follow guidance, including the identification of appropriate species, provided in Appendix B of the ACCWP C.3 Technical Guidance.
- Incorporate trees in landscaped areas within parking lots.

G-3 Bay Friendly Landscape Principles

Bay-Friendly landscapes create and maintain healthy, beautiful and vibrant landscapes by:

- Landscaping in harmony with the natural conditions of the San Francisco Bay watershed
- Reducing waste and recycling materials
- Nurturing healthy soils while reducing fertilizer use
- Conserving water, energy and topsoil
- Using integrated pest management to minimize chemical use

- Reducing stormwater runoff and air pollution
- Protecting and enhancing wildlife habitat and diversity

Designing qualified GSI facilities to be a rated Bay Friendly Landscape may enable portions of the facility to be funded with Measure D Funds (the Alameda County Waste Reduction and Recycling Act). Bay Friendly Landscape design, construction and maintenance practices should be considered from project conception. For more information on Bay Friendly Landscape principles, refer to Rescape California at https://rescapeca.org/.

G-4 Guidelines for Coordination of Projects

Installing GSI components at a project prior to the completion of that project, or the construction of an adjacent project, has the potential to degrade the functioning of the GSI facility. Street improvement or other infrastructure projects, the development of public parcels, and other public and private projects should therefore include coordination of construction schedules to minimize impacts to GSI.

The following measures should be implemented in all GSI projects to protect investments in GSI:

1. Do not use GSI facilities as temporary sediment basins during construction.
2. Include protections for GSI in erosion control plans.
3. Protect installed GSI facilities from construction runoff and keep offline until the contributing drainage area is stabilized.
4. Contractors are encouraged to construct GSI facilities at the end of a project, to help protect the facilities from construction-related impacts.

G-5 Stormwater Management Plan Content

This document was created to inform Staff and project proponents about required content for stormwater management plans that apply to GSI projects. It includes requirements for both the entitlement stage and building permit/improvement plan stage.

G-6 Public Works Improvement Plans General Notes

The Public Works improvement plan general notes include notes that apply during design, construction, project sign-off, and at post-construction.

G-7 Stormwater Review Checklist

This document was created to assist Staff during plan review. Staff use the tip sheet as a reminder for items to check while conducting stormwater plan review.

G-8 Landscape Plan Checklist

The City created this checklist to guide Staff through the Water Efficient Landscape Ordinance plan review. Steps for checking conformance with GSI plans are included in the checklist.

G-9 Inspector Final Inspection Checklist

Dublin developed the Inspector Final Inspection Checklist to ensure that inspectors verify all components of a project prior to final project acceptance, including checking for critical GSI information.

G-10 C.3 Operations & Maintenance Inspection Form

Staff use the C.3 Operations & Maintenance (O&M) Inspection Form developed by the ACCWP for the initial project inspection conducted at project close-out and during regular O&M inspections. As described in Section 4.3, Staff also conduct inspections of GSI facilities during critical points of construction.

G-11 Worksheet for Identifying Green Infrastructure Potential in Municipal Capital Improvement Program Projects

Staff is using this worksheet developed by ACCWP, which was based on the guidance developed by the Bay Area Municipal Management Agencies Association, to help identify for which capital improvement projects it is feasible to include green stormwater infrastructure. The feasibility is initially conducted to determine if there are technical constraints that would limit the inclusion of GSI; a funding analysis is conducted after feasibility is determined.

Appendix H

FUNDING AND FINANCING STRATEGY DOCUMENTS

Prepared for

City of Dublin
100 Civic Plaza
Dublin, California 94568

FINAL
ALTERNATIVE COMPLIANCE HANDBOOK

Prepared by

Geosyntec consultants

engineers | scientists | innovators

1111 Broadway, 6th Floor
Oakland, California 94607

Project Number: WW2298

June 2019

TABLE OF CONTENTS

LIST OF ACRONYMS AND ABBREVIATIONS

BMP	best management practice
DCMR	District of Columbia Municipal Regulations
DOEE	Department of Energy and Environment
FSP	fine sediment particles
GSI	green stormwater infrastructure
LID	low-impact development
LIDI	Low Impact Development Initiative
MRP	Municipal Regional Stormwater Permit
MS4	Municipal Separate Storm Sewer
P3s	Public-Private Partnerships
PDPs	Priority Development/Redevelopment Projects
Region 9	Region 9 Water Quality Control Board
SFPUC	San Francisco Public Utilities Commission
TMDLs	total maximum daily loads
USEPA	United States Environmental Protection Agency

1. ALTERNATIVE COMPLIANCE HANDBOOK OVERVIEW

This *Alternative Compliance Handbook* has been prepared for the City of Dublin (City) to provide information on the requirements and resources needed for initiating an alternative compliance program in accordance with the San Francisco Bay Regional Water Quality Control Board Municipal Regional Stormwater NPDES Permit (MRP; Order No R2-2015-0049). This *Alternative Compliance Handbook* provides background and regulatory information about alternative compliance programs for stormwater, example programs, and recommended next steps for the City for developing an alternative compliance program for stormwater.

This *Alternative Compliance Handbook* is organized as follows:

- Section 2 provides a summary of the requirements included in the MRP;
- Section 3 provides background information on stormwater alternative compliance programs, as well as descriptions of other alternative compliance programs across the country;
- Section 4 provides considerations, studies, and recommended steps for developing an alternative compliance program for stormwater;
- Section 5 includes a summary of stormwater alternative compliance policy or ordinance contents and examples;
- Section 6 describes cost considerations for program development; and
- Section 7 provides a suggested timeline for program exploration and/or development for the City.

2. REGULATORY REQUIREMENTS

The MRP gives Permittees the authority to allow regulated projects to provide alternative compliance with the stormwater treatment provisions of C.3.b using low-impact development (LID) treatment at an offsite location or payment of an In-Lieu Fee. The specific MRP language corresponding to alternative compliance and In-Lieu Fee is included below.

"C.3.e. Alternative or In-Lieu Compliance with Provision C.3.b.

i. The Permittees may allow a Regulated Project to provide alternative compliance with Provision C.3.b in accordance with one of the two options listed below:

(1) Option 1: LID Treatment at an Offsite Location

Treat a portion of the amount of runoff identified in Provision C.3.d for the Regulated Project's drainage area with LID treatment measures onsite or with LID treatment measures at a joint stormwater treatment facility and treat the remaining portion of the Provision C.3.d runoff with LID treatment measures at an offsite project in the same watershed. The offsite LID treatment measures must provide hydraulically-sized treatment (in accordance with Provision C.3.d) of an equivalent quantity of both stormwater runoff and pollutant loading and achieve a net environmental benefit.

(2) Option 2: Payment of In-Lieu Fees

Treat a portion of the amount of runoff identified in Provision C.3.d for the Regulated Project's drainage area with LID treatment measures onsite or with LID treatment measures at a joint stormwater treatment facility and pay equivalent In-Lieu Fees[4] to treat the remaining portion of the Provision C.3.d runoff with LID treatment measures at a Regional Project.[5] The Regional Project must achieve a net environmental benefit.

(3) For the alternative compliance options described in Provision C.3.e.i.(1) and (2) above, offsite and Regional Projects must be completed within three years after the end of construction of the Regulated Project. However, the timeline for completion of a Regional Project may be extended, up to five years after the completion of the Regulated Project, with prior Executive Officer approval. Executive Officer approval will be granted contingent upon a demonstration of good faith efforts to implement the Regional Project, such as having funds encumbered and applying for the appropriate regulatory permits."

A Regional Project is defined in the MRP as:

> *"Regional Project - A regional or municipal stormwater treatment facility that discharges into the same watershed as the Regulated Project."*

Reporting requirements for alternative compliance are included as follows in the MRP:

> *"C.3.b.iv (2) Annual Reporting*
>
> *(m) Alternative compliance measures for Regulated Project (if applicable) (i) If alternative compliance will be provided at an offsite location in accordance with Provision C.3.e.i.(1), include information required in Provision C.3.b.iv.(2)(a) – (l) for the offsite project;*
>
> *and*
>
> *(ii) If alternative compliance will be provided by paying In-Lieu Fees in accordance with Provision C.3.e.i.(2), provide information required in Provision C.3.b.iv.(2)(a) – (l) for the Regional Project. Additionally, provide a summary of the Regional Project's goals, duration, estimated completion date, total estimated cost of the Regional Project, and estimated monetary contribution from the Regulated Project to the Regional Project"*

2.1 Green Stormwater Infrastructure Plan Requirements

The MRP also requires that Permittees submit a Green Infrastructure Plan (otherwise known as, and hereinafter referred to as, a Green Stormwater Infrastructure Plan) during the current permit term. Alternative compliance, In-Lieu Fee, and/or water quality credit trading programs may be used to help implement the Green Stormwater Infrastructure Plan(s) by providing a potential means to fund, at least partially, or cause to be constructed, public green stormwater infrastructure projects. Components of the GI Plan that could be related to and/or require integration with an alternative compliance program may include (paraphrased from C.3.j.i.(2)):

a) A mechanism to prioritize and map areas for potential and planned projects for the following time frames (consistent with assessing load reductions specified in Provisions C.11 and C.12):
    a. By 2020
    b. By 2030

c. By 2040

b) Outputs from the selected mechanism, including but not limited to project prioritization criteria, maps, lists, and other information.
c) Targets for the amount of impervious surface (public and private) to be retrofitted within the identified time frames (i.e., by 2020, by 2030, and by 2040).
d) A process for tracking and mapping completed projects and making the information publicly available.
e) General guidelines for streetscape and project design and construction.
f) Standard specifications and, as appropriate, typical design details and related information necessary to incorporate green stormwater infrastructure projects into the Permittee's jurisdiction.
g) Requirements that projects be designed to meet the treatment and hydromodification sizing requirements in Provisions C.3.c and C.3.d of the MRP.
h) A summary of planning documents the Permittee has updated or otherwise modified to appropriately incorporate green stormwater infrastructure requirements.
i) To the extent not addressed with other components, a workplan identifying how the Permittee will ensure that green stormwater infrastructure and low impact development measures are appropriately included in future plans.
j) A workplan to complete prioritized projects identified as part of a Provision C.3.e Alternative Compliance program or part of Provision C.3.j Early Implementation.
k) An evaluation of prioritized project funding options.

The Green Stormwater Infrastructure Plan must be developed with consideration of meeting the green infrastructure load reduction requirements included in Provisions C.11 and C.12 (i.e., required mercury and PCBs load reductions).

The MRP also requires a Reasonable Assurance Analysis to demonstrate that the MRP Permittees will collectively achieve a mercury load reduction of 10 kilograms per year and a PCBs load reduction of 3 kilograms per year from implementation of green stormwater infrastructure projects by 2040.

3. ALTERNATIVE COMPLIANCE PROGRAM BACKGROUND

3.1 Background

Alternative compliance programs are typically optional jurisdiction-specific or regional programs that allow municipalities or other Permittees to develop or redevelop projects using offsite mitigation for stormwater. These programs are enabled by specific

provisions within a Municipal Separate Storm Sewer (MS4) permit and are intended to allow for increased flexibility and efficiency (i.e., time or cost) in addressing stormwater requirements. Alternative compliance programs vary but generally allow a project to satisfy a portion, or all, of its stormwater treatment obligations at an offsite location. Offsite locations that could be considered in the City of Dublin include those identified in the Green Stormwater Infrastructure Plan.

A summary of terms relevant to this *Alternative Compliance Handbook* are provided:

- Offsite mitigation – Defined for the purposes of this *Alternative Compliance Handbook* as:

  The use of best management practices (BMPs) at a location outside the development or redevelopment footprint of a project to satisfy stormwater treatment requirements in place of, or to supplement the use of, onsite BMPs.

- In-Lieu Fees – Defined in the MRP as:

  "Monetary amount necessary to provide both hydraulically-sized treatment (in accordance with Provision C.3.d) with LID treatment measures of an equivalent quantity of stormwater runoff and pollutant loading, and a proportional share of the operation and maintenance costs of the Regional Project."

- Water Quality Trading – *The Water Quality Trading Toolkit* (United States Environmental Protection Agency [USEPA], 2007) defines water quality trading as follows:

  "The use of water quality Credits generated at one location for compliance with water quality-based requirements at another location within a trading area."

  Water quality trading can be a particularly useful tool in watersheds with established total maximum daily loads (TMDLs). The TMDL, however, will largely dictate the type and geographic extent of allowed trading. Furthermore, tradable credits can only be generated when a source reduces loadings below the allocation set by the TMDL.

- Public-Private Partnerships (P3s) – P3s are performance-based business ventures, funded and operated through partnerships by and between government and the private sector. Stormwater P3s are intended to help communities optimize limited labor resources, meet compliance obligations, and control risk and finances to help build and maintain public infrastructure. A P3's role in an alternative compliance program is typically as the implementer of a credit generating or In-

Lieu Fee BMP.

3.2 Examples of Alternative Compliance Approaches and Programs

3.2.1 City of Emeryville, California

The City of Emeryville provides a local example of alternative compliance. Rather than develop a full alternative compliance program, the City implemented a single alternative compliance arrangement as the need arose. The City of Emeryville entered into an agreement with a private developer for funding of off-site LID to meet alternative compliance with the MRP for a redevelopment project (City of Emeryville, 2017).

Eight potential locations to site GSI in the watershed were identified, and five were selected for implementation by the City Engineer. The selection by the City Engineer was based on a combination of factors, including utility locations, traffic and parking needs, and beautification. Street trees (camphor trees) in poor condition that were identified for removal through the capital improvement project (CIP) list will also be removed as part of the construction of the projects.

This approach was successful because the potential locations of public GSI retrofit could be quickly assessed by a City Engineer knowledgeable of the needs and priorities of the City and could additionally be leveraged by a CIP list. Additionally, the City representatives were able to present the single case to the City Council for quick approval. This example may be replicated in other similar cities, i.e., where potential public GSI retrofit is known and/or can be quickly assessed, City priorities are well established, redevelopment areas are delineated, and decision-makers can come to agreement on a single project quickly. For more complex cities, it is recommended that consideration of future projects be conducted (minimally) before a single implementation of alternative compliance without the prior development of a more comprehensive alternative compliance program. Any alternative compliance that is approved by the City is likely to set the precedent for subsequent alternative compliance agreements. Suggested considerations and steps to take for development of an alternative compliance program are provided in sections 4 and 5.

3.2.2 City of San Diego, California

The City of San Diego Alternative Compliance Program consists of two phases, the second of which is under development. Phase 1 of the program is similar to Option 1 of the MRP (LID Treatment at an Offsite Location). This Phase allows Priority Development/Redevelopment Projects (PDPs) to satisfy their pollutant control and hydromodification control requirements by implementing stormwater BMPs at an offsite location within the same watershed. Phase 1 is referred to as "applicant implemented" alternative compliance because project applicants/owners are responsible for all aspects of the offsite alternative compliance project, including land acquisition, design and construction, and long-term operation and maintenance of the offsite BMP. Offsite alternative compliance projects must demonstrate that they provide a greater overall water quality benefit through application of the procedures and formulas included in the *Water Quality Equivalency Guidance Document* (County of San Diego, 2015), a regional guidance document developed by the San Diego co-permittees and approved by the Region 9 Water Quality Control Board (Region 9; as required by the 2013 San Diego Regional MS4 Permit).

The City of San Diego is in the process of expanding its program through development of a stormwater credit trading program. This program would allow Priority PDPs to satisfy their pollutant control and hydromodification control requirements by purchasing credits generated from offsite BMPs. Credits transactions would occur between generators and buyers and be tracked through an online dashboard. The City of San Diego program is being led by the Transportation and Storm Water Department. Program development has also relied heavily upon feedback from the City of San Diego's Development Services Department, Public Works Department, City of San Diego Attorney's Office, and Planning Department.

The City of San Diego is in the process of initiating a Programmatic environmental impact report for their Alternative Compliance Program. They are estimating the program will be launched in early 2021. The City will publish a Program Standards Document, detailing the rules and requirements governing the program, when the program launches. The Program Standards are being developed by conducting a review of other trading programs and through an extensive advisory process, which is used to evaluate program options and incorporate feedback from local and national subject matter experts. The advisory process has included bi-monthly meetings open to the public as well as internal City of San Diego workgroup meetings.

3.2.3 Washington, D.C.

Washington, D.C.'s Department of Energy and Environment (DOEE) requires new development and redevelopment to install stormwater management facilities that retain a portion of the runoff generated from the development. DOEE administers a program in which eligible properties may install green stormwater infrastructure to capture excess volume (that meets the program's requirements) to generate stormwater retention credits; those credits can then be sold to other properties (i.e., developers that need retention credits) through a credit exchange (the DOEE Stormwater Database). Projects/developers that cannot meet their full onsite compliance requirements, but do not want to purchase stormwater credits, have the option to pay an In-Lieu-Fee. The In-Lieu Fee is based on the most expensive BMP in the most expensive area within the watershed (DOEE, 2018).

3.2.4 Chesapeake Bay (Prince George's County), Maryland

The Prince George's County program is a partnership between the County and tax-exempt faith-based organizations and 501(c)(3) nonprofit organizations to treat and reduce stormwater runoff in exchange for a reduction in their Clean Water Act Fee (Prince George's County, 2018). These organizations may agree to one or all three alternative compliance options, which include an easement whereby the County will install stormwater BMPs on the property; an outreach and education campaign that encourages other property owners to participate in the Rain Check Rebate Program; and/or a demonstrated commitment to work with certified lawn and landscaping companies or to conduct good housekeeping practices on their property. This form of alternative compliance is not the same as the City of San Diego or the Washington D.C. programs, and requires the existence of a stormwater utility fee.

3.2.5 Lake Tahoe

The Lake Tahoe Lake Clarity Program is a quantitative load reduction program that tracks pollutant control measures in the Lake Tahoe basin. The regulating agencies for the program are the Lahontan Regional Water Quality Control Board and the Nevada Division of Environmental Protection. The program is implemented and documented by seven local jurisdictions: El Dorado, Placer, Washoe, and Douglas counties; the City of South Lake Tahoe; California Department of Transportation; and Nevada Department of

Transportation. The program aims to improve lake clarity by tracking the pollutants that contribute to lake clarity degradation: fine sediment particles (FSP), nitrogen, and phosphorus.

To implement the program, the seven jurisdictions can "reward" actions that achieve load reductions of the target pollutants with credits. The jurisdictions can then implement the most cost-effective treatment system, by either trading, sharing, or utilizing the distributed credits. The crediting process requires each jurisdiction to estimate the expected loads, register expected credits, inspect actual conditions, and declare credits for each treatment BMP included. The crediting process utilizes four stormwater tracking tools that are made available to each jurisdiction (Lahontan Water Quality Control Board and Nevada Division of Environmental Protection, 2015). This program is a crediting program for permit accounting, so also has a different structure than the other alternative compliance programs described above.

3.2.6 San Francisco Public Utilities Commission

The San Francisco Public Utilities Commission (SFPUC) is in the process of developing an alternative compliance and In-Lieu Fee programs for their Stormwater Management Requirements. The program will be released to the public when it is completed.

4. DEVELOPING AN ALTERNATIVE COMPLIANCE PROGRAM

4.1 Initial Considerations

While alternative compliance programs may provide additional flexibility and efficiencies for Permittees, there are also costs associated with program development and implementation. Additionally, the type of alternative compliance allowed through the program, and the rules and conditions associated with compliance, will have a direct impact on participation rates and program costs. For these reasons, it is important to evaluate certain initial conditions before establishing a program. These may include the following conditions. Some of these conditions may not apply to smaller cities or cities where minimal new or re- development is anticipated.

1. Equivalency and Net Environmental Benefit
    a. What equations, metrics, and models can be used to demonstrate treatment of an "equivalent quantity of both stormwater runoff and pollutant loading" and achievement of a "net environmental benefit" as required by the MRP?
2. Administrating Department(s)
    a. Which City department will manage the program? Any alternative compliance program will require the review and approval of additional plans and submittals. Offsite mitigation also requires annual reporting, tracking, and enforcement. Which City department(s) are best equipped to assume these responsibilities, and how will the City coordinate additional efforts?
3. Total Costs and Funding Mechanisms
    a. How will the cost of program administration be distributed and where will additional funds come from?
    b. Does the managing department have the budget/staff needed to expand its current responsibilities?
    c. Can costs be recovered with normal plan review fees, or are additional fees warranted that are specific to alternative compliance projects?
    d. For In-Lieu Fee compliance, how will the fee be set and how will ongoing operation and maintenance be funded?
4. Liability Concerns (If Insufficient Applicants for In-Lieu Fee Program)
    a. If the City plans construction of a regional BMP and collects In-Lieu Fees that cover only a portion of the BMP cost, how will the additional cost be covered? Furthermore, if a regional BMP fails after construction, what funding sources are there for rehabilitation/replacement?
    b. If construction of the regional BMP is delayed beyond the allowable three-year (or extended five-year) window due to unforeseeable circumstances, is the City liable for unmitigated water quality impacts?

5. Configuration and Responsible Party for Tracking System
    a. How will offsite mitigation be tracked and what will the configuration of the tracking and reporting mechanism be? For example, DOEE manages a Stormwater Database that tracks available and purchased credits or internal Access Databases or Spreadsheets.
    b. Who would manage the In-Lieu Fee program, and how would it be tracked? How would fees paid into the program be managed over time (e.g., if it takes five years to build a project)?
6. Application and Approval Process
    a. Who will be allowed to participate in the program and how will participating applicants be identified and approved?
    b. Can existing submittals and templates be amended to include alternative compliance sections or provisions, or do new templates need to be developed?
    c. Similarly, can existing review and approval processes be amended to include alternative compliance, and at what stage of project submittal/approval can alternative compliance be used?
7. Reporting
    a. How will the City include alternative compliance projects into its annual report?
    b. Will self-reporting of offsite mitigation projects be sufficient, or will the City require internal or third-party inspection/review of projects annually?
8. Interest from and Coordination with Cooperating Parties (i.e., Developers)
    a. How could the combination of offsite mitigation project and program costs, additional planning and engineering, onsite technical feasibility, and development/redevelopment patterns and rates impact program participation rates?
    b. If LID treatment at an offsite location is the only alternative compliance options available, will participation rates be high enough to justify additional program costs?

c. Who will provide outreach to developers? How often will trainings/ workshops be provided?

4.2 Potential Studies Needed

Several studies, meetings, workgroups, and/or other coordination may be needed prior to initiating program development to answer the questions posed in section 4.1 and establish the program framework. Identifying the potential to implement C.3.e. can be examined through a series of feasibility/interest studies, including:

1. Is treatment at an offsite location feasible for developers?
    a. Space – Feasibility study to identify potential opportunities for offsite treatment within the same watershed for known C.3. projects (should those projects choose to move forward with alternative compliance).
    b. Cost – Analysis to determine if the cost of developing opportunities for offsite treatment would be financially feasible.
    c. Interest – Is there interest in development community for an alternative compliance program or an In-Lieu Fee program? Suggest sending a survey to developers to identify interest in use of program.
2. Is alternative compliance program feasible for City?
    a. Cost – What is the administrative cost for the City to implement a program to track alternative compliance? How many projects would need to participate for financial feasibility?
    b. Tracking/Review – Study to develop a tracking and review methodology or system, including identifying who/what department would be responsible for tracking projects and who/what department would be responsible for reviewing and approving projects.
3. Is an In-Lieu Fee program feasible for the City?
    a. Regional projects – Feasibility study to identify whether sufficient potential opportunities for Regional Projects exist to mitigate the development that is likely to trigger C.3.
    b. Cost – Analyses to estimate how much identified Regional Projects would cost, and how many development projects would have to contribute In-

Lieu Fees to cover those costs, including the administrative and full lifecycle costs must be covered by the fee.

c. Potential for Liability – If the City designates specific Regional Projects for In-Lieu Fees, and not as many developers as expected pay the In-Lieu Fee, how will the costs be covered to ensure that those developers that have paid the In-Lieu Fee are in compliance (i.e., that the Regional Project(s) still gets built)?

4. How will treatment equivalency be established?

   a. Study to identify what mechanism(s) will be used to equate offsite water quality improvements with onsite improvements. Any alternative compliance program is founded upon an established equivalency between onsite and offsite projects. Offsite projects must demonstrate that they are able to provide an equal or greater water quality benefit to the control that would have been built onsite. Establishing equivalency requires the consideration of expected pollutant loads at both the onsite and offsite location (i.e., land use differences in the tributary areas), volume treated by the BMP, and BMP removal efficiencies. The *Water Quality Equivalency Guidance Document* for Region 9 developed by the San Diego regional Co-permittees provides one example (County of San Diego, 2015).

4.3 Steps Needed to Develop a Program

Suggested steps to develop a program include (adapted from the In-Lieu Fee Guidance document and other sources):

1. Form a team within the City that is responsible for program development. This may include a representative from the County or neighboring cities, who will help decide if a watershed-based program (which extends across City boundaries) is desired.
2. As a team, identify the feasibility studies that are needed (see questions posed in section 4.1 and suggested studies in section 4.2) and determine a budget to perform the studies. Arrange for the studies to occur in-house and/or through an outside consultant or other party.

3. Review the results of the feasibility studies and use the results to determine the degree to which the City could implement an alternative compliance and/or In-Lieu Fee program.
4. Develop a policy or ordinance based on the findings and program determination (see section 5). Identify (as part of policy or separately) a method for "adaptive management" (i.e., altering the program based on findings from program operation).
5. Identify who is responsible for tracking and reporting; set up a system to automate or simplify tracking. This should include a method for financial tracking and accounting, as well as considerations of units of measurement for compliance and equivalency reporting.
6. Develop a guidance manual and outreach program for developers interested in alternative compliance and/or an In-Lieu Fee.
7. Submit program documents to the Regional Water Quality Control Board for review and approval.
8. Launch program.
9. Complete annual reporting and make programmatic changes through adaptive management mechanisms established during program development.

5. POLICY OR ORDINANCE OVERVIEW

Language about offsite alternative compliance could be added to a broader stormwater management ordinance, or it could be developed for a standalone ordinance pertaining only to offsite alternative compliance. A City-specific offsite alternative compliance ordinance would include the following elements:

1. Applicant Requirements – These include, but are not limited to, minimum onsite stormwater requirements for projects using alternative compliance, application details, and eligibility requirements.
2. Offsite Mitigation Project Requirements – These include, but are not limited to, project location, priority watershed location requirements/considerations, land rights and easement information, maintenance agreements, documentation requirements, and construction requirements.

3. City or Water Authority Requirements – These include, but are not limited to, inspection specifications, rights, and frequencies, construction authorization/approval, and authority to conduct construction inspections.
4. In-Lieu Fee requirements – Information on whether a payment-in-lieu option is available to applicants, and if so, how the rate will be calculated, collected, and tracked.

5.1 Existing Policies and Ordinances

5.1.1 Washington, D.C.

DOEE adopted the 2013 Stormwater Management Rule, an amendment to Chapter 5 (Water Quality and Pollution) of Title 21 (Water and Sanitation) of the District of Columbia Municipal Regulations (DCMR). The amendment provides regulated sites with an option to meet a portion of their stormwater management compliance requirements with offsite retention by using Stormwater Retention Credits or paying an In-Lieu Fee to DOEE.

5.1.2 West Virginia

The Center for Watershed Protection developed *Guidance for Developing an Off-Site Stormwater Compliance Program in West Virginia* in 2012 (West Virginia Department of Environmental Protection, 2012). The document includes "Appendix B: Model Ordinance for Off-Site Compliance," which includes language that covers the four elements outlined above in the draft ordinance summary.

5.1.3 Central Coast, California

Central Coast Low Impact Development Initiative (LIDI), which is endowed by the Central Coast Regional Water Quality Control Board and the Bay Foundation of Morro Bay, supports "the vision of healthy watersheds through the implementation of LID design principles…throughout the Central Coast Region." LIDI developed the *Central Coast Draft Municipal Alternative Compliance Model Ordinance* (2014), a draft ordinance for jurisdictions that want to establish an alternative compliance program. This document draws on concepts and language provided in the West Virginia Model Ordinance.

5.1.4 USEPA

The USEPA published the *Model Post-Construction Stormwater Runoff Control Ordinance* in 2015 to assistant communities with creating their own stormwater management ordinances (USEPA, 2015). The model ordinance includes high-level language about offsite facilities and In-Lieu Fees for stormwater management practices.

6. COSTS

The costs associated with developing, implementing, and managing an alternative compliance program vary considerably based on the following factors:

1. The availability of existing program elements (i.e., equivalency methods/guidance and ordinances/policies).
2. The type of offsite compliance allowed through the program (i.e., applicant implemented, In-Lieu Fee, and/or credit trading).
3. The size/extent of the program and expected level of participation.

The cost of establishing the most basic alternative compliance options (applicant implemented) can range from tens of thousands of dollars to hundreds of thousands of dollars, with the lower end of the cost spectrum representing programs that already have established equivalency and policy/ordinance components (or, minimally, simple frameworks).

The cost of establishing In-Lieu Fee programs can be significantly greater than that of developing a simple applicant implemented program due to the required fee studies and legal/program assurance mechanisms. Developing these programs can cost hundreds of thousands of dollars.

The cost of establishing a Credit Trading Program can be similar or greater than the cost of establishing an In-Lieu Fee program. This cost varies greatly based on the type of credit trading allowed (single or multiple types of credits), the size of the trading areas (local jurisdiction and watershed based or cross-jurisdictional), the role of the municipality in program administration, and the type of credit market established, among other considerations. Costs of establishing a Credit Trading Program can range from hundreds of thousands of dollars to millions of dollars.

7. RECOMMENDED NEXT STEPS

Given the summary/information above, next steps recommended for the City of Dublin are provided. These dates are intended as a guide; they may differ depending on the number of studies identified, the extent of administrative discussions, and the resources available to complete the recommended actions.

Timeline	Recommended Action
Year 1	1. Identify Alternative Compliance Team 2. Identify and Initiate Feasibility Studies
Year 2	3. Complete Feasibility Studies and Review Results 4. Determine Type and Extent of Program and Develop Policy or Ordinance
Year 3	5. Identify Technical and Financial Tracking Procedures 6. Author Guidance Manual and Develop Outreach Program 7. Submit Documents to the Regional Water Quality Control Board for Review and Approval
Year 4 +	8. Launch Program 9. Prepare Annual Reports and Adaptively Manage Program

8. REFERENCES

Central Coast Low Impact Development Initiative (LIDI), 2014. *Draft Municipal Alternative Compliance Model Ordinance*. 4 April. Retrieved 9 May 2018. Available from https://storage.googleapis.com/centralcoastlidi-org/uploads/Model Alt_Compliance_Ordinance.pdf

City of Emeryville, 2017. *Resolution Of The City Council Of The City Of Emeryville Authorizing The City Manager To Enter Into The Public Market Off-Site Stormwater Improvement Agreement With AC-CCRP PUBLIC MARKET, L.P. To Construct Off-Site Low Impact Development Stormwater Treatment Measures On Public Right-Of-Way And Public Open Space As An Alternative Method Of Compliance With The Requirements Of The Municipal Regional Stormwater*

National Pollutant Discharge Elimination System (NPDES) Permit For The Redevelopment Of The Emeryville Marketplace, And Accept $154,000 As A One-Time Lump Sum Payment To The City For The On-Going Long Term Maintenance Of Said Stormwater Treatment Measures. Memorandum to Carolyn Lehr, City Manager. 20 June.

County of San Diego, 2015. *Water Quality Equivalency Guidance Document for Region* **9.** Available from https://www.projectcleanwater.org/water-quality-equivalency-guidance/

District of Columbia Department of Energy and Environment (DOEE), 2018. *Stormwater Retention Credit Trading Program*. Retrieved May 2018. Available from https://doee.dc.gov/src

Lahontan Water Quality Control Board and Nevada Division of Environmental Protection, 2015. *Lake Clarity Crediting Program Handbook: for Lake Tahoe TMDL Implementation v2.0*. Prepared by Environmental Incentives, LLC.

Lotus Water, 2018. E-mail communication with E. Zickler. 30 April.

Prince George's County, 2018. Alternative Compliance. Retrieved April 2018. Available from https://www.princegeorgescountymd.gov/311/Alternative-Compliance

United States Environmental Protection Agency (USEPA), 2007. *Water Quality Trading Toolkit for Permit Writers*. Updated 2009. Available from https://www.epa.gov/npdes/water-quality-trading-toolkit-permit-writers

USEPA, 2015. *Model Post-Construction Stormwater Runoff Control Ordinance*. Retrieved 9 May 2018. Available from https://www.epa.gov/sites/production/files/2015-12/documents/modelillicit_0.pdf

West Virginia Department of Environmental Protection, 2012. *Guidance for Developing an Off-Site Stormwater Compliance Program in West Virginia.* December. Retrieved 9 May 2018. Available from http://dep.wv.gov/WWE/Programs/stormwater/MS4/permits/Documents/WV_Mitigation-FeeInLieu-Guidance_Final_Jan-2013.pdf

Prepared for

City of Dublin
100 Civic Plaza
Dublin, California 94568

PUBLIC-PRIVATE-PARTNERSHIPS (PERFORMANCE-BASED INFRASTRUCTURE) FOR STORMWATER AND MS4 PERMIT COMPLIANCE

WHITE PAPER

Prepared by

Geosyntec consultants

engineers | scientists | innovators

1111 Broadway, 6th Floor
Oakland, California 94607

Project Number: WW2298

June 2019

TABLE OF CONTENTS

White paper developed by Ken Susilo, Senior Principal, and Kelly Havens, Senior Engineer, Geosyntec Consultants.

1. INTRODUCTION/OVERVIEW

The City of Dublin (City) is investigating Public-Private-Partnerships (P3s) as a potential implementation approach toward attaining Municipal Regional Permit (MRP) compliance. This white paper was developed to provide an overview of P3s for stormwater.

P3s are performance-based business ventures, funded and operated through partnerships by and between government and the private sector. There have been inconsistent levels of performance and success in some industries (e.g., with transportation P3s), which has made some decision-makers wary of P3 applications. As such, and particularly in the stormwater context, P3s may be better (and equally accurately) described as Performance-Based Infrastructure (PBI), where the focus is on the alignment of design. Construction, operations and maintenance are key concepts, with the ultimate focus on meeting project objectives. Stormwater P3s are intended to help communities optimize limited labor resources, meet compliance obligations, and control risk and finances to help build and maintain public infrastructure.

As previously noted, P3s (while relatively new for stormwater applications) have resulted in the design, construction, and maintenance of many types of major public infrastructure across the United States, Canada, and globally. Benefits of P3 implementation can include the development of multi-objective, multi- benefit projects that fill multiple needs, resulting in lower agency-specific costs. An example of this is where multiple agencies, such as stormwater agencies, public works departments, water departments, and/or parks departments can cost-share as there are shared, multiple benefits of green stormwater infrastructure implementation. P3s can significantly decrease administrative complexity and increase the speed of implementation by streamlining the procurement and financing portions of projects. In the stormwater context, P3s could demonstrate (to regulators, third parties, and the public) proactive action toward Municipal Separate Storm Sewer (MS4) permit compliance, while sharing some of the permit-associated risk (schedule and regulatory compliance, financial, performance, etc.). When properly executed, true value can be realized by utilizing innovation and leading-edge tools (such as real-time forecasting and controls) and regulatory options (such as alternative compliance approaches), while focusing on outcomes as performance-based metrics.

1.1 Typical P3 Structures

P3s have been implemented through multiple program structures. One common structure is Design-Build-Finance-Operate-Maintain (DBFOM). After project needs, performance metrics, and long-term obligations are established (and preliminary studies conducted), the DBFOM structure entails that the P3 Developer (or Concessionaire) produces the final design and constructs the project or projects. Unless there are significant cash reserves or significant and available bonding capacity available to the public sponsor or owner (i.e., the permittee), the P3 Developer would arrange for financing of up-front costs. For projects with more complex performance metrics, the P3 Developer

has the option to conduct initial monitoring and optimization studies and implement adaptive management, in order to confirm the project performs as expected or better. Then, long-term facility performance preservation actions (and or including operations and maintenance in compliance with applicable requirements) are conducted for the life of the project. Ultimately, after both performance and financial obligations are met, the P3-developed assets are returned to the owning public agency.

An example of the P3 relationships that may be involved in a DBFOM or similar P3 program structure is provided in Figure 1.

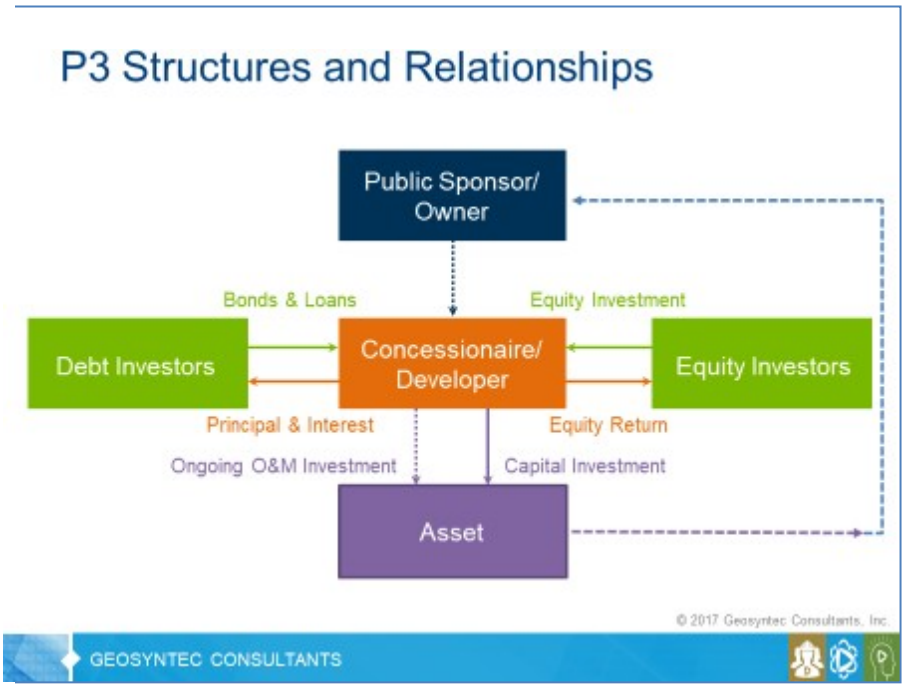


Figure 1: P3 Structures and Relationships (Susilo, 2017)

A more detailed demonstration of the functional roles and relationships between the public owner, outside parties, and various members of the implementation team in a typical DBFOM P3 structure is shown in Figure 2. Of note is the significant potential obligation and risk taken by the P3 Developer in this process, as they are largely responsible for the majority of the implementation tasks. While this risk transfer presents a significant benefit to the public owner (i.e., permittee), the risks must be quantified and monetized and included in the delivery cost to adequately incentivize P3 Developers.

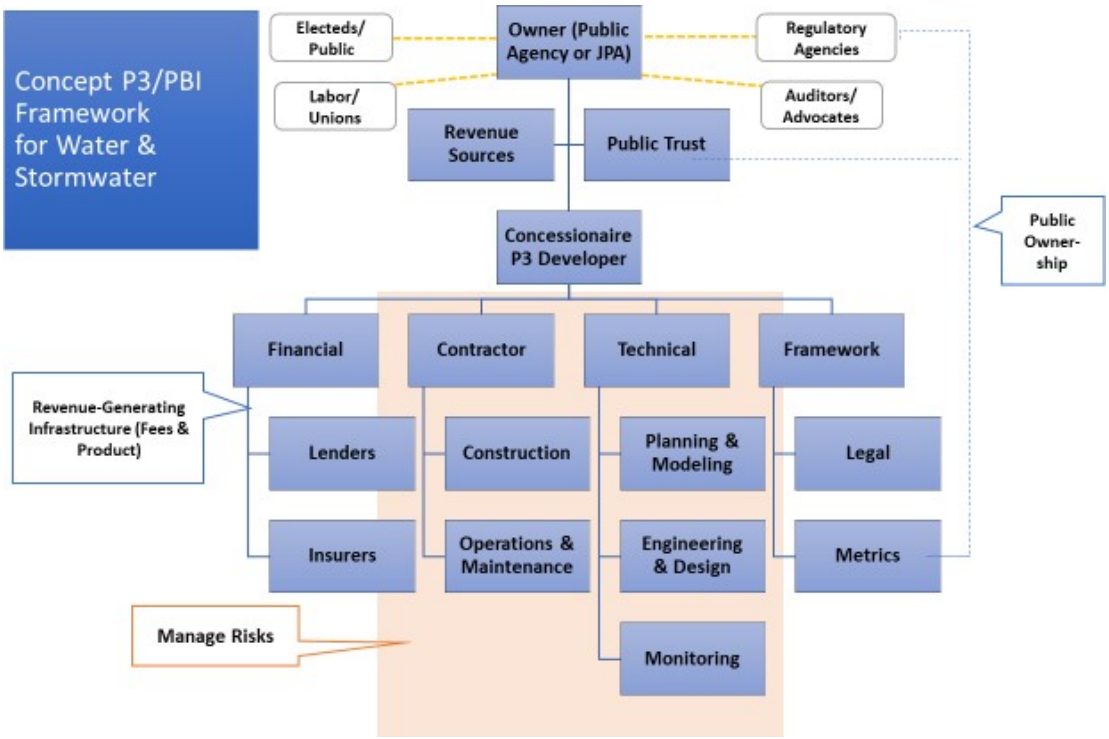


Figure 2: Functional Roles for Parties Involved in Typical P3 Structure (Adapted from Susilo, 2017)

2. EXAMPLES OF STORMWATER P3 IMPLEMENTATION

Examples of implementation of full stormwater P3s are scarce. Two examples are provided from the Mid-Atlantic region and Southern California in the following sections; it should be recognized, however, that neither example is fully analogous to the stormwater P3s described in other sections of this white paper.

2.1 Prince Georges County, MD – Community-Based P3

The first stormwater P3 in the nation is currently being implemented at Prince Georges County (PGC), Maryland, and was initiated in 2015. This program, led by Corvias Solutions and the Clean Water Partnership, is unique in that it is a Community-Based P3 (CBP3), which incorporates a substantial community engagement and jobs component. It also does not require the P3 Developer to provide financing (thus would not be

considered a full DBFOM). One potential factor in the program's success is that compliance with the Chesapeake Bay total maximum daily load (TMDL) is quite straight-forward when compared to California TMDLs and MS4 Permit requirements (i.e., it is more like implementation of new development requirements than meeting California MS4 end-of-pipe and receiving water monitoring objectives).

Initial program objectives were to retrofit 2,000 impervious acres (the compliance unit of measure for the Chesapeake Bay TMDLs) with green stormwater infrastructure, with the flexibility to potentially expand to 15,000 acres by 2025. The CBP3 required support and leadership from the County Executive, Legislative Branch, and Department of the Environment and Department of Central Services.

In 2016, the first full construction season resulted in the completion of 24 projects and the retrofit of 349 acres to meet the regulatory compliance requirements. To meet social and economic goals (particularly utilization of local, small, and minority businesses), programs such as a mentor-protégé program and a collaboration with the public schools were implemented as key milestones. By mid-2017, the program had completed 38 retrofit projects encompassing 690 total impervious acres. Over 2,100 acres have been retrofitted to date (through March 2019).

Figure 3: Information Regarding the PGC CBP3 is available online (Clean Water Partnership)

6

2.2 Mill Creek Wetlands

Mill Creek Wetlands was a $17 million P3 developed in the Inland Empire (Riverside and San Bernardino Counties), California. The project was developed as a partnership between the City of Ontario, Lewis Operating Group (Lewis), United States Army Corps of Engineers, State Water Resources Control Board, and the Santa Ana Regional Water Quality Control Board (who provided grant funding). Other participating agencies included the County of San Bernardino and City of Chino, where the project was located. Lewis led the project design and engineering and worked with the City of Ontario (project public owner) on permit negotiations, environmental clearance, and funding acquisition efforts. The public agencies involved are responsible for long-term operations and maintenance.

The project treated dry weather flows and "first-flush" stormwater from an approximate 77-square-mile drainage area through a 140-acre-foot (45-acre) constructed wetland system, located in the Prado Dam basin (and 500-year flood inundation limit). The project diverts water from Cucamonga Channel/Mill Creek, and partially mitigates the stormwater runoff from an upstream 3,000-acre development. Public benefits were calculated to be approximately three times the conventional approach. The approach is also very similar to the Alternative Compliance methods currently being explored in Southern California (e.g., San Diego County).

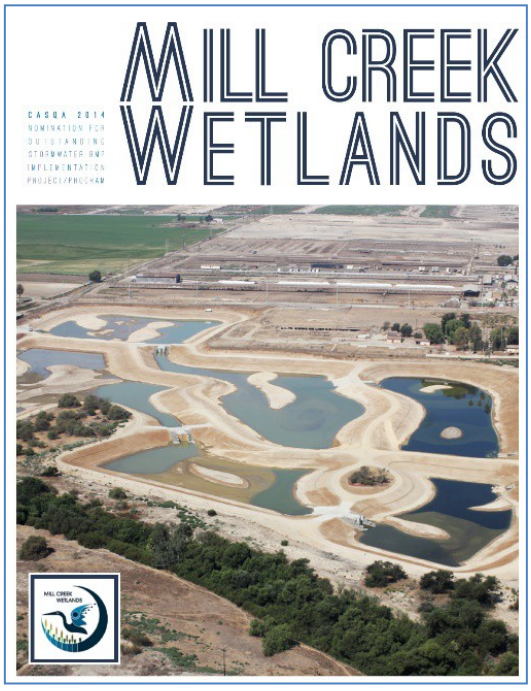


Figure 4: The Mill Creek Wetlands P3 Project (Susilo, 2014)

8

3. INITIAL STEPS FOR P3 PROGRAM DEVELOPMENT

The following describes a few potential initial next steps toward exploring the feasibility of P3s for stormwater in the City.

3.1 Demonstration Project

As P3 implementation has not been well established in California for current MS4 Permit (and TMDL) compliance, a demonstration or pilot-scale implementation could be the first step toward assessing the efficacy of the process. For this demonstration, performance metrics consistent with permit requirements would need to be drafted, confirmed with the Alameda Countywide Clean Water Program and the San Francisco Regional Water Quality Control Board, and established by the City. Because establishment of a reliable funding stream is critical for full-scale implementation, an initial allocation of resources would be needed for demonstration purposes. The political, procedural, legal, regulatory, financial, and technical details developed as part of a demonstration project could confirm whether P3 implementation is feasible. Additionally, if the intent of the process is to target social and economic benefits, a demonstration project could provide foundational evidence to justify more sustainable funding streams.

3.2 Request for Information (or Expressions of Interest)

As part of either a demonstration project or full-scale program implementation, a request for information (RFI) or request for expressions of interest (RFEI) could be issued by the City. Objectives of this approach would be to:

- Determine concessionaire and attorney perspectives on funding and financing options, risk transfer potential, performance metrics (performance-based infrastructure), monitoring, portfolio needs, etc.;
- Develop potential mutually beneficial framework and governance structures, duration of potential agreements;
- Identify potential range of contract values and scopes;
- Explore possible technology applications (asset management, real time controls); and
- Confirm the roles and responsibilities (and any risk transfer) for the City.

3.3 Workshop

A third (or potentially, first) implementation activity could be the conducting of a workshop with elected officials, directors, and policy leaders to explore options and ultimate objectives. This could provide foundational elements for a pilot demonstration and/or RFI/RFEI.

4. POTENTIAL REVENUE AND FUNDING SOURCES

4.1 California Government Code 5956

California Government Code 5956 states the following conditions, including the provision that infrastructure produce fees, for P3s in California:

> *The ability of local government to fund necessary infrastructure improvements is limited by funding constraints. If local governmental agencies are going to maintain the quality of life that this infrastructure provides, they must find new funding sources. One source of new money is private sector investment capital utilized to design, construct, rebuild, repair, operate and maintain infrastructure facilities. Unless private sector investment capital becomes available to study, plan, design, construct, develop, finance, rebuild, repair, or operate and maintain, or any combination thereof, fee-producing infrastructure facilities, some local governmental agencies will be unable to replace deteriorating infrastructure. Further, some local governmental agencies will be unable to expand and build new infrastructure facilities to serve increasing population.*

As such, ultimately a stormwater fee or utility will be likely be critical for implementation.

4.2 SB 231 (Hertzberg)

Proposition 218 exempts "sewer" fees and taxes from its provisions. Court decisions have interpreted the meaning of "sewer" to preclude "stormwater" within its definition. As a result, counties and municipalities have been reluctant to go to the voters with tax proposals to support stormwater capture and urban runoff programs and projects to

comply with MS4 requirements. Some (Contra Costa County[1]) have tried and failed. Some (Culver City) have succeeded. The Culver City approach included a "bottom-up" approach to establishing fee amounts (Culver City, 2017). An illustration of a "top-down" fee study, conducted to address current MS4/TMDL compliance obligation, was completed in San Diego in 2016 (City of San Diego, 2016).

SB 231 simply defines "sewer" to include "stormwater" in such a way as to exempt stormwater fees and taxes from its provisions. The intent of the change is to provide guidance to the courts in their interpretation of "sewer" in the context of Proposition 218.

It is anticipated (by Senator Hertzberg and others) that any city or county taking advantage of the provisions of SB 231 by adopting a stormwater fee or tax without complying with the election provisions of Proposition 218 will be challenged in court by the Howard Jarvis Taxpayers Association. Senator Hertzberg has indicated that there is a jurisdiction willing to serve as a "test case" and that he and attorney Michael Colantuono are encouraging SB 231 supporters to join in the anticipated litigation. According to Senator Hertzberg, the California League of Cities, County Supervisors Association, the Association of California Water Agencies, and California Coast Keeper would support the test case. The legislation became effective on 1 January 2018, but action by the "test case" jurisdiction has not yet occurred (Hertzberg, 2017 and Monterey Regional Storm Water Management Program [MRSWMP], 2017).

4.3 Keys to Successful Implementation of P3s

The following are a few elements that will likely be key to successful implementation of P3s:

- If not managed by a single entity (e.g., a department within the City of Dublin), an adequately flexible governance structure (e.g., Joint Powers Authority, Tax Exempt Public-Benefit [63-20] Corporation, Property-Assessed Clean Energy model, etc.) will be needed;
- Political willingness and support by elected officials;
- Highly qualified and willing partners, both on the owner and P3 Developer side;

[1] See article from The Mercury News, 2012.

- Identifiable revenue sources (through a fee or utility);
- Specific technical elements that would likely include:
    - Asset "optimization" (but multiple variables, not just cost);
    - Adaptive asset management (open/flexible platforms);
    - Operations and maintenance of best management practices (BMPs) over project life; and
    - New technologies (such as real-time controllers and project dashboards).

5. SUMMARY

P3s and PBIs are potentially viable options for stormwater agencies faced with aggressive implementation schedules and onerous permit requirements. While there are many potential benefits to this approach, past experience with other types of P3s highlights the need for a thoughtful and well-vetted approach to establishing metrics, as well as maintaining quality and long-term sustainability. In addition, political support and long-term funding would be essential to a viable California P3 program. The exploration or development of these elements are potential next steps in the evaluation of P3s as an implementation solution.

6. REFERENCES

City of San Diego, 2016. City of San Diego Storm Water Fee Study. September. https://www.sandiego.gov/sites/default/files/csd_stormwaterfeestudy_submission.pdf.

Clean Water Partnership, 2017. https://thecleanwaterpartnership.com.

Culver City, 2017. Measure CW. Available at http://www.culvercity.org/city-hall/information/election-information/ballot-measure-information/clean-culver-city.

Hertzberg, 2017. Webinar: Getting it right: Stormwater Stewardship. Available at http://sd18.senate.ca.gov/sb231-webinar.

Monterey Regional Storm Water Management Program (MRSWMP), 2017. Notice and Agenda, Management Committee for the Monterey Regional Storm Water Management Program (MRSWMP). 25 October. Available at http://montereysea.org/wp-content/uploads/2017/10/MRSWMP-MC-Agenda-10-25-17-2.pdf.

Reader and Vorderbrueggen, 2012. Contra Costa water fee defeated. *The Mercury News*. 7 May. Available at http://www.mercurynews.com/2012/05/07/contra-costa-water-fee-defeated/.

Susilo, K., 2014. Mill Creek Wetlands: A Demonstration of Regional Project Benefits, Public-Private Partnerships, and Water Quality Improvement in Southern California. CASQA Annual Conference, Orange County, California.

Susilo, K., 2017. Performance Based Infrastructure and Public Private Partnership (P3) Solutions for Water Resources and Stormwater Quality, City and County Engineers Association, Monterey Park.

United States Fish and Wildlife Service (FWS), 2009. Conservation Banking: Incentives for Stewardship. July. https://www.fws.gov/sacramento/es/Conservation-Banking/Home/Documents/conservation_banking.pdf.

Program/ Grant Name	Agency or Source	Description	Multi-Benefit Possibilities	Current Funding Level	Anticipated Rigor (Low, Moderate, High)
Clean Water State Revolving Fund Program (CWSRF)	California Environmental Protection Agency - State Water Resources Control Board (SWRCB)	The Clean Water State Revolving Fund (CWSRF) program offers low cost financing for a wide variety of water quality projects. The program has significant financial assets, and is capable of financing projects from <$1 million to >$100 million.	Multi-benefits identified include: wastewater treatment and water recycling; point and non-point source stormwater flow control and treatment; aquatic health improvements; climate resilient and sustainable water resources. The primary scoring concerns five Resources/Impacts: Drinking Water Source; Delta Water Quality; Water Recycling; Impaired Water Body; Water Quality Control Plan or Permit. For any/all of these, the project Purpose is categorized as: Corrective, Preventive, or Improvement. Secondary scoring includes points for: multi-benefits; adoption of a climate change action plan/policy; project is cited in multi-agency regional environmental management plan, increases local drinking water supply, or has multi-media environmental benefits; fund matching.	Annual average is $500,000,000	Moderate rigor
Stormwater Grant Program (SWGP)	California Environmental Protection Agency - State Water Resources Control Board (SWRCB)	Part of Proposition 1 (AB 1471); Round 2 focus on *Implementation.*	Multi-benefits identified include: green infrastructure; stormwater capture and treatment facilities. Purpose of project to improve water quality and/or adapt water infrastructure to climate change. It should be noted that project must be included as part of a Storm Water Resource Plan, or functional equivalent, to be eligible for grant funds.	$90 Million	Low rigor, given lead time; recommended for an applicable project.
Groundwater Grant Program (GWGP)	California Environmental Protection Agency - State Water Resources Control Board (SWRCB)	Part of Proposition 1 (AB 1471, Chapter 10); in Round 2; for groundwater that serves, or has served, as a source of drinking water.	The Program Guidelines include multi-benefits as one of the preferences when assessing an application. To be considered multi-benefit, the project must be designed to address any/all of the following: more than one Proposition 1 prioritization criteria (manage/mitigate contaminated groundwater; enhance local water supply; maximize recharge opportunities); more than one California Water Action Plan objective (prevent spread, or accelerate cleanup, of contamination in current or former drinking water aquifer; protect drinking water aquifer; provide clean drinking water to DACs or EDAs); or is an integrated part of a groundwater recharge program.	$800 Million total (not certain of available funds for Round 2)	Moderate rigor, though award for GI may be challenging. Valuable resources available on website.
California Infrastructure State Revolving Fund (ISRF); **Loan**	California Infrastructure and Economic Development Bank (IBank)	The ISRF Program provides financing to public agencies and non-profit corporations sponsored by public agencies for a wide variety of infrastructure and economic development projects (excluding housing).	Multi-benefits are not specifically a criteria, though various types of infrastructure projects are eligible. Amongst those, the following types may be most applicable: city streets; county highways; drainage, water supply, and flood control; environmental mitigation measures; public transit; state highways.	Funding level ranges: $50,000 to $25,000,000	Probably low rigor, though it is a loan program.

Program/ Grant Name	Agency or Source	Description	Multi-Benefit Possibilities	Current Funding Level	Anticipated Rigor (Low, Moderate, High)
Bullitt Foundation: Grant	Bullitt Foundation	The Bullitt Foundation focuses on infrastructure design that optimizes efficiencies among land use, transportation, energy, water, and waste systems; operates at a cost effective scale; enhances natural systems; reduces carbon emissions; and stores carbon. It advances green infrastructure alternatives to grey infrastructure. The Foundation also seeks to develop conservation finance mechanisms, metrics, and other needed tools to encourage protection and restoration of ecosystem service values related to urban, agricultural, forest, and open space lands. The Foundation funds 501(c)(3) nonprofit organizations, Municipal Corporations, Public Agencies, and Tribal Governments.	The multi-benefit approach is embraced in the "Resilient Cities, Healthy Communities" program (http://www.bullitt.org/programs/resilient-cities-healthy-communities/). As part of the Sustainable Infrastructure component, multi-benefits include: Advance decentralized, biomimetic, and environmentally resilient systems; Prioritize health and well-being of humans and nature by promoting walking, biking, and public transportation; Promote systems and cultures in which physical activity is viewed as a benefit; Encourage green infrastructure design that optimizes efficiencies among land use, transportation, energy, water, and waste systems, operates at scale, enhances natural systems, reduces CO2 emissions, and stores carbon.	Previous grants range from $10,000-$120,000.	Unknown, potentially challenging to be awarded.
Five Star and Urban Waters Restoration Grant Program	National Fish and Wildlife Foundation	The Five Star and Urban Waters Restoration Program seeks to develop nation-wide-community stewardship of local natural resources, preserving these resources for future generations and enhancing habitat for local wildlife. Projects seek to address water quality issues in priority watersheds, such as erosion due to unstable streambanks, pollution from stormwater runoff, and degraded shorelines caused by development.	Multi-benefits include: wetland, riparian, forest and coastal habitat restoration; wildlife conservation, community tree canopy enhancement, water quality monitoring and green infrastructure best management practices for managing run-off; increase access to the benefits of nature; reduce the impact of environmental hazards and engage local communities, particularly underserved communities, in project planning, outreach and implementation. From 2018 grantees, there was a range of recipients, with one GI project (https://www.nfwf.org/fivestar/Documents/2018grantslate.pdf; see "Park Forest Green Infrastructure for Stormwater Management (IL)" on page 6).	Approximately $2.5 million in 2017. Awards range from $20,000 to $50,000 with an average size of $30,000 and 40-50 grants awarded per year.	Potentially low feasibility of award; focus on urban waters.
The Rockefeller Foundation: Grant	The Rockefeller Foundation	The Rockefeller Foundation works to achieve meaningful and measurable impact for poor and vulnerable communities through smart globalization. A portfolio of work structured around core issue areas include: Resilience; Climate Change; Water and Fisheries; Transportation and Infrastructure; Transform Cities; Revalue Ecosystems; and Secure Livelihoods.	Multi-benefits broadly in an urban infrastructure context for climate change resilience (as evidenced by the "100 Resilient Cities" initiative, including Resilient by Design Challenge).	The Foundation has awarded grants from under $100,000 to over $2,000,000.	Competitive; low probability of acceptance.

Program/ Grant Name	Agency or Source	Description	Multi-Benefit Possibilities	Current Funding Level	Anticipated Rigor (Low, Moderate, High)
Better Utilizing Investments to Leverage Development (BUILD) Transportation Discretionary Grants program	U.S. Department of Transportation (DOT)	Better Utilizing Investments to Leverage Development (BUILD) Transportation grants replace the pre-existing Transportation Investment Generating Economic Recovery (TIGER) grant program. As the Administration looks to enhance America's infrastructure, FY 2018 BUILD Transportation grants are for investments in surface transportation infrastructure and are to be awarded on a competitive basis for projects that will have a significant local or regional impact. BUILD funding can support roads, bridges, transit, rail, ports or inter-modal transportation.	From the Program website: "The eligibility requirements of BUILD allow project sponsors at the State and local levels to obtain funding for multi-modal, multi-jurisdictional projects that are more difficult to support through traditional DOT programs." Further: "The BUILD program enables DOT to use a rigorous merit-based process to select projects with exceptional benefits, explore ways to deliver projects faster and save on construction costs, and make needed investments in our Nation's infrastructure." Considering the value of transporation assets, having multi-benefit (flood control, water quality, resiliency) attributes would result in a competitive application.	$1.5 billion to be awarded by DOT for the BUILD Transportation program. Maximum grant award is $25,000,000 and no more than $150,000,000 can be awarded to a single State.	Moderate rigor; feasible, though competitive.
Urban Waters Small Grants (UWSG)	U.S. Environmental Protection Agency (EPA)	The objective of the Urban Waters Small Grants is to fund projects that will foster a comprehensive understanding of local urban water issues, identify and address these issues at the local level, and educate and empower the community. In particular, the Urban Waters Small Grants seek to help restore and protect urban water quality and revitalize adjacent neighborhoods by engaging communities in activities that increase their connection to, understanding of, and stewardship of local urban waterways.	Multi-benefit priorities: restore urban waters, improve water quality (treatment of urban runoff), community revitalization. From the website: "Improving urban waters requires various levels of government and local stakeholders (e.g., community residents, local businesses, etc.) to work together in developing effective and long-term solutions with multiple benefits. EPA supports and empowers communities, especially in under-served areas, who are working on solutions to address multiple community needs and fostering successful collaborative parnterships."	The grants are competed and awarded every two years, with individual award amounts of up to $60,000.	Competitive; low probability of acceptance.
Local Streets and Roads Program	California Transportation Commission	Senate Bill 1; administered by CTC.	Multi-benefits are not a driver. The program focus is basic maintenance, rehabilitation, and safety. If a connection can be made to any/all of these, with the added benefit of GI, then may be competitive (consider Complete Streets investments).	$1.5 Billion annually	Applicable. Recommended for an applicable project.
Transportation Alternatives; Surface Transportation Block Grant Program (STBG)	Federal Highway Administration (FHWA)	Authorizes funding for programs and projects defined as transportation alternatives, including on- and off-road pedestrian and bicycle facilities, infrastructure projects for improving non-driver access to public transportation and enhanced mobility, community improvement activities such as historic preservation and vegetation management, and environmental mitigation related to stormwater and habitat connectivity; recreational trail projects; safe routes to school projects; and projects for planning, designing, or constructing boulevards and other roadways largely in the right-of-way of former divided highways.	Multi-benefits not a requirement, but beneficial to strengthen application. Amongst eligible projects are those qualified by 23 USC 328 (environmental restoration and pollution abatement, which includes stormwater treatment). This grant program is measured on "Performance Management", of which includes the natural environment (see Appendix A of the "Transportation Alterantives Program Performance Management Guidebook": https://www.fhwa.dot.gov/environment/transportation_alternatives/performance_management/guidebook/page07.cfm). Note that the Guidebook (can be accessed by working backward through that link) is very useful in framing what is valued as performance for FHWA.	Fiscal Year 2019: $11.876 Billion; Fiscal Year 2020: $12.136 Billion	Applicable; feasible, though competitive

Program/ Grant Name	Agency or Source	Description	Multi-Benefit Possibilities	Current Funding Level	Anticipated Rigor (Low, Moderate, High)
Caltrans Financial Contribution Only (FCO)	Caltrans	Green infrastructure that would have mutual regulatory benefits for Caltrans and partner.	Benefits include: stormwater treatment, TMDL credits, trash load reduction. Multi-benefits not required for eligibility. Ideally, part of the tributary shed should include Caltrans Right-of-Way.	funding entered into SHOPP cycle	Low rigor, though SHOPP cycle updated every 2 years
Caltrans Cooperative Implementation Agreement (CIA)	Caltrans	Green infrastructure that would have mutual regulatory benefits for Caltrans and partner.	Benefits include: stormwater treatment, TMDL credits, trash load reduction. Multi-benefits not required for eligibility. Part of the tributary shed must include Caltrans Right-of-Way.	funding contingent upon available support excess during Fiscal Year	Low rigor, though available funds typically not known until last quarter of Fiscal Year
Caltrans Project-Specific Mitigation	Caltrans	Alternative compliance.	Benefits include: stormwater treatment, TMDL credits, trash load reduction. Multi-benefits not required for eligibility. The alternative compliance must satisfy the mitigation obligation, and be sanctioned by the San Francisco Bay Regional Water Quality Control Board (RWQCB).	funding contingent upon mitigation needs	Low rigor, though only available when Caltrans capital project needs alternative compliance. Coordination with either Caltrans District 4 or SF Bay RWQCB necessary to determine mitigation needs.

Appendix I
RESOLUTION 65-19

RESOLUTION NO. 65 – 19

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF DUBLIN

* * * * * * * * * * * *

APPROVING THE CITY OF DUBLIN GREEN STORMWATER INFRASTRUCTURE PLAN

WHEREAS, the San Francisco Bay Regional Water Quality Control Board adopted the Municipal Regional Stormwater National Pollutant Discharge Elimination System Permit (MRP) on November 19, 2015 as Order No. R2-2015-0049; and

WHEREAS, the City of Dublin is a permittee under the MRP; and

WHEREAS, per the MRP a Green Stormwater Infrastructure Plan must be adopted describing how permittees intend to include green stormwater infrastructure (GSI) in appropriate projects on public and private lands to reduce to the maximum extent practicable adverse water quality impacts due to urbanization and to meet the Total Maximum Daily Loads wasteload allocations for mercury and polychlorinated biphenyls; and

WHEREAS, the GSI Plan is intended to describe how permittees, over the long-term, will shift impervious surfaces and storm drain infrastructure from gray, or traditional storm drain infrastructure where runoff flows directly into the storm drain and then to receiving water, to green, which is a more resilient, sustainable system that slows runoff using vegetated systems; and

WHEREAS, GSI can provide additional benefits such as mitigating for the urban heat island effect, improving local air quality, reducing localized flooding, providing carbon sequestration opportunities, and improving the streetscape enhancing the bicycle-pedestrian experience; and

WHEREAS, the City of Dublin has demonstrated its commitment to an environmentally sustainable future through its policy goals and actions and intends to incorporate GSI into projects when doing so will benefit the environment and when a funding source for GSI has been identified; and

WHEREAS, in order to be in compliance with the MRP, a Green Stormwater Infrastructure Plan has been prepared for the City of Dublin.

NOW, THEREFORE, BE IT RESOLVED, that the City Council of the City of Dublin does hereby approve the City of Dublin Green Stormwater Infrastructure Plan, attached as **Exhibit A**.

BE IT FURTHER RESOLVED that the City Manager, or designee, is authorized to update the Green Stormwater Infrastructure Plan, including maps and potential project locations, as necessary and identified through an adaptive management process.

PASSED, APPROVED AND ADOPTED this 18th day of June, 2019, by the following vote:

AYES: Councilmembers Goel, Hernandez, Josey, Kumagai, and Mayor Haubert

NOES:

ABSENT:

ABSTAIN:

Mayor

ATTEST:

City Clerk