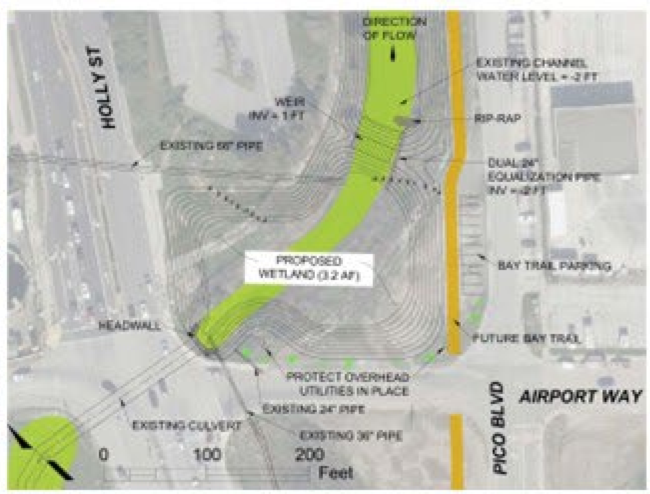
OFFICE OF SUSTAINABILITY
COUNTY OF SAN MATEO

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

Concept Design Report

San Carlos Airport Regional Project

May 31, 2022



San Mateo County Office of Sustainability (OOS)
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craft water engineering, inc.

ADVANCING REGIONAL STORMWATER MANAGEMENT IN SAN MATEO COUNTY

CONCEPT DESIGN REPORT

SAN CARLOS AIRPORT REGIONAL PROJECT

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PRESENTED TO

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
ac-ft	acre-feet
BMP	Best Management Practice
cfs	cubic feet per second
EPA	Environmental Protection Agency
EWMP	Enhanced Watershed Management Program
ft	feet
GIS	Geographic Information System
hr	hour
in	inch
LACDPW	Los Angeles County Department of Public Works
LACFCD	Los Angeles County Flood Control District
LiDAR	Light Detection and Ranging
LSGR	Lower San Gabriel River
LSGR WMP	Lower San Gabriel River Watershed Management Program
LSPC	Loading Simulation Program C++
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NSF	National Sanitation Foundation
O&M	Operations and Maintenance
RAA	Reasonable Assurance Analysis
RWL	Receiving Water Limit
SUSTAIN	System for Urban Stormwater Treatment and Analysis IntegratioN
TMDL	Total Maximum Daily Loads
WMMS	Watershed Management Modeling System
WMP	Watershed Management Program
WQBEL	Water Quality-Based Effluent Limit

1.0 INTRODUCTION AND EXISTING CONDITIONS

Figure 1-1. Project location.

To address the requirements of the Municipal Regional Permit (MRP), the County of San Mateo, City/County Association of Governments of San Mateo County (C/CAG) and other agencies are collaborating to determine the most impactful and effective ways to capture stormwater and improve water quality in managed watersheds that include their jurisdiction. The MRP, a Phase I municipal stormwater permit, was issued by the San Francisco Bay Regional Water Quality Control Board and includes requirements for Permittees to address regional water quality issues including trash loading and TMDLs (Total Maximum Daily Loads) for mercury and PCBs (polychlorinated biphenyls) as part of the San Francisco Bay Basin Plan. To provide required pollutant reductions and contribute to other regional watershed management goals (flood management, green infrastructure, water reuse, etc.), C/CAG has taken a progressive approach to achieve compliance with the MRP in a cost-efficient manner by promoting multi-benefit projects and leveraging collaboration and funding sources. C/CAG's recently completed Regional Collaborative Program Framework White Paper (C/CAG, 2022) provides a cost-benefit analysis of regional project implementation and countywide programmatic implementation of distributed green infrastructure (GI). The White Paper identifies regional projects as a more cost-effective and optimized approach to achieving multi-benefit objectives. An additional outcome of the White Paper is the identification and prioritization of the next round of regional project opportunities throughout the County.

A regional stormwater capture project is proposed at the San Carlos Airport near San Carlos within San Mateo County jurisdiction. The map above (Figure 1-1) shows the location of the proposed project. The project is an online system intended to intercept the dry-weather flow and wet-weather stormwater flows from the adjacent open channel to a restored stormwater wetland/detention basin along the airport access road within the Phelps Slough. Stormwater will be diverted from the open channel running west to east within the northeastern side of the airport property. The site location proposes several technical design decisions that will be addressed in this document, including the following:

- Online Stormwater versus a Diversion Location
- Best Management Practice (BMP) Type and Configuration

Each of these components of design for this project have been evaluated with emphases on feasibility, constructability, cost-effectiveness, and water quality impact. The full range of options for this project has been assessed to ensure that final design recommendations best match desired outcomes for the project and provide the maximum benefit given site constraints. Additional considerations for the project have been evaluated to ensure that the final design considers community impact and enhancement, regional water reuse efforts, and ongoing operations and maintenance costs. Details of this analysis and the findings can be found herein.

1.1 PROJECT OBJECTIVES

The objective of this report is to provide 10% design-level documents that will ultimately guide the development of the 100% detailed design documents and project implementation. The project concepts presented herein will be optimized to meet the stormwater management needs of the region, as demonstrated by supporting technical design, hydrologic, hydraulic, and water quality analytics. This document demonstrates preliminary consideration of the technical challenges for this project as well as creative solutions that overcome these challenges by ensuring the technical feasibility of the project and positioning the design for future grant-funding with a clear demonstration of effectiveness and constructability.

1.2 EXISTING SITE CONDITIONS

This project site near 395 Shoreway Rd, San Carlos, CA 94070 is composed of two parcels owned by the San Carlos Airport within San Mateo County. The eastern parcel has an area of 1.5 acres and the western parcel has an area of 3.6 acres. The site is accessible from the surrounding streets: Holly St on the northwest, Airport Way on the southwest, and Pico Blvd on the southeast. The parcels are the upper most portion of the Phelps Slough and and contain a channelized storm drain that passes between various commercial developments. The channel slope conveys flows from west to east with sizeable levee sidewalls at an approximate 7:1 slope. The south corner of the parcel is a flat and open area separated from the rest the parcel by a fence. This empty area will be transformed into the future Bay Trail, a parking lot, and a portion of the proposed wetland. The rest of the parcel is covered by vegetation, gravel, and a few trees. A paved but unkept maintenance access road can be found on the north side of the parcel that travels parallel to the channel. The access road has significant cracks and weathering and has developed vegetation within the pavement openings. The project bounds are outside of the airport runway approach/takeoff and is immediately north of the hanger and maintenance facilities of the airport.

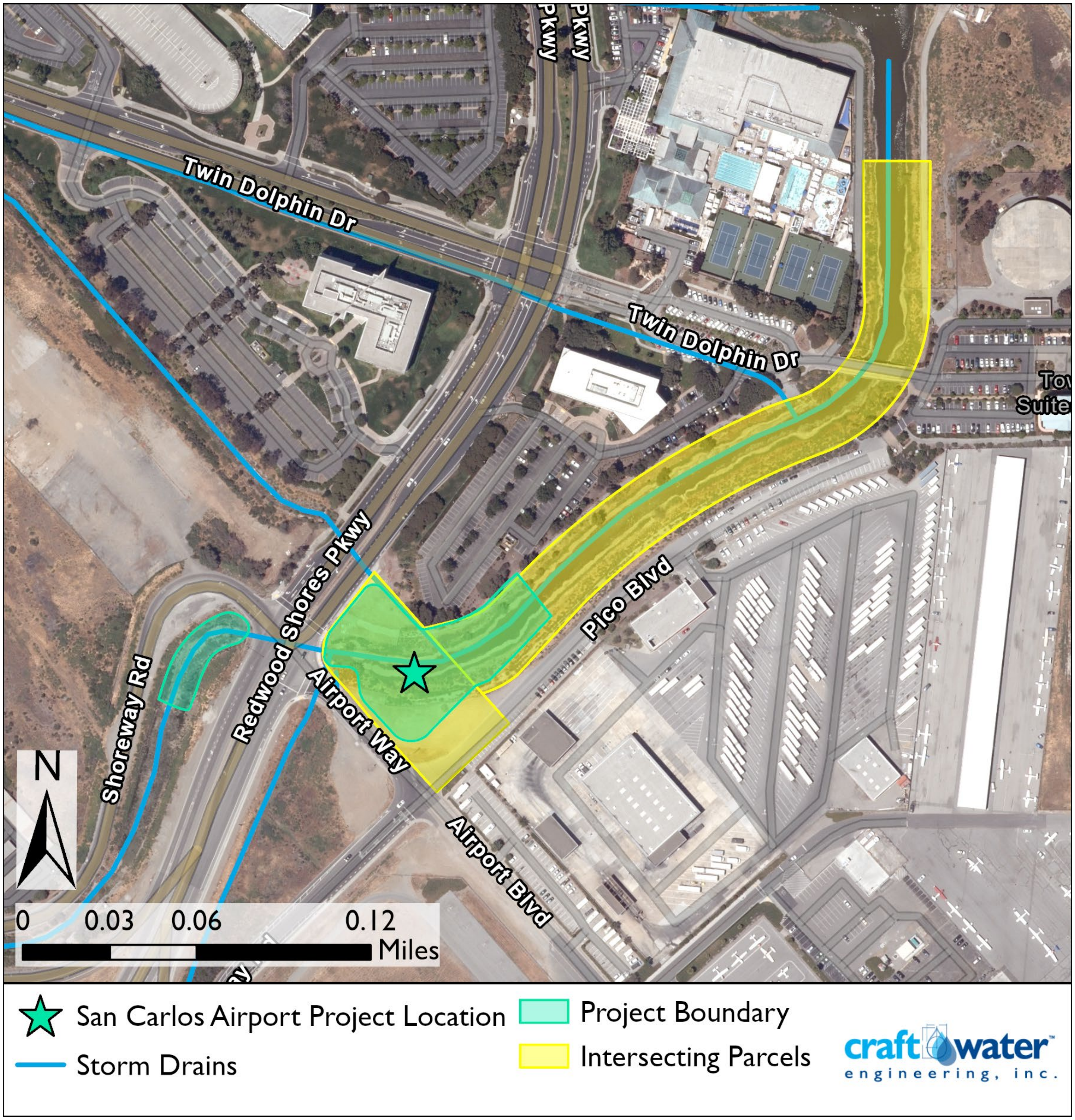


Figure 1-2. Site location and project boundary.

1.2.1 Utility Information

Various utilities exist on the southwest side of the proposed wetland along Airport Way. Two utility poles with overhead cables and guy wire anchors in addition to select underground utilities were observed along Airport Way. Several storm drains discharge into Phelps Slough; a 66" pipe across Holly Street, a 24" pipe on the east side of Airport Way, a 36" pipe across Airport Way, and a culvert running beneath the intersection of Holly Street, Airport Way and Shoreway Road. Care will need to be taken when crossing or constructing near each of these utilities. The exact invert depths will need to be determined during the design phase of the proposed project.

1.2.2 Geotechnical Investigation Constraints

A review of the San Mateo Plain Groundwater Basin Assessment dated July 2018, (County of San Mateo) revealed shallow groundwater depths at the project site which is anticipated due to the proximity to the San Francisco Bay and present water surface elevations of the Phelps Slough within the project site of 2 feet below sea level. While this information is sufficient to develop preliminary design concepts, it is recommended that additional geotechnical investigation be conducted given the results of this report to further develop geotechnical design recommendations in support of final design documents.

1.2.3 Stormwater Capture/Diversion Location

The San Carlos Airport site provides multiple capture/diversion points that can be drawn from to route to the proposed facility to improve water quality. The potential locations were identified (Figure 1-3), and will require careful future analysis of flood control capacity, hydraulic capacity required to tie-in to existing infrastructure, and retrofit of existing infrastructure, as well as agency permitting and coordination that the diversion may require. A box culvert beneath the intersection of Shoreway Rd, Airport Way and Holly St runs west to east and is connected to Phelps Slough. Three other storm drains discharge into Phelps Slough: a 66” pipe running northwest to southeast under Holly St; a 36” pipe and a 24” pipe both running south to north under Airport Way. The wetland basin is positioned to treat and detain runoff from each of these pipes.

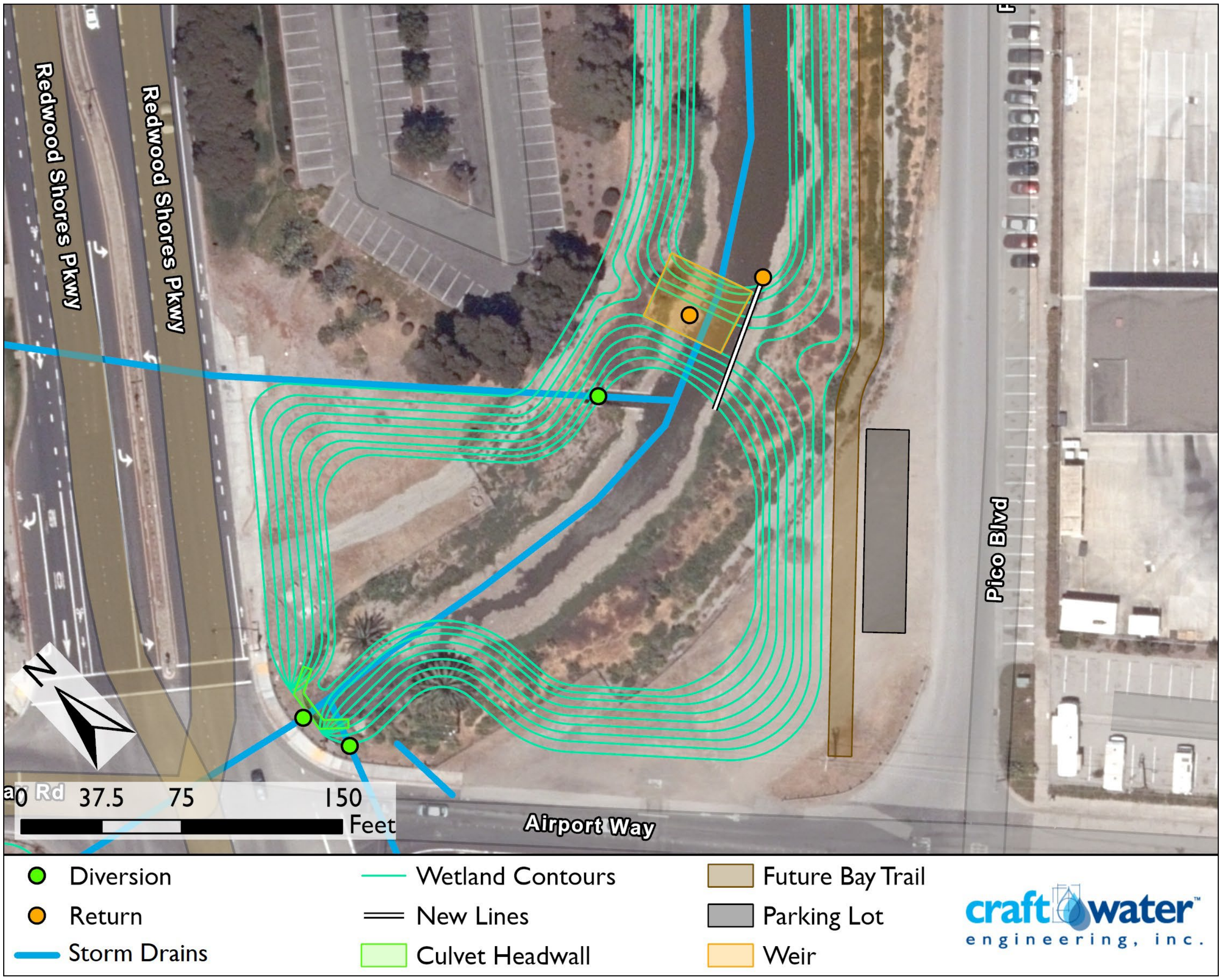


Figure 1-3. Map of capture/diversion locations.

2.0 DECISION SUPPORT MODELING

The purpose of the San Carlos Airport project is to maximize pollutant removal and stormwater capture for groundwater recharge and/or beneficial reuse of captured stormwater; therefore, alternative system configurations were modeled to quantify potential performance associated with these goals and provide design options and considerations for advancing this project concept. The performance of the project as a whole is dependent on a number of configuration options as well as site constraints that determine the range of options available for the stormwater capture unit. The following sections briefly summarize the strategy to most accurately simulate these realistic engineering constraints while optimizing the system configuration to provide the most cost-effective recommendation that best meets the goals of runoff capture, water quality benefit, and water supply augmentation and reuse.

2.1 BASELINE CONDITIONS AND CONSTRAINTS

The following subsections summarize the performance targets, baseline runoff and pollutant loading, onsite non-potable water demand, and groundwater considerations used to inform modeling.

2.1.1 Stormwater Performance Targets

In accordance with the MRP sizing requirements and other countywide multi-benefit stormwater goals, the goal of capturing 80% of annual runoff over the long term has been established for regional projects. This target follows the regional goal of maximizing stormwater treatment by effectively treating the water quality design runoff volume for a project's drainage area. Long-term baseline hydrology from the Reasonable Assurance Analysis (RAA) was utilized to assess how different project options contribute to this goal at the project site. Runoff capture was also paired with pollutant reductions to contextualize the multi-benefits offered by different design options for this project. By leveraging long-term hydrology and pollutant modeling, the final recommendations reflect performance for a broader range of precipitation conditions that can better address potential variations in precipitation related to climate change.

2.1.2 Watershed Characterization

For this study, the Loading Simulation Program C++ (LSPC) from the RAA (C/CAG 2020) was used to simulate the sediment-bound pollutant loading, runoff volume, and flow rate associated with a long-term, 10-year continuous time series (Water Year 2006 to Water Year 2015). This model was developed and calibrated to meet criteria established by the *Bay Area Reasonable Assurance Analysis Guidance Document* (BASMAA 2017).

The drainage area delineation for the project site (see Figure 2-1) was developed using geospatial data associated with the RAA modeling subwatersheds and verified/corrected slightly using further geographic information system (GIS) analysis where full subwatersheds did not coincide with project locations. Digital storm drain inventories and high-resolution Light Detection and Ranging (LiDAR) elevation data were used to accomplish subwatershed splitting. Developed drainage areas were used to model runoff and water quality that was then utilized to optimize the BMP decision variables. The overall drainage area size and impervious fraction are summarized in Table 2-1.

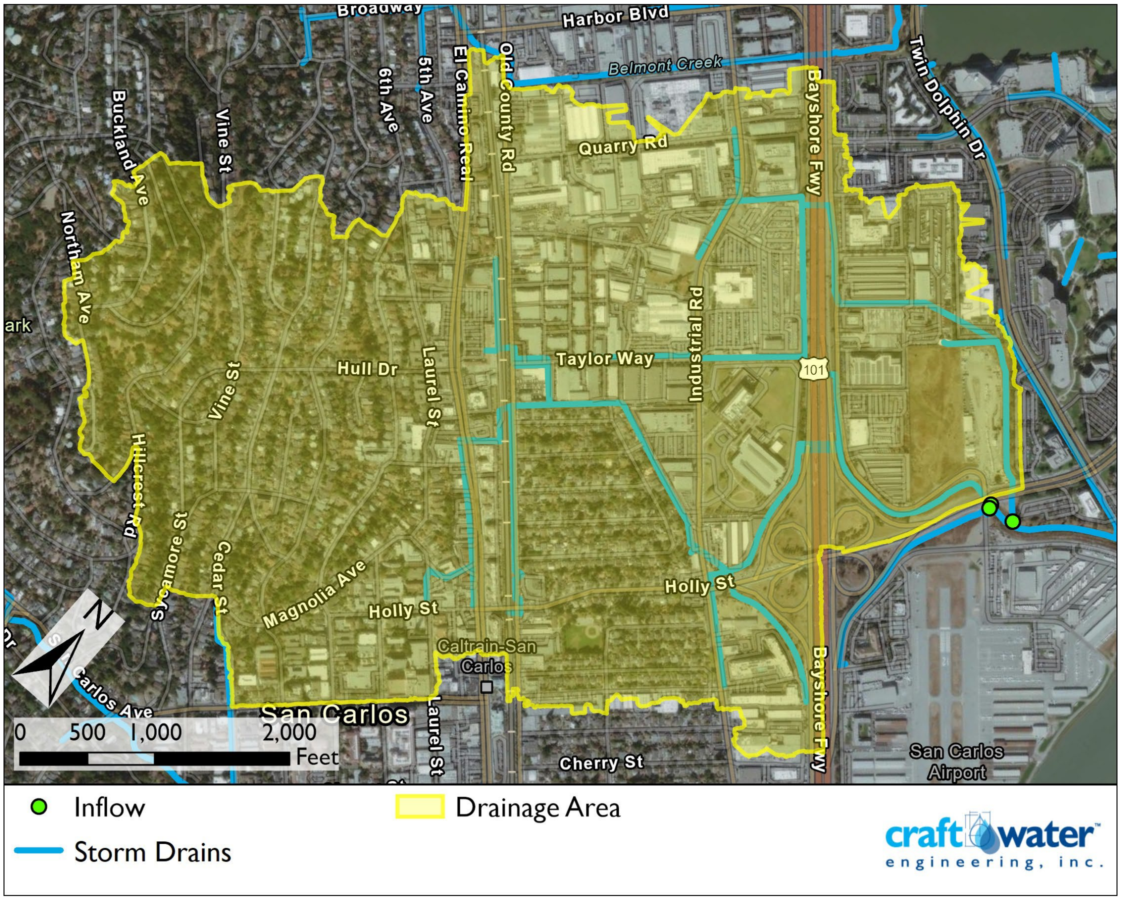


Figure 2-1. Project drainage area.

Table 2-1. Summary of modeled watershed hydrologic and water quality conditions for the Project drainage area.

Total Drainage Area (ac)	Impervious Drainage Area (ac)	Average Annual Runoff (ac-ft)	80% Avg. Annual Runoff Capture Target (ac-ft)	Average Annual TSS Loading (lbs)	Average Annual PCB Loading (g)	Average Annual Hg Loading (g)
569	400 (70%)	303	242	220,000	56.9	11.3

2.1.3 Hydrologic Considerations

Long-term baseline flows and pollutant loads to the site using the 2020 RAA model are summarized in Table 2-1. The annual loadings presented in this table represent the maximum possible reductions that could be achieved by control measures at the project site. However, pragmatic diversion limitations, space constraints, and subsequent treatment mechanisms will ultimately limit how much runoff and associated pollutant levels can potentially be diverted into the BMP. The 80% long-term runoff capture target is also identified in the table and will serve as a design consideration in sizing the BMP and making a final recommendation for this site.

2.1.4 Primary BMP Treatment/Discharge Alternatives

Multiple fates for the discharge of captured stormwater have been considered for the San Carlos Airport Project. They are detailed here with acknowledgement of specific constraints and parameters that have been used in BMP modeling to accurately simulate the differences among the alternatives.

2.1.4.1 Detention/Wetland Flow

The San Carlos Airport Project has been initially conceived of as a wet/dry detention area that provides storage for stormwater capture, detention, and slow release back to the channel. Treatment of captured runoff would occur via pretreatment and the detention of water within the wetland to allow for settling of remaining sediments within the storage basin. The ultimate design for this basin should define detention times for water related to final configurations and should design the outlet orifice that will return flow to the channel with this detention time in mind. As this is an initial concept, these details will be reserved until further site information and configuration decisions have been made as they are highly sensitive to other components and constraints of design. For purposes of this initial concept report, wetland detention time has been modeled according to benchmark throughflow rates of 2, 4, 6, and 8 cfs to represent a range of potential performance that could be realized at this site. These rates span the range of typically available filtration devices and have modeled to find an approximate optimal value, but final design modeling should be updated according to selected filtration device specifications. In further stages of design, detention and treatment rates can be defined and designed to meet the ideal throughflow for the wetland basin subject to other site-specific considerations and configurations.

2.1.4.2 Infiltration

Typical stormwater wetland design often entails sealing off the basin to native soils to ensure the wetland maintains a standing pool of water and baseflow. However, wet/dry detention basins in more seasonally dry climates can utilize a detention basin that is only seasonally inundated and use infiltration as a primary treatment mechanism in addition to detention and settling when the basin experiences wet-weather flows. No local geotechnical investigations for the project site have been conducted, so subsurface infiltration rates are currently unknown. Local soil types indicate mostly urban soils exist at the site in HSG C. Most of San Mateo County's soils are either in HSG C or undefined, and these soils are not typically associated with high infiltration rates. Modeling in the RAA (C/CAG 2020) utilized an infiltration rate of 0.5 in/hr for projects with similar soil types. This infiltration rate was utilized in modeling this site but will need to be verified in future design stages due to the high sensitivity of BMP performance and sizing recommendations related to this important performance variable. A more conservative infiltration rate of 0.2 in/hr was also modeled which represents average rates for HSG C soils identified by a large review of national studies (MSSC 2005) and documents relating this property to the HSG. Geotechnical investigation will be needed to further verify that infiltration is feasible at this location, and it may potentially be infeasible due to the proximity to the Bay.

2.1.4.3 On-site non-potable use

Capture, storage, and filtration of stormwater is increasingly utilized for on-site non-potable use as stormwater offers an attractive supplemental water source where water demands can be met by dry-weather flows. Coordination with the City/County can identify other non-contact uses including municipal tree watering, street sweeping, or other on-site non-contact uses through airport operations This option will require a treatment system that filters and sanitizes stormwater so that it is safe for irrigation and able to meet or exceed National Sanitation Foundation NSF-350 standards for non-potable water, as well as any local water quality standards. An assessment of expected monthly irrigation demand and average monthly dry-weather flows will provide further information whether this practice would be warranted at this site.

2.1.4.4 Filtration / Return to Storm Drain

As an enhancement to detention and wetland processes, the San Carlos Airport Project site could be designed to capture stormwater and filter it, using a proprietary stormwater filtration unit before returning captured flows to the channel. This option typically offers an alternative discharge in areas where infiltration is infeasible or limited in throughput and provides assurance that captured water will be treated effectively and that the BMP will operate efficiently. Based on current regulatory interpretations in the area, filtration of captured stormwater and return to storm drains using proprietary devices is not currently acceptable practice to receive full credit for treatment via regional BMPs. This option was still considered, and performance results will be shared herein as an alternative treatment if necessary in the future.

2.2 WATER QUALITY OPTIMIZATION STRATEGY

The primary design goal of the San Carlos Airport Project is to capture runoff and reduce long-term annual loading of pollutants to the watershed and downstream receiving waters. To ensure that the system will be sized to maximize load reductions in a cost-effective manner, optimization modeling was performed.

The purpose of optimization modeling is to balance design components (including BMP volume and inflow diversion rates) such that no one component limits the performance of the system subject to potential discharge options (see Figure 2-2 at right). Optimization supports decision making throughout the design process by guiding selection of the most cost-effective system design.

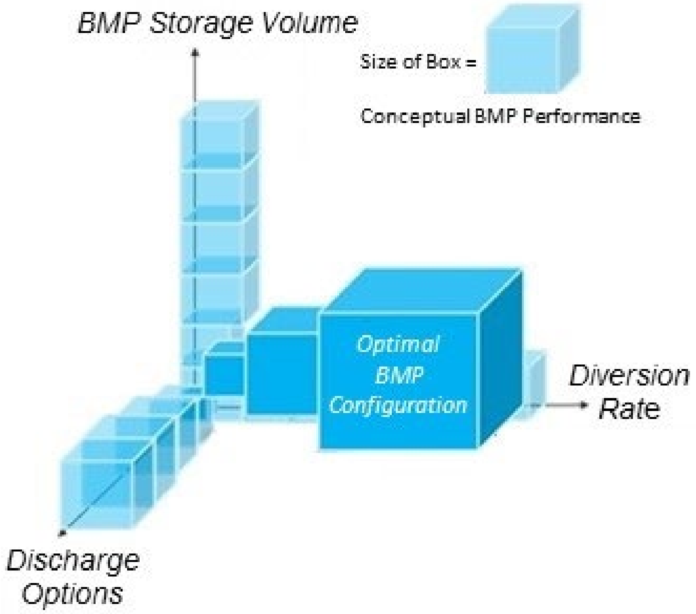


Figure 2-2. Conceptual graphic representing BMP configuration optimization.

The model setup for water quality simulation and optimization is complex, involving several modeling systems and iterative feedback from design engineers. In this approach, sediment pollutant loading capture is a useful surrogate for overall water quality cost-optimization as significant pollutants of concern (metals, PCBs, nutrients) are typically sediment bound. The general methodology is discussed below, and the results are presented thereafter.

2.2.1 Preliminary Size and Diversion Optimization

The first step of the modeling was to predict BMP performance for a range of potential BMP sizes, diversion points and inflow rates, and discharge alternatives. A custom BMP model was used to improve upon certain modeling limitations in EPA's System for Urban Stormwater Treatment and Analysis Integration (SUSTAIN). This custom model is grounded in the physical BMP representations used in SUSTAIN, and it provides built-in optimization algorithms to more systematically automate the process of evaluating many different BMP configurations to select a cost-effective solution related to project goals. The model was run using 10 years of runoff and pollutant loading time-series data generated by LSPC at an hourly time step. During this preliminary decision-support modeling, the discharge alternatives were simulated using certain site constraints to capture approximate BMP throughflow rates at the same time as varying the diversion rate and storage volume. These preliminary optimization model runs produced a point cloud from which the optimal cost-effectiveness curves were extracted. Subsequent targeted modeling then provided a clear decision pathway for the development of optimal project alternatives. Modeling efforts investigated the range of BMP configurations as detailed in the following subsections.

2.3 OPTIMIZATION MODELING RESULTS

The optimization analysis aimed to maximize the long-term runoff capture and pollutant load reduction by simultaneously varying the diversion rate, BMP size, and discharge rates related to options previously discussed. Each of these design features has an associated range of options that were modeled to assess alternatives against long-term water quality benefits and identify the most effective alternative. By optimizing based on these variables, multiple pathways to achieve maximum water quality benefit were identified and the most cost-effective alternatives were determined. Different configuration alternatives and modeling parameters are presented below to demonstrate the cost-effectiveness associated with these options and narrow them down to a few key recommended project configurations that will provide the most cost-effective range of benefits in line with regional stormwater management goals.

2.3.1 Diversion Rate

Because of different on-site operational constraints at the San Carlos Airport, a project at this site will be required to be sited in-line with flows along the existing drainage channel with multiple additional outfalls to the channel located in the vicinity of the in-channel storage that will be created. As such, the project will receive the full magnitude of flows from the associated drainage area and a diversion to an off-line storage facility is not recommended.

2.3.2 Sizing for Runoff Capture Volume Targets

The ultimate water quality goal for the San Carlos Airport Project would be to size the BMP so that it is able to capture 80% or more of the long-term estimated annual runoff. The BMP was modeled across different storage sizes up to 5.0 ac-ft to assess the relationship between storage and runoff volume capture. Figure 2-4 shows how runoff capture varies with storage volume for an in-line BMP at this site. Because of the large drainage area and predicted flow regime, the BMP is not able to meet the 80% runoff reduction target for the modeled range of BMPs at this site in this storage size range. While the 80% runoff capture target might be infeasible to accomplish for this site, a regional BMP at San Carlos Airport would still offer substantial runoff capture and water quality benefit for the drainage area.

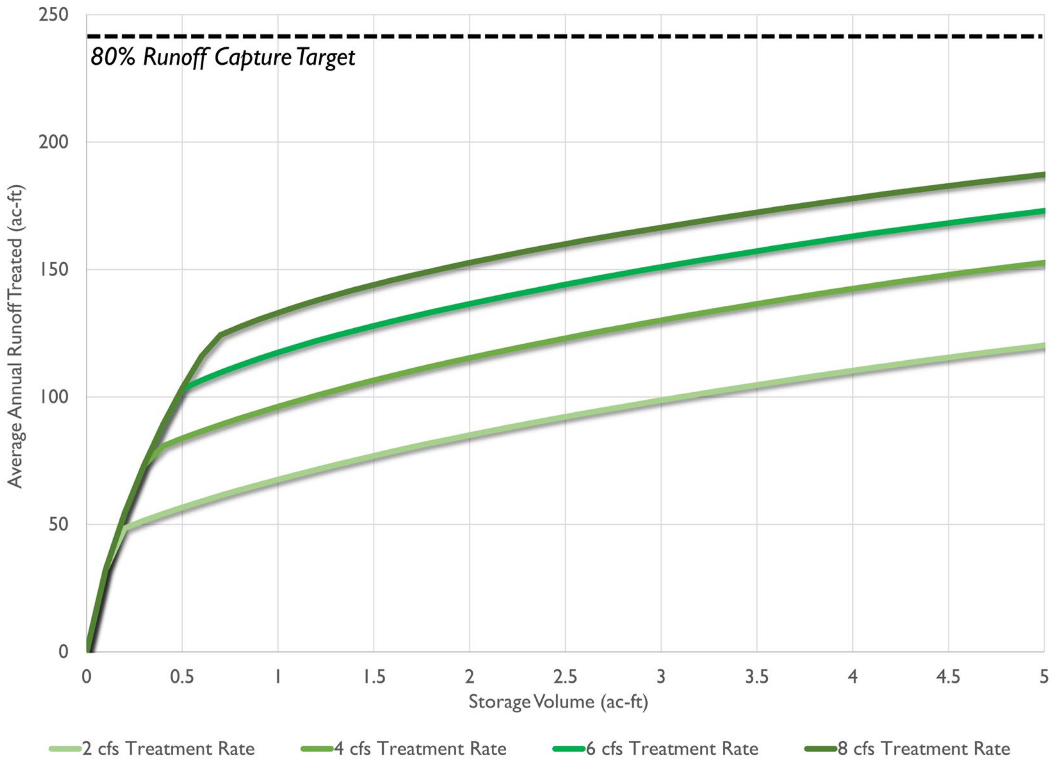


Figure 2-3. Runoff capture as a function of storage volume for the project.

2.3.3 Sizing for Water Quality Benefits

Often regional BMPs have very large drainage areas and only a modest portion of annual runoff can be captured. If sized correctly, these practices can still be very impactful in terms of pollutant reductions. Assessing the modeling results across BMP storage volumes for an in-line BMP, it is evident that this is the case at the San Carlos Airport Project site (Figure 2-5). It can be seen by the shape of these curves that runoff capture and pollutant reduction do not occur in sync and that these dynamics are related to storage volume in a somewhat different manner due to the different dynamics in the watershed related to rainfall-runoff responses and pollutant generation. In lieu of meeting runoff capture targets, it is useful to size a BMP to maximize water quality benefits as a secondary criterion at a storage volume along these curves before they show diminishing returns (ie, only slight increases in water quality benefit for increased storage volumes). This sizing will be revisited in the following section to highlight multiple potential BMP endpoints for this site.

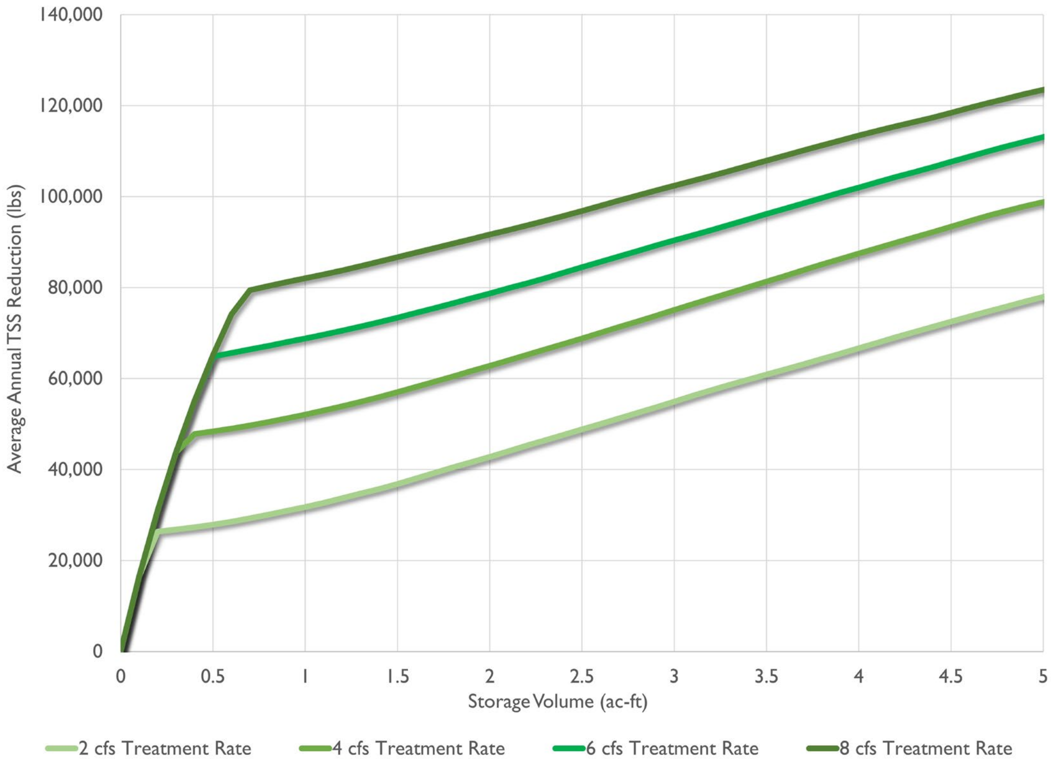


Figure 2-4. Water quality benefit as a function of storage volume for the project.

2.3.4 Considering On-site Irrigation Reuse

The use of captured stormwater for irrigation use was not explicitly modeled. This is because this reuse option would accompany infiltration options as an ancillary benefit and would not have a significant additional impact on overall annual water quality benefit estimates. Dry-weather flows are typically tapped as a resource for irrigation reuse because the volume is more manageable, reliable, and appropriate for use as an irrigation water source. Because of the large drainage area treated by this Project, dry-weather flows are likely to be larger and more reliable than most urban sites. There is typically adequate available storage in the BMP during dry conditions to capture all dry-weather flows and either filter them for irrigation use or allow them to discharge normally. To better understand on-site irrigation demands, monthly estimates for the San Carlos Airport site were calculated based on average monthly evapotranspiration data (CIMIS 2019) using the SLIDE rule (Simplified Landscape Irrigation Demand Estimation; ANSI 2017). These results are displayed in Figure 2-6, and they indicate that average monthly irrigation demand (here presented for up to 0.5 acres of irrigated area) exceeds dry-weather runoff for most of the year. For these purposes, dry-weather runoff here has been defined as modeled runoff on days when rainfall is less than 0.1 inches. While dry-weather flows should always be verified through monitoring, the size of the drainage area may not supply enough flow to meet local irrigation demands nearby this site and is not likely to be effective for this project.

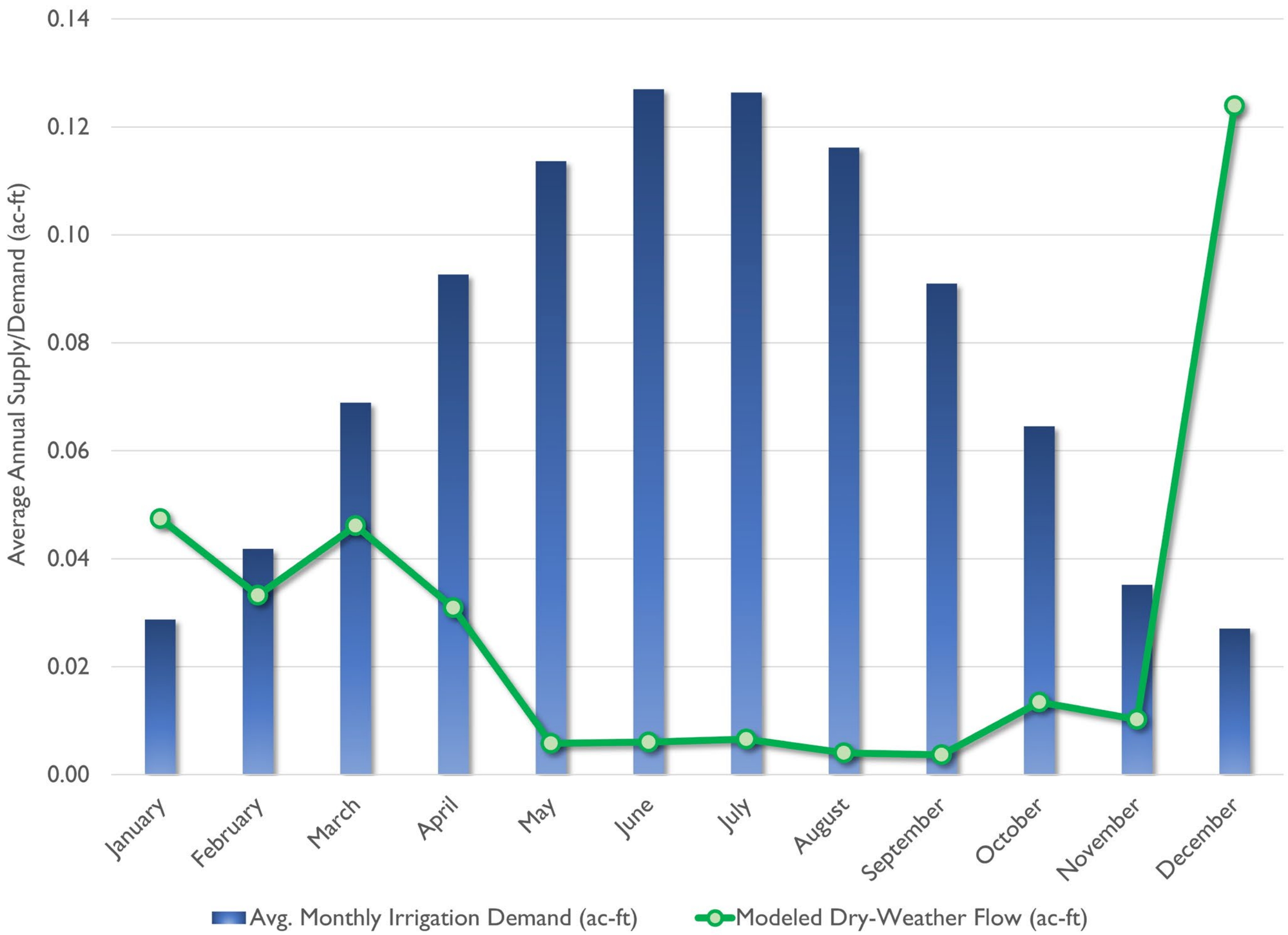


Figure 2-5. Estimated irrigation water demand and potential dry weather supply for the project.

2.3.5 Cost Considerations and Final Project Sizing

To make final recommendations, water quality benefits predicted for the different BMP configuration options must be weighed against capital construction and operations and maintenance costs (O&M; 20 years included) to determine the optimal choice for the San Carlos Airport Project. Table 2-2 details key aspects of cost that are both consistent among and differentiate the various modeled options. These should be weighed when deciding between final configuration and options.

Table 2-2. Summary of key cost components for different discharge options.

Cost applicable to….	Key Cost Components	O&M Cost Components
All Options	Diversion Infrastructure, Pretreatment	Inspection, Sediment Removal
Wetland Basin	Excavation/Grading, Planting, Outlet Control	Plant Upkeep, Outlet Cleanout
Irrigation Reuse	Filtration Unit, Irrigation System	Filter Operation, Cleaning/Replacement
Auxiliary Filtration	Excavation, Filtration Unit(s)	Filter Cartridge Cleaning

2.3.5.1 Project Sizing Decisions

Sizing BMP storage for a given project site is typically done to one of two endpoints; (1) being the most cost-effective size related to a certain performance metric or (2) to the maximum feasible size given site footprint constraints if the cost-effective size exceeds this maximum. Investigation of the existing topography at the San Carlos Airport site indicated a maximum storage size of 3.2 ac-ft without raising the banks or weirs in the vicinity of the project location. Based on the curves for water quality benefit at this site (shown in Figure 2-7), points of diminishing returns are beyond the maximum feasible project size for the site. Thus, building this Project out to this maximum size is advisable. Performance details for the four modeled treatment rates is summarized in Table 2-3.

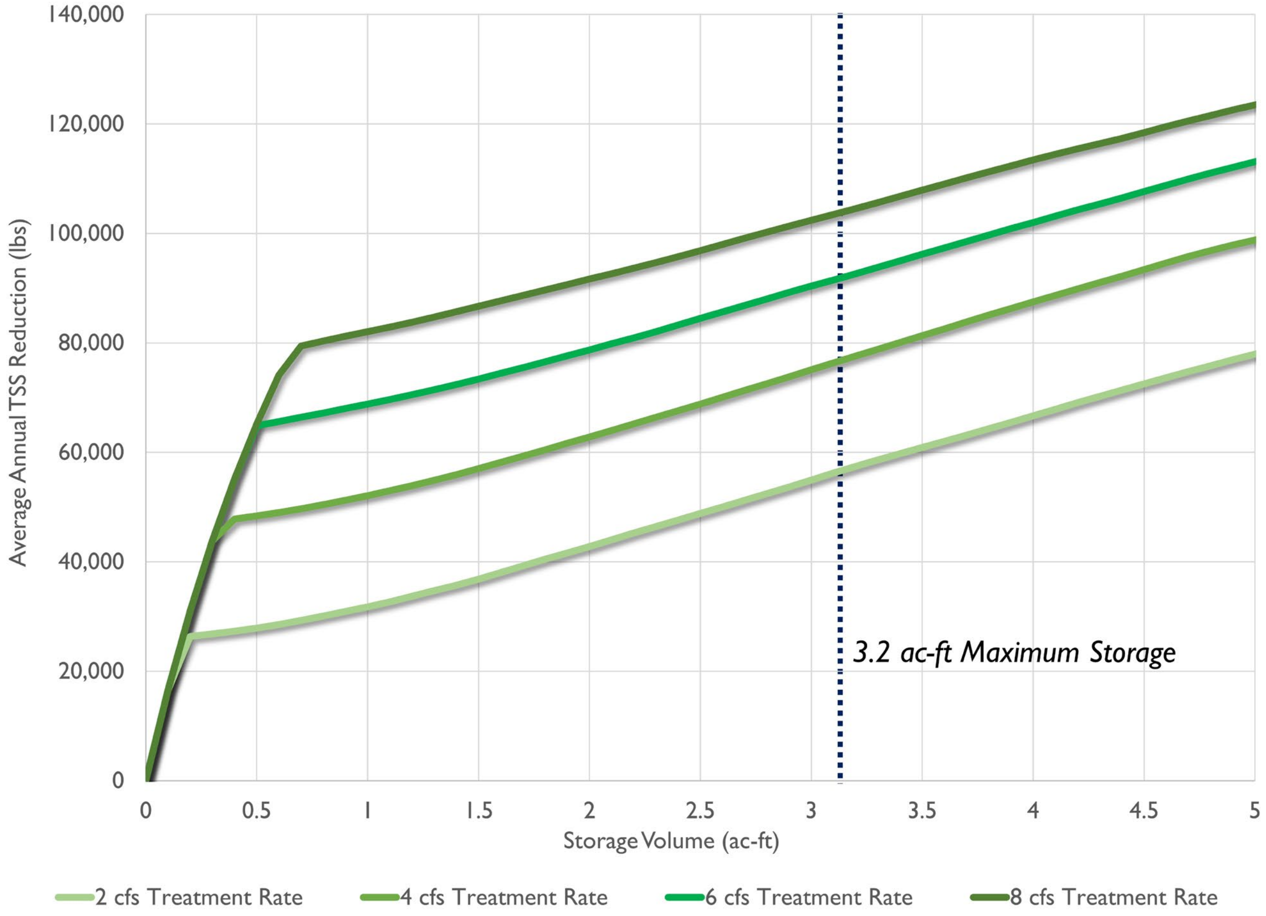


Figure 2-6. Project storage volume vs pollutant reduction for an in-line BMP at the site.

BMP Size Options

The following BMP sizes are recommended based on different endpoints of design and with the range of performance that might be realized using different discharge options.

Capture of 80% of Long-Term Annual Runoff

Feasible capture of 80% of average annual runoff is not possible across modeled BMP storage volumes with in-line flow, nor any other project size or configuration considered. Because of the large drainage area treated by this project, this goal is not practical with a project at this site alone for this drainage. However, a BMP at San Carlos Airport will provide capture and treatment of lower baseflows and wet-weather for smaller rain events, and this water can be targeted for reuse if desired as well.

Most Cost-Effective Pollutant Reduction

Because capture of 80% of the long-term annual runoff at this site would be difficult and cost-prohibitive, a more cost-effective sizing approach would be to right-size the BMP to maximize water quality benefits up to a BMP size of diminishing returns. Since this sizing would be at or beyond the maximum feasible storage size for the site, a BMP with the maximum of 3.2 ac-ft of storage is recommended. The expected benefits for this BMP size have been summarized in Table 2-3 for different treatment rate endpoints that will need to be further defined in later stages of design. These are also displayed in Figure 2-7.

Table 2-3. Summary of cost-effective BMP performance for each discharge option

Treatment Rate	Avg. Annual Runoff Capture (%)	Avg. Annual TSS Reduction (%)
2 cfs Total	33%	26%
4 cfs Total	44%	35%
6 cfs Total	51%	42%
8 cfs Total	56%	48%

Most cost-effective BMP size for the San Carlos Airport site

Based upon the performance analysis, it will be best to size the in-line BMP to the maximum 3.2 ac-ft size. As far as the treatment rate goes, capture seems to start to diminish after a 6 cfs treatment rate based on the results in Table 2-3, so this is the recommended treatment rate to aim for. Further iterations and levels of detail of design should focus on designing detention, the use of infiltration, or a combination of the two to approximate this treatment flowrate. These recommendations can be revisited once site infiltration rates are verified to ensure that this sizing is still the most cost-effective and that a 6 cfs treatment rate still makes sense.

3.0 BMP DESIGN COMPONENTS

This section presents the engineering and design components recommended for the San Carlos Airport project based on the preceding decision support modeling to capture both dry weather and wet weather flows from the channel. An in-stream wetland is proposed at the project location (see Figure 3-1 and Figure 3-2). The system consists of two major components: the treatment wetland, and its outlet structures. Floodplain modeling will need to be performed to refine the current design once detailed survey data of the parcel and surrounding parcels becomes available.

Treatment wetlands are treatment systems that mimic the physical, biological, and chemical treatment processes occurring in natural wetlands. They are designed to enhance treatment processes found in natural wetlands to remove fine sediments, nutrients and other pollutants (e.g. pesticides, heavy metals). While not currently supported by the MRP in terms of LID management and pollutant reduction goals, treatment wetlands are used extensively to treat primary and secondary municipal sewage, landfill leachate, industrial wastewaters, and urban stormwater run-off.

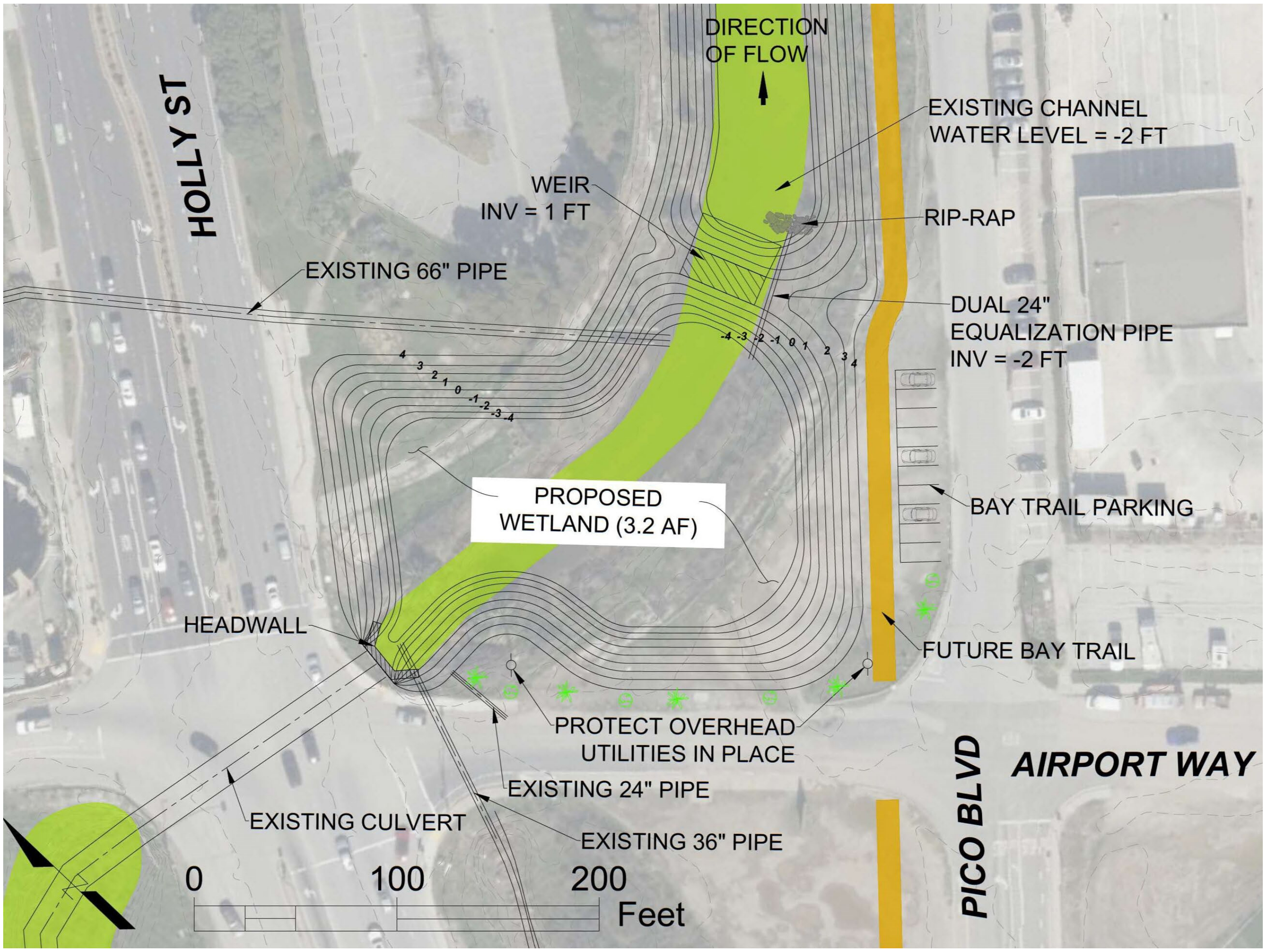


Figure 3-1. San Carlos Airport BMP Layout

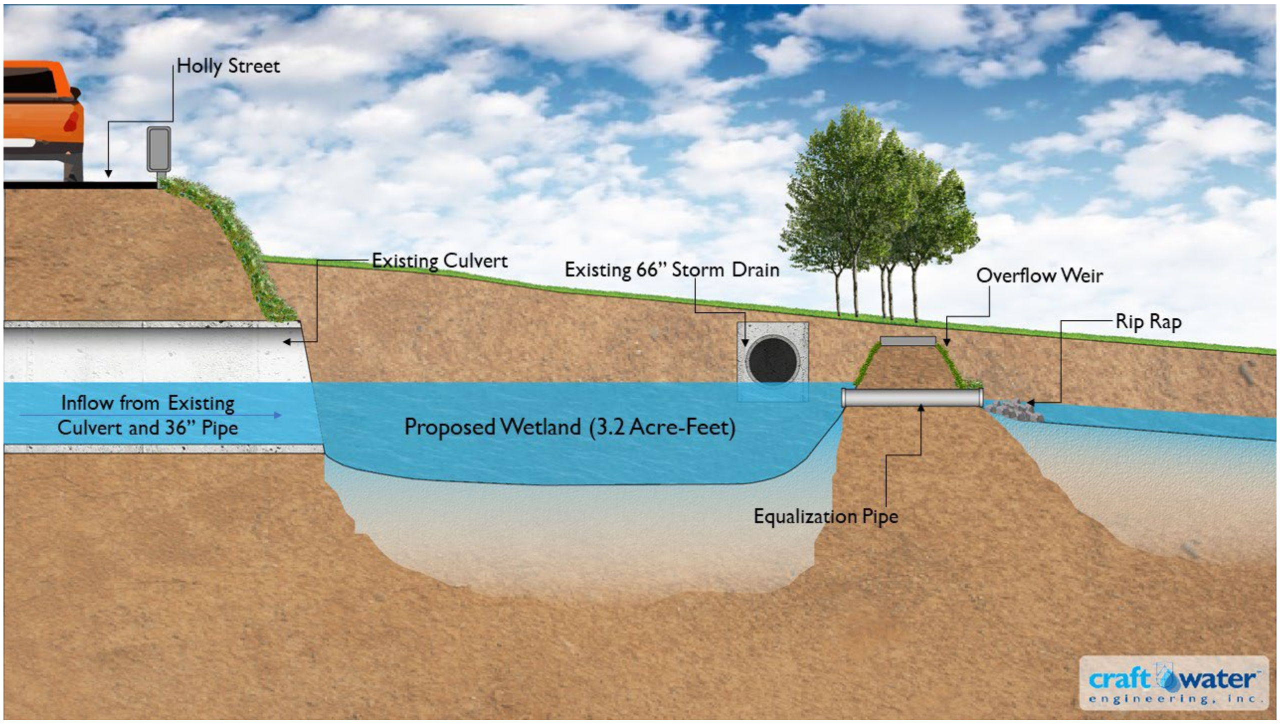


Figure 3-2. San Carlos Airport BMP Preliminary Concept Profile

3.1 TREATMENT WETLAND

Water from three storm drains and a culvert will enter an in-stream, online wetland. The entry point will be armored to prevent scour and erosion and slow the entering flows down. The proposed wetland will have a capacity of 3.2 ac-ft at a maximum depth of 5 feet, and a normal depth of 2 feet under regular flow conditions. The banks of the wetland will have native vegetation that can improve water quality through plant uptake and nitrogen cycling as well as animal habitats. The wetland detention will be separated from the downstream channel by a berm set at 5 feet above the wetland bottom or 3 feet above the current water level. The water level in the wetland is expected to be higher than the current level, which may also raise the water level in the upstream channel outside of the project parcel. A full hydraulic analysis of the detention feasibility to evaluate the flooding risk and tidal effects upstream will need to be examined in the course of design.

3.2 EQUALIZATION PIPE AND WEIR

Water will be treated in the wetland and discharged through an equalization pipe into the existing downstream channel to the Phelps Slough. To maintain a normal depth of 2 feet in the wetland, the equalization pipe will be at the current water surface level of -2 feet. During high flow events when the wetland is full, the flow through the equalization pipe will be supplemented with a high-flow spillway weir that also flows to the downstream Phelps Slough. In-depth hydrological modeling is required in future studies to ensure that the flood control capacity of the channel is not impaired.

3.3 INTEGRATION WITH ONGOING AND FUTURE PROJECTS

A future Bay Trail project will cross the project parcel. The green line in Figure 3-3 shows the trail that runs parallel to the channel. The wetland design takes the anticipated trail and parking area into consideration by leaving enough space on the southeastern side of the parcel.

An additional consideration is the nearby Silicon Valley Clean Water large tunnel/storage project that is located immediately to the north of the project site. This 16 ft diameter tunnel serves as a storage basin for later potable water use. While the tunnel is substantially deep, potential to divert flow from the channel into the tunnel can be further investigated. A flow meter would monitor the directed runoff to evaluate the benefits being realized by the project. This alternative was not evaluated as a part of this project concept report but could be investigated further during project pre-design.

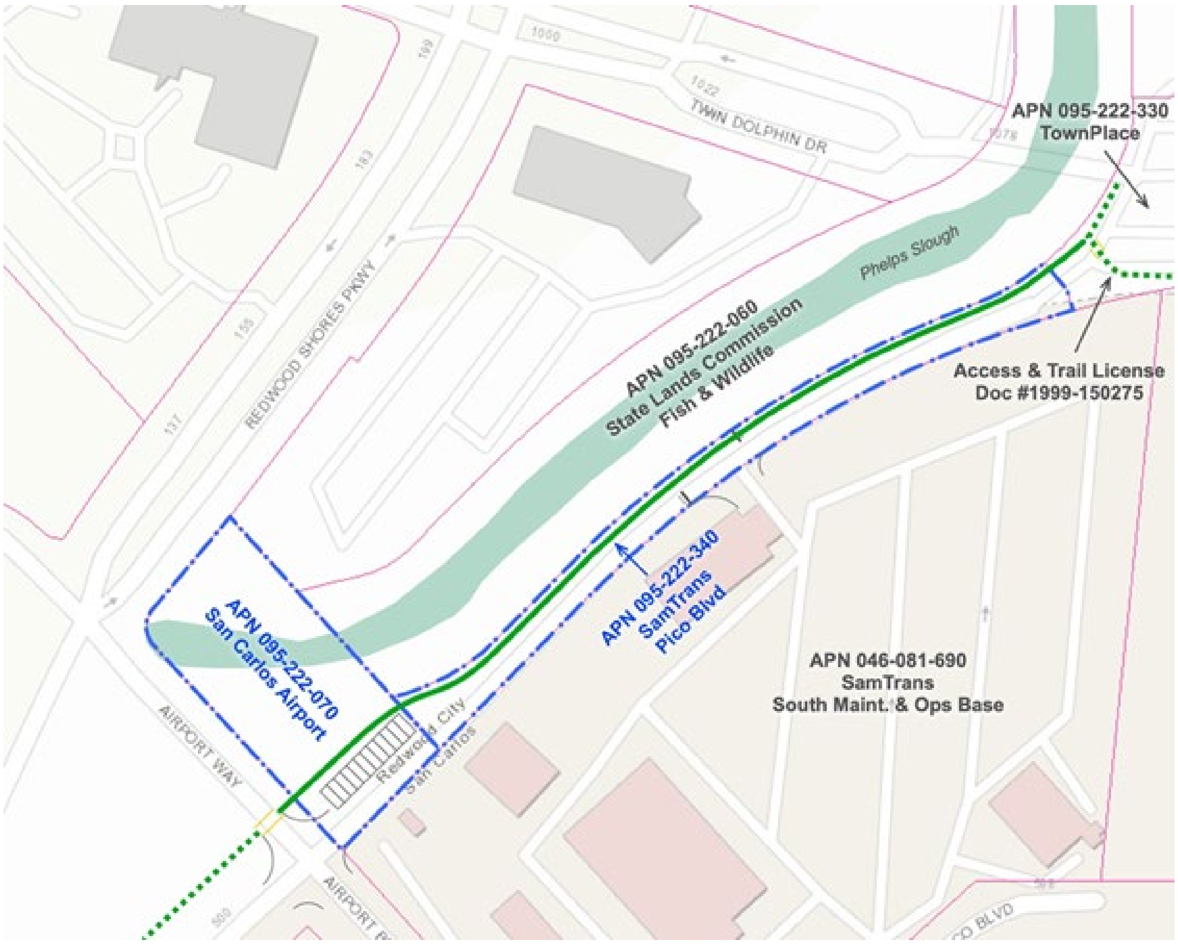


Figure 3-3. Map of the future Bay Trail

4.0 ANTICIPATED PERMITS AND COORDINATION

Consultation with regulatory agencies and acquisition of permits is required before the project components can be constructed. The following table summarizes the plan checks, regulatory permits and approvals relevant to the project (Table 4-1). Additionally, a full Phase I environmental study should be performed at the site.

Table 4-1: Listing of Anticipated Required Permits.

Agency	Permit/Notification Name	Rationale	Initial Steps
United States Army Corps of Engineers	Section 404 Permit	Potential discharge of dredged or fill material into waters of the United States	File a permit with the Army Corps of Engineers
State Water Resources Control Board	CWA Section 401, Water Quality Certification	Potential discharge of dredged or fill material to waters of the State	File a permit with the Regional Board
State Water Resources Control Board	Construction General Permit	One or more acres of soil will be disturbed during construction.	Develop a Storm Water Pollution Prevention Plan (SWPPP).
California Department of Fish & Wildlife	Streambed Alteration Notification 1601	Diversion of flow and alteration of the bed of any river	Submit Lake and Streambed Alteration (LSA) Notification CA DFW
CA Natural Resources Agency	CEQA Initial Study	State mandated environmental review	Prepare the Initial Study and associated documentation (Mitigated Negative Declaration [MND] or Environmental Impact Report [EIR])
AB52 Tribal Resources Consultation	Consultation with Native American representatives	Required per AB 52	Identify tribes that have asked to be notified by the County and prepare letters for submission to the surrounding indigenous tribes
Bay Area Air Quality Management District	Regulation 6, Rule 1	Prevent, reduce, or mitigate fugitive dust emissions from construction activities.	Construction in the Bay Area Air Basin must incorporate best available control measures in conformance with Regulation 6, Rule 1
San Mateo County Public Works	Erosion and Sediment Control Plan	Project will require grading and site disturbance	Preparation of the erosion control plan in conjunction with the SWPPP development
San Mateo County Public Works	Encroachment Permit	Project will disturb the public right of way	Contact Department of Public Works
City of San Carlos	Stormwater Control Plan	The trail design will need to address treatment of runoff from the trail and/or parking lot.	Contact City of San Carlos
San Mateo County Mosquito & Vector Control District	Mosquito & Vector Abatement District	Potential mosquito concerns.	Provide Vector Control District conceptual project plans for review.
San Carlos Airport	NA	Potential concerns near runway	Contact San Carlos Airport

5.0 COST ESTIMATE AND SCHEDULE

The cost estimate and project schedule have been created to validate that the project concept may be built within the specified budget and within the time allocated to use the funds.

5.1 PROJECT COST ANALYSIS

The cost analysis is utilized as a tool to ensure the project concept is within the amount of funds available to the project. If the cost analysis indicates that the project is not feasible, then the design will need to be adjusted to bring it within the project budget while still meeting the project goals. The cost analysis was developed using various sources of information, as well as the Cost Estimator's judgment.

5.1.1 Construction Costs

The construction cost entails the various components of the project that a Contractor would construct. Construction costs do not include items of work not directly performed by the Contractor, such as the County's construction management during construction. The construction costs were developed using various sources of cost information. The estimated total construction cost is $2,077,359 for the recommended BMP configuration. Table 5-1 lists the respective breakdowns of the items required to complete the project. A more detailed cost estimate can be found in Appendix B.

Table 5-1. Estimated Construction Costs, Optimal BMP Configuration.

PLANNING LEVEL COST ESTIMATE				
Description	Quantity	Unit	Unit Price	Total
Temporary Diversion	2	EA	$20,000	$40,000
Pretreatment (Trash Netting)	2	EA	$100,000	$200,000
Channel Protection	440	CY	$323.45	$142,320
Excavation & Site Demo	7,061	CY	$41.38	$292,199
Wetland Detention Basin	6,152	CY	$56.08	$344,981
Overflow Pipe & Spillway	1	EA	$77,805	$77,805
Surface Restoration	20,000	SF	$14.38	$287,600
CAPITAL SUBTOTAL				$1,384,905
Mobilization (10% capital)				$138,491
Contingency (15% capital)				$207,736
Design (15% of Capital, Mobilization, and Contingency)				$259,670
Environmental Documentation & Permitting (10%)				$173,114
CONSTRUCTION TOTAL				$2,163,916
Assumptions: -Full itemized cost estimate included in Appendix B -Rough order of magnitude preliminary opinion of costs. Actual costs may vary -Trash nets include all required attachment structures -Surface restoration includes the bay trail and parking areas within the footprint -Wetland is online and will not require diversion. Only temporary construction diversion.				

5.1.2 Operations & Maintenance Costs

Long-term maintenance of the system is vital to its operation. The operations and maintenance costs were developed on the basis that a service contractor would maintain the various components of the system. Estimated total annual operations and maintenance costs are presented in Table 5-2.

Table 5-2. Annual Estimated Operations & Maintenance Costs.

PLANNING LEVEL OPERATIONS & MAINTENANCE ESTIMATE				
Description	**Frequency**	**# Times per Year**	**Unit Price**	**Total**
Inlet Protection	Monthly	12	$4,000	$48,000
Basin – Excavation	Annually	1	$50,000	$50,000
Trash Net Maintenance	Monthly	12	$2,000	$24,000
Plant Maintenance & Invasive Species Removal	Semi-Annual	2	$10,000	$20,000
TOTAL (Annual)				$142,000

5.2 IMPLEMENTATION SCHEDULE

The preliminary project implementation schedule is provided in Figure 5-1. The schedule includes finalizing the design plans, environmental planning and permitting, bid and award, and construction.

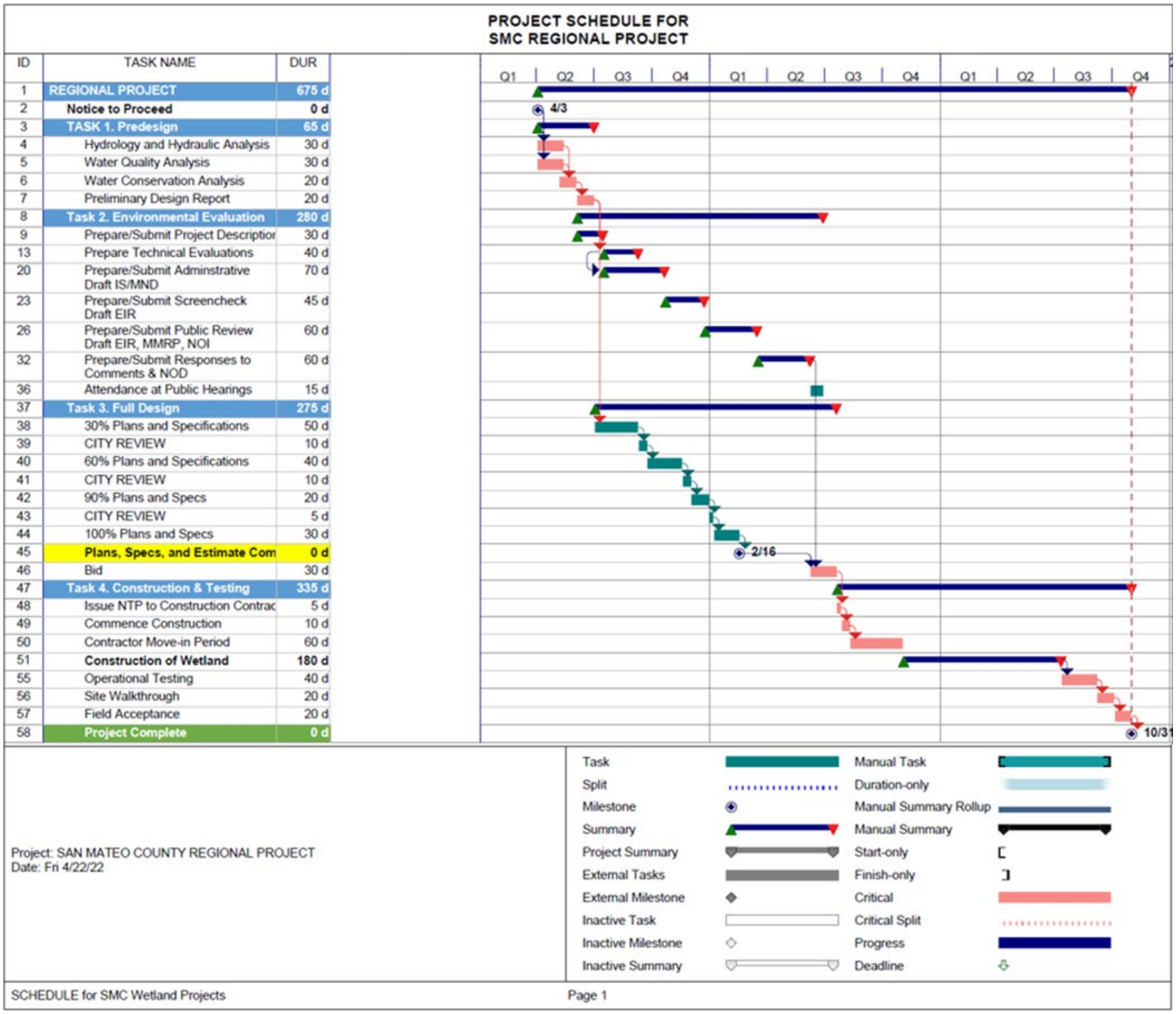


Figure 5-1. Project schedule.

6.0 CONCLUSIONS & RECOMMENDATIONS

While there are many options for the San Carlos Airport Regional Project, the recommended option given the full range of identified outcomes and constraints for this project is a 3.2 ac-ft in-stream wetland that will provide stormwater capture and treatment while also integrating with the future Bay Trail. This wetland will feature the following key components:

- A 3.2 ac-ft treatment wetland that stores and treats the stormwater from a culvert and three storm drains,
- An outfall trash net to reduce the trash load to the channel,
- An equalization pipe between the wetland and the downstream channel, and an emergency spillway.

This BMP will provide substantial pollutant reduction for runoff to Phelps Slough and will carry an estimated construction cost of $2,163,916 and an estimated annual operation and maintenance cost of $142,000. Configuration details and costs will be refined at further stages of design and may be subject to change.

7.0 REFERENCES

Bay Area Stormwater Management Agencies Association (BASMAA). 2017. *Bay Area Reasonable Assurance Analysis Guidance Document*. June 2017.

California Stormwater Quality Association (CASQA). 2003. *California Stormwater BMP Handbook – New Development and Redevelopment.*

City/County Association of Governments of San Mateo County (C/CAG). 2020*. San Mateo County-Wide Reasonable Assurance Analysis Addressing PCBs and Mercury: Phase I Baseline Modeling Report.* September 2020*.*

City/County Association of Governments of San Mateo County (C/CAG). 2022. *Advancing Regional-Scale Stormwater Management in San Mateo County: Regional Collaborative Program Framework White Paper*. January 2022.

County of San Mateo 2018. *San Mateo Plain Groundwater Basin Assessment.*

Minnesota Stormwater Steering Committee (MSSC), 2005. "The Minnesota Stormwater Manual". Developed by Emmons and Olivier Resources for the Stormwater Steering Committee, Minnesota Pollution Control Agency, St. Paul, MN. http://www.pca.state.mn.us/pyria84.

APPENDIX A: CONCEPTUAL DESIGN FACT SHEET

Note: The site configuration may be modified during final design.

SAN CARLOS AIRPORT REGIONAL STORMWATER PROJECT – PROJECT CONCEPT DESIGN

OFFICE OF SUSTAINABILITY
COUNTY OF SAN MATEO

ADVANCING REGIONAL STORMWATER MANAGEMENT IN SAN MATEO COUNTY

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

PROJECT LOCATION, DESCRIPTION, & PURPOSE

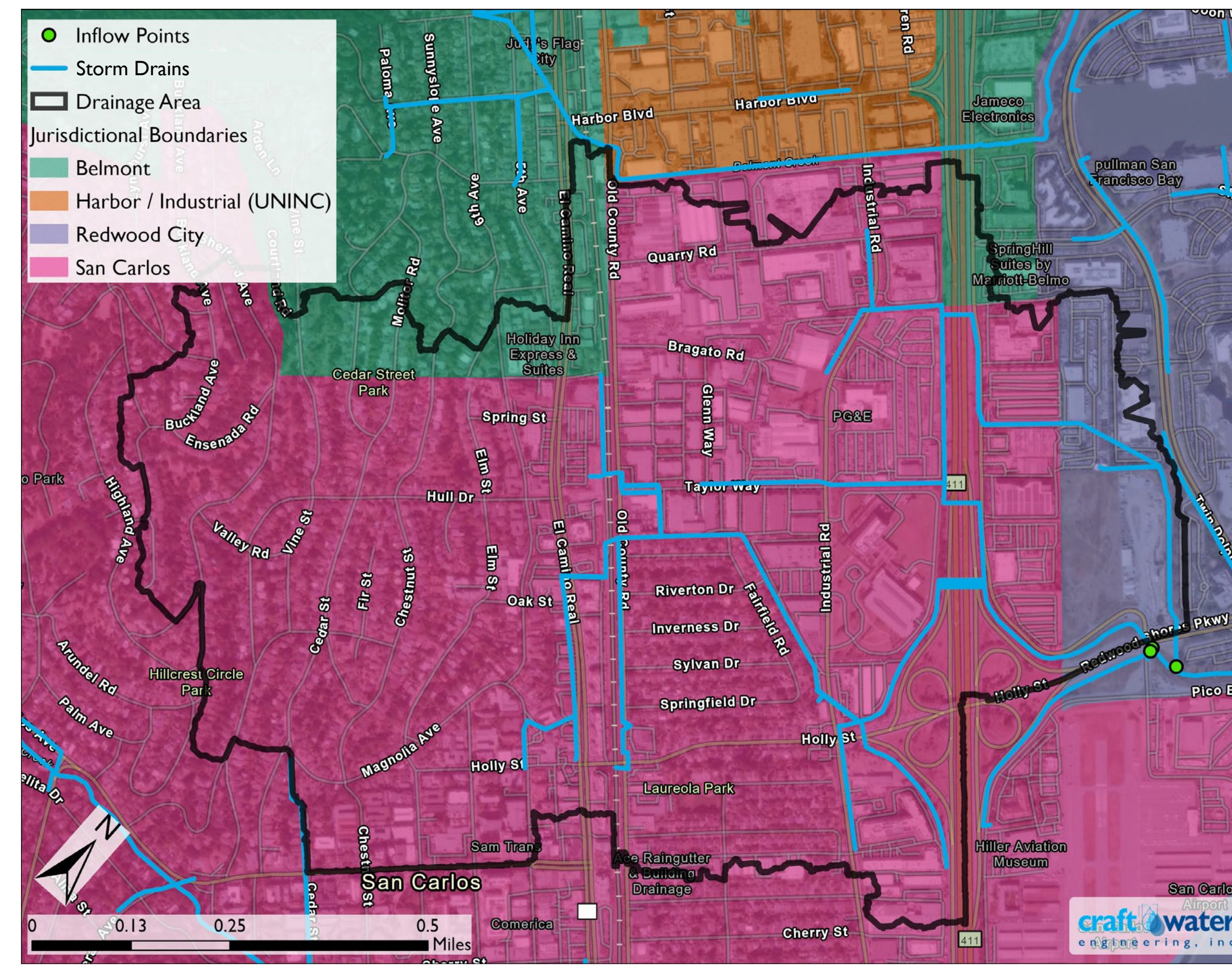
LOCATION: 395 Shoreway Rd, San Carlos, CA 94070	**LAT**: 37°31'01.0"N, **LONG**: 122°15'11.9"W	**SITE OWNER**: San Carlos Airport

DESCRIPTION: This project is proposed at the San Carlos Airport near San Carlos within San Mateo County. The project is intended to intercept the dry-weather flow and a sizeable portion of the stormwater flows from the adjacent storm drains to a restored stormwater wetland basin along Airport Way within the Phelps Slough. Stormwater will be diverted from an open channel and three storm drains, stored and treated in the wetland, and then discharged through a weir and an equalization pipe into Phelps Slough. Both outlets will be designed to maintain the channel's flood control capacity. The wetland will be integrated with the future Bay Trail on the same parcel. The project is sized to optimize the TSS reductions as a retrofit project with the most cost-effective sizing balancing pollutant removal and cost.

PURPOSE & NEED: San Mateo County is required to improve water quality, per the MS4 permit, in addition to providing flood protection to the residents. The most recent iteration of the Municipal Regional Permit (MRP) focuses water quality benefits on trash removal, pollutant reduction, and impervious areas managed, while the County is also interested in water supply augmentation and flood risk reduction. Targeted projects in old industrial areas in conjunction with green streets and regional stormwater capture projects are proposed to meet the water quality goals for San Francisco Bay discharges. The project at the San Carlos Airport can provide significant runoff volume management, trash reduction, and impervious area treated as illustrated by the project benefits table on this page.

PROJECT BENEFITS

PCB Reduction	44.62 g/yr
Volume Managed	217 ac-ft/yr
Volume Reduction of 10yr, 24hr	24.3 ac-ft/yr
Peak Reduction of 10yr, 24hr	0 cfs
Water Supply Volume	0 ac-ft/yr
Site Water Demand Offset	0%
WPP Trash Generation Area Treated	121 ac
CALTRANS Trash Capture Area	47 ac
Population in Walking Distance (1/2 mi)	837 people



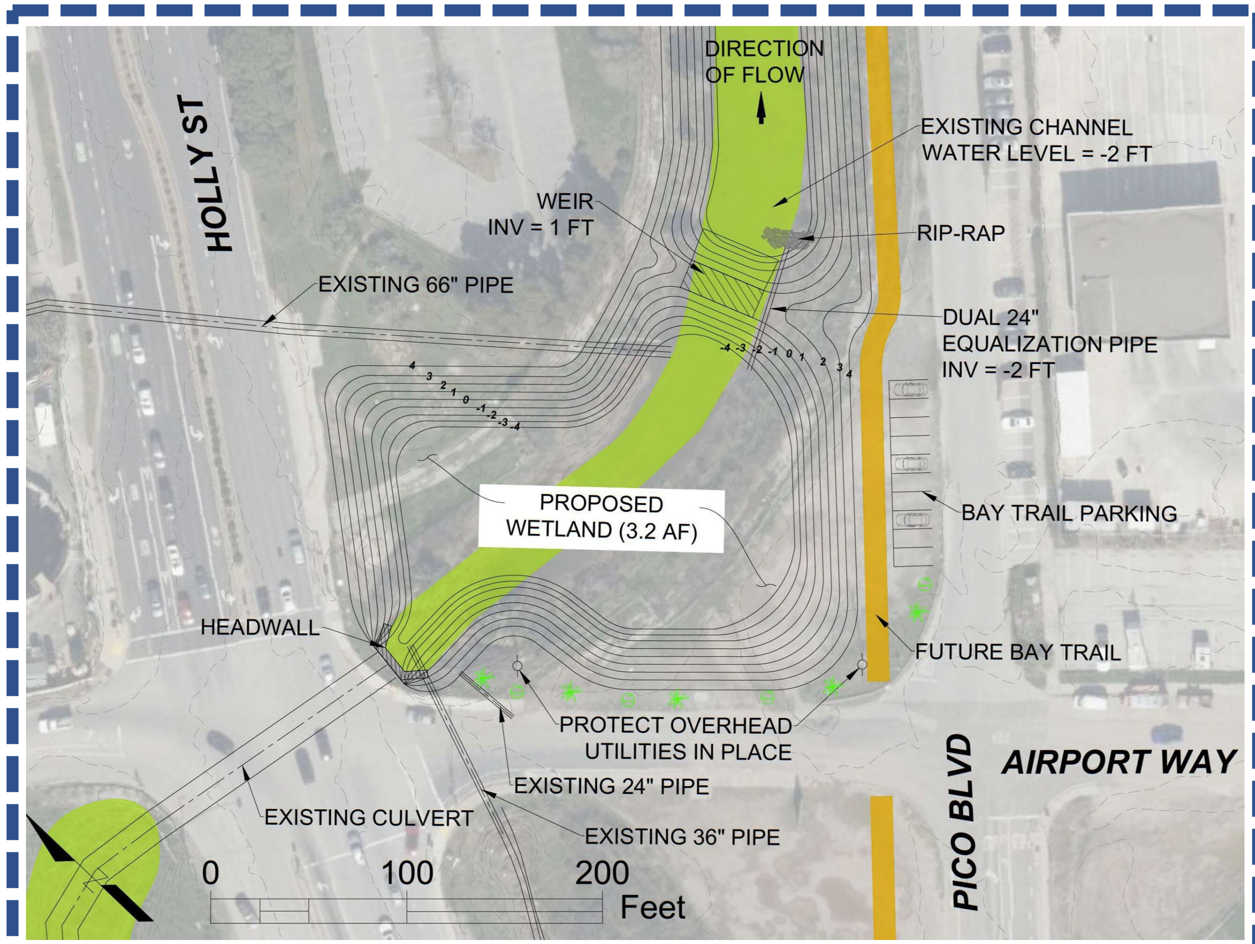
ACKNOWLEDGEMENT

This project was funded by the EPA San Francisco Bay Water Quality Improvement Fund

Concept Prepared by:
craftwater engineering, inc.

SAN CARLOS AIRPORT REGIONAL STORMWATER PROJECT – PROJECT CONCEPT DESIGN

ADVANCING REGIONAL STORMWATER MANAGEMENT IN SAN MATEO COUNTY



SITE DESIGN VALUES

PROJECT TYPE	Wetland
TREATMENT METHOD	Wetland
INFILTRATION RATE	0 in/hr (assumed)
FOOTPRINT	0.81 acres
MAXIMUM DEPTH	5.0 ft
DIVERSION RATE & TYPE	70 cfs (Gravity)
CAPACITY	3.2 ac-ft

DRAINAGE CHARACTERISTICS

RECEIVING WATER	Phelps Slough
TOTAL DRAINAGE AREA	563 ac Belmont (6.1%) San Carlos (87.5%) Redwood City (6.4%)
TOTAL IMPERVIOUS AREA	361 ac
SIZING CRITERIA	Cost-effective PCB reduction
BASELINE RUNOFF (Avg)	299.2 ac-ft/yr
BASELINE PCB (Avg)	56.2 g/yr
EXISTING STORM DRAIN	Open channel

KEY PROJECT ASSUMPTIONS

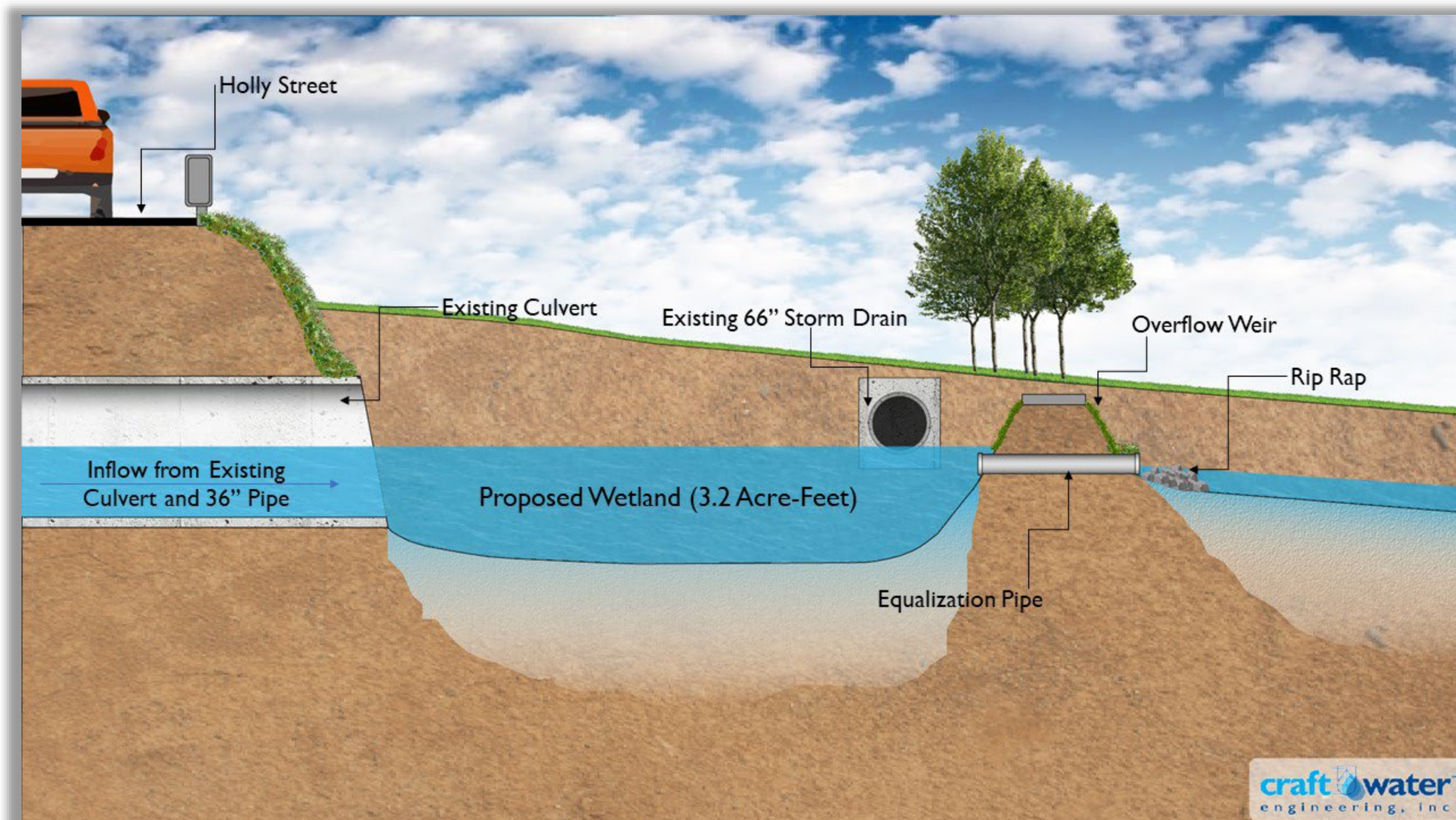
The area is assumed to have HSG C soil with an infiltration rate of 0.2 - 0.5 in/hr. The system is a wetland and is not intended to infiltrate.

Design and cost estimate are based on assumed topography using the highest-resolution data available.

Water level in the creek is assumed to be at -2 ft during low flows.

It is assumed the improvement area can extend outside of the parcel and down the slough channel.

Existing Conditions



Typical Section

SAN CARLOS AIRPORT REGIONAL STORMWATER PROJECT – PROJECT CONCEPT DESIGN

ADVANCING REGIONAL STORMWATER MANAGEMENT IN SAN MATEO COUNTY

PLANNING LEVEL COST ESTIMATE

Description	Quantity	Unit	Unit Price	Total
Temporary Diversion	2	EA	$20,000	$40,000
Pretreatment (Trash Net)	2	EA	$100,000	$200,000
Channel Protection	440	CY	$323.45	$142,320
Excavation & Site Demo	7,061	CY	$41.38	$292,199
Wetland Detention Basin	6,152	CY	$56.08	$344,981
Overflow Pipe & Spillway	1	EA	$77,805	$77,805
Surface Restoration	20,000	SF	$14.38	$287,600
			CAPITAL SUBTOTAL	$1,384,905
Mobilization (10% capital)				$138,491
Contingency (15% capital)				$207,736
Design (15% of Capital, Mobilization, and Contingency)				$259,670
Environmental Documentation &Permitting (10% total)				$173,114
			GRAND TOTAL	$2,163,916

Assumptions:

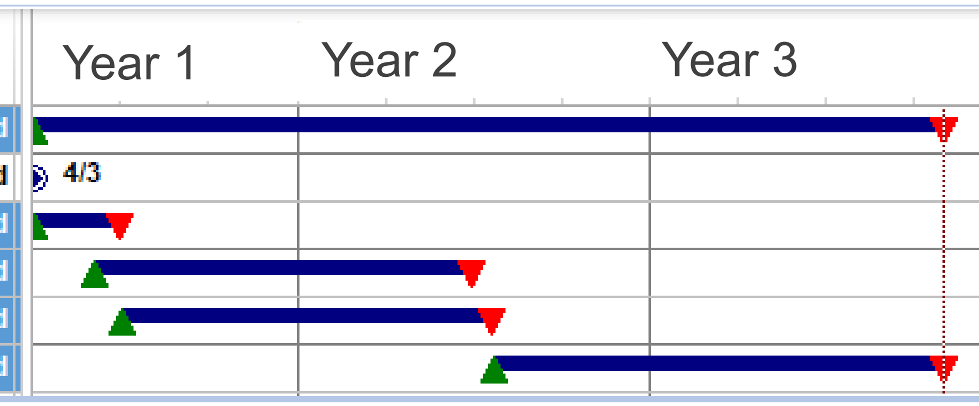
-Full itemized cost estimated included in Appendix B
-Rough order of magnitude preliminary opinion of costs. Actual costs may vary
-Trash nets include all required attachment structures
-Surface restoration includes the bay trail and parking areas within the footprint
-Wetland is online and will not require diversion. Only temporary construction.

PLANNING LEVEL OPERATIONS & MAINTENANCE ESTIMATE

Description	Frequency	# Times per Year	Unit Price	Total
Inlet Protection	Monthly	12	$4,000	$48,000
Basin – Excavation	Annually	1	$50,000	$50,000
Trash Net Maintenance	Monthly	12	$2,000	$24,000
Plant Maintenance & Invasive Species Removal	Semi-Annually	2	$10,000	$20,000
			TOTAL (Annual)	$142,000

PRELIMINARY PROJECT SCHEDULE

TASK NAME	DUR
REGIONAL PROJECT	675 d
Notice to Proceed	0 d
TASK 1. Predesign	65 d
Task 2. Environmental Evaluation	280 d
Task 3. Full Design	275 d
Task 4. Construction & Testing	335 d



ADDITIONAL CONSIDERATIONS

This project concept is planning-level and requires further analysis and review for full design.

Storm Drain Locations: The wetland is designed so that the discharge from three storm drains could be captured and treated. The locations, sizes and inverts of these storm drains will need to be verified.

Geotechnical Investigation: The infiltration rates, groundwater depths, and soil suitability require a full evaluation to determine infiltrative capability of the project. Initial soils data indicate suitable infiltration rates, but field-tested values are required for the full design analysis.

Utilities: Several utilities have been identified around the site, including a culvert, three storm drains, and two utility poles. The wetland is shaped so that most utilities can be protected in place. A full utility investigation will be required during design.

Integration with Future Bay Trail: Wetland design will leave enough space for the development of future bay trail and parking area. The vegetated slope of the wetland will improve the aesthetic around the channel.

Environmental Documentation: The project is anticipated for eligibility for a mitigated negative declaration in response to CEQA. A full project description and evaluation is required during design.

Sizing Criteria: As a stormwater capture and pollutant removal project, the MRP designated design goal is to capture 80% of the annual runoff. As such, the project is intended to maximize pollutant removal while minimizing overall costs. Project sizing used 10-years of continuous simulation to estimate the average annual PCB loading and removal by various combinations of diversion and storage.

APPENDIX B: ENGINEER'S 10% COST ESTIMATE

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Client: **San Mateo County**
Project: **San Carlos Airport Site**
Status: **10% Cost Estimate**

Prepared by: **YW**
Checked by: **MMT**
Date **6/10/2022**

Description	Qty	Unit	Unit Price	Total
Diversion From Creek				**$40,000**
Temporary Diversion	2	EA	$20,000.00	$40,000
Pretreatment (Trash Netting)				**$200,000**
Outfall Trash Net	2	EA	$100,000.00	$200,000
Channel Protection				**$142,320**
Headwall	1	EA	$20,000.00	$20,000
Rip-rap	440	CY	$278.00	$122,320
Excavation & Site Demo				**$292,199**
Excavation	7,061	CY	$35.00	$247,135
Tree Removal	3	EA	$1,500.00	$4,500
Clearing & Grubbing	81,127	SF	$0.50	$40,564
Wetland Detention Basin (6.3 AF)				**$344,981**
Backfill and Compaction	909	CY	$25.00	$22,725
Hauling	6,152	CY	$28.00	$172,256
Construction Dewatering	1	LS	$150,000.00	$150,000
Outflow Pipe & Spillway				**$77,805**
Piping (24" RCP) to Outfall (Includes excavation & shoring)	70	LF	$324.00	$22,680
Concrete Spillway	75	CY	$735.00	$55,125
Surface Restoration				**$287,600**
Tree Replacement	6	EA	$2,500.00	$15,000
Shrubs, Perennials, and Grasses	20,000	SF	$5.00	$100,000
AC Paving (Parkling Lot)	2,000	SF	$9.00	$18,000
Decomposed Granite Path (Bay Trail)	6,460	SF	$10.00	$64,600
90-Day Plant Establishment Period	1	LS	$90,000.00	$90,000
SUBTOTAL				**$1,384,905**
Mobilization / Demobilization (10% capital)	1	LS	$138,491.00	$138,491
Contingency (15% capital)	15%	LS	$207,736.00	$207,736
			Construction Subtotal	**$1,731,132**
Design (15% Total)	15%	LS	$259,670.00	$259,670
Environmental Documentation & Permitting (10% total)	10%	LS	$173,114.00	$173,114
	GRAND TOTAL			**$2,163,916**

craftwater engineering, inc.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Client:	**San Mateo County**	Prepared by:	**YW**
Project:	**San Carlos Airport Site**	Checked by:	**MMT**
Status:	**10% Cost Estimate**	Date	**6/10/2022**

Description	Qty	Unit	Unit Price	Total

Assumptions and Exclusions

1 This is a rough order of magnitude preliminary opinion of probable construction costs only. Actual costs may vary.
2 The unit cost data is derived from inhouse sources, recent bids on similar construction, and RSMeans current construction cost data.
3 This opinion of cost is based on the project program and plans made available at the time of preparation.
4 Material prices are based on current quotations and do not include escalation.
5 This opinion of cost assumes that all improvements will be constructed at one time.
6 Quantity take offs were performed when possible and parametric estimates and allowances are used for items that cannot be quantified at this stage of the design.
7 This opinion has been based on a competitive open bid situation with a recommended 5 - 7 bonafide reputable bids from general contractors and a minimum of 3 bidders for all items of subcontracted work.
8 All unit costs take into account sales tax, general conditions, bonding and insurance, and subcontractor and general contractor overhead and profit.
9 Where applicable, unit costs include the cost of freight.

The following are excluded:

1 Environmental clearances and permits
2 Hazardous spoil disposal, if encountered
3 Property and Right of Way acquisition or easements
4 Legal and accounting fees
5 Plan check, building permit fees
6 Utility Connection Fees
7 Testing and inspection
8 Fire and all risk insurance
9 Removal of unforeseen underground obstructions
10 Relocation of unforeseen subsurface utilities
11 Signage and wayfinding
12 Additional fill or import
13 Loose furniture and equipment
14 Utility connection fees
15 Tel/data system
16 Construction contingency
17 Work done after business hours
18 Design, engineering and consulting fees other than those specifically listed in the above estimate

Items that may affect the cost estimate:

1 Modifications to the scope of work included in this estimate
2 Unforeseen sub-surface conditions
3 Restrictive technical specifications or excessive contract conditions
4 Any other non-competitive bid situations
5 Bids delayed beyond the projected schedule

OPERATIONS AND MAINTENANCE ESTIMATE

Client: **San Mateo County**
Project: **San Carlos Airport Site**

Prepared by: **MT/ODG**
Checked by: **ODG**

Operations and Maintenance (Annual Estimate)

Date: **June 10, 2022**

Description	Frequency	No. of Times per Year	Unit Price	Total
Inlet Protection - Inspection	Monthly	12	$4,000	$48,000
Basin - Excavation	Annually	1	$50,000	$50,000
Trash Net Maintenance	Monthly	12	$2,000	$24,000
Plant Maintenance & Invasive Removal	Semi-Annual	2	$10,000	$20,000

TOTAL (Annual) $142,000