MEMORIAL PARK DETENTION BASIN PROJECT

Attachment 6 - Monitoring, Assessment, and Performance Measures

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1.0 General Overview of Monitoring, Assessment, and Performance Measures

This attachment presents project monitoring, assessment, and performance measures that will be used to quantify and verify the performance of the Memorial Park Detention Basin Project with respect to its benefits and objectives. The information in this attachment will go into a monitoring plan that will be developed if the grant application is successful.

The Memorial Park Detention Basin Project will provide multiple benefits including flood damage reduction, water supply, water quality, ecosystem restoration, and recreation and public access. Accordingly, the monitoring, assessment, and performance measures were developed for each of the project benefits.

Figure 1 shows an overview of monitoring locations for the Memorial Park Detention Basin Project. The project monitoring defines monitoring elements (*what*) and the reasons for each monitoring element (*why*). It also defines the timing, frequency and duration of monitoring (*when*), the locations of monitoring sites (*where*), and the responsibility for monitoring data collection, analysis and reporting (*who*). The planned project monitoring is designed to guide project operations and aid evaluation of project performance.

What:
Monitored elements to be considered in the planned monitoring, assessment, and performance measures will include:

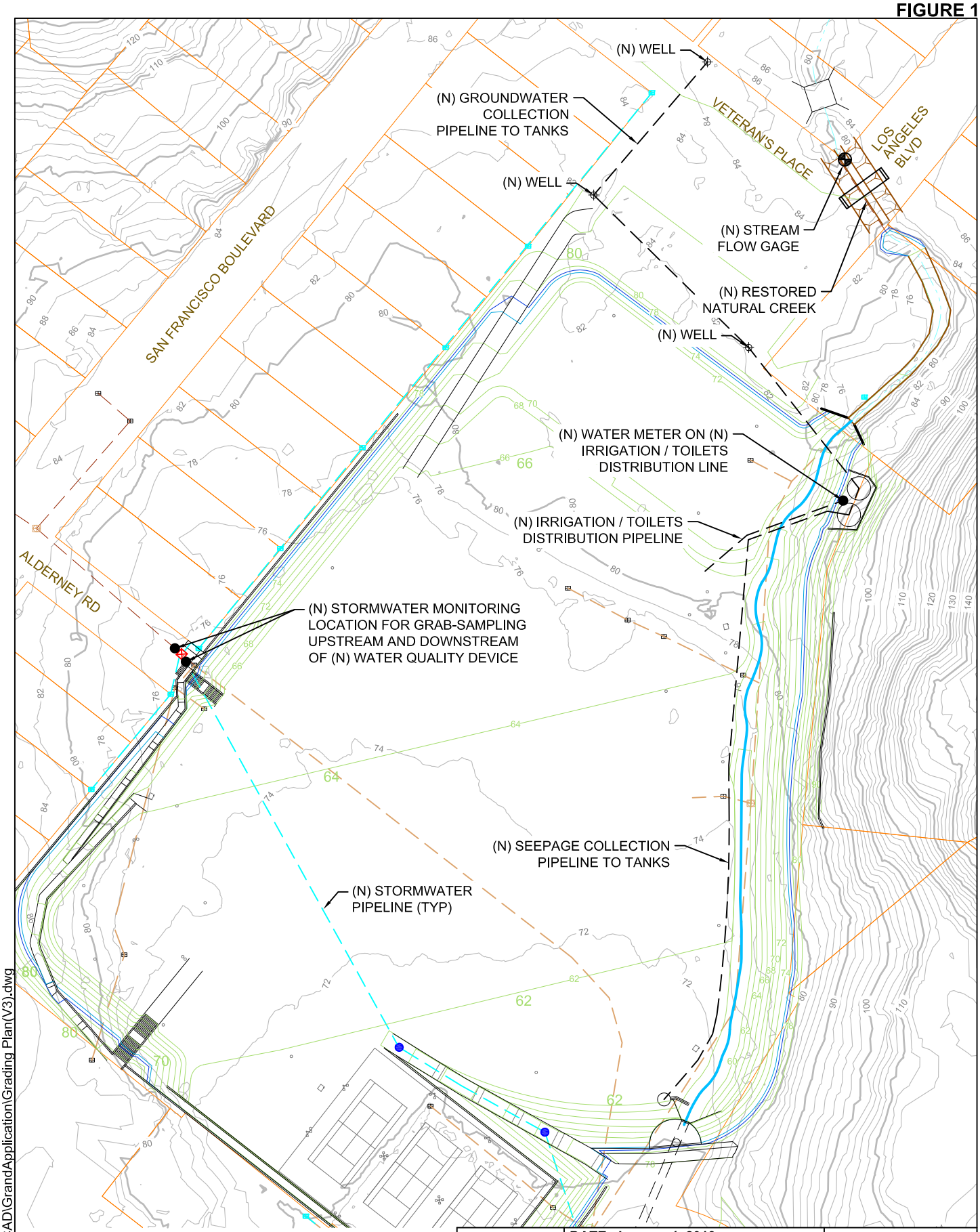
- Hydrology
- Groundwater supply quantity
- Water quality
- Aquatic habitat
- Recreational utilization of the park

Why:
The monitoring tasks included in the planned monitoring, assessment, and performance measures will guide project operations and aid measurement of specific project performance criteria. Some variables, such as those covered by water quality monitoring, will only be monitored when identified as a specific project issue or an indicator.

When:
Project evaluation monitoring will be needed as follows:

- pre-construction, for two seasons before construction to establish baseline conditions;
- during construction, as necessary, to monitor compliance with design parameters; and,
- post-construction, until such time that achievement of project objectives has been demonstrated, or as set forth in the grant agreement.

FIGURE 1



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STETSON ENGINEERS INC.

DATE: January 4, 2013

JN: 2438

MONITORING SYSTEM

Where:
Selection of monitoring sites is a critical step in developing the monitoring, assessment, and performance measures. The selected monitoring sites will be located:

- within the project area;
- immediately upstream of project; and,
- immediately downstream of project.

Who:
The planned project monitoring, assessment, and performance measures will define who will be responsible for the various elements of the monitoring activities. These elements will include:

- Equipment acquisition and maintenance;
- Quality assurance and quality control (QA/QC);
- Data collection;
- Chain of custody for lab samples and specimens;
- Data organization;
- Data analysis and evaluation;
- Reporting;
- Information dissemination;
- Funding; and,
- Review and approval.

The Town of San Anselmo will have responsibilities and specific duties as indicated.

Monitoring Plan – The Town of San Anselmo will develop a monitoring plan, prepares a cost estimate, and identify the funding mechanism for the monitoring plan.

Field Monitoring - The Town of San Anselmo will implement monitoring activities, organize monitoring data into the accepted reporting format, and conduct QA/QC check of the data.

Data Analysis, Evaluation, and Reporting – The Town of San Anselmo will analyze and report the monitoring results and perform performance evaluation.

Database Management – The Town of San Anselmo will assign a database coordinator to oversee the collection, storage, and dissemination of monitoring data and to ensure that the data management and monitoring deliverables are consistent with the Bay Area IRWMP standards. As part of the Bay Area IRWMP implementation, data will be collected to support assessment of the performance of Memorial Park Detention Basin Project, as well as in meeting the regional goals and objectives identified in the Bay Area IRWMP. Data collection will be ensured to be comparable with the statewide data collection programs, such as the Surface Water Ambient Monitoring Program (SWAMP). Upon completion of the performance assessment, the collected data, along with its associated quality assurance/quality control information, will be provided to the State in a format that can be easily integrated into statewide data collection and tracking programs.

As appropriate, the collected data will be contributed to the following statewide data programs:

- California Environmental Resources Evaluation System (CERES), an information system developed by the California Resources Agency to facilitate access to natural resource data; and,
- California Environmental Data Exchange Network (CEDEN), a website developed by the State for coordinated data sharing.

2.0 Flood Damage Reduction

2.1 Goals and Objectives

The goal of the Project in flood damage reduction is to enable Memorial Park to also function as a flood detention basin. The objective of flood detention operations is to attenuate flows produced in the upper Sorich Creek watershed sufficiently to reduce the peak discharge to lower Sorich Creek, and hence lower San Anselmo Creek as well as the downstream Corte Madera Creek, during the 1-percent-chance-annual flood (or 100-year flood) by about 200 cfs[1]. In order to achieve this objective, the Memorial Park detention basin needs to provide about 79 acre-feet of flood storage capacity for floodwater attenuation. To provide this storage capacity for floodwater detention, the park floor will be excavated and lowered by an average of 10 ft below existing grade, and concrete wall structures will be constructed along the southern and western sides. A large, gated culvert (i.e., low-level outlet) will pass beneath the embankment at the southern end of the basin in order to pass floodwaters to the existing culverted reach of Sorich Creek below the detention basin. The gate will normally be kept open to allow unimpeded passage of flows (as well as sediment, woody debris, and wildlife) and the basin will normally be kept empty. During unusually heavy storms when flooding downstream in downtown San Anselmo is imminent[2], the gate will be closed for floodwater detention. In extreme floods when the basin becomes full (approx. >100-year flood), overflow will spill over an internal semi-circular glory hole type spillway and pass to the discharge culvert. An external emergency spillway will provide redundancy to pass any additional overflow that exceeds the capacity of the internal glory hole spillway.

2.2 Performance Measures

Table 1 is a summary of performance measures that will be used to quantify and verify project performance with respect to the project goal and objective identified for the Project. Table 1 (and the following sentences) also summarizes how monitoring data and measures will be used to evaluate project performance in meeting the overall goals and objectives of the Bay Area IRWMP.

[1] Memorial Park detention basin can also reduce peak flows for smaller floods. The amounts of peak flow reduction at the Ross streamflow gage for the 50-year, 25-year, 10-year, and 5-year floods are estimated to be approximately 180 cfs, 160 cfs, 120 cfs, and 0 cfs, respectively.

[2] Downtown San Anselmo floods at flood magnitudes of about the 5- to 8-year recurrence interval.

As a flood detention basin project, reducing flood damage would, of course, be the desired outcome. Since flood reduction is achieved by way of flood detention, the flow hydrograph below the detention basin, the peak flow at the Ross streamflow gage, and the extent of floodplain inundation are selected as the output indicators (or measures to effectively track output). The *attenuated* flow hydrograph below the detention basin, the *reduced* peak flow at the Ross streamflow gage, the *reduced* extent of floodplain inundation, and the *reduced* flood damage (i.e., event benefit) relative to the without-Project conditions are selected as the outcome indicators to evaluate the change that is a direct result of the Project. These output and outcome indicators, particularly for the without-Project conditions, can not be directly measured. As such, the following analyses will be conducted:

- Hydrologic modeling to simulate water levels of the detention basin and flow hydrograph at Ross streamflow gage under without-Project conditions and compare those with the observed data under with-Project conditions (modeling tool: HEC-HMS).
- Hydraulic modeling to simulate the flood extent and depth for both with- and without-Project conditions (modeling tool: MIKE FLOOD).
- Floodplain inundation mapping for both with- and without-Project conditions (mapping tool: GIS)
- Flood damage analysis for both with- and without-Project conditions (method: as described in Attachment 7 (Technical Justification of Project) and Attachment 8 (Benefits and Cost Analysis).

The simulated flows developed through the hydrologic modeling will be used as flow inputs for the hydraulic modeling. The simulated flood extent and depth developed through the hydraulic modeling will be used to conduct floodplain inundation mapping and flood damage analysis.

Table 1 Flood Damage Reduction Performance Measures

Project Goal	• Reduce flood damage downstream
Bay Area IRWMP Goals and Objectives Met by Project	• A7; B3; C2; E8 (Refer to the Table in Section 1.10 of Attachment 3, Work Plan)
Desired Outcomes	• Reduced peak discharge in lower San Anselmo Creek and downstream in Corte Madera Creek • Reduced flood damage in these downstream reaches
Output Indicators (Measures)	• Flow hydrograph downstream of detention basin • Peak flow at Ross streamflow gage • Extent and depth of floodplain inundation
Outcome Indicators (Measures)	• Observed (attenuated) flow hydrograph below the detention basin relative to the simulated without-Project hydrograph • Reduced peak flow at Ross streamflow gage relative to the simulated without-Project condition • Reduced extent of floodplain inundation relative to the simulated without-Project condition • Reduced flood damage relative to the simulated without-Project condition
Measurement Tools and Methods	• HEC-HMS hydrologic modeling • MIKE FLOOD hydraulic modeling • GIS floodplain inundation mapping • Flood damage analysis (use methods described in Attachment 7 and Attachment 8)
Targets	• Reduce the 1-percent-chance-annual flood (or 100-year flood) by about 200 cfs at Ross streamflow gage relative to the simulated without-Project conditions • Reduce the 50-year, 25-year, and 10-year floods by about 180 cfs, 160 cfs, and 120 cfs, respectively at Ross streamflow gage relative to the simulated without-Project conditions

2.3 Monitoring System

The monitoring system for the flood damage reduction benefit is shown in Figure 1 and Table 2 is a summary of the monitoring plan. One streamflow gage will be installed at the upstream of the detention basin. The location of the streamflow gage will be carefully selected so that the detention basin water level will not cause any backwater effects on gage readings. The new gage will provide data to guide operations of the detention basin during flood events and provide data for simulating the without-Project hydrologic condition, which is needed for the evaluation of the performance of the Project in flood damage reduction.

Table 2 Summary of Monitoring Plan for the Flood Damage Reduction Benefit

	Description
What	• Hydrology (streamflow in the wet season, particularly during floods)
Why	• Provide data to guide project operations • Provide data for simulating the without-Project hydrologic conditions as needed for evaluating project performance
When	• Continuous streamflow in the wet season: o *Post-construction*
Where	• Streamflow immediately upstream of the detention basin
Who	• Town of San Anselmo

2.4 Data Analysis, Evaluation, and Reporting

Data will be collected and stored in all years. Analysis, evaluation and reporting will be done only in flood years by the Town of San Anselmo. Hydrologic modeling, hydraulic modeling and floodplain mapping, flood damage analysis, and reporting will be conducted in flood years to evaluate project performance. The flood year report will contain the following elements:

- Introduction (Background and Objectives);
- Project operations in the wet season;
- Streamflow monitoring results in the wet season;
- Hydrologic modeling;
- Hydraulic modeling and floodplain mapping;
- Flood damage analysis; and,
- Evaluation of project performance.

3.0 Water Supply

3.1 Goals and Objectives

The Memorial Park Detention Basin Project includes installation of a groundwater supply system to provide water for irrigation and restroom/toilet use for the rehabilitated park and, in turn, reduce dependency on the water supplies from the local retail purveyor, Marin Municipal Water District (MMWD). There is a need to reduce water demand to MMWD because MMWD reliable water supply is less than the current water demand, especially during drought conditions. Reducing the water demand to MMWD provides MMWD with much needed water supply reliability.

3.2 Performance Measures

Table 3 is a summary of performance measures that will be used to quantify and verify project performance with respect to the project goal and objective identified for the water supply benefit. Table 3 (and the following sentences) also summarizes how monitoring data and measures will be used to evaluate project performance in meeting the overall goals and objectives of the Bay Area IRWMP. The desired outcome of the water supply benefit is to provide water for irrigation during the dry season and for restroom toilets year round. The amount of water distributed for irrigation and restroom toilet use provided by the groundwater supply system can be used as the output indicator and outcome indicators. The project performance in water supply can be evaluated simply based on the direct measurement of the water distributed.

Table 3 Water Supply Performance Measures

Project Goal	• Provide groundwater for irrigation and restroom toilets and thereby reduce water demand on MMWD
Bay Area IRWMP Goals and Objectives Met by Project	• A10; B1; B2; B5; B9; E1 (Refer to the Table in Section 1.10 of Attachment 3, Work Plan)
Desired Outcomes	• Groundwater supply quantity
Output Indicators (Measures)	• Groundwater supply quantity
Outcome Indicators (Measures)	• Groundwater supply
Measurement Tools and Methods	• Direct measurement of groundwater supply distributed to irrigation and restroom toilets
Targets	• Provide groundwater for irrigation and restroom toilets

3.3 Monitoring System

The monitoring system for the water supply benefit is shown in Figure 1 and Table 4 is a summary of the monitoring plan.

Table 4 Summary of Monitoring Plan for the Water Supply Benefit

	Description
What	• Irrigation and restroom toilet quantity
Why	• Provide data to evaluate project performance
When	• Continuous measurement of groundwater distributed for irrigation and restroom toilet use: o *Post-construction*
Where	• At the storage tank discharge to the irrigation and restroom distribution line
Who	• Town of San Anselmo

3.4 Data Analysis, Evaluation, and Reporting

Data analysis and evaluation will be done by the Town of San Anselmo. Reporting will be done annually. The annual report will contain the following elements:

- Introduction (Background and Objectives)
- Monitoring results
- Evaluation of project performance

4.0 Water Quality

4.1 Goals and Objectives

The Memorial Park Detention Basin Project will improve the stormwater quality of the Alderney storm drain discharge to Sorich Creek, which is a tributary to San Anselmo/Corte Madera Creek. The existing Alderney storm drain collects urban stormwater from a 23-acre drainage area upstream of Memorial Park. The storm drain runs beneath Memorial Park and discharges to the Sorich Creek culvert. Urban stormwater runoff has been cited as a major nonpoint pollution source (NPS). The typical pollutants associated with the urban stormwater are trash/debris, sediment, nutrients, bacteria and viruses, oil and grease, metals, organics, and pesticides. During the park floor excavation process the Alderney storm drain under the park will be removed and replaced following a new alignment beneath the park. A CONTECH CDS® hydrodynamic separation device (or similar device) will be installed at the inlet of the replaced Alderney storm drain to remove trash/debris and improve stormwater quality, including removal of sediment and oil and grease, and any other pollutants that are bound with suspended sediments.

4.2 Performance Measures

Table 5 is a summary of performance measures that will be used to quantify and verify project performance with respect to the project goal and objective identified for the water quality benefit. Table 5 (and the following sentences) also summarizes how monitoring data and measures will be used to evaluate project performance in meeting the overall goals and objectives of the Bay Area IRWMP.

The following measures are selected as output indicators:

- Trash and debris
- Suspended sediment; and
- Oil and grease.

Removed volume of trash/debris and the difference in concentrations of the pollutants above between the inflow and outflow locations are selected as outcome indicators. The project performance of the water quality benefit will be evaluated based on the direct measurement of output indicators.

Table 5 Water Quality Performance Measures

Project Goal	• Improve stormwater quality
Bay Area IRWMP Goals and Objectives Met by Project	• B5; D3; D7; F2; F4; F5; F6; F9 (Refer to the Table in Section 1.10 of Attachment 3, Work Plan)
Desired Outcomes	• Prevent trash/debris from entering the storm drain at the inlet • Improve stormwater quality
Output Indicators (Measures)	• Volume of trash/debris • Concentrations of suspended sediment • Concentrations of oil and grease
Outcome Indicators (Measures)	• Volume of removed trash/debris • Decreased concentrations of the selected pollutants
Measurement Tools and Methods	• Direct measurement of the output indicators for both inflows and outflows under post-construction conditions
Targets	• Volume of removed trash/debris • Decreased concentrations of the selected pollutants

4.3 Monitoring System

The monitoring system for the water quality benefit is shown in Figure 1 and Table 6 is a summary of the monitoring plan. Monitoring of concentrations will be accomplished by grab samples taken at the storm drain inlet; one sample upstream of the inlet and one sample downstream (i.e., downstream of the water quality device). Monitoring of trash/debris volume will be accomplished by measuring the volume of trash and debris captured by the water quality device during period cleaning visits.

Table 6 Summary of Monitoring Plan for the Water Quality Benefit

	Description
What	• Trash/debris • Suspended sediment • Oil and grease
Why	• Provide data to evaluate project performance
When	• Monthly sampling of stormwater quality during the months of November through March, 15-30 minutes after storm events: o *Post-construction*
Where	• At the storm drain inlet inflow • At the storm drain inlet outflow (i.e., below the treatment device)
Who	• Town of San Anselmo

4.4 Data Analysis, Evaluation, and Reporting

Data analysis and evaluation will be done by the Town of San Anselmo. Reporting will be done annually. The annual report will contain the following elements:

- Introduction (Background and Objectives)
- Hydrologic conditions
- Data acquisition, equipment, and results
- Evaluation of project performance

5.0 Ecosystem Restoration

5.1 Goals and Objectives

The Memorial Park Detention Basin Project will daylight the 580-ft long culverted Sorich Creek reach, and the daylighted Sorich Creek will be vegetated to restore the creek ecosystem and improve stormwater quality via plant uptake and filtration for nutrients and heavy metals.

In addition, the Memorial Park Detention Basin Project will remove the 70-ft long Los Angeles Street culvert and daylight the creek there to increase hydraulic capacity, plus installation of a new pre-fabricated vehicle/pedestrian bridge there.

5.2 Performance Measures

Table 7 is a summary of performance measures that will be used to quantify and verify project performance with respect to the project goal and objective identified for the ecosystem restoration benefit. Table 7 (and the following sentences) also summarizes how monitoring data and measures will be used to evaluate project performance in meeting the overall goals and objectives of the Bay Area IRWMP. The desired outcome of the ecosystem restoration benefit is to restore riparian and aquatic conditions of the daylighted Sorich Creek. Native vegetation growth along the daylighted creek will be used as an output indicator and the length of creek reach with successful native vegetation growth will be used as outcome indicator. Project performance in ecosystem restoration will be evaluated based on the direct measurement of the length of creek reach with successful native vegetation growth.

Table 7 Ecosystem Restoration Performance Measures

Project Goal	• Restore riparian and aquatic habitat conditions of the daylighted Sorich Creek
Bay Area IRWMP Goals and Objectives Met by Project	• C3; D3; F2; F3; F4; F5; F6; F7; F9 (Refer to the Table in Section 1.10 of Attachment 3, Work Plan)
Desired Outcomes	• Restoration of riparian and aquatic habitat along the daylighted creek reach
Output Indicators (Measures)	• Native vegetation growth along the daylighted creek reach
Outcome Indicators (Measures)	• Length of creek reach with successful native vegetation growth
Measurement Tools and Methods	• Direct measurement of length of creek reach with successful native vegetation growth
Targets	• Successful native vegetation growth along the entire daylighted reach of Sorich Creek

5.3 Monitoring System

Table 8 is a summary of the monitoring plan. The plan includes field surveys of native vegetation growth along the daylighted creek reaches by a qualified biologist to assess the length of creek reach with successful native vegetation growth.

Table 8 Summary of Monitoring Plan for the Ecosystem Restoration Benefit

	Description
What	• Length of creek reach with successful native vegetation growth
Why	• Provide data to evaluate project performance
When	• One-time measurement during the native vegetation growth period each year for an estimated 5 years or until entire reach has achieved native vegetation growth: o *Post-construction*
Where	• Along the daylighted creek reach of Sorich Creek
Who	• Town of San Anselmo

5.4 Data Analysis, Evaluation, and Reporting

Data analysis and evaluation will be done by the Town of San Anselmo. Reporting will be done annually. The annual report will contain the following elements:

- Introduction (Background and Objectives)
- Hydrology conditions
- Monitoring results and evaluation of project performance

6.0 Recreation and Public Access

6.1 Goals and Objectives

The Memorial Park Detention Basin Project will enhance opportunities for public enjoyment of the park, one of the most heavily used recreational areas in San Anselmo. The Project will daylight and restore Sorich Creek. Access to the creek will be encouraged by providing pathways leading to the creek, and the creek will be placed in a "nature grove" so as to integrate it into the overall park recreational area. An upgraded field and drainage system will be installed to increase public use of the park by allowing the expanded sports programs and use of the fields for longer periods throughout the year while reducing field upkeep and maintenance costs. Pathways and park elements will be ADA accessible, accommodating to a larger extent people with disabilities compared to the current park. All these improvements will aim to enhance public access, safety, aesthetics, and overall public enjoyment.

6.2 Performance Measures

Table 9 is a summary of performance measures that will be used to quantify and verify project performance with respect to the project goal and objective identified for the recreation and public access benefit. Table 9 (and the following sentences) also summarizes how monitoring data and measures will be used to evaluate project performance in meeting the overall goals and objectives of the Bay Area IRWMP.

The desired outcome of the recreation and public access benefit is an accommodation of more park users and an increase in users' satisfaction. Increased number of programs and hours for programs using park facilities are selected as outcome indicators. Records of reservations made for programs using park facilities will be used to evaluate project performance. Records for programs before construction will be compared with those after construction to measure increase. Recorded user comments will be used to measure enhanced user satisfaction.

Table 9 Recreation and Public Access Performance Measures

Project Goal	• Improve public access and recreational opportunities
Bay Area IRWMP Goals and Objectives Met by Project	• A6; A8; A9; A10 (Refer to the Table in Section 1.10 of Attachment 3, Work Plan)
Desired Outcomes	• Accommodate users • Increase satisfaction of users
Output Indicators (Measures)	• Number of programs using park facilities • Number of hours programmed for park facilities • Satisfaction of users
Outcome Indicators (Measures)	• Increased number of programs relative to pre-construction conditions • Increased hours for programs relative to pre-construction conditions • Increased satisfaction of users relative to pre-construction conditions
Measurement Tools and Methods	• Facility reservation records and user comments
Targets	• Increased number of programs • Increased number of hours programmed for park facilities • Increased number of comments expressing satisfaction

6.3 Monitoring System

Table 10 is a summary of the monitoring plan. Facility reservation records will be used to evaluate the project performance in the recreation and public access benefit. No field surveys are needed.

Table 10 Summary of Monitoring Plan for the Recreation and Public Access Benefit

	Description
What	• Number of programs • Number of hours programmed for park facilities • Number of user comments expressing satisfaction
Why	• Provide data to evaluate project performance
When	• Facility reservation records: o *Pre-construction* o *Post-construction*
Where	• Facility reservation records
Who	• Town of San Anselmo

6.4 Data Analysis, Evaluation, and Reporting

Data analysis and evaluation will be done by the Town of San Anselmo. Reporting will be done every two years. The two-year report will contain the following elements:

- Introduction (Background and Objectives)
- Usage of park recreational programs and hours
- Evaluation of project performance and user satisfaction