STANISLAUS COUNTY
DEPARTMENT OF PUBLIC WORKS

Stanislaus Multi-Agency Regional Storm Water Resource Plan

Technical Memorandum: Quantitative Methods

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Technical Memorandum

Stanislaus Multi-Agency Regional Storm Water Resource Plan

Subject:	**Quantitative Methods**
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1 Introduction

The Stanislaus Multi-Agency Regional Storm Water Resource Plan (SWRP), led by Stanislaus County, is being developed in accordance with the SWRP Guidelines (SWRCB 2015) to coordinate regional-scale multiple-benefit stormwater management approaches. The primary purpose of the SWRP is to identify and assess stormwater projects, prioritizing those multi-benefit projects that can best achieve watershed and regional planning goals.

As part of this process, plan proponents must develop quantitative methodologies for identifying and prioritizing stormwater and dry weather runoff capture projects. SWRPs are required to include "a metrics-based and integrated evaluation and analysis of multiple benefits to maximize water supply, water quality, flood management, environmental, and other community benefits within the watershed" (California Water Code, § 10562 (b)(2)).

This Technical Memo (TM) describes the quantitative methodologies used for the integrated identification, prioritization, and analysis of multiple benefit projects and programs for the Stanislaus Multi-Agency Regional SWRP. The following sections summarize the benefit metrics used, tools available for quantifying project benefits, and the method used for determining collective benefits of SWRP projects, which ensures that the SWRP will achieve the water management objectives of the planning area.

2 Description of Quantitative Methodologies

2.1 Benefit Metrics

Stormwater benefits are evaluated within five different categories: water quality, water supply, flood management, environmental, and community benefits. Within each category, specific main and additional benefits have been identified. These categories and benefits align with those presented in the SWRP Guidelines (SWRCB 2015). In addition, the SWRP identified quantitative metrics for each main and additional benefit. For example, one benefit in the community benefit category is "community involvement." The metric for quantifying this benefit is "participants per year." Table 1 and Table 2 list each of the main and additional benefits in each benefit category as well as the metric used for quantification of each benefit.

Table 1. SWRP Main Benefits and Quantitative Metrics

Benefit Category	Benefit	Quantitative Metrics
Water Quality Benefits	Increased filtration and/or treatment of runoff	• Average annual pollutant load reduction (unit varies by pollutant) • Volume of water treated (mgd) • Volume of runoff infiltrated (af/year)
Water Supply Benefits	Water supply reliability	• Increase in water supply through direct groundwater recharge (af/year) • Increase in water supply through direct use (af/year)
	Conjunctive use	• Increase in water supply through in lieu recharge/conjunctive use (af/year)
Flood Management Benefits	Decreased flood risk by reducing runoff rate and/or volume	• Reduction in peak flow discharge (cfs) • Reduction in volume of potential flood water (af/year)
Environmental Benefits	Environmental habitat protection and improvement, including wetland enhancement/creation, riparian enhancement, and/or instream flow improvement	• Size of habitat protected or improved • Amount of instream flow rate improvement (cfs)
	Increased urban green space	• Size of increase in urban green space (acres)
Community Benefits	Employment opportunities provided	• Number of employment opportunities provided
	Public education	• Number of outreach materials provided, or events conducted

Table 2. SWRP Additional Benefits and Quantitative Metrics

Benefit Category	Benefit	Quantitative Metrics
Water Quality Benefits	Nonpoint source pollution control	• User-defined
	Reestablished natural water drainage and treatment	• User-defined
Water Supply Benefits	Water conservation	• Reduction in water use (af/year)
Flood Management Benefits	Reduced sanitary sewer overflows	• Reduction in sewer overflow volumes (af/year)
Environmental Benefits	Reduced energy use, greenhouse gas emissions, or provides a carbon sink	• Amount of energy consumption reduced (KWH/year) • Amount of GHG emissions reduced (tons/year)
	Reestablishment of natural hydrograph	• User-defined
	Water temperature improvements	• Amount of temperature improvement
Community Benefits	Community involvement	• Number of participants per year
	Enhance and/or create recreational and public use areas	• Estimated visits per year

Benefit criteria and metrics were established through a series of steps. First, benefit criteria were developed based on an initial characterization of the planning area; criteria then were further refined using region-specific studies (discussed further in Section 2.2). The SWRP Technical Advisory Committee (TAC) provided input and approved the final benefit criteria. This approach resulted in a prioritization methodology containing benefits and metrics that are targeted to the watersheds in the SWRP planning area. Thus, the prioritization of projects will reflect the regional priorities established in the SWRP.

2.2 Technical Studies Supporting Quantitative Benefits Assessments

Technical studies are currently being conducted by agencies within Stanislaus County in conjunction with the SWRP. These studies will provide quantitative assessments of stormwater pollutant loading to receiving waters to estimate potential water quality benefits and the potential for groundwater recharge using stormwater to provide water supply benefits.

In the first study, stormwater quality data will be collected at key outfalls to assess potential contaminant loading from stormwater to the County's surface receiving waters and groundwater basins. The results, in combination with existing water quality data from regional, County, and municipal monitoring programs, will help establish baseline water quality conditions to support watershed characterization, as well as project assessments and prioritization in the SWRP.

Additionally, a study of managed aquifer recharge is being conducted that focuses on using diffused stormwater to recharge groundwater basins. Potential stormwater capture/groundwater recharge sites are being assessed through field work and laboratory testing. These study results will inform project site selection and appropriate modeling activity.

Other studies have been conducted to examine hydrologic conditions and pollutant loading within the planning area to inform the SWRP benefits assessment and project prioritization methodology. The City of Oakdale completed its *Storm Drain Master Plan* in 2015, which included an evaluation of the existing storm drain system in the City of Oakdale (MCR Engineering, 2015). Hydrologic and water quality analysis contained in the master plan informed the SWRP project prioritization methodology. Another useful document, the *Empire Community Storm Drainage Report Low Impact Development & Greening Study*, examined urban greening and LID approaches in the Empire community (Stanislaus County, 2014). The study modeled stormwater runoff and evaluated a range of LID options for Empire's storm drainage system and discussed target pollutants, pollutant sources, and the efficacy of selected LID strategies for pollutant removal. This information guided the project prioritization methodology; for example, the prioritization process awards points to projects that reduce loading of certain pollutants that are known to be problematic in the area. The study contributed to the overall understanding of regional pollutants and the LID options available to address them. .

2.3 Available Tools for Quantitative Assessment of Benefits

The SWRP project solicitation process allows project applicants to submit quantitative metrics for each benefit. The quantitative information that is provided will be used by the SWRP to report total benefits for each SWRP main and additional benefit, which are quantified by aggregating the benefits associated with each project submitted to the SWRP.

Due to the short timeframe for the preparation of the SWRP, the County is relying on project proponents to determine quantitative methods appropriate for their projects. It is expected that project applicants will have already performed quantitative assessment of their proposed stormwater and dry weather runoff projects to develop the metrics shown in Table 1 and Table 2 above. In most cases, these quantitative assessments will have been performed as part of a planning or feasibility study in support of the project. This section briefly discusses some quantitative assessment tools that are available and may be used by project proponents to develop metrics for SWRP main and additional benefits.

EPA System for Urban Stormwater Treatment and Analysis Integration Model

The Environmental Protection Agency (EPA) System for Urban Stormwater Treatment and Analysis Integration (SUSTAIN) is a decision support system capable of analyzing multiple projects. SUSTAIN assists with developing and implementing plans for flow and pollution control measures to protect source waters and meet water quality goals (USEPA 2014). SUSTAIN allows watershed and stormwater practitioners to develop, evaluate, and select optimal best management practice (BMP) combinations at various watershed scales based on cost and effectiveness. SUSTAIN runs on an ArcGIS platform and has seven modules. The tool supports users with selecting suitable locations for common structural BMPs that meet user-defined site suitability criteria, such as soil type and drainage area. SUSTAIN performs hydrologic and water quality modeling and can be used to determine optimal management practices to achieve water quality objectives based on cost-effectiveness. The tool provides simulation outputs detailing treatment containment volume, attenuation, and pollutant removal effectiveness.

EPA Storm Water Management Model

EPA's Storm Water Management Model (SWMM) is used for stormwater planning, analysis, and design (USEPA 2017). SWMM is a dynamic hydrology-hydraulic water quality simulation model used primarily for urban areas. SWMM accounts for various hydrologic processes that produce runoff from urban areas and includes a flexible set of hydraulic modeling capabilities used to route runoff and external inflows through the drainage system network of pipes, channels, storage/treatment units and diversion structures. SWMM can also estimate the production of pollutant loads associated with stormwater runoff and the reduction in pollutant loading attributable to a project. Newer versions of SWMM have been expanded to include support for modeling the performance (including infiltration, percolation, and runoff reduction) of

low-impact development (LID) stormwater controls, including rain gardens, vegetative swales, and permeable pavement.

Central Valley Hydrologic Study

The Central Valley Hydrology Study (CVHS) was developed by the California Department of Water Resources (DWR) and the United States Army Corps of Engineers (USACE) to provide a basis for defining existing hydrologic conditions at locations throughout the Central Valley to support flood management analyses (DWR and USACE 2015). The CHVS includes the following study products:

- Unregulated flow-frequency curves at key locations (201 analysis points) in the Central Valley. 138 of these are based on flow-frequency analysis, and 63 are based on rainfall-runoff modeling.
- Unregulated flow time series (which serve as the basis of the frequency analysis and transform development).
- Reservoir operations models of Central Valley reservoirs developed in the Reservoir System Simulation (HEC-ResSim) software developed by the USACE Hydrologic Engineering Center.
- Regulated flow times series (unregulated flows routed through the reservoir simulation model).

The unregulated and regulated flow time series were developed using the USACE Hydrologic Engineering Center's River Analysis System (HEC-RAS) model, which contains analysis components for (1) steady flow water surface profile computations, (2) one- and two-dimensional unsteady flow simulation, (3) movable boundary sediment transport computations, and (4) water quality analysis. In addition to flow simulations and water quality analyses, HEC-RAS can also be used to map datasets such as floodplain boundaries. SWRP applicants can use the CVHS models to evaluate flood management benefits related to peak flow discharges and changes in the volume of potential flood water.

2.4 Integrated Metrics-Based Analysis of Project Benefits

An integrated analysis of project benefits will be conducted once projects have been submitted to the SWRP. The purpose of this analysis is to quantify the benefits provided by the SWRP as a whole (assuming all projects submitted are implemented).

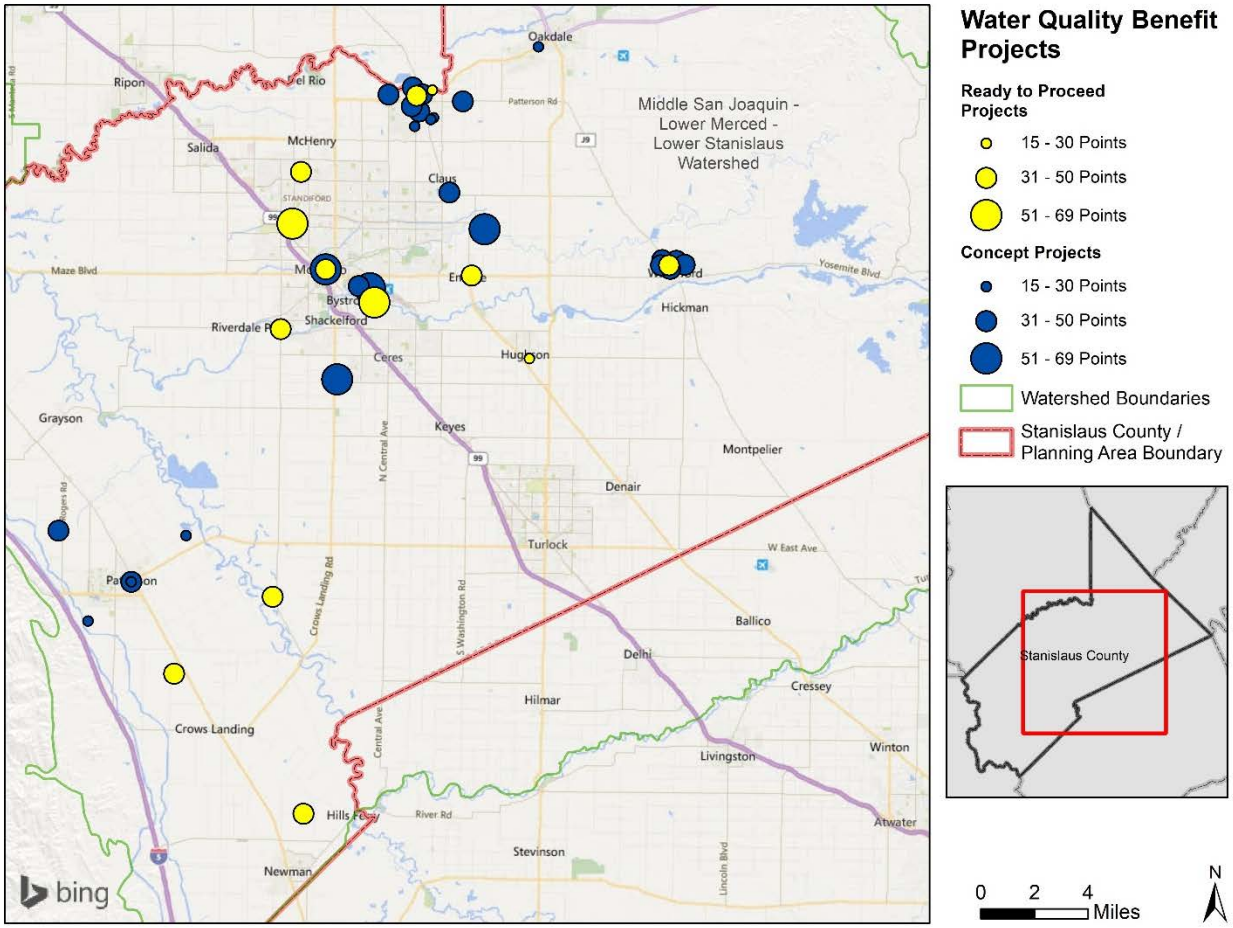
The integrated analysis will be achieved through use of OPTI, an online data management system. OPTI was developed for use during the East Stanislaus Integrated Regional Water Management Plan (IRWMP) development and has been adapted to facilitate project solicitation for the SWRP. OPTI was made available through the East Stanislaus IRWMP website (http://irwm.rmcwater.com/es). The OPTI system allows project information to be submitted, reviewed, organized, and regularly updated electronically by project proponents. As part of submitting projects to OPTI, project proponents provide information on the quantitative benefits of the project, as shown in Table 1 and Table 2. In addition to the benefit metrics listed in Table 1 and Table 2, users may define their own benefit metric for any main or additional SWRP benefit.

The quantitative benefit information provided by project proponents will be used as the basis for the integrated analysis. The OPTI system will be used to automate aggregation of benefits and produce reports on the total benefits for each watershed (or alternative geographic area), as well as for the SWRP planning area as a whole. SWRP benefits will be quantified in each of the five SWRP benefit categories: water quality, water supply, flood management, environmental, and community. The use of OPTI allows for a streamlined assessment of the SWRP benefits across varied geographic scales. In addition, each project's relative contribution to the SWRP objectives can be quantified through the Opti system. Through these analyses, SWRP benefits will be thoroughly characterized and summarized as most relevant to Stanislaus County. The information provided by project proponents will be synthesized for the SWRP, including summaries in tabular and map form, as shown in Table 3 and Figure 1.

Table 3. Example Summary Table of SWRP Benefits

Total Benefits for Water Quality				
Benefit	**Watershed A**	**Watershed B**	**Watershed C**	**Planning Area Total**
Pollutant A (lbs/year)	55	600	125	780
Pollutant B (lbs/year)	2500	100	450	3050
Discharge to Water Body A (mgd)	5	2	0	7

Figure 1. Water Quality Benefit Projects and Scores



The SWRP is intended to be a living document. In practice, this means that projects will be updated and added beyond the initial creation of the SWRP. Project solicitation periods would likely occur prior to funding solicitation periods or as needed. The use of OPTI allows Stanislaus County to maintain a dynamic project list that is conducive to continued project solicitation. OPTI makes it easy for project proponents to add new information as their project progresses, including additional quantitative information regarding project benefits. OPTI is used to facilitate an aggregated analysis of projects. As more projects are added to the SWRP and as existing projects develop, more quantitative information will be submitted to OPTI, allowing for an increasingly robust analysis of benefits.

The following sections describe the evaluation methods for each of the benefit categories that will be aggregated and assessed in OPTI for the SWRP.

2.4.1 Water Quality Benefits

Water quality improvements include the reduction of specific pollutants of concern in Stanislaus County, such as nitrates and pesticides. Water quality improvements can also support the implementation of TMDLs in the County. Project proponents may submit quantified water quality benefits into OPTI, including pollutant load reduced (which varies by constituent), the volume of water treated, or the volume of water infiltrated (rather than discharging to surface water). For the SWRP, water quality benefits will be analyzed at the watershed and/or planning area level, as appropriate, depending on the quantitative information provided by project proponents. Project proponents can specify pollutant load reduction for one or more of the following constituents: total suspended solids (TSS), mercury, diazinon, chlorpyrifos, selenium, diuron, bacteria, pyrethroids, trash, total nitrogen. Individual project proponents may calculate these benefits using different tools or methodologies but would rely on the same types of information. For example, in order to determine pollutant load reduction, project proponents would need to know information about stormwater quality, precipitation quantity, the volume of stormwater intercepted or treated by the project, and the amount of pollutant removal provided by the project.

2.4.2 Water Supply Benefits

Water supply benefits will likely be summarized at the planning area level, with finer scale analysis if the submitted quantitative information allows. Water supply benefits will mainly be quantified in terms of water supply reliability or conjunctive use benefits. In order to calculate benefits obtained from conjunctive use or in-lieu recharge, project proponents would rely on information such as soil type and permeability, precipitation volume, aquifer characteristics, and groundwater pumping. The total benefit to the planning area would be evaluated in terms of total increase in water supply provided by stormwater projects.

2.4.3 Flood Management Benefits

Flood management benefits may be quantified through measures such as peak flow reduction, flood volume reduction, or reduced sanitary sewer overflows. Project proponents will need to conduct hydraulic modeling in order to determine the project's impact on the overall storm drainage and/or sanitary sewer system. Detailed information on the relevant infrastructure or watershed features, such as location and capacity, would likely be needed to quantify flood management benefits. These benefits may be synthesized at a planning area or watershed level.

2.4.4 Environmental Benefits

Environmental benefits include improvements such as habitat restoration, increased urban green space, or reduced greenhouse gas emissions. Quantification methods used by project proponents will vary widely due to the diversity of these benefits. A benefit such as increased urban green space may be relatively simple to calculate based on project design information. In order to calculate greenhouse gas emission reduction, for example, a project proponent must determine the energy usage of the project compared to the existing conditions, the emissions factor for any energy sources, and estimates for carbon sequestration potential. Environmental benefits are likely to be quantified in a range of ways, and the SWRP will aggregate them based on a planning area basis. Environmental benefits may be quantified at the watershed level if sufficient quantitative information is received from project proponents.

2.4.5 Community Benefits

Community benefits can be quantified using metrics such as number of jobs created, number of community participants, or number of outreach materials distributed. These types of benefits would likely be decided upon during the planning phases of projects. For example, project proponents would estimate the number

of temporary and permanent jobs needed to implement a project. Outreach projects (or project components) would include quantitative targets in their planning process and the outreach program would be structured to meet those targets. Quantification of community benefits would rely on organizer experience, rather than the types of modeling approaches typical for other benefit types. Community benefits could be quantified at a planning area or watershed scale, as well as by each community impacted.

3 Approach for Identification and Prioritization of Projects

3.1 Project Solicitation

Project solicitation is the process by which agencies, organizations, and/or members of the public can submit project concepts for inclusion in the SWRP. To be considered for the SWRP, projects must be described in sufficient detail to identify the need being met, infrastructure to be constructed and operated, tasks to be implemented, and the impacts and benefits of the project. However, the projects can be in any stage of development, from conceptual to final design. There are many benefits to submitting a project for inclusion in the SWRP, including raising local awareness of the potential project and its associated benefits, identification of potential project improvements and/or integration, and positioning the project for potential State funding.

In order to facilitate project solicitation, project benefit criteria and metrics were established based on the SWRP Guidelines and region-specific information, as discussed in Section 2.1. The selected benefits were reviewed and approved by the TAC; these served as the basis for the project prioritization methodology. The prioritization methodology was then incorporated into OPTI. Project proponents were also provided with the option to submit the project information form via hard copy or email if they elected not to use OPTI. Access to project summaries is available to all interested parties with the intention of improving SWRP transparency. Any interested community member can create an OPTI account and log in to view all project information.

A stakeholder meeting was held on October 23, 2017, to provide background information on the SWRP, announce the project solicitation, and to review OPTI and the ways the project proponents could submit projects. Stakeholders identified by the TAC and through other planning efforts (East Stanislaus and Westside San Joaquin IRWMPs) were notified of this meeting via email. At this meeting, stakeholders were informed about project eligibility requirements, how to use OPTI and the process for scoring submitted projects. The project solicitation period was open from October 23, 2017 through December 8, 2017.

3.2 Project Eligibility

To be considered for inclusion in the SWRP, a project is required to fulfill the following conditions:

- Project must be sponsored by an eligible applicant. Proposition 1 (Water Code section 79712(a)) states that eligible applicants consist of:
    - Public agencies;
    - 501(c)(3) Nonprofit organizations;
    - Public utilities;
    - Federally recognized Indian tribes;
    - State Indian tribes listed on the Native American Heritage Commission's Tribal Consultation List; and
    - Mutual water companies.
- Project must be a stormwater or dry weather runoff project.

  - A stormwater project is defined as a project affecting temporary surface water runoff and drainage generated by immediately preceding storms.
  - A dry weather runoff project is defined as a project affecting surface water runoff and flow in storm drains, flood control channels, or other means of runoff conveyance produced by non-stormwater resulting from irrigation, residential, commercial and industrial activities.
- Project must contribute to two or more SWRP main benefits.
  - SWRP main benefits are shown in Table 1 above.
- Project must contribute to at least one SWRP additional benefits.
  - SWRP additional benefits are shown in Table 2 above.

These four requirements ensure that (1) projects would be submitted by applicants eligible to receive funding, (2) the project is of the appropriate type, and (3) the project provides multiple benefits as required by the SWRP Guidelines. Projects are screened for these four characteristics in order to qualify for inclusion in the SWRP. Projects that did not meet these requirements are not included in the SWRP.

3.3 Project Prioritization

A project prioritization process was developed to comply with the SWRP Guidelines, which specify that the SWRP "should prioritize individual projects and programs for implementation based on an integration of quantitative factors to assure the greatest water quality, water supply, conservation, and community needs are addressed." The prioritization process, which was approved by the TAC, was based on specific regional needs and priorities, as discussed in Section 2.1.

Projects may be submitted to the SWRP at various stages of completeness. Some projects were submitted to the SWRP while still at a conceptual stage, with little or no preliminary planning completed. These projects are included in the SWRP provided that they met the eligibility requirements, however, the scores for the "conceptual" projects are not compared directly to other projects due to lack of available information.

Projects are prioritized based on a system of points, allocated to reflect priorities of the stormwater management planning area. The SWRP scoring system follows guidance provided in the SWRP Guidelines, which encourage projects to be prioritized based on factors such as secure ongoing funding, use of a metrics-driven approach, location on public lands, augmentation of local water supplies, and habitat restoration.

Table 4 lists the points awarded to a project for each SWRP main and SWRP additional benefit that will be provide by the project. Additional points are awarded if a quantitative metric was provided for that benefit (either main or additional). This supports the SWRP's emphasis on quantification of benefits and encourages project proponents to include these metrics.

Points are also awarded according to the project's ability to address regional watershed priorities, as shown in Table 5. Questions in this category award points to projects that help achieve the goals of an existing TMDL or reduce pollutant discharges into a 303(d)-listed water body, thus supporting water quality regulations. Credit is also given if a project supports water supply augmentation and/or benefits disadvantaged communities (DACs) and economically distressed areas (EDAs).

Finally, project prioritization takes into account the project status in terms of funding, siting, and readiness to proceed (Table 6). Projects with secure sources of funding receive points, as do projects that are either located on public lands or have existing easements or right-of-way agreements. Projects also earn points based on the amount of documentation completed as an indicator of readiness to proceed.

Table 4. Points Awarded Per SWRP Main Benefit and Additional Benefit

Providing SWRP Main Benefits and Additional Benefits	Points
Providing SWRP Main Benefits	
Points per benefit provided	4
Additional points if a quantitative metric can be provided for that benefit	2
Providing SWRP Additional Benefits	
Points per benefit provided	2
Additional points if a quantitative metric can be provided for that benefit	1

Table 5. Points Awarded for Addressing Regional Watershed Priorities

Addressing Regional Watershed Priorities	Points
Implements water quality improvements to help achieve the goals of an existing TMDL?	4
Reduces pollutant discharges into a 303(d) listed Impaired Water Body?	2
Augments water supply by capturing stormwater or dry weather runoff for recharge into a groundwater basin?	4
Does the project provide a SWRP Main or Additional Benefit to a disadvantaged community or an economically distressed area?	4

Table 6. Points Awarded Based on Status of Project Implementation

Progress Towards Project Implementation	Points
Is the project supported by entities that have created permanent, local or regional funding?	4
Is the project located on public land? If not, is there an existing easement or right of way agreement with a local land owner?	4
Readiness of project to proceed (award points for each one completed):	
Planning Study or Feasibility Study	1
Environmental Assessment/EIR	1
Preliminary Project Design	2
Acquisition of all required environmental permits	2

4 Summary

In summary, the Stanislaus Multi-Agency SWRP benefits will be assessed through use of the OPTI database system. Project proponents will use available tools and existing studies to quantify their project's benefits. These benefits will be submitted to OPTI along with other project information during the project submission process. OPTI will then be used to facilitate the integrated metrics-based analysis of total SWRP benefits, with reports and data output as appropriate. Project prioritization will also be conducted based on the information submitted through OPTI; the prioritization process encourages project proponents to provide quantitative benefit information for their projects in order to achieve a higher score. Through these steps, project and SWRP benefits will be quantified for Stanislaus County as a whole.

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