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Program Manager

May 15, 2005

Mr. Bruce H. Wolfe, Executive Officer
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612

Mr. Thomas R. Pinkos, Executive Officer
California Regional Water Quality Control Board
Central Valley Region
11020 Sun Center Drive #200
Rancho Cordova, CA 95670-6114

Re: Hydrograph Modification Management Plan (HMP)

Dear Messrs. Wolfe and Pinkos:

This Hydrograph Modification Management Plan is submitted pursuant to Provision C.3.f of San Francisco Bay Board Order R2-2003-0022. The HMP, once approved by the Water Board, will be implemented so that "… post-project runoff shall not exceed estimated pre-project rates and/or durations, where the increased stormwater discharge rates and/or durations will result in increased potential for erosion …."

Contents of this Submittal

Our HMP includes this cover letter and Attachments 1-6.

This cover letter includes:

- Summary of HMP Features
- Background

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- Approach and Rationale
- Implementation Plan and Schedule
- Continuous Improvement

The attachments are as follows:

- Attachment 1 summarizes the Program's standards and criteria for implementing the HMP. All Co-permittees will require new and re-development projects subject to Provision C.3.f to meet these standards and criteria.
- Attachment 2 is a technical memorandum detailing development of sizing factors for hydrograph modification integrated management practices (IMPs). Applicants for development approvals in Contra Costa County may include these IMPs in their development projects as a means of attaining compliance with the Program's HMP standards.
- Attachment 3 is a technical memorandum specifying how applicants may use computer models and long-term hourly rainfall records to simulate runoff peaks and durations and demonstrate HMP compliance.
- Attachment 4 is a technical memorandum with methods and criteria for assessing and classifying stream reaches according to risk of accelerated erosion due to increases in runoff.
- Attachment 5 is a chronology of previous submittals pursuant to Provision C.3.f, correspondence with Water Board staff, and public outreach related to the Program's development of the HMP.
- Attachment 6 is a response to Water Board staff comments on the Program's November 15, 2004 draft HMP.

Summary of HMP Features

The distinguishing features of the Program's HMP are:

- Our HMP is ready to be implemented now. The Program will incorporate HMP requirements into a new, third edition of the Program's *Stormwater C.3 Guidebook* ninety days following the Water Board's final approval of the HMP. All Contra Costa municipalities would begin implementing the new requirements for project applications deemed complete after that date.
- To facilitate review by the Water Board and Water Board staff, our HMP standards are stated succinctly in Attachment 1. These standards will be incorporated into the

Stormwater C.3 Guidebook. The supporting information and guidance in the accompanying technical memoranda (Attachments 2, 3, and 4) will be adapted to the *Guidebook's* user-friendly format.

- Our HMP standards for control of runoff peaks and durations are based on continuous simulation of runoff using local rainfall data and locally derived parameters for initial infiltration. Our consultants used USEPA's Hydrologic Simulation Program—Fortran (HSPF), which is the same program and method that underlies the Western Washington Hydrology Model. The standards we propose are adapted from the Western Washington standards.
- Our HMP promotes the use of IMPs to provide both stormwater treatment and flow control. The HMP includes standard designs and details for IMPs. The Program's IMP sizing factors were derived by analyzing continuous simulations of runoff in HSPF.
- Our HMP allows applicants to propose in-stream restoration, in lieu of flow control, where the benefits of a proposed restoration project substantially outweigh the potential impacts of additional runoff of the proposed development project. In stream reaches where accelerated erosion due to increased watershed imperviousness is not likely but is possible ("medium risk"), applicants may use a somewhat streamlined analysis. In stream reaches where increases in runoff flows are likely to accelerate bed and bank erosion, applicants must conduct a comprehensive geomorphic watershed analysis before proposing an in-stream project in lieu of flow control.
- We propose no exemptions, other than those stated in the permit, for project size. However, should the Water Board provide such exemptions in other counties, we will add the exclusion to our HMP standard.
- We propose no exemptions for "infill projects in highly developed watersheds." Many projects in dense urban areas may not need to fully control runoff peaks and durations because they will drain to hardened channels or will replace existing impervious area. We feel it would be difficult to create and implement workable, consensus, quantitative criteria for "infill projects in highly developed watersheds." Instead, the Program has focused on developing the technical means to assist applicants to achieve peak flow and duration control on small, urban sites using IMPs. Should the Water Board accept a workable definition of "infill projects in highly developed watersheds" in another county, we will add the definition and exemption to our HMP standard.
- We propose no exemption based on project cost, because we believe the IMPs and procedures we have developed will make it possible for applicants to achieve HMP compliance at reasonable cost. We also note the difficulty inherent in assessing,

categorizing, and monitoring project expenditures, particularly after a project receives planning approval. Should the Water Board accept exemptions from permit requirements based on project cost in another county, the Program will add these exemptions to our HMP standard.

Background

As noted in Water Board staff's fact sheet accompanying Order R2-2003-0022, increases in runoff flows associated with urbanization may accelerate erosion and sediment transport in downstream watercourses, cause more frequent flooding, and widen and downcut stream channels. These impacts, in turn, can degrade stream aesthetics, habitat, and other beneficial uses.

Provision C.3.f requires the Co-permittees to implement an HMP to "…manage increases in peak runoff flow and increased runoff volume, for all Group I projects, where such increased flow and/or volume is likely to cause increased erosion of creek beds and banks, silt pollutant generation, or other waterbody impacts to beneficial uses due to increased erosive force."

The Water Board staff fact sheet describes the HMP as "an analytical method, with the inclusion of available relevant data, which a developer employs to demonstrate to the Permittees that the eventual design for the project will not lead to damaging flow impacts, when mitigative measures are included in the project."

To put the Program's approach to developing the analytical method in perspective, we note:

- Analytical methods used to evaluate hydrologic and geomorphic processes are subject to considerable uncertainty. These uncertainties are related both to the variability inherent in natural systems and to ongoing changes in scientific understanding of those systems. Mechanistic models currently available can provide insight into stream processes, but cannot provide precise predictions of stream response to hydrologic changes.
- Implementation is the key to a viable and effective HMP. Whatever analytical method or design standards are chosen, they must support the design of facilities that can be practically built and maintained in the high-value, high-density development sites typical of Contra Costa County and the Bay Area. Because the HMP will be implemented through the municipal development review process, it must specify design criteria that can be incorporated into conditions of approval.

To develop a practical HMP analytical method, Program staff and consultants have drawn on the scientific and professional disciplines of hydrology (including computer simulation of rainfall, infiltration, storage, and runoff), and stream geomorphology. Each of these disciplines employs accumulated empirical evidence, professional experience, and analysis within a generalized scientific framework. Some members of the consultant team have long-term experience in the development and application of the Western Washington Hydrology Model. Other team members have many years' experience analyzing the impacts of development on Contra Costa streams and designing stream restoration projects to mitigate those impacts. In addition, program staff and consultants have followed closely the joint effort by the Santa Clara Valley Urban Runoff Pollution Prevention Program and the Santa Clara Valley Water District to develop an HMP for municipalities in northern Santa Clara County.

This HMP provides straightforward compliance standards and tools (including design procedures, criteria, and standard details for IMPs) to assist applicants to demonstrate compliance with the Program's standards. The design criteria are conservative but reasonable. The IMPs have been selected and designed to perform reliably and consistently in the variety of different locations, soil types, and modes of development found in Contra Costa County.

HMP Approach and Rationale

Integration with other C.3 Provisions and with the development review process

Each Co-permittee has adopted an updated stormwater ordinance, based on a model provided by the Program, mandating implementation of the Provision C.3 requirements. The ordinances require development permit applications be accompanied by a Stormwater Control Plan that meets the criteria in the most recent version of the Program's *Stormwater C.3 Guidebook.*

The *Guidebook* includes step-by-step instructions to assist applicants to prepare Stormwater Control Plans. Each project's Stormwater Control Plan documents—in a consistently organized, easy-to-check format—that the project has been planned and designed to comply with each of the C.3 provisions.

The current *Guidebook* (second edition, March 2005) already contains instructions for minimizing impervious area, creating "self-retaining" areas that are disconnected from the drainage system, and for selecting and sizing integrated management practices (IMPs) to treat runoff in compliance with the requirements of Provision C.3.d.

The ordinances and *Guidebook* also already require each site with treatment facilities to have a Stormwater Facilities Operation and Maintenance Plan. These same operation and maintenance requirements will be extended to hydrograph modification management facilities.

Implementation of the other C.3 provisions began February 15, 2005. The Co-permittees' initial experience working with the first applications for projects subject to the C.3 requirements tends to validate the *Guidebook* approach.

Following approval of this HMP by the Water Board, the Program will incorporate HMP requirements into a third edition of the *Guidebook.* Applicants' documentation of compliance with the HMP will be incorporated into their Stormwater Control Plans.

HMP Standard and Methods of Demonstrating Compliance

Attachment 1 is the Program's HMP Standard. Applicants may demonstrate compliance by any of the following methods:

1. Show there will be no increase in directly connected impervious area.
2. Use IMPs that meet Program design requirements to control all runoff from new impervious areas.
3. Model and compare post-project to pre-project runoff peaks and durations.
4. Show projected increases in runoff peaks and/or durations will not accelerate erosion of receiving stream reaches.

The discussion below articulates the background and rationale for each method and addresses how the Co-permittees will implement each method.

Method #1: Demonstrate there is no increase in directly connected impervious area.

Hydrograph modification impacts of development are caused by the replacement of pervious soil with impervious surfaces such as rooftops and paving. Therefore, the *Guidebook* will include instructions for applicants to document, measure, and compare pre-project to post-project directly connected impervious area (DCIA). If there is no change in DCIA, it is assumed that the major hydrograph modification impacts are avoided. Other provisions, described below, address potential impacts not related to DCIA.

Development projects may also alter the infiltration characteristics of pervious areas, either decreasing or increasing the amount of runoff as compared with pre-project conditions. In the case of "D" soils characteristic of much of the county, soil amendments needed to support landscaping will increase infiltration rates and moisture retention, reducing runoff rates. In addition, the Program's *Guidebook* requires applicants implement, to the maximum extent practicable, landscape features that minimize runoff including (for example) concave medians. Using the *Guidebook* step-by-step instructions for drainage design, applicants are strongly encouraged to make landscaped areas "self-retaining," and thereby avoid the cost and trouble of treating runoff from these areas.

A related concern expressed by Water Board staff is that in some developments, a new drainage system could convey runoff more efficiently, even where the impervious area decreases or remains the same. Under such a scenario, volumes would remain the same or decrease, durations would decrease, but peak runoff rates would increase. This scenario is addressed by the Program's approach to implementing stormwater treatment requirements. Following the instructions in the *Stormwater C.3 Guidebook*,[1] applicants' designs must direct runoff to self-retaining areas (at a maximum 2:1 ratio of impervious:pervious area) or route runoff from impervious areas to treatment IMPs such as swales, planter boxes, and bioretention areas. These treatment IMPs detain runoff in a surface reservoir, filter it through 18 inches of soil, collect the filtrate in a subsurface trench filled with aggregate, and then allow the treated runoff to either seep into the ground or into perforated pipes (to be collected and transported to the storm drain system).

Although not specifically designed for flow control, these facilities extend the time of concentration, particularly for small storms. As an additional method to ensure against increases in peak flow, the *Guidebook* will require applicants to include, in their stormwater control plans, a qualitative comparison of pre-project and post-project drainage efficiency.

This method allows applicants for projects on previously developed sites, where an increase in impervious area is not proposed, to easily and simply demonstrate HMP compliance. Where applicable, this option will obviate any need to document an HMP exemption based on impracticability, proportion of watershed "build-out," proximity to transit, or characteristics of the receiving stream.

[1] In the second edition, the instructions begin on page 53.

Method #2: Use Hydrograph Modification Integrated Management Practices (IMPs)

The Program has developed standard specifications and sizing criteria for seven hydrograph modification IMPs. The specifications and sizing criteria will be included in the *Stormwater C.3 Guidebook,* along with instructions for site planning for IMP implementation. The applicant will first divide the project site into discrete drainage areas, disconnecting impervious areas from the drainage system and creating "self-retaining areas" wherever possible. Drainage from remaining impervious areas is routed to IMPs.

Versions of these IMPs—suitable for meeting the runoff treatment requirements of Permit Provisions C.3.c and C.3.d—are already included in the second edition of the Program's *Stormwater C.3 Guidebook*.[2] The Program has adapted the treatment IMP standard specifications to maximize runoff storage and to meter outflow to manage hydrograph modification impacts in addition to providing runoff treatment. The Program has also developed a spreadsheet-based automated sizing tool that will allow applicants to select suitable hydrograph modification IMPs and readily obtain the required dimensions. Attachment 2 includes the designs of each IMP and details how the sizing criteria were developed. A summary follows.

Sizing factors reflect the surface area of an IMP that is required to manage runoff from a given impervious drainage area, expressed as a percentage of the drainage area. That is, if a 50 square foot IMP is required to manage runoff from a 1000 square foot impervious drainage area, the sizing factor for that IMP is 0.05. The HMP standard for managing runoff is described in Attachment 1. Program consultants used the USEPA's Hydrologic Simulation Program—Fortran (HSPF) computer model and a 35-year record of hourly rainfall data from a gauge in Martinez to develop sizing factors for the seven IMPs included in the *Guidebook*. The following steps were performed:

- Compute hourly runoff for pervious and impervious unit areas for the 35-year period.
- Establish stage-storage-discharge relationships based on the IMP designs.
- Route runoff from the impervious unit area to each IMP.
- Track and analyze infiltration and outflow from each IMP's overflow and underdrain (if any) to compute hourly discharge from the IMP.
- Compare model results for IMP discharges to those for pervious unit area runoff.
- Adjust each IMP size until the required control of peaks and durations is achieved.
- As a final step, establish correction factors for differences in rainfall patterns within the County.

[2] See the fact sheets in Attachment C-1 to *Guidebook* Appendix C.

To analyze the effectiveness of IMPs in controlling runoff peaks and durations, Program consultants compared two sets of runoff curves representing pre-project post-project, and post-project-with-IMP conditions.

The first set of curves reflects "Flow Duration Statistics" for the various model runs. These curves are plots of runoff flow (in cubic feet per second) against the percent of time that flow is exceeded *during the entire period of rainfall record.* That is, the curves reflect the number of hours that a given flow rate is exceeded over the 35-year simulation period. The flow duration curves are the most direct and complete way of representing the duration of flows in a critical range, regardless of the storm event that generates those flows. For HMP purposes, critical flows are those most likely to move sediment (i.e., cause erosion). The consultant team compared pre-project and IMP flow duration curves to select IMP sizing factors that adequately control flow durations within the critical range of flows.

The second set of curves reflects "Peak Flow Statistics" for the various model runs. These curves are plots of the highest flow that occurs, on average, during any 1 year, 2 year, 3 year, and on up to any 10-year period within the rainfall record. The peak flow curves provide a way to evaluate peak flows associated with storm events by looking at their frequency of occurrence. The consultant team compared pre-project and IMP peak flow curves to select IMP sizing factors that control flow peaks within the critical range of events.

Visual comparison of the post-project curves to the pre-project curves (Figures 8-11, 13-14, 17-20, 22-25, 27-28, 30-31, and 33-34 in Attachment 2) shows that all seven IMPs effectively control post-project flows to pre-project conditions. Post-project flows are always below pre-project flows in the most critical portions of the curves (between one half the flow of the pre-project runoff event with an average recurrence of two years, or 0.5Q2, and the flow of the pre-project runoff event with an average recurrence of 10 years, or Q10) and are below or close to pre-project flows in the less-critical portions of the curves.

The resulting sizing factors are adjusted for different patterns of rainfall throughout the County. IMPs discharge differently in Group A or B soils vs. Group C or D soils (i.e. via infiltration vs. underdrains) so different adjustment factors are applied for IMPs associated with the different soil groups.

Use of IMPs will provide reasonable certainty that a project will not cause increased flow peaks and durations in the range most likely to increase erosion or have other significant effects on beneficial uses. The IMPs provide a cost-effective, constructible option for HMP compliance on small and large sites—and meet the requirements for stormwater treatment as well.

Because hydrograph modification IMPs also act as treatment IMPs—and because their cost and space requirements are only marginally higher than for treatment IMPs—we expect most applicants, particularly those proposing smaller developments, will select this option rather than seek compliance through site-specific runoff modeling (Method #3) or addressing characteristics of the receiving stream (Method #4).

IMPs could be designed to provide even more control of outflows in the range of flows below 0.5Q2. This would be accomplished by reducing allowable underdrain outflow and increasing the sizing factors. The Program rejected this idea because (1) we believe the current sizing factors achieve the HMP standard, as evidenced by a comparison of the resulting runoff curves, and (2) it would make the IMPs less attractive to applicants, thereby undermining the advantages to be had by promoting the use of IMPs.

The consultant team used conservative assumptions to model pre-project runoff and IMP performance. Further modeling, collection of field data, and calibration are proposed as continuous improvement tasks and could result in adjustments to sizing factors. (See discussion below under the "Continuous Improvement" heading.)

Method #3: Model and Compare Pre- and Post-Project Runoff

Although the Program's IMP designs provide a simple and flexible means for most applicants to demonstrate compliance with the HMP standard, some applicants may wish to use other devices or strategies. Examples:

- Detention basins for flow control.
- IMPs in series, such as a flow-through planter draining to a swale, where the size of each IMP may be reduced accordingly.
- Water features, such as ponds or constructed wetlands, for hydrograph modification management.
- IMPs not included in the *Guidebook*, such as cisterns or rooftop detention.

To provide flexibility and encourage innovation, Co-permittees may allow applicants to demonstrate compliance with the HMP by modeling and comparing post-project site runoff (with and without hydrograph modification management) to pre-project site runoff.

To use this method, applicants will need to arrange for an experienced hydrologic modeler to simulate runoff from the site in its existing (pre-project) condition. The modeler will also need to establish runoff routing and stage-storage-discharge relationships for the planned detention and infiltration facilities.

Attachment 3 is the Program's guidance for modeling pre- and post-project runoff using HSPF. The guidance includes values or ranges of the key parameters, instructions for representing detention facilities, and instructions for presenting and analyzing output data.

Output data will be evaluated using the following standard, which was adapted from the Washington Department of Ecology's standard:

1. Post-project peak flows shall not exceed pre-project peak flows for recurrence intervals up to two years (Q2). For peak flows with recurrence intervals of two years through ten years (Q2 through Q10), post-project peak flows may exceed pre-project peak flows by up to 10% within a 1-year-wide band. For example, the post-project flows could exceed the pre-project flows by up to 10% between Q9 and Q10 or from Q5.5 to Q6.5, but not from Q8 to Q10.

2. Post-project runoff durations, from one-half the pre-project 2-year runoff event (0.5Q2) to Q2 shall not exceed pre-project runoff durations. For flow rates above Q2, post-project durations shall be less than or equal to pre-project runoff durations, except that the post-project duration may exceed the pre-project durations for no more than 10% of the time.

Method #4: Demonstrate projected increases in runoff peaks and durations will not accelerate erosion of receiving stream reaches.

This HMP encourages applicants for development approvals to use IMPs to control runoff peaks and durations to pre-project levels, where possible, rather than seeking exemptions or implementing in-stream mitigation. The Co-permittees would allow increases in runoff peaks and durations only when the applicant can show, with reasonable certainty, that the increases would not accelerate erosion in receiving streams or potentially degrade beneficial uses, or that the potential for erosion or other impacts to beneficial uses is minimal.

Provision C.3.f.(ii) states in part:

> [HMP requirements do] not apply to new development and significant redevelopment projects where the project discharges stormwater runoff into creeks or storm drains where the potential for erosion or other impacts is minimal. Such situations may include discharges into creeks that are concrete-lined or significantly hardened (e.g., with rip-rap, sackcrete, etc.) downstream to their outfall in San Francisco Bay, underground storm drains discharging to the Bay, and infill projects in highly developed watersheds, where the potential for

> single-project and/or cumulative impacts is minimal. Guidelines for such situations shall be included as part of the HMP.

To implement this requirement, the Program has prepared a definition of a "low-risk" stream. The definition is in paragraph 4.a. of Attachment 1. Projects in such situations must still reduce imperviousness to the maximum extent practicable, and will still include treatment BMPs, but need not match post-project runoff peaks and durations to pre-project peaks and durations.

In other streams, it may be possible and appropriate, in some circumstances, to allow applicants to mitigate potential effects of increased runoff by implementing in-stream restoration techniques.

Provision C.3.f.(vii) states:

> The Dischargers may develop an equivalent limitation protocol, as part of the HMP, to address impacts from changes in the volumes, velocities, and/or durations of peak flows through measures other than control of those volumes and/or durations. The protocol may allow increases in peak flow and/or durations, subject to the implementation of specified design, source control, and/or treatment control measures and land planning practices that take into account expected stream change (e.g., increase in the cross-sectional area of stream channel) resulting from changes in discharge rates and/or durations, while maintaining or improving beneficial uses of waters.

Although some Contra Costa streams are in good condition, there is a substantial backlog of needed restoration work. Some of these restoration projects would require extensive watershed analysis before proceeding to design; others (particularly on streams which have generally stable beds but also have eroding bends or bank failures) could proceed quickly following analysis of the localized problem.

The HMP standard (Attachment 1) accommodates these differing situations by distinguishing "medium risk" vs. "high risk" of accelerating stream erosion. Attachment 4 includes a detailed methodology and instructions for classifying streams and development situations as "medium risk" vs. "high risk".

In a "medium risk" stream reach, accelerated erosion due to increased watershed imperviousness is not likely but is possible, and the uncertainties can be more easily and effectively addressed by a mitigation project than by additional study.

After a preliminary report indicates a project presents a "medium risk," the applicant has the option—as an alternative to matching post-project to pre-project runoff peaks and

durations—to propose a mitigation project. If a suitable project exists in the same stream reach or watershed, that project should be proposed; otherwise, a project in another watershed may be acceptable. The proposal must include a preliminary design and an opinion and supporting analysis by a qualified environmental professional that the expected environmental benefits of the restoration project substantially outweigh the potential impacts from the increase in runoff that would be produced by the development project.

By contrast, a project in a "high-risk" situation, including any project over 20 acres and any project discharging to an unstable stream (e.g., incised or confined channel, or having beds or banks composed of fine materials, as detailed in Attachment 4) could propose a mitigation project only after completing a comprehensive analysis to determine design objectives for channel restoration. (Or the applicant may choose to match post-project runoff peaks and durations to pre-project peaks and durations using IMPs (Option #2) or site-specific modeling and design (Option #3)).

Plan and Schedule for HMP Implementation

Following Water Board approval of this HMP, the steps to implementation are:

- Finalize and test the IMP sizing tool.
- Incorporate the HMP policies, IMP sizing tool, IMP designs, and other technical information into a third edition of the Program's *Stormwater C.3 Guidebook.*
- Prepare and conduct information/training sessions for municipal staff and land development professionals.
- Validate the approach by conducting a comprehensive assessment of one Contra Costa watershed.
- Initiate Continuous Improvement.
- Begin requiring HMP implementation in Stormwater Control Plans for projects deemed complete after a set date.

The Program proposes to complete these tasks and begin implementation 90 days after the Water Board's final approval of this HMP.

Continuous Improvement

The HMP incorporates the Co-permittees' initial success in implementing C.3 requirements (using the *Stormwater C.3 Guidebook*), uses current scientific understanding and technical tools, and adopts generally conservative assumptions throughout. We believe implementation will ensure estimated post-project runoff peaks and durations do not exceed estimated pre-project peaks and durations where increased stormwater runoff peaks or durations could cause erosion or other significant effects on beneficial uses.

We also expect to gain, through the first years of implementation, information and insights that will help us meet the HMP's objectives more efficiently and effectively.

The initial step in this process will be to conduct an analysis of one watershed development scenario to evaluate the effectiveness of the Program's HMP standard (including use of IMPs) in controlling the cumulative effects of many development projects within a single watershed. The analysis will also help the program refine guidance for evaluating and mitigating impacts of development in situations where there is a "high risk" of accelerated erosion.

The HMP will be continuously improved through the following plan-do-check-adapt cycle:

Plan

- Adoption of this HMP by the Water Board.
- Initiation of HMP requirements according to the 90-day schedule above.

Do

- Implementation by municipalities of HMP requirements on all projects subject to the HMP.
- Documentation of each project's HMP implementation in a Stormwater Control Plan.

Check

- Tabulation, reporting, and summary of all projects countywide in the Program's Annual Report.
- Evaluation of HMP effectiveness. The evaluation will be based on a review of project Stormwater Control Plans, review of construction documents, and visits to constructed projects. The evaluation will note problems and issues encountered in implementation and anecdotal reports of IMP performance.

- Monitoring. The Program will investigate means to monitor flow from IMPs as a way of evaluating flow control effectiveness.
- Evaluation of articles, design manuals, and technical reports regarding Low Impact Development, IMP design, and IMP modeling outside Contra Costa County.
- Refinement of IMP sizing factors. The Program may refine technical assumptions used in development of the sizing factors, re-run the models, and refine sizing factors accordingly.
- Evaluation of any in-stream projects implemented in connection with the HMP.

Adapt

- Updates to the Stormwater C.3 Guidebook as needed
- Between Guidebook updates, interim Program guidance memoranda to municipal staff as needed.

In closing, we express our appreciation for the effort and contributions of Water Board staff, particularly Christine Boschen, Keith Lichten, and Jan O'Hara, as we prepared the HMP.

Should you have any questions regarding the HMP, please contact Tom Dalziel at (925) 313-2392.

Sincerely,

Donald P. Freitas
Program Manager

DPF:td
cc. C. Boschen, SFBRWQCB
C. Palisoc, CVRWQCB