CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

ORDER No. R2-2006-0050
NPDES PERMIT NO. CAS0029912

AMENDMENT REVISING ORDER NO. R2-2003-0022 FOR:

CONTRA COSTA COUNTY, CONTRA COSTA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT, CITY OF CLAYTON, CITY OF CONCORD, TOWN OF DANVILLE, CITY OF EL CERRITO, CITY OF HERCULES, CITY OF LAFAYETTE, CITY OF MARTINEZ, TOWN OF MORAGA, CITY OF ORINDA, CITY OF PINOLE, CITY OF PITTSBURG, CITY OF PLEASANT HILL, CITY OF RICHMOND, CITY OF SAN PABLO, CITY OF SAN RAMON, CITY OF WALNUT CREEK, which have joined together to form the CONTRA COSTA CLEAN WATER PROGRAM.

The California Regional Water Quality Control Board, San Francisco Bay Region, hereinafter referred to as the Board, finds that:

Findings

1. Incorporation of related documents: The Fact Sheet for this Order includes cited references and additional explanatory information in support of the requirements of this amendment. This information, including any supplements thereto, and any future response to comments on the Tentative Order, is incorporated herein by this reference.

Existing Orders

2. Contra Costa County, Contra Costa County Flood Control and Water Conservation District, City of Clayton, City of Concord, Town of Danville, City of El Cerrito, City of Hercules, City of Lafayette, City of Martinez, Town of Moraga, City of Orinda, City of Pinole, City of Pittsburg, City of Pleasant Hill, City of Richmond, City of San Pablo, City of San Ramon, and City of Walnut Creek (hereinafter Dischargers), have joined together to form the Contra Costa Clean Water Program (hereinafter Program). On July 21, 1999, the Board re-issued waste discharge requirements (NPDES Permit No. CAS0029912, Order No. 99-058, hereinafter Permit) under the National Pollutant Discharge Elimination System (NPDES) to the Program to discharge stormwater runoff from storm drains and watercourses within the Dischargers' jurisdictions by complying with the Permit and implementing the Permit's associated Stormwater Management Plan (hereinafter Plan).

3. On February 19, 2003, the Board adopted Order No. R2-2003-0022, amending Provision C.3 (New and Redevelopment Component) of the Permit. On July 21, 2004, the Board adopted Order No. R2-2004-0059 and Order No. R2-2004-061, amending the Permit in response to the San Francisco Superior Court's Writ of Mandate and Statement of Decision. The amendments pertained to monitoring requirements and the process for amending the Permit, including the Plan, as well as adopting as requirements the changes to the Plan since 1999.

4. Order Nos. 99-058 and R2-2003-0022 recognize the Plan as the Dischargers' Comprehensive Control Program and requires implementation of the Plan, which describes a framework for management of stormwater discharges. The Plan has been modified since 1999 and describes the Program's goals and objectives and contains Performance Standards, which represent the baseline level of effort required of each of the Dischargers. The Plan contains Performance Standards for five different stormwater management components.

5. The Permit specifically requires a level of implementation of best management practices (BMPs), including source control, site design, and structural stormwater treatment measures in new development and significant redevelopment, that removes pollutants from the discharge to the maximum extent practicable (MEP). This is done through additional requirements to incorporate source control measures, site design principles, and structural stormwater treatment controls in new development and redevelopment projects in order to reduce water quality impacts of stormwater runoff for the life of these projects. The consistent application of such measures is intended to greatly reduce the adverse impacts of new development and redevelopment on water quality and beneficial uses by reducing stormwater pollutant impacts, and impacts of increases in peak runoff rate.

Hydromodification Management Plan (HMP) Report

6. On May 15, 2005, the Program submitted its Hydromodification Management Plan (HMP) as required under this Permit. The intent of the HMP is to reduce the hydromodification impacts from stormwater discharges from certain development projects within the Dischargers' jurisdictions. Attachment 1 of the Program's HMP is the Hydrograph Modification Management Standard[1]. This Order amends the Permit to approve and impose the Hydrograph Modification Management Standard as set forth in Attachment A of this Order.

7. The Program has developed an innovative model for sizing "integrated management practices" (IMPs), which are intended to control excess runoff and hydromodification impacts. Due to the innovative nature of the model, the Program has committed to carry out a Model Calibration and Validation Plan, which is hereby incorporated into the Permit as Attachment B of this Order. Data collected pursuant to the Model Calibration and Validation Plan may indicate that changes are needed in the sizing and/or design of IMPs, in which case the Program will be required to make the necessary changes in a timely fashion, e.g., within three months of data collection and analysis.

8. In addition, this Order requires submission of a revised *Stormwater C.3 Guidebook*[2], which the Dischargers intend to use to assist the regulated community to comply with the Hydrograph

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[1] The proposed Hydrograph Modification Management Standard was submitted in Attachment 1 of the Contra Costa Clean Water Program *Hydrograph Modification Plan*, May 15, 2005.

[2] *Stormwater C.3 Guidebook*, Contra Costa Clean Water Program *Stormwater Quality Requirements for Development Applications*, Second Edition-March 2005. Available at http://www.cccleanwater.org/construction/nd.php#Guidebook

Modification Management Standard, for Executive Officer concurrence to ensure that the *Stormwater C.3 Guidebook* is consistent with and conforms to the Standard.

9. It is the Board's intention to make all the permit requirements and implementation dates essentially uniform for all Bay Area municipal stormwater permittees in the near future. Revisions of the Dischargers' HMP provisions may be needed to make the Dischargers' HMP consistent with the HMPs of other Bay Area municipal stormwater permittees. This will occur in all likelihood through a region-wide permit, through a blanket permit amendment for all Bay Area Permittees, or through reissuance of the Dischargers' permit in a manner consistent with the other Bay Area municipal stormwater permittees.

10. The Executive Officer may request that all Bay Area municipal stormwater permittees investigate potential incremental costs, and benefits to waterways, from controlling a range of flows up to the 35 or 50-year peak flow, versus controlling up to the 10-year peak flow, as required by parts of this Order. In addition, the allowable low-flow (also called Qcp and currently specified as 10% of the pre-project 2-year runoff from the site) from hydromodification control units will be investigated with the goal that Bay Area streams are protected from cumulative impacts from increased erosion associated with urbanization. Further investigation of the effectiveness of "self-retaining areas" for post-project flows and durations will occur also. Any future revisions of the Dischargers' HMP provisions may reflect improved understanding of these issues.

12. The Board strongly encourages land use planning agencies and developers to carefully consider, early in the development planning process, the potential impacts on water quality and beneficial uses of new development projects. The Board strongly discourages modifying watercourses to adapt to increased flows and durations of runoff, except in limited circumstances where avoidance or other natural alternatives are not feasible. In these limited circumstances, project proponents should first demonstrate that hydromodification has been minimized to the extent practicable by minimizing increases in flows and durations of runoff discharge from the site. Second, the project proponents should demonstrate that off site mitigation measures have been employed to the maximum extent practicable to avoid hydromodification impacts. Project proponents also should document that there will be no adverse effects to water quality or beneficial uses.

13. Certain control measures implemented or required by Dischargers for urban runoff management may create a habitat for vectors (e.g., mosquitoes and rodents) if not properly designed or maintained. Close collaboration and cooperative effort among Dischargers, local vector control agencies, Board staff, and the State Department of Health Services is necessary to minimize potential nuisances and public health impacts resulting from vector breeding.

14. The Board recognized in its "Policy on the Use of Constructed Wetlands for Urban Runoff Pollution Control" (Resolution No. 94-102) that urban runoff treatment wetlands that are constructed and operated pursuant to that Resolution and are constructed outside of a creek or other receiving water, are stormwater treatment systems and, as such, are not waters of the State and United States subject to regulation pursuant to Sections 401 or 404 of the federal Clean Water Act. Board staff is working with the California Department of Fish and Game (CDFG)

and U.S. Fish and Wildlife Service (USFWS) to identify how maintenance for stormwater controls required under orders such as this Order can be appropriately streamlined, given CDFG and USFWS requirements, and particularly those that address special status species. The Dischargers are expected to work diligently and in good faith with the appropriate agencies to obtain any approvals necessary to complete maintenance activities for treatment controls. If the Dischargers have done so, when necessary and where maintenance approvals are not granted by the agencies, the Dischargers shall be considered by the Board to be in compliance with Provision C.3.e of the Permit.

Applicable Federal, State, and Regional Regulations

15. Pursuant to 40 CFR Sections 124.5.c.2 and 122.62, only those conditions to be modified by this amendment shall be reopened with this amendment. All other aspects of the existing Permit shall remain in effect and are not subject to modification by this amendment.

16. Provision C.12 (formerly C.11) of the Permit anticipated that the Plan may need to be modified, revised or amended from time to time to respond to new information, changed conditions, and to incorporate more effective approaches to pollutant control. It further states that changes to the Plan, which is an integral and enforceable part of the Permit, will be made in accordance with applicable State and federal law for permit modifications. Amending the Permit to require additional, more effective and stringent requirements is consistent with State and federal law for permit modifications.

18. This action to modify an NPDES permit is exempt from the provisions of the California Environmental Quality Act (Division 13 of the Public Resources Code, Chapter 3, Section 21100, et.seq.) in accordance with Section 13389 of the California Water Code.

Notification to Dischargers and Interested Parties

19. The Dischargers and interested agencies and persons have been notified of the Board's intent to modify waste discharge requirements for the existing discharge and have been provided opportunities for public meetings and to submit their written views and recommendations.

IT IS HEREBY ORDERED that the Dischargers, in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted hereunder and the provisions of the Clean Water Act as amended and regulations and guidelines adopted hereunder, shall comply with the following revisions:

Provisions C.3.f. of Order No. 2003-0022 are hereby modified and amended as follows: additions to the Provisions are displayed as **underlined Bold type,** and deletions of text are displayed as ~~strikeout~~ format.

C.3.f.

i. **No later than ~~September~~ October 14, 2006, t**~~T~~he Dischargers shall manage increases in peak runoff flow and increased runoff volume, for all Group 1 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. Such management shall be through implementation of **the** ~~a~~ Hydrograph Modification Management Plan**'s** (HMP)~~.~~ **Hydrograph Modification Management Standard as set forth in Attachment A and Model Calibration and Validation Plan as set forth in Attachment B of this Order. Attachments A and B are hereby incorporated into this Permit as requirements. The Dischargers shall require Group 1[3] projects to comply with these requirements. Additionally, the Dischargers shall submit to the Water Board Executive Officer a revised Stormwater C.3 Guidebook that is consistent with and conforms to the Hydromodification Management Standard no later than October 1, 2006, and shall obtain Executive Officer concurrence that the revised Stormwater C.3 Guidebook is consistent with and conforms to the Hydrograph Modification Management Standard.**

The ~~HMP, once approved by the Regional Board, will~~ **Hydrograph Modification Management Standard shall** 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 or other significant adverse impacts to beneficial uses, attributable to changes in the amount and timing of runoff. The term duration in this Provision is defined as the period that flows are above a threshold that causes significant sediment transport and may cause excessive erosion damage to creeks and streams.

I, Bruce H. Wolfe, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region, on July 12, 2006.

Bruce H. Wolfe
Executive Officer

Attachment A: Hydrograph Modification Management Standard
Attachment B: IMP Model Calibration and Validation Plan

[3] This Standard will apply only to projects that create or replace one acre or more of impervious surface until such time as this size threshold is changed through such mechanisms as a region-wide permit, a blanket permit amendment for all Bay Area Permittees, or through reissuance of the Dischargers' permit accomplished in a consistent fashion with the other Bay Area Permittees.

Attachment A:

Hydrograph Modification Management Standard

I. Hydrograph Modification Management Standard

All projects subject to this Standard[4] shall ensure estimated post-project runoff peaks and durations do not exceed estimated pre-project peaks and durations if increased stormwater runoff peaks or durations could cause erosion or other significant effects on beneficial uses.[5]

By allowing no increase or impact from any individual project, the standard is intended to ensure that beneficial uses are reasonably protected from the potential cumulative effects of future development in the same watershed. In addition, each of the following methods and criteria for demonstrating compliance with the standard is defined using conservative criteria (e.g., by using an upward bias when assessing and estimating potential impacts of hydrograph modification and a downward bias when estimating the effectiveness of hydrograph modification management measures). Finally, the methods and criteria emphasize distributed, infiltration-based integrated management practices (IMPs) that mimic natural infiltration processes, minimizing the potential for cumulative impacts.

II. Demonstrating Compliance with the Standard

Project proponents shall demonstrate compliance with the standard by demonstrating that any one of the following four options is met:

1. **No increase in impervious area.** The project proponent may compare the project design to the pre-project condition and show the project will not increase impervious area and also will not facilitate the efficiency of drainage collection and conveyance. The comparison shall include all of the following:
   a. Assessment of site opportunities and constraints to reduce imperviousness and retain or detain site drainage.
   b. Description of proposed design features and surface treatments used to minimize imperviousness.
   c. Inventory and accounting of existing and proposed impervious areas.
   d. A qualitative comparison of pre-project to post-project efficiency of drainage collection and conveyance that demonstrates that opportunities to decrease imperviousness and retain / detain runoff have been maximized. Stormwater treatment IMPs such as those in the *Stormwater C.3 Guidebook* increase time of concentration, particularly for smaller storms, and are considered to substantially reduce drainage efficiency.
2. **Implementation of hydrograph modification IMPs.** The project proponent may select and size IMPs to manage hydrograph modification impacts, using the design procedure, criteria, and sizing factors specified in the Contra Costa Clean Water Program's *Stormwater C.3 Guidebook.* The use of flow-through planters shall be limited to upper-story plazas, adjacent

[4] This Standard will apply only to projects that create or replace one acre or more of impervious surface until such time as this size threshold is changed through such mechanisms as a region-wide permit, a blanket permit amendment for all Bay Area Permittees, or through reissuance of the Dischargers' permit accomplished in a consistent fashion with the other Bay Area Permittees.
[5] This is a restatement of Water Board Order R2-2003-0022, Provision C.3.f.i.

to building foundations, on slopes where infiltration could impair geotechnical stability, or in similar situations where geotechnical issues prevent use of IMPs that allow infiltration to native soils. Limited soil infiltration capacity in itself does not make use of other IMPs infeasible.

3. **Estimated post-project runoff durations and peak flows do not exceed pre-project durations and peak flows.** The project proponent may use a continuous simulation hydrologic computer model such as USEPA's Hydrograph Simulation Program—Fortran (HSPF) to simulate pre-project and post-project runoff, including the effect of proposed IMPs, detention basins, or other stormwater management facilities. To use this method, the project proponent shall compare the pre-project and post-project model output for a rainfall record of at least 30 years, using limitations and instructions provided in the Program's *Stormwater C.3 Guidebook*, and shall show the following criteria are met:

   a. For flow rates from 10% of the pre-project 2-year runoff event (0.1Q2) to the pre-project 10-year runoff event (Q10), the post-project discharge rates and durations shall not deviate above the pre-project rates and durations by more than 10% over more than 10% of the length of the flow duration curve.

   b. For flow rates from 0.5Q2 to Q2, the post-project *peak flows* shall not exceed pre-project peak flows. For flow rates from Q2 to Q10, post-project peak flows may exceed pre-project flows by up to 10% for a 1-year frequency interval. For example, post-project flows could exceed pre-project flows by up to 10% for the interval from Q9 to Q10 or from Q5.5 to Q6.5, but not from Q8 to Q10.

4. **Projected increases in runoff peaks and durations will not accelerate erosion of receiving stream reaches.** The project proponent may show that, because of the specific characteristics of the stream receiving runoff from the project site, or because of proposed stream restoration projects, or both, there is little likelihood that the cumulative impacts from new development could increase the net rate of stream erosion to the extent that beneficial uses would be significantly impacted. To use this option, the project proponent shall evaluate the receiving stream to determine the relative risk of erosion impacts and take the appropriate actions as described below and in Table A-1. Projects 20 acres or larger in total area shall not use the medium risk methodology in "b" below.

   a. **"Low Risk."** In a report or letter report, signed by an engineer or qualified environmental professional, the project proponent shall show that all downstream channels between the project site and the Bay/Delta fall into one of the following "low-risk" categories.

      i. Enclosed pipes.

      ii. Channels with continuous hardened beds and banks engineered to withstand erosive forces and composed of concrete, engineered riprap, sackcrete, gabions, mats, etc. This category excludes channels where hardened beds and banks are not engineered continuous installations (i.e., have been installed in response to localized bank failure or erosion).

      iii. Channels subject to tidal action.

iv. Channels shown to be aggrading, i.e., consistently subject to accumulation of sediments over decades, and to have no indications of erosion on the channel banks.

b. **"Medium Risk."** Medium risk channels are those where the boundary shear stress could exceed critical shear stress as a result of hydrograph modification, but where either the sensitivity of the boundary shear stress to flow is low (e.g., an oversized channel with high width to depth ratios) or where the resistance of the channel materials is relatively high (e.g., cobble or boulder beds and vegetated banks). In "medium-risk" channels, accelerated erosion due to increased watershed imperviousness is not likely but is possible, and the uncertainties can be more easily and effectively addressed by mitigation than by additional study.

In a preliminary report, the project proponent's engineer or qualified environmental professional will apply the Program's "Basic Geomorphic Assessment"[6] methods and criteria to show each downstream reach between the project site and the Bay/Delta is either at "low-risk" or "medium-risk" of accelerated erosion due to watershed development. In a following, detailed report, a qualified stream geomorphologist[7] will use the Program's Basic Geomorphic Assessment methods and criteria, available information, and current field data to evaluate each "medium-risk" reach. For *each* "medium-risk" reach, the detailed report shall show one of the following:

i. A detailed analysis, using the Program's criteria, showing the particular reach may be reclassified as "low-risk."

ii. A detailed analysis, using the Program's criteria, confirming the "medium-risk" classification, and:

1. A preliminary plan for a mitigation project for that reach to stabilize stream beds or banks, improve natural stream functions, and/or improve habitat values, and

2. A commitment to implement the mitigation project timely in connection with the proposed development project (including milestones, schedule, cost estimates, and funding), and

3. An opinion and supporting analysis by one or more qualified environmental professionals that the expected environmental benefits of the mitigation project substantially outweigh the potential impacts of an increase in runoff from the development project, and

4. Communication, in the form of letters or meeting notes, indicating consensus among staff representatives of regulatory agencies having jurisdiction that the mitigation project is feasible and desirable. In the case of the Regional Water

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[6] Contra Costa Clean Water Program *Hydrograph Modification Management Plan*, May 15, 2005, Attachment 4, pp. 6-13. This method must be made available in the Program's *Stormwater C.3 Guidebook.*

[7] Typically, detailed studies will be conducted by a stream geomorphologist retained by the lead agency (or, on the lead agency's request, another public agency such as the Contra Costa County Flood Control and Water Conservation District) and paid for by the project proponent.

Board, this must be a letter, signed by the Executive Officer or designee, specifically referencing this requirement. (This is a preliminary indication of feasibility required as part of the development project's Stormwater Control Plan. All applicable permits must be obtained before the mitigation project can be implemented.)

c. **"High Risk."** High-risk channels are those where the sensitivity of boundary shear stress to flow is high (e.g., incised or entrenched channels, channels with low width-to-depth ratios, and narrow channels with levees) or where channel resistance is low (e.g., channels with fine-grained, erodible beds and banks, or with little bed or bank vegetation). In a "high-risk" channel, it is presumed that increases in runoff flows will accelerate bed and bank erosion.

To implement this option (i.e., to allow increased runoff peaks and durations to a high-risk channel), the project proponent must perform a comprehensive analysis to determine the design objectives for channel restoration and must propose a comprehensive program of in-stream measures to improve channel functions while accommodating increased flows. Specific requirements are developed case-by-case in consultation with regulatory agencies having jurisdiction. The analysis will typically involve watershed-scale continuous hydrologic modeling (including calibration with stream gauge data where possible) of pre-project and post-project runoff flows, sediment transport modeling, collection and/or analysis of field data to characterize channel morphology including analysis of bed and bank materials and bank vegetation, selection and design of in-stream structures, and project environmental permitting.

Table A-1: Summary of Option #4

Summary only. If there are conflicts between this summary table and the text of the Hydrograph Modification Management Standard, the text shall apply.

Risk Classification and Definition	To Show Classification Applies	Requirements for HMP Compliance
Low: Enclosed pipes, channels with continuous hardened beds and banks, channels subject to tidal action, and channels shown to be aggrading over time with no sign of bank erosion.	An engineer or qualified environmental professional reviews all downstream reaches between the project site and the Bay/Delta and writes report/letter showing all reaches meet the "low risk" definition.	No additional requirements.
Medium: Channels where the boundary shear stress could exceed critical shear stress as a result of hydrograph modification, but where either the sensitivity of the boundary shear stress to flow is low (e.g., an oversized channel with high width to depth ratios) or where the resistance of the channel materials is relatively high (e.g., cobble or boulder beds and vegetated banks). Accelerated erosion due to increased watershed imperviousness is not likely but is possible, and the uncertainties can be more easily and effectively addressed by mitigation than by additional study. Not allowed for projects 20 acres or larger in total area.	An engineer or qualified environmental professional applies the Program's Basic Geomorphic Assessment* methods and Risk Class criteria and shows in a Preliminary Report that each downstream reach between the project site and the Bay/Delta is either "medium risk" or "low risk."	The project proponent's qualified geomorphologist applies the Program's Basic Geomorphic Assessment* methods and criteria, available information, and current field data to show, for each reach that was characterized as "medium risk" in the Preliminary Report. The geomorphologist prepares a detailed report showing, for each reach, either: The particular reach should be reclassified as "low risk." [No further action for that reach is required.] OR The particular reach is confirmed to be "medium risk". Present a mitigation project plan to stabilize stream bed and/or banks, improve natural stream functions, and/or improve habitat values as described in Section 4.b.ii of the Standard. Approval includes Water Board staff written approval.
High: Channels where the sensitivity of boundary shear stress to flow is high (e.g., incised or entrenched channels, channels with low width-to-depth ratios, and narrow channels with levees) or where channel resistance is low (e.g., channels with fine-grained, erodible beds and banks, or with little bed or bank vegetation).	Default classification if neither "low" or "medium" risk classification applies to all downstream channels between the project site and the Bay/Delta fall.	The project proponent's qualified geomorphologist conducts a Detailed Geomorphic and Hydrologic Assessment* to determine the design objectives for stream restoration and a comprehensive program of in-stream measures to improve channel functions while accommodating increased flows. Specific requirements are developed case-by-case in cooperation with the applicable regulatory agencies. As with all in-stream activities, Water Board staff sign off is required, and input should be sought in the project's early stages.

* These methods are described in Contra Costa Clean Water Program *Hydrograph Modification Management Plan*, May 15, 2005, Attachment 4, and must be described in the Program's *Stormwater C.3 Guidebook*.

III. IMP Model Calibration and Validation

The Program shall monitor flow from Hydrograph Modification Integrated Management Practices (IMPs) to determine the accuracy of its model inputs and assumptions. Monitoring will be conducted with the aim of evaluating flow control effectiveness of the IMPs. The Program will implement monitoring where feasible at future new development projects to gain insight into actual versus predicted rates and durations of flow from IMP overflows and underdrains.

At a minimum, five locations shall be monitored for a minimum of two rainy seasons. If two rainy seasons are not sufficient to collect enough data to determine the accuracy of model inputs and assumptions, monitoring shall continue until such time as adequate data are collected.

The IMP monitoring shall be conducted as described in Attachment B, IMP Model Calibration and Validation Plan. Monitoring results shall be submitted to the Executive Officer by June 15 of each year following collection of monitoring data. If the first year's data indicate IMPs are not effectively controlling flows as modeled in the HMP, the Executive Officer may require the Program to make adjustments to the IMP sizing factors or design, or otherwise take appropriate corrective action. An IMP Monitoring Report shall be submitted by August 30 of the second year[8] of monitoring. The IMP Monitoring Report shall contain, at a minimum, all the data, graphic output from model runs, and a listing of all model outputs to be adjusted, with full explanation for each. Board staff will review the IMP Monitoring Report and require the Program to make any appropriate changes to the model within a three-month timeframe.

IV. Stormwater C.3 Guidebook

1. NRCS Soil Groups: The *Stormwater C.3 Guidebook* shall include IMP sizing factors for use on development sites with Hydrologic Soil Group "B" and "C" soils, which shall be calculated using the methods and references in the *Contra Costa Clean Water Program Hydrograph Modification Management Plan,* dated May 15, 2005.

2. Self-Retaining Areas: The *Stormwater C.3 Guidebook* shall also include appropriate criteria, based on detailed hydrologic analysis, to ensure runoff peak flows and durations from "self-retaining areas" do not exceed pre-project peak flows and durations from these same areas. Until such time as the Executive Officer approves these criteria, no areas shall be considered "self-retaining" for the purposes of designing and implementing hydromodification management controls (i.e., stormwater flow and duration controls).

[8] In the case that the monitoring extends beyond two years, an IMP Monitoring Report shall be submitted by August 30 annually until model calibration and validation is complete.

V. Model Testing & Refinement

Section 7, Attachment 2 of the Program's HMP describes five simplifying assumptions that the Program may address in the future in order to refine the model that establishes IMP sizing factors. The Program shall complete the following studies and data collection efforts as set forth below:

1. MODEL TESTING: The Program states that its model was calibrated to local stream flow data, based on the consultant team's previous experience using the same base model for projects in Contra Costa County streams and calibrating it to local stream gauge data at those times. The Program shall either (1) submit information demonstrating that the HMP model is calibrated to local stream flows, including but not limited to representative data sets, stream gauge data, and associated model calibration parameters; or (2) test the model results presented in the HMP by comparing model output with local stream gauging records in appropriate Bay Area watersheds and adjust the model and its outputs as necessary to produce a more accurate result set. All information supporting this model testing shall be submitted to the Executive Officer by July 1, 2007.

2. INFILTRATION RATES: To verify the HMP's assumption that the Type A soil infiltration rate in Contra Costa County is 0.3 inches per hour, the Program shall measure actual infiltration rates in Type A soils, done as standard percolation tests, in likely development sites in Contra Costa County. If results of this testing show average percolation rates are higher, then the Program shall re-analyze and correct the IMP sizing factors for Type A soils. The results of this work will be reported to the Executive Officer by July 1, 2007.

The Executive Officer will notify interested parties and the public in general of the availability of these studies and data and will consider public input as this work is reviewed.

Attachment B:

IMP Model Calibration and Validation Plan

IMP Model Calibration and Validation Plan

Objective

As part of the process of continuous improvement of the HMP, the Program shall investigate means to monitor flow from Hydrograph Modification Integrated Management Practices (IMPs). Monitoring shall be conducted with the aim of evaluating flow control effectiveness of the IMPs. The Program shall implement monitoring where feasible at future new development projects at a minimum of five locations and for a minimum of two rainy seasons to gain insight into actual versus predicted rates and durations of flow from IMP overflows and underdrains. If two rainy seasons are not sufficient to collect enough data to determine the accuracy of model inputs and assumptions, monitoring shall continue until such time as adequate data are collected.

I. The Dischargers shall Identify and Establish Monitoring Sites

Program staff shall work with municipal Co-permittees to identify potential monitoring sites on development projects that implement IMPs. Proposed sites should be identified during review of planning and zoning applications so that monitoring stations can be designed and constructed as part of the development project. Monitoring shall begin after the development project is complete and the site is in use.

Criteria for appropriate sites include, but are not limited to, the following:

- To ensure applicability of results, the development project and IMPs should be typical of development sites and types of IMPs foreseen throughout the County. In particular, at least one each of the infiltration planter, flow-through planter, and "dry" swale will be selected for monitoring.
- The area tributary to the IMP should be clearly defined, should contain and direct runoff at all rainfall intensities to the IMP. Two monitoring locations shall contain tributary areas that are a mix of pervious and impervious areas, to test the pervious area simplifying assumptions used in the HMP, Table 14, Attachment 2, page 49. If no such locations are constructed by the monitoring period, modeling of mixed (pervious and impervious) tributary areas can substitute for direct monitoring of this type of location.
- The site should be easily accessible at all times of day and night to allow inspection and maintenance of measurement equipment.
- Hourly rain gauge data representative of the site's location should be available.

II. Documentation of Monitoring Sites

The Dischargers shall record and report (i.e., document) pertinent information for each monitoring site. Documentation of each monitoring site shall include:

- Amount of tributary area.
- Condition of roof or paving.
- Grading and drainage to the IMP, including calculated time of concentration.
- Locations and elevations of inlets and outlets.
- As-built measurements of the IMP including depth of soil and gravel layers, height of underdrain pipe above the IMP floor or native soil.

- Detailed specifications of soil and gravel layers and of filter fabric and other appurtenances.
- Condition of IMP surface soils and vegetation.

III. Design, Construction, and Operation of Monitoring Sites

The Dischargers shall ensure that IMPs selected for monitoring are equipped with a manhole, vault, or other means to install and access equipment for monitoring flows from IMP overflows and underdrains.

Development of suitable methods for monitoring the entire range of flows may require experiment. The Program and Water Board are interested in the timing and duration of very low flows from underdrains, as well as higher flows from IMP overflows. The Dischargers shall ensure that equipment is configured to measure the entire range of flows and to avoid potential clogging of orifices used to measure low flows.

The Dischargers shall ensure that construction of IMPs is inspected carefully to ensure IMPs are installed as designed and to avoid potential operational problems. For example, gravel used for underdrain layers should be washed free of fines and filter fabric should be installed without breaks.

The Dischargers shall ensure that, following construction, artificial flows are applied to the IMP to verify the IMP and monitoring equipment are operating correctly and to resolve any operational problems prior to measuring flows from actual rain storms.

The Dischargers shall ensure that monitoring equipment is properly maintained. Maintenance of monitoring equipment will require, initially, inspections during and after storms that produce runoff. The inspection and maintenance schedule may be adjusted as additional experience is gained.

IV. Data to be Obtained

The Dischargers shall collect the following data for each IMP, during the monitoring period:

- Hourly rainfall and more frequent rainfall data where available;
- Hourly IMP outflow and 15-minute outflow for all time periods in which sub-hourly rainfall data are available;
- Hourly IMP inflow (if possible) and more frequent inflow (if possible) when sub-hourly rainfall data are available; and
- Notes and observations.

V. Evaluation of Data

The principal use of the monitoring data will be a comparison of predicted to actual flows. The Dischargers shall ensure that the HSPF model is set up as it was to prepare the curves in Attachment 2 of the HMP, with appropriate adjustments for the drainage area of the IMP to be monitored and for the actual sizing and configuration of the IMP. Hourly rainfall data from observed storms shall be input to the model, and the resulting hourly predicted output recorded. Where sub-hourly rainfall data are available, the model shall be run with, and output recorded for, 15-minute time steps.

The Dischargers shall compare predicted hourly outflows to the actual hourly outflows. As more data are gathered, the Dischargers may examine aggregated data to characterize deviations from predicted performance at various storm intensities and durations.

Because high-intensity storms are rare, it will take many years to obtain a suitable number of events to evaluate IMP performance under overflow conditions. Underdrain flows will occur more frequently, but possibly only a few times a year, depending on rainfall and IMP characteristics (e.g., extent to which the IMP is oversized, and actual, rather than predicted, permeability of native soils). However, evaluating a range of rainfall events which do *not* produce underflow will help demonstrate the effectiveness of the IMP.