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FOLLOW UP TO NOTIFICATION TO TRADITIONAL, SMALL MS4s REGARDING PROCESS FOR ENROLLING UNDER THE STATE'S GENERAL NPDES PERMIT FOR STORMWATER DISCHARGES

On February 15, 2008, I sent a letter to you with my expectations regarding the content of Storm Water Management Plans (SWMPs), and an explanation of our process for enrolling traditional, small Municipal Separate Storm Sewer Systems (MS4s) under the State's General Storm Water Permit. This letter responds to feedback we received regarding my February 15 letter and is a follow up to the meetings we have had with several municipalities.

This letter presents:

- An example approach for including quantifiable measures of healthy watersheds in stormwater management programs
- Additional time for developing interim hydromodification criteria
- Reiteration of our authority to provide expectations for SWMP content
- The current status of the enrollment process
- The availability of technical and financial assistance

My February 15 letter emphasized that SWMPs must include BMPs to achieve the following conditions, which are necessary to ensure protection of water quality, beneficial uses, and the biological and physical integrity of watersheds and aquatic habitat:

I. Maximize infiltration of clean stormwater, and minimize runoff volume and rate
II. Protect riparian areas, wetlands, and their buffer zones
III. Minimize pollutant loading; and
IV. Provide long-term watershed protection

My February 15 letter specifically required your SWMP to include an "Evaluation of Program Effectiveness and Progress toward Water Quality Goals." This means that your SWMP must identify quantifiable measures to determine whether your stormwater program achieves the conditions (I.-IV.) above and any other water quality goals your SWMP is designed to achieve (e.g., pollution reduction). In my February 15 letter I included interim requirements for hydromodification control that could serve as quantifiable measures and that I considered adequate for recommending SWMP approval to our Board.

Several responses to my February 15 letter requested that I consider different interim requirements for hydromodification control that could serve as quantifiable measures for recommending SWMP approval to our Board. This information is discussed in the next section on quantifiable measures, below. We also received requests for additional time to align SWMPs with my expectations. This issue is discussed below under **Additional Time for Developing Interim Criteria for Hydromodification.** Finally, some responses questioned our legal authority to base SWMP approvals on the expectations I presented in the Feb. 15 letter and claimed that they are not necessary for compliance with the State General Permit. This issue is discussed below under **Legal Authority to Provide Expectations for SWMP Content**.

The list of goals above (listed as I. through IV.) includes our expectation that you "provide long-term watershed protection." This means that your SWMP must include a schedule (of BMPs) to integrate all stormwater management control measures into all aspects of land use planning and development (municipal plans, policies, ordinances, codes, conditions of approval, etc.) to attain/protect healthy watersheds. Municipalities must understand the specific water quality and watershed issues in their areas, such as pollutant loading, aquatic habitat degradation, types of land uses and their impacts, trends, and the cumulative effects from multiple municipalities in a watershed. Municipalities must plan comprehensively to define their future growth, including infrastructure and redevelopment, in the context of long-term watershed protection. I recommend that municipalities located in the same watershed work together and pool resources to define water quality and watershed scale issues, and assess watershed conditions, in a coordinated manner. This type of collaborative approach is being used by almost 3000 farmers in our region, as they also learn how to comply with the Water Board's requirements to define and resolve water quality and watershed scale issues. Farmers in our region established a non-profit organization that coordinates and streamlines their compliance efforts, helps minimize costs, and helps disseminate information among farmers and between farmers and the Water Board.

We acknowledge the challenge this presents, and that it will take years for municipalities to learn how to incorporate and implement these changes beyond the project or site-specific scale. It will take time to build the institutional capacity to do the work, and to measure results. Please see the section at the end of this letter on the availability of financial and technical assistance.

An Example Approach for Including Quantifiable Measures of Healthy Watersheds in Stormwater Management Programs

The attached information may help you develop quantifiable measures of healthy watersheds, including numeric criteria for hydromodification control and watershed protection controls. The information is not comprehensive, but provides examples to demonstrate how a control measure should be linked to, a) a desired condition (or goal), b) the parameter(s) that define the condition, and c) quantifiable measures that serve to evaluate performance of the control measure. We will use this type of approach to evaluate the control measures and quantifiable measures (including interim criteria for hydromodification controls) in your SWMPs.

We recognize that different Phase II communities are at different junctures in developing or implementing their SWMPs and selecting quantifiable measures. Thus, the attached information may assist you in different ways; for example, it may assist your selection of interim hydromodification criteria, or, it may help you improve your SWMP's measures of long-term performance.

Additional Time for Developing Interim Criteria for Hydromodification

My February 15 letter stated that we expect you to implement our interim requirements for hydromodification control for all projects subject to your agency's discretionary approvals within six (6) months of your enrollment in the Phase II General Permit, i.e., when your SWMP is approved by the Executive Officer or adopted by the Water Board. In response to the feedback we received, we are providing flexibility in three ways: 1) I am providing you an additional six (6) months, (to make it a full year), before you apply interim criteria for hydromodification control, 2) I am willing to consider other hydromodification control criteria that you develop, if they are reasonably equivalent to those I specified in my February 15 letter, and 3) I am willing to consider the applicability of hydromodification control criteria based on local conditions.

Water Board staff's expectation is that within one year of enrollment under the General Permit, you will have adequate development review and permitting procedures to impose conditions of approval, or other enforceable mechanisms, to implement quantifiable measures (numeric criteria) for hydromodification control. Your SWMP must include a commitment and a schedule to develop any alternative interim criteria, should you choose to develop them. If you fail to develop alternative criteria acceptable to the Water Board, you will be subject to our interim criteria as stated in the February 15 letter.

We are available to discuss hydromodification control measures (BMPs), acceptable numeric criteria for those controls, and the criteria for their application (applicability criteria). If you intend to develop your own interim criteria for hydromodification control, please include your schedule for developing the criteria in your SWMP and allow for a period of no less than three (3) weeks for Water Board staff to review the proposed criteria. Water Board staff will also consider economic factors in reviewing hydromodification control criteria and applicability criteria.

To ensure our allowance of additional time does not come at a cost to watershed health, we propose that by our original six-month date, you inform property developers that, in the absence of established detailed criteria (interim or otherwise) for hydromodification control, you only approve and permit projects that incorporate substantive hydromodification evaluation and controls (that is, the developers can propose their own approach to meet the intent until detailed criteria are established).

Legal Authority to Provide Expectations for SWMP Content

As noted in my February 15 letter, the federal Clean Water Act (CWA) provides that National Pollutant Discharge Elimination System (NPDES) permits for MS4s must require municipalities to reduce pollutants in their stormwater discharges to the Maximum Extent Practicable (MEP) (CWA §402(p)(3)(B)). The California Water Boards have established the meaning and application of this standard through several adopted stormwater permits (the MEP standard is the same for Phase I and Phase II municipalities)[1]. The Water Board implements the General Permit to be consistent with its Water Quality Control Plan (Basin Plan) to ensure protection of water quality, beneficial uses, and the biological and physical integrity of watersheds according to the issues in the Regions. The General Permit contemplates that low impact development will be a component of

[1] Several stormwater permits adopted by different Regional Boards have been legally challenged. All have been upheld by the State Water Resources Control Board and the courts. The Water Boards have broad authority to regulate stormwater and land use activities that result in discharges to waters of the State. Urbanization is one the most important land use activities affecting water quality, beneficial uses, and the physical and biological integrity of watersheds in the Central Coast Region.

SWMPs. See Fact Sheet to General Order at page 6. The General Permit also requires the SWMP to contain measurable goals, including, for example, percent reduction in pollution load. The General Permit has been in effect for nearly five years and the Central Coast Water Board expects that Phase II communities will have benefited from their own experience and other communities in developing a robust SWMP. The General Permit expects Phase II communities to learn from Phase I communities in implementing MEP. The February 15 letter did not require that each community include the specific recommendations, but rather stated that the Executive Officer would not approve a SWMP that does not include adequate low impact development BMPs and measurable goals. Our approach, including our February 15, 2008 letter, is consistent with the General Permit.

Current Status of Enrollment Process

Since initiation of the new enrollment strategy, several enrollment cycles have begun. Table 1 presents the status of the cycles. Please check our website for more specific scheduling information and notices for public comment periods.
http://www.swrcb.ca.gov/rwqcb3/stormwater/index.htm

Availability of Technical and Financial Assistance

Several grant programs are currently available to provide matching grants to local public agencies to protect watersheds, reduce and prevent stormwater pollution, and implement LID planning and design principles and practices. These programs include California Proposition 84 Storm Water funds, California Proposition 1E Flood Prevention and Stormwater Management, and the US EPA West Coast Estuaries Initiative. I encourage you to pursue these grant opportunities. For more information specifically on the Proposition 84 Storm Water Grant Program and workshops, visit the State Water Board's website at:
http://www.waterboards.ca.gov/water_issues/programs/grants_loans/prop84/index.shtml

You may also contact our grant manager, Angela Schroeter, at 805-542-4644, or at ASchroeter@waterboards.ca.gov, regarding these grant opportunities.

The Water Board is also providing partial funding for a Central Coast Low Impact Development Center. The Center will assist municipalities, engineers, and developers to implement Low Impact Development on the Central Coast. We anticipate technical assistance will be available from the Central Coast LID Center office starting fall 2008. In the meantime, we encourage you to contact the LID Center of Maryland (http://www.lowimpactdevelopment.org/), as they have extensive experience in helping municipalities implement LID throughout the Unites States, including California. We also encourage you to contact other professionals who are qualified to implement LID and watershed protection, such as the Center for Watershed Protection (www.cwp.org and www.stormwatercenter.net), and The Center for Water and Land Use (http://extension.ucdavis.edu/unit/center_for_water_and_land_use/about.asp) to use their many technical and educational resources (many of which are free). These services will help you create the institutional capacity to integrate all stormwater management control measures into all aspects of land use planning and development (municipal plans, policies, ordinances, municipal codes, conditions of approval, etc.) to protect healthy watersheds.

Table 1: Status of Enrollment Cycles for Attachment 1 and 2 MS4s

Cycle	MS4 Group	Group Members	Projected Start Date for Enrollment Cycle	Projected Executive Officer SWMP Approval	Projected Board SWMP Approval[2]	Staff Phone (805 Area Code)
1	Santa Maria	Santa Maria	Underway	August 11, 2008	Sept. 5, 2008 San Luis Obispo	Dominic Roques 542-4780
2	Coastal Santa Barbara County	Goleta Carpinteria Santa Barbara UC Santa Barbara Lompoc *(originally in Cycle 1)*	Underway	September 2, 2008	Oct. 17, 2008 Santa Barbara	Brandon Sanderson 549-3868
3	Santa Cruz Mountains and Coast	Santa Cruz County Watsonville City of Santa Cruz Scotts Valley UC Santa Cruz	Underway	February, 2009	March 6, 2009 San Luis Obispo	Phil Hammer 549-3882
4	Coastal San Luis Obispo County	Arroyo Grande Grover Beach Pismo Beach Oceano CSD Morro Bay Los Osos CSD	Underway	January 2009	2009 – 1st Quarter San Luis Obispo	Tamara Presser 549-3334
5	Upper Salinas	King City Templeton Atascadero	June 2008	February 2009	2009 – 1st Quarter Salinas	David Innis 549-3150
6	City of San Luis Obispo	City of San Luis Obispo	Underway	April 2009	2009 – 2nd Quarter San Luis Obispo	Tamara Presser 549-3334
7	Upper Pajaro	Gilroy San Martin Santa Clara	Early November 2008	August 2009	2009 – 3rd Quarter Watsonville	Dominic Roques 542-4780
8	Santa Ynez	Buellton Solvang Vandenberg AFB	Mid November 2008	August 2009	2009 – 3rd Quarter San Luis Obispo	Dominic Roques 542-4780

Agencies, municipalities, and consultants are all on a learning curve with respect to stormwater management, LID implementation, and watershed protection. Water Board staff are not design or planning experts, and as with all of our requirements, we cannot legally tell those we regulate how to comply. Municipalities must build their capacity to be able to comply with the Board's requirements. This includes hiring qualified personnel to develop and implement SWMPS, and providing the most up to date, relevant education on an ongoing basis. When relying on consultants, it is critical that you carefully consider the qualifications and experience of the professionals you retain. Many consulting firms are on the same learning curve as agencies and municipalities.

If you have any questions regarding this letter, please contact **Dominic Roques**, at

[2] Board approval only required if a hearing is requested by stakeholder

droques@waterboards.ca.gov or at **(805) 542-4780.** If you have any questions regarding the status of a particular enrollment cycle, please contact the staff person indicated in Table 1.

Thank you for your commitment to developing a SWMP that will support healthy watersheds in the Central Coast Region.

Sincerely,

Roger W. Briggs
Executive Officer

Cc:
Hillary Hauser, Heal The Ocean
Steve Shimek, The Otter Project
Kira Redmond, Santa Barbara ChannelKeeper
Christine Sotelo, SWRCB
Chris Crompton, California Stormwater Quality Association
Jerry Bunin, Homebuilders Association of the Central Coast

Attachment: An Example Approach for Including Quantifiable Measures of Healthy Watersheds for Stormwater Management Programs

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An Example Approach for Including Quantifiable Measures of Healthy Watersheds in Stormwater Management Programs

The Water Board implements the General Permit for Phase II Stormwater Dischargers to be consistent with the Central Coast Water Quality Control Plan to ensure protection of water quality, beneficial uses, and the biological and physical integrity of watersheds in the Central Coast Region. The Water Board's Executive Officer requires Storm Water Management Plans (SWMPs) to include BMPs that achieve the following, which are necessary to ensure protection of water quality, beneficial uses, and the biological and physical integrity of watersheds and aquatic habitat:

I. Maximize infiltration of clean stormwater, and minimize runoff volume and rate
II. Protect riparian areas, wetlands, and their buffer zones
III. Minimize pollutant loading; and
IV. Provide long-term watershed protection

Together these objectives support healthy watersheds and SWMPs must identify quantifiable measures to determine whether stormwater programs achieve these objectives. Water Board staff must have quantifiable measures by which to evaluate compliance with the General Permit.

Using the Example Approach

The attached table may assist you in developing quantifiable measures of healthy watersheds, including hydromodification control criteria. It identifies the *desired conditions* of healthy watersheds affected by stormwater, including hydrologic and geomorphic conditions and the habitat conditions they drive. The table also identifies *control measures* that function to protect, support, or restore desired conditions. The table then identifies *parameters* and *proxy parameters* that describe these desired conditions. And finally, the table includes examples of *quantifiable measures* associated with particular parameters.

Water Board staff expects SWMPs to rely on a variety of control measures to achieve the desired condition of healthy watersheds. Each control measure should be linked to a desired condition, the parameter(s) that define that condition and quantifiable measures that serve as performance goals for the control measure. The following example illustrates how the framework can be used:

> Example:
> Optimal riparian habitat is a desired condition of healthy watersheds. One parameter that describes optimal riparian habitat is the width of the riparian area. A specific dimension – a width of 100 feet – can be established as a quantifiable measure of the width parameter. The result, a control measure or Best Management Practice, requiring the establishment of riparian setbacks of 100 feet, supports the goal of maintaining a healthy watershed. As this example illustrates, some control measures and quantifiable measures can be applied beyond the site scale up to the watershed scale.

Desired Conditions of Healthy Watersheds

Desired conditions of healthy watersheds are defined here as the physical attributes and processes that are characteristic of watersheds possessing the essential water quality condition of physical and biological integrity. These conditions include observable and measurable outcomes in the landscape and watershed that are aligned with the Central Coast Water Board's vision of healthy watersheds and are consistent with our Basin Plan. Our vision is the

attainment of healthy watersheds throughout the Central Coast Region by 2025. To that end, we have defined the following desired conditions of healthy watersheds:

A. Rainfall surface runoff at pre-development levels,
B. Watershed storage of runoff, through infiltration, recharge, baseflow, and interflow, at pre-development levels,
C. Watercourse geomorphic regimes within natural ranges (stream banks are stable within natural range; sediment supply and transport within natural ranges), and
D. Optimal riparian and aquatic habitats (including: stream flow, in-channel, water column, and biotic conditions).

Direct Parameters
Parameters are accurate and precise descriptions and elements of desired conditions. The parameters listed in the attached table are examples of those conventionally used to describe, characterize and/or evaluate the conditions. Direct parameters allow direct examination, description, or assessment of a desired condition.

Proxy Parameters for Applying Quantifiable Measures
Proxy parameters, while still descriptors of the desired condition, lend themselves to quantifiable measurement more readily than direct parameters. Proxy parameters are often used where there are impediments to directly measuring the elements or attributes of a desired condition.

Quantifiable Measures
Quantifiable measures include numeric criteria and metrics applied to a particular parameter. For example, specific hydrograph criteria are quantifiable measures used to ensure post-development runoff volumes are equivalent to pre-development runoff volumes. For some conditions and their parameters it is challenging to develop quantifiable measures, or criteria. For example, broad consensus is lacking on the appropriate criteria for Large Woody Debris (LWD) in streams, an important component of in-channel aquatic habitat in fish-bearing streams. For the LWD parameter, research continues on the appropriate amount of LWD necessary to maintain its roles in providing habitat and structural complexity to stream channels. In such cases, managers can select provisional targets as interim criteria for a parameter and employ adaptive management to improve on the criteria over time.

Hydromodification Control Criteria: Quantifiable Measures (i.e., numeric criteria) for hydromodification are an important component of stormwater management programs. Hydromodification refers to the effects of urbanization on runoff and stream flows that in turn may cause erosion and/or sedimentation in stream channels. Throughout the State, hydromodification is a major cause of most current and future water quality issues associated with urban runoff and is also a major cause of flooding. Projected population growth, and pressure to develop new landscapes, compounds this problem. Hydromodification control aims to prevent erosion in stream channels that receive runoff from new and redevelopment areas. Hydromodification control is clearly important to maintaining or achieving the desired condition of healthy watersheds and Water Board staff will continue to require hydromodification control for new and redevelopment. Healthy watershed conditions associated with surface runoff (A, above), watershed storage (B), and geomorphic regimes (C) are typically the subjects of hydromodification management planning and assessment. Such planning and assessment can provide a basis for establishing regionally specific hydromodification control. Examples of quantifiable measures for hydromodification are identified in the table with a check mark in the column "HMC" (Hydromodification Criteria).

Watershed Protection Criteria: Quantifiable Measures (i.e., numeric criteria) for watershed protection are also an important component of stormwater management programs. Watershed protection means integration and incorporation of stormwater management control measures that support healthy watersheds into all aspects of land use planning and development. Watershed protection aims to preserve and protect riparian areas, wetlands and aquatic habitats (D, above) while a variety of land uses, including urban development, continue in the watersheds. Examples of quantifiable measures for watershed protection are included in the table as well (Richards-Baker Flashiness Index, continuous flow duration curves, stream setback criteria, Effective Impervious Area thresholds, and Basin Plan Water Quality Objectives).

Control Measures

Control measures include best management practices (BMPs) that contribute to sustaining the desired conditions of healthy watersheds. For example, control measures requiring Low Impact Development, discussed below, applied to new development, can directly maintain pre-development runoff rates on many sites. Some control measures are more indirect in their effect on desired conditions. For example, hydrograph management can contribute to maintaining sediment supply within a natural range – desired condition C – by maintaining the frequency and timing of flows that transport sediment. However, maintaining frequency and timing of flows cannot compensate for a lack of sediment caused by an upstream dam for example. Additionally, control measures requiring riparian setbacks protect riparian and aquatic habitats.

Low Impact Development (LID):

LID is a land planning and design strategy with the goal of maintaining or replicating the pre-development hydrologic regime through the use of design techniques to create a functionally equivalent hydrologic site design. Hydrologic functions of storage, infiltration and ground water recharge, as well as the volume and frequency of discharges are maintained through the use of integrated and distributed micro-scale stormwater retention and detention areas, reduction of impervious surfaces, capture and reuse of runoff, and the lengthening of runoff flow paths and flow time. Other related strategies include the preservation/protection of environmentally sensitive site features such as riparian buffers, wetlands, steep slopes, valuable (mature) trees, flood plains, woodlands, and highly permeable soils. LID is a preferred site scale control measure because it integrates measures that address all of the desired conditions of a healthy watershed. In fact, the term "Integrated Management Practices" (IMPs) is often used in lieu of the term LID.

Watershed Scale Control Measures:

Subwatershed or watershed planning can be undertaken through general planning, specific area planning, and district planning. Such planning results in municipal plans, policies, ordinances, codes, etc., that improve or protect desired conditions of healthy watersheds (A-D above). Staff at the Central Coast Water Board expect Storm Water Management Programs to include strategies for conducting watershed-based planning that yield control measures beyond the site-specific or individual project scale. Such planning should be conducted to determine how best to integrate site-specific scale stormwater management control measures into all aspects of land use planning and development. For example, a riparian setback can be applied to individual development proposals on a case-by-case basis as a generally protective site level control. However, watershed-scale planning may indicate that development should be restricted within a setback distance for designated reaches of a stream, as a sub-watershed or watershed scale control, to protect identified sensitive habitat, take advantage of a high value stream

recharge zones, or prevent potential downstream hydrologic impacts. To that end, several of the parameter/quantifiable measure combinations identified in the attached table are useful both in evaluating watershed scale controls, and the effect of site controls at the watershed scale (e.g., Richards-Baker Flashiness Index, Continuous flow duration curves, stream setback criteria, Effective Impervious Area thresholds, and Basin Plan Water Quality Objectives).

The attached table includes a small selection from the abundance of site-specific scale control measures available to achieve healthy watershed conditions. However, the blanket application of site-specific scale requirements invariably yields unintended consequences. Applicability criteria, which define what types of projects and under what circumstances controls and quantifiable measures apply, are a necessary component of effective implementation. The challenge in developing applicability criteria is to require control measures sufficient to achieve the desired effect on watershed conditions, while avoiding unintended outcomes. For example, hydrologic performance should not outweigh other important environmental goals such as infill, redevelopment priorities, and regional growth patterns that can also affect watershed health. An example from a report recently commissioned by the California Ocean Protection Council illustrates a limitation of site scale control measures:

> *LID requirements are often written to apply to individual projects, which results in uneven application:* LID is often defined as a site-level approach, and as such, many LID regulations set one uniform performance standard across all "projects" that are part of a "common development plan." Developers of large greenfields projects have leeway in arranging lots and open space to meet the performance standard. For example, if a new development must be limited to no more than 10 percent impervious cover, individual home sites need not meet this requirement as long as the overall development plan has less than 10 percent cover. However, for redevelopment, most projects are individual sites with little or no space or flexibility for BMP design. This creates a situation where a large greenfield project allows flexibility as a common development plan, but redevelopment must meet the entire performance standard within the site boundaries. [1]

To achieve the appropriate balance of environmental and societal goals, stormwater managers should consider and select control measures (BMPs) and applicability criteria at a watershed scale. The effect of exemptions from hydromodification control requirements for individual projects for example, must be examined from a broad enough perspective to determine whether the desired conditions of healthy watershed are achieved. There is a growing belief that subwatershed planning is the best structure for matching control measures to runoff stressors (ibid).

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[1] *State and Local Policies Encouraging or Requiring LID in California, Attachment 1, p. A-12, Prepared by Tetra Tech Inc. for the California Ocean Protection Council, January 2008.*

Table: Framework to Support Development of Quantifiable Measures of Healthy Watersheds for Stormwater Management Programs

Control Measure	Direct Parameter	Proxy Parameter for Applying Quantifiable Measure	Example Quantifiable Measure	HMC[2]	Cite[3]
DESIRED CONDITION A: SURFACE RUNOFF AT PRE-DEVELOPMENT LEVELS					**1, 5, 22, 26, 30**
Hydrograph Mgmt LID BMPs	Volume Rate Duration Timing	Continuous Flow Duration Curves	The post-project-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, for flow rates from 20% of the pre-project 5-yr runoff event to the pre-project 10-yr runoff event.	✓	12, 16
		Event-Based Hydrograph Matching	For storms up to the 2-yr, 24-hr recurrence interval, the volume of runoff that leaves a site must not exceed the volume that would occur from the site under fully forested condition, given the soils present	✓	6, 14, 31
		Drainage Density	Preserve predevelopment drainage density for all drainage areas serving a first order stream or larger	✓	11
		Time of Concentration	Ensure that post-project time of concentration is equal or greater than pre-project time of concentration	✓	11
		Effective Impervious Area (EIA)	EIA less than or equal to 5% of total project area	✓	5, 9, 16, 21, 27, 28,
		Richards-Baker Flashiness Index	Not Available		1
DESIRED CONDITION B: NATURAL WATERSHED STORAGE					
Hydrograph Mgmt LID BMPs	Infiltration Groundwater flow & recharge	Time of Concentration Drainage Density Flow duration curves Groundwater elevations	SAA[4] SAA SAA Not Available		
	Interflow Baseflow	Event-based hydrograph matching	SAA		
		EIA	SAA		
DESIRED CONDITION C: GEOMORPHIC REGIME WITHIN NATURAL RANGE					
Stream Bank Stability[5] within Natural Range					
Riparian Buffers Stream Setbacks In-stream Grade-Control	Entrenchment Width-Depth Ratio Bank Failure	Stream Setback Width	100-feet setback on streams of first order and above		2, 18

[2] Hydromodification Control (HMC).
[3] Citations (see end of Table) include source of example Quantifiable Measure and/or select supporting literature and documents.
[4] SAA = Same As Above. Quantifiable Measure example is same as the above Quantifiable Measure for the specified parameter.
[5] Stream bank stability: a condition in which the sediment sizes and loads, water discharges, and channel shapes and slopes are in balance.

		Channel Enlargement Ratio	Channel enlargement ratio must either stay below 1.0 or not increase from the pre-development enlargement ratio.		15
		Riparian Buffer (width, density)	Forest buffers shall be a minimum of 100 feet wide, with the requirement to expand the buffer depending on: 1) stream order[6], 2) percent slope, 3) 100-year floodplain, 4) wetlands or critical areas.		7, 10
			Streamside zone[7] shall extend a minimum of 25 feet from top of bank and shall be maintained as a mature forest; Middle zone shall extend a minimum of 50 feet, plus additional buffer width if necessary, and shall be a managed forest with some allowable clearing; Outer zone shall extend a minimum of 25 feet and shall encourage forestation (Note: Refer to citation for allowed uses within each zone.)		2, 7
		Drainage Density	SAA		
		Time of Concentration	SAA		
Sediment Supply within Natural Range					
Erosion and Sediment Control Riparian Buffers Stream Setbacks In-stream Grade-Control Structures Hydrograph Mgmt LID BMPs	Loads Frequency Sediment Size	Settling Time	Adequate detention volume shall be available to permit 90% Total Suspended Solids (TSS) removal of runoff leaving the site for a 2-yr, 24-hr storm event.		9, 24
		Suspended Sediment Concentration	Not Available		
		Annual Sediment Yield	Post development annual sediment yield[8] shall closely mimic pre-development annual sediment yield.		29
		Riparian Buffer (width, density)	SAA		
		Stream Setback Width	SAA		
		Drainage Density	SAA		
		Time of Concentration	SAA		
Sediment Transport within Natural Range					

[6] Stream order is a method of classifying streams in an order of hierarchy starting with first-order streams, which are comprised of headwater streams with no upstream tributaries. Second-order streams are formed below the intersection of two first-order tributaries; third-order streams are formed below the intersection of two second-order streams, and so on.

[7] Streamside Zone (Zone 1): Extends from stream edge of the active channel to top of bank. The streamside zone function is to protect the physical and ecological integrity of the stream ecosystem. Middles Zone (Zone 2): Extends from streamside zone to outer zone. The middle zone functions are to protect key stream components and to provide distance between the upland development and streamside zone. Outer Zone (Zone 3): Extends from middle zone to nearest permanent structure. The outer zone functions are to prevent encroachment into the buffer zone and to filter urban runoff.

[8] Sediment yield (annual): Product of annual gross erosion (tons/unit area) and sediment delivery ratio (less than 1).

Hydrograph Mgmt LID BMPs	Rate Scour Fill Armoring	Flow duration curves EIA Drainage Density Time of Concentration Event-based hydrograph matching	SAA SAA SAA SAA SAA		
DESIRED CONDITION D: HABITAT OPTIMAL					30, 18, 5
Riparian and Wetland Habitat Optimal					
Setback Requirements: Streams, Wetlands		Setback Dimension	Minimum Buffer on each side of stream = 98 feet to 1,640 feet+		10
Riparian Buffers	Buffer Dimension & Density	Riparian Buffer (width, density)	SAA		
		Alluvial Groundwater Elevation	Not Available		20
	Bank Erosion/Failure	Bank Erosion Potential Index	Not Available		3
LID BMPs Hydrograph Mgmt					
Aquatic Habitat Optimal					
Clean Water					
LID BMP (filtration) Filters Active Treatment	Water Column Physical and Chemical Parameters		Basin Plan Water Quality Standards		4
			For projects that install stormwater treatment systems which function primarily as infiltration devices, the Permittee shall require that: (a) Appropriate pollution prevention and source control measures are implemented to protect groundwater at the project site, including the inclusion of a minimum of 2 ft of fine grain soil in the infiltration flow path of the infiltration system; (b) Adequate maintenance is provided to maximize pollutant removal capabilities		13
			Treatment systems whose primary mode of action depends on flow capacity shall be sized to treat: (a) 10% of the 50-yr peak flowrate; (b) The flow of runoff produced by a rain event equal to at least two times the 85th percentile hourly rainfall intensity for the applicable area, based on historical records of hourly rainfall depths; or (c) The flow of runoff resulting from a rain event equal to at least 0.2 inches per hour intensity.		13
		Pollutant Loading	Annual pollutant loading in site runoff, calculated for all Pollutants of Concern (POCs) specified by the municipality for the site, shall not increase from pre-development conditions to post-development conditions.		25, 5
Detention with Settling		Detention Time	Draw down time no less than 24 hours		N/A
			Turbidity shall not exceed levels that will adversely impact fish.		17
Stream Flow: Velocity, depth, timing					

Hydrograph Mgmt		Event-Based Hydrograph Matching	Flow requirements for fish same as above		31
In-Channel Conditions					
	Stream Substrates	Particle Size Distribution: percent coarse fine sediment less than 0.6 mm in spawning gravels	Less than or equal to 30% by wet volume		8
	Pools and Riffles	Residual Pool Volume	Less than or equal to 0.21 (mean) and 0.45 (max)		8
Biota					
Hydrograph Mgmt LID BMPs	Index of Biotic Integrity		Southern California IBI		23, 21

Citations

1. "Application of the Richards-Baker Flashiness Index to Gaged Michigan Rivers and Streams." Michigan Department of Environmental Quality. August 3, 2007
2. "Aquatic Buffers." Center for Watershed Protection. June 6, 2008 <http://www.cwp.org/aquatic_buffers.htm>
3. "Bank Erosion Potential Index (BEPI) Worksheet. (The BEPI Worksheet is adapted from Rosgen, David L. "A Practical Method of Computing Streambank Erosion Rate", Wildland Hydrology Inc., Pagosa Springs, CO, 10 pp.) http://www.dnr.state.wi.us/org/water/fhp/waterway/permits/BankErosionPotentialIndexWorksheet.pdf
4. "Basin Plan." Central Coast Regional Water Quality Control Board. (8 September 1994) 9 June 2008 <http://www.swrcb.ca.gov/centralcoast/BasinPlan/Index.htm>.
5. Beach, Dana. "Coastal Sprawl: The Effects of Urban Design on Aquatic Ecosystems in the United States." The Pews Oceans Commission. (8 April 2002). 11 June 2008 <http://www.pewtrusts.org/our_work_report_detail.aspx?id=30037>.
6. Booth, Derek, and Rhett Jackson. "Urbanization of Aquatic Systems – Degradation Thresholds, Stormwater Detention, and the Limits of Mitigation." American Water Resources Association. 22.5 (1997). 9 June 2008 <http://kvue.iewatershed.com/kvue/urban_hydro_boothwrb.pdf>.
7. "Buffer Model Ordinances." The Stormwater Manager's Resource Center: Model Ordinances for Aquatic Resource Protection. 9 June 2008 <http://www.stormwatercenter.net/Model%20Ordinances/buffer_model_ordinance.htm>.
8. Central Coast Regional Water Quality Control Board. San Lorenzo River Total Maximum Daily Load for Sediment. September 20, 2002.
9. Coleman, Derrick, et al. "Effect of Increases in Peak Flows and Imperviousness on the Morphology of Southern California Streams." Southern California Coastal Water Research Project. Technical Report 450 (2005).
10. "County of Santa Clara Riparian Corridor Study." Planning Office Environmental Resources Agency, County of Santa Clara, 5 June 2003: p. 12.
11. "Draft NPDES General Permit for Stormwater Discharges Associated Construction and Land Disturbance Activities." California State Water Resources Control Board. (18 March 2008): 29 June 2008 <http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/constpermits/draft/draftconst_permit_031808.doc >.
12. "Draft Tentative Order Orange County Municipal Separate Storm Sewer System Permit." San Diego Regional Water Quality Control Board. (12 December 2007): 38. 9 June 2008 <http://www.waterboards.ca.gov/sandiego/water_issues/programs/stormwater/index.shtml>.
13. "Draft Tentative Order San Francisco Bay Region Municipal Municipal Regional Municipal Regional Stormwater National Pollutant Discharge Elimination System (NPDES) Permit: Urban Runoff Quality Mgmt, Provision C.3." San Francisco Bay Regional Water Quality Control Board. (4 December 2007—Updated 14 December 2007): 21-22. 11 June 2008 <http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/stormwater/muni/mrp/mrptentativeorder121407updated.pdf>.
14. "Draft Tentative Order Ventura County Municipal Separate Storm Sewer System Permit." Los Angeles Regional Water Quality Control Board. (29 April 2008): 56. 9 June 2008 <http://www.waterboards.ca.gov/losangeles/water_issues/programs/stormwater/municipal/ventura_ms4/08_0429/draft_Tentative_Ventura_County_MS4_Permit.pdf>.
15. "Dynamics of Urban Stream Channel Enlargement." The Practice of Watershed Protection. Article 19 (2000): 99-104.

16. Geosyntec Consultants. Memorandum to Mark Grey, Building Industry Association of Southern California: Review of Investigation of the Feasibility and Benefits of Low-Impact Site Design Practices for Ventura County. 28 May 2008.
17. "Impact of Suspended and Deposited Sediment." The Practice of Watershed Protection. Article 14 (2000): 64-65.
18. "Impacts of Impervious Cover on Aquatic Systems, Watershed Protection Research Monograph No. 1." Center for Watershed Protection, Ellicott City, Md., March 2003.
19. "Impervious Cover Method." ENSR International. (October 2005). 11 June 2008 <http://www.epa.gov/ne/eco/tmdl/assets/pdfs/ensr_pilot/Section2.pdf>.
20. Kondolf, G.M., Maloney, L.M., Williams, J.G. "Effects of Bank Storage and Well Pumping on Base Flow, Carmel River Monterey County, California," Journal of Hydrology JHYDA7 Vol. 91, No. 3/4, p 351-369, 15 June 1987.
21. "Methods for Evaluating Wetland Condition: Developing Metrics and Indexes of Biological Integrity." U.S. Environmental Protection Agency. (2002) June 6, 2008 <http://www.epa.gov/waterscience/criteria/wetlands/6Metrics.pdf>
22. Moglen, Glenn, and Sunghee Kim. "Limiting Imperviousness." Journal of the American Planning Association 73.3 (2007): 161-171.
23. Ode, Peter R., Andrew C. Rehn, and Jason T. May. "A Quantitative Tool for Assessing the Integrity of Southern Coastal California Streams." Environmental Management. 35.4 (2005): 493-504. 12 June 2008 <http://www.ccamp.org/ccamp/documents/SoCalIBI.pdf>.
24. "Performance of Sediment Controls at Maryland Construction Sites." The Practice of Watershed Protection. Article 59 (2000): 345-347.
25. "Simple and Complex Stormwater Pollutant Load Models Compared." The Practice of Watershed Protection. Article 13 (2000): 60-65.
26. "Stormwater C.3 Guidebook." Contra Costa Clean Water Program. Third Edition (2006) <http://www.cccleanwater.org/new-developmentc3/>.
27. Sutherland, R.C. "Impervious Area Assumptions Used in Hydrologic Modeling of CWS Watersheds." Pacific Water Resources, Inc. (30 August 2005). 5 June, 2008 <http://www.cleanwaterservices.org/content/SWMP/Technical%20Memo%208-30-05.pdf>.
28. Sutherland, R.C. "Methods for Estimating the Effective Impervious Area of Urban Watersheds." The Practice of Watershed Protection. Article 32 (2000): 193-195.
29. United States Department of Agriculture: Soil Conservation Service. "Sediment Sources, Yields, and Delivery Ratios." National Engineering Handbook. Section 3. 12 June 2008 <http://policy.nrcs.usda.gov/media/pdf/neh3ch6.pdf>.
30. "Water Quality Criteria." U.S. Environmental Protection. June 6, 2008 <http://www.epa.gov/waterscience/criteria/>
31. Wenger, Seth, Tim Carter, R. Alfred Vick, and Laurie Fowler. "Runoff Limits." Stormwater Magazine. (March 2008). 9 June 2008. <http://www.stormh2o.com/march-april2008/ecologically-stormwater-management.aspx>.