prior to the 2nd day of rain. Lastly, to be conservative, we assumed that any daily rainfall total that exceeded the 95th percentile event resulted in runoff. That is, if the rainfall total was 2.25 inches with a facility sized for a 2.0 inch event, then 0.25 inches was not retained.

Volume Multiplier Derived through Basin Sizer Program

We previously prepared an analysis of water quality volumes and volume multipliers using the program Basin Sizer. This analysis resulted in a recommended **volume multiplier of 1.30**.

NOAA Atlas 14 Rainfall Frequency Estimates

Rainfall statistics available through NOAA Atlas 14 were referenced to help answer the question "**what is an appropriate back-to-back storm to consider for SCM design?**" For the rain gauges we've analyzed, the 95th percentile 24-hour event is generally equivalent to the 1-year 24-hour event per the NOAA frequency estimates. Therefore, to maintain consistency with the 95th percentile requirement, the appropriate storm to analyze for back-to-back events is the 1-year 2-day storm. For the locations reviewed the 1-year 2-day storm was found to be an approximate 25% increase from the 1-day event. By comparison, a back-to-back 95th percentile event is between a 2 to 5-year storm.

SCM Sizing Calculations: Hydrograph Routing Analysis

We prepared an SCM sizing analysis using the PCRs retention volume criteria and the computer program HydroCAD. HydroCAD is a commonly used and widely accepted program for calculating runoff and sizing stormwater management features. We used the Santa Barbara Unit Hydrograph (SBUH) method, in conjunction with various storm distributions, to calculate required SCM storage capacity to fully retain the Attachment D volume, with varying storm events including the 95th percentile and back-to-back storms, and with varying SCM infiltration rates. We used average infiltration rates corresponding to hydrologic soil group (HSG), as presented in the Ventura County Stormwater Manual. We also derived the SCM infiltration rate that would result in a drawdown time of 48-hours, and included this infiltration rate as one sizing example.

Based on this analysis, an SCM sized for the 95th percentile event could also retain the back-to-back storm identified through the NOAA rainfall statistics, with no volume multiplier, for draw-down times up to 48 hours. Drawdown times longer than 48 hours were associated with HSG C and D soils, where SCM infiltration rate limits the capacity for site retention even with undeveloped conditions. For example, drawdown time for the 95th percentile event is 92 hours and 12 Days, for soil types HSG C and D, respectively. This analysis resulted in the volume multipliers listed in Table 4.

Table 4. Volume Multiplier for Drawdown Time Greater than 48 Hours

95th Percentile Rainfall Depth	Volume Multiplier	Location
1.4 inches	1.12	Paso Robles
2.0 inches	1.11	San Luis Obispo
2.5 inches	1.02 – 1.12	Goleta

It is important to note that the multipliers developed through this analysis are representative of a two-day storm event. The required multiplier for SCMs with low infiltration may increase compared to the results in Table 4 with a longer duration storm event (3-days or more), analyzed through continuous simulation modeling.

Summary of Variables Used in This Analysis

The following variables were used to calculate the tabulated SCM capacities for varying rainfall depths and soil conditions.

- SCM Infiltration: based on average value for HSG soil types A through D, as presented in the Ventura County Stormwater Manual
- Rainfall distribution: varies, listed in tabulated results
- Time of concentration: 10 minutes
- Hydrograph method: SBUH
- Time increment: 0.10 hours
- Storage (SCM) routing: storage-indication

Unit Storage Volume Comparison (Simple Sizing and Routing Method)

Another way to evaluate feasibility of the PCRs is to look at retention requirements in terms of unit storage volume, that is, cubic feet of storage required per square foot of impervious surface. Multiple agencies in California have developed design criteria for peak flow control based on local continuous simulation modeling, which includes a minimum unit storage volume. For example, the Contra Costa C.3 Guidebook provides minimum unit volume for peak flow control of the 2-year through 10-year storm. Contra Costa unit volumes range from 0.058 to 0.116. In comparison, by the simple sizing approach the PCRs require a unit retention volume ranging from 0.146 to 0.364, for storms between 1-inch and 2.5-inches. This retention volume is 2 to 3 times greater than what Contra Costa requires to control the 10-year storm event. These values are based on the current Attachment D multiplier of 1.963. Dropping the multiplier results in unit retention volumes ranging from 0.074 to 0.185, still over 50% greater than the Contra Costa 10-year peak flow control standard. By comparison, a hydrograph routing approach to SCM sizing with the PCR retention volume results in unit volumes ranging between 0.03 to 0.162, generally equivalent to the Contra Costa criteria.

SCM SIZING: VARIABLES FOR ROUTING METHOD CALCULATION

The purpose of this section is to address the variables that are involved in our routing method calculations for SCM sizing. In particular, Regional Board Staff requested information on rainfall distribution and intensity, and how this may affect SCM sizing in areas with high 85th and 95th percentile rainfall depths.

The following variables are included in an event based routing calculation for SCM sizing, listed in order of relative effect on calculated storage capacity:

- SCM Infiltration capacity.
- Rainfall distribution.
- Time of concentration.
    - Sensitivity: Doubled time of concentration to 20 min, volume reduces by 5%.
- Hydrograph Method - SBUH or SCS. SCS produces slightly higher intensity, therefore slightly higher retention capacity.
    - Sensitivity: Expected to be at most 5% difference between methods.
- Time increment. Typically set to 0.10 hour with SBUH method.
    - Sensitivity: Doubled time increment, volume reduction approximately 1%.
    - Difference may be greater if storm distributions other than NRCS are used.
- Pond Routing Method. Storage-indication typical for detention routing.

SCM Infiltration Capacity

Geotechnical Engineers at Earth Systems Pacific are currently working under contract with the Central Coast Low Impact Development Initiative to develop standard testing procedures and recommendations for identifying soil infiltration capacity. Therefore, testing for infiltration capacity will not be discussed further as part of this document.

For the purpose of this analysis infiltration capacity was modeled based on average values for HSG soil types A through D, as presented in the Ventura County Stormwater Manual.

Rainfall Distribution

The rainfall distribution tells us the amount of water that falls within a given period of time. Rainfall distribution has the greatest effect in sizing facilities for soils with high infiltration. In a high infiltrating soil, a low intensity storm may be fully infiltrated as it flows into the facility, in other words, no storage is required. As rainfall intensity increases relative to the infiltration capacity, the required storage also increases. The effect of varying rainfall intensity is negligible for calculating storage capacity for low infiltrating soils. This is because the infiltration capacity is typically much less than the inflow to the facility, regardless of storm intensity. For comparison, an average HSG Type A soil can infiltrate over 80 times faster than the average Type D soil.

We prepared a sensitivity analysis to evaluate the affect of rainfall intensity on required retention capacity. For the analysis we used the program HydroCAD to calculate required storage capacity with varying rainfall distributions, holding rainfall depth and all other variables constant. The following describes inputs and results for the sensitivity analysis.

NRCS Storm Distributions

NRCS has developed standard 24-hour rainfall distributions for hydrologic analysis, commonly used for design of detention and retention facilities. These rainfall distributions were intended to represent intensities associated with shorter duration storms, ranging from a 30 min to 12 hour duration. (*Ponce*).

The NRCS Type I storm applies to the west coast of California, including the Central Coast Region. The Type 1 rainfall distribution was derived using NOAA Atlas 2 rainfall statistics for the 1-year through 100-year storm. (*NRCS*)

Benefits: Widely available, commonly used, conservative approach. For sites with flow control same method could be used for both retention and peak flow.
Drawbacks: May be overly conservative in some cases

For comparison, the NRCS Type 1A distribution applies to the west coast of Northern California, Oregon and Washington. This rainfall distribution was also developed by NRCS using NOAA Atlas 2 statistics, but the peak intensity for this distribution is significantly lower than Type 1 due to the variation in rainfall patterns between the two regions. We used the Type 1A as an input to the sensitivity analysis to demonstrate the resulting difference in SCM sizing due to variation in storm intensity. The Type 1A storm distribution is not applicable to the Central Coast Region and is not recommended for design of stormwater facilities in our area.

NOAA Atlas 14

Rainfall intensity statistics available through NOAA Atlas 14 were reviewed for comparison to storm intensity associated with the NRCS storm distributions. The NOAA Atlas 14 statistics were compiled for locations throughout the Central Coast Region, and, the statistics were

translated into 1-year storm distributions within HydroCAD for the three locations where we analyzed SCM sizing.

The peak intensity from the NRCS Type 1 storm distribution corresponds to a 5-minute to 10-minute intensity for the 1-year storm per NOAA Atlas 14. In comparison, the peak intensity for the Type 1A storm distribution corresponds to the 60-minute intensity for a 1-year storm. The NRCS Type 1 overestimates the peak intensity compared to NOAA Atlas 14 in three locations: Felton, Goleta, and Santa Barbara. All three of these locations also have relatively high rainfall depths for the 1-year storm.

Values for the 95th percentile storm depth are not yet readily available throughout the Region. However, we have found in the locations where we have calculated the 95th percentile storm depth it is generally equivalent to the 1-year 24-hour storm. Therefore, we used 1-year storm values to compare intensities for locations throughout the Central Coast Region. A summary table of the peak rainfall intensity statistics is attached at the end of this document.

Results

Rainfall intensity has the greatest effect on storage capacity for sites with high infiltrating soils. In a well draining soil, a low intensity storm may be fully infiltrated as it flows into the facility. As rainfall intensity increases relative to the infiltration capacity, the required storage also increases. The effect of varying rainfall intensity is negligible for calculating storage capacity for low infiltrating soils. This is because the infiltration capacity is typically much less than the inflow to the facility, regardless of storm intensity.

Results of the comparison illustrate that the effect of rainfall intensity is negligible for most soils. Type A soils have the greatest increase in required capacity with an increase in storm intensity. Soil types B and B/C had a minimal increase, and types C and D did not require any increase in capacity. Table 5 below summarizes results of the analysis for the 95th percentile storm event, comparing the NOAA Atlas 14 rainfall distribution for Goleta to the NRCS Type I distribution. In this location, NRCS Type I has the higher intensity.

Table 5: Capacity Increase Required for 30% Increase in Rainfall Intensity

HSG Soil Type	Infiltration Rate (in/hr)	Required Increase of Storage Capacity
A	5	28%
B	1	6%
B/C	0.6	4%
C	0.23	0%
D	0.06	0%

NOTE: This table represents a comparison of the NRCS Type I storm to the NOAA Atlas 14 1-year storm for Goleta

Results were similar comparing the NOAA rainfall distribution to the NRCS Type 1A, which has a lower peak intensity. The greatest affect occurred with Type A soils, with Types C and D showing no change in storage capacity required.

Also, even with the highest storm intensity modeled, required surface area for Type A soils was 4% of EISA, assuming 12-inches of surface ponding. This is the minimum surface area required for water quality treatment, based on the maximum loading rate required by the PCRs (5.0 inches/hour maximum loading for a 0.2 inch/hour rainfall intensity).

Recommendation
Allow applicants to use the NRCS Type I rainfall distribution, or, rainfall distribution based on local rainfall data for the 1-year or 95th percentile storm.

Time of Concentration

Agencies have typically already adopted time of concentration calculations to be used for drainage and flood control. The same calculations would apply for retention SCM sizing. A greater time of concentration equates to a lower peak runoff, and therefore a smaller SCM capacity for high infiltrating soils. As stated earlier, the effect of varying intensity on lower infiltrating soils is negligible. The overall effect of time of concentration is fairly low. We compared a Tc of 10 minutes to the same catchment with a Tc of 20 minutes and calculated a 5% reduction in SCM volume for Type A soils.

Recommendation
Allow agencies to continue use of time of concentration calculations as included in their current drainage and flood control standards.

Hydrograph Method

The two hydrograph methods evaluated as part of this analysis are the NRCS unit hydrograph and the Santa Barbara Urban Hydrograph (SBUH) method. The two methods are similar in approach. The main differences are:

1. The NRCS method utilizes a standard unit hydrograph to generate the runoff hydrograph. The SBUH method routes the rainfall through a reservoir with retention time equal to the time of concentration.
2. The SBUH method calculates runoff from pervious and impervious areas separately, where the NRCS method calculates runoff with a composite CN value. The separate pervious/impervious calculation in the SBUH method accounts for the non-linear relationship between CN and runoff.

The result of these two main differences is that the two methods produce different peak runoff values, even using the same rainfall distribution as an input. However, as discussed in more detail under the rainfall distribution section, the effect of peak runoff intensity is noteworthy only for the highest infiltrating soils. The difference in SCM sizing as a result of peak intensity differences between the two methods is anticipated to be in the range of 5 percent for Type A soils, and negligible for other soils.

Recommendation
Allow for either the NRCS or SBUH method to be used for hydrograph sizing analysis.

Calculation Time Increment

Hydrograph routing is an iterative procedure, that is, results for rainfall runoff, inflow, storage volume, and outflow are calculated for each time step to achieve mass balance. The time duration between calculations is referred to as the time increment. In general, a smaller time increment will provide a more precise result. The time increment can be set to a very small value when an automated program is used for the analysis, with little affect on computation time. If the calculation is done by hand than the time increment results in a lengthier computation.

Time increment for the SBUH method is typically set to 0.10 hour. The NRCS method does not have a standard time increment associated. However, rainfall distributions may also have a

preferred time increment, based on the number of points in the curve. When evaluating a hydrograph, the time interval between points isn't specified directly, but is inferred from the storm duration and the number of points using the following equation: Interval = Duration / (#points-1). A hydrograph with a 0.10 increment will have 241 points (*HydroCAD Software Solutions*). Using the NRCS storm distributions, we found that time increment created negligible changes to the results of our analysis. However, using the NOAA rainfall distributions the peak intensity varied substantially with variation in time increment. The NOAA rainfall distributions contain 241 points, therefore a time increment of 0.10 hour is appropriate.

Recommendation
Require a time increment of 0.10 hour, unless otherwise justified to be more correct based on the input parameters for rainfall.

Storage Routing Method

The routing method is the procedure for calculating storage and outflow for each time step. There are multiple standardized procedures for storage routing. The most common method for detention and retention facilities is the storage-indication method. This method is discussed in detail in the NRCS TR-55 and numerous other references, and will therefore not be described in more detail in this document.

Recommendation
Require the storage-indication method, unless another method is justified to be more correct based on site and storage conditions.

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ATTACHMENTS

Paso Robles, CA: NOAA Rain Gauge NCDC 6730
October 1951 - December 2010

Storm Duration Statistics						
Storm Duration (Days)	Number of Occurances	Total Rain Days	Percent of Storms	Percent of Rain Days		
1	564	564	60%	36%		
2	238	476	25%	30%		
3	79	237	8%	15%		
4	31	124	3%	8%		
5	17	85	2%	5%		
6	11	66	1%	4%		
7	2	14	0.2%	1%		
8	2	16	0.2%	1%		
9	0	0	0%	0%		
Totals	944	1582				
Multi-Day Storm Totals		NOTE: 95th percentile 24-hour storm is 1.4 inches				
Storm Duration (days)	Min Depth (in)	Ave Depth (in)	Max Depth (in)	Median (in)	Number of Storm Totals that Exceed the 95th	Percent of Storm Totals that Exceed the 95th
1	0.11	0.43	3.88	0.32	13	2%
2	0.22	1.00	7.10	0.86	45	19%
3	0.50	1.78	8.76	1.56	45	57%
4	0.71	2.52	7.31	2.13	25	81%
5	2.02	3.49	5.69	2.97	17	100%
6	1.54	4.22	6.44	4.16	11	100%
7	3.16	---	5.46	---	2	100%
8	6.50	---	7.84	---	2	100%
Approximate Volume Capture, by Drawdown Time and Design Volume Multiplier						
Total Rainfall on Record:		830	inches			
	Design Storm:	95th percentile, 24-hour storm				
Drawdown	**No Multiplier**		**Multiplier = 1.963**		**Multiplier = 1.1**	
	Runoff (inches)	**Percent Capture**	**Runoff (inches)**	**Percent Capture**	**Runoff (inches)**	**Percent Capture**
24 hours	52	94%	8	99%	42	95%
48 hours	72	91%	11	99%	57	93%
Definitions for purpose of this exhibit:						
	Rain Day:	Greater than or equal to 0.10 inch of rainfall				
	Storm:	1 or more consecutive rain days				

Prepared by Wallace Group
January 2013

San Luis Obispo, CA: CIMIS Station 52
April 1986 - August 2012

Storm Duration Statistics						
Storm Duration (Days)	Number of Occurances	Total Rain Days	Percent of Storms	Percent of Rain Days		
1	263	263	60%	35%		
2	103	206	24%	28%		
3	44	132	10%	18%		
4	16	64	4%	9%		
5	4	20	1%	3%		
6	3	18	1%	2%		
7	1	7	0.2%	1%		
8	3	24	0.7%	3%		
9	1	9	0%	1%		
10	0	0	0%	0%		
Totals	438	743				
Multi-Day Storm Totals		NOTE: 95th percentile 24-hour storm is 1.97 inches				
Storm Duration (days)	Min Depth (in)	Ave Depth (in)	Max Depth (in)	Median (in)	Number of Storm Totals that Exceed the 95th	Percent of Storm Totals that Exceed the 95th
1	0.10	0.50	2.98	0.35	5	2%
2	0.25	1.19	4.60	0.95	16	16%
3	0.56	2.41	10.65	2.17	24	55%
4	1.45	3.89	6.66	3.83	15	94%
5	2.37	3.68	5.40	3.48	4	100%
6	1.74	5.32	8.66	5.55	2	67%
7	6.28	---	6.28	---	1	100%
8	4.47	6.16	8.94	5.08	3	100%
9	5.28	---	5.28	---	1	100%
Approximate Volume Capture, by Drawdown Time and Design Volume Multiplier						
Total Rainfall on Record:		483	inches			
	Design Event:	95th percentile, 24-hour storm				
Drawdown	**No Multiplier**		**Multiplier = 1.963**		**Multiplier = 1.1**	
	Runoff (inches)	**Percent Capture**	**Runoff (inches)**	**Percent Capture**	**Runoff (inches)**	**Percent Capture**
24 hours	26	95%	3	99%	19	96%
48 hours	35	93%	4	99%	27	94%
Definitions for purpose of this exhibit:						
	Rain Day:	Greater than or equal to 0.10 inch of rainfall				
	Storm:	1 or more consecutive rain days				

Prepared by Wallace Group
January 2013

GOLETA PETITION FOR REVIEW
EXHIBIT A

Table 5.4 **Values of coefficient a in Equation 5.2 for finding the maximized detention storage volume (Guo and Urbonas, 1995).**[a]

		Drain time of capture volume		
		12 hours	24 hours	48 hours
Event capture ratio	a =	1.109	1.299	1.545
	r^2 =	0.97	0.91	0.85
Volume capture ratio	a =	1.312	1.582	1.963
	r^2 =	0.80	0.93	0.85

[a] Approximately 85th percentile runoff event (range 82 to 88%).

Volume = a × C × P_6

48 hr drawdown multiplier = 48 hr volume / 24 hr volume

a = regression constant from least-squares analysis;
C = watershed runoff coefficient; and
P_6 = mean storm precipitation volume, watershed in. (mm).

Event = 1.545 / 1.299 = 1.19

Volume = 1.963 / 1.582 = 1.24

Table 5.4 lists the maximized detention volume/mean precipitation ratios based on either the ratio of the total number of storm runoff events captured or the fraction of the total stormwater runoff volume from a catchment. These can be used to estimate the annual average maximized detention volume at any given site. All that is needed is the watershed's runoff coefficient and its mean annual precipitation.

The actual size of the runoff event to target for water quality enhancement should be based on the evaluation of local hydrology and water quality needs. However, examination of Table 5.3 indicates that the use of larger detention volumes does not significantly improve the average annual removal of total suspended sediments or other settleable constituents. It is likely that an extended detention volume equal to a volume between the runoff from a mean precipitation event taken from Figure 5.3 and the maximized event obtained using Equation 5.2 will provide the optimum-sized and most cost-effective BMP facility. A BMP sized to capture such a volume will also capture the leading edge (that is, first flush) of the runoff hydrograph resulting from larger storms.

Runoff volumes that exceed the design detention volume either bypass the facility or receive less efficient treatment than do the smaller volume storms and have only a minimal net effect on the detention basin's performance. If, however, the design volume is larger and has an outlet to drain it in the same amount of time as the smaller basin, the smallest runoff events will be detained only for a brief interval by the larger outlet. Analysis of long-term precipitation records in the U.S. shows that small events always seem to have the greatest preponderance. As a result, oversizing the detention can cause the most frequent runoff events to receive less treatment than provided by properly designed smaller basins.

MEMORANDUM

REVIEW OF VOLUME MULTIPLIER FOR THE CENTRAL COAST POST-CONSTRUCTION STORMWATER REQUIREMENTS

Date: 11 December 2012

To: Craig Campbell, PE

From: Valerie Huff, PE

Subject: Volume Multiplier Research

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PURPOSE AND EXECUTIVE SUMMARY

The purpose of this memo is to address Central Coast RWQCB stakeholder concerns regarding the 48-hour drawdown multiplier of 1.963, as presented in the Post-Construction Requirements Attachment D. Additional resources have been reviewed to identify an appropriate volume multiplier for those stormwater facilities that do not drain with 24-hours. Based on review and research of available rain gauge information, a 48-hour drawdown volume multiplier of 1.30 is proposed. This multiplier was identified through the software program Basin Sizer, using the CASQA BMP method which incorporates results of continuous simulation modeling developed by the Army Corps of Engineers. Using Basin Sizer, a total of 14 rain gauge stations in the developed areas of the Central Coast Region were evaluated for 48-hour drawdown multipliers. The resulting multipliers range from 1.24 to 1.35, with an average of 1.30 and a standard deviation of 0.04. The multiplier of 1.30 is reasonable based on a comparison of Basin Sizer program results to design criteria developed for Bay Area municipalities through continuous simulation modeling.

BACKGROUND

The Central Coast Regional Water Quality Control Board adopted Post-Construction Stormwater Management Requirements for Development Projects in the Central Coast Region on September 6, 2012 (Resolution R3-2012-0025). Subsequent to adoption, stakeholders have expressed concerns regarding design guidelines for stormwater control measures as presented in Attachment D of the Post-Construction Requirements (PCRs).

Specifically, stakeholders have expressed concern regarding the use of a multiplier to calculate design volume. A multiplier of 1.963 is specified in Attachment D, to calculate both Retention Volume and Water Quality Volume. This multiplier is specified to account for additional volume that may be required in order to capture runoff from back to back storms, for those facilities that do not drain within 24 hours. This multiplier is meant to provide a simple approach to design, in lieu of continuous

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CALIFORNIA 93401
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F 805 544-4294
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simulation modeling. However, the intended use of the 1.963 multiplier, as taken from a WEF/ASCE design manual, is to calculate water quality runoff volume based on average rainfall value, not to provide buffer storage as is done in the PCRs. Therefore, additional resources have been reviewed, in order to identify an appropriate volume multiplier and address stakeholder concerns.

PROPOSED SOLUTION

A multiplier of 1.30 is proposed for the Central Coast (RWQCB Region 3), to be used for design of stormwater facilities in lieu of continuous simulation modeling. This multiplier was derived based on a review of 14 rain gauge stations throughout the developed areas of the Central Coast. The software program Basin Sizer was used to evaluate water quality volumes corresponding to varying design drawdown times. Basin Sizer is a public domain software program developed for Caltrans by the Office of Water Programs at California State University Sacramento. Additional information on the program Basin Sizer is included as Attachment A.

Within Basin Sizer, the CASQA method for calculating water quality volume was used for both 80% and 90% runoff volume capture and a 24-hour and 48-hour drawdown time. The design volume for 24-hour drawdown was compared to the 48-hour drawdown volume to calculate the corresponding multiplier for each percent capture. Results of the analysis are summarized in Table 1.

Table 1: Unit Volume Based on Percent Capture and Drawdown Time

Rain Gauge Station	80% Capture			90% Capture		
	24 hrs	48 hrs	Multiplier 24 hrs to 48 hrs	24 hrs	48 hrs	Multiplier 24 hrs to 48 hrs
San Miguel	0.46	0.62	1.35	0.67	0.9	1.34
Santa Margarita	1.09	1.47	1.35	1.53	2.07	1.35
San Luis Obispo	0.79	1.04	1.32	1.13	1.45	1.28
King City	0.5	0.64	1.28	0.7	0.9	1.29
Santa Maria Airport	0.54	0.68	1.26	0.76	0.96	1.26
San Benito	0.47	0.61	1.30	0.66	0.84	1.27
Lompoc	0.5	0.63	1.26	0.76	0.94	1.24
Santa Ynez	0.73	0.95	1.30	1.09	1.39	1.28
San Juan Bautista	0.56	0.75	1.34	0.78	1.05	1.35
Santa Barbara	0.99	1.28	1.29	1.4	1.85	1.32

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Rain Gauge Station	80% Capture			90% Capture		
	24 hrs	48 hrs	Multiplier 24 hrs to 48 hrs	24 hrs	48 hrs	Multiplier 24 hrs to 48 hrs
Gilroy	0.58	0.78	1.34	0.8	1.08	1.35
Carpinteria	0.94	1.27	1.35	1.39	1.84	1.32
Del Monte	0.41	0.53	1.29	0.58	0.73	1.26
Sunset Beach (Mont Co)	0.57	0.74	1.30	0.8	1.04	1.30
Average			**1.31**	**Average**		**1.30**
Std Dev			**0.03**	**Std Dev**		**0.04**

In addition, to verify the validity of results from the Basin Sizer program, results from Basin Sizer were compared to design criteria included in the C.3 Handbook. The C.3 Stormwater Handbook was developed through the Santa Clara Valley Urban Runoff Pollution Prevention Program and last updated in 2012. The Handbook includes sizing criteria for stormwater facilities based on continuous simulation modeling. The C.3 Criteria reviewed was developed by Geosyntec Consultants for the Bay Area Stormwater Management Agencies Association (BASMAA), using the continuous simulation program SWMMM5.0. Results of this comparison and verification are provided in Tables 2 and 3.

Table 2: C.3 Stormwater Handbook Volume Multipliers

Location	Percent Capture	Multiplier 24 hrs to 48 hrs
Morgan Hill (Figure F-7)	80%	1.38
	90%	N/A
Palo Alto (Figure F-8)	80%	1.38
	90%	1.35
San Jose (Figure F-9)	80%	1.30
	90%	1.35

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Table 3: Comparison of Basin Sizer Results and C.3 Stormwater Handbook Criteria

80% Capture Volume per Acre Impervious, 48-hour drawdown				
C.3 Appendix I		Basin Sizer Results		
Location	**Volume**	**Unit Volume**	**Volume**	**Percent Difference**
Berkeley	23,000	0.85	23,080	0.3%
Brentwood	19,000	0.71	19,278	1.5%
Dublin	21,000	0.75	20,364	-3.0%
Hayward	23,500	0.89	24,166	2.8%
Lake Solano	29,000	1.08	29,325	1.1%
Martinez	23,000	0.81	21,993	-4.4%
Morgan Hill	25,500	0.97	26,338	3.3%
Palo Alto*	16,500	0.54	14,662	-11.1%
San Francisco	20,000	0.71	19,278	-3.6%
San Francisco Oceanside	19,000	0.69	18,735	-1.4%
San Jose	15,000	0.54	14,662	-2.3%

*The San Jose rain gauge in Basin Sizer is the nearest gauge to the C.3 Palo Alto gauge. The relatively high percent difference is likely due to weather variations between these two stations.

Based on the comparison to the C.3 continuous simulation modeling results, the volume multiplier obtained through the Basin Sizer program is reasonable and defensible.

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F 805 544-4294
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ATTACHMENT A
BASIN SIZER PROGRAM INFORMATION

The Basin Sizer program was:

- Developed by the Office of Water Programs, California State University Sacramento.
- Developed for Caltrans. The program computes water quality volumes and water quality flows by methods approved for Caltrans use to meet the requirements of the State Water Quality Control Board.
- Updated in 2006 to include CASQA California Stormwater BMP Handbook methods.

California Stormwater BMP Handbook Approach

The CASQA California Stormwater BMP Handbook approach is based on results of a continuous simulation model, developed by the Hydrologic Engineering Center of the U.S. Army Corps of Engineers. The Storage, Treatment, Overflow, Runoff Model (STORM) was applied to long-term hourly rainfall data at numerous sites throughout California. STORM translates rainfall into runoff, then routes the runoff through detention storage. The results of the STORM model are incorporated into the California Stormwater BMP Handbook approach.

Basin Sizer User Guide Excerpt

Basin Sizer is a software tool developed for the California Department of Transportation (Caltrans). This software computes water quality volumes (WQVs) and water quality flows (WQFs) by methods approved for Caltrans use to meet the requirements of the State Water Quality Control Board (SWQCB).

The software allows easy selection of rainfall stations through a graphical interface and displays results in US customary or metric units. The graphical map interface allows zooming and panning of a map of California, which shows rainfall stations, State and Federal highways and rivers.

Basin Sizer was developed to help engineers and designers who are often given a variety of methods to determine WQVs or WQFs. These methods vary by region and by regulator. Commonly WQVs are defined as "the 85th percentile 24-hour runoff event determined as the maximized capture of stormwater volume for the area" or as "the 85th percentile 24-hour storm rainfall depth". In some areas WQVs are not calculated, instead a specific number is give by a regulator. For example, the Tahoe Basin has a WQV of 1". WQFs are often determined to be "the 85th percentile hourly rainfall depth" or a number determined by a regulator.

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Peak Rainfall Intensity Statistics

Location		NOAA Atlas 14 1-year 24-hour depth (in)	1-year Peak Storm Intensity by Rainfall Curve (in/hr)		NOAA Atlas 14 1-year Storm Intensity by Duration (in/hr)				
			NRCS 1	NRCS 1A	5-min	10-min	15-min	60-min	2-hr
Buellton	Hwy 246 / Hwy 101	2.36	1.77	0.57	1.74	1.25	0.99	0.56	0.43
Carmel	Ocean Ave / Junipero St	1.55	1.16	0.37	1.81	1.30	1.05	0.47	0.32
Carpinteria	Linden Ave / 5th Street	2.74	2.06	0.66	2.24	1.60	1.29	0.64	0.49
Felton	**Hwy 9 / Graham Hill Rd**	**4.55**	**3.41**	1.09	**2.99**	2.14	1.72	0.85	0.67
Gilroy	Hwy 152 / Hwy 101	1.83	1.37	0.44	1.51	1.08	0.87	0.42	0.32
Goleta	**Fire Station / Los Carneros**	**2.72**	**2.04**	0.65	**1.74**	1.25	1.02	0.59	0.43
Greenfield	Walnut Ave / Hwy 101	1.21	0.91	0.29	0.97	0.70	0.57	0.27	0.21
Grover Beach	Grand Ave / 4th St	1.73	1.30	0.42	1.39	0.99	0.80	0.40	0.31
Hollister	4th St / San Felipe Rd	1.27	0.95	0.30	1.15	0.82	0.66	0.32	0.24
Lompoc	H Street / Hwy 246	1.94	1.46	0.47	1.45	1.04	0.84	0.48	0.35
Morro Bay	Main St / Hwy 1	1.55	1.16	0.37	1.32	0.95	0.76	0.39	0.30
Pacific Grove	Lighthouse Ave / Forest Ave	1.41	1.06	0.34	1.74	1.25	1.00	0.44	0.30
Paso Robles	Union Rd / Golden Hill Rd	1.47	1.10	0.35	1.32	0.95	0.76	0.39	0.29
Salinas	N Main St / Laurel Dr	1.41	1.06	0.34	1.20	0.86	0.69	0.33	0.24
San Luis Obispo	Broad St / Orcutt Rd	2.06	1.55	0.49	1.80	1.29	1.04	0.51	0.39
Santa Barbara	**State / Anapamu**	**2.77**	**2.08**	0.66	**1.82**	1.30	1.05	0.63	0.45
Santa Cruz	17th Ave / Portola Dr	2.36	1.77	0.57	1.93	1.40	1.12	0.54	0.40
Santa Maria	Betteravia Rd / Hwy 135	1.70	1.28	0.41	1.67	1.19	0.96	0.47	0.34
Watsonville	Main St / Hwy 129	2.05	1.54	0.49	1.75	1.26	1.01	0.48	0.35

Attachment D SCM Sizing Analysis
City of Goleta, per Acre of Impervious

PROJECT DATA				
	Impervious Area	1	acres	
		43,560	square feet	
	Pervious Area	0	square feet	
	Percent Impervious	100%		
	WMZ	4	retain 95th via infiltration	
	85th % storm	1.44	inches	
	95th % storm	2.4	inches	
Bioretention design parameters				
	Ponding Depth	6	inches	
	Engineered Soil Depth	24	inches	
	Engineered Soil Porosity	25%		
	Engineered Soil Storage	6	inches	
	Gravel Depth	12	inches	
	Gravel Porosity	35%		
	Gravel storage	4	inches	
	Available Storage Depth	16	inches	
	NOTE: Facility storage depth must be increased by storm depth, in order to capture rain that falls on bioretention feature			
	Gravel Depth to Capture design storm	7	inches	
	Total Facility Depth	49	inches	
	Total Underground Depth	43	inches	
Attachment D Calculations				
	Runoff Coefficient	0.89	unitless	
	95th Runoff Volume	7,771	cubic feet	
		0.178	acre-feet	
	Min. Surface Area for full volume	5,756	square feet, based on depth above	
	Percent of Surface Area	13%		
	85th Retention Volume	4,663	cubic feet	
		0.11	acre-feet	

HYDROGRAPH ROUTING FOR SCM SIZING: SBUH METHOD WITH HYDROCAD PROGRAM

95th percentile, NOAA 1-year storm curve, AMC 2 — Peak intensity = 1.38 in/hr

Soil Condition	Req'd Surface Area	Percent of Imp Area	Drawdown (hrs)	Total Bioretention Volume	Percent of Ret. Volume	Volume as Percent of Imp Area	Infiltration Rate (in/hr)	Ponding Depth
HSG A	2,000	5%	24	2,000	26%	0.046	5	6 inches
HSG A	1,400	3%	25	1,458	19%	0.033	5	12 inches
HSG B	2,700	6%	38	3,645	47%	0.084	1	6 inches
HSG B/C	3,350	8%	48	4,523	58%	0.104	0.60	6 inches
HSG C	4,700	11%	92	6,345	82%	0.146	0.23	6 inches
HSG D	5,800	13%	12 days	7,830	101%	0.180	0.06	6 inches

95th percentile, Type 1 storm curve, AMC 2 — Peak intensity = 1.81 in/hr

Soil Condition	Req'd Surface Area	Percent of Imp Area	Total Bioretention Volume	Percent of Ret. Volume	Percent of NOAA storm curve	Percent of 1A storm curve	Volume as Percent of Imp Area	Ponding Depth
HSG A	2,550	6%	2,550	33%	128%	159%	0.059	6 inches
HSG A	1,750	4%	1,823	23%	125%	114%	0.042	12 inches
HSG B	2,850	7%	3,848	50%	106%	110%	0.088	6 inches
HSG B/C	3,500	8%	4,725	61%	104%	106%	0.108	6 inches
HSG C	4,700	11%	6,345	82%	100%	100%	0.146	6 inches
HSG D	5,800	13%	7,830	101%	100%	100%	0.180	6 inches

Back-to-back storms, 0.70 then 95th percentile, NOAA 1-year storm curve, both AMC 2

Soil Condition	Req'd Surface Area	Percent of Imp Area	Total Bioretention Volume	Percent of Ret. Volume	Back to Back Multiplier	Volume as Percent of Imp Area	Ponding Depth
HSG A	2,000	5%	2,000	26%	1.00	0.046	6 inches
HSG A	1,400	3%	1,400	18%	1.00	0.032	12 inches
HSG B	2,700	6%	3,645	47%	1.00	0.084	6 inches
HSG B/C	3,350	8%	4,523	58%	1.00	0.104	6 inches
HSG C	4,800	11%	6,480	83%	1.02	0.149	6 inches
HSG D	6,600	15%	8,910	115%	1.14	0.205	6 inches

Back-to-back storms, 0.70 then 95th percentile, Type 1 storm curve, both AMC 2

Soil Condition	Req'd Surface Area (sq ft)	Percent of Imp Area	Total Bioretention Volume (cu. Ft)	Percent of Ret. Volume	Back to Back Multiplier	Volume as Percent of Imp Area	Ponding Depth
HSG A	2,550	6%	2,550	33%	1.00	0.059	6 inches
HSG A	1,750	4%	1,750	23%	1.00	0.040	12 inches
HSG B	2,850	7%	3,848	50%	1.00	0.088	6 inches
HSG B/C	3,500	8%	4,725	61%	1.00	0.108	6 inches
HSG C	4,750	11%	6,413	83%	1.01	0.147	6 inches
HSG D	6,600	15%	8,910	115%	1.14	0.205	6 inches

85th percentile storm, NOAA 1-year curve, AMC 2 — Peak intensity = 0.83 in/hr

Soil Condition	Req'd Surface Area (sq ft)	Percent of Imp Area	Total Bioretention Volume (cu. Ft)	Percent of Ret. Volume	Volume as Percent of Imp Area
HSG A	1,150	3%	1,150	25%	0.026
HSG B	1,550	4%	2,093	45%	0.048
HSG B/C	1,950	4%	2,633	56%	0.060
HSG C	2,650	6%	3,578	77%	0.082
HSG D	3,250	7%	4,388	94%	0.101

85th percentile storm, Type 1 storm curve, AMC 2 — Peak intensity = 1.09 in/hr

Soil Condition	Req'd Surface Area (sq ft)	Percent of Imp Area	Total Bioretention Volume (cu. Ft)	Percent of Ret. Volume	Percent of NOAA Storm Curve	Volume as Percent of Imp Area
HSG A	1,450	3%	1,450	31%	126%	0.033
HSG B	1,650	4%	2,228	48%	106%	0.051
HSG B/C	2,000	5%	2,700	58%	103%	0.062
HSG C	2,700	6%	3,645	78%	102%	0.084
HSG D	3,250	7%	4,388	94%	100%	0.101

NOTES:

95th percentile storm = 2.40 inches

85th percentile storm = 1.44 inches

AMC = Antecedent Moisture Condition

PROJECT DATA				
	Impervious Area	5.4	acres	
		235,224	square feet	
	Pervious Area	0	square feet	
	Percent Impervious	100%		
	WMZ	4	retain 95th via infiltration	
	85th % storm	0.9	inches	
	95th % storm	1.4	inches	
	Tested infiltration	6	inches/hour	
Bioretention design parameters				
	Ponding Depth	6	inches	
	Engineered Soil Depth	18	inches	
	Engineered Soil Porosity	25%		
	Engineered Soil Storage	5	inches	
	Gravel Depth	12	inches	
	Gravel Porosity	35%		
	Gravel storage	4	inches	
	Total Available Depth	15	inches	
	NOTE: Facility storage depth must be increased by storm depth, in order to capture rain that falls on bioretention feature			
Gravel Depth to Capture design storm		4	inches	
	Total Facility Depth	40	inches	
Attachment D Calculations				
	Runoff Coefficient	0.89	unitless	
	95th Percentile Volume	24,479	cubic feet	
		0.56	acre-feet	
Min. Surface Area for full volume		19,983	square feet, based ondepth above	
	Percent of Surface Area	8%		
	85th Percentile Volume	15,736	cubic feet	
		0.36	acre-feet	

HYDROGRAPH ROUTING FOR SCM SIZING: SBUH METHOD WITH HYDROCAD PROGRAM

95th percentile, 2-year SLO storm distribution, AMC 2

Soil Condition	Req'd Surface Area (sq ft)	Percent of Imp Area	Drawdown (hrs)	Total Bioretention Volume (cu. Ft)	Percent of Ret. Volume	Volume as Percent of Imp Area
Actual	5,800	2%	24	5,075	21%	0.022
HSG A	5,800	2%	24	5,075	21%	0.022
HSG B	8,900	4%	38	10,903	45%	0.046
HSG B/C	11,000	5%	48	13,475	55%	0.057
HSG C	14,800	6%	92	18,130	74%	0.077
HSG D	18,000	8%	12 days	22,050	90%	0.094

95th percentile, NRCS Type 1 Storm distribution, AMC 2

Soil Condition	Req'd Surface Area (sq ft)	Percent of Imp Area	Drawdown (hrs)	Total Bioretention Volume (cu. Ft)	Percent of Ret. Volume	Volume as Percent of Imp Area
Actual	8,100	3%	24	7,088	29%	0.030
HSG A	8,100	3%	24	7,088	29%	0.030
HSG B	8,900	4%	38	10,903	45%	0.046
HSG B/C	11,100	5%	48	13,598	56%	0.058
HSG C	14,600	6%	92	17,885	73%	0.076
HSG D	18,000	8%	12 days	22,050	90%	0.094

Back-to-back storms, 0.4 then 95th percentile, 2-year SLO storm distribution, both AMC 2

Soil Condition	Req'd Surface Area (sq ft)	Percent of Imp Area	Total Bioretention Volume (cu. Ft)	Percent of Ret. Volume	Back to Back Multiplier	Volume as Percent of Imp Area
Actual	5,800	2%	5,075	21%	1.00	0.022
HSG A	5,800	2%	5,075	21%	1.00	0.022
HSG B	8,900	4%	10,903	45%	1.00	0.046
HSG B/C	11,000	5%	13,475	55%	1.00	0.057
HSG C	14,800	6%	18,130	74%	1.00	0.077
HSG D	20,200	9%	24,745	101%	1.12	0.105

85th percentile storm, 2-year SLO storm distribution, AMC 2

Soil Condition	Req'd Surface Area (sq ft)	Percent of Imp Area	Total Bioretention Volume (cu. Ft)	Percent of Ret. Volume	Volume as Percent of Imp Area
Actual	3,600	2%	3,150	20%	0.013
HSG A	3,600	2%	3,150	20%	0.013
HSG B	5,400	2%	6,615	42%	0.028
HSG B/C	6,600	3%	8,085	51%	0.034
HSG C	8,900	4%	10,903	69%	0.046
HSG D	10,800	5%	13,230	84%	0.056

NOTES:

95th percentile storm = 1.43 inches

85th percentile storm = 0.9 inches

AMC = Antecedent Moisture Condition

Attachment D SCM Sizing Analysis
City of San Luis Obispo, per Acre of Impervious

PROJECT DATA				
	Impervious Area	1	acres	
		43,560	square feet	
	Pervious Area	0	square feet	
	Percent Impervious	100%		
	WMZ	4	retain 95th via infiltration	
	85th % storm	1.18	inches	
	95th % storm	1.97	inches	
Bioretention design parameters				
	Ponding Depth	6	inches	
	Engineered Soil Depth	18	inches	
	Engineered Soil Porosity	25%		
	Engineered Soil Storage	5	inches	
	Gravel Depth	12	inches	
	Gravel Porosity	35%		
	Gravel storage	4	inches	
	Available Storage Depth	15	inches	
	NOTE: Facility storage depth must be increased by storm depth, in order to capture rain that falls on bioretention feature			
	Gravel Depth to Capture design storm	6	inches	
	Total Facility Depth	42	inches	
	Total Underground Depth	36	inches	
Attachment D Calculations				
	Runoff Coefficient	0.89	unitless	
	95th Retention Volume	6,379	cubic feet	
		0.15	acre-feet	
	Min. Surface Area for full volume	5,207	square feet, based on depth above	
	Percent of Surface Area	12%		
	85th Retention Volume	3,821	cubic feet	
		0.09	acre-feet	

HYDROGRAPH ROUTING FOR SCM SIZING: SBUH METHOD WITH HYDROCAD PROGRAM						
95th percentile, 2-year SLO storm distribution, AMC 2						
Soil Condition	Req'd Surface Area (sq ft)	Percent of Imp Area	Drawdown (hrs)	Total Bioretention Volume (cu. Ft)	Percent of Ret. Volume	Volume as Percent of Imp Area
HSG A	1,500	3%	24	1,313	21%	0.030
HSG B	2,400	6%	38	2,940	46%	0.067
HSG B/C	2,850	7%	48	3,491	55%	0.080
HSG C	3,900	9%	92	4,778	75%	0.110
HSG D	4,700	11%	12 days	5,758	90%	0.132
95th percentile storm, NRCS Type 1 storm distribution, AMC 2						
Soil Condition	Req'd Surface Area (sq ft)	Percent of Imp Area	Total Bioretention Volume (cu. Ft)	Percent of Ret. Volume	Percent of SLO Curve Volume	Volume as Percent of Imp Area
HSG A	2,100	5%	1,838	29%	140%	0.042
HSG B	2,400	6%	2,940	46%	100%	0.067
HSG B/C	2,850	7%	3,491	55%	100%	0.080
HSG C	3,900	9%	4,778	75%	100%	0.110
HSG D	4,700	11%	5,758	90%	100%	0.132
Back-to-back storms, 0.50 then 95th percentile, 2-year SLO storm distribution, both AMC 2						
Soil Condition	Req'd Surface Area (sq ft)	Percent of Imp Area	Total Bioretention Volume (cu. Ft)	Percent of Ret. Volume	Back to Back Multiplier	Volume as Percent of Imp Area
HSG A	1,500	3%	1,313	21%	1.00	0.030
HSG B	2,400	6%	2,940	46%	1.00	0.067
HSG B/C	2,850	7%	3,491	55%	1.00	0.080
HSG C	3,900	9%	4,778	75%	1.00	0.110
HSG D	5,200	12%	6,370	100%	1.11	0.146
Back-to-back storms, 0.50 then 95th percentile, NRCS Type I storm distribution, both AMC 2						
Soil Condition	Req'd Surface Area (sq ft)	Percent of Imp Area	Total Bioretention Volume (cu. Ft)	Percent of Ret. Volume	Back to Back Multiplier	Volume as Percent of Imp Area
HSG A	2,100	5%	1,838	29%	1.00	0.042
HSG B	2,400	6%	2,940	46%	1.00	0.067
HSG B/C	2,850	7%	3,491	55%	1.00	0.080
HSG C	3,900	9%	4,778	75%	1.00	0.110
HSG D	5,200	12%	6,370	100%	1.11	0.146
NOTES:						
95th percentile storm = 1.97 inches			85th percentile storm = 1.18 inches			
AMC = Antecedent Moisture Condition						

Development and Implementation of Hydromodification Control Methodology

Support for Selection of Criteria

Prepared for:

Central Coast Regional Water Quality Control Board
895 Aerovista Place, Suite 101
San Luis Obispo, CA 93401

Prepared by:

Tetra Tech
301 Mentor Drive, Suite A
Santa Barbara, CA 93111

Stillwater Sciences
P.O. Box 904
Santa Barbara, CA 93102

May 9, 2012

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Introduction

The ***Management Strategy - Example Criteria - Watershed Process*** table (Appendix A) was developed to provide a linkage between broad groups of stormwater management objectives (***Strategies***), specific examples of stormwater management criteria for each strategy from California and around the nation (***Criteria***), and how implementation of each criterion is anticipated to preserve or replace critical watershed processes identified previously during the project (***Watershed Processes***). Each ***Criterion*** is rated from a scale of 0 to 4 (using symbols) according to how well it performs for preserving or replacing each ***Watershed Process***. The three terms are shown in ***bold italics*** in this document to help communicate the linkage between them; note that the word "criteria" is left as normal text when used to discuss stormwater management criteria in general, outside of the context of the table and the specific ***Criteria*** that are evaluated in the table.

An additional table is provided showing examples of stormwater management techniques that cannot be easily rated, but are also judged effective for protecting ***Watershed Processes***. In total, these provide a toolbox that developers can use to meet overall stormwater objectives.

Support for Selection of Criteria

Management Strategies

While the term "hydromodification" is not used in the majority of past or present stormwater management manuals or ordinances, the concepts of protecting water quality, maintaining water balance, and preserving stream channel stability have been in the mainstream for decades. The ***Criteria*** presented in this review are grouped according to the following five broad ***Strategies***:

1. Flow Control
2. Water Quality Treatment
3. Preservation of Sediment and Organic Delivery
4. Land Preservation
5. Maintenance of Soil and Vegetation Regime

Flow Control encompasses a broad range of stormwater criteria for addressing hydraulic and hydrologic goals. Three sub-groups are included and defined below: *Storm Event Peaks*, *Flow Duration Matching and Storm Volume Control*, and *Retain/Infiltrate Volume*.

Storm Event Peaks. Use of detention storage for peak flow control has perhaps the longest history in stormwater management. Requirements for managing storm event peak flows grew out of need to provide flood control on a more localized scale in urban areas. Regulations typically mandate that post-development peak flows are less than or equal to pre-development peak flows for a series of intermediate and/or large design storm events (e.g., the 2-, 10-, and 25-year 24-hour events) – thus ensuring, at least in theory, that new development will not create additional flooding hazards.

Flow Duration Matching and Storm Volume Control. The need for storm event volume control was recognized in the late 1980's and came into mainstream use in the early 2000's. Peak control criteria were recognized as ineffective for mitigating channel erosion (Booth, 1989; MacRae, 1992, 1993; Bledsoe and Watson, 2001). The goal thus became to control the runoff from storm events in the 1-year to 2-year recurrence range, corresponding to the frequency with the highest risk potential for channel erosion (commonly correlated with the bankfull event), and by extension damage to aquatic habitat. Standards were promulgated to provide extended detention (minimum 24- to 48-hour drawdown time) for a sufficient volume to mitigate risk of channel erosion. A drawback of volume control criteria, however, is that the resulting outflow hydrograph does not necessarily match pre-developed conditions. In response, "flow duration matching" was first introduced in King County, WA in 1990 and became popular throughout many counties in California during the mid-2000's in response to hydromodification requirements from Water Boards. The objective is simple on the surface – match the aggregate duration of sediment-transporting discharges. The specific criteria are rather complex and technical in their implementation; this is necessary because there has to be an objective statistical basis to *measure*

compliance; in other words one cannot simply perform a subjective visual comparison of peak frequencies and flow durations.

Retain/Infiltrate Volume. None of these preceding ***Flow Control Strategies*** address the full range of flows from the largest storm to baseflow during the driest time of the year. To address this gap, a handful of regulating authorities have implemented requirements for infiltrating runoff or retaining it onsite, without specific reference to the range of stream-channel flows that are affected or that can be measured to evaluate compliance or effectiveness. Goals include maintaining groundwater flow, reducing overall runoff volume, or both.

Water Quality Treatment criteria address urban sources of pollutants such as nutrients from fertilizer, metals from brake pads, pet waste, sediment from exposed soil surfaces, and solids washed off impervious surfaces. Use of stormwater control measures (SCM's) for treatment of pollutants in urban runoff became popular in the 1990's, as the focus of water quality programs moved from traditional end-of-pipe point source control to management of nonpoint sources. Impervious surfaces and soil compaction lead to an increase in runoff volume, but an important question faced by decision makers was (and still is) how much of the runoff should be treated. Early research by Schueler (1987) found a point of diminishing returns between percent capture of annual runoff and pollutant removal effectiveness, and that majority of pollutant mass tended to be carried in runoff during the beginning of storm events, called the "first flush," in many (but not all) climatological regions. Over the next several years, most stormwater programs developed treatment criteria targeting this first-flush volume, with regulations coalescing around treatment of the 85th to 90th percentile annual storm depth, called the Water Quality Volume. California programs took a more robust approach, adding flow-based criteria for SCM's that do not require storage volume (such as swales which treat via filtration), and publishing 85th percentile isopluvial maps to account for highly variable rainfall patterns across the state. While some SCM's designed for water quality treatment also have benefits for reducing peak flows and promoting infiltration and evapotranspiration, the primary reasons for their use are linked to the local water quality requirements, which reflect goals of protecting aquatic life, drinking water resources, and minimizing risk of disease resulting from contact with pathogens in water bodies.

Preservation of Sediment and Organic Delivery. Natural delivery of sediment and organic matter into the channel network are critical processes for the maintenance of various habitat features and aquatic ecosystems in the fluvial setting. While preservation of these functions is not a goal found in most stormwater regulations, it is often discussed qualitatively as the purpose in establishing or justifying riparian buffer requirements.

Land Preservation.

Open Space Requirements are sometimes used as a technique in stormwater regulation, especially when a receiving stream or reservoir has a high value placed on its protection.

Minimize Effective Impervious Area. There are several regulating authorities with requirements for limiting impervious area and directing runoff from impervious surfaces to pervious areas, rather than routing it directly to the storm drain (thus converting "effective" impervious area to "ineffective" impervious area, namely hard surfaces where the runoff can reinfiltrate into the ground instead of connecting directly to the channel network). These practices serve to reduce Effective Impervious Area.

Maintenance of Soil and Vegetation Regime

The need for water quality treatment "facilities" is widely understood in stormwater management, but the underlying reason for such a need is commonly recognized only partly. Although the import of new pollutants into a watershed is one dimension of water quality impairment, the greater cause is typically the isolation of soil and vegetation from the path of urban stormwater runoff. In an undisturbed watershed, the processes of filtration, adsorbtion, biological uptake, oxidation, and microbial breakdown (collectively termed the ***Watershed Process*** of "chemical and biological transformations" by the Joint Effort) provide extremely effective purification of most (though not all) contaminants, both natural and anthropogenic. The most obvious evidence of this is enshrined in Health Department rules, nationwide, that typically mandate no more than 100 feet of separation between a raw sewage discharge (via drainfield) and a human drinking-water supply. The effectiveness of this treatment does not rely on structural measures, but rather on the ability of natural soil and vegetation to purify water of most of its even most deleterious contaminants.

This management ***Strategy*** embraces not only the "natural" approach to water quality treatment and protection but also major components of how the rainfall–runoff relationship is attenuated in an undisturbed watershed. Evapotranspiration, infiltration, interflow, and deep recharge in an undisturbed watershed all reflect the presence of soil and vegetation; maintaining these elements is thus an obvious ***Strategy*** for protecting these processes as well. As such, this ***Strategy*** overlaps with several others: not only can it accomplish water quality treatment, but also it provides an effective (but non-engineered and so difficult to quantify) approach to stormwater volume-based flow control. In addition, if adjacent to water bodies it preserves the delivery of sediment and organics to waterbodies; and it is a (typically intentional) byproduct of any application of land-preservation ***Strategies*** as well.

Example Criteria

The ***Criteria*** are drawn from a cross-section of ordinances and regulations from municipalities, states, and the federal government. Examples from California were preferentially selected, but existing examples from this state are not broad enough in scope to address all of the ***Strategies***. In many instances, a regulating authority uses similar ***Criteria*** as provided in the table example; these are noted as "Similar Criteria" in highlighted boxes. Key assumptions regarding how the ***Criteria*** are related to the ***Watershed Process*** ratings are provided in italicized text.

It is important to note that the ***Criteria*** are not mutually exclusive among the ***Strategies*** – some meet multiple objectives. In addition, the ***Criteria*** are not presented in the more holistic context of the goals of their ordinance or requirement; often a regulating authority has multiple (and sometimes tiered) criteria for addressing several water resource management goals.

Watershed Processes

Each ***Watershed Process*** is discussed, both in the context of the natural setting and the developed landscape.

Overland flow

Precipitation reaching the ground surface that does not immediately soak in must run over the land surface (thus, "overland" flow). Most uncompacted, vegetated soils have infiltration capacities of one to several inches per hour at the ground surface, which exceeds the rainfall intensity of even unusually intense storms of the Central Coast and so confirms the field observations of little to no overland flow in undisturbed watersheds. In contrast, pavement and hard surfaces reduce the effective infiltration capacity of the ground surface to zero, ensuring overland flow regardless of the meteorological attributes of a storm, together with a much faster rate of runoff relative to flow over vegetated surfaces. Some stormwater practices work specifically to promote returning concentrated flow to overland flow on pervious surfaces (such as downspout disconnection) or prevent flow from concentrating in the first place (such as permeable pavement).

Infiltration and groundwater recharge

These closely linked hydrologic processes are dominant across most intact landscapes of the Central Coast Region. They can be thought of as the inverse of overland flow; most precipitation that reaches the ground surface and does not immediately run off has infiltrated. Their widespread occurrence is expressed by the common absence of surface-water channels on even steep, undisturbed hillslopes. Thus, on virtually any geologic material on all but the steepest slopes (or bare rock), infiltration of rainfall into the soil is inferred to be widespread, if not ubiquitous. With urbanization, changes to the process of infiltration are also quite simple to characterize: some (typically large) fraction of that once-infiltrating water is now converted to overland flow.

Interflow

Interflow takes place following storm events as shallow subsurface flow (usually within 3 – 6 feet of the surface) occurring in a more permeable soil layer above a less permeable substrate. In the storm response of a stream, interflow provides a transition between the rapid response from surface runoff and much slower stream discharge from deeper groundwater. In some geologic settings, the distinction between "interflow" and "deep groundwater" is artificial and largely meaningless; in others, however, there is a strong physical discrimination between "shallow" and "deep" groundwater movement. Development reduces infiltration and thus interflow as discussed previously, as well as reducing the footprint of the area supporting interflow volume.

Evapotranspiration

In undisturbed humid-region watersheds, the process of returning water to the atmosphere by direct evaporation from soil and vegetation surfaces and by the active transpiration by plants can account for nearly one-half of the total annual water balance; in more arid regions, this fraction can be even higher. Development covers soils with impervious surfaces and usually results in the compaction of soils when grading occurs. Native plants are often replaced with turfgrass, which typically have lower rates of evapotranspiration unless irrigated throughout the summer months.

Delivery of sediment to waterbodies

Sediment delivery into the channel network is a critical process for maintaining various habitat features in fluvial systems (although excessive sediment loading from watershed disturbance can instead be a significant source of degradation). Development commonly covers surfaces, and non-native vegetation may also prevent the natural supply of sediment from reaching the stream.

Delivery of organic matter to waterbodies

Introduction of allochthonous organic material into the stream network, either as fine organic material suitable for food or as coarse organic material that can provide physical structure and hydraulic resistance in the channel, is critical for maintaining aquatic life. Development may reduce the input of organic matter to streams, especially when native vegetation near streams is cleared or replaced with turfgrass.

Chemical/biological transformations

This encompasses the suite of ***Watershed Processes*** that alter the chemical composition of water as it passes through the soil column on its path to (and after entry into) a receiving water. The conversion of subsurface flow to overland flow in a developed landscape eliminates much of the opportunity for such transformations, and this loss is commonly expressed through degraded water quality.

Stream Stability

While an indicator of watershed conditions and not a ***Watershed Process*** itself, stream stability may be important to consider when development cannot achieve an adequate degree of performance for the other ***Watershed Processes***. This is more likely to occur as impervious footprints become large and overwhelm the ability of the remaining landscape to absorb development impacts, and where inadequate mitigation has occurred.

The following ratings are used in the table to link the performance of the ***Criteria*** to each ***Watershed Process***. Key assumptions regarding how the ***Criteria*** relate to the ***Watershed Processes*** are provided in italicized text.

Rating	Description
4 ●	***Criterion*** preserves or fully replaces the ***Watershed Process*** relative to natural conditions.
3 ◕	***Criterion*** substantially preserves the ***Watershed Process*** or replaces most of the process relative to natural conditions.
2 ◑	***Criterion*** partially preserves or replaces the ***Watershed Process***.
1 ◔	***Criterion*** minimally replaces a portion of the ***Watershed Process***.
0 ○	***Criterion*** provides no protection or support of the ***Watershed Process***.

Summary

The following ***Criteria*** provide the best overall protection of ***Watershed Processes***:

- Section 438 of EISA – Retain 95th Percentile Event

- City of Santa Monica – Urban Runoff Mitigation Plan
- City of Santa Barbara SWMP – Volume Reduction Requirement
- State of Delaware – Final Draft Stormwater Regulations

King County, Washington – Requirements for Sensitive Watersheds also scores highly, but the rankings are due primarily to the percentage of land left in an undeveloped state.

The four ***Criteria*** listed above share a common gap in their coverage of ***Watershed Processes***, namely the delivery of sediment and organic matter to waterbodies. Where these processes require protection, a buffer zone requirement is the most common and effective vehicle to address the gap.

Many areas within the Central Coast region require protection for only a subset of the ***Watershed Processes***, depending on their Watershed Management Zone classification. As a result, a one-size-fits-all approach is not likely to provide flexibility in the development of stormwater management requirements. Multiple techniques are likely to be needed to address varying objectives. It is also important to note that some ***Criteria*** (such as flood control requirements) may score poorly for individual ***Criteria*** but still have an important role in stormwater management by virtue of community needs or concerns.

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Appendix A: Management Strategy - Example Criteria - Watershed Process table

MANAGEMENT STRATEGY - EXAMPLE NUMERIC CRITERIA – WATERSHED PROCESS TABLE

Criteria Rating Description

Rating	Description
	Criterion preserves or fully replaces the watershed process relative to natural conditions.
	Criterion substantially preserves the watershed process or replaces most of the process relative to natural conditions.
	Criterion partially preserves or replaces the watershed process.
	Criterion minimally replaces a portion of the watershed process.
	Criterion provides no protection or support of the watershed process.

Preserve/maintain ● ◕ ◑ ◔ ○ No benefit

Management Strategy	Example Criteria	Watershed Processes: Overland flow	Infiltration and groundwater recharge	Interflow	Evapotranspiration	Delivery of sediment to waterbodies	Delivery of organic matter to waterbodies	Chemical/biological transformations	Stream Stability
Flow Control **Storm Event Peaks** Post-development peak flows match pre-development peak flows for a specific set of design storm events. *Note: Peak control basins are assumed to typically have pervious bottoms with some vegetation.*	Santa Barbara County, CA – Flood Control Requirements vary by location. For example, Santa Ynez Valley and South Coast – post-development peak flows do not exceed pre-development peak flows for the 2 through 100-year storm events. *Note: Santa Barbara is assumed to perform better than City of Durham; the basin will likely be larger to capture a fuller range of design storm volumes. Increased surface area provides more opportunity for infiltration and ET of frequent low volume storm events.*	○	◔	○	◔	○	○	○	○
	City of Durham, NC – Peak Runoff Control Post-development peak flows do not exceed pre-development peak flows for the 2-year and 10-year 6-hour storm events. *Note: Peak control basins in Durham are assumed to have a smaller basin footprint-to-drainage area ratio than in Santa Barbara, resulting in minimal influence on hydrology.* Similar Criteria – Santa Barbara SWMP (2-, 5-, 10-, and 25-year 24-hour events)	○	○	○	○	○	○	○	○

Preserve/maintain ● ◕ ◑ ◔ ○ No benefit

Management Strategy	Example Criteria	Watershed Processes: Overland flow	Infiltration and groundwater recharge	Interflow	Evapotranspiration	Delivery of sediment to waterbodies	Delivery of organic matter to waterbodies	Chemical/biological transformations	Stream Stability
Flow Control **Flow Duration Matching and Storm Volume Control** The goal of both techniques is to reduce risk of downstream channel erosion. The goal of flow duration matching is for post-development hydrographs to match pre-development hydrographs across a wide range of storm events, taking both flow rates and duration of discharge into account. Ratings assume that hydromodification criteria with lower flow thresholds a fraction of Q_2 are typically met using structural practices that promote infiltration and ET (e.g., bioretention). These same practices provide a high degree of water quality treatment.	<u>San Diego County – Hydromodification Plan</u> • **Flow Duration.** For flow rates ranging from the lower flow threshold to the pre-project 10-year runoff event (Q_{10}), the "post-project discharge rates and durations shall not deviate above the pre-project rates and durations by more than 10 percent over and more than 10 percent of the length of the flow duration curve." • **Peak Flow Frequencies.** "For flow rates ranging from the lower flow threshold to Q_5, the post-project peak flows shall not exceed pre-project peak flows. For flow rates from Q_5 to Q_{10}, post-project peak flows may exceed pre-project flows by up to 10 percent for a 1-year frequency interval." *Note: The "lower flow threshold" is site-specific and depends on the level of protection needed for the receiving stream, based on screening method developed for the HMP. The lower flow threshold may be $0.1Q_2$, $0.3Q_2$, or $0.5Q_2$; in the absence of a downstream analysis, the value is set to $0.1Q_2$. The San Diego SUSMP and Hydromodification Plan promote site design options that retain some runoff in pervious areas, and practices that detain/treat the majority of runoff using practices that promote infiltration and evapotranspiration. Detention basins are viewed as a last resort when other options are not feasible. Since the default lower flow threshold is 0.1Q2, a given practice tends to have larger footprint requirements than those seen in other jurisdictions for the same practice.* Similar Criteria – San Francisco Bay Area Counties, Contra Costa County, Ventura County, Sacramento County	◔	◕	◕	◑	○	○	◕	◕

Preserve/maintain ● ◕ ◑ ◔ ○ No benefit

Management Strategy	Example Criteria	Watershed Processes: Overland flow	Infiltration and groundwater recharge	Interflow	Evapotranspiration	Delivery of sediment to waterbodies	Delivery of organic matter to waterbodies	Chemical/biological transformations	Stream Stability
Flow Control **Flow Duration Matching and Storm Volume Control (continued)**	Western Washington State – Flow Duration Post-project runoff durations from $0.5Q_2$ to Q_{50} shall not exceed pre-project runoff durations, where "pre-project" is defined as fully forested land cover unless the site was demonstrably prairie (modeled as "pasture") prior to settlement. *Note: Ratings assume Western Washington site designs provide somewhat less infiltration and emulation of interflow than those assumed for San Diego County. The $0.5Q_2$ lower flow threshold used in Western Washington is likely to result in a relatively lower capture volume.*	○	◑	◑	◑	○	○	◕	◕

Preserve/maintain ● ◕ ◑ ◔ ○ No benefit

Management Strategy	Example Criteria	Watershed Processes: Overland flow	Infiltration and groundwater recharge	Interflow	Evapotranspiration	Delivery of sediment to waterbodies	Delivery of organic matter to waterbodies	Chemical/biological transformations	Stream Stability
Flow Control **Flow Duration Matching and Storm Volume Control (continued)** For volume control, a specified runoff volume (based on a design storm event) is captured and released over an extended time period.	Town of Huntersville, NC – Treatment Volume Control and treat increase in runoff volume between pre- and post-developed conditions for the 2-year 24-hour storm event (rural zones) or the 1-year 24-hour storm event (urban zones). Volume must be released over a minimum of 48 hours. Practices must be distributed throughout the site, with no drainage area larger than five acres. *Note: The ordinance places a strong focus on the use of LID practices for water quality treatment and volume control, and includes requirements for distributing BMPs throughout a site rather than having one BMP at the drainage area outlet. However, the relative treatment volume is lower than those specified for the Flow Duration Criteria examples (when accounting for the difference between Southeastern and Pacific Coast hydrology), and there is stronger reliance on detention facilities for addressing large storm event volumes. Ratings are assumed to be reduced for infiltration and interflow.*	◔	◔	◔	◑	○	○	◕	◑
	State of Maryland – Channel Protection Storage Volume Runoff volume from the 1-year 24-hour storm event must be detained and released over a minimum of 24 hours (12-hours in some locations). Note: Design criteria provide specifications for several types of structural practices, but the larger suite of requirements tend to favor the selection of wet ponds, and practices that promote infiltration and ET are less likely to be utilized. Ratings are assumed to reflect reliance on ponding basins for volume control and other requirements. Similar Criteria – State of Georgia, Knox County TN	○	○	○	◔	○	○	◑	◑

Preserve/maintain ● ◕ ◑ ◔ ○ No benefit

Management Strategy	Example Criteria	Watershed Processes: Overland flow	Infiltration and groundwater recharge	Interflow	Evapotranspiration	Delivery of sediment to waterbodies	Delivery of organic matter to waterbodies	Chemical/biological transformations	Stream Stability
Flow Control **Retain/Infiltrate Volume** Runoff from all storms up to a threshold depth is retained on site and does not leave as surface runoff.	<u>Section 438 of EISA – Retain 95th Percentile Event</u> Prevent offsite discharge from runoff-generating events up to the 95th percentile precipitation event. This volume must be infiltrated, evaporated/transpired, or harvested for later use to the maximum extent technically feasible. *Note: To achieve high volume retention, there is a strong incentive to use as much of the pervious area for infiltration as possible. Practices such as downspout disconnection and redirection of runoff to pervious areas are likely to be used. By extension, site water quality is likely to be improved since runoff from the vast majority of storms is not allowed to leave the site. Ratings assume that capturing and retaining the 95th percentile event results in the use of a suite of practices that come close to returning the site to pre-development annual hydrology.*	●	●	●	●	○	○	◕	◑
	<u>City of Santa Barbara SWMP – Volume Reduction Requirement</u> Provide retention for the larger of the following two volumes: • The volume difference between the pre- and post-conditions for the 25-year, 24-hour design storm (the "pre-condition" means an undeveloped state) • The volume generated from a one-inch, 24-hr storm event *Note: The Santa Barbara volume reduction requirement applies to Tier 3 Large Projects, defined as > 4,000 ft² of new/replaced impervious surface. Tier 1 Small Projects and Tier 2 Medium Projects are exempt. Ratings assume that the requirement results in less volume retention than EISA. The exemptions are also assumed to decrease the overall effectiveness somewhat.*	◑	◑	◕	◑	○	○	◕	◑

Preserve/maintain ● ◕ ◑ ◔ ○ No benefit

Management Strategy	Example Criteria	Watershed Processes: Overland flow	Infiltration and groundwater recharge	Interflow	Evapotranspiration	Delivery of sediment to waterbodies	Delivery of organic matter to waterbodies	Chemical/biological transformations	Stream Stability
Flow Control **Retain/Infiltrate Volume (continued)**	State of New Jersey – Groundwater Recharge Two options are available. 1. The site retains 100% of its average annual pre-construction groundwater recharge volume, as shown by hydraulic/hydrologic analysis. 2. The increase in runoff volume between the pre-construction and post-construction 2-year storm event is infiltrated, as shown by hydraulic/hydrologic analysis. *Note: For a given site, the New Jersey volume requirement may be less than the EISA volume requirement, since the 95th percentile event is large enough to produce runoff in most regions, which would be in excess of the New Jersey volume. As a result, the ET benefit may be diminished. However, the New Jersey criteria place a strong focus on infiltration, so infiltration, interflow, and groundwater recharge are rated higher than EISA.*	◑	●	●	◑	○	○	◑	◔

Preserve/maintain ● ◕ ◑ ◔ ○ No benefit

Management Strategy	Example Criteria	Watershed Processes: Overland flow	Infiltration and groundwater recharge	Interflow	Evapotranspiration	Delivery of sediment to waterbodies	Delivery of organic matter to waterbodies	Chemical/biological transformations	Stream Stability
Water Quality Treatment Structural BMPs designed specifically for pollutant removal treat runoff from smaller, more frequent storm events.	City of San Diego – Water Quality Criteria • **Volume-based Treatment.** BMPs must treat (infiltrate, filter, or provide extended detention for settling) the volume generated by the 85th percentile storm event. • **Flow-based Treatment.** BMPs must treat a maximum flow rate of runoff produced by a) a rainfall intensity of 0.2 in/hour or b) the maximum runoff rate produced by the 85th percentile storm event multiplied by a factor of two. Similar Criteria – Los Angeles County SUSMP, Riverside County Stormwater NPDES Permit, Sacramento County *Note: The criteria do not require retention of the capture volume, so there is a cost incentive to developers to select flow-based BMPs (such as swales) or detention basins with gradual release rates. As a result, the first four Watershed Processes are assumed to have relatively low ratings. However, Riverside County requires development projects to use practices that promote infiltration first, then use bio-treatment if necessary, and use detention if there are no other alternatives. Depending on enforcement during design review, this requirement could improve the ratings for the first four Watershed Processes.*	○	◑	◑	◑	○	○	◕	◔

Preserve/maintain ● ◕ ◑ ◔ ○ **No benefit**

Management Strategy	Example Criteria	Watershed Processes: Overland flow	Infiltration and groundwater recharge	Interflow	Evapotranspiration	Delivery of sediment to waterbodies	Delivery of organic matter to waterbodies	Chemical/biological transformations	Stream Stability
Water Quality Treatment (continued)	<u>City of Santa Monica – Urban Runoff Mitigation Plan</u> All new development or redevelopment must retain the entire 0.75 inch storm event on site, using structural BMPs, nonstructural BMPs, and storm water reuse to evaporate/transpire, infiltrate, or utilize the captured volume. *Note: The plan was implemented to address water quality concerns; however, the criteria could also be classified as* Retain/Infiltrate Volume *under* Flow Control. *The first four* Watershed Processes *are rated highly since the criterion is sufficiently strict to promote the use of nonstructural and structural practices for infiltration and ET.*	◑	◕	◕	◕	○	○	◕	◔

Preserve/maintain ● ◕ ◑ ◔ ○ No benefit

Management Strategy	Example Criteria	Watershed Processes: Overland flow	Infiltration and groundwater recharge	Interflow	Evapotranspiration	Delivery of sediment to waterbodies	Delivery of organic matter to waterbodies	Chemical/biological transformations	Stream Stability
Water Quality Treatment (continued)	City of Santa Barbara SWMP – Water Quality Treatment Requirement • **Volume-based Treatment.** BMPs must treat (infiltrate, filter, or provide extended detention for settling) the volume generated by the 1-inch 24-hour design storm event. • **Flow-based Treatment.** BMPs must treat a maximum flow rate of runoff produced by a rainfall intensity of 0.25 in/hour for four hours. *Note: The Santa Barbara water quality requirement applies to Tier 3 Large Projects, defined as > 4,000 ft^2 of new/replaced impervious surface. For Tier 1 Small Projects, compliance is voluntary. Tier 2 Medium Projects are required to implement "Basic BMP Options" which include several nonstructural options for reducing runoff at the source.*	○	◑	◑	◑	○	○	◕	◔
	State of Maryland – Water Quality Volume Capture and treat runoff from 90th percentile storm event to achieve an 80 percent annual load reduction for post-development TSS and a 40 percent annual load reduction for post-development TP. Similar Criteria (TSS only) – State of New Jersey, State of North Carolina	○	◑	◑	◑	○	○	◕	◔

Preserve/maintain ● ◕ ◑ ◔ ○ No benefit

Management Strategy	Example Criteria	Watershed Processes: Overland flow	Infiltration and groundwater recharge	Interflow	Evapotranspiration	Delivery of sediment to waterbodies	Delivery of organic matter to waterbodies	Chemical/biological transformations	Stream Stability
Preservation of Sediment and Organic Delivery **Buffer Zones** Buffer zones are established adjacent to streams where development and disturbance are limited or excluded. Goals include habitat protection, water quality treatment of upland flow, and maintenance of woody debris, among others. The ratings assume low chemical and biological transformation potential; typically the majority of a development site (>80 percent) lies beyond the zone where runoff can enter the buffer as overland flow. Concentrated flow or piped flow would not be treated. Concentrated flow also carries a high erosion risk.	<u>Teton County and Jackson Wyoming – Land Development Regulations for Protection of Waterbodies and Wetlands (Variable Width)</u> • Major rivers – 150' • Streams with flow > 3 cfs or critical wildlife habitat – 50' to 150' • Wetlands – 30' No development is permitted in the buffers, and uses are severely restricted. Ratings assume that the required width (relative to the other examples) provides hydrology benefits by virtue of increasing the amount of undeveloped natural area, as well as targeting the portion of the landscape (stream corridors) with the strongest connection to hydrology. However, runoff from the developed footprint of sites may not receive any benefit if flow is piped through the buffers, or flow concentrates before entering the buffers.	◔	◑	◔	◔	◕	◕	◔	◔
	<u>North Carolina TMDL Riparian Buffer Rules (50' fixed width)</u> The Rule applies to intermittent and perennial water bodies. The first 30' landward of the edge of the water body must remain as undisturbed forest vegetation. The next 20' feet can have managed vegetation but activities are severely restricted. Existing uses are exempt from the rule if they were present at the time of adoption. The rules apply to all land uses. *Note: The rule addresses the concentrated flow issue by requiring that stormwater runoff must enter the buffer as diffuse flow, by using level spreaders or other devices. As a result, some credit is given to maintaining overland flow, even though the portion of the buffer in native vegetation is relatively narrow.*	◔	◔	○	○	◕	◕	◔	◔

Preserve/maintain ● ◕ ◑ ◔ ○ No benefit

Management Strategy	Example Criteria	Watershed Processes: Overland flow	Infiltration and groundwater recharge	Interflow	Evapotranspiration	Delivery of sediment to waterbodies	Delivery of organic matter to waterbodies	Chemical/biological transformations	Stream Stability
Preservation of Sediment and Organic Delivery **Buffer Zones (continued)**	<u>City of Napa – Municipal Code (20' fixed width)</u> The City requires a development setback of 20' from perennial and intermittent streams for channel erosion protection goals. No building is allowed in the setback, and the setback area is to be protected from access using fencing, etc. The area is to be maintained in a natural state. *Note: Natural vegetation requirements appear to be less strict in the Napa requirements than in the other examples, so* Delivery of Organic Matter *is rated less highly.*	○	◔	○	○	◑	◑	◔	◔
Preservation of Sediment and Organic Delivery **Buffer Zones (continued)**	<u>Santa Cruz – City-wide Creeks and Wetlands Management Plan (Variable Width)</u> The Plan maps the watercourses and known wetlands in the City and identifies development setbacks based on stream and channel type, habitat type, extent of existing riparian vegetation, wildlife habitat, and existing land use patterns. Each waterbody is placed in one of three categories: • Category A (125' or more) – high quality habitat, few gaps in the vegetated corridor, or special species • Category B (30' to 125') – limited riparian habitat in urban areas • Category C (no buffer)– low or no habitat value (e.g., concrete channels) A separate riparian corridor with restricted uses is established within the setbacks; the width of the corridor varies based on local conditions and protection goals. *Note: Santa Cruz is not rated differently than Teton County, but it provides an alternative method for achieving goals.*	◔	◑	◔	◔	◕	◕	◔	◔

Preserve/maintain ● ◕ ◑ ◔ ○ No benefit

Management Strategy	Example Criteria	Watershed Processes: Overland flow	Infiltration and groundwater recharge	Interflow	Evapotranspiration	Delivery of sediment to waterbodies	Delivery of organic matter to waterbodies	Chemical/biological transformations	Stream Stability
Land Preservation **Open Space Requirements** A portion of a site is set aside either as natural area or for passive recreational use. In some cases the purpose is linked directly to hydrology and water quality goals. More often, land preservation is required for aesthetic or other reasons. The following examples reflect open space requirements specifically for hydrology/water quality.	<u>King County, Washington – Requirements for Sensitive Watersheds</u> In its Surface Water and Drainage Ordinance, King County has strict forest preservation requirements for select watershed areas. Clearing must be limited to a maximum 35 percent of the lot or plat area. If the approved permit requires a flow control and water quality facility, then clearing can be increased to 60 percent of the lot or plat area. *Note: The* Watershed Process *ratings assume the 35 percent clearing limit. The Sediment and Organic Matter delivery ratings assume that development avoids stream corridors in favor of upland areas.*	◕	◕	◕	◕	◕	◕	◑	◔
	<u>City of Bothell, Washington – Regulations for Sensitive Watershed Areas</u> To protect the ground and surface water within the Palm, Woods, and Cole Creek drainage areas, the City requires that forest cover on a development site not be less than 50 percent for lands zoned 10 units per acre, and 60 percent for lands zoned 1 or 5 units per acre. Forest cover is to be based upon the gross area of the total site, not just the lots. *Note: The* Watershed Process *ratings assume the 50 percent clearing limit. The Sediment and Organic Matter delivery ratings assume that development avoids stream corridors in favor of upland areas.*	◑	◑	◑	◑	◕	◕	◑	◔

Preserve/maintain ● ◕ ◑ ◔ ○ No benefit

Management Strategy	Example Criteria	Watershed Processes: Overland flow	Infiltration and groundwater recharge	Interflow	Evapotranspiration	Delivery of sediment to waterbodies	Delivery of organic matter to waterbodies	Chemical/biological transformations	Stream Stability
Land Preservation **Open Space Requirements (continued)**	Mecklenburg County, North Carolina – Undisturbed Open Space Requirements The post-construction stormwater ordinance stipulates that undisturbed natural open space area is required for all development unless mitigated offsite. The percentage of the natural open space area required depends on a project's built upon area: sites with less than 24 percent built upon area require a minimum 25 percent undisturbed open space; sites with between 24 percent and 50 percent built upon area require a minimum 17.5 percent undisturbed open space; and sites with greater than 50 percent built upon area, a minimum of 10 percent undisturbed open space is required. Previously disturbed areas can be re-vegetated to meet the requirement.	◔	◔	◔	◔	◔	◔	◔	○

Preserve/maintain ● ◕ ◑ ◔ ○ No benefit

Management Strategy	Example Criteria	Watershed Processes: Overland flow	Infiltration and groundwater recharge	Interflow	Evapotranspiration	Delivery of sediment to waterbodies	Delivery of organic matter to waterbodies	Chemical/biological transformations	Stream Stability
Land Preservation **Minimize Effective Impervious Area** Effective Impervious Area (EIA) represents the portion of the site with impervious surfaces that generates runoff directly to the site's drainage system. If runoff from impervious surfaces is allowed to flow onto pervious surfaces and infiltrate (i.e., disconnection), then EIA may be reduced.	<u>City of Bothell, Washington – Regulations for Sensitive Watershed Areas</u> In order to protect surface and ground waters and provide cool water sources, the City enacted a number of measures including limitations in EIA for new development and redevelopment. EIA shall not exceed 20 percent for lands zoned 5 and 10 units per acre, and 15 percent for lands zoned 1 unit per acre based upon the gross area of the total site. *Note: The EIA requirements are not particularly strict for the 1 unit per acre criterion. In addition, the requirements apply only to impervious surfaces and do not address clearing limits or preservation of natural vegetation. At a result, many of the ratings are relatively low.*	◔	◔	○	◔	○	○	○	○
	<u>State of Delaware – Final Draft Stormwater Regulations</u> Delaware's Draft Sediment Control and Stormwater Management Regulations require impervious area to be controlled such that there is no direct contribution of stormwater runoff (i.e., the equivalent of 0 percent effective impervious area). Specifically, the regulations require that after runoff reduction practices have been implemented on the disturbed area, the site's impervious area shall not directly contribute stormwater runoff during a rain event that has a 99 percent annual probability of occurring. While the regulations are under public review, they have been under development with stakeholder participation during the previous year. *Note: A high degree of disconnection should rate well for site hydrology, but does not guarantee protection of stream corridors. Flow directly to pervious surfaces may re-concentrate, especially for large storm events that would quickly inundate the infiltration capacity of site pervious area. The stream stability rating is assumed to reflect moderate protection.*	◕	◕	◕	◕	○	○	◕	◑

		Preserve/maintain ● ◕ ◑ ◔ ○ No benefit							
		Watershed Processes							Stream Stability
Management Strategy	**Example Criteria**	Overland flow	Infiltration and groundwater recharge	Interflow	Evapotranspiration	Delivery of sediment to waterbodies	Delivery of organic matter to waterbodies	Chemical/biological transformations	
Maintenance of Soil and Vegetation Regime Soil and vegetation are maintained to allow treatment of precipitation via the physical and biological processes that occur in soil. These differ from *Open Space Requirements* in their goal of preventing soil disturbance to protect natural soil processes.	Seattle, Washington – Green Factor The purpose of this ordinance is to increase the quality and quantity of landscaping in urban areas. Numerous landscaping elements can be used to achieve the required Green Factor score for each zoning district. Of the different landscape element options a developer can choose in order to meet the required Green Factor score, landscape areas with a soil depth of more than 24 inches or more are given one of the highest multipliers or weights, essentially incentivizing soil preservation. Similar Criteria – Washington D.C. Green Area Ratio	Not rated since the benefit is scaled to the area of implementation. The Green Factor is discussed in more detail in the Example Programs table.							

		✓ Approach addresses Watershed Process						
		Watershed Processes						
Example Program	**Approaches**	**Overland flow**	**Infiltration and groundwater recharge**	**Interflow**	**Evapotranspiration**	**Delivery of sediment to waterbodies**	**Delivery of organic matter to waterbodies**	**Chemical/biological transformations**
Bay Area NPDES Permit Permittees must require "Regulated Projects" to implement one or more of the listed site design measures.	Direct roof runoff into cisterns or rain barrels for reuse. *Note: Rating assumes captured water is used for outdoor irrigation.*		✓		✓			
	Direct roof runoff onto vegetated areas.	✓	✓	✓	✓			
	Direct runoff from sidewalks, walkways, and/or patios onto vegetated areas.	✓	✓	✓	✓			
	Direct runoff from driveways and/or uncovered parking lots onto vegetated areas.	✓	✓	✓	✓			
	Construct sidewalks, walkways, and/or patios with permeable surfaces.		✓					
	Construct bike lanes, driveways, and/or uncovered parking lots with permeable surfaces.		✓					

		✓ Approach addresses Watershed Process						
		Watershed Processes						
Example Program	**Approaches**	**Overland flow**	**Infiltration and groundwater recharge**	**Interflow**	**Evapotranspiration**	**Delivery of sediment to waterbodies**	**Delivery of organic matter to waterbodies**	**Chemical/biological transformations**
Seattle Green Factor The Seattle Green Factor requires certain types of development to achieve a cumulative score by implementing a set of practices. While the stated purpose is to increase the quality and amount of planted areas, the practices address other goals including reducing runoff and improving water quality. Select practices are listed with some context about how they are scored.	Landscaped areas with a soil depth 24 inches or greater are given six times the credit of landscaped areas with soil depths less than 24 inches.		✓	✓	✓			
	For vegetation planted in landscaped areas, the highest credit is given for trees that are large at maturity (canopy spread of 26 to 30 feet)				✓			
	A very high credit (2 times the large tree credit in the previous approach) is given for preserving existing trees with trunks six or more inches in diameter.				✓			
	Green roofs	✓			✓			
	Permeable pavement	✓	✓	✓	✓			
	Vegetated walls receive a high credit to meet aesthetic goals of the program, but they do provide benefits to Watershed Processes				✓			
	A bonus is provided for using rainwater harvesting (i.e., cisterns) to supply 50 percent or more of annual irrigation to landscaped areas		✓		✓			

Linda S. Adams
Agency Secretary

California Regional Water Quality Control Board
Central Coast Region

Arnold Schwarzenegger
Governor

Internet Address: http://www.waterboards.ca.gov/centralcoast
895 Aerovista Place, Suite 101, San Luis Obispo, California 93401-7906
Phone (805) 549-3147 • FAX (805) 543-0397

April 3, 2009

Steven Wagner, Community Services Director
City of Goleta
130 Cremona Drive, Suite B
Goleta, CA 93117

Dear Mr. Wagner

NOTICE OF ENROLLMENT – NPDES SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS GENERAL PERMIT; CITY OF GOLETA, SANTA BARBARA COUNTY, WDID # 3 42MS03022

The Central Coast Regional Water Quality Control Board (Water Board) received a Notice of Intent, Storm Water Management Plan (SWMP), map, and fee for the City of Goleta's (City's) Municipal Separate Storm Sewer System (MS4). These items are required to enroll in the National Pollutant Discharge Elimination System General Permit for the Discharge of Storm Water from Small Municipal Separate Storm Sewer Systems, Order No. 2003-0005-DWQ (General Permit).

Water Board staff reviewed the City's SWMP and found it, combined with a number of specific revisions described in Attachment 1, to meet the maximum extent practicable (MEP) standard established in the General Permit. The City's SWMP was available to the public for a 60-day comment period, and we received comments from stakeholders. The comments are contained in Attachment 2. Water Board staff responses to these comments are contained in Attachment 3.

I am hereby approving the City's SWMP with the following condition:
Pursuant to Water Code Section 13383, the City of Goleta is required to amend the SWMP no later than **June 2, 2009**, to include all the changes shown in the "Final Table of Required Revisions," Attachment 1 to this letter. Per Water Code Section 13385, failure to make these revisions may subject the City of Goleta to Administrative Civil Liability for up to $10,000 for each day of violation. The City of Goleta must provide a copy of the revised SWMP to the Water Board no later than **June 5, 2009**.

As of April 3, 2009, discharges from the City's MS4 are authorized by the General Permit. The City is required to implement the SWMP and comply with the General Permit. The City's first annual reporting period ends April 30, 2010. The City's first annual report is due to the Water Board on August 1, 2010 (approximately 90 days after the reporting period).

As part of the revised SWMP, the City is required to develop interim hydromodification control criteria using one of the options identified in the "Final Table of Required Revisions," as well as a Hydromodification Management Plan. I agree it is appropriate for the City to consider and

include exemptions to the interim hydromodification control criteria and the Hydromodification Management Plan for certain new development and redevelopment projects, where an assessment of downstream channel conditions and proposed hydrology indicates the increased stormwater discharge rates and durations resulting from development will not result in off-site erosion or other significant adverse impacts to beneficial uses. We will consider the examples of exemptions you've previously provided when we review your proposed interim hydromodification control criteria in one year.

Also, I will notify the City of Goleta and other interested persons of the acceptability of the City's proposed interim hydromodification criteria for new development and redevelopment projects. The Central Coast Water Board shall provide interested persons the opportunity for comment and a hearing before the Water Board, if any party is aggrieved by the staff's determination, prior to Water Board action being final.

Thank you for your cooperation and efforts to get the City of Goleta enrolled under the General Permit. If you have questions regarding this matter, please contact **Brandon Sanderson** at **(805) 549-3868**, or bsanderson@waterboards.ca.gov or Matt Thompson at (805) 549-3159 or mthompson@waterboards.ca.gov.

Sincerely,

Roger W. Briggs
Executive Officer

cc: (by electronic mail)
Kimberly Nilsson, City of Goleta
Kira Redmond, Santa Barbara Channelkeeper
Hilary Hauser, Heal the Ocean

Enclosures:
Attachment 1: Final Table of Required Revisions
Attachment 2: Comment Letters Received during 60-day Public Comment Period
Attachment 3: Response to Comments

S:\Shared\Stormwater\Stormwater Facilities\Santa Barbara Co\Municipal\City of Goleta\June 2008 SWMP\Final SWMP Approval, April 2009\FINAL Notice of Enrollment and Table of Req Rev to Goleta June 08 SWMP, April 2009.doc

FINAL TABLE of REQUIRED REVISIONS
Goleta SWMP April 2009 – April 2014

Acronyms:

BMP	- Best Management Practice
CASQA	- California Stormwater Quality Association
CEQA	- California Environmental Quality Act
IDDE	- Illicit Discharge Detection and Elimination
MG	- Measurable Goal
SWMP	- Storm Water Management Plan
SWPPP	- Storm Water Pollution Prevention Plan
TMDL	- Total Maximum Daily Load
POCs	- Pollutants of Concern

* Denotes addition of Required Revision since last review

Item Number	SWMP Section	Subject	Problem	Required Revisions
1	All	TMDLs	TMDLs are currently being developed for bacteria in Goleta Slough and the Pacific Ocean at Goleta Beach, to which the City discharges. The City may be required to demonstrate that it is reducing pathogen loading. The SWMP does not recognize the current development of TMDLs.	Add language to the SWMP that recognizes these impairments, and state that the City will prioritize these issues to the extent that potential storm water pollutant sources are within the City's jurisdiction. The SWMP must also acknowledge that adoption of TMDL requirements may require revisions of the City's SWMP.
2	All	Effectiveness Assessment	The City's BMPs and/or MGs do not always have adequate measures of effectiveness to assess the appropriateness and effectiveness of individual BMPs and the SWMP as a whole. Effectiveness assessment discussions in the SWMP are often excluded or do not provide appropriate detail to be evaluated effectively.	The City must adequately address effectiveness assessment in its SWMP by including the following components to establish measurements of effectiveness. This includes the development of MGs with interim milestones and implementation frequency where appropriate. 1. Assessment of program effectiveness in terms of achieving permit requirements and MGs.

Item Number	SWMP Section	Subject	Problem	Required Revisions
			The City MGs often do not provide adequate measures of success in the implementation of associated BMPs. For further assistance please see EPA's "Measurable Goals Guidance" at: http://cfpub1.epa.gov/npdes/stormwater/measurablegoals/index.cfm and Annual Report Guidance at: http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/sm_ms4_arg.doc	2. Assessment of program effectiveness in terms of protecting and restoring water quality and beneficial uses. 3. Identification of quantifiable effectiveness measurements for each BMP, including measurements that link BMP implementation with improvement of water quality and beneficial use conditions. 4. Emphasis on assessment of BMPs specifically targeting primary POCs. 5. Incorporation of the effectiveness assessment process similar to that outlined in CASQA's *Municipal Stormwater Program Effectiveness Assessment Guide* (www.casqa.org). 6. Identification of the steps that will be taken to revise the SWMP and optimize BMP effectiveness, when effectiveness assessments identify BMPs or programs that are ineffective or can be improved.
3	4.0 Public Education	BMP Development	This section does not identify link between BMP development/implementation and primary POCs. For example outreach should focus on proper handling of trash (especially plastic debris), pet waste management, septic system maintenance, fertilizer use, hydromodification, automotive activities, etc.	Revise BMPs PEO 1, 2, and 4 to emphasize primary POCs in education and outreach materials and efforts.
4	4.0	BMP Selection	The Public Education and Outreach	Include a BMP that commits to assessing

Item Number	SWMP Section	Subject	Problem	Required Revisions
	Public Education	Community-based Social Marketing	BMPs rely heavily on information campaigns that utilize education and advertising to encourage behavior change. While these efforts can be effective in creating public awareness and in changing attitudes, numerous studies show that behavior change rarely occurs as a result of simply providing information. One particularly promising approach to public education is community-based social marketing. Community-based social marketing is based upon research in the social sciences that demonstrates that behavior change is most effectively achieved through initiatives delivered at the community level which focus on removing barriers to an activity while simultaneously enhancing the activities benefits. More information on community-based social marketing is available at: http://www.cbsm.com/. The techniques of community-based social marketing should be considered when developing and implementing your public education and outreach program.	community-based social marketing strategies, and incorporating them into your program where appropriate.
5	4.0 BMP-PEO 3	Green Business Program	BMP lacks commitment to ensure certified businesses continue to meet environmental criteria.	Revise MG to 1) include periodic inspections, and 2) determine the appropriate frequency of inspections.
6	4.0	K-6 Education	The BMP is unclear regarding annual	Revise BMP to state, "educate 25% of school

GOLETA PETITION FOR REVIEW
EXHIBIT B

Item Number	SWMP Section	Subject	Problem	Required Revisions
	BMP-PEO 4		requirement.	children (K-6) annually (Year 1-5 or 2-5)."
7* Additional info added	4.0 BMP-PEO 6	Stormwater Hotline	The description of tracking calls lacks detail. The City does not ensure discharges are responded to and prioritized appropriately on a daily basis including weekends.	Revise MG to include tracking of location, nature and time of day of incidents reported. The MG must be revised to address an appropriate response to discharges on weekends. Responses should be prioritized based on severity of the discharge.
8*	5.0 Public Involvement	Public Involvement in Storm Water Ordinance(s)	The SWMP lacks a clear commitment on the part of the City to involve the public in review and commenting on draft ordinances.	Add a BMP equivalent to the following: The City will solicit public comments on draft ordinances, provide sufficient time for the public to comment, and respond to comments by incorporating revisions to draft ordinances as appropriate.
9	6.0 IDDE	BMP Development	This section does not identify link between BMP development/implementation and target POCs.	Revise BMPs to identify links to target POCs (e.g., pathogens, nutrients, trash, copper, and sediment).
10	6.1 IDDE	Non-Storm Water Discharges Exempt under General Permit	This section does not provide adequate detail (no BMPs or MGs included) for the City's proposed evaluation of exempt non-storm water discharges, to determine if they have the potential to be significant sources of pollutants.	Add BMPs and MGs, including a schedule for the evaluation of non-stormwater discharges identified as exempt under the General Permit. (See City of Santa Barbara's SWMP pg. 47.)
11	BMP # IDDE-2	Storm Water Ordinance	This BMP lacks detail on the ordinance approval process. The SWMP states that development and approval of an ordinance will be complete within year 1. The City must have a general sense	Revise the BMP to include detail on the development and adoption of the ordinance, including a tentative schedule that includes at least one widely advertised public meeting to solicit input on the content of the ordinance

Item Number	SWMP Section	Subject	Problem	Required Revisions
			of the development and approval process.	before it is presented to the City Council.
12	6.0 IDDE	Enforcement	Procedures for enforcement must be included with greater detail in the SWMP.	Include a description of potential enforcement procedures for an escalating enforcement strategy.
13	BMP# IDDE-2	Storm Water Ordinance	The scope of the ordinance is not described.	Revise the BMP to indicate that pet wastes (including horse waste) restrictions are included in the ordinance.
14	BMP # IDDE-4	IDDE Monitoring	The BMP lacks detail and specificity. The SWMP states the City monitors industrial areas near water bodies it has identified having potential for illicit discharges (p. 31). However, the BMP for monitoring does not include this monitoring.	Revise the BMP to indicate how current monitoring is integrated into the City's stormwater monitoring and state when and how often industrial areas near water bodies will be monitored.
15	BMP# IDDE-4	Complaint Investigation	The BMP lacks detail regarding identification and investigation procedures.	Revise the BMP to include detailed procedures for complaint investigation and response. Detail must include tracking of the time, location, and nature of complaint calls along with total numbers and outcomes.
16	BMP# IDDE-4	Complaint Investigation Follow-up	The BMP lacks detail regarding identification and investigation follow-up procedures.	Revise the BMP to indicate that field inspection documentation will include follow-up (re-inspection) on observed and abated discharges to ensure discharges have been eliminated.
17	BMP# IDDE-4	Field Investigations	The BMP lacks detail about investigation procedures.	Revise the BMP to provide detail on field investigation procedures, including the number of field personnel assigned to

Item Number	SWMP Section	Subject	Problem	Required Revisions
				inspections, what areas they will target, when and how often inspections will be conducted, and how they will be conducted (e.g., drive by, on foot).
18	6.0 IDDE	Effectiveness measurement	Many of the MGs do not provide for effectiveness measurement of the IDDE program and BMPs as required in the annual report.	See above general statement on Effectiveness Measurement. Add effectiveness assessment in the SWMP when appropriate. For example, the City could provide response cards to complainants that describe the City's resolution of their complaint, direct call number for continued discharge, and program evaluation survey. This can be used as effectiveness measurement for many of the BMPs in the IDDE program.
19	6.0 IDDE	IDDE Training	The SWMP lacks training for municipal staff. The City does not commit to making the detection and elimination of illicit discharges a priority.	Include a BMP to train City staff (especially field staff) on IDDE requirements, inspection, and enforcement procedures.
20	6.0 IDDE	Hazardous Spill Response	Hazardous Spill Response is not addressed in the SWMP.	Add a BMP to review and update the hazardous spill response program and training to address potential discharges to the MS4.
21* Additional info added	7.0 CSRC	Inadequate MCM Details for Construction Runoff Controls	The current scope of this Minimum Control Measure is limited.	Revise the SWMP to acknowledge that the City is required to establish construction site controls for sites less than an acre that are part of a larger common plan of development. Add BMPs demonstrating that the City will

Item Number	SWMP Section	Subject	Problem	Required Revisions
				comply with General Permit requirements to: (1) develop procedures for site plan review, (2) develop requirements for construction site operators to control waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality, and (3) develop procedures for receipt and consideration of information submitted by the public
22*	7.0 CSRC	Construction site operator education & training	The City does not clearly articulate how it will educate construction site personnel about stormwater pollution prevention.	In addition to pre-construction meetings, include a BMP that discusses how the City will educate and train construction personnel on projects within the City's jurisdiction, on the proper implementation of stormwater runoff controls (e.g., City sponsored trainings, fact sheets). Include information on proper site planning, minimization of soil movement, capturing sediment, and good housekeeping.
23*	BMP # CSRC-1	Grading Ordinance	The BMP does not include appropriate MGs	Include a MG committing the City to review and update the existing ordinance in year 1.
24	BMP # CSRC-1	Construction Site Enforcement and Inspections	The MGs do not provide information to evaluate effectiveness of review procedures, inspections, and City follow-up actions based on inspections (e.g., enforcement).	Revise MGs to track site information, including: owner, contractor, start and completion dates, size in acres, inspection dates, findings from inspections, complaints received and City's response to inform effectiveness of review, inspection and follow-up procedures. Include a review of the existing grading

Item Number	SWMP Section	Subject	Problem	Required Revisions
				ordinance in year one as a MG.
25	BMP # CSRC-2	Staff Training	The frequency of training is not indicated.	Revise the BMP to include frequency of staff training (e.g., all staff will receive 4 hours of training per year).
26	BMP # CSRC-2	Staff Training	The scope of training is not indicated.	Revise the BMP to state the City will train staff on proper installation, operation and maintenance of construction site BMPs, inspection methods and enforcement strategies.
27* Additional info added	BMP# PCRC-1	Policy Updates	This BMP lacks detail concerning policy development and updates. The City lists many programs and resources (e.g., CEQA Guidelines & Checklist, interpretive and implementation guidelines, conditions of approval, mitigation measures) that will be used under this BMP, some of which the City states will be developed or updated.	Add individual BMPs or MGs within this BMP to state when updates and revisions to cited guidelines, conditions, and measures will occur; explain revision procedures. The City must apply standard conditions of approval to all projects. Educate applicant on need for stormwater control during all requested planner consult meetings and Development Review Committee meetings. The City must implement interpretive and implementation guidelines and include them in application packages.
28	BMP# PCRC-4	Project Design Approval	The City's review process for new and re-development projects as described lacks adequate detail to know whether the process could allow project environmental analysis to conclude	Modify the section in the BMP that describes the City's development project review/approval process for completeness and to be consistent with the following, or add a BMP equivalent to the following: The

Item Number	SWMP Section	Subject	Problem	Required Revisions
			without evaluation of specific stormwater management BMPs proposed.	City will insure that applications are only deemed complete if they identify the types of post-construction BMPs to be implemented and their locations. In addition, identify in the SWMP the particular stage(s) in the City's development project review/approval process that will be used to apply all specific hydromodification control/LID criteria and standards to development projects.
29	8.0 PCRC BMP# PCRC-1	Inspection Procedures & Enforcement	This BMP lacks specificity regarding inspection protocol and tracking system.	Add or revise the BMP to indicate when and how often inspections will occur to ensure correct BMP installation, maintenance, and functionality. Include measures to ensure that inspectors are informed of conditions, measures, and control BMPs they must track.
30	8.0 PCRC	Enforcement	The BMP does not have a description of penalty provisions for non-compliance of standards or conditions of approval.	Add a BMP identifying specific procedures, enforcement and range of penalties for non-compliance.
31	8.0 PCRC	Long-term Maintenance Agreements	Statements are vague and ambiguous and do not commit to long-term maintenance.	Add a BMP indicating that the City must require a signed maintenance agreement stating that: 1) maintenance will be performed in perpetuity, and 2) new owners must be notified of maintenance requirements.
32	BMP # PCRC-2	Enforcement of Hydromodification Control Standards	Enforcement tracking for the Hydromodification Control Standards is not specified.	Add a BMP equivalent to the following: The City will track enforcement of post-construction storm water controls required

Item Number	SWMP Section	Subject	Problem	Required Revisions
				as conditions of approval, in Years 2 and 3.
33* Additional info added	BMP # PCRC-2	Hydromodification Control/Low Impact Development	The Draft hydromodification control standards included as Appendix G are not supported by technical findings. Any proposed control standards, including numeric criteria for volume and rate control, will require a review by Water Board staff based on technical findings to determine the standards' adequacy. The City has 12 months from the date of their enrollment under the General Permit to develop and adopt interim hydromodification control standards with Water Board approval. Inclusion of the draft standards in the SWMP is not appropriate at this time.	Remove Appendix G, or mark it "DRAFT, Not approved by Water Board." Add a BMP stating the following or equivalent: Within one year of enrollment under the General Permit, the City 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 on projects whose applications are deemed complete after the first anniversary of enrollment under the General Permit.
34	BMP # PCRC-2	Interim Hydromodification Criteria	The BMP does not include a schedule or approach to develop criteria. The City's October 31, 2008 comment letter included a proposal to implement the design standards of General Permit Attachment 4 instead of preparing interim hydromodification control criteria within one year of SWMP approval. The design standards of General Permit Attachment 4 require stormwater runoff	Modify the SWMP to include the development of interim hydromodification criteria using one of the options listed below: Option 1: The proposed criteria may include the following types of requirements which provide a high degree of assurance of effective hydromodification control without regard to the nuances of individual

Item Number	SWMP Section	Subject	Problem	Required Revisions
			peak control and treatment only. The design standards do not control hydromodification, therefore cannot be considered interim hydromodification control criteria.	watersheds: 1. For new and re-development projects, Effective Impervious Area[1] shall be maintained at less than five percent (5%) of total project area. 2. For new and redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface, the post-construction runoff hydrographs shall match within one percent (1%) the pre-construction[2] runoff hydrographs, for a range of events with return periods from 1-year to 10-years. 3. For projects whose disturbed project area exceeds two acres, preserve the pre-construction drainage density (miles of stream length per square mile of watershed) for all drainage areas serving a first order stream3 or larger, and ensure that post-project time of concentration is equal or greater than pre-project time of concentration. Other acceptable approaches to develop interim criteria that are as effective as Option 1 include:

[1] Effective Impervious Area is that portion of the impervious area that drains directly to a receiving surface waterbody via a hardened storm drain conveyance without first draining to a pervious area. In other words, impervious surfaces tributary to pervious areas are not considered Effective Impervious Area.

1. [2] Pre-construction condition is defined as undeveloped soil type and vegetation.
2. [3] A first order stream is defined as a stream with no tributaries.

Item Number	SWMP Section	Subject	Problem	Required Revisions
				Option 2: Adopt and implement hydromodification criteria developed by another local municipality and approved by the Water Board, such as the criteria the Water Board adopted for the City of Salinas, as interim criteria. OR Option 3: The City shall: 1. Identify a range of runoff flow rates for which post-project runoff flow rates and durations shall not exceed pre-development runoff rates and durations, where the increased discharge rates and durations will result in off-site erosion or other significant adverse impacts to beneficial uses. Pre-development refers to the soil type, vegetation and amount of impervious surface existing on the site prior to the proposed development or redevelopment project. 2. Establish numeric criteria for development projects to maximize infiltration on-site and approximate natural infiltration levels to the maximum extent practicable and to effectively implement applicable low-impact

Item Number	SWMP Section	Subject	Problem	Required Revisions
				development strategies. 3. Identify the projects, including project type, size and location, to which the City will apply the interim criteria. The projects to which the City will apply the interim criteria will include all those projects that will cause off-site erosion or other significant adverse impacts to beneficial uses. 4. Identify methods to be used by project proponents to demonstrate compliance with the interim discharge rate and duration criteria, including continuous simulation of the entire rainfall record. 5. Identify methods to be used by project proponents to demonstrate compliance with the interim infiltration criteria, including analysis of site imperviousness.
35	8.2.2 PCRC	Hydromodification Management Plan	The description of the process to develop the City's Hydromodification Management Plan lacks required objectives.	Add a BMP stating how and when the City will develop hydromodification criteria and control measures based on an assessment of the impacts of urbanization on the watershed and that determines the effectiveness of the proposed control measures. An adequate technical assessment would consider the following: • Hydrograph modification (volume, duration, and rate); • A wide range of flow events (e.g., 1- to

Item Number	SWMP Section	Subject	Problem	Required Revisions
				10-year return period) and/or continuous flow modeling; • Limits on imperviousness; • Evaluation of downstream affects (stream stability); • Estimate buffer zone requirements; and • Estimate water quality impacts. The assessment should result in: • Numeric criteria for runoff rate and volume control for development and redevelopment projects; • Numeric criteria for stream stability impacts for development and redevelopment projects; • Identification of areas within the City where these criteria must be met; • Specific performance and monitoring criteria for installed hydromodification control infrastructure; • Riparian buffer zone requirements; and • Appropriate hydromodification controls measures such as LID concepts, on-site hydrologic and water quality controls, in-stream controls, and/or regional facilities to meet future development conditions.
36*	BMP # PCRC-3	Staff Training	BMP lacks methods to determine effectiveness.	Include a MG that will evaluate effectiveness of trainings (e.g., post-training tests).
37	8.0 PCRC	Long-Term Watershed Protection	The City must commit to providing long-term watershed protection. The City has provided examples of its efforts of watershed protection through land use	Include a BMP stating how and when the City will 1) develop quantifiable measures that indicate how the City's watershed protection efforts achieve desired watershed

Item Number	SWMP Section	Subject	Problem	Required Revisions
			policies, plans, ordinances, guidance manuals, and BMPs. However, the City must provide more detail and evidence that these will achieve desired watershed conditions.	conditions, 2) evaluate the existing watershed protection efforts (the referenced land use policies, plans, ordinances, guidance manuals, and BMPs), and 3) adapt or change the existing efforts if necessary.
38	9.0 PPGH	Inadequate MCM Details	The Pollution Prevention and Good Housekeeping for Municipal Operations (PPGH) control measure lacks detail and specificity. (See City of Santa Barbara and Santa Maria SWMPs for example of expected content.)	Revise the SWMP to provide greater discussion of program elements for effective evaluation and approval. Discussion must address who, what, where, why, how, and when statements.
39	9.0 PPGH	MS4 Maintenance Operations	The BMP lacks a description of maintenance activities and procedures implemented to prevent pollutant discharges to the MS4.	Include a BMP to develop a schedule for maintenance of City facilities (e.g., public roads, bridges, sidewalks, and building facades) to prevent pollutants from entering MS4. Identify procedures for proper removal of collected waste.
40	9.0 PPGH	Hazardous Spill Response	This is not addressed.	Revise the BMP to say City commits to update hazardous spill response and training to address potential discharges to the MS4 (if necessary).
41	BMP # PPGH-3	Facility Surveys	This BMP does not clearly indicate whether all City facilities will be surveyed.	1) Revise or add a BMP or MG to indicate the City will evaluate all of its facilities for potential to discharge to storm drains. 2) Develop a comprehensive inventory of facilities, including all corporation yards and public facilities (i.e., golf courses, parks, etc.).
42	BMP # PPGH-3	Facility Surveys	The BMP does not indicate what and how many City facilities will be	Revise the MG to indicate inspection frequency.

Item Number	SWMP Section	Subject	Problem	Required Revisions
			inspected annually.	
43*	BMP # PPGH-4	Purchasing & Contracts	The BMP does not include MGs to ensure contractors comply with the SWMP.	Include a MG to revise standard contract language to include specific binding language requiring compliance with the City's SWMP and implementation of BMPs to protect water quality.
44* Additional info added	BMP # PPGH-4	Contract Enforcement	This BMP lacks clarification and detail about how contracts containing storm water pollution prevention specifications will be tracked and enforced.	Revise the BMP to add procedures for evaluating compliance and enforcement if contracts are violated. Revise MG to include tracking compliance of contractors. The City must attempt not to hire contractors that have not met stormwater control requirements.
45*	BMP # PPGH-6	Mutt-Mitt Program	The BMP lacks clear measures of effectiveness.	Revise MG to including tracking the number of Mutt-Mitts consumed annually.

SANTA BARBARA
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August 12, 2008

Mr. Dominic Roques
Central Coast Regional Water Quality Control Board
895 Aerovista Place, Suite 101
San Luis Obispo, CA 93401-7906

Re: City of Goleta Storm Water Management Plan

Dear Mr. Roques:

Please accept the following comments on the City of Goleta's June 2008 Draft Storm Water Management Plan (SWMP), which are hereby submitted by Santa Barbara Channelkeeper. Channelkeeper is a non-profit organization dedicated to protecting and restoring the Santa Barbara Channel and its watersheds, and for the past five years we have been reviewing and commenting on the draft SWMPs of municipalities throughout Santa Barbara County with the goal of ensuring that they will meet the requirements of California's General Permit for Storm Water Discharges from Small Municipal Storm Sewer Systems (MS4s) and will be effective in protecting water quality and reducing the discharge of pollutants to the Maximum Extent Practicable (MEP).

Channelkeeper finds that the City of Goleta has made good progress in revising its SWMP, and we commend the City's efforts to solicit and incorporate public comments into the final draft submitted to the Central Coast Regional Water Quality Control Board (RWQCB), and to produce detailed responses to public comments it received on its May 2008 draft. We find that the SWMP is greatly improved over previous drafts. We do, however, have a few recommendations that we urge the RWQCB to require prior to approving Goleta's SWMP.

Public Education and Outreach

Business Based Education Program: Channelkeeper applauds the City's commitment to develop and implement a Business Based Education Program and to conduct routine site visits to all businesses in the City. To aid in implementing this program, we recommend that the City utilize inspection checklists and reporting forms for different types of businesses (i.e. food service establishments, automotive shops and gas stations, nurseries), such as those appended to the Monterey Regional SWMP. We also recommend establishing a training program for City inspectors so they are well-versed in what industry-specific problems and BMPs to look for when conducting their inspections.

Green Business Program: We recommend that this BMP be revised to commit the City to conducting annual inspections of certified businesses to ensure that they continue to meet the

environmental criteria before their green certification is renewed.

Educational Programs for School Children: Channelkeeper recommends that the City document the specific demographics of the children they reach with their educational programs, and that they aim to reach 25% of school children in each year of the permit term, rather than just in Years 2 and 4 as laid out in the Measurable Goal.

Stormwater Hotline: We urge the City to document not only the number of calls received but also their nature, location and time of day in order to track patterns of problems as well as repeat offenders. The Measurable Goal of responding to community calls within 24 hours should also include weekends as well as a commitment to take appropriate enforcement action where needed.

Illicit Discharge Detection and Elimination

Non-Storm Water Discharges: Channelkeeper appreciates the City's commitment to develop practices for reviewing, testing and evaluating non-stormwater discharges to determine whether they are significant sources of pollutants and to develop BMPs to remediate those that are, and we recommend that this be included as a Measurable Goal in the SWMP.

Education and Outreach: We recommend that the City detail how it proposes to distribute its educational materials to ensure that they reach the appropriate audiences.

Identification and Elimination of Illicit Discharge Sources: With regard to spill complaint and response, the City should develop a tracking system that records the time, location and nature of illicit discharges detected in addition to their number and final outcome. In addition, Channelkeeper urges the City to be more systematic in its development of a Field Investigation and Abatement program, for instance by focusing on high-priority areas with known pollution problems and likely sources of illicit discharges and establishing a scheduled frequency for conducting field investigations. Finally, a Measurable Goal should be added to conduct follow-up inspections and take enforcement action when necessary to ensure the elimination of 100% of illicit discharges identified.

Construction Site Runoff Control

Goleta's SWMP fails to note that the City is obligated to reduce stormwater discharges from construction activity disturbing less than one acre if part of a larger common plan of development or sale that would disturb one acre or more. The SWMP also fails to clearly articulate how the City will meet the requirements for construction site operators to control construction-related waste, nor what procedures will be implemented for site plan review and for receipt and consideration of information submitted by the public. These requirements need to be addressed in the City's final SWMP.

Another important BMP is also missing from this MCM: educating construction site operators and workers about stormwater pollution prevention through the distribution of brochures, BMP fact sheets and City-sponsored trainings. These efforts should include detailed information about the proper installation and maintenance of appropriate erosion and sediment control BMPs, as well as references to recognized BMP manuals widely applied by the construction community.[1]

[1] For example, California Department of Transportation, *Storm Water Quality Handbook: Construction Site Best Management Practices Manual*; California Regional Water Quality Control Board San Francisco Region, *Erosion*

Grading Ordinance: Channelkeeper supports the City's commitment to review and update the existing Grading Ordinance as appropriate and urges that this be included as a Measurable Goal.

Construction Site Enforcement, Inspections: This BMP lacks sufficient detail about the "standard City procedures" used to address non-compliance. Additionally, Channelkeeper urges the City to develop and utilize a more sophisticated system for tracking construction sites and inspections and enforcement, including basic site information (i.e. owner, address, contractor, etc.), status (active/complete), project start and anticipated completion dates, size in acres, proximity to natural and man-made hydrologic features, required inspection frequency, details of inspection findings, complaints or reports submitted by the public, any history of non-compliance, enforcement actions taken, and follow-up inspections to ensure correction.

Staff Training: In addition to training in currently applicable regulations and compliance standards, relevant staff must be trained in the proper installation, operation and maintenance of construction site BMPs, appropriate inspection techniques and enforcement strategies. This should be included in the BMP.

Post Construction Runoff Control

Watershed/Wetland Protection Policies: It is vitally important that development projects specify BMPs and control measures to protect water quality in the early stages of design. As such, Channelkeeper recommends that pre-application meetings be made mandatory rather than voluntary for moderately complex and complex projects, and that the City *does* implement interpretive and implementation guidelines to assist planners in the interpretation of its water quality policies as soon as possible. The latter should be included as a Measurable Goal, as should the efforts outlined under "Standard Conditions of Approval/Mitigation Measures" (developing and adopting a new list of standard conditions of approval) and under "CEQA Review" (updating the initial study checklist form; developing new CEQA guidelines for surface and stormwater quality; and developing new mitigation measures and standard conditions that include water quality BMPs). The SWMP should also make it clear that final BMPs must be selected, sized and sited in order for CEQA review to be completed, rather than later during the land use clearance and permit compliance process.

Hydromodification Management Plan: While Channelkeeper appreciates the City's proactive effort to lay out a strategy to develop a watershed-based hydromodification management plan and to present draft hydromodification control standards, we find that the strategy and standards do not conform to the requirements laid out in the RWQCB's February 15, 2008 Notification letter. We concur that this section needs to be modified in line with the required changes laid out in the RWQCB's August 5, 2008 Table of Required Revisions.

Staff Training: The training of permitting and review staff to properly condition projects to protect water quality is a vitally important BMP. Channelkeeper therefore recommends that methods be implemented (such as post-training tests) to evaluate the effectiveness of the trainings.

Monitor Discretionary Projects: The General Permit requires the City to ensure long-term operation and maintenance of BMPs. The current version of the SWMP omits an important BMP

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and Sediment Control Field Manual; and California Stormwater Quality Task Force, *California Storm Water Best Management Practices Handbooks: Construction Activity; Industrial/Commercial Activity; and Municipal Activity.*

that was included in the previous draft – to monitor discretionary projects for compliance with water quality measures and to take appropriate enforcement action where necessary. We strongly urge that this BMP be included in the final SWMP, along with appropriate Measurable Goals stating the frequency and protocols for inspection to ensure that all long-term BMPs remain functional.

Pollution Prevention/Good Housekeeping for Municipal Operations

Evaluation of City Facilities and Appropriate BMPs: Channelkeeper supports the City's goal to assess all City facilities and services to determine their potential impacts on stormwater quality and to implement appropriate BMPs, but we recommend that a MG be added to conduct annual inspections or audits of all City facilities and services to ensure that the BMPs are being implemented, and report on the results of these audits in its annual SWMP implementation reports to the RWQCB.

Purchasing and Contracts: An explicit Year 1 Measurable Goal should be added to revise standard City contract templates to include specific and binding language requiring contractors to comply with the City's SWMP and implement all necessary BMPs to protect water quality. The SWMP must also explain how the City intends to evaluate contractor compliance. Finally, the Measurable Goal of reporting the number of violations should also include a commitment to track the compliance of particular contractors and to not rehire contractors who have violated the stormwater pollution prevention provisions of their contracts in the future.

Mutt Mitt Program: We recommend that the City document the number of Mutt Mitts used each year.

Thank you for the opportunity to provide comments on the City of Goleta's SWMP. Please do not hesitate to contact me should you have any questions or concerns regarding the above comments.

Sincerely,

Kira Redmond
Executive Director

Home Builders Association
OF THE CENTRAL COAST
creating quality housing and communities

August 22, 2008

Dominic Roques
Regional Water Quality Control Board
895 Aerovista Place, Suite 101
San Luis Obispo, CA 93401

RE: Phase II MS4 Storm Water Management Plan – City of Goleta
Dear Dominic Roques:

The Home Builders Association appreciates the opportunity to comment on the City of Goleta Storm Water Management Plan published on your web site, with public comment due by August 22, 2008. Please accept the following comments on behalf of the Home Builders Association.

1. **Time to complete Interim Hydromodification Management Plan ("HMP")**. We believe that it would be prudent that the City of Goleta be allowed two (2) years to complete the plan, rather than the one (1) year proposed by the Regional Water Quality Control Board (the "Water Board"). Several Central Coast cities have expressed concern to us regarding the HMP one (1) year deadline. In addition, our members experience in Southern California has indicated that a one-year time limit is not realistically achievable.

   It is important that the HMP be well researched, carefully studied, practical, and reflect site characteristics such that future liability issues are minimized to the greatest extent possible. We do not want a HMP created in a "hurried" manner to meet an artificially restrictive deadline. Most Central Coast jurisdictions have small staffs, thereby lacking the human and financial resources to realistically comply with the one (1) year deadline. In such cases, complying with the one year deadline could result in a one-size-fits-all approach which is not the desired result.

2. **SWMP Post-Construction Application Cut-Off Point**. The most appropriate approach to implementing hydro modification/LID methods is at the beginning of the project design phase. The later in the process that the post-construction storm water methods are attempted to be applied to a project, the greater the cost and timing burdens that are placed on the jurisdiction and the project and the least likely that an efficient, less expensive, and effective solution will be achieved.

   A Tentative Subdivision Map cut-off point for the application of the new standards, as proposed by the Water Board is much too late in the design process. A better approach for cut-off is to use the "deemed complete" point in the project entitlement process. Projects that have not been "deemed complete" would be best able to implement the more desirable LID solutions without unnecessary hardship on the applicant or jurisdiction. A project application that has been accepted by a jurisdiction ("deemed complete") as ready for processing and a public hearing should not have to be re-designed to meet the new standards. By that time, both the applicant and jurisdiction have expended significant time and funds on the project. During the transition process, projects should be encouraged to voluntarily use LID methods during their pre-application stage.

   We propose that projects whose application has been "deemed complete" by the City of Goleta be exempt from the new post construction standards, but would be encouraged to comply with the regulations on a voluntary basis. Obviously, all projects in later stages of the entitlement, design, or construction process would be exempt from the application of the regulations as well.

   The term "deemed complete" comes from the Permit Streamlining Act. It requires public agencies (including charter cities like Santa Barbara and San Luis Obispo) to follow standardized time limits and

811 El Capitan Way, Suite 120
San Luis Obispo, California
93401-3333

805.546.0418: phone
805.546.0339: fax
www.hbacc.org: internet

procedures for specified types of land use decisions. The act applies to development projects that need adjudicatory approvals such as tentative maps, conditional use permits, and variances. It does not apply to legislative acts, like general plan amendments and rezonings (or development agreements or specific plans), or to ministerial acts, like lot line adjustments, building permits, or certificates of compliance.

Public agencies must establish one or more lists specifying the information an applicant must submit for a development project to be deemed complete. For instance, San Luis Obispo requires an application to include a vicinity map, statement on zoning, site development, description of any common areas and open space, CC&Rs, setbacks, drainage, faulting, slope analysis, technical reports like biological, cultural, noise, traffic, soils, engineering geology, and noise, archaeological recourse inventory, endangered species survey, preliminary title report, school site, environmental assessment, and an affordable housing plan. Some of these studies and reports will not be needed for each application, but it is obvious that getting a project to be "deemed complete" takes extensive work. In addition, once the agency receives the application (with fees), the agency has 30 days to either deem the application complete or notify the applicant what needs to be done to be deemed complete. If the city does not respond within 30 days, the application is deemed complete.

Once the application is deemed complete, then the environmental review process begins. Once that environmental document is approved, the city or county has 60 days if the environmental document is a negative declaration or 180 days if the project required an EIR to approve or deny the project. Cities and counties generally approve the environmental document at the same hearing as they approve/deny the project

3. Project Phase-In Period Clarification. Although it is not necessarily spelled out in the current plan, it should be clarified that the application of the new post-construction regulations to projects in the entitlement process would begin at the adoption of the City's Interim HMP (proposed at two (2) years in item 1 above) and would be applied to all projects that have not been "deemed complete" (item 2 above) at that time.

4. Incorporating assessments from project geotechnical and soils consultants. All sites throughout the Central Coast do not have the same soils/site conditions. Specific site conditions may preclude applying the new standards due to low infiltration capability of soils or the potential for damage to other infrastructure. Applying the standards in those conditions can result in a public safety hazard.

   We recommend that the city's storm water plan include a communitywide analysis by a geotechnical engineer to determine which areas within the boundary are suitable for infiltration and at what rate.

   We also suggest that the city's storm water plan emphasize that it will rely on the applicant's geotechnical/soils consultant's analysis as part of the decision-making in determining when and where infiltration/low impact development BMP's are practical, how much is achievable, and what other best management practices should be used when infiltration is not usable.

5. Normal maintenance of existing infrastructure by public agencies, project developers, and home owners associations be exempted from the new standards. When maintaining existing infrastructure, existing site conditions may preclude applying the new standards. For example, when resurfacing an existing roadway that has no "extra" land available, it will not be possible to provide additional land for filtration purposes.

   We propose that normal maintenance of existing infrastructure by public agencies, project developers, and home owners associations be exempt from the new standards.

6. The "pre-development" definition is critical. How pre-development is defined is critical as the baseline for determining the increase in storm water volumes and rates for new development on a site. Defining pre-development as the original natural condition, regardless of current usage, would make many urban infill, smart growth projects infeasible. The Water Board's approach seems counter productive to the current sustainability and new urbanism planning concepts.

   We believe pre-development should be defined as the immediate pre-project condition.

811 El Capitan Way, Suite 120
San Luis Obispo, California
93401-3333

805.546.0418: phone
805.546.0339: fax
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7. **Economic balance:** As previously mentioned, most Central Coast municipalities have small staffs and very limited financial resources. We urge the Central Coast Regional Water Quality Control Board to allow local governments to use housing affordability, their General Plan goals promoting new urbanism (smart growth), market-place economics, local municipal economics, and local public acceptance as factors in determining what are the best methods to implement the MS4 Storm Water Management Plans.

8. **Storm water management plans and HMP's should include stakeholder involvement:** Each storm water management plan should state that the city or county will involve stakeholders, including the HBA in the development of the community's HMP and criteria.

9. **Countywide Technical Advisory Committee:** The RWQCB should encourage and assist the various jurisdictions of each county in the formation of a Technical Advisory Committee to provide advice on the preparation of the HMP's. In some counties, there may already be a format for such collaboration, but in others there may be none. In those cases where there is not a collaboration vehicle, we urge that the RWQCB take the proactive approach of helping organize such a group. The County of San Diego is successfully using such an approach.

   The technical committee can help provide guidance and share information in various technical specialties. The result should be HMP's that are feasible, practical, and usable, and achieve the intended objectives of the MS4 permit.

Sincerely yours,

Jerry Bunin
Government Affairs Director
Home Builders Association

cc:
Steve Chase, Goleta Director of Planning and Environmental Services
Steve Wagner, Goleta Director of Community Services
Kimberly Nilsson, Goleta Storm Water Project Manager

811 El Capitan Way, Suite 120
San Luis Obispo, California
93401-3333

805.546.0418: phone
805.546.0339: fax
www.hbacc.org: internet

CITY OF GOLETA

October 31, 2008

Brandon Sanderson
Environmental Scientist
Regional Water Quality Control Board
895 Aerovista Place, Suite 101
San Luis Obispo, CA 93401

RE: Response to Draft Required Revisions Table and Public Comment Letters on City of Goleta's June 2008 Draft SWMP

Dear Mr. Sanderson,

On behalf of the City of Goleta, I am pleased to submit our response to your letter dated August 5, 2008 titled "Water Board Staff Comments on City of Goleta June 2008 Draft Storm Water Management Plan". Thank you for allowing us additional time to address the voluminous comments that were included in the draft table of required revisions as well as the various public comment letters. Attached to this submittal letter are our responses to the draft required revisions table as well as our responses to the comment letter from Santa Barbara Channelkeeper dated August 12, 2008 and the comment letter from the Home Builders Association dated August 22, 2008.

Based up our review of the draft required revision table and comment letters submitted, we believe that a vast majority of the issues and concerns raised can be addresses through revisions to the SWMP text and/or BMPs/MGs as appropriate. We expect that incorporation of these revisions will result in an improved SWMP for the City of Goleta.

Out of the thirty-five (35) items listed in the draft required revisions table, the City concurs with thirty four (34). Revisions to the draft SWMP are being incorporated as necessary to address these items.

However, with respect to revision item # 27 the City does not concur. This requires the adoption of interim hydromodification criteria. It is our understanding that item #27 will be modified based on the Board's recent approval of the City of Lompoc's SWMP at the October 17, 2008 hearing.

The City supports the development and implementation of appropriate hydromodification criteria but only as tailored to address local conditions. The City remain willing to invest significant time and resources to develop and implement a hydromodification plan in a collaborative manner with other participating agencies and interested parties. The hydromodification plan will provide the necessary framework of engineering analysis to determine appropriate hydromodification criteria based on local conditions.

Attachment 4 of the Small MS4 Permit sets forth specific design standards that include hydromodification criteria. The Small MS4 Permit requires certain MS4s to adopt an ordinance (or other document) to ensure the implementation of the specified design standards or a functionally equivalent program that is acceptable to the RWQCB.

The interim hydromodification criteria referenced in the February 15, 2008 letter far exceed the requirements specified in Attachment 4 of the Small MS4 Permit. Requiring the City to adopt interim hydromodification criteria that are "as effective as" the interim criteria referenced in the February 15, 2008 letter exceeds the authority granted to the Board by the Small MS4 Permit.

Although the Small MS4 Permit does not require the City to adopt interim hydromodification criteria, we are willing to adopt design standards included in Attachment 4 of the Small MS4 Permit or other functionally equivalent program acceptable to the RWQCB in year one and implement the design standards until appropriate, area specific hydromodification criteria are determined as part of the hydromodification plan.

The City desires to work with you and other RWQCB staff as necessary to reach a consensus on this remaining issue so we can obtain permit coverage. As such we request your consideration of our proposal described above and included in the attached table.

If, after consideration of our responses, we are unable to reach a consensus on this issue we respectfully request that the City of Goleta not be enrolled prior to being afforded our right to present this issue to the Board at a future public hearing.

If you have any questions regarding this letter, our responses to the draft table of required revisions or our responses to the comment letters please contact Kimberly Nilsson of my staff at 805-961-7565.

Sincerely,

Steve Wagner

Steve Wagner
Community Services Director

cc: Dan Singer, City Manager
Tim Giles, City Attorney
Mayor and City Council

ATTACHMENT 3
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

Response to Comments
City of Goleta Storm Water Management Plan June 2008

Introduction
This document includes Water Board staff responses to the comments received during the Water Board's 60-day public comment period (June 23 – August 22, 2008) for the City of Goleta's Storm Water Management Plan (SWMP) and Water Board staff's Draft Table of Required Changes. We received comments from the following organizations:

August 12, 2008: Santa Barbara ChannelKeeper
August 22, 2008: Home Builders Association of the Central Coast
October 31, 2008: City of Goleta *(late submittal allowed due to limited time provided for response to Water Boards draft Required Revisions)*

Comments from Santa Barbara Channelkeeper, August 12, 2008

Comment: Please accept the following comments on the City of Goleta's June 2008 Draft Storm Water Management Plan (SWMP), which are hereby submitted by Santa Barbara Channelkeeper. Channelkeeper finds that the City of Goleta has made good progress in revising its SWMP, and we commend the City's efforts to solicit and incorporate public comments into the final draft submitted to the Central Coast Regional Water Quality Control Board (RWQCB), and to produce detailed responses to public comments it received on its May 2008 draft. We find that the SWMP is greatly improved over previous drafts. We do, however, have a few recommendations that we urge the RWQCB to require prior to approving Goleta's SWMP.

Comment: Public Education and Outreach
Business Based Education Program: To aid in implementing this program, we recommend that the City utilize inspection checklists and reporting forms for different types of businesses (i.e. food service establishments, automotive shops and gas stations, nurseries), such as those appended to the Monterey Regional SWMP. We also recommend establishing a training program for City inspectors so they are well-versed in what industry-specific problems and BMPs to look for when conducting their inspections.
Response: Water Board staff agrees that utilizing inspection checklists and reporting forms for different types of businesses will aid in implementing this program. Water Board staff encourages the City to improve this BMP/MG by utilizing such checklists and reporting forms, but is not recommending any changes as a condition of SWMP approval. Water Board staff will evaluate progress and effectiveness during review of each Annual Report.

Regarding the development of a staff training program, Water Board staff agrees and has included Required Revision No. 19, which requires the City to include a BMP to train City staff under the IDDE MCM requiring.

Comment: Green Business Program: We recommend that this BMP be revised to commit the City to conducting annual inspections of certified businesses to ensure that they continue to meet the environmental criteria before their green certification is renewed.
Response: Staff agrees certified businesses should be inspected, but not annually. Staff added Required Revision No. 5, which requires the City to conduct periodic inspections and determine the appropriate frequency of inspections .

Comment: Educational Programs for School Children: Channelkeeper recommends that the City document the specific demographics of the children they reach with their educational programs, and that they aim to reach 25% of school children in each year of the permit term, rather than just in Years 2 and 4 as laid out in the Measurable Goal.
Response: Water Board staff agrees that documenting student demographics can improve the effectiveness of the City's outreach and encourages the City to do so. However, staff is not recommending any changes as a condition of SWMP approval. Staff will evaluate progress and effectiveness during review of each Annual Report.

Staff agrees that the MG and implementation year are inconsistent and must be clarified to state, "educate 25% of school children (K-6) annually (years 1-5 or 2-5)." Required Revision No. 6 addresses this.

Comment: Stormwater Hotline: We urge the City to document not only the number of calls received but also their nature, location and time of day in order to track patterns of problems as well as repeat offenders. The Measurable Goal of responding to community calls within 24 hours should also include weekends as well as a commitment to take appropriate enforcement action where needed.
Response: Water Board staff agrees. Required Revisions 7 and 15 address this.

Comment: Illicit Discharge Detection and Elimination
Non-Storm Water Discharges: Channelkeeper appreciates the City's commitment to develop practices for reviewing, testing and evaluating non-stormwater discharges to determine whether they are significant sources of pollutants and to develop BMPs to remediate those that are, and we recommend that this be included as a Measurable Goal in the SWMP.
Response: Staff agrees. Required Revision No. 10 requires the City to add BMPs and MGs regarding evaluation of non-stormwater discharges. The City of Santa Barbara SWMP is a good example.

Comment: Education and Outreach: We recommend that the City detail how it proposes to distribute its educational materials to ensure that they reach the appropriate audiences.
Response: The City includes its distribution procedures in the PEO section of the SWMP (pg. 19). Educational materials will be distributed based on the nature of the target audience, whether through general outreach, or explicit enforcement. Water Board staff finds this to be an acceptable approach for this particular BMP.

Comment: Identification and Elimination of Illicit Discharge Sources: With regard to spill complaint and response, the City should develop a tracking system that records the time, location and nature of illicit discharges detected in addition to their number and final outcome. In addition, Channelkeeper urges the City to be more systematic in its development of a Field Investigation and Abatement program, for instance by focusing on high-priority areas with known pollution problems and likely sources of illicit discharges and establishing a scheduled frequency for conducting field investigations. Finally, a Measurable Goal should be added to conduct follow-up inspections and take enforcement action when necessary to ensure the elimination of 100% of illicit discharges identified.

Response: Staff agrees. Staff added Required Revisions No. 7, 15, 16, and 17 requiring the City to provide revisions. Nonetheless, the City has addressed the comment regarding prioritization of field investigation and abatement efforts in the SWMP Section 6.2.4 (pg. 31) and BMP IDDE 4 (pg. 36).

Comment: Construction Site Runoff Control
Goleta's SWMP fails to note that the City is obligated to reduce stormwater discharges from construction activity disturbing less than one acre if part of a larger common plan of development or sale that would disturb one acre or more. The SWMP also fails to clearly articulate how the City will meet the requirements for construction site operators to control construction-related waste, nor what procedures will be implemented for site plan review and for receipt and consideration of information submitted by the public. These requirements need to be addressed in the City's final SWMP.
Response: Staff agrees. Required Revision No. 21 requires the City to include all sites that are part of a larger common plan of development in its runoff controls.

Comment: Another important BMP is also missing from this MCM: educating construction site operators and workers about stormwater pollution prevention through the distribution of brochures, BMP fact sheets and City-sponsored trainings. These efforts should include detailed information about the proper installation and maintenance of appropriate erosion and sediment control BMPs, as well as references to recognized BMP manuals widely applied by the construction community.
Response: Staff agrees. Required Revision No. 22 requires the City to include a BMP that discusses how the City will educate and train construction personnel.

Comment: Grading Ordinance: Channelkeeper supports the City's commitment to review and update the existing Grading Ordinance as appropriate and urges that this be included as a Measurable Goal.
Response: Staff agrees. Required Revision No. 23 requiring the City to include a MG committing the City to review and update the existing ordinance in year 1.

Comment: Construction Site Enforcement, Inspections: This BMP lacks sufficient detail about the "standard City procedures" used to address non-compliance. Additionally, Channelkeeper urges the City to develop and utilize a more sophisticated system for tracking construction sites and inspections and enforcement, including basic site information (i.e. owner, address, contractor, etc.), status (active/complete), project start and anticipated completion dates, size in acres, proximity to natural and man-made hydrologic features, required inspection frequency, details of inspection findings, complaints or reports submitted by the public, any history of non-compliance, enforcement actions taken, and follow-up inspections to ensure correction.
Response: Staff agrees. Required Revision No. 24 requires the City to track site information to inform effectiveness of review, inspection and follow-up procedures.

Comment: Staff Training: In addition to training in currently applicable regulations and compliance standards, relevant staff must be trained in the proper installation, operation and maintenance of construction site BMPs, appropriate inspection techniques and enforcement strategies. This should be included in the BMP.
Response: Staff agrees. Required Revision No. 26 requires the City to revise the BMP to include the scope of the training.

Comment: Post Construction Runoff Control
Watershed/Wetland Protection Policies: It is vitally important that development projects specify BMPs and control measures to protect water quality in the early stages of design. As such,

Channelkeeper recommends that pre-application meetings be made mandatory rather than voluntary for moderately complex and complex projects, and that the City *does* implement interpretive and implementation guidelines to assist planners in the interpretation of its water quality policies as soon as possible. The latter should be included as a Measurable Goal, as should the efforts outlined under "Standard Conditions of Approval/Mitigation Measures" (developing and adopting a new list of standard conditions of approval) and under "CEQA Review" (updating the initial study checklist form; developing new CEQA guidelines for surface and stormwater quality; and developing new mitigation measures and standard conditions that include water quality BMPs). The SWMP should also make it clear that final BMPs must be selected, sized and sited in order for CEQA review to be completed, rather than later during the land use clearance and permit compliance process.

Response: Staff agrees. Early consideration of stormwater controls is essential for project success. Required Revisions 27 and 28 address this.

Comment: Hydromodification Management Plan: While Channelkeeper appreciates the City's proactive effort to lay out a strategy to develop a watershed-based hydromodification management plan and to present draft hydromodification control standards, we find that the strategy and standards do not conform to the requirements laid out in the RWQCB's February 15, 2008 Notification letter. We concur that this section needs to be modified in line with the required changes laid out in the RWQCB's August 5, 2008 Table of Required Revisions.

Response: Staff agrees. Required Revisions 33, 34, and 35 address this.

Comment: Staff Training: The training of permitting and review staff to properly condition projects to protect water quality is a vitally important BMP. Channelkeeper therefore recommends that methods be implemented (such as post-training tests) to evaluate the effectiveness of the trainings.

Response: Staff agrees. Required Revision No. 36 addresses this.

Comment: Monitor Discretionary Projects: The General Permit requires the City to ensure long-term operation and maintenance of BMPs. The current version of the SWMP omits an important BMP that was included in the previous draft – to monitor discretionary projects for compliance with water quality measures and to take appropriate enforcement action where necessary. We strongly urge that this BMP be included in the final SWMP, along with appropriate Measurable Goals stating the frequency and protocols for inspection to ensure that all long-term BMPs remain functional.

Response: Staff agrees. Required Revisions 29 through 32 address this.

Comment: Pollution Prevention/Good Housekeeping for Municipal Operations
Evaluation of City Facilities and Appropriate BMPs: Channelkeeper supports the City's goal to assess all City facilities and services to determine their potential impacts on stormwater quality and to implement appropriate BMPs, but we recommend that a MG be added to conduct annual inspections or audits of all City facilities and services to ensure that the BMPs are being implemented, and report on the results of these audits in its annual SWMP implementation reports to the RWQCB.

Response: Staff agrees. Required Revisions 41 and 42 require the City to inspect all of its facilities and indicate inspection frequency.

Comment: Purchasing and Contracts: An explicit Year 1 Measurable Goal should be added to revise standard City contract templates to include specific and binding language requiring contractors to comply with the City's SWMP and implement all necessary BMPs to protect water quality. The SWMP must also explain how the City intends to evaluate contractor compliance. Finally, the Measurable Goal of reporting the number of violations should also include a

commitment to track the compliance of particular contractors and to not rehire contractors who have violated the stormwater pollution prevention provisions of their contracts in the future.
Response: Staff agrees. Staff added Required Revisions 43 and 44, which require the City to revise standard contract language and to revise BMPs to include enforcement procedures, including tracking compliance.

Comment: Mutt Mitt Program: We recommend that the City document the number of Mutt Mitts used each year.
Response: Staff agrees. Mutt Mitt counts is a simple measure of effectiveness. Required Revision No. 45 requires the City to track the number of Mutt-Mitts consumed annually.

Comments from Homebuilders Association of the Central Coast, August 22, 2008

Comment: The Home Builders Association appreciates the opportunity to comment on the City of Goleta Storm Water Management Plan published on your web site, with public comment due by August 22, 2008. Please accept the following comments on behalf of the Home Builders Association.

Comment: Time to complete Interim Hydromodification Plan: We believe that it is prudent, and propose that the City of Goleta be allowed two (2) years to complete the plan, rather than the one (1) year proposed by the Regional Water Quality Control Board (the "Water Board"). Several Central Coast cities have expressed concern to us regarding the hydromodification plan one (1) year deadline. In addition, our members experience in Southern California has indicated that a one-year time limit is not realistically achievable... Most Central Coast jurisdictions have small staffs, thereby lacking the human and financial resources to realistically comply with the one (1) year deadline. In such cases, complying with the one year deadline could result in a one-size-fits-all approach which is not the desired result.
Response: The Water Board is not requiring an "Interim Hydromodification Plan," but rather interim hydromodification control criteria. Required Revision No. 35 requires the City to develop a Hydromodification Management Plan, but allows the City to identify its schedule for completing the Plan within the five-year permit cycle. The Executive Officer's July 10, 2008 letter to the City was responsive to Central Coast communities' concerns about the schedule put forth in his February 15, 2008 letter and provided an additional six months to make it a full year for the City to develop interim criteria. This is in addition to the time between February 15, 2008 and the present, during which the City has known of Water Board expectations (approximately seven months) that it develop interim hydromodification criteria. The City has included criteria in its SWMP that are unsupported by technical findings. As such, the City's task in Year 1 of SWMP implementation would be to provide supportable criteria. The Executive Officer's July 10, 2008 letter also provided an example approach to developing quantifiable measures for storm water management programs. Furthermore, the City of Goleta could avail itself of the examples from other Central Coast communities that have already provided interim criteria, or year-long plans to develop them (e.g., City of Santa Barbara, Santa Maria, and Santa Cruz County). The proposed schedule for developing interim hydromodification criteria is reasonable and appropriate.

Comment: SWMP Post-Construction Application Cut-Off Point. The most appropriate approach to implementing hydro modification/LID methods is at the beginning of the project design phase... A Tentative Subdivision Map cut-off point for the application of the new standards, as proposed by the Water Board is much too late in the design process. A better approach for cut-

off is to use the "deemed complete" point in the project entitlement process...We propose that projects whose application has been "deemed complete" by the City of Goleta be exempt from the new post construction standards, but would be encouraged to comply with the regulations on a voluntary basis.

Response: Water Board staff understands that it is important to implement hydromodification at the beginning of the project design phase and that it may not be reasonable to require standards on projects that have already been "deemed complete", as proposed by the commenter. For these projects, and others for which applications are submitted during the first year of SWMP implementation, the City can voluntarily notify applicants that they should consider Low Impact Development (LID) and address hydromodification in designing their projects. (Central Coast Low Impact Development Center assistance may also be available to consult applicants on ways to integrate LID into project design.) The City will also continue to impose its existing policy for watershed management, which Water Board staff recognizes offers some degree of protection from hydromodification. Therefore, staff agrees that the "deemed complete" milestone is an appropriate cut-off point in the entitlement process, after which projects would not be subject to new hydromodification requirements. See Required Revision No. 33.

Comment: Project Phase-In Period Clarification. Although it is not necessarily spelled out in the current plan, it should be clarified that the application of the new post-construction regulations to projects in the entitlement process would begin at the adoption of the City's Interim HMP (proposed at two (2) years in item 1 above) and would be applied to all projects that have not been "deemed complete" (item 2 above) at that time.

Response: New post-construction requirements will be applied as conditions of approval, or through some other enforceable means, to all applicable projects not deemed complete by the first anniversary of the City's enrollment under the General Permit. See Required Revision No. 33.

Comment: Incorporating assessments from project geotechnical and soils consultants: All sites throughout the Central Coast do not have the same soils/site conditions. Specific site conditions may preclude applying the new standards due to low infiltration capability of soils or the potential for damage to other infrastructure. Applying the standards in those conditions can result in a public safety hazard. We propose that the applicant's geotechnical/soils consultant's analysis be part of the decision-making in determining when and where infiltration/low impact development BMP's are practical and how much is achievable.

Response: Water Board staff expects geotechnical/soils information to continue to inform site design for projects in Goleta. However, we do not expect such information to preclude those sites from using LID BMPs or to exempt them from having to mimic the natural hydrograph in post-development runoff events. The Water Board will review the City of Goleta's hydromodification controls, stormwater treatment BMPs, and applicability criteria (where and when specific numeric criteria are to be met by post-construction BMPs for new and redevelopment) to determine if the City is achieving water quality protection from these pollution sources to the maximum extent practicable. Should the City propose to exempt certain developments from infiltration or LID BMPs, the City would need to demonstrate that alternative or conventional BMPs result in the desired conditions of healthy watersheds, including the conditions of rainfall runoff, groundwater recharge, sediment transport and supply, and riparian and aquatic habitat. To achieve the appropriate balance of environmental and societal goals, the City should consider and select BMPs and applicability criteria from a watershed perspective.

Comment: Normal maintenance of existing infrastructure by public agencies, project developers, and home owners associations [should] be exempted from the new standards: When maintaining existing infrastructure, existing site conditions may preclude applying the new standards. For example, when resurfacing an existing roadway that has no "extra" land available, it will not be possible to provide additional land for filtration purposes. We propose that normal maintenance of existing infrastructure by public agencies, project developers, and home owners associations be exempt from the new standards.

Response: At this time, the City is committed to developing new requirements for hydromodification control for new and redevelopment. Maintenance activities for existing public infrastructure are subject to multiple BMPs to reduce their potential contribution to stormwater pollution (see the Pollution Prevention/Good Housekeeping for Municipal Operations management measure in the SWMP). Through other management measures in the SWMP, private developments and home owners associations would be subject to education as well as potential enforcement on source control, pollution prevention, and illicit discharges, but would not be subject to hydromodification controls for maintenance activities.

Comment: The "pre-development" definition is critical. How pre-development is defined is critical as the baseline for determining the increase in storm water volumes and rates for new development on a site. Defining pre-development as the original natural condition, regardless of current usage, would make many urban infill, smart growth projects infeasible. The Water Board's approach seems counter productive to the current sustainability and new urbanism planning concepts. We believe pre-development should be defined as the immediate pre-project condition.

Response: Changing the definition of pre-development condition to accommodate a lower standard for post-construction runoff control is a fundamentally flawed basis for regulation. We agree that hydrologic performance should not outweigh other important environmental goals such as infill, redevelopment priorities, and regional growth patterns that can also affect watershed health. Effective implementation, that balances these goals, requires well-crafted applicability criteria, which define what types of projects and under what circumstances controls and quantifiable measures apply.

Water Board staff will consider applicability criteria, including baseline conditions defining "pre-development," when the City prepares its interim and long-term hydromodification criteria. The options for developing interim hydromodification control criteria, presented in the Final Table of Required Revisions, Item 34, provide flexibility for defining the pre-development conditions. Specifically, the Water Board Executive Officer has approved the City of Santa Maria's methodology for developing interim hydromodification criteria, including the City's selection of pre-construction conditions as a baseline for hydrologic conditions in redevelopment projects.

Comment: Economic balance: We urge the Central Coast Regional Water Quality Control Board to allow local governments to use housing affordability, their General Plan goals promoting new urbanism (smart growth), market-place economics, local municipal economics, and local public acceptance as factors in determining what are the best methods to implement the MS4 Storm Water Management Plans.

Response: Water Board staff acknowledge that in determining the best methods to implement the MS4 Storm Water Management Plans, we must take into account a range of issues potentially constraining local governments' choices about land use development. We recognize that cities are influenced by State requirements for affordable housing as well as state mandates and policies affecting, among other things, transportation infrastructure, greenhouse gas emissions, water supply, and public

safety. We understand these requirements contribute to development patterns. For this reason, we have asked the local agencies subject to the Phase II General Permit to engage in long-term watershed planning to provide a context for weighing the multiple objectives affecting development patterns. At the same time, Water Board staff has refrained from dictating specific applicability requirements, and instead, has provided the opportunity for MS4s to develop applicability criteria that strike an appropriate balance of social, economic, and environmental goals.

Water Board staff acknowledges that no stormwater management strategy, or suite of approaches, has been identified that can achieve full hydrologic mitigation for the impacts of urbanization. While recognizing the challenges of applying LID in certain circumstances, for example in poorly drained soils, staff nonetheless considers LID to represent a more comprehensive effort at mitigating the hydrologic impacts of urbanization.

Water Board staff subscribes to the following "Hydrologic Philosophy of Smart Growth," as presented by Richard McCuen.[1] As this philosophy and its associated seven principles directly parallel the guiding principle of LID, to mimic the natural hydrograph, Water Board staff finds that LID and hydromodification control are fundamentally consistent with smart growth strategies.

> **Hydrologic Philosophy of Smart Growth:**
> ***If society is to control urban sprawl, then guiding principles of smart growth are needed. These principles will form the basis for a philosophy of smart growth. Seven principles related to hydrologic aspects of smart growth include:***
> ***Principle 1: Control Runoff at Microwatershed Level***
> ***Principle 2: Consider Hydrologic Processes in Microwatershed Layout***
> ***Principle 3: Maintain First-Order Receiving Streams***
> ***Principle 4: Maintain Vegetated Buffer Zones***
> ***Principle 5: Control Spatial Pattern of Hydrologic Storage***
> ***Principle 6: Control Upland Flow Velocities***
> ***Principle 7: Control Temporal Characteristics of Runoff***

Comment: Storm water management plans and HMP's should include stakeholder involvement: Each storm water management plan should state that the city or county will involve stakeholders, including the HBA in the development of the community's HMP and criteria.
Response: The City currently includes stakeholder involvement for all aspects of the Storm Water Management Plan through its Public involvement/Participation program within the SWMP. This includes local, county, and regional committee planning meetings and public forums.

Comment: Countywide Technical Advisory Committee: The RWQCB should encourage and assist the various jurisdictions of each county in the formation of a Technical Advisory Committee to provide advice on the preparation of the HMP's. In some counties, there may already be a format for such collaboration, but in others there may be none. In those cases where there is not a collaboration vehicle, we urge that the RWQCB take the proactive approach of helping organize such a group. The County of San Diego is successfully using such

[1] For further explanation refer to: Richard H. McCuen, Smart Growth: Hydrologic Perspective, *Journal of Professional Issues in Engineering, Education and Practice*, Vol. 129, No. 3, July 1, 2003. ©ASCE, ISSN 1052-3928/2003/3-151–154.

an approach. The technical committee can help provide guidance and share information in various technical specialties. The result should be HMP's that are feasible, practical, and usable, and achieve the intended objectives of the MS4 permit.

Response: **Water Board staff agrees that collaboration around the development of hydromodification controls is essential and has in fact encouraged it, from our initial discussion of such controls in the Executive Officer's February 15, 2008 letter, to the present. Additionally, the Water Board has committed substantial resources to establishing the Central Coast Low Impact Development Center, to provide local agencies with the technical assistance needed to develop hydromodification controls. Several local agencies in the Central Coast Region have already assembled into groups, which would be the most appropriate organization to convene such technical advisory committees. Examples include the Santa Barbara County Intergovernmental Committee and the San Luis Obispo County Partners for Water Quality. Water Board staff is willing to participate in these technical advisory groups, but limited funding precludes Water Board staff from convening or leading such committees.**

Comments from City of Goleta, October 31, 2008

The City of Goleta concurs with thirty-four out of the thirty-five items listed in the draft required revisions table and has committed to revising the SWMP accordingly. Water Board staff has responded only to comments provided for item # 27 within the table in which the City does not concur.

Comment: The Small MS4 Permit does not require the City to implement interim hydromodification requirements, and it does not require the City to adopt interim hydromodification requirements that are "as effective as" the Regional Board's interim hydromodification requirements as stated in the February 15, 2008 letter.

The interim criteria referenced in the February 15, 2008 letter exceed the requirements of the Small MS4 Permit. The City proposes to adopt the Attachment 4 design standards or functional equivalent program as required in the Small MS4 Permit in year 1.

A BMP will be added to state that the City will develop appropriate interim numeric and narrative hydromodification criteria in accordance with the requirements of the Small MS4 Permit by the end of year 1. The hydromodification criteria will be based on an engineering analysis specific to the hydrologic and geologic conditions of the City of Goleta. At that same time the definition of "pre construction" will be determined. The schedule for development and submittal of appropriate hydromodification criteria pursuant to Attachment 4 of the Small MS4 Permit will include the 3 week review time as requested. [Paraphrased]

Response: **Water Board staff cannot accept the City's proposal to implement the design standards of General Permit Attachment 4 instead of preparing interim hydromodification control criteria. The design standards of General Permit Attachment 4 require stormwater runoff peak control and treatment only. The design standards do not control hydromodification, therefore cannot be considered interim hydromodification control criteria. In order to meet the Clean Water Act's Maximum Extent Practicable (MEP) standard, the City's interim criteria must:**

1) **Provide numeric thresholds that demonstrate optimization of infiltration in order to approximate natural infiltration levels (such as would be achieved by implementation of appropriate low impact development practices); and**
2) **Achieve post-project runoff discharge rates and durations that do not exceed estimated pre-development levels, where increased discharge rates and durations will**

results in increased potential for erosion or other significant adverse impacts to beneficial uses.

Required Revision No. 34 requires the City to revise its SWMP to include a schedule for developing interim hydromodification control criteria, including a period of no less than three (3) weeks to allow for Water Board staff's review of the proposed criteria. The revised SWMP shall state that any interim hydromodification control criteria (numeric and non-numeric) proposed by the City will be submitted by one year from SWMP approval by the Water Board. The interim hydromodification control criteria should maximize infiltration of clean storm water, minimize runoff volume and rate, serve as a useful quantifiable measure of healthy watersheds, and be consistent with the intended goals of the Water Board including, but not limited to, healthier and more sustainable watersheds by 2025. The revised SWMP shall provide language stating the City will chose one of the three options provided in Required Revision No. 34 for developing interim hydromodification criteria:

The Central Coast Water Board Executive Officer will notify the City and other interested persons of the acceptability of the City's proposed interim hydromodification control criteria for new and re-development. The Water Board shall provide interested persons the opportunity for comment and a hearing, if requested, before the Water Board if any party is aggrieved by the Water Board staff's determination, prior to Water Board action being final.

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