December 17, 2012

Jeanine Townsend, Clerk to the Board
State Water Resources Control Board
101 I Street, 24th Floor
Sacramento, CA 95814

Sent via email to commentletters@waterboards.ca.gov

Subject: Third Draft Phase II Small MS4 General Permit
Attachment J: Central Coast Post-Construction Requirements

Dear Members of the Board:

Wallace Group supports the Regional Board and State Board in their efforts to protect our watersheds, and we are advocates of improving water quality. Wallace Group appreciates the opportunity to submit these comments, and it is hoped that these comments assist the State Board in finalizing the Draft General Permit, and also in future development of Post-Construction requirements throughout California.

The Central Coast Post-Construction Requirements have been incorporated verbatim into the State Board's Draft Phase II Small MS4 General Permit as Attachment J. We respectfully request that the Central Coast Requirements are included by reference to the Regional Board Resolution only, or that Attachment J is removed from the General Permit. We are concerned that if the Requirements are adopted into the State Permit, then the Regional Board's stated intention to revise the Requirements to resolve technical issues will be hindered by the necessity to reopen the State Permit for revisions.

The following statements regarding the Post-Construction Requirements were made by Regional Board Staff and the Board, during the September 6, 2012 Regional Board meeting when the Requirements were adopted.

> "By definition, it is an iterative process… you put in place a requirement, and you have to go back and revise it. …there will be changes." Dominic Roques
>
> "We will also have the ability to be responsive to what we might call unanticipated barriers, and to think through and relook at how to modify and adjust so that we are dealing with conditions on the ground here." Dr. Monica Hunter

These statements are just examples of the discussion that continued regarding the need for future modifications to the Requirements. It is important for the State Board to recognize the framework within which the Requirements were adopted, and provide the Regional Board the authority and flexibility they intended to effectively implement and revise their Post-Construction Requirements.

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The following comments are in regards to Attachment J. As outlined below, we have identified technical issues with the Central Coast Requirements that could have unintended and negative consequences on watershed health.

Item B4 Page 6: Retention of the 85th and 95th Percentile Storm Event

The Requirements specify retention of the 95th percentile storm for specific watershed management zones, yet the Requirements do not identify the size of the 95th percentile storm. Regional Board staff have stated that they will provide rainfall statistics prior to the implementation date of September 6, 2013. However, we are concerned that because the 95th percentile statistic is not readily available, and has not yet been provided by the Regional Board, that the magnitude of this requirement has not been reviewed by the public, permittees, or more importantly, has not been reviewed by the Regional Board prior to adopting the Requirements.

We have reviewed rain gauge data for a number of locations on the Central Coast and found that the 95th percentile storm is between 1.5 to 2 times greater than the 85th percentile storm. For an undeveloped site, only extremely well draining soils or terrain with natural sump conditions will retain the 95th percentile event, and likely only in unsaturated conditions. The widespread application of this requirement on the Central Coast would result in increased infiltration beyond the natural response, which could be detrimental to the receiving streams and watershed health.

The basis for 95th percentile storm retention is Section 438 of the Energy Independence and Security Act (EISA). However, the Requirements do not reference the full text of Section 438 which lists the 95th percentile requirement as one of two options for compliance. The second option is a site specific analysis, in order to match existing hydrologic conditions. Per the EISA document:

> "the performance based approach in Option 1 (Retain 95th) is intended to be a surrogate for determining the pre-development reference condition and this standard is intended to be used in cases where it is more practical, cost effective, and/or expeditious than Option 2 (Site Specific Hydrologic Analysis), or where it is difficult or infeasible to identify the relevant reference conditions for the site." (EPA 841-B-09-001 Page 16).
>
> ""Option 2 could also be used if predevelopment runoff conditions can be maintained by retaining less than the 95th percentile rainfall event." (EPA 841-B-09-001 Page 12)

We recommend a requirement similar to EISA Section 438, to retain a specific storm event or match existing hydrology.

Low-impact development protects water quality through infiltrating, filtering, storing, evaporating, and detaining runoff close to its source. We understand the goal of retaining stormwater onsite is to limit the potential pollutants that could flow to surface water through stormwater runoff. For this reason, where infiltration is not feasible or desirable, many agencies allow high efficiency treatment in-lieu of infiltration. The Requirements include this allowance, but do not provide criteria or guidance for identifying when sites could pursue this alternative path to compliance. In addition, a

10-percent minimum area for retention still applies, so surface area for flow-through facilities may be necessary in addition to retention facilities.

References:

- The EPA Energy Independence and Security Act (EISA) provides two options for compliance with hydromodification requirements:
    - Option 1: Retain the 95th Percentile Storm Event, or
    - Option 2: Site Specific Hydrologic Analysis
- Potential negative effect of increased infiltration: "*In some locations upgradient of an ephemeral stream, increased infiltration may cause undesirable habitat type changes downstream of the site due to increased periods of base flows that result in vegetation changes. There has been a lack of consideration of the overall water balance effects that a "retention on site" requirement may have in terms of habitat*." (Strecker and Poresky)
- Infiltration exemption for tight soils: *If design infiltration rate is less than 0.25 inches per hour (measured rate of 0.50 inches per hour saturated), infiltration facilities are typically not approved as a means to meet flow control or water quality treatment requirements.* (City of Seattle Page 4-29)
- Infiltration exemption for tight soils: *Sites with soils that do not infiltrate (less than 2.0 inches/hour saturated infiltration rate), unstable, soils, contamination or high risk of contamination, and wellhead protection areas are exempt from the total infiltration requirement.* (City of Portland Page 1-28)

Recommendations:

- Identify the 85th percentile storm event
- Identify the 95th percentile storm event
- Prepare a cost-benefit analysis for retention of the 95th percentile storm compared to the 85th percentile storm
- Modify the Water management Zone map to reflect areas of varying infiltration capability, based on surface soils – or provide an exception process accordingly
- Modify the Requirements to retain a specific storm event or match existing hydrology
- Modify the Requirements to acknowledge land uses that have such water quality that direct infiltration should not be allowed.
- Identify criteria where the Regional Board would allow for water quality treatment in-lieu of retention, and exempt these projects from the 10-percent minimum surface area requirement.

Attachment D: Hydrologic Analysis and Stormwater Control Measure Sizing

A multiplier of 1.963 is specified in Attachment D Item 2.d, to calculate both Retention Volume and Water Quality Volume. This multiplier has been described by Water Board Staff as a means to increase facility size, to account for additional volume that may be required 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 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 Requirements. There is no scientific or engineering basis to apply the 1.963 multiplier in this fashion, nor has any back-up data been provided by Regional Board staff to justify this calculation approach. We have reviewed available rainfall data and continuous simulation modeling results and determined that a volume multiplier of 1.30 would be applicable and appropriate for our region, for facilities with a 48-hour drawdown time. Our research is based on data compiled by the Office of Water Programs at Sacramento State University. A summary of our research is attached at the end of this letter.

Attachment D Item 3.a. allows for facilities to function as a retention/detention facility if full retention cannot be achieved. A minimum detention time of 48-hours is specified. This drawdown time is reasonable for facilities where pollutants and sediment must settle and drop out before stormwater is discharged. However, this drawdown time is not appropriate for facilities that provide biofiltration, where vegetation or soil is accomplishing the removal of sediment and pollutants prior to stormwater flowing offsite.

Also, it is important to note that Attachment D and Attachment E were added to the Requirements following the release of the Draft for public review, and therefore have not gone through the public review and comment process at the Regional level.

Recommendations:

- Remove the volume multiplier from the Retention Volume and Water Quality Volume calculation, until such time that a multiplier can be demonstrated to be reasonable and justified.
- Remove the volume multiplier for those facilities that infiltrate or drain within 24-hours.
- Exclude facilities that provide biofiltration from the 48-hour drawdown requirement.

Item C Page 13: Alternative (Off-site) Compliance

Item C1.c is a list of “Technical Infeasibility” examples, describing various reasons why LID principles may not be feasible or appropriate for a site. In the case that meeting requirements onsite is infeasible, offsite compliance would be required. The natural site constraints identified as infeasibility criteria limit what can be achieved through LID site planning and design efforts. Some of the examples, such as high groundwater and low depth to an impervious soil layer, would also prevent or limit natural infiltration and associated stormwater retention on an undeveloped site.

In these cases, adding retention requirements, even offsite, could result in unnatural hydrology. With the goal of the requirements being to match existing conditions, rather than requiring off-site compliance, if a site cannot meet retention criteria due to technical infeasibility, then a “maximum extent practicable” clause should apply. For example, under the current Requirements, a site with a shallow depth to bedrock would be required to either dedicate 10-percent of the site area to retention or provide the equivalent land area off-site. Forcing infiltration on such a site would not achieve the goal of natural runoff response, and could lead to instability of the surface soils and possible landslides. Therefore, the geotechnical constraints may preclude the ability to dedicate 10-percent of the site to retention and force this site into off-site compliance.

Feasibility is defined in the Requirements by limiting the land area dedicated to retention facilities to 10-percent of the site's "Equivalent Impervious Surface Area". However, the Requirements do not provide any scientific basis for the 10-percent value, or relate this value to the ability for a site to infiltrate. In addition, the 10-percent value is over double the 4-percent criteria used by numerous agencies in California, including the Contra Costa post-construction agencies and the City and County of San Diego.

Feasibility could also be concretely defined in the Requirements by limiting the total cost of compliance, for example by placing a cap on the cost of stormwater control measures to a percentage of overall project cost.

Wallace Group is in full agreement with the Regional Board and State Board that protecting water quality is an important goal. We also place equal importance on the cost-benefit of implementing measures to protect water quality. We recommend a cost-benefit analysis is conducted by the Regional Board, to evaluate the economic feasibility and overall value of implementing the Requirements.

Examples:

- Limit requirement to the amount technically feasible: *"In cases where the facility has a defensible showing of technical infeasibility and can provide adequate documentation of site conditions or other factors that preclude full implementation of the performance design goal, the facility should still install stormwater practices to infiltrate, evapotranspire, and/or harvest and use onsite the maximum amount of stormwater technically feasible."* (EPA 841-B-09-001 Page 18).
- Measure practicability based on cost of compliance: *"Full implementation of the HMP will be considered impracticable if the combined construction cost of both required stormwater treatment and flow control measures exceeds 2% of the project construction cost".(* Santa Clara Valley Page 5-4)

Recommendations:

- Provide an overall MEP clause
- Provide specific cost-based feasibility limit (i.e. percentage of total project cost)
- Conduct a cost-benefit analysis for the 10% Equivalent Impervious Surface Area Requirement

Feasibility of Retention in Type C and D Soils

The section on Feasibility of Achieving Retention in the Regional Board's Technical Support Document makes reference to a study by Horner and Gretz. The Horner and Gretz study provides important insight as to the practical meaning of implementing the proposed standards on various soils. Many areas of the Central Coast have Type C and D soils. Table 6 of the Support Document indicates that 46 percent of the urban areas on the Central Coast are Type C and D soils. The Horner and Gretz Study evaluated sample projects on all types of soils in various communities, with the most representative of Central Coast conditions being the Southwest Climate case study.

Most areas of the Central Coast would have greater rainfall than the Southwest Climate (9.68 inches annually).

The Requirements Performance Standard No. 3 Runoff Retention requires that projects retain the runoff from either the 85th or 95th percentile storm, depending on the Watershed Management Zone (WMZ). The WMZ designations are not correlated with the surface soil types and therefore there are Type C and D (poor infiltrating) soil types that would be required to retain the 95th percentile storm.

The Horner and Gretz Study notes the following regarding Type D soils:

Pg 34: *"Standards 2 and 3 were never estimated to be met in any Type D soil case".* In the study Standard 2 is the ability to retain the 95th percentile storm – rephrasing this, the study is indicating that it is not feasible to retain the 95th percentile storm in a development on Type D soils, even when using Full ARCD (defined below).

The Horner and Gretz Study assumed the use of "Full ARCD" on Type D soils. In the study Full ARCD includes roof runoff management techniques and the report commented on how this might be done:

Pg 25: *"For retail commercial development (COMM), roof runoff management was assumed to be accomplished by harvesting, temporarily storing, and applying water to use in the building…the assumption was made that commercial development would be able to manage and would have the capacity to store and make use of the entire roof runoff volume…this particular assumption is, on its own, speculative…"*. Therefore, according to the study, projects on Type D soils, and many on type C soils, would have to store their entire roof runoff, and install a dual plumbing system (rain water for non-potable use in the building), in order to partially achieve the standard. We question the cost-benefit and ability to store 100 percent of roof runoff, and whether it is widely understood that this was the basis for evaluating feasibility.

The Horner and Gretz Study also made assumptions related to the use of the pervious areas of a project. For Type D soils, the assumption is that 100 percent of pervious areas "*would be required (*for bioretention*) to achieve given results"* (Table 15, and footnote b Table 12). We believe that the assumption of 100 percent of pervious areas being used for bioretention is neither feasible nor cost effective.

In summary, the Horner and Gretz study, concludes the following for projects in the Southwest region:

- Retention of the 95th percentile storm **cannot** be met on Type D soils
    - Even with 100 percent storage and graywater use of roof water; combined with
    - 100 percent of pervious areas being used for bioretention.
    - Also note that the Southwest region average annual rainfall (9.68 inches) is less than most areas of the Central Coast

- Retention of the 85th percentile storm:
    - Can be met for the Southwest region (average annual rainfall = 9.68 inches);

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- In comparison, can be met for the South Central region (average annual rainfall = 32.67 inches) assuming 100 percent of pervious areas being used for bioretention for commercial and redevelopment projects.

In reviewing site feasibility, the Horner and Gretz Study also evaluated the effect of the proposed measures on total annual runoff. The study noted "*with effective infiltrating bioretention it is possible for post-development annual recharge to exceed the pre-development quantity*" (Pg 28), and "*one reason … is that bioretention is set up to hold water, increasing the time for infiltration to occur instead of letting it runoff*" (Pg 28). In fact – some of their scenarios show 100 percent infiltration is possible where it does not occur naturally (Tables 8-15). The focus of the study is that the more retention the better – to further reduce pollutants - but we believe that runoff is essential to the receiving streams and that over-retention is undesirable.

We recommend that the assumptions and ramifications of the Horner and Gretz Study be carefully considered and the Requirements and Technical Support Document be modified accordingly, as summarized below.

Recommendations:

- Relate the retention and treatment standards to surface soil types which control site infiltration capability
- Evaluate the possible detrimental effect of bioretention causing reduced surface flow to receiving streams, or increased subsurface flow to ephemeral streams
- Highlight the need for roof runoff storage and graywater systems to meet the Requirements, and evaluate the feasibility and cost-benefit
- Highlight the need for 100 percent of pervious areas being required for bioretention, and evaluate the feasibility and cost-benefit

Regional vs. Parcel Scale Analysis

We are concerned with the approach of the Requirements to specify hydromodification controls at the parcel level. The greatest level of hydromodification control, and therefore watershed protection, could be achieved by evaluating overall development potential and land use changes from a watershed scale perspective. Parcel scale analysis may not reveal cumulative effects of development, and lead to inefficiency in the design and review process. Multiple parcel scale evaluations for different sites within the same watershed may provide little to no regional information while being redundant and rigorous in nature.

Agencies need the flexibility to plan for hydromodification within and throughout designated land use zones. For example, a single mixed-use parcel could be built to maximum density, accommodating businesses and high density housing, with a nearby parcel maintained as an open space park. If approached on a parcel scale, both parcels would be developed, and two smaller open spaces would be created. The single larger open space would have a higher value for the community, as it could function as a neighborhood gathering spot within a densely developed area, and accommodate a wider variety of recreational uses.

The Requirements include provisions for permittees to submit a Watershed or Regional Plan for consideration by the Regional Board, specific to Off-Site Compliance.

However, it is not clear that multiple projects could be analyzed and designed for compliance together, without the need for a full “Regional” plan.

Recommendations:

- Include provisions for combining parcels and projects in a single evaluation, in lieu of a Regional analysis

Summary

In summary, Wallace Group believes that long-term watershed protection can be accomplished through good land use planning and a regional approach to treatment and infiltration. We are advocates of both water quality protection and the move towards redevelopment and infill to create a dense urban core that minimizes effect on the environment by reducing pollutants associated with extension of the urban boundary. We believe that re-development should not be penalized for replacing existing impervious surfaces, and that infiltration should be considered on a case-by-case basis based on surface soils and other site specific constraints rather than uniformly required for all projects.

We appreciate the effort and goals that have resulted in the Central Coast Post-Construction Requirements and the public process of review and comments. We believe that consideration of such comments is essential to achieving standards that can provide maximum benefit to receiving waters with a cost effective and practical program.

Thank you for the opportunity to provide comments on the Draft General Permit, and please do not hesitate to contact me should you have any questions or concerns.

Sincerely,

WALLACE GROUP

Craig Campbell, PE, PLS, QSD/P, CPESC
Principal Engineer

References

City of Portland. Stormwater Management Manual. August 2008.

City of Sacramento. Hydromodification Management Plan. 2011.

City of San Diego. Storm Water Standards. January 2012.

City of Seattle. Stormwater Manual Volume 3. November 2009.

Contra Costa Clean Water Program. Stormwater C.3 Guidebook. February 2012.

EPA. 841-B-09-001 Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act. December 2009.

Horner and Gretz. Investigation of the Feasibility and Benefits of Low-Impact Site Design Practices Applied to Meet Various Potential Stormwater Runoff Regulatory Standards. 2011.

Maryland Department of the Environment. Maryland Stormwater Design Manual, Volumes I and II. May 2009.

San Diego County. Final Hydromodification Management Plan. March 2011.

Santa Clara Valley Urban Runoff Pollution Prevention Program. Hydromodification Management Plan Final Report. April 2005.

Strecker and Poresky. The Feasibility and Desirability of Stormwater Retention On Site in California and on the West Coast. 2010.

Attachments

Wallace Group. Review of Volume Multiplier for the Central Coast Post-Construction Stormwater Management Requirements. 2012.

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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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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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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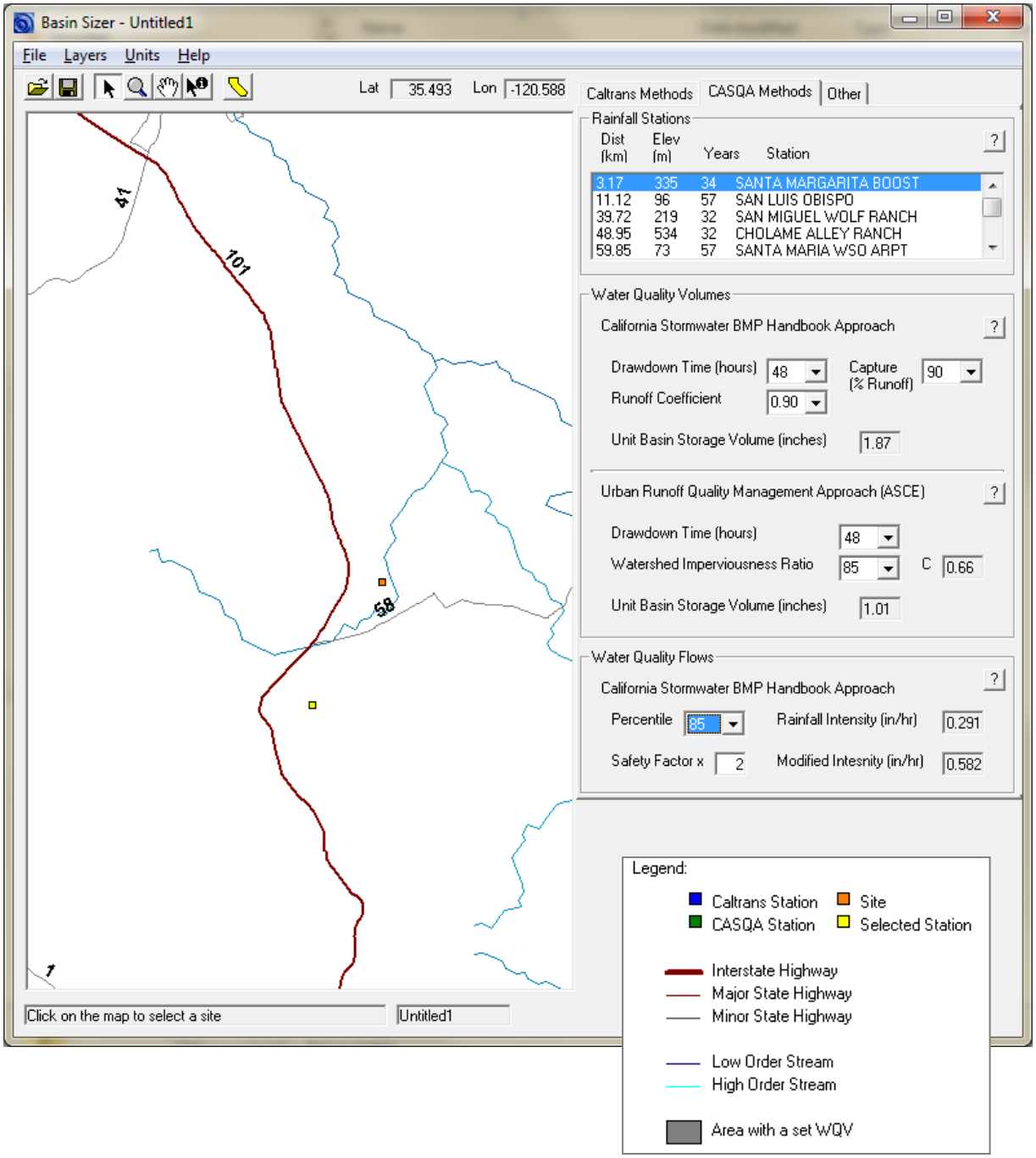
Basin Sizer Program Screen View



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