

## 7.0 NEW DEVELOPMENT/SIGNIFICANT REDEVELOPMENT

With the adoption of the Third Term Permits in early 2002, the Permittees were required to modify their current New Development/Significant Redevelopment Program (**1993 DAMP Appendix G**) to meet new permit requirements.

The goals for the updated New Development/Significant Redevelopment Program are to provide the Permittees with:

- A program framework for reducing the adverse impacts that new development and significant redevelopment may have on water quality
- Methodologies to meet NPDES permit requirements

This section and its exhibits provide the new countywide Model New Development/Significant Redevelopment Program (Model Program). The Model Program is intended to be implemented as described in **DAMP Section A-7** of each Permittee's Local Implementation Plan. In developing its Local Implementation Plan, the Permittee may modify the Model Program in response to local conditions. It is not the intent for this Model Program to restrict city or county planning commissions or their governing bodies from imposing additional stormwater management requirements as a condition of development or significant redevelopment.

### 7.1 Regulatory Requirements

The federal stormwater regulations specify that drainage area management plans include "a description of planning procedures including a comprehensive master plan to develop, implement, and enforce controls to reduce the discharge of pollutants...from areas of new development and significant redevelopment."

The Regional Boards have identified a need for individual stormwater quality management plans to apply equally to private and public agency projects. Transportation corridors, schools, parks, flood control projects and other public facilities are thus subject to the same requirements as planned communities and mini-malls.

The New Development/Significant Redevelopment Program was developed (see **DAMP Section 7.3**) as a model for fulfilling the new development and significant redevelopment commitments and requirements of:

- Section XII of the Santa Ana Regional Water Quality Control Board Municipal NPDES Stormwater permit, Order No. R8-2002-0010
- Section F.1 of the San Diego Regional Water Quality Control Board Municipal NPDES Stormwater permit, Order No. R9-2002-0001

Although there is a provision in the State regulations that school districts must obtain municipal approval for "improvements which affect drainage", the Government Code effectively prevents

city/county regulation of many federal and state agencies and local special districts. The First and Second Term Permits, however, identify these entities as potential dischargers of stormwater to the Orange County drainage areas and the expectation is that these entities will work cooperatively with the Permittees to manage urban runoff and stormwater pollution. These entities include: Caltrans, universities and colleges, Metropolitan Water District, Department of Defense, school districts, sanitation districts, water districts and railroads. During the Third Term Permit, regulation of a number of these is expected under Phase II of the Federal stormwater regulations.

## **7.2 Program Development**

The regulatory requirements and permit conditions have necessitated the development of a program to ensure that stormwater quality management is considered during a project's planning phase, implemented during construction, and ultimately maintained for the life of the project

### 7.2.1 First and Second Term Permit

In 1993, the New Development/Construction Task Force, comprised of representatives from the Principal Permittee, Building Industry Association (BIA), Association of General Contractors (AGC) and Civil Engineers & Land Surveyors of California (CELSOC), completed a report that provided the basis for requiring the incorporation of structural and non-structural Best Management Practices (BMPs) into new development and significant redevelopment. The report, entitled "Best Management Practices For New Development Including Nonresidential Construction Projects (1-5 acres)" (**1993 DAMP Appendix G**), involved additional contributions on specific BMPs from the Western States Petroleum Association (WSPA), Food Sanitation Advisory Council (FSAC), and Orange County's sanitary districts.

At the end of this process, the Permittees had developed an effective and flexible program for new development and significant redevelopment that allowed a strong focus to be placed on constituents of concern identified through the monitoring program and water quality planning process.

In 1997 the Permittees certified that they were implementing the **1993 DAMP Appendix G**. Since that time, the Permittees and development industry have gained considerable experience in implementing over a thousand Water Quality Management Plans (WQMPs) countywide. The **1993 DAMP Appendix G** contained the following elements:

- Each new private development and significant redevelopment is required to implement appropriate "routine" non-structural BMPs in keeping with the size and type of development, to minimize the introduction of pollutants into the drainage system (i.e. educational materials, landscape management, spill contingency plans, litter control, employee training, street sweeping).

- Each new private development and significant redevelopment is required to implement appropriate "routine" structural BMPs in keeping with the size and type of development.

"Routine" structural BMP's are economical, practicable, small scale-measures, which can be feasibly applied at the smallest unit of development, using standard plans developed by the New Development/ Construction Task Force. Routine structural BMP's may function either to minimize the introduction of pollutants into the drainage system or to remove pollutants from the drainage system and are intended to address drainage water quality impacts inherent in development, and need not be related to any identified water quality problem (i.e. filtration, efficient irrigation, landscape design, car wash racks, trash container areas, motor fuel concrete dispensing areas and canopies, catch basin stenciling, water quality inlets).

- "Special" structural BMPs are to be installed in new development and significant redevelopment to address specific water quality problems identified in the water quality monitoring program or the water quality planning process. This requirement may be addressed by providing an on-site "special" structural BMP, or by contributing to the implementation of a structural BMP specified within a watershed plan.

"Special" structural BMP's are engineered facilities designed to address specific pollutant problems identified in the water quality planning process, runoff management plan, CEQA process, or similar watershed planning. However, it was not the intent of this program to restrict city or county planning commissions or their governing bodies from imposing additional stormwater management requirements as a condition of development (i.e. water quality ponds, dry/wet basins).

- Each new private development or significant redevelopment is required to prepare a Project WQMP specifying the "routine" structural and non-structural BMPs (and any "special" BMPs) that will be used on site for approval by the Permittee with jurisdiction over the site (single family residences may be exempted from this requirement).
- Each private grading permit applicant with a development greater than five (5) acres (subsequently revised to one (1) acre) is required to provide proof of coverage under Construction Permit.
- Each private commercial or industrial project 1-5 acres is required to have special construction notes on the building plans and grading plans.

**Tables 1 and 2** of the **1993 DAMP Appendix G** provide an outline of standard practice site specific structural and non-structural BMPs for categories of development such as residential, industrial, retail/office centers, restaurants, warehouses/grocery, fuel dispensing areas and vehicle repair/maintenance facilities

In early 2001, to prepare for the Third Term Permits, the Permittees began the process of re-establishing the New Development/Construction Task Force. During the initial meetings of the

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Permittees, it was determined that the Task Force should provide a technical review role that would be able to provide feedback on either the proposed controls themselves or the impact of their implementation.

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The following participants were identified to participate in the Task Force:

Permittees	Additional Members
County of Orange	Association of General Contractors
City of Anaheim	American Planners Association
City of Brea	American Society of Civil Engineers
City of Huntington Beach	Building Industry Association
City of Irvine	California Association of Community Managers
City of Laguna Beach	Food Sanitation Advisory Council
City of Orange (Chair)	Irvine Ranch Water District
City of San Clemente	Orange County Water District
City of San Juan Capistrano	Orange County Sanitation District
City of Westminster	Rancho Mission Viejo
	South Orange County Wastewater Authority
	The Irvine Company
	Vector Control District
	Western States Petroleum Association
	Non-Affiliated Technical Experts
	Representatives of the Santa Ana and San Diego Regional Water Quality Control Boards as Ex-Officio Members

With the adoption of the Third Term Permits in early 2002, the Permittees were required to begin to modify their current New Development/ Significant Redevelopment Program (**1993 DAMP Appendix G**) to meet new permit requirements.

During the public review process for the approval of the New Development/Significant Redevelopment Program by the Santa Ana Regional Board, extensive input was received from the Santa Ana Regional Board, the Natural Resources Defense Council, Defend the Bay and the Orange County Coastkeeper.

### **7.3 Model New Development/Significant Redevelopment Program**

#### 7.3.1 Introduction

The Model Program provides a framework and a process for following the requirements to incorporate watershed protection/stormwater quality management principles into the Permittees' General Plan process, environmental review process, and development permit approval process, as required by the Third Term Permits. The Model Program also defines requirements and provides guidance for compliance with the requirements for project specific planning, selection, and design of BMPs in a new development or significant redevelopment project. The program covers initial project planning through design, construction and completion, including requirements for long-term maintenance of permanent BMPs. Detailed requirements for construction phase BMPs and procedures are contained in the Construction Model Program (**DAMP Section 8.4**).

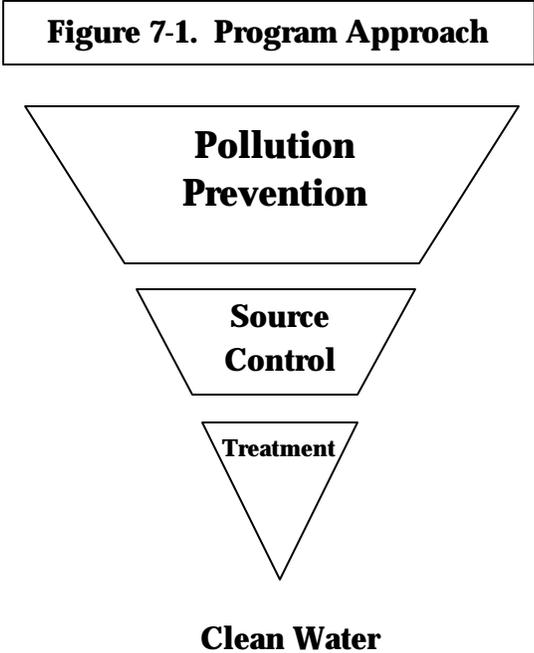
#### 7.3.2 Model Program Requirements and Objectives

Each Permittee is required to minimize short and long-term impacts on receiving water quality from new development and significant redevelopment to the maximum extent practicable and must at a minimum:

- 1) Assess the need to revise and update General Plans to include watershed and stormwater quality and quantity management considerations. (Section XII of Santa Ana Region Permit, Section F.1 of the San Diego Region Permit)
- 2) Review CEQA process for potential stormwater quality impacts and mitigation. (Section XII of Santa Ana Region Permit, Section F.1 of San Diego Region Permit)
- 3) Review Development Planning/Permit approval process for stormwater protection principles. (Section XII of Santa Ana Region Permit, Section F.1 of the San Diego Region Permit)
- 4) Review existing BMPs and develop Model WQMP (also referred to as a Standard Urban Stormwater Mitigation Plan – SUSMP) to address impact from new and significant redevelopment. (Section XII of Santa Ana Region Permit, Section F.1 of the San Diego Region Permit)
- 5) Conduct education or training for Model Environmental Review Program elements. (Section XII of Santa Ana Region Permit, Section F.1 of the San Diego Region Permit)

The overall objective of the Model Program is to provide guidance to the Permittees on how to implement the Third Term Permit requirements into their respective General Plan and environmental review and development permit processes. The Model Program will address the specific requirements contained in the Third Term Permits with distinctions as appropriate where the permits differ in their requirements.

Use of the procedures in the Model Program are intended to promote countywide consistency among the Permittees, which provides for uniform receiving water quality protection and program effectiveness assessment. The Model Program is based upon a three-tiered approach for reducing the potential impact of new development and significant redevelopment projects on water quality. The three tiers are Pollution Prevention, Source Control, and Treatment, as shown in **Figure 7-1**.



Pollution Prevention controls are emphasized and will be used as the first line of defense and include measures such as education for property owners and tenants and occupants and common areas landscape maintenance. Source Control BMPs will be included in new development and significant redevelopment projects to further reduce the amount of pollutants released into the environment and Treatment Control BMPs will be incorporated as described later to further supplement the Pollution Prevention and Source Control BMPs by actually treating the water to remove the pollutants.

For the purposes of this section of the DAMP, the following definitions apply:

*Pollution Prevention* - any practice that reduces or eliminates the creation of pollutants.

*Source Controls* - practices that prevent pollution by reducing pollutants at their source.

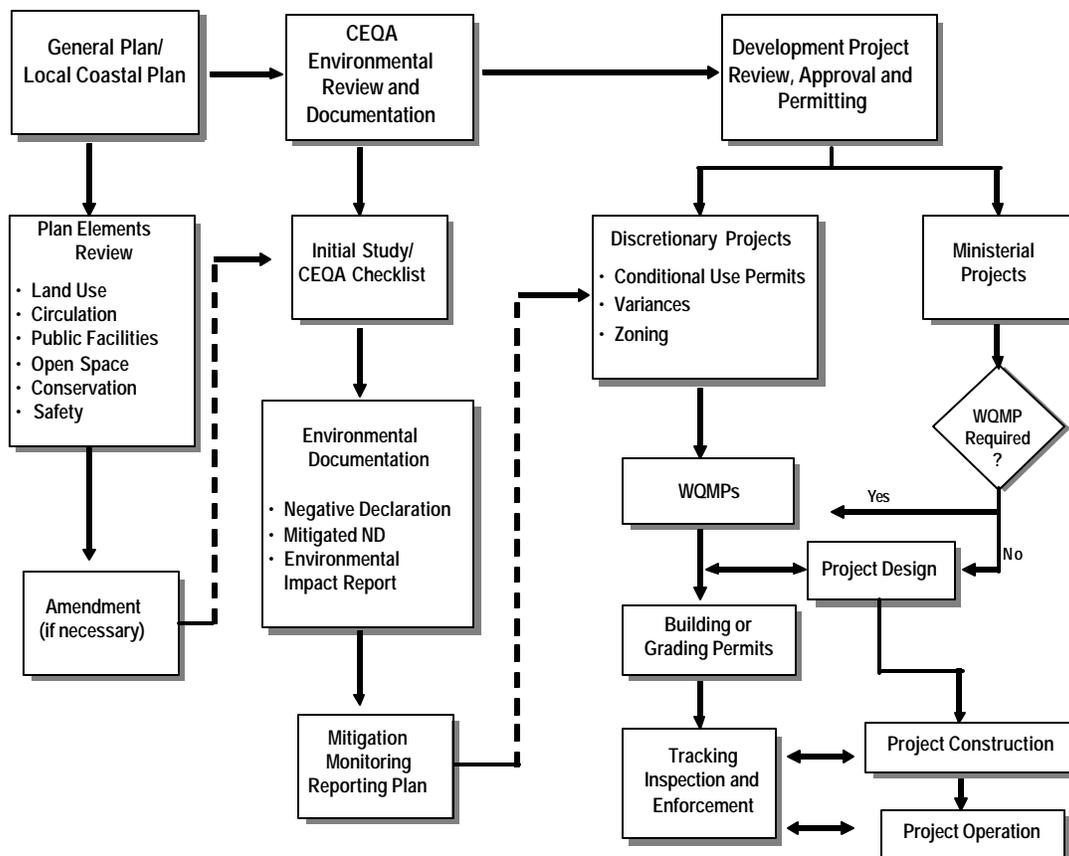
*Treatment Controls* - practices that remove pollutants from the water.

7.3.3 Model Program Overview

The Model Program links new development BMP design, construction and operation to the earlier phases of new development project planning encompassed by the General Plan, environmental review process, and development permit approval processes. A City/County General Plan specifies policies that guide new development. The environmental review process examines impacts from proposed new development with respect to the General Plan policies and many environmental issues, including water quality, and includes consideration of mitigation measures to reduce any identified significant impacts.

The development permit approval process carries forth mitigation requirements in the form of conditions of approval, design specifications, tracking, inspection and enforcement actions. These three “front-end” planning processes must be coordinated and linked to the later phases of BMP design, construction and operation for new development and significant redevelopment projects to help ensure stormwater quality protection features are planned, designed and evaluated in accordance with City/County goals for protection of water quality and other environmental resources. **Figure 7-2** is a generalized flow diagram that depicts the relationship of the General Plan, environmental review process and development planning and permit process, as well as the project design, construction, and operation phases.

**Figure 7-2. Relationship between General Plan, Environmental Review Process and Development Permit Process**



### 7.3.4 Contents of Model Program

The guidance provided by the Model Program is presented in the following subsections:

- Section 7.4 - General Plan Assessment and Amendment describes the process for the Permittees to assess their existing General Plans and make any needed amendments to include watershed and stormwater quality and quantity management considerations.
- Section 7.5 - CEQA Environmental Review Process provides guidance for utilizing/revising checklists and guidance for conducting environmental review for stormwater quality impact assessment.
- Section 7.6 - Development Project Review, Approval and Permitting provides policies and procedures for project plan review including information pertaining to discretionary permits, ministerial permits, Project WQMP requirements, tracking, inspection and enforcement. The guidance and procedures for Project WQMP preparation and for selection and design of regional/watershed and site specific BMPs is provided in Exhibit 7.II, Model WQMP.
- Section 7.7 - Post Construction BMP Inspection and Verification provides information on the periodic review of approved final Project WQMPs
- Section 7.8 - Model Program Training and Outreach provides general information on the training modules that have been developed for use by each Permittee in informing municipal staff, developers and contractors.
- Section 7.9 - Annual Reporting and Assessing Program Effectiveness describes the annual reporting on the implementation and effectiveness of the New Development /Significant Redevelopment Program by the Permittees.

## **7.4 General Plan Assessment and Amendment**

### 7.4.1 Introduction

Each Permittee is required by the Third Term Permits to minimize short and long-term impacts on receiving water quality from new development and significant redevelopment to the maximum extent practicable. With regard to the General Plan, the Permittees must at a minimum review and update General Plans, as necessary, to ensure that watershed and stormwater quality and quantity management are considered.

This section of the Model Program addresses these General Plan assessment requirements:

- The San Diego Region Permittees must provide a work plan as part of their submittal on February 13, 2003 with a time schedule detailing any changes to their General Plans regarding water quality and watershed protection.
- The Santa Ana Region Permittees must review their General Plan by December 19, 2002 to ensure urban-runoff related issues are properly considered and addressed. The findings of this review and the actions taken by the Santa Ana Region Permittees must be reported to the Santa Ana Regional Board by January 2, 2003. Each Santa Ana Region Permittee must provide the Santa Ana Regional Board with the draft amendment or revision when a pertinent General Plan element or the General Plan is noticed for public comment.

The next section provides background on the General Plan and Local Coastal Program followed by a process for reviewing and amending General Plans, as necessary, to incorporate urban runoff and stormwater pollution issues.

### 7.4.2 Background on the General Plan and Local Coastal Program

#### *7.4.2.1 General Plan*

Under California State law (California Government Code §65300) each city and county in California must prepare a comprehensive, long-term General Plan for the physical development of its community. The General Plan must consist of a statement of development policies and include a diagram(s) and text setting forth objectives, principles, standards and plan proposals (California Government Code §65302).

The General Plan consists of seven mandatory elements and any optional element that a city or county chooses to adopt. The mandatory elements include:

- Land Use
- Open Space
- Circulation and Infrastructure

- Conservation
- Housing
- Safety
- Noise

Any optional elements that are adopted by a city/county, such as Public Facilities, have equal authority as the mandatory elements. The legislative body of each city (the city council) and each county (the board of supervisors) adopts zoning, subdivision and other ordinances to regulate land uses and to carry out the policies in the General Plan. The plan is also used to guide decision-makers in determining whether or not land use proposals are consistent with the applicable goals, objectives, and policies.

### *7.4.2.2 General Plan Amendment Process*

A General Plan Amendment is a request to revise some component of the City's or County's General Plan. This can include addition, deletion or modification of goals and policies; modifications to the land use map or other diagrams; or other changes. A General Plan Amendment is a legislative act. Under State law, General Plan Amendments are allowed four times per year (California Government Code §65358(b)).

A General Plan Amendment must be approved by the Planning Commission and City Council or at the County level by the Board of Supervisors at public hearings. In approving a General Plan Amendment, the approving body must assess the policy implications of the proposed General Plan Amendment and the impact and compatibility of the proposed General Plan Amendment on the long-term goals and desires of the City or County and its citizens.

Most General Plan Amendments are carried out in conjunction with a specific development proposal, although the City, County, or any other agency or party can request an amendment without a specific development proposal in mind.

In evaluating a proposed General Plan Amendment, the approving body must look at the "global" impacts of the proposed amendment. Although a General Plan Amendment may be proposed in conjunction with a specific development proposal, the amendment proposed might have policy and/or land use impacts far beyond any given project or property. General Plan Amendments are frequently proposed in conjunction with other legislative acts such as Zone Changes, Zone Text Amendments and Local Coastal Program Amendments.

### *7.4.2.3 Local Coastal Program*

The California Coastal Commission (Commission) was established in 1972 and made permanent by the Legislature in 1976 (via the Coastal Act). The primary mission of the Commission, as the lead agency responsible for carrying out California's federally approved coastal management program, is to plan for and regulate land and water uses in the coastal zone consistent with the policies of the Coastal Act.

California's coastal management program is carried out through a partnership between state and local governments. Implementation of Coastal Act policies is accomplished primarily through the preparation of local coastal programs (LCPs) that are required to be completed by each of the counties and cities located in whole or in part in the coastal zone. Completed LCPs must be submitted to the Commission for review and approval. In Orange County, the cities responsible for preparing an LCP include Seal Beach, Huntington Beach, Newport Beach, Laguna Beach, Dana Point and San Clemente. The County also has areas subject to an LCP.

The objective of an LCP is to protect coastal resources, provide greater access and recreational opportunities for the public's enjoyment, while allowing for orderly and well-planned urban development and the siting of coastal-dependent and coastal-related industry. The plan incorporates, to the maximum possible extent, local plans and policies that are consistent with the Coastal Act.

An LCP includes a land use plan, which is the relevant portion of the local General Plan, including any maps necessary to administer it, the zoning ordinances, zoning district maps, and other legal instruments necessary to implement the land use plan. Coastal Act policies are the standards by which the Commission evaluates the adequacy of LCPs (Public Resources Code §30108.6).

After certification of the land use plan and zoning components of the LCP, the review authority for new development within the coastal zone, which is now vested in the Coastal Commission, is returned to local government. Development within the coastal zone may not commence until a coastal development permit has been issued by either the Commission or a local government that has a Commission-certified LCP. The local government, in issuing coastal development permits after certification, must make the finding that the development is in conformity with the approved LCP.

#### *7.4.2.4 Local Coastal Program Amendment Process*

Any amendments to a certified LCP have to be approved by the State Coastal Commission. To ensure that coastal resources are effectively protected in light of changing circumstances, such as new information and changing development pressures and impacts, the Commission is required to review each certified LCP at least once every five years (California Coastal Commission 2002).

#### 7.4.3 Plan for Assessing General Plan Elements and Local Coastal Program

The San Diego Region Permit states:

“Each Permittee’s General Plan or equivalent plan (e.g., Comprehensive, Master, or Community Plan) shall include water quality and watershed protection principles and policies to direct land use decisions and require implementation of consistent water quality protection measures for development projects.”

The Santa Ana Region Permit states:

“Permittees shall review their watershed protection principles and policies in their General Plan or related documents (such as Development Standards, Zoning Codes, Conditions of Approval, Development Project Guidance) to ensure that these principals and policies are properly considered and are incorporated into these documents.”

The Permittees recognize the importance of addressing watershed protection and stormwater quality control in the land development process. The Permittees are requiring that stormwater quality BMPs be included in plans for new development and significant redevelopment.

Therefore, in accordance with State Planning and Zoning Law which provides that requirements placed on land development projects must be compatible with a community’s General Plan and Local Coastal Program, watershed protection principles and stormwater pollution control objectives for land development should be reflected in the appropriate policies, goals, and objectives of each Permittee’s General Plan and LCP.

Many of the General Plan Elements contain existing goals and policies that can be related to watershed protection and stormwater pollution control. For example, stormwater quality may be controlled by the type, location, and density of development. Such controls may be established through policies commonly found in the Land Use and Open Space Elements of the General Plan (e.g., development policies, development location guidelines, landscaping guidelines, open space policies, policies on preservation of and integration with natural features).

Development of local streets and roads, regulated under the policies of the Circulation and Infrastructure Element and to some extent, the Safety Element, results in increased impervious surfaces and accumulation of stormwater pollutants from vehicles. The Public Facilities Element provides management policies for construction, operation and maintenance of various public facilities including as flood control channels and storm drains, which convey stormwater runoff. The Conservation Element contains policies on water conservation that can be linked to water quality protection through efficient use of irrigation systems to prevent runoff.

The Permittees will review their General Plan Elements and relevant sections of the LCP (if a coastal city with an approved LCP) that cover land development issues and in which it may be appropriate to reflect watershed protection and stormwater quality management policies.

This will include review of goals and policies in the following General Plan Elements:

- Land Use;
- Safety;
- Circulation and Infrastructure (i.e., transportation);
- Public Facilities;
- Open Space; and
- Conservation.

Permittees will review development goals and policies, landscaping policies and requirements, open space goals and policies including preservation or integration with natural features, water conservation policies, and public facilities operation and maintenance policies of these Elements. When reviewing the General Plan Elements and LCPs, special attention will be given to how the Element/LCP addresses water quality protection from urban runoff and stormwater pollution. The Permittees will keep in mind the following questions during this review, which may trigger the need for specific urban runoff and stormwater pollution protection policies in the General Plan and LCP either as new policies and objectives or amended text to existing policies and objectives:

- 1) Are there sensitive water resources in or downstream of the jurisdiction?
- 2) Are there existing Total Maximum Daily Loads (TMDLs) or other such regulations pertaining to receiving waters within the jurisdiction?
- 3) Is major new development or significant redevelopment expected?
- 4) Are major new infrastructure projects anticipated (e.g. roads, sewer, flood control, storm drains)?
- 5) Does urban runoff and stormwater pollution affect recreational use of water bodies within the jurisdiction?

Upon review of the Permittees General Plan Elements and LCP, as well as related documents (such as Development Standards, Zoning Codes, Conditions of Approval, Development Project Guidance, referred to collectively as Related Documents), the Permittees will determine which sections should be modified, if any, to include specific policies and objectives that address water quality protection as specified in the San Diego Region and Santa Ana Region Permits (See **DAMP Section 7.4.4** following).

If the General Plans or Related Documents of the Permittees do not contain the policies, goals and objectives of the relevant Third Term Permit, then additional policies, goals, or objectives that stress the importance of stormwater quality control, or that are necessary in order to implement certain types of stormwater management programs, should be incorporated in the General Plans or Related Documents. The need for and the extent of revisions to the General Plan or Related Documents should be coordinated with each Permittee's legal counsel.

#### 7.4.4 Consideration of Additional Water Quality and Watershed Protection Concepts in General Plan and Local Coastal Program

The Permittees will review and consider the following additional objectives for the General Plan Elements and LCPs, as specified by the Third Term Permits, respectively:

*San Diego Region Permit:*

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- 1) Minimize the amount of impervious surfaces and directly connected impervious surfaces in areas of new development and significant redevelopment and, where feasible, slow runoff and maximize on-site infiltration of runoff.
- 2) Implement pollution prevention methods supplemented by pollutant source controls and treatment. Use small collection strategies located at, or as close as possible to, the source to minimize the transport of urban runoff and pollutants offsite and into an MS4 (municipal storm drain).
- 3) Preserve, and where possible, create or restore areas that provide important water quality benefits, such as riparian corridors, wetlands, and buffer zones. Encourage land acquisition of such areas.
- 4) Limit disturbances of natural water bodies and natural drainage systems caused by development including roads, highways, and bridges.
- 5) Prior to making land use decisions, utilize methods available to estimate increases in pollutant loads and flows resulting from projected future development. Require incorporation of structural and non-structural BMPs to mitigate the projected increases in pollutant loads and flows.
- 6) Avoid development of areas that are particularly susceptible to erosion and sediment loss; or establish development guidance that identifies these areas and protects them from erosion and sediment loss.
- 7) Reduce pollutants associated with vehicles and increasing traffic resulting from development. Coordinate local traffic management reduction efforts with Orange County Transit Authority's Congestion Management Plan.
- 8) Post-development runoff from a site shall not contain pollutant loads that cause or contribute to an exceedance of receiving water quality objectives and which have not been reduced to the maximum extent practicable.

### *Santa Ana Region Permit:*

- 1) Limit disturbance of natural water bodies and drainage systems; conserve natural areas; protect slopes and channels; and minimize impacts from stormwater and urban runoff on the biological integrity of natural drainage systems and water bodies.
- 2) Minimize changes in hydrology and pollutant loading; require incorporation of control, including structural and non-structural BMPs, to mitigate the projected increases in pollutant loads and flows; ensure that post-development runoff rates and velocities from a site have no significant adverse impact on downstream erosion and stream habitat; minimize the quantity of stormwater directed to impermeable surfaces and the MS4s (municipal storm drain); and maximize the percentage of permeable surfaces to allow more percolation of stormwater into the ground;

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- 3) Preserve wetlands, riparian corridors, and buffer zones and establish reasonable limits on the clearing of vegetation from the project site;
- 4) Encourage the use of water quality wetlands, biofiltration swales, watershed-scale retrofits, etc., where such measures are likely to be effective and technically and economically feasible;
- 5) Provide for appropriate permanent measures to reduce stormwater pollutant loads in stormwater from the development site; and,
- 6) Establish development guidelines for areas particularly susceptible to erosion and sediment loss.

For further reference, the Permittees may review the sample general plan amendment text and sample urban runoff water quality general plan element outlined in *Model Urban Runoff Program, A How to Guide for Developing Urban Runoff Programs for Small Municipalities (City of Monterey, et al, July 1998)*.

If a Permittee, in consultation with its legal counsel, determines that it needs to amend its General Plan (or Related Documents) or LCP (if applicable) to incorporate watershed and stormwater management policies, goals or objectives, it may do so whenever elements of the Permittee's General Plan (or Related Documents) or LCP are significantly rewritten or by the July 1, 2004 date specified by the Santa Ana Region Permit. As part of any General Plan Amendment, maps will be revised, as necessary, to reflect location-specific watershed protection/stormwater quality management policies, and eliminate conflicts among land use districts, permitted land uses, and stormwater-specific goals and policies.

## 7.5 CEQA Environmental Review Process Modifications

### 7.5.1 Introduction

Each Permittee is required by the Permits to minimize short and long-term impacts on receiving water quality from new development and significant redevelopment to the maximum extent practicable. The Santa Ana Region Permit (Section XII.A.3) requires the Permittees to review their California Environmental Quality Act (CEQA) document preparation process to ensure urban runoff and stormwater pollution-related issues are properly considered and addressed. If necessary, the processes should be revised to consider and mitigate impacts to stormwater quality. The San Diego Region Permit (Section F.1.C) requires to the extent feasible that the Permittees revise their current environmental review process to include requirements for evaluation of water quality effects and identification of appropriate mitigation measures.

The San Diego Region Permittees must revise their environmental review process by February 13, 2003. The Santa Ana Region Permittees must review their CEQA documentation processes by December 19, 2002 to ensure urban-runoff related issues are properly considered and addressed.

The next section provides background on the CEQA environmental review process followed by a series of revisions that the Permittees will implement to ensure that urban runoff and stormwater pollution issues are incorporated in the process.

#### 7.5.1.1 Background on CEQA

The California Environmental Quality Act (CEQA) applies to all discretionary activities proposed to be carried out or approved by the cities and County, unless an exemption applies. CEQA applies to public and private sector activities that require discretionary City/County approvals. The basic goal of CEQA (Public Resources Code §21000 et seq.) is to develop and maintain a high-quality environment now and in the future, while the specific goals of CEQA are for the cities/County and other public agencies to:

- 1) Identify the significant environmental effects of their actions; and, either
- 2) Avoid those significant environmental effects, where feasible; or
- 3) Mitigate those significant environmental effects, where feasible.

The implementation of CEQA is regulated by the Secretary for Resources, via the Office of Planning and Research's "State CEQA Guidelines" (Guidelines) (California Code of Regulations Title 14, Chapter 3, §15000 through 15007). These Guidelines are binding on all cities/counties and other public agencies in California.

There are three phases for implementing CEQA. These include:

- Preliminary review of a project to determine whether it is subject to CEQA.

- Preparation of an Initial Study to determine whether the project may have a significant environmental effect.
- Preparation of an Environmental Impact Report (EIR) if the project may have a significant environmental effect or a Negative Declaration or Mitigated Negative Declaration if no significant effects will occur (Guidelines §15002(k)).

### 7.5.1.2 *Preliminary Review*

Once an application for permits, approvals, or other entitlements has been submitted to the Lead Agency for CEQA review, the Lead Agency has 30 days to review the application for completeness. For private sector projects, the Lead Agency may require submittal of baseline environmental setting and detailed project description information to enable the Lead Agency to prepare the Initial Study. Appendix H of the CEQA Guidelines provides a sample project application form. Lead Agencies can rely on the sample form, but are free to devise their own project application forms (Guidelines §15002(k), to include, for example, specific information on BMPs.

### 7.5.1.3 *Initial Study*

The Lead Agency must conduct an Initial Study to determine if the project may have a significant effect on the environment. If the Lead Agency can determine that an EIR will clearly be required for the project, an Initial Study is not required but may still be desirable. (§15063). The Initial Study typically consists of the project applicant information obtained during the preliminary review process, the completed Initial Study checklist and required checklist explanations. An Initial Study checklist is provided in Appendix G of the CEQA Guidelines that covers all environmental topics for the Lead Agency to consider during the Initial Study, including Hydrology/Water Quality. All entries on the checklist must be explained during the Initial Study process. Lead Agencies are free to devise their own Initial Study checklists for use in the Initial Study process (Guidelines §15002(k). This may include more detailed questions related to urban runoff and stormwater pollution, if the Lead Agency deems appropriate for its jurisdiction.

### 7.5.1.4 *Environmental Impact Report (EIR)*

An EIR must be prepared if the proposed project may have a significant environmental effect. The most common type of EIR examines the environmental impacts of a specific development project. This type of EIR focuses primarily on the changes in the environment that would result from the development project. The EIR examines all phases of the project including planning, construction, and operation (§15161).

Immediately after deciding that an EIR is required for a project, the Lead Agency sends to each Responsible Agency a Notice of Preparation (NOP) stating that an EIR will be prepared. For water quality issues, responsible agencies would include the State Water Resources Control Board (State Board), the respective Regional Boards, the U.S. Army Corps of Engineers (for projects with discharges of dredge/fill into waters of the U.S.) and California Department of Fish and Game (for alternations of streambeds affecting waters of the state). This notice is also

sent to every federal and state agency involved in approving or funding the project and to each Trustee Agency responsible for natural resources affected by the project. The NOP must provide the Responsible Agencies with sufficient information describing the project and the potential environmental effects. The responses from the NOP assist in identifying the significant environmental issues and reasonable alternatives and mitigation measures that the Responsible Agency will need to explore in the draft EIR. (§15082). If water quality issues are identified as a significant environmental issue, then water quality would be discussed in the environmental setting (baseline), impact, and, if applicable, mitigation sections of the EIR.

#### 7.5.1.5 *Negative Declaration*

A public agency prepares a Negative Declaration or Mitigated Negative Declaration for a project subject to CEQA when:

- 1) The initial study shows that there is no substantial evidence, in light of the whole record before the agency, that the project may have a significant effect on the environment, or
- 2) The initial study identifies potentially significant effects, but:
  - a) Revisions in the project plans or proposals made by, or agreed to by the applicant before a proposed mitigated negative declaration and initial study are released for public review would avoid the effects or mitigate the effects to a point where clearly no significant effects would occur, and
  - b) There is no substantial evidence, in light of the whole record before the agency, that the project as revised may have a significant effect on the environment. (§15070)

A Negative Declaration circulated for public review must include a brief description of the project; the location of the project; a proposed finding that the project will not have a significant effect on the environment; an attached copy of the Initial Study documenting reasons to support the finding; and mitigation measures, if any, included in the project to avoid potentially significant effects. (§15071) Water quality issues are addressed in a Negative Declaration in the Initial Study and if applicable, mitigation measures are developed.

#### 7.5.2 Revisions to the CEQA Initial Study Process

The San Diego Region Permit (Section F.1.C) requires, to the extent feasible, that the Permittees revise their current environmental review process to include requirements for evaluation of water quality effects and identification of appropriate mitigation measures. The San Diego Region Permit lists the following questions for consideration in the environmental review process to address increased pollutants and flows from proposed projects:

- a) Could the proposed project result in an increase in pollutant discharges to receiving waters? Consider water quality parameters such as temperature, dissolved oxygen, turbidity and other typical stormwater pollutants (e.g. heavy metals, pathogens, petroleum

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derivatives, synthetic organics, sediment, nutrients, oxygen-demanding substances, and trash).

- b) Could the proposed project result in significant alternation of receiving water quality during or following construction?
- c) Could the proposed project result in increased impervious surfaces and associated increased runoff?
- d) Could the proposed project create a significant adverse environmental impact to drainage patterns due to changes in runoff flow rates or volumes?
- e) Could the proposed project result in increased erosion downstream?
- f) Is the project tributary to an already impaired water body, as listed on the Clean Water Act Section 303(d) list? If so, can it result in an increase in any pollutant for which the water body is already impaired?
- g) Is the project tributary to other environmentally sensitive areas? If so, can it exacerbate already existing sensitive conditions?
- h) Could the proposed project have a potentially significant environmental impact on surface water quality to either marine, fresh, or wetland waters?
- i) Could the proposed project have a potentially significant adverse impact on groundwater quality?
- j) Could the proposed project cause or contribute to an exceedance of applicable surface or groundwater receiving water quality objectives or degradation of beneficial uses?
- k) Can the project impact aquatic, wetland, or riparian habitat?

The Santa Ana Region Permit (Section XII.A.3) requires the Permittees to review their CEQA document preparation process to ensure urban runoff and stormwater pollution-related issues are properly considered and addressed. If necessary, the processes should be revised to consider and mitigate impacts to stormwater quality. The Santa Ana Region Permit lists the following potential impacts to be considered during CEQA review:

- a) Potential impact of project construction on stormwater runoff;
- b) Potential impact of project's post-construction activity on stormwater runoff;
- c) Potential for discharge of stormwater pollutants from areas of material storage, vehicle or equipment fueling, vehicle or equipment maintenance (including washing), waste handling, hazardous materials handling or storage, delivery areas, loading docks or other outdoor work areas;

- d) Potential for discharge of stormwater to affect the beneficial uses of the receiving waters;
- e) Potential for significant changes in the flow velocity or volume of stormwater runoff to cause environmental harm; and
- f) Potential for significant increases in erosion of the project site or surrounding areas.

These urban runoff and stormwater pollution issues will be considered in the Initial Study process (project application forms and checklists) and in the preparation and reviews of EIRs discussed in the following sections.

#### *7.5.2.1 Project Application Form*

The current project application form contained in Appendix H of the CEQA Guidelines (State of California Office of Planning and Research, February, 2001) contains many questions about the project to help environmental planners assess the potential for significant environmental impacts. However, there are no specific project description questions that help characterize the potential for urban runoff and stormwater pollution impacts. The Permittees will review their existing project application forms and, as deemed necessary, will revise the form to include line items for:

- Expected percent change in pervious surface area of the site; and
- Submittal of preliminary Project WQMP, if applicable, (along with required submittal of other development plans).

#### *7.5.2.2 Initial Study Checklist*

The current Initial Study Checklist contained in Appendix G of the CEQA Guidelines (State of California Office of Planning and Research, February 2001) was recently updated and is used by nearly all Permittees in their environmental review process. This Checklist contains the following considerations under the environmental impact category "Hydrology and Water Quality (Section VIII):

Would the project:

- a) Violate any water quality standards or waste discharge requirements?
- b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?

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- c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?
- d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site?
- e) Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?
- f) Otherwise substantially degrade water quality?
- g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?
- h) Place within a 100-year flood hazard area structures that would impede or redirect flood flows?
- i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?
- j) Inundation by seiche, tsunami, or mudflow?

The Permittees have concluded that urban runoff and stormwater pollution considerations are generally covered in questions a) through f) of the CEQA Guidelines Appendix G checklist, but with less specificity than the questions provided in both the San Diego and Santa Ana Region Permits. To ensure that the Initial Study thoroughly considers all issues listed in the Permits, the Permittees will review the Initial Study checklist and make appropriate changes to assure that the additional considerations provided in the Third Term Permits (or their equivalent) are reflected in the Permittees' CEQA review processes.

The Permittees will also consider adding the following question to the Hazardous and Hazardous Materials Section (Section VII) or Utilities and Service Systems Section (Section XVI) of the checklist:

Would the project include new or retrofitted stormwater Treatment Control BMPs, (e.g. water quality treatment basin, constructed treatment wetlands), the operation of which could result in significant environmental effects (e.g. increased vectors and odors)?

To promote the consideration of all of the various impacts related to urban runoff and stormwater pollution as identified in the Third Term Permits, the Permittees may provide the list of permit considerations to:

- Environmental planning staff for use in preparing and reviewing CEQA documents for internal city/county projects and when reviewing CEQA documents prepared by the private sector
- Consultants and other members of the private sector for use in preparing CEQA documents for private and public sector projects
- Project applicants during the CEQA preliminary review process
- Participants attending training programs

### 7.5.3 Environmental Review Guidance for CEQA Initial Studies and CEQA Document Preparation and Review

The guidance in **Exhibit 7.I** may be used by the Permittees in evaluating the CEQA Initial Study checklist questions in Section VIII. Hydrology and Water Quality including any additional questions included by the Permittees in response to the San Diego and Santa Ana Region Permits. This guidance is also applicable to the review and preparation of CEQA documents including Negative Declarations, Mitigated Negative Declarations and EIRs. This guidance will be reviewed annually, updated as needed, and its status/use will be discussed in the Annual Progress Report.

## 7.6 Development Project Review, Approval, and Permitting

### 7.6.1 Introduction

The Third Term Permits require that the Permittees address the following elements, which affect development project review, approval, and permitting

- Modify Project WQMP requirements by imposing additional BMP requirements for new development and redevelopment projects that fall under “Priority Project” categories (see **Table 7-1**)
- Review and revise standard conditions of approval and plan check procedures to ensure that the short and long-term impacts of new development and significant redevelopment on receiving water quality are minimized and that watershed protection principles are incorporated into project plans. (To support this objective, Permittees shall also review their standard conditions of approval, plan check procedures, and permit conditions to ensure that they are not in conflict with any provisions of the Santa Ana Region Permit or the San Diego Region Permit (as applicable), the DAMP, California’s General Permit for Stormwater Discharges Associated with Construction Activity, California’s General Permit for Stormwater Discharges Associated with Industrial Activity and adopted Total Maximum Daily Load allocations within their jurisdiction).

The Santa Ana Permit uses the term WQMP to describe the overall program that Permittees adopt to define the existing and expanded requirements for incorporating BMPs into new development and significant redevelopment. The San Diego Permit uses the term Standard Urban Stormwater Mitigation Plan (SUSMP) for the overall program requirements. The terms WQMP and SUSMP are also used to define the project-specific plan for BMPs for each new project.

Under the 1993 DAMP, Permittees throughout the County required all projects (not just Priority Projects) to prepare a WQMP to identify permanent BMPs that will be included in the project. Therefore, the WQMP terminology will continue to be used within all jurisdictions, but the revised requirements described in this **DAMP Section 7** and associated Local Implementation Plan (LIP) (**DAMP Appendix A-7**) and Model WQMP (**Exhibit 7.II**) are intended to allow Project WQMPs to be consistent with both the WQMP requirements of the Santa Ana Permit and the SUSMP requirements of the San Diego Permit.

The remainder of this section describes the processes for incorporating the new Model WQMP requirements into the project planning and approval process and modifications to conditions of approval and plan check processes to assure consistency with Third Term Permit requirements. As stated previously, a Model WQMP is provided as **Exhibit 7.II**. The Model WQMP provides guidance for the development and review of Project WQMPs.

### 7.6.2 Project Review, Approval, and Permitting Process Overview

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For all new development and significant redevelopment projects meeting the minimum requirements defined herein, a Project WQMP shall be developed to define the quality and quantity of stormwater runoff that must be considered during project planning to identify permanent (post-construction) BMPs that will be included in project design, constructed as part of the project, and ultimately implemented and maintained for the life of the project. Commitments from a project or permit applicant to incorporate, implement, and maintain the BMPs must be described in a Project WQMP.

The Third Term Permits require that the Permittees revise their WQMP. Prior to the dates shown below for each jurisdiction, projects will be required to prepare Project WQMP's in accordance with the 1993 DAMP:

Within the jurisdiction of the Santa Ana RWQCB – Upon approval of the revised WQMP by the Executive Officer but not later than October 1, 2003. The approved WQMP shall apply to new development projects, defined as projects for which tentative tract or parcel map approval was not received by July 1, 2003 and new significant re-development projects, defined as projects for which all necessary permits were not issued by July 1, 2003. New development projects do not include projects receiving map approvals after July 1, 2003 that are proceeding under a common scheme of development that was the subject of a tentative tract or parcel map approval that occurred prior to July 1, 2003.

Within the jurisdiction of the San Diego RWQCB – Upon a Permittee's adoption of a local WQMP following submittal of the Model WQMP to the RWQCB. The local WQMP must be adopted not later than August 13, 2003. Upon the Permittee's adoption of the local WQMP, the local WQMP requirements shall apply to priority projects that have not yet begun grading or construction activities. If a Permittee determines that lawful prior approval of a project exists, whereby application of the newly adopted local WQMP requirements to the project is infeasible, such WQMP requirements need not apply to the project.

### *Program Coverage and Definitions*

Project WQMPs are required for private new development and significant redevelopment projects within Permittees' jurisdictions, and equivalent public agency capital projects undertaken by the Permittees for projects that:

- Qualify as one of the Priority Project Categories listed in **Table 7-1**, regardless of project size.
- Do not qualify as one of the Priority Project Categories but meet one of the following
  - Require discretionary action that will include a precise plan of development, except for those projects exempted by the Water Quality Ordinance (as applicable)
  - Require issuance of a non-residential plumbing permit

Such projects will be referred to as "Non-Priority Projects."

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The primary difference between a Priority Project and a Non-Priority Project is that Priority Projects will be required to include Treatment Control BMPs in project design. To ensure that Priority Projects, which require the incorporation of Treatment Control BMPs, are identified as early in the planning process as possible, the Permittees will utilize a checklist to document the

**Table 7-1 Priority Projects Categories**

1. Residential development of 10 units or more
2. Commercial and industrial development greater than 100,000 square feet including parking areas
3. Automotive repair shop (SIC codes 5013, 5014, 5541, 7532-7534, and 7536-7539)
4. Restaurant where the land area of development is 5,000 square feet or more including parking areas (SIC code 5812)
5. <b>For San Diego Region</b> - Hillside development greater than 5,000 square feet <b>For Santa Ana Region</b> - Hillside development on 10,000 square feet or more, which is located on areas with known erosive soil conditions or where natural slope in 25 percent or more
6. Impervious surface of 2,500 square feet or more located within, directly adjacent to (within 200 feet), or discharging directly to receiving water within Environmentally Sensitive Areas <sup>1</sup> .
7. Parking lot area of 5,000 square feet or more, or with 15 or more parking spaces, and potentially exposed to urban runoff
8. <b>For San Diego Region</b> - Streets, roads, highways, and freeways which would create a new paved surface that is 5,000 square feet or greater
9. <b>For Santa Ana Region</b> - All significant redevelopment projects, where significant redevelopment is defined as the addition of 5,000 or more square feet of impervious surface on an already developed site

<sup>1</sup> Environmentally Sensitive Areas are shown in maps available from the County and cities

identification of a project as a Priority Project or a Non-Priority Project (see the Local Implementation Plan **DAMP Appendix A-7**).

New Development - means land disturbing activities; structural development, including construction or installation of a building or structure, the creation of impervious surfaces; and land subdivision.

Significant Redevelopment - means development that would add 5,000 or more square feet of impervious surface on an already developed site. Significant redevelopment includes, but is not limited to:

- Expansion of a building footprint;
- Addition of a building and/or structure;
- Addition of an impervious surface that is not part of a routine maintenance activity such as construction of a new parking lot.
- Replacement of impervious surfaces, buildings and/or structures when 5000 or more square feet of soil is exposed during replacement construction. Replacement does not

include routine maintenance activities, trenching and resurfacing associated with utility work, resurfacing and reconfiguring the surface of parking lots (unless 5000 or more square feet of impervious surface is added to the existing parking lot area) or reconfiguration of pedestrian ramps and replacement of damaged pavement.

Where the significant redevelopment results in an increase of less than fifty percent of the impervious surface of a previously existing development, the treatment requirements apply only to the addition, and not to the entire development. In this circumstance, Permittees are encouraged to explore with project proponents ways by which treatment BMPs can be provided for the entire site (or a greater percentage of the site), consistent with the overall pollution reduction goals of the Third Term Permits and DAMP.

Where the significant redevelopment results in an increase of fifty percent or more of the impervious surface of a previously existing development, the treatment requirements apply to the entire development.

#### *Private Development WQMP Submittal*

The Project WQMP may be prepared and submitted at one of two different points in project planning and permitting:

- During the discretionary approval process (land use permit) of a proposed project, when the Permittee must exercise judgment or deliberation in order to approve or disapprove a development or significant redevelopment project, or
- During the ministerial approval process of issuing a grading, building, demolition, or similar “construction” permits in which only fixed standards or objective measures are applied.

**Figure 7-3** depicts the primary steps in the process of reviewing, approving, and permitting a private new development or significant redevelopment project.

A discretionary action under CEQA is defined as “an activity which requires the public agency to exercise judgment in deciding whether to approve or disapprove the particular activity, as distinguished from situations where the public agency merely has to determine whether there has been conformity with applicable ordinances or other laws.”<sup>1</sup> For proposed projects subject to discretionary approval, the Permittees will require a preliminary or conceptual Project WQMP as part of the application for project approval (land use entitlement) unless the project is subject to a regional or watershed program. The level of detail in a preliminary or conceptual Project WQMP submitted during the land use entitlement process will depend upon the level of detail known about the overall project design at the time project approval is sought.

Ministerial actions are those where little or no judgment or deliberation by a Permittee is required. Some ministerial approvals, those projects meeting one or more criteria under

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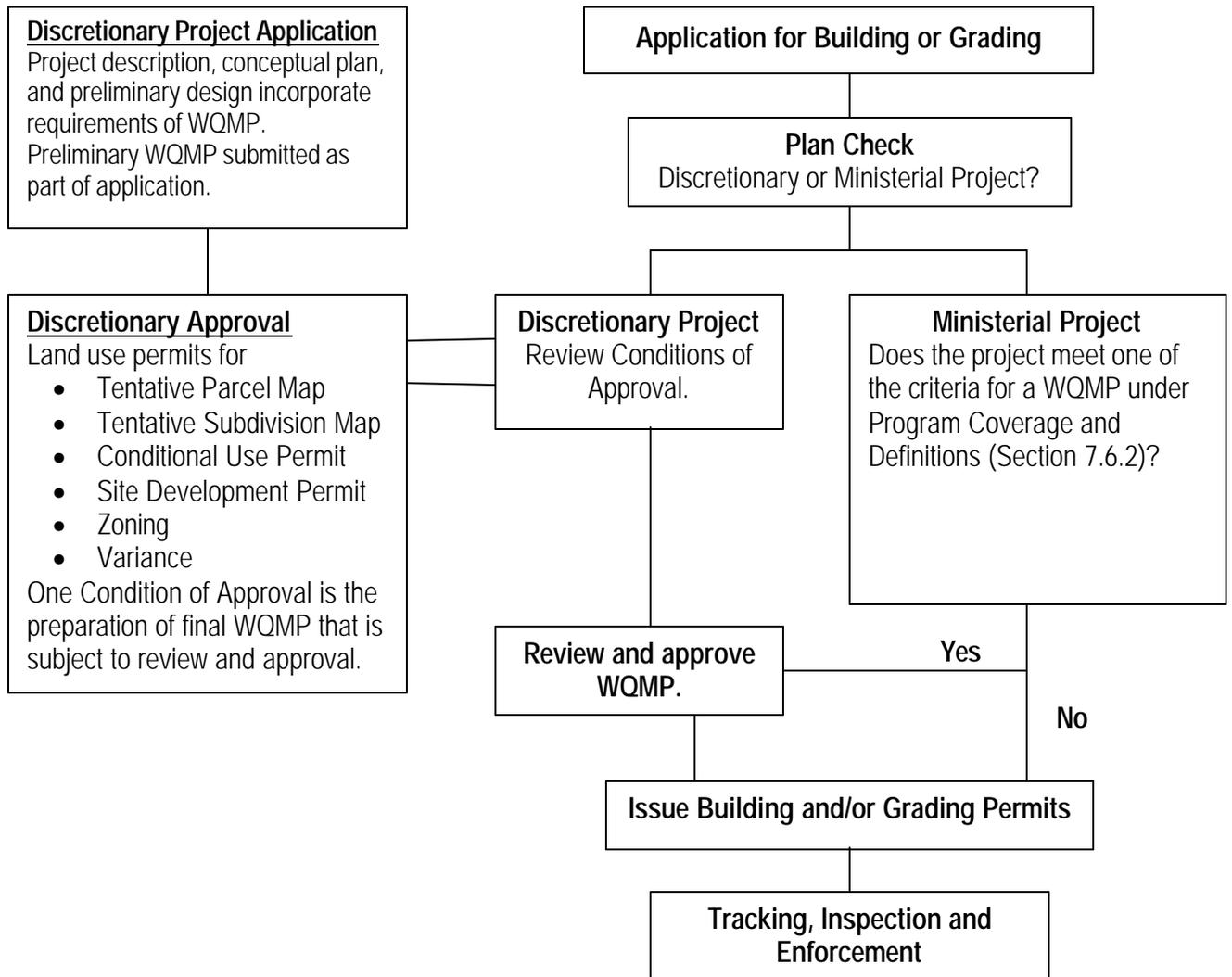
<sup>1</sup> California Public Resources Code § 21080(a); CEQA Guidelines § 15357.

Program Coverage and Definitions (see **Section 7.6.2**), require that the applicant prepare a Project WQMP, whereas ministerial approvals that do not meet these criteria may not necessitate a Project WQMP.

Many projects will be subject to discretionary approval during the planning phase (land use entitlement) and ministerial approval for subsequent grading or building permits. For such projects, Project WQMPs may be submitted initially as “preliminary” or during the discretionary approval process and submitted as “final” prior to approval of a grading or building permit. For projects subject to and consistent with regional or watershed programs, the project may rely upon the approved regional/watershed program document during the entitlement process, and may submit the final Project WQMP documentation in the format approved by the relevant permittee prior to obtaining ministerial permit(s).

### **Figure 7-3. Development Project Review, Approval and Permitting**

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### *Public Agency WQMP Submittal*

The requirement for managing the quality and quantity of stormwater runoff from new development or significant redevelopment applies equally to private sector and public agency projects meeting the minimum requirements. In many public agencies the process for planning, design, approval, and oversight of public facilities differs from the process for private sector development projects. For example, typically private development projects are regulated through a process of a development plan approval (i.e., conditions of approval); building or grading permit applications, and permit conditions. Public agency projects in comparison may undergo design review by the contracting agency of the municipality; may or may not be issued permits or similar administrative authorizations; and are then regulated through the enforcement of contract terms and approved plans and specifications.

Further, the review, approval, and inspection of public agency projects and private sector development projects are frequently performed by different municipal departments. Recognizing the differences in the process, each Permittee will incorporate the requirement for a Project WQMP into the process of planning, design, approval, and oversight of their public agency projects or provide an equivalent approach. Typically, the Permittee's design/engineering department or the design architect/engineer contractor will prepare a WQMP for a public agency project.

Project WQMPs will not be required for public agency projects consisting of routine maintenance or emergency construction activities required to protect public health and safety; interior remodeling with no outside exposure of construction materials or construction waste to stormwater; mechanical permit work; electrical permit work; and sign permit work.

There are eight categories of Priority Projects listed in **Table 7-1**. Although public agencies do not plan and design some of these categories of projects per se, public agency projects may have similar functions or characteristics or may conduct similar activities after construction is completed. Therefore, some public agency projects should be considered Priority Projects. For example, a corporation yard may include a vehicle and equipment maintenance facility, which is very similar to an automotive repair shop. Other examples are a civic center or library that is very similar in its characteristics to that of a commercial office building and a senior citizens center or a jail may have a cafeteria, which is very similar to a restaurant.

For other public agency projects that are not Priority Projects, the Permittees may decide on a project specific basis not to require a WQMP, but may elect instead to require that all routine structural Source Control BMPs applicable to the project features be identified and included in the project, and Site Design BMPs be considered where applicable. Project types include, but are not limited to:

- Parks and recreation facilities
- Public Buildings
- Streets and roadways
- Above ground drainage facilities (e.g. channels and basins)

### 7.6.3 Conditions of Approval

The Permittees will review and revise their standard conditions of approval to ensure that the standard conditions are not in conflict with any provisions of the Santa Ana Region Permit or the San Diego Region Permit (as applicable), the DAMP, California's General Permit for Stormwater Discharges Associated with Construction Activity, California's General Permit for Stormwater Discharges Associated with Industrial Activity and adopted Total Maximum Daily Load allocations within their jurisdiction.

For example, a condition requiring "sweeping or washing public access points within 30 minutes of dirt deposition" should be revised to specify that "washing" must include capture and proper disposal of all wash water. A second example is that a standard condition requiring the applicant of a retail gasoline outlet or automotive vehicle repair facility to demonstrate coverage under the General Permit for Stormwater Discharges Associated with Industrial Activity prior to issuance of a preliminary or precise grading permit should not be used. Retail gasoline outlets and automotive vehicle repair facilities are not required to comply with California's General Permit for Stormwater Discharges Associated with Industrial Activity.

To minimize the short-term and long-term impacts on receiving water quality from new development and significant redevelopment, Permittees will review and revise or supplement their standard conditions of approval that may be used for projects to include the following conditions or the equivalent, as determined appropriate:

#### *General Conditions*

- Prior to the issuance of any grading or building permits (*add grubbing, clearing, surface mining or paving permits as appropriate*) for projects that will result in soil disturbance of one or more acres of land, the applicant shall demonstrate that coverage has been obtained under California's General Permit for Stormwater Discharges Associated with Construction Activity by providing a copy of the Notice of Intent (NOI) submitted to the State Water Resources Control Board and a copy of the subsequent notification of the issuance of a Waste Discharge Identification (WDID) Number or other proof of filing. Projects subject to this requirement shall prepare and implement a Stormwater Pollution Prevention Plan (SWPPP). A copy of the current SWPPP shall be kept at the project site and be available for County review on request.
- Prior to the issuance of any grading or building permits (*add or prior to recordation upon subdivision of land if determined applicable*), the applicant shall submit for review and approval a Project WQMP that:
  - Discusses regional or watershed programs (if applicable)
  - Addresses Site Design BMPs (as applicable) such as minimizing impervious areas, maximizing permeability, minimizing directly connected impervious areas, creating reduced or "zero discharge" areas, and conserving natural areas

- Incorporates the applicable Routine Source Control BMPs as defined in the DAMP
  - Incorporates Treatment Control BMPs as defined in the DAMP
  - Generally describes the long-term operation and maintenance requirements for the Treatment Control BMPs,
  - Identifies the entity that will be responsible for long-term operation and maintenance of the Treatment Control BMPs, and
  - Describes the mechanism for funding the long-term operation and maintenance of the Treatment Control BMPs.
- Prior to grading or building permit close-out and/or the issuance of a certificate of use or a certificate of occupancy, the applicant shall:
    - Demonstrate that all structural best management practices (BMPs) described in the Project WQMP have been constructed and installed in conformance with approved plans and specifications,
    - Demonstrate that applicant is prepared to implement all non-structural BMPs described in the Project WQMP,
    - Demonstrate that an adequate number of copies of the project's approved final Project WQMP are available for the future occupiers,
    - Submit for review and approval an Operations and Maintenance (O&M) Plan for all structural BMPs.

*Projects Adjacent to Beaches and Receiving Waters*

- During the construction phase, the applicant shall comply with the following requirements:
  - All construction materials, wastes, grading or demolition debris, and stockpiles of soil, aggregates, soil amendments, etc. shall be properly covered, stored, and secured to prevent transport into coastal and receiving waters by wind, rain, tracking, tidal erosion or dispersion.

*Projects Adjacent to Beaches*

- Grading and Drainage Plans shall be prepared with the following design objectives:
  - All surface runoff and subsurface drainage shall be directed to the nearest acceptable drainage facility, via sump pumps if necessary, as determined by the Building Official.
  - Onsite surface drainage and subdrain systems shall not discharge over the blufftop or hilltop.
  - All roof drains shall be required to connect into a tight-line drainage pipe or concrete swales that drain to the nearest acceptable drainage facility as determined by the Building Official.
  - Landscaping plans shall utilize only native, drought-tolerant landscape materials.
  - Irrigation system plans shall not include irrigation lines for the bluff-side of the parcel.

- All grading and improvements shall be made in accordance with the Grading Ordinance and to the satisfaction of the Building Official or designee. Grading shall be in substantial compliance with the approved grading plans. Surety to guarantee the completion of grading, erosion and sediment control measures shall be posted satisfactory to the Building Official.

*Projects in Hilly Areas*

- Drainage facilities discharging onto adjacent property shall be designed to imitate the manner in which runoff is currently produced from the project site. Alternatively, the project applicant may obtain a drainage acceptance and maintenance agreement, suitable for recordation, from the owner of said adjacent property

*Industrial Facilities*

- For industrial facilities subject to California's General Permit for Stormwater Discharges Associated with Industrial Activity as defined by Standard Industrial Classification (SIC) code, prior to grading or building permit close-out and/or the issuance of a certificate of use or a certificate of occupancy, the applicant shall demonstrate that coverage under the permit has been obtained providing a copy of the Notice of Intent (NOI) submitted to the State Water Resources Control Board and a copy of the notification of the issuance of a Waste Discharge Identification (WDID) Number or other proof of filing.

*Special Conditions*

- Prior to the issuance of any grading and building permits, the applicant shall include in the plans all BMPs identified in the approved final Project WQMP and any other urban runoff and stormwater pollution control measures deemed necessary by the City/County Planning Director.
- Prior to issuance of certificates of use and occupancy or building permits for individual tenant improvements or construction permits for a tank or pipeline, uses shall be identified and, for specified uses, the applicant shall propose plans and measures for chemical management (including, but not limited to, storage, emergency response, employee training, spill contingencies and disposal). The chemical management measures shall be incorporated as an element of a Project WQMP and shall be subject to the approval of the Planning and Development Services Department and other specified agencies such as the Orange County Fire Authority, the Orange County Health Care Agency and sewerage agencies (as appropriate) to ensure implementation of each agency's respective requirements. Certificates or permits may be ministerially withheld if features needed to properly manage chemicals cannot be incorporated into a previously completed building, center or complex.

### 7.6.4 Review and Approval of WQMPs

Project WQMPs may be submitted as “preliminary” during the discretionary or land use entitlement phase depending upon the level of detail known about the overall project design at the time project approval is sought. However, prior to issuance of grading or building permits, the project applicant must submit the final Project WQMP for review and approval. The review and approval of a final Project WQMP is one of the last critical points at which a Permittee can impose conditions or standards that will minimize the impacts of urban runoff and stormwater pollution on local water resources. The Model WQMP (**Exhibit 7.II**) is expected to be used as a guide for preparation of a Project WQMP. To ensure that Priority Projects, which require the incorporation of Treatment Control BMPs, are properly identified, the Permittees will utilize a checklist to document the identification of a project as a Priority Project or a Non-Priority Project and to assure thorough and consistent reviews of Project WQMPs, the Permittees will utilize a WQMP Review Checklist (see LIP, **DAMP Appendix A-7** for the checklists). The Model WQMP may also be used to aid in review.

#### *WQMP Elements*

The Project WQMP is expected to address water quality BMPs applicable to the project to address pollutants or conditions of concern. The BMPs required vary for Priority Projects versus Non-Priority Projects.

The Project WQMP for a Priority Project must include:

- Regional or watershed programs (if applicable)
- Routine structural and non-structural Source Control BMPs
- Site Design BMPs (as appropriate)
- Treatment Control BMPs (Treatment Control BMP requirements may be met through either project specific (on-site) controls or regional or watershed management controls that provide equivalent or better treatment performance, subject to certain conditions described in the Model WQMP))
- The mechanism(s) by which long-term operation and maintenance of all structural BMPs will be provided.

The Project WQMP for a Non-Priority Project must include:

- Routine structural and non-structural Source Control BMPs
- Site Design BMPs (as appropriate)
- The mechanism(s) by which long-term operation and maintenance of all structural BMPs will be provided.

The categories of stormwater pollution control BMPs (Source Control, Site Design, and Treatment Control) are summarized in **Table 7- 2**, together with applicable projects and primary pollution prevention objectives of the BMPs. Each of the BMP categories is further defined in subsequent sections.

When reviewing Project WQMPs submitted for approval, Permittees will assess the potential project impacts on receiving waters and ensure that the Project WQMP adequately identifies such impacts, including all pollutants and conditions of concern. The Permittees will examine all identified BMPs, as a whole, to ensure that they address the pollutants and conditions of concern identified within the Project WQMP. Additionally, Permittees will consider potential cumulative impacts of build-out within the watershed based upon available watershed chapters of the DAMP (**DAMP Appendix D**), information learned from any CEQA documentation regarding the project, Permittee knowledge of watershed-wide and jurisdictional problems and programs and compliance with the requirements of the Third Term Permits.

The Permittees recognize the importance of understanding the physical, chemical and biological conditions of the receiving waters at a watershed scale and the impact of incremental projects on these conditions and will continue to enlarge their understanding of receiving waters on a watershed scale through implementation of the watershed chapters of the DAMP. This information will assist in providing a strong linkage between the planning process (**Sections 7.4 and 7.5 and Exhibit 7.I**) and the development review and permitting process (**Section 7.6**) as required by the Third Term Permits

The Permittees have initiated watershed-scale assessments in some watersheds for watershed restoration and TMDL purposes, including modeling and other types of evaluations, and will continue efforts to provide forecasting tools that protect water resources from the impacts of new development and significant redevelopment. This information will be compiled and made available as a public database for cumulative impact assessment by the Principal Permittee. A prototype of this database will be developed for a selected watershed, with user guidance, for submittal with the 2003-04 Annual Progress Report. When evaluating the adequacy of a Project WQMP the Permittees will utilize the information gathered and the forecasting tools developed under the watershed scale portion of the program in determining whether the Project WQMP is adequate to protect the water quality of the receiving waters including cumulative effects.

The Project WQMP is a project planning level document and as such is not expected to contain final BMP design drawings and details (these will be in the construction plans). However, the Project WQMP must identify and locate selected BMPs, provide design parameters including hydraulic sizing of treatment BMPs and convey final design concepts. BMP fact sheets can be used in conjunction with project-specific design parameters and sizing to convey design intent. There are a number of resources listed in the Model WQMP for Source Control, Site Design, and Treatment Control BMPs that should be considered to guide the design and implementation of the BMPs. Fact sheets from one available reference - the 2003 California Stormwater Quality Association the California Stormwater Best Management Practice Handbook – New Development and Redevelopment are provided in the Local Implementation Plan (**DAMP Section A-7**). The fact sheets contain detailed descriptions of each BMP, applications, advantages/disadvantages, design criteria, design procedure, and inspection and maintenance requirements to ensure optimal performance of the BMPs

Table 7- 2. Summary of BMPs for Development/Significant Redevelopment Projects

BMP Category		Applicable Projects	Pollution Prevention Objective
Source Control BMPs	Routine Non-Structural BMPs	Required for all projects – as applicable	Prevent pollution by educating the public on proper disposal of hazardous or toxic wastes, regulatory approaches, street sweeping and facility maintenance, and detection and elimination of illicit connections and illegal dumping
	Routine Structural BMPs	Required for the following project features: <ul style="list-style-type: none"> <li>• Private roads</li> <li>• Residential driveways and guest parking</li> <li>• Loading dock areas</li> <li>• Maintenance bays</li> <li>• Vehicle wash areas</li> <li>• Outdoor processing areas</li> <li>• Equipment wash areas</li> <li>• Parking areas</li> <li>• Roadways</li> <li>• Fueling areas</li> <li>• Hillside landscaping</li> <li>• Wash water control for food preparation areas</li> <li>• Community car wash racks</li> </ul>	Prevent potential pollutants from contacting rainwater or stormwater runoff and prevent discharge of contaminated runoff to the storm drain system or receiving waters. Reduce the creation or severity of potential pollutant sources and reduce the alteration of the project site's natural flow regime
Site Design BMPs		Shall incorporate - as appropriate	Minimize or prevent potential pollutants from contacting rainwater or stormwater runoff or to prevent discharge of contaminated runoff to the storm drain system or receiving waters.
Treatment Control BMPs or Regional Program		All priority projects – at least one Treatment Control BMP required	Remove pollutants from stormwater runoff prior to discharge to the storm drain system or receiving waters

### *Structural Source Control BMPs*

Structural Source Control BMPs are low-technology practices designed to prevent pollutants from contacting stormwater runoff or to prevent discharge of contaminated runoff to the storm drainage system. Site-specific structural Source Control BMPs have been established for a number of common site features such as outdoor material storage areas, trash storage, outdoor loading/unloading docks, outdoor repair and maintenance areas, outdoor washing areas, outdoor fueling areas, and parking lots. Typical required design features include berms, covers, screens, signage, grading, sanitary sewer connections, and emergency storm drain seals. Fact sheets detailing these BMPs are presented in the Local Implementation Plan (**DAMP Section A-7**). The fact sheets include design criteria established to ensure effective implementation of the required Source Control BMPs.

### *Site Design BMPs*

Site Design BMPs prevent pollution of stormwater by minimizing the introduction of pollutants and conditions of concern that may result in significant impacts generated from site runoff to the stormwater conveyance system. Site Design BMPs shall be implemented, as appropriate, for all projects including regional or watershed programs. Site Design BMPs include the following design features and considerations:

- Control Peak Stormwater Runoff Discharge Rates
- Minimize Project's Impervious Footprint
- Conserve Natural Areas
- Minimize Directly Connected Impervious Areas (DCIAs)
- Protect Slopes and Channels

Fact sheets are presented in the Local Implementation Plan (**DAMP Appendix A-7**). The fact sheets include design criteria established to ensure effective implementation of the required Site Design BMPs.

### *Treatment Control BMPs*

Treatment Control BMPs are engineered technologies designed to remove pollutants from stormwater runoff and are required to augment Source Control and Site Design BMPs for Priority Projects to eliminate or reduce pollution from stormwater discharges. The type of Treatment Control BMP(s) to be implemented at a site depends on a number of factors including: type of pollutants in the stormwater runoff, volume or flow of stormwater runoff to be treated, project site conditions, receiving water conditions, and General Industrial Permit requirements, when applicable. Land requirements, and costs to design, construct and maintain Treatment Control BMPs vary by Treatment Control BMP.

Fact sheets are presented in the Local Implementation Plan (**DAMP Appendix A-7**). The fact sheets include design criteria established to ensure effective implementation of the required Treatment Control BMPs.

### *Regional or Watershed BMPs*

Regional or watershed BMPs that are designed to address runoff from new development and significant redevelopment projects may be used to meet the treatment BMP requirement. If this method is selected, the BMPs must be designed to provide equivalent treatment objectives for the new development and significant redevelopment projects for the entire area or the new development and significant redevelopment projects served by the regional or watershed BMPs. Detailed analysis (such as detailed planning and modeling) should be employed and cross-jurisdictional issues must be clearly defined and coordinated.

### *BMP Design Standards*

An intensive search was conducted in order to find agencies that may have developed standard plans (details) for Treatment Control BMPs. The search concluded that many entities throughout the country that have developed graphic depictions of Treatment Control BMPs, but no standard plan-level details have been developed at this time.

The California Department of Transportation (Caltrans) has “as-built” drawings for their pilot treatment BMPs. The “as-built” drawings are available directly from Caltrans. Design guidelines and detailed schematics are available from several sources including EPA (various dates), the Urban Drainage and Flood Control District (Denver Colorado, September 1999), and the Caltrans Project Planning and Design Guide (May 2002). These references provide schematics for biofilters (grass swales), extended detention basins, sand filters, wetlands, and other treatment BMPs. No standard BMP plans have been adopted by any of the Permittees.

One reference for designing permanent BMPs is the 2003 California Stormwater Best Management Practice Handbook – New Development and Redevelopment . Many other resources available for consultation are listed in the Model WQMP (**Exhibit 7.II Attachment D**).

### 7.6.5 Plan Check: Issuance of Grading or Building Permits

Once a project reaches the plan check phase, the applicant must have an approved final Project WQMP, since the construction plans submitted by the applicant for plan check must incorporate all of the structural BMPs identified in the approved final Project WQMP. Therefore, the Permittees will encourage (but not necessarily require) applicants to obtain approval of the project’s final Project WQMP prior to submitting construction plans for plan check.

#### *Standard Notes for Plan Sheets*

Prior to the issuance of a grading or building permit, Permittees shall require the permit applicant to include the following as general or special notes on the plan sheets for new development or significant redevelopment projects:

- Sediment from areas disturbed by construction shall be retained on site using structural controls as required by the statewide General Construction Stormwater Permit.
- Stockpiles of soil shall be properly contained to eliminate or reduce sediment transport from the site to streets, drainage facilities or adjacent properties via runoff, vehicle tracking, or wind as required by the statewide General Construction Stormwater Permit.
- Appropriate BMPs for construction-related materials, wastes, spills or residues shall be implemented to eliminate or reduce transport from the site to streets, drainage facilities, or adjoining properties by wind or runoff as required by the statewide General Construction Stormwater Permit.
- Runoff from equipment and vehicle washing shall be contained at construction sites and must not be discharged to receiving waters or the local storm drain system.

- All construction contractor and subcontractor personnel are to be made aware of the required best management practices and good housekeeping measures for the project site and any associated construction staging areas.
- At the end of each day of construction activity all construction debris and waste materials shall be collected and properly disposed in trash or recycle bins.
- Construction sites shall be maintained in such a condition that a storm does not carry wastes or pollutants off the site. Discharges other than stormwater (non-stormwater discharges) are prohibited, except as authorized by an individual NPDES permit or the statewide General Construction Stormwater Permit.

Potential pollutants include but are not limited to: solid or liquid chemical spills; wastes from paints, stains, sealants, solvents, detergents, glues, lime, pesticides, herbicides, fertilizers, wood preservatives, and asbestos fibers, paint flakes or stucco fragments; fuels, oils, lubricants, and hydraulic, radiator or battery fluids; concrete and related cutting or curing residues; floatable wastes; wastes from engine/equipment steam cleaning or chemical degreasing; wastes from street cleaning; and super-chlorinated potable water from line flushing and testing.

During construction, disposal of such materials should occur in a specified and controlled temporary area on-site physically separated from potential stormwater runoff, with ultimate disposal in accordance with local, state and federal requirements.

- Discharging contaminated groundwater produced by dewatering groundwater that has infiltrated into the construction site is prohibited. Discharging of contaminated soils via surface erosion is also prohibited. Discharging non-contaminated groundwater produced by dewatering activities requires a National Pollutant Discharge Elimination System (NPDES) permit from the respective State Regional Water Quality Control Board.

### *Plan Check for Projects with Land Use Permits*

For projects with land use permits, the environmental (CEQA) documentation (including the Mitigation Monitoring and Reporting Program), the conditions of approval, and the approved final Project WQMP shall be reviewed for an understanding of the water quality issues and structural BMPs required. Construction plans shall be reviewed for conformity with the project's approved final Project WQMP. If the selected BMPs were approved in concept during the land use entitlement process, the applicant shall submit detailed construction plans showing locations and design details of all BMPs that are in substantial conformance with the preliminary approvals. The construction plans shall be reviewed to assure that the plans are consistent with the BMP design criteria and guidance provided in **Exhibit 7.II**.

### *Plan Check for Projects with By-Right Zoning (Ministerial Projects)*

For projects with by-right zoning or projects that do not need discretionary review, applicants will typically submit a grading or building permit application consisting of a proposed Project

WQMP and construction plans that incorporate the BMPs included in the proposed Project WQMP. The Permittee shall first review the proposed Project WQMP for conformity with the requirements described in **Exhibit 7.II**. The approved Project WQMP shall then be used in reviewing the construction plans for consistency with the BMP design criteria and guidance provided in **Exhibit 7.II**.

*Design Review for Public Agency Projects*

Prior to initiating grading or construction activities, Permittees shall ensure that the construction plans for public works projects reflect the structural BMPs described in the approved final Project WQMP. The design review for public agency projects shall include a review of construction plans and specifications for conformity with the approved final Project WQMP and for consistency with the BMP design criteria and guidance provided in **Exhibit 7.II**.

*Plan Check for Projects with Alternative Treatment Control BMPs (see **Exhibit 7.II, Section 3.3.4**)*

An applicant may choose to incorporate into a Project WQMP and construction plans Treatment Control BMPs that are not included in the Treatment Control BMP Selection Matrix provided in the Model WQMP. If an applicant chooses to utilize Alternative Treatment Control BMPs, the Permittee shall require the project's engineer of record to certify the Alternative Treatment Control BMPs as being equally or more effective in pollutant reduction than comparable BMPs found in the Model WQMP.

**7.6.6** Permit Closeout, Certificates of Use, and Certificates of Occupancy

The Project WQMP continues with the property after the completion of the construction phase and the Permittees may require that the terms, conditions and requirements be recorded with the County Recorder's office by the property owner or any successive owner as authorized by the Water Quality Ordinance. In lieu of recordation the Permittee may require the Project WQMP to include a Notice of Transfer Responsibility Form, which serves to notify the Permittee that a change in ownership has occurred and notify the new owner of its responsibility to continue implementing the Project WQMP. The end of the construction phase therefore represents a transition from the New Development/Significant Redevelopment Program to the Existing Development Program (**DAMP Section 9**). Accompanying this is a close out of permits and issuance of certificates of use and occupancy. The Permittees will use this juncture to assure satisfactory completion of all requirements in the Project WQMP by requiring the applicant to:

- Demonstrate that all structural BMPs described in the Project WQMP have been constructed and installed in conformance with approved plans and specifications,
- Prepare and submit for review and approval by the Permittee an O&M Plan for all structural BMPs,

- Demonstrate that a mechanism or agreement acceptable to the Permittee has been executed for the long-term funding and performance of BMP operation, maintenance, repair, and/or replacement.
- Demonstrate that the applicant is prepared to implement all non-structural BMPs described in the Project WQMP,
- Demonstrate that an adequate number of copies of the Project WQMP are available onsite, and
- For industrial facilities subject to California's General Permit for Stormwater Discharges Associated with Industrial Activity as defined by Standard Industrial Classification (SIC) code, demonstrate that coverage has been obtained by providing a copy of the Notice of Intent (NOI) submitted to the State Water Resources Control Board and a copy of the notification of the issuance of a Waste Discharge Identification (WDID) Number.

An approved final Project WQMP defines the permanent (post-construction) BMPs that will be implemented to provide long-term runoff management once the project is operational or occupied, and also describes the mechanism by which long-term operation and maintenance will be provided. A structural BMP is not considered effective unless a mechanism is in place to provide for long-term reliability, which is achieved through proper operation and maintenance. Therefore, once construction of a new development or significant redevelopment project is complete, assurance is required for the long-term operation and maintenance of structural BMPs, and most particularly for Treatment Control BMPs.

An O&M Plan for structural BMPs will be prepared by the applicant for private sector projects or by a Permittee's design/engineering department or the design architect/engineer contractor for public agency projects.

The O&M Plan that is prepared by the applicant for private sector projects shall include:

- Description of structural BMPs
- Description of employee responsibilities and training for BMP operation and maintenance
- Operating schedule
- Inspection/maintenance frequency and schedule
- Specific maintenance activities
- Required permits from resource agencies, if any
- Forms to be used in documenting maintenance activities
- Recordkeeping requirements (at least 5 years)

At a minimum, an annual inspection frequency will be established for all structural BMPs including inspection and performance of any required maintenance in the late summer/early fall, prior to the start of the rainy season.

The ownership, operation, and maintenance of structural BMPs may be the responsibility of a private entity or a public agency (for example, a Permittee) under various arrangements and with various funding sources. The responsibility to provide for the long-term operation and maintenance of structural BMPs associated with private development projects may:

- Remain with a private entity (property owner, home owners association, etc.); or
- Be transferred to a public entity (e.g., a city, county, special district, etc.) through dedication of the property; or
- Be transferred to a public entity, or another private party through a contract.

Following satisfactory inspection, the Permittee will accept structural BMPs within public right-of-ways, or on land dedicated to public ownership. Upon acceptance, responsibility for operation and maintenance will transfer from the developer or contractor to the appropriate Permittee department, including the funding mechanism identified in the approved final Project WQMP. If a property owner or a private entity, such as a homeowners association (HOA), retains or assumes responsibility for operation and maintenance of structural BMPs, the Permittee shall require access for inspection through an agreement.

If the Permittee will be responsible for operating and maintaining structural BMPs on private property, an easement will be established to allow for entry and proper management of the BMPs. Such access easements shall be binding throughout the life of the project, or until the BMPs requiring access are acceptably replaced with a BMP not requiring access. Funding for the long-term operation and maintenance of structural BMPs will be front-funded, or otherwise guaranteed via mechanisms such as approved assessment districts, or other funding mechanisms.

### *Public Agency Projects*

For public agency projects, upon completion of construction when contract close-out occurs the responsibility for operation and maintenance of the structural BMPs will transfer from the contractor to the appropriate Permittee department and become part of the Municipal Activities Program (**DAMP Section 5**). The Permittee has the authority to approve the transfer of structural BMPs to any other public entity within its jurisdiction and shall negotiate satisfactory operation and maintenance standards with the public agencies accepting the operation and maintenance responsibilities. Alternatively, the responsibility for the operation and maintenance of structural BMPs may be transferred to a private entity through contracts or lease agreements. In any such transfer agreement, the Permittee shall be identified as a third-party beneficiary empowered to enforce maintenance agreements.

### **7.7 Post Construction BMP Inspection and Verification**

Verification of the implementation and O&M of structural and non-structural BMPs will be performed by the Permittee. Assessment of BMP effectiveness will take place during verification.

The City/County will perform verification at 90% of developments with approved final Project WQMPs. The number of verifications necessary to achieve the above goal will be based on either the total area of approved final Project WQMP projects, or the total number of Project WQMPs approved. The implementation of BMPs, and ongoing maintenance of BMPs by the mechanisms described in the Project WQMP will be verified.

Verification of BMP implementation and ongoing O&M will be conducted by inspection, self-certifications, surveys, or other equally effective approaches. An assessment report will be produced each year describing BMP implementation and ongoing O&M effectiveness, for submittal with the Permittee's annual progress report.

Verification of BMP implementation of Public Agency Projects will be incorporated into each Permittees Municipal Activities Program.

## **7.8 Model Program Training and Outreach**

Education and training of municipal and/or other agency staff is one of the keys to a successful stormwater program. To assist the responsible municipal and private development staff in understanding the Model Program, two training modules are currently being developed and will be held by the Principal Permittee (**DAMP Appendix B-7**).

In addition to the Permittee sponsored training, the Permittees are also encouraged to attend training seminars or workshops related to stormwater management and water quality conducted by other organizations.

### 7.8.1 Training Modules

Two training modules have been prepared that cover different aspects of the Model Program. These modules are provided in **DAMP Appendix B-7**.

*New Development/Significant Redevelopment Program Management (DAMP Appendix B, Exhibit B-7.I)*

This training module is generally targeted for Permittee Stormwater Program managers and the managers of a Permittee's planning and building departments. It provides an overview of the Stormwater Program as it pertains to a Permittee's General Plan, the preparation and review of environmental documents (Initial Studies, EIRs, EISs, Negative Declarations, Mitigated Negative Declarations, etc.), conditions of approval for projects, the review of Project WQMPs, plan check, and permit closeout. The training module also briefly describes a Permittee's responsibility for verifying and inspecting permanent BMPs and for assessing the effectiveness of the New Development/Significant Redevelopment Program element.

*Project Planning and Design: Environmental Review, Planning and Permitting, and WQMP Development (DAMP Appendix B, Exhibit B.7.II)*

This training module is generally targeted for planners, plan checkers, developers and engineers, and will address: the laws and regulations applicable to new development and significant redevelopment; the connection between new development and significant redevelopment and water quality; how to review and prepare CEQA compliance documents with regard to urban runoff and stormwater pollution effects, how to develop and review a Project WQMP; and how to design and incorporate into a project Source Control, Site Design and Treatment Control BMPs to minimize impact to receiving waters.

## 7.9 Program Effectiveness Assessment

The overall Program Effectiveness Assessment (PEA) serves as the foundation for the submittal of the Annual Progress report that is submitted each year to the Principal Permittee and subsequently to the Regional Boards and serves as the basis for evaluating each municipality's individual new development and significant redevelopment efforts (See **DAMP Appendix C-7**).

By completing the effectiveness assessment, the Permittees will each have a baseline by which they can compare subsequent evaluations and identify trends. This information can then be used to determine where modifications within the program may be necessary and ensures that the iterative evaluation and improvement process is applied to the program component and used as an effective management tool.

**DAMP EXHIBIT 7.I**

**GUIDANCE FOR PREPARING AND REVIEWING CEQA INITIAL STUDIES AND ENVIRONMENTAL IMPACT REPORTS (EIRS)**

## 7.I - 1 Guidance for Preparing and Reviewing CEQA Initial Studies

### Step 1: Consider the project characteristics as provided by the applicant

Review the project application and draft plan submittals, including location in a given watershed, site acreage, change in percent impervious surface area, and BMPs to be incorporated into the project design (from applicant's preliminary WQMP if available). It may be helpful to review **Table 7-I.1**, Priority Projects Categories. This table identifies "priority projects" that must address the full range of BMPs in their project designs, due to their potential to contribute pollutants in stormwater discharges. Accordingly, applications for projects that fall into one of these categories should be carefully reviewed for potential stormwater/urban runoff impacts.

**Table 7-I.1 Priority Projects Categories**

1. Residential development of 10 units or more
2. Commercial and industrial development greater than 100,000 square feet including parking areas
3. Automotive repair shop (SIC codes 5013, 5014, 5541, 7532-7534, and 7536-7539)
4. Restaurant where the land area of development is 5,000 square feet or more including parking areas (SIC code 5812)
5. <b>For San Diego Region</b> - Hillside development greater than 5,000 square feet <b>For Santa Ana Region</b> - Hillside development on 10,000 square feet or more, which is located on areas with known erosive soil conditions or where natural slope in 25 percent or more
6. Impervious surface of 2,500 square feet or more located within, directly adjacent to (within 200 feet), or discharging directly to receiving water within Environmentally Sensitive Areas <sup>1</sup> .
7. Parking lot area of 5,000 square feet or more, or with 15 or more parking spaces, and potentially exposed to urban runoff
8. <b>For San Diego Region</b> - Streets, roads, highways, and freeways which would create a new paved surface that is 5,000 square feet or greater
9. <b>For Santa Ana Region</b> - All significant redevelopment <sup>2</sup> projects, where significant redevelopment is defined as the addition of 5,000 or more square feet of impervious surface on an already developed site

<sup>1</sup> Environmentally sensitive areas are shown in maps available from the County and Cities

<sup>2</sup> "Significant Redevelopment" in the Santa Ana Regional Board area means:

*Development that would create or add 5,000 square feet or more of impervious surfaces on an already developed site. Significant redevelopment includes, but is not limited to:*

? *Expansion of a building footprint*

? *Addition of a building and/or structure*

? *Addition of an impervious surface that is not part of a routine maintenance activity such as construction of a new parking lot*

? *Replacement of impervious surfaces, buildings and/or structures when 5000 or more square feet of soil is exposed during replacement construction. Replacement does not include routine maintenance activities, trenching and resurfacing associated with utility work, resurfacing and reconfiguring the surface of parking lots (unless 5000 or more square feet of impervious surface is added to the existing parking lot area) or reconfiguration of pedestrian ramps and replacement of damaged pavement.*

## Step 2: Identify receiving waters

Review maps to identify all receiving waters that may receive runoff from the project site. This includes canyon drainages, natural open channels, lined drainage channels, storm drains, springs, creeks (ephemeral, perennial, intermittent), rivers, lakes, estuaries, lagoons, bays, surface reservoirs, groundwater basins, and the ocean. Available maps include General Plan (Resources Element), USGS topographic maps, RWQCB Water Quality Control Plan (Basin Plan), and NPDES flood control and Environmentally Sensitive Area (ESA) maps. Review of aerial photos, if available, may also be helpful.

## Step 3: Determine the sensitivity of the receiving waters

Many sensitive receiving waters exist in Orange County and are regulated by a variety of federal, state and local laws and regulations. The ESA maps identify the location of Areas of Special Biological Significance, 303(d) listed impaired water bodies and additional water bodies specified by the San Diego Regional Board. Several of the County's water bodies are currently listed as impaired and the Regional Boards have or are in the process of establishing a Total Maximum Daily Loads (TMDLs) for these water bodies. Some are also subject to a Regional Board 13225 Directive. **Table 7-I.2** shows the 2002 303(d) of water quality limited receiving water segments and the pollutant listing(s) associated with the segment. The RWQCB Basin

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*Where the significant redevelopment results in an increase of less than fifty percent of the impervious surface of a previously existing development, the treatment requirements apply only to the addition, and not to the entire development. In this circumstance, the County will work with the project proponent ways by which Treatment Control BMPs can be provided for the entire site (or a greater percentage of the site), consistent with the overall pollution reduction goals of the Third Term Permits and DAMP, of which this LIP is a part.*

*Where the significant redevelopment results in an increase of fifty percent or more of the impervious surface of a previously existing development, the treatment requirements apply to the entire development.*

“Significant Redevelopment” in the San Diego Regional Board area means:  
*Development that would create or add at least 5,000 square feet of impervious surfaces on an already developed site. Significant redevelopment includes, but is not limited to:*

- ? *Expansion of a building footprint*
- ? *Addition to or replacement of a structure*
- ? *Replacement of an impervious surface that is not part of a routine maintenance activity*
- ? *Land disturbing activities related with structural or impervious surfaces.*

*Replacement of impervious surfaces includes any activity that is not part of a routine maintenance activity where impervious material(s) are removed, exposing underlying soil during construction. Significant redevelopment does not include trenching and resurfacing associated with utility work; resurfacing and reconfiguring surface parking lots; new sidewalk construction, pedestrian ramps, or bike lane on public and private existing roads; and replacement of damaged pavement.*

*Significant Redevelopment projects may fall into one of several categories:*

- ? *Following redevelopment, the entire development (including the redeveloped area) would meet one of the Project Priority categories listed in **Figure A-7.2**. The project would be considered a Priority Project and require a WQMP including treatment controls. Where the significant redevelopment results in an increase of less than fifty percent of the impervious surface of a previously existing development, and the existing development was not subject to WQMP requirements, the treatment requirements apply only to the addition, and not to the entire development.*
- ? *Following redevelopment, the entire development (including the redeveloped area) would not meet one of the Project Priority categories listed in **Figure A-7.2**, but would require discretionary action that will include a precise plan of development, or require issuance of a non-residential plumbing permit. The project would be considered a Non-Priority Project and require a WQMP but would not require treatment controls.*
- ? *The redevelopment activity would not result in a Priority Project and would not require discretionary action that will include a precise plan of development or issuance of a non-residential plumbing permit. The project would not require a WQMP.*

Plans should also be used to identify Beneficial Uses and Water Quality Objectives of the receiving waters, and may further identify sensitive water resources.

Step 4: Characterize the potential water quality impacts

New development and significant redevelopment can be expected to generate potential pollutants in stormwater runoff. **Table 7-I.3** provides a summary of potential pollutants generated by land use type. This table can be used to identify the pollutants expected to be generated by a proposed project. Compare the list of pollutants for which the receiving water(s) are impaired (303(d) listed) and for which a TMDL exists or is proposed. Also, consider other applicable Regional Board Directives for a receiving water, as well as specific narrative and numeric Water Quality Objectives for the receiving water outlined in the Basin Plan. Where a proposed project is expected to generate specific pollutants that are subject to a TMDL, Directive or other water quality objectives, then a potential impact to receiving water quality may be expected but may be shown not to exist after focused analysis during the CEQA process.

**Table 7-I.2  
Summary of the 2002 303(d) Listed Water Bodies and Associated Pollutants of Concern for Orange County\***

Region	Water Body	Watershed	Pollutant							
			Bacteria Indicators/ Pathogens	Metals	Nutrients	Pesticides	Toxicity	Trash	Salinity/ID S/ Chlorides	Turbidity
Region 8 Santa Ana	Anaheim Bay	C		X		X				
	Bolsa Chica	C		X						
	Buck Gully Creek	H	X							
	Huntington Beach State Park	C	X							
	Huntington Harbour	D	X	X		X				
	Los Trancos Creek (Crystal Cove Creek)	H	X							
	Newport Bay, Lower	G		X		X				
	Newport Bay, Upper (Ecological Reserve)	G		X		X				
	Orange County Beaches	Varies								
	San Diego Creek, Reach 1	F	X			X				
	San Diego Creek, Reach 2	F		X			X			
	Santiago Creek, Reach 4								X	
	Seal Beach	A	X							
Silverado Creek	E	X						X		
Region 9 San Diego	Aliso Creek (Mouth)	J	X							
	Aliso Creek (19 Miles)	J	X		X		X			
	Dana Point Harbor	K	X							
	Pacific Ocean Shoreline, Aliso Beach HSA	J	X							
	Pacific Ocean Shoreline, Dana Point HSA	K	X							
	Pacific Ocean Shoreline, Laguna Beach and San Joaquin Hills HSAs	I	X							
	Pacific Ocean Shoreline, Lower San Juan HSA	L	X							
	Pacific Ocean Shoreline, San Clemente, San Mateo, and San Onofre HSAs	M	X							
	Prima Deshecha Creek	M			X					X
	San Juan Creek (Lower one Mile)	L	X							
	San Juan Creek (Mouth)	L	X							
	Segunda Deshecha Creek	M			X					X

Table 7-1.3 Anticipated and Potential Pollutants Generated by Land Use Type

Priority Project Categories and/or Project Features	General Pollutant Categories								
	Bacteria/Virus	Heavy Metals	Nutrients	Pesticides	Organic Compounds	Sediments	Trash & Debris	Oxygen Demanding Substances	Oil & Grease
Detached Residential Development	X		X	X		X	X	X	X
Attached Residential Development	P		X	X		X	X	P <sup>(1)</sup>	P <sup>(2)</sup>
Commercial/ Industrial Development >100,000 ft <sup>2</sup>	P <sup>(3)</sup>	P	P <sup>(1)</sup>	P <sup>(1)</sup>	P <sup>(5)</sup>	P <sup>(1)</sup>	X	P <sup>(1)</sup>	X
Automotive Repair Shops		P			X <sup>(4,5)</sup>		X		X
Restaurants	X						X	X	X
Hillside Development >5,000 ft <sup>2</sup> In SDRWQCB	X		X	X		X	X	X	X
Hillside Development >10,000 ft <sup>2</sup> In SARWQCB	X		X	X		X	X	X	X
Parking Lots	P <sup>(6)</sup>	X	P <sup>(1)</sup>	P <sup>(1)</sup>	X <sup>(4)</sup>	P <sup>(1)</sup>	X	P <sup>(1)</sup>	X
Streets, Highways & Freeways	P <sup>(6)</sup>	X	P <sup>(1)</sup>	P <sup>(1)</sup>	X <sup>(4)</sup>	X	X	P <sup>(1)</sup>	X

X = anticipated.

P = potential

(1) A potential pollutant if landscaping or open area exist on-site.

(2) A potential pollutant if the project includes uncovered parking areas.

(3) A potential pollutant if land use involves food or animal waste products.

(4) Including petroleum hydrocarbons.

(5) Including solvents.

(6) Analyses of pavement runoff routinely exhibit bacterial indicators.

### Step 5: Identify hydrologic conditions of concern

Common impacts to the hydrologic regime resulting from new development include increased runoff volume and velocity; reduced infiltration; increased flow frequency, duration, and peaks; faster time to reach peak flow; and water quality degradation. These hydrologic changes in a watershed have the potential to increase erosion and sedimentation in downstream channels as well as impact downstream aquatic habitats due changes in resulting water quality (increased dilution effects, increased sedimentation, etc). A change to a project site's hydrologic regime would be considered a condition of concern if the change would have a significant impact on downstream natural channels and habitat integrity, alone or in conjunction with impacts of other projects.

The extent that downstream receiving waters are natural, partially-improved, or fully-improved channels, sensitive natural receiving waters and drainages, etc, should be considered along with the potential for the project to generate significant increases in runoff volume (e.g. major changes in the percent of pervious surface area to be converted to impervious area).

### Step 6: Assess project impact significance to water quality

Review the list of stormwater/urban runoff water quality considerations provided in the Third Term Permits in light of the project location, sensitivity of receiving waters, project features and proposed BMPs, and the potential for project runoff to impact water quality without additional mitigation measures. In many cases, potential short-term construction impacts and long-term (post-construction) impacts to receiving water quality may be considered less than significant with incorporation of BMPs into project plans (e.g. project WQMP).

The review will consider the required short-term construction site BMPs (specified in the Construction Model Program) and permanent BMPs specified in the applicant's preliminary WQMP prepared for a project (if applicable). The assessment will be coordinated with staff from the City's Public Works Department and Principal Permittee, as necessary, to determine the probable effectiveness of the construction BMPs and the WQMP in controlling pollutants in stormwater discharges.

Construction site BMPs and BMPs specified in WQMPs are implemented to eliminate or reduce the introduction of pollutants into the municipal storm drain system to achieve the appropriate standard, as specified in the Third Term Permits. Meeting the standards set forth in the Third Term Permits may not, in all circumstances, result in mitigation to a level of insignificance under CEQA and/or may not satisfy other regulatory requirements (e.g. Clean Water Act (CWA) Sections 401 or 404 and California Department of Fish and Game Code 1601).

There may be occasions when a proposed project would create a stormwater quality impact that cannot be mitigated though the use of BMPs specified in the draft WQMP. For example, a large-scale residential development constructed in an undeveloped area (pervious surfaces) draining to an impaired water body or Area of Special Biological Significance may not be susceptible to full mitigation under CEQA despite full implementation of BMPs to the standards required by the Third Term Permits. Additional mitigation measures and BMPs could be required as part of the CEQA document in order to reduce potential water quality impacts to less than significant levels or the project may result in significant unmitigatable impacts which could be subject to a statement of overriding considerations under CEQA.

Other possible mitigation may be required as a result of compliance with Clean Water Act Section 404 Permit, Section 401 Water Quality Certification, and CDFG Code 1601 Streambed Alteration Agreements, if required. These permit compliance requirements may be discussed in the biological resources sections of CEQA documents, but should be considered in the water quality impact analysis. If no additional measures can be identified, the analysis must conclude that the project would be expected to create a significant impact on receiving water quality.

## **7.I - 2 Guidance for Preparing and Reviewing CEQA Environmental Impact Reports (EIRs)**

In addition to the guidance provided in Section 7.I.1, the following additional considerations pertain to the EIR preparation and review process:

### Thresholds of Significance

A threshold of significance is an identifiable quantitative, qualitative or performance level of a particular environmental effect, non-compliance with which means the effect will normally be determined to be significant by the agency and compliance with which means the effect normally will be determined to be less than significant. The Santa Ana and San Diego Regional Boards have not identified specific quantitative criteria that can be used to determine the level of significance of urban and stormwater runoff impacts from a project. However, the Third Term Permits provide qualitative considerations for assessing stormwater/urban runoff impacts that may be used as thresholds of significance with respect to stormwater discharge/urban runoff impacts to water quality. The Permittees may use the CEQA Initial Study Checklist Questions under Hydrology/Water Quality as thresholds of significance. The Permittees will continue or consider using the CEQA Initial Study checklist questions and may enhance the list with the Third Term Permit considerations as specified by the Santa Ana and San Diego Regional Boards.

### Quantitative Water Quality Analysis

If a proposed project has the potential to create a major new stormwater discharge<sup>3</sup> to a water body with an established TMDL, the Permittees may require that the EIR include a quantitative analysis of the anticipated pollutant loads in the stormwater discharges to the receiving waters. This type of analysis will be prepared by an environmental specialist with experience or training in hydrology, sediment transport and pollutant load calculations. Such an analysis is likely to be provided in conjunction with an applicant's preliminary WQMP (if applicable) prepared for major land development projects. For private sector projects, the quantitative analysis will be reviewed by Permittee staff familiar with the NPDES stormwater program and water quality issues within the jurisdiction. In some instances, the Permittee may also seek review by the Principal Permittee. For public sector projects, each Permittee may prepare the quantitative analysis in-house or contract it out to consulting environmental specialists. However, a similar review process will be followed.

### Cumulative Impact Assessment

As required by CEQA, an EIR must include a reasonable analysis of the cumulative impacts of a proposed project together with past, present and reasonably anticipated future projects (related

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<sup>3</sup> Major land development project that has the potential to convert large amounts of pervious land surface to impervious surface area.

projects) that could produce cumulative impacts with the proposed project. For the stormwater quality cumulative impact assessment, the Permittees will consider both land development projects and water resource projects (e.g. reservoir storage project, diversion project, flood control project, detention basin, etc). In lieu of a list of anticipated land development projects, a summary of projections contained in an adopted general plan or other related planning documents may be used. Additionally, Permittees will consider potential cumulative impacts of build-out within the watershed based upon available watershed chapters of the DAMP (**DAMP Appendix D**), information learned from any CEQA documentation regarding the project, Permittee knowledge of watershed-wide and jurisdictional problems and programs and compliance with the requirements of the Third Term NPDES Permits. A public database for cumulative impact assessment is under development by the Principal Permittee. Identification of water resource projects may be coordinated through each Permittee, the Principal Permittee, local water districts, and local districts of the U.S. Army Corps of Engineers and California Department of Fish and Game.

The cumulative impact discussion need not provide as much detail as is provided for the proposed project impact analysis, but must be guided by the standards of practicality and reasonableness (CEQA Guidelines Section 15130(b)). The discussion should include a summary of the expected environmental effects to be produced by the proposed project and a reasonable analysis of the cumulative impacts of the proposed project together with the related projects or plan projection summaries. The cumulative impact assessment for stormwater quality impacts will include among other things, descriptions of new sources of stormwater runoff from new land development projects that would carry pollutants to local receiving waters; elimination of a critical riparian or wetland areas that could have an adverse effects on water quality; descriptions of water resource projects that together with the proposed project could cumulatively impact volume of flow in the receiving water. The discussion should also contain reasonable options for mitigating or avoiding any significant cumulative effects of the proposed project together with a related project.

#### Project Features versus Mitigation Measures

Project features related to water quality, such as construction site BMPs and post-construction (permanent) BMPs, preservation of open space areas as well as compliance with ordinances and regulatory permits such as grading and water quality ordinances, Clean Water Act Sections 401 (Water Quality Certifications) and Section 404, and California Department of Fish and Game Code Section 1600, should be identified up front in the project description and regulatory compliance sections of the EIR, and therefore, not included as mitigation measures. Project features may be included as mitigation measures if requested by an agency or the public as a means to identify and track a responsible party to ensure that specific project features are completed. It may be determined that the short-term construction BMPs or permanent BMPs included as part of the applicant's preliminary WQMP (if applicable) may not, in all cases, reduce a potential impact to below a level of significance. In such cases, additional mitigation measures and BMPs, if available and reasonable, will be identified and incorporated into the CEQA document as mitigation measures to be included in the applicant's final WQMP.

#### Mitigation Monitoring and Reporting Plan

Reporting generally consists of a written compliance review that is presented to the decision-making body or authorized staff person. A report may be required at various stages of a

project. Reporting is suited to projects that have readily involved regular review under some other law or ordinance. (Public Resources Code §15097(c)(1)). Monitoring is generally an ongoing process of project oversight and is suited to projects with complex mitigation that exceed the expertise of the local agency's expertise, expected to be implemented over a period of time, or require careful implementation to assure compliance (Public Resources Code §15097(c)(2)).

The mitigation monitoring and reporting program contained in any Permittee's certified EIR will be reviewed during the plan check process to ensure that all mitigation measures are incorporated into the final project plans, including the erosion control plan or storm water pollution prevention plan for the construction phase and the WQMP (if applicable) for the post-development phase. Final mitigation monitoring and reporting programs will include cross-compliance with building/grading inspections for tracking BMP implementation.

**EXHIBIT 7.II**

**MODEL WATER QUALITY MANAGEMENT PLAN  
(WQMP)**

## MODEL WATER QUALITY MANAGEMENT PLAN (WQMP)

### 7.II - 1.0 INTRODUCTION

The Model Water Quality Management Plan (Model WQMP) has been developed to address post-construction urban runoff and stormwater pollution from all new development and significant redevelopment projects. The goal of the Model WQMP is to ensure that new development and significant redevelopment do not increase pollutant loads from a project site, or contribute to increased urban runoff flow rates or velocities. This goal may be achieved through practicable and enforceable site-specific project-based controls, or a combination of project-based and regional or watershed-based controls.

This Model WQMP identifies appropriate controls, commonly referred to as Best Management Practices (BMPs), for new development and significant redevelopment projects that are subject to WQMP requirements pursuant to Section 7 of the Drainage Area Management Plan (DAMP). This includes both private and public agency projects. The Model WQMP will be reviewed and approved by the Santa Ana Regional Water Quality Control Board (Santa Ana Regional Board) in accordance with the relevant Third Term Permit (Order No. R9-2002-001) (“North County Permit”). The Santa Ana Regional Board will solicit public review and comment prior to approval. Using the Model WQMP as a guide, North County Permittees will review and approve project-specific Water Quality Management Plans (Project WQMPs) as part of the development plan and entitlement approval process or the ministerial permit approval process for Priority and Non-Priority Projects as defined in **DAMP Section 7.6** and **Table 7.II-1**.

The San Diego Regional Water Quality Control Board (San Diego Regional Board) will review the Model WQMP for compliance with the relevant Third Term Permit (Order R9-2002-001) (“South County Permit”). South County Permittees are required to adopt their own local WQMP (see **DAMP, Appendix A-7**) based on the Model WQMP submitted to the San Diego Regional Board and may adapt the Model WQMP for local conditions. Using the local WQMP as a guide, each South County Permittee will review and approve Project WQMPs as part of the development plan and entitlement approval process or the ministerial permit approval process for Priority and Non-Priority Projects as defined in **DAMP Section 7.6** and **Table 7.II-1**.

New development and significant redevelopment projects are required to develop and implement a Project WQMP that includes BMPs. Depending upon the project size and characteristics, these may include:

- Site Design BMPs (as appropriate)
- Applicable Source Control BMPs
- Project-based Treatment Control BMPs; and/or participation in an approved regional or watershed management program as defined in **Section 7-II.3.3.3** of this document in the affected watershed.

Descriptions and examples of the above BMP types are provided later within this document.

This model provides requirements for two types of new development and significant redevelopment projects:

- Priority Projects (**Section 7.II-3.0**)
- Non-Priority Projects (**Section 7.II-4.0**)

A project is a Priority Project if it meets any of the following criteria:

**Table 7.II-1**  
**Priority Projects Categories**

1.	Residential development of 10 units or more
2.	Commercial and industrial development greater than 100,000 square feet including parking area
3.	Automotive repair shops (SIC codes 5013, 5014, 5541, 7532-7534, and 7536-7539)
4.	Restaurants where the land area of development is 5,000 square feet or more including parking area (SIC code 5812)
5.	<i>For San Diego Region</i> - Hillside development greater than 5,000 square feet <i>For Santa Ana Region</i> - Hillside developments on 10,000 square feet or more, which are located on areas with known erosive soil conditions or where natural slope is twenty-five percent or more
6.	Impervious surface of 2,500 square feet or more located within, directly adjacent to (within 200 feet), or discharging directly to receiving waters within Environmentally Sensitive Areas
7.	Parking Lots 5,000 square feet or more, or with 15 parking spaces or more, and potentially exposed to urban stormwater runoff.
8.	<i>For San Diego Region</i> - Streets, roads, highways, and freeways which would create a new paved surface that is 5,000 square feet or greater
9.	<i>For Santa Ana Region</i> - All significant redevelopment projects, where significant redevelopment is defined as the addition of 5,000 or more square feet of impervious surface on an already developed site.

Definitions of the above terms and conditions are located in **Attachment E**.

The Project WQMP for all new development and significant redevelopment projects that are Priority Projects are required to:

- Incorporate and implement all Source Control BMPs (routine structural and routine non-structural), unless not applicable to the project due to project characteristics, and document clearly why any applicable Source Control BMP was not included.
- Incorporate and implement Site Design BMPs, as appropriate, and document the Site Design BMPs that are included; and
- Either incorporate and implement Treatment Control BMPs, by including a selection of such BMPs into the project design; or participate in or contribute to an acceptable regional or

watershed based program as defined in **Section 7-II.3.3.3** of this document. Projects participating in a regional or watershed program will also implement Source Control BMPs and Site Design BMPs consistent with the requirements of the approved regional or watershed-based plan.

- The combination of Source Control, Site Design, and Treatment Control BMPs or regional or watershed-based programs must adequately address all identified pollutants and hydrologic conditions of concern.

In the instance where only a project feature falls into a Priority Project category, such as a 6,000 sq. ft. parking lot for an industrial development that is less than 100,000 sq. ft., only the parking lot feature is subject to Model WQMP requirements.

All Non-Priority Project WQMPs are required to:

- Incorporate and implement all Source Control BMPs (routine structural and routine non-structural), unless not applicable to the project due to project characteristics, and document clearly why any applicable Source Control BMP was not included; and
- Incorporate and implement Site Design BMPs, as appropriate.

The Project WQMP must be completed as follows:

- For projects not participating in a regional or watershed-based program, the Project WQMP must be completed either prior to discretionary project approval or ministerial permit, (grading or building) issuance for discretionary projects, and prior to ministerial permit issuance for projects requiring only ministerial permits.
- For projects participating in regional or watershed-based programs the regional or watershed program may be relied upon during the discretionary review process subject to a discussion of how the project will participate in the program, but a site specific Project WQMP must be completed prior to permit issuance.

Requirements of the Project WQMP shall be incorporated into project design and shown in the project plans to be submitted to the Permittee.

Departments carrying out public agency projects that are not required to obtain permits shall be responsible for ensuring that Model WQMP requirements are incorporated into the project design and shown on the project plans prior to bidding for construction contracts or similar contracts. Project WQMP requirements will be incorporated into the design of public agency projects and shown on the project plans before allowing the project to commence.

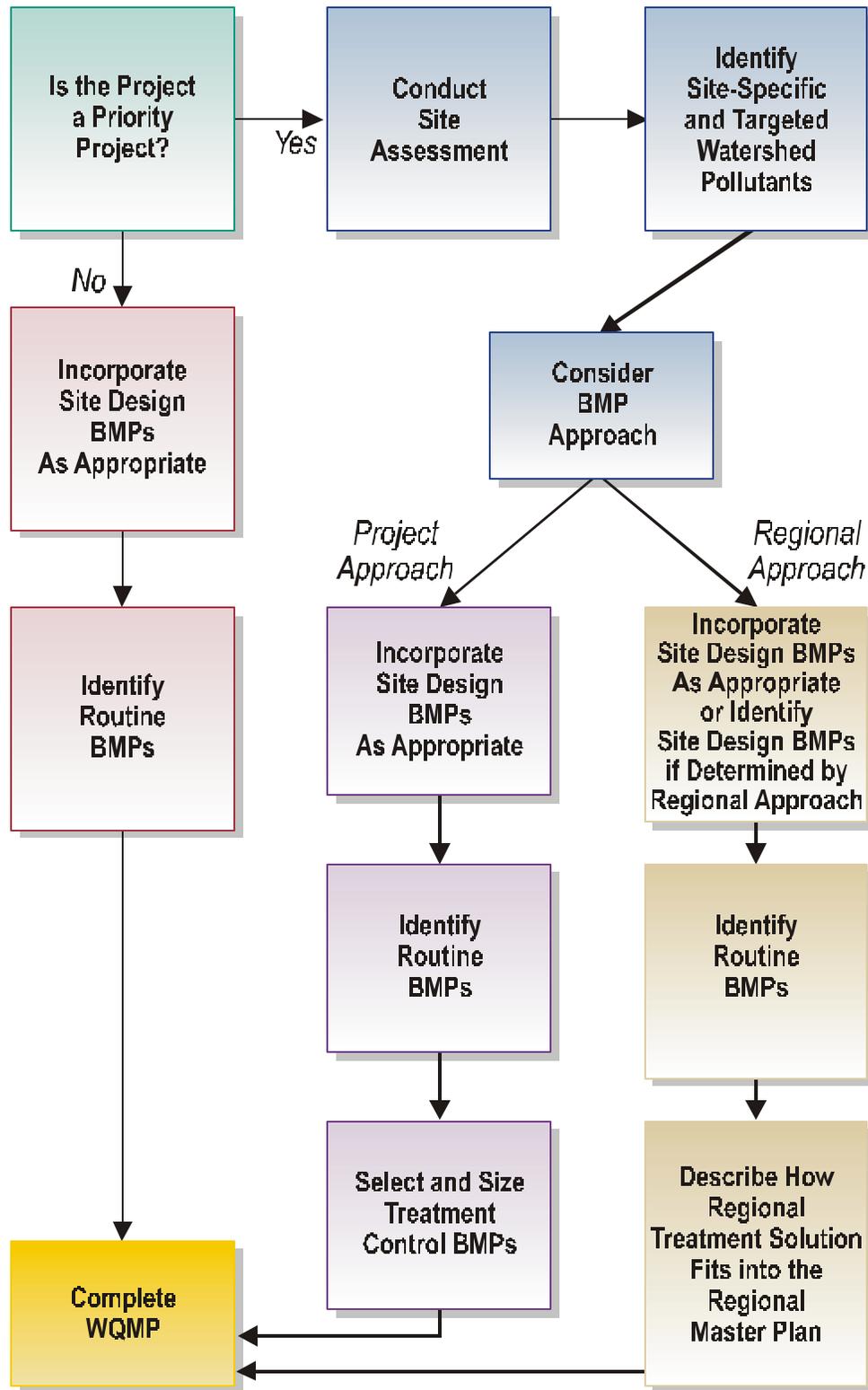
**Limited Exclusion:** Trenching and resurfacing work associated with utility projects are not considered Priority Projects. Parking lots, buildings, and other structures associated with utility

projects are subject to Model WQMP requirements if one or more of the criteria for the above categories are met.

## **7.II - 2.0      WQMP PREPARATION**

Several steps are involved in completing an approvable Project WQMP for new development or significant redevelopment projects. **Figure 7.II-1** displays the implementation steps and decision steps that must be followed to successfully complete a Project WQMP.

**Figure 7.II-1**  
**Development Planning and WQMP Preparation Steps**



## **7.II - 3.0 PRIORITY PROJECT WQMP PREPARATION**

New development and redevelopment projects that are Priority Projects will perform the following steps for Project WQMP preparation:

- Site assessment (**Section 7.II-3.1**)
- Identification of pollutants and hydrologic conditions of concern (**Section 7.II-3.2**)
- Incorporation of Site Design BMPs, as appropriate (**Section 7.II - 3.3.1**)
- Incorporation of Source Control BMPs, as applicable (**Section 7.II-3.3.2**)
- Selection of regional, watershed or project-based approach to Treatment Control BMPs (**Section 7.II-3.3.3**)
- Selection, sizing, and incorporation of Treatment Control BMPs (**Section 7.II-3.3.4**)

### **7.II - 3.1 Site Assessment**

Site assessment involves compiling the following:

- Planning Area/Community Name: Provide exhibit of subject and surrounding planning areas in sufficient detail to allow project location to be plotted on a base map of the Permittee
- Site specifics such as general and specific location, site address, and size (acreage to the nearest 1/10 acre)
- Watershed name
- Site characteristics, including description of site drainage and how it ties with drainage of surrounding property. Reference to the Project WQMP's Plot Plan showing drainage flow arrows and how drainage ties to drainage of surrounding property

### **7.II - 3.2 Identification of Pollutants and Hydrologic Conditions of Concern**

Priority Project proponents shall use these guidelines to identify expected pollutants of concern and hydrologic conditions of concern associated with the project that will be mitigated by the control measures to be set forth in Project WQMP. Appropriate control measures for various pollutants and hydrologic conditions of concern are specified in **Section 7.II-3.3**.

Site design and source control measures are identified for pollutants commonly associated with the proposed project land use (see **Table 7.II-2**). A combination of Site Design, Source Control and on-site Treatment Control BMPs or regional and watershed programs are required in order to fully address a project's expected pollutants of concern and hydrologic conditions of concern.

### 7.II - 3.2.1 General Categories of Pollutants of Concern

Urban runoff and stormwater pollution from a developed site has the potential to contribute pollutants, including oil and grease, suspended solids, metals, gasoline, pesticides, and pathogens from the municipal storm drain system to tributary receiving waters. For the purpose of identifying pollutants of concern and associated stormwater BMPs, pollutants are grouped in nine general categories:

- ***Bacteria and Viruses*** – Bacteria and viruses are ubiquitous microorganisms that thrive under certain environmental conditions. Their proliferation is typically caused by the transport of animal or human fecal wastes from the watershed. Water, containing excessive bacteria and viruses can alter the aquatic habitat and create a harmful environment for humans and aquatic life. Also, the decomposition of excess organic waste causes increased growth of undesirable organisms in the water.
- ***Metals*** – The primary source of metal pollution in stormwater is typically commercially available metals and metal products. Metals of concern include cadmium, chromium, copper, lead, mercury, and zinc. Lead and chromium have been used as corrosion inhibitors in primer coatings and cooling tower systems. Metals are also raw material components in non-metal products such as fuels, adhesives, paints, and other coatings. At low concentrations naturally occurring in soil, metals may not be toxic. However, at higher concentrations, certain metals can be toxic to aquatic life. Humans can be impacted from contaminated groundwater resources, and bioaccumulation of metals in fish and shellfish. Environmental concerns, regarding the potential for release of metals to the environment, have already led to restricted metal usage in certain applications.
- ***Nutrients*** – Nutrients are inorganic substances, such as nitrogen and phosphorus. They commonly exist in the form of mineral salts that are either dissolved or suspended in water. Primary sources of nutrients in urban runoff are fertilizers and eroded soils. Excessive discharge of nutrients to water bodies and streams can cause excessive aquatic algae and plant growth. Such excessive production, referred to as cultural eutrophication, may lead to excessive decay of organic matter in the water body, loss of oxygen in the water, release of toxins in sediment, and the eventual death of aquatic organisms.
- ***Pesticides*** – Pesticides (including herbicides) are chemical compounds commonly used to control nuisance growth or prevalence of organisms. Excessive or improper application of a pesticide may result in runoff containing toxic levels of its active ingredient.
- ***Organic Compounds*** – Organic compounds are carbon-based. Commercially available or naturally occurring organic compounds are found in pesticides, solvents, and hydrocarbons. Organic compounds can, at certain concentrations, indirectly or directly constitute a hazard to life or health. When rinsing off objects, toxic levels of solvents and cleaning compounds can be discharged to storm drains. Dirt, grease, and grime retained in the cleaning fluid or rinse water may also adsorb levels of organic compounds that are harmful or hazardous to aquatic life.

- **Sediments** – Sediments are soils or other surficial materials eroded and then transported or deposited by the action of wind, water, ice, or gravity. Sediments can increase turbidity, clog fish gills, reduce spawning habitat, lower young aquatic organisms survival rates, smother bottom dwelling organisms, and suppress aquatic vegetation growth.
- **Trash and Debris** – Trash (such as paper, plastic, polystyrene packing foam, and aluminum materials) and biodegradable organic matter (such as leaves, grass cuttings, and food waste) are general waste products on the landscape. The presence of trash and debris may have a significant impact on the recreational value of a water body and aquatic habitat. Excess organic matter can create a high biochemical oxygen demand in a stream and thereby lower its water quality. In addition, in areas where stagnant water exists, the presence of excess organic matter can promote septic conditions resulting in the growth of undesirable organisms and the release of odorous and hazardous compounds such as hydrogen sulfide.
- **Oxygen-Demanding Substances** – This category includes biodegradable organic material as well as chemicals that react with dissolved oxygen in water to form other compounds. Proteins, carbohydrates, and fats are examples of biodegradable organic compounds. Compounds such as ammonia and hydrogen sulfide are examples of oxygen-demanding compounds. The oxygen demand of a substance can lead to depletion of dissolved oxygen in a water body and possibly the development of septic conditions.
- **Oil and Grease** – Oil and grease are characterized as high-molecular weight organic compounds. Primary sources of oil and grease are petroleum hydrocarbon products, motor products from leaking vehicles, esters, oils, fats, waxes, and high molecular-weight fatty acids. Introduction of these pollutants to the water bodies are very possible due to the wide uses and applications of some of these products in municipal, residential, commercial, industrial, and construction areas. Elevated oil and grease content can decrease the aesthetic value of the water body, as well as the water quality.

#### 7.II - 3.2.2 Identify Pollutants from the Project Area

Using **Table 7.II-2**, identify pollutants that are expected from the proposed Priority Project land use categories. Site-specific conditions must also be considered as potential pollutant sources, such as legacy pesticides or nutrients in site soils as a result of past agricultural practices or hazardous materials in site soils from industrial uses. Hazardous material sites that have been remediated and do not pose a current threat, and will not pose a future threat, to stormwater quality, are not considered a pollutant of concern.

#### 7.II - 3.2.3 Identify Pollutants of Concern

To identify pollutants of concern in receiving waters, each Priority Project proponent shall, at a minimum, do the following:

1. For each of the proposed project discharge points, identify the receiving water for each point of discharge and all water bodies downstream of the receiving water, using

hydrologic unit basin numbers as identified in the most recent version of the Water Quality Control Plan for Ocean Waters of California (Ocean Plan) prepared by the State Water Resources Control Board; the Water Quality Control Plan for the Santa Ana Basin prepared by the Santa Ana Regional Board; or the Water Quality Control Plan for the San Diego Basin<sup>1</sup>, prepared by the San Diego Regional Board.

2. Identify each receiving water identified above that is listed on the most recent list of Clean Water Act Section 303(d) impaired water bodies (**Table 7.II-3**). List any and all pollutants for which the receiving waters are impaired. (**Table 7.II-3**) and identify each Clean Water Act Section 303 (d) impaired water body that is downstream of the receiving waters identified above. .

Compare the list of pollutants for which the receiving waters are impaired with the pollutants anticipated to be generated by the project (as discussed in **Section 7.II.3.2.2**).

**Primary Pollutants of Concern** - Any pollutants identified by **Table 7.II-2**, that have also been identified as causing impairment of project receiving waters

**Other Pollutants of Concern** - Those pollutants identified using **Table 7.II-2** that have not been identified as causing impairment of project receiving waters.

If a comprehensive evaluation of site-specific conditions is completed (e.g., in a CEQA document), supported by scientific and engineering studies, the site-specific information may be used to modify the pollutants identified in Tables 7.II-2 for that project. Any projects for which the pollutant list is modified shall be reported by the Permittees to the Regional Board in the appropriate Annual Progress Report. Watershed planning documents should also be reviewed for identification of specific implementation requirements that address pollutants of concern.

Salinity, total dissolved solids (TDS), and chlorides are listed within the above-referenced 303(d) tables, but are not addressed in this Model WQMP, as they are not commonly of concern in typical development urban runoff and stormwater pollution.

**Table 7.II-2  
Anticipated and Potential Pollutants Generated by Land Use Type**

Priority Project Categories and/or Project Features	General Pollutant Categories								
	Bacteria/Virus	Heavy Metals	Nutrients	Pesticides	Organic Compounds	Sediments	Trash & Debris	Oxygen Demanding Substances	Oil & Grease
Detached Residential Development	X		X	X		X	X	X	X
Attached Residential Development	P		X	X		X	X	P <sup>(1)</sup>	P <sup>(2)</sup>
Commercial/ Industrial Development >100,000 ft <sup>2</sup>	P <sup>(3)</sup>	P	P <sup>(1)</sup>	P <sup>(1)</sup>	P <sup>(5)</sup>	P <sup>(1)</sup>	X	P <sup>(1)</sup>	X
Automotive Repair Shops		P			X <sup>(4,5)</sup>		X		X
Restaurants	X						X	X	X
Hillside Development >5,000 ft <sup>2</sup> In SDRWQCB	X		X	X		X	X	X	X
Hillside Development >10,000 ft <sup>2</sup> In SARWQCB	X		X	X		X	X	X	X
Parking Lots	P <sup>(6)</sup>	X	P <sup>(1)</sup>	P <sup>(1)</sup>	X <sup>(4)</sup>	P <sup>(1)</sup>	X	P <sup>(1)</sup>	X
Streets, Highways & Freeways	P <sup>(6)</sup>	X	P <sup>(1)</sup>	P <sup>(1)</sup>	X <sup>(4)</sup>	X	X	P <sup>(1)</sup>	X

X = anticipated.

P = potential

(1) A potential pollutant if landscaping or open area exist on-site.

(2) A potential pollutant if the project includes uncovered parking areas.

(3) A potential pollutant if land use involves food or animal waste products.

(4) Including petroleum hydrocarbons.

(5) Including solvents.

(6) Analyses of pavement runoff routinely exhibit bacterial indicators.

**Table 7.II-3  
Summary of the 2002 303(d) Listed Water Bodies and Associated Pollutants of Concern for Orange County**

Region	Water Body	Watershed	Pollutant							
			Bacteria Indicators/ Pathogens	Metals	Nutrients	Pesticides	Toxicity	Trash	Salinity/TD S/ Chlorides	Turbidity
Region 8 Santa Ana	Anaheim Bay	C		X		X				
	Bolsa Chica			X						
	Buck Gully Creek	H	X							
	Huntington Beach State Park	C	X							
	Huntington Harbour	D	X	X		X				
	Los Trancos Creek (Crystal Cove Creek)	H	X							
	Newport Bay, Lower	G		X		X				
	Newport Bay, Upper (Ecological Reserve)	G		X		X				
	Santiago Creek Reach 4	E							X	
	San Diego Creek, Reach 1	F	X			X				
	San Diego Creek, Reach 2	F		X			X			
	Seal Beach	A	X							
	Silverado Creek	E	X						X	
Region 9 San Diego	Aliso Creek (Mouth)	J	X							
	Aliso Creek (20 Miles)	J	X		X		X			
	Dana Point Harbor	K	X							
	Pacific Ocean Shoreline, Aliso Beach HSA	J	X							
	Pacific Ocean Shoreline, Dana Point HSA	K	X							
	Pacific Ocean Shoreline, Laguna Beach and San Joaquin Hills HSAs	I	X							
	Pacific Ocean Shoreline, Lower San Juan HSA	L	X							
	Pacific Ocean Shoreline, San Clemente HSA	M	X							
	Prima Deshecha Creek	M			X					X
	San Juan Creek (Lower one Mile)	L	X							
	San Juan Creek (Mouth)	L	X							
	Segunda Deshecha Creek	M			X					X

#### 7.II - 3.2.4 Identify Hydrologic Conditions of Concern

Common impacts to the hydrologic regime resulting from development typically include increased runoff volume and velocity; reduced infiltration; increased flow frequency, duration, and peaks; faster time to reach peak flow; and water quality degradation. Under certain circumstances, changes could also result in the reduction in the amount of available sediment for transport; storm flows could fill this sediment-carrying capacity by eroding the downstream channel. These changes have the potential to permanently impact downstream channels and habitat integrity.

A change to a Priority Project site's hydrologic regime would be considered a condition of concern if the change would have a significant impact on downstream natural channels and habitat integrity, alone or in conjunction with impacts of other projects. Because of these potential impacts, the following steps shall be followed by each Priority Project:

1. Determine whether a downstream stream channel is fully natural or partially improved with a potential for erosive conditions or alteration of habitat integrity to a degree that, cumulatively or individually, adversely affects beneficial uses, as a result of upstream development. If either of these conditions exists, continue with the following steps.
2. Evaluate the project's conditions of concern in a drainage study report prepared by a registered civil engineer in the State of California, with experience in fluvial geomorphology and water resources management. The report shall consider the project area's location (from the larger watershed perspective), topography, soil and vegetation conditions, percent impervious area, natural and infrastructure drainage features, and any other relevant hydrologic and environmental factors to be protected specific to the project area's watershed.
3. Review watershed plans, drainage area master plans or other planning documents to the extent available to identify BMP requirements for new development that address cumulative inputs from development in the watershed.
4. As part of the drainage study, the civil engineer shall conduct a field reconnaissance to observe and report on representative downstream conditions, including undercutting erosion, slope stability, vegetative stress (due to flooding, erosion, water quality degradation, or loss of water supplies) and the area's susceptibility to erosion or habitat alteration as a result of an altered flow regime or change in sediment transport.
5. The drainage study shall compute rainfall runoff characteristics from the project area including, at a minimum, peak flow rate, flow velocity, runoff volume, time of concentration, and retention volume. These characteristics shall be developed for the two-year and 10-year frequency, Type I storm of six-hour or 24-hour duration

(whichever is the closer approximation of the site's time of concentration), during critical hydrologic conditions for soil and vegetative cover<sup>2</sup>.

The drainage study shall report the project's conditions of concern based on the hydrologic and downstream conditions discussed above. Where downstream conditions of concern have been identified, the drainage study shall establish, with documentation deemed adequate by the permittee, that pre-project hydrologic conditions affecting downstream conditions of concern would be maintained by the proposed project, satisfactory to the Permittee, by incorporating the site design, source control, and treatment control requirements identified in **Section 7.II-3.3**. For conditions where a reduction in sediment transport from the project development and features would significantly impact downstream erosion, the Treatment Control BMPs proposed should be evaluated to determine if use of the BMPs would result in reducing beneficial sediment (i.e. sand and gravel) significantly below pre-development levels. Under such conditions alternative BMPs (such as watershed based approaches for erosional sediment control) may need to be considered.

### **7.II - 3.3 BMP Selection**

All Priority Projects shall consider, incorporate and implement urban runoff and stormwater BMPs into the project design, in the following progression:

- Site Design BMPs
- Source Control BMPs (routine non-structural and routine structural)
- Treatment Control BMPs (or participation in a regional or watershed program)

At a minimum, Priority Projects must implement applicable Source Control BMPs (routine non-structural and routine structural), Site Design BMPs, as appropriate, and Treatment Control BMPs (and/or participate in a regional or watershed program) unless a waiver is granted based on the infeasibility of all Treatment Control BMPs as discussed in **Section 7.II-6.0**. BMPs must also achieve the performance standards set out in **Section 7.II-3.3.4**. Upon completion, Public Agency projects will become subject to the Municipal Activities Program. Therefore it is not necessary to identify routine non-structural BMPs in the WQMP for Public Agency projects provided that such BMPs already have been identified as part of the Municipal Activities Program (see **DAMP Section 5**).

A number of the Site Design and Treatment Control BMPs rely on infiltration of runoff to reduce the volume and load of pollutants to surface receiving waters. While such approaches can be very effective, there are potential limitations with respect to both soil stability and

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<sup>2</sup> Design storms can be found at <http://www.wrcc.dri.edu/pcpnfreq.html>. The Permittees may calculate the storm events using local rain data. In addition, isopluvial maps contained in the Orange County Hydrology Manual may be used to extrapolate rainfall data to areas where insufficient data exists. If isopluvial maps are selected, Permittees shall describe their method for using isopluvial maps in their Local Implementation Plan.

groundwater quality that are discussed in **Section 7.II-3.3.4** under RESTRICTIONS ON USE OF INFILTRATION BMPs.

#### 7.II - 3.3.1 Site Design BMPs

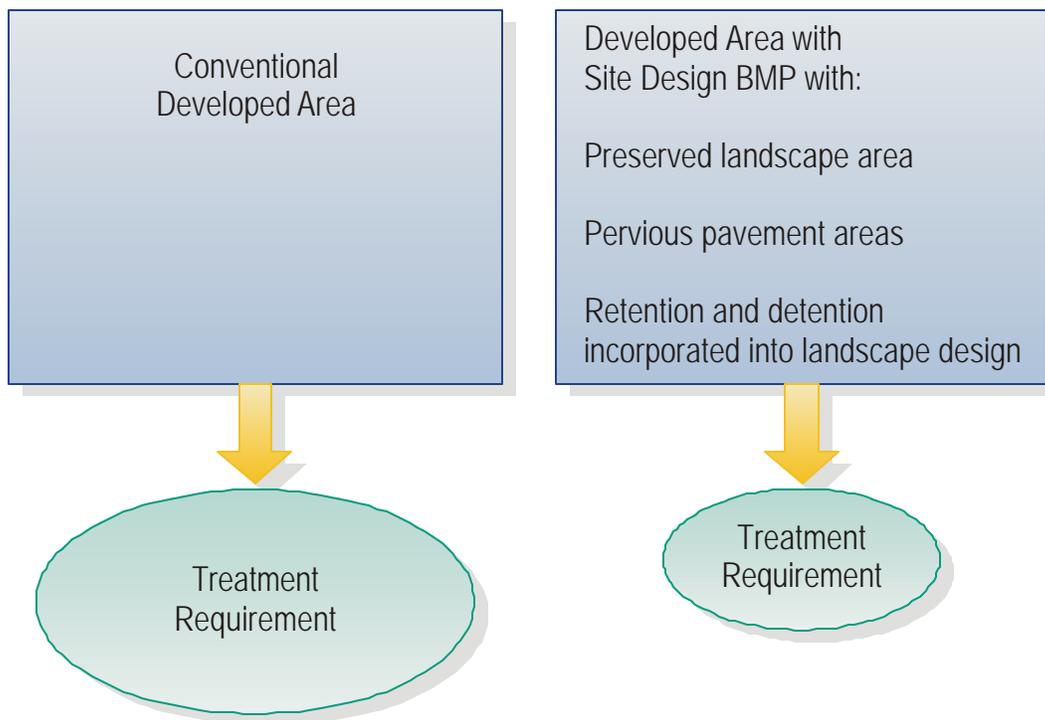
Priority Projects shall be designed to minimize the introduction of pollutants that may result in significant impacts, generated from site runoff to the municipal storm drain system through a combination of BMPs, including, Site Design BMPs, as appropriate, Source Control BMPs, as applicable, and Treatment Control BMPs and/or participation in regional or watershed program. Priority Projects for which hydrologic conditions of concern have been identified shall also control post-development peak stormwater runoff discharge rates and velocities to maintain or reduce pre-development downstream erosion rates and to protect stream habitat. Priority Projects can address these objectives by the incorporation, of appropriate Site Design BMPs that are intended to create a hydrologically functional project design that attempts to mimic the natural hydrologic regime. Mimicking a site's natural hydrologic regime can be pursued by:

- Reducing imperviousness, conserving natural resources and areas, maintaining and using natural drainage courses in the municipal storm drain system, and minimizing clearing and grading.
- Providing runoff storage measures dispersed uniformly throughout a site's landscape with the use of a variety of detention, retention, and runoff practices.
- Implementing on-lot hydrologically functional landscape design and management practices.

Runoff from developed areas may be reduced by using alternative materials or surfaces with a lower Coefficient of Runoff, or "C Factor". The C Factor is a representation of the ability of a surface to produce runoff. Surfaces that produce higher volumes runoff are represented by higher C Factors. By incorporating more pervious, lower C Factor surfaces into a development, lower volumes of runoff will be produced. Lower volumes and rates of runoff translate directly to lowering treatment requirements.

Detention and retention areas incorporated into landscape design provide areas for retaining and detaining stormwater flows, resulting in lower runoff rates and reductions in volume due to limited infiltration and evaporation. Such Site Design BMPs may reduce the size of Treatment Control BMPs.

**Figure 7.II-2**  
**Reduction of Treatment by Incorporation of Site Design BMPs**



These design principles offer an innovative approach to urban stormwater management, one that does not rely on the conventional end-of-pipe or in-the-pipe structural methods but instead uniformly or strategically integrates stormwater controls throughout the urban landscape. Useful resources for applying these principles, referenced in **Section 7.II-8.0 and Attachment B**, include *Start at the Source* (1999), and *Low-Impact Development Design Strategies* (1999).

***DESIGN CONCEPT 1: MINIMIZE STORMWATER RUNOFF, MINIMIZE PROJECT'S IMPERVIOUS FOOTPRINT AND CONSERVE NATURAL AREAS***

Minimize and/or control the post-development peak stormwater runoff discharge rates, velocities and volumes by utilizing measures that reduce runoff rates and volumes, and increase infiltration. A reduction in the stormwater runoff from a development project using properly designed BMPs, can yield a corresponding reduction in the amount of pollutants transported from the site. The undeveloped runoff volume should be determined by considering the project site to be in a natural condition with surface vegetation in place.

The following site design options shall be considered and incorporated where applicable and feasible, during the site planning and approval process consistent with applicable General Plan policies, other development standards and regulations and with any Site Design BMPs included in an applicable regional or watershed program

1. Maximize the permeable area. This can be achieved in various ways, including, but not limited to increasing building density (number of stories above or below ground) and developing land use regulations seeking to limit impervious surfaces. Decreasing the project's footprint can substantially reduce the project's impacts to water quality and hydrologic conditions, provided that the undeveloped area remains open space.
2. Conserve natural areas. This can be achieved by concentrating or clustering development on the least environmentally sensitive portions of a site while leaving the remaining land in a natural, undisturbed condition. Where available, permittees should also refer to their Multiple Species Conservation Plans or other biological regulations, as appropriate to assist in determining sensitive portions of the site. Sensitive areas include, but are not limited to: areas necessary to maintain the viability of wildlife corridors, occupied habitat of sensitive species and all wetlands, and coastal scrub and other upland communities.
3. Construct walkways, trails, patios, overflow parking lots, alleys, driveways, low-traffic streets and other low-traffic areas with open-jointed paving materials or permeable surfaces, such as pervious concrete, porous asphalt, unit pavers, and granular materials
4. Construct streets, sidewalks and parking lot aisles to the minimum widths necessary, provided that public safety and a walk able environment for pedestrians are not compromised<sup>3</sup>. Incorporate landscaped buffer areas between sidewalks and streets.
5. Reduce widths of street where off-street parking is available<sup>4</sup>
6. Maximize canopy interception and water conservation by preserving existing native trees and shrubs, and planting additional native or drought tolerant trees and large shrubs
7. Minimize the use of impervious surfaces, such as decorative concrete, in the landscape design
8. Use natural drainage systems.
9. Where soils conditions are suitable, use perforated pipe or gravel filtration pits for low flow infiltration<sup>5</sup>
10. Construct onsite ponding areas or retention facilities to increase opportunities for infiltration
11. Other site design options that are comparable, and equally effective

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<sup>3</sup> Sidewalk widths must still comply with Americans with Disabilities Act regulations and other life safety requirements.

<sup>4</sup> However, street widths must still comply with life safety requirements for fire and emergency vehicle access.

<sup>5</sup> However, projects must still comply with hillside grading ordinances that limit or restrict infiltration of runoff.

## ***DESIGN CONCEPT 2: MINIMIZE DIRECTLY CONNECTED IMPERVIOUS AREAS (DCIAs)***

Priority Projects shall incorporate the following design characteristics, as appropriate, and incorporate any Site Design BMPs included in any regional or watershed program that the project relies upon for Treatment Control BMPs.

1. Where landscaping is proposed, drain rooftops into adjacent landscaping prior to discharging to the storm drain
2. Where landscaping is proposed, drain impervious sidewalks, walkways, trails, and patios into adjacent landscaping
3. Increase the use of vegetated drainage swales in lieu of underground piping or imperviously lined swales
4. Use one or more of the following (for further guidance, see Start at the Source [1999]):
  - a. Rural swale system: street sheet flows to vegetated swale or gravel shoulder, curbs at street corners, culverts under driveways and street crossings
  - b. Urban curb/swale system: street slopes to curb; periodic swale inlets drain to vegetated swale/biofilter
  - c. Dual drainage system: First flush captured in street catch basins and discharged to adjacent vegetated swale or gravel shoulder, high flows connect directly to municipal storm drain systems
  - d. Other design concepts that are comparable and equally effective
5. Use one or more of the following features for design of driveways and private residential parking areas:
  - a. Design driveways with shared access, flared (single lane at street) or wheel strips (paving only under tires); or, drain into landscaping prior to discharging to the municipal storm drain system
  - b. Uncovered temporary or guest parking on private residential lots may be: paved with a permeable surface; or, designed to drain into landscaping prior to discharging to the municipal storm drain system
  - c. Other design concepts that are comparable and equally effective
6. Use one or more of the following design concepts for the design of parking areas:

- a. Where landscaping is proposed in parking areas, incorporate landscape areas into the drainage design
  - b. Overflow parking (parking stalls provided in excess of the Permittee's minimum parking requirements) may be constructed with permeable paving
  - c. Other design concepts that are comparable and equally effective
7. Other design characteristics that are comparable and equally effective

### 7.II - 3.3.2 Source Control BMPs

The following Source Control BMPs (routine non-structural BMPs, routine structural BMPs and BMPs for individual categories/project features) are required within all new development and significant redevelopment projects regardless of their priority, including those identified in an applicable regional or watershed program, unless they do not apply due to the project characteristics. If any of the following Source Control BMPs are not included in the project, an explanation of why must be included in the Project WQMP or the applicable regional or watershed program.

#### ***INCLUDE ROUTINE NON-STRUCTURAL SOURCE CONTROL BMPs:***

- *N1 Education for Property Owners, Tenants and Occupants*

For developments with no Property Owners Association (POA) or with POAs of less than fifty (50) dwelling units, practical information materials will be provided to the first residents/occupants/tenants on general housekeeping practices that contribute to the protection of stormwater quality. These materials will be initially developed and provided to first residents/occupants/tenants by the developer. Thereafter such materials will be available through the Permittees' education program. Different materials for residential, office commercial, retail commercial, vehicle-related commercial and industrial uses will be involved.

For developments with POA and residential projects of more than fifty (50) dwelling units, project conditions of approval will require that the POA provide environmental awareness education materials, made available by the municipalities, to all member periodically. Among other things, these materials will describe the use of chemicals (including household type) that should be limited to the property, with no discharge of wastes via hosing or other direct discharge to gutters, catch basins and storm drains.

- *N2 Activity Restrictions*

If a POA is formed, conditions, covenants and restrictions (CCRs) shall be prepared by the developer for the purpose of surface water quality protection. An example would be not allowing car washing outside of established community car wash areas in multi-unit

complexes. Alternatively, use restrictions may be developed by a building operator through lease terms, etc. These restrictions must be included in the Project WQMP.

- *N3 Common Area Landscape Management*

On-going maintenance consistent with County Water Conservation Resolution or city equivalent, plus fertilizer and/or pesticide usage consistent with Management Guidelines for Use of Fertilizers (**DAMP Section 5.5**). Statements regarding the specific applicable guidelines must be included in the Project WQMP.

- *N4 BMP Maintenance*

Identify responsibility for implementation of each non-structural BMP and scheduled cleaning and/or maintenance of all structural BMP facilities.

- *N5 Title 22 CCR Compliance*

Compliance with Title 22 of the California Code of Regulations and relevant sections of the California Health & Safety Code regarding hazardous waste management shall be enforced by County Environmental Health on behalf of the State. The Project WQMP must describe how the development will comply with the applicable hazardous waste management section(s) of Title 22.

- *N6 Local Water Quality Permit Compliance*

The Permittees, under the Water Quality Ordinance, may issue permits to ensure clean stormwater discharges from fuel dispensing areas and other areas of concern to public properties.

- *N7 Spill Contingency Plan*

Prepared by building operator for use by specified types of building or suite occupancies and which mandates stockpiling of cleanup materials, notification of responsible agencies, disposal of cleanup materials, documentation, etc.

- *N8 Underground Storage Tank Compliance*

Compliance with State regulations dealing with underground storage tanks, enforced by County Environmental Health on behalf of State.

- *N9 Hazardous Materials Disclosure Compliance*

Compliance with Permittee ordinances typically enforced by respective fire protection agency for the management of hazardous materials. The Orange County, health care agencies, and/or other appropriate agencies (i.e. Department of Toxics Substances Control

are typically responsible for enforcing hazardous materials and hazardous waste handling and disposal regulations.

- *N10 Uniform Fire Code Implementation*

Compliance with Article 80 of the Uniform Fire Code enforced by fire protection agency.

- *N11 Common Area Litter Control*

For industrial/commercial developments and for developments with POAs, the owner/POA shall be required to implement trash management and litter control procedures in the common areas aimed at reducing pollution of drainage water. The owner/POA may contract with their landscape maintenance firms to provide this service during regularly scheduled maintenance, which should consist of litter patrol, emptying of trash receptacles in common areas, and noting trash disposal violations by tenants/homeowners or businesses and reporting the violations to the owner/POA for investigation.

- *N12 Employee Training*

Education program (see N1) as it would apply to future employees of individual businesses. Developer either prepares manual(s) for initial purchasers of business site or for development that is constructed for an unspecified use makes commitment on behalf of POA or future business owner to prepare.

- *N13 Housekeeping of Loading Docks*

Loading docks typically found at large retail and warehouse-type commercial and industrial facilities shall be kept in a clean and orderly condition through a regular program of sweeping and litter control and immediate cleanup of spills and broken containers. Cleanup procedures should minimize or eliminate the use of water. If washdown water is used, it must be disposed of in an approved manner and not discharged to the storm drain system. If there are no other alternatives, discharge of non-stormwater flow to the sanitary sewer may be considered only if allowed by the local sewerage agency through a permitted connection.

- *N14 Common Area Catch Basin Inspection*

For industrial/commercial developments and for developments with privately maintained drainage systems, the owner is required to have at least 80 percent of drainage facilities inspected, cleaned and maintained on an annual basis with 100 percent of the facilities included in a two-year period. Cleaning should take place in the late summer/early fall prior to the start of the rainy season. Drainage facilities include catch basins (storm drain inlets) detention basins, retention basins, sediment basins, open drainage channels and lift stations.

- *N15 Street Sweeping Private Streets and Parking Lots*

Streets and parking lots are required to be swept prior to the storm season, in late summer or early fall, prior to the start of the rainy season .

- *N16 Commercial Vehicle Washing*

*This BMP Has Been Removed.*

- *N17 Retail Gasoline Outlets*

Retail gasoline outlets (RGOs) are required to follow operations and maintenance best management practices shown in the California Stormwater Quality Association (CASQA, formerly California Stormwater Quality Task Force) Best Management Practice Guide for Retail Gasoline Outlets. This document may be obtained by downloading from the CASQA website at <http://www.stormwatertaskforce.org/swqtf/RGOGuide.htm> or from forthcoming CASQA website.

### ***INCLUDE ROUTINE STRUCTURAL SOURCE CONTROL BMPs***

#### *Provide Storm Drain System Stenciling and Signage*

Storm drain stencils are highly visible source control messages, typically placed directly adjacent to storm drain inlets. The stencils contain a brief statement that prohibits the dumping of improper materials into the municipal storm drain system. Graphical icons, either illustrating anti-dumping symbols or images of receiving water fauna, are effective supplements to the anti-dumping message. Stencils and signs alert the public to the destination of pollutants discharged into stormwater. The following requirements shall be included in the project design and shown on the project plans:

1. Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language (such as: “NO DUMPING- DRAINS TO OCEAN”) and/or graphical icons to discourage illegal dumping.
2. Post signs and prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.
3. Maintain legibility of stencils and signs.

#### *Design Outdoor Hazardous Material Storage Areas To Reduce Pollutant Introduction*

Improper storage of materials outdoors may increase the potential for toxic compounds, oil and grease, fuels, solvents, coolants, wastes, heavy metals, nutrients, suspended solids, and other pollutants to enter the municipal storm drain system. Where the plan of development includes

outdoor areas for storage of hazardous materials that may contribute pollutants to the municipal storm drain system, the following stormwater BMPs are required:

1. Hazardous materials with the potential to contaminate urban runoff shall either be: (1) placed in an enclosure such as, but not limited to, a cabinet, shed, or similar structure that prevents contact with runoff or spillage to the municipal storm drain system; or (2) protected by secondary containment structures (not double wall containers) such as berms, dikes, or curbs.
2. The storage area shall be paved and sufficiently impervious to contain leaks and spills.
3. The storage area shall have a roof or awning to minimize direct precipitation and collection of stormwater within the secondary containment area.
4. Any stormwater retained within the containment structure must not be discharged to the street or storm drain system.

Location(s) of installations of where these preventative measures will be employed must be included on the map or plans identifying BMPs.

#### *Design Trash Storage Areas To Reduce Pollutant Introduction*

All trash container areas shall meet the following requirements (limited exclusion: detached residential homes):

1. Paved with an impervious surface, designed not to allow run-on from adjoining areas, designed to divert drainage from adjoining roofs and pavements diverted around the area, screened or walled to prevent off-site transport of trash; and
2. Provide attached lids on all trash containers that exclude rain, or roof or awning to minimize direct precipitation.
3. Connection of trash area drains to the municipal storm drain system is prohibited.

#### *Use Efficient Irrigation Systems and Landscape Design*

Projects shall design the timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the municipal storm drain system. (Limited exclusion: detached residential homes.) The following methods to reduce excessive irrigation runoff shall be considered, and incorporated on common areas of development and other areas where determined applicable and feasible by the Permittee:

1. Employing rain shutoff devices to prevent irrigation after precipitation.
2. Designing irrigation systems to each landscape area's specific water requirements.

3. Using flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
4. Implementing landscape plan consistent with County Water Conservation Resolution or city equivalent, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.
5. The timing and application methods of irrigation water shall be designed to minimize the runoff of excess irrigation water into the municipal storm drain system.
6. Employing other comparable, equally effective, methods to reduce irrigation water runoff.
7. Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider other design features, such as:
  - Use mulches (such as wood chips or shredded wood products) in planter areas without ground cover to minimize sediment in runoff.
  - Install appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant material where possible and/or as recommended by the landscape architect.
  - Leave a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible.
  - Choose plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth.

#### *Protect Slopes and Channels*

Project plans shall include Source Control BMPs to decrease the potential for erosion of slopes and/or channels, consistent with local codes and ordinances and with the approval of all agencies with jurisdiction, e.g., the U.S. Army Corps of Engineers, the Regional Boards and the California Department of Fish and Game. The following design principles shall be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

1. Convey runoff safely from the tops of slopes.
2. Avoid disturbing steep or unstable slopes.
3. Avoid disturbing natural channels.
4. Install permanent stabilization BMPs on disturbed slopes as quickly as possible.

5. Vegetate slopes with native or drought tolerant vegetation.
6. Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
7. Install permanent stabilization BMPs in channel crossings as quickly as possible, and ensure that increases in runoff velocity and frequency caused by the project do not erode the channel.
8. Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
9. Onsite conveyance channels should be lined, where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are large enough to erode grass or other vegetative linings, riprap, concrete soil cement or geo-grid stabilization may be substituted or used in combination with grass or other vegetation stabilization.
10. Other design principles that are comparable and equally effective.

**INCORPORATE REQUIREMENTS APPLICABLE TO INDIVIDUAL PROJECT FEATURES:**

All projects, regardless of priority, shall adhere to each of the individual project category requirements that apply to the project (e.g., a restaurant would be required to incorporate the requirements for Equipment Wash Areas into the project design). Where identified in **Table 7.II-4**, the following requirements shall be incorporated into applicable Priority Projects.

**Table 7.II-4  
Source Control and Site Design Stormwater BMP Selection Matrix**

Priority Project Category	Source Control BMPs <sup>(1)</sup>	Requirements Applicable to Individual Project Features (or Priority Project Categories) <sup>(2)</sup>									Site Design BMPs <sup>(3)</sup>
		Loading Dock Areas	Maintenance Bays	Vehicle Wash Areas	Outdoor Processing Areas	Equipment Wash Areas	Fueling Areas	Hillside Landscaping	Washwater Controls for Food Preparation Areas	Community Car Wash Racks	
Detached Residential Development	R							R			C
Attached Residential Development	R							R		R	C
Commercial/Industrial Development >100,000 ft <sup>2</sup>	R	R	R	R	R	R	R	R	R		C
Automotive Repair Shop	R	R	R	R		R	R				C
Restaurants	R	R				R		R	R		C
Hillside Development >5,000 ft <sup>2</sup> in SDRWQCB	R							R			C
Hillside Development >10,000 ft <sup>2</sup> in SARWQCB	R							R			C
Parking Lots	R							R			C
Streets, Highways & Freeways	R							R			C

R = Required; select BMPs as required from the applicable steps in Section 7.II-3.3.2 or equivalent.  
C = Incorporate in site design, as appropriate.  
(1) Required for all projects regardless of priority. Refer to Section 7.II-3.3.2.  
(2) Priority project categories must apply specific stormwater BMP requirements, where applicable. Projects are subject to the requirements of all Priority Project categories that apply.  
(3) Refer to Section 7.II-3.3.1.

### *Loading Dock Areas*

Loading/unloading dock areas shall include the following:

1. Cover loading dock areas, or design drainage to preclude urban run-on and runoff.
2. Direct connections to the municipal storm drain system from below grade loading docks (truck wells) or similar structures are prohibited. Stormwater can be discharged through a permitted connection to the storm drain system with a Treatment Control BMP applicable to the use.
3. Other comparable and equally effective features that prevent unpermitted discharges to the municipal storm drain system.
4. Housekeeping of loading docks shall be consistent with N13.

### *Maintenance Bays*

Maintenance bays shall include the following:

1. Repair/maintenance bays shall be indoors; or, designed to preclude urban run-on and runoff.
2. Design a repair/maintenance bay drainage system to capture all wash water, leaks and spills. Provide impermeable berms, drop inlets, trench catch basins, or overflow containment structures around repair bays to prevent spilled materials and wash-down waters from entering the storm drain system. Connect drains to a sump for collection and disposal. Discharge from the repair/maintenance bays to the municipal storm drain system is prohibited. If there are no other alternatives, discharge of non-stormwater flow to the sanitary sewer may be considered, but only when allowed by the local sewerage agency through permitted connection.
3. Other comparable and equally effective features, that prevent discharges to the municipal storm drain system.

### *Vehicle Wash Areas*

Projects that include areas for washing/steam cleaning of vehicles shall use the following:

1. Self-contained or covered with a roof or overhang.
2. Equipped with a wash racks constructed in accordance with the guidelines in **Attachment C**, and with the prior approval of the sewerage agency (Note: Discharge monitoring may be required by the sewerage agency).

3. Equipped with a clarifier or other pretreatment facility.
4. Other comparable and equally effective features that prevent unpermitted discharges, to the municipal storm drain system.

#### *Outdoor Processing Areas*

Outdoor process equipment operations, such as rock grinding or crushing, painting or coating, grinding or sanding, degreasing or parts cleaning, landfills, waste piles, and wastewater and solid waste handling, treatment, and disposal, and other operations determined to be a potential threat to water quality by the Permittee shall adhere to the following requirements.

1. Cover or enclose areas that would be the sources of pollutants; or, slope the area toward a sump that will provide infiltration or evaporation with no discharge; or, if there are no other alternatives, discharge of non-stormwater flow to the sanitary sewer may be considered only when allowed by the local sewerage agency through permitted connection
2. Grade or berm area to prevent run-on from surrounding areas.
3. Installation of storm drains in areas of equipment repair is prohibited.
4. Other comparable or equally effective features that prevent unpermitted discharges to the municipal storm drain system.
5. Where wet material processing occurs (e.g. electroplating), secondary containment structures (not double wall containers) shall be provided to hold spills resulting from accidents, leaking tanks or equipment, or any other unplanned releases (Note: If these are plumbed to the sanitary sewer, the structures and plumbing shall be in accordance with **Section 7.II-Attachment C**, and with the prior approval of the sewerage agency). See also **Section 7.II-3.4.2, N10**. Design of secondary containment structures shall be consistent with *Design of Outdoor Material Storage Areas To Reduce Pollutant Introduction*

Some of these land uses (e.g. landfills, waste piles, wastewater and solid waste handling, treatment and disposal) may be subject to other permits including Phase I Industrial Permits that may require additional BMPs.

#### *Equipment Wash Areas*

Outdoor equipment/accessory washing and steam cleaning activities shall use the following:

1. Be self-contained or covered with a roof or overhang.
2. Design an equipment wash area drainage system to capture all wash water. Provide impermeable berms, drop inlets, trench catch basins, or overflow containment structures around equipment wash areas to prevent wash-down waters from entering the storm

drain system. Connect drains to a sump for collection and disposal. Discharge from equipment wash areas to the municipal storm drain system is prohibited. If there are no other alternatives, discharge of non-stormwater flow to the sanitary sewer may be considered, but only when allowed by the local sewerage agency through a permitted connection.

3. Other comparable or equally effective features that prevent unpermitted discharges to the municipal storm drain system.

### *Fueling Areas*

Fuel dispensing areas shall contain the following:

1. At a minimum, the fuel dispensing area must extend 6.5 feet (2.0 meters) from the corner of each fuel dispenser, or the length at which the hose and nozzle assembly may be operated plus 1 foot (0.3 meter), whichever is less.
2. The fuel dispensing area shall be paved with Portland cement concrete (or equivalent smooth impervious surface). The use of asphalt concrete shall be prohibited.
3. The fuel dispensing area shall have an appropriate slope (2% - 4%) to prevent ponding, and must be separated from the rest of the site by a grade break that prevents run-on of stormwater.
4. An overhanging roof structure or canopy shall be provided. The cover's minimum dimensions must be equal to or greater than the area of the fuel dispensing area in #1 above. The cover must not drain onto the fuel dispensing area and the downspouts must be routed to prevent drainage across the fueling area. The fueling area shall drain to the project's Treatment Control BMP(s) prior to discharging to the municipal storm drain system.

### *Hillside Landscaping*

Hillside areas that are disturbed by project development shall be landscaped with deep-rooted, drought tolerant plant species selected for erosion control, satisfactory to the Permittee.

### *Wash Water Controls For Food Preparation Areas*

Food establishments (per State Health & Safety Code 27520) shall have either contained areas or sinks, each with sanitary sewer connections for disposal of wash waters containing kitchen and food wastes. If located outside, the contained areas or sinks shall also be structurally covered to prevent entry of stormwater. Adequate signs shall be provided and appropriately placed stating the prohibition of discharging washwater to the storm drain system.

### *Community Car Wash Racks*

In complexes larger than 100 dwelling units where car washing is allowed, a designated car wash area that does not drain to a storm drain system shall be provided for common usage. Wash waters from this area may be directed to the sanitary sewer (in accordance with **Attachment C**, and with the prior approval of the sewerage agency); to an engineered infiltration system; or to an equally effective alternative. Pre-treatment may also be required. Signage shall be provided prohibiting discharges of washwater outside of the designated area.

#### 7.II - 3.3.3 Selection of Regional or Project-Based Approach to Treatment Control BMPs

Regional or watershed management programs that address runoff from new development/significant redevelopment are encouraged as alternatives to Project WQMPs within the Santa Ana Regional Board permit area. Under certain conditions within the San Diego Regional Board permit area, offsite controls can also be considered. Regional or watershed programs that plan to incorporate Treatment Control BMPs to support new development or significant redevelopment projects must be approved by each Permittee utilizing the program. Regional or watershed programs are meant to provide comprehensive water quality solutions for the new development or significant projects they are meant to serve as well as providing opportunities to address other watershed needs and runoff from existing developed areas. To this end, all BMPs applicable to individual projects served by the approved regional or watershed program as well as details of applicable Site Design BMPs and offsite (as well as any on-site) Treatment Control BMPs will be predetermined in the approved regional or watershed program

A new development /significant redevelopment project may be approved based upon reliance on the Treatment Control BMPs contained in a regional or watershed program if the following criteria are met:

- The project incorporates all routine Source Control BMPs and Site Design BMPs identified in the regional or watershed plan as applicable to or appropriate for individual projects participating in the plan.
- One or more Permittees (or, in some cases another agency) has prepared a regional or watershed plan to determine where on-site and/or regional or watershed Treatment Control BMP facilities are appropriate and it has been approved by each Permittee intending to utilize the Treatment Control BMP facilities as part of the new development/significant redevelopment program. During the Third Term Permit, the Executive Officer, after notice to interested parties, must make a determination that the regional or watershed treatment BMP exceeds the water quality solution provided by the onsite structural BMPs otherwise required by section XII B 3 of the Permit and is otherwise consistent with the Third Term Permit and the Clean Water Act. The request for determination should be made as early in the design process as possible.

- When it is determined by the Permittees that on-site facilities for individual projects are necessary, each Permittee would either define the performance standards to be consistent with or more stringent than this Model WQMP.
- When regional or watershed Treatment Control BMPs are determined to be most practical, a developer may need to construct these facilities (for larger development projects), or pay a share of the costs of these facilities through an equitable fee-in-lieu-of method.
- The regional or watershed Treatment Control BMPs must be sized and selected to meet the following criteria:
  - The regional or watershed Treatment Control BMP(s) collectively must have the capacity to treat more than the cumulative volume (or flow rate) of runoff from all new development or significant redevelopment projects included in the regional or watershed plan, calculated using the applicable project-based water quality design volume or flow rate from each project. The water quality design storm runoff volume or flow rate obligation for projects participating in the regional or watershed program may be reduced based on the incorporation of any Site Design BMPs that offset treatment requirements for pollutants of concern.
  - Treatment Control BMP selection will be determined as part of the regional or watershed program planning. Regional or watershed Treatment Control BMPs must be selected to address pollutants of concern in the downstream receiving waters and anticipated to be generated from the type of new development or significant redevelopment within the watershed in accordance with the selection procedures in **Section 7.II-3.3.4**. In the alternative, individual projects that intend to rely on the regional or watershed treatment facility must incorporate site-specific BMPs to address any specific pollutant of concern from that project that is not addressed by the regional or watershed Treatment Control BMPs.
- The regional or watershed Treatment Control BMPs should be sized consistent with site constraints and opportunities with the goal of treating runoff volume (or flow rate) from the developed areas of the watershed in addition to the new development or significant redevelopment.
- The BMPs in a regional or watershed program with impaired waterbodies and/or watersheds subject to Total Maximum Daily Loads are to address the applicable implementation requirements of any adopted TMDLs.
- The regional or watershed plan must contain an implementation component that includes funding mechanisms, schedules and identification of responsible parties for design, construction, long-term operation and maintenance, and administration of the program

including financing. The Project WQMP will describe or reference the regional or watershed plan and describe how the project will participate in or contribute to the program. The implementation component will also identify an appropriate level of project-specific monitoring and coordination with regional monitoring programs. The implementation component will also account for contingencies such as inadequate performance or failure of the BMPs.

- Participation of a project in a regional or watershed program may be approved provided construction of the regional or watershed structural Treatment Control BMP(s) is completed (or an equivalent temporary alternative is put in place) prior to the post-construction use of the regional/watershed BMP by the new development or significant redevelopment project being approved. Interim project-based stormwater BMPs that provide equivalent or greater treatment than is required by the Model WQMP may be implemented until each regional or watershed Treatment Control BMP is operational. If interim BMPs are selected, the BMPs shall remain in use until permanent BMPs are operational.

When deciding to implement a regional or watershed management program, specific performance criteria should be evaluated. These performance criteria are listed as follows:

- The degree of pollution control provided under typical operating conditions.
- Variability of efficiency from pollutant to pollutant
- Variability of efficiency with storm characteristics
- The effect of design variables on performance
- Stability of efficiency over time
- Effectiveness relative to other BMPs
- Reduction of toxicity
- Improvement in, or protection of, downstream biotic communities
- Potential downstream negative impacts

Several factors affect whether a regional/watershed or project-based (on-site) structural approach is more feasible. Among these are removal effectiveness, cost, maintenance and construction timing:

#### *Pollutant Removal Effectiveness*

A variety of pollutant removal methods have been utilized in BMP monitoring studies to evaluate efficiency. The following are six methods typically used by investigators:

- Efficiency ratio
- Summation of loads
- Regression of loads
- Mean concentration
- Efficiency of individual storm loads
- Reference watersheds and before/after studies

Equations and example calculations are provided in the ASCE/EPA Technical Memorandum titled “Development of Performance Measures”, which can be found in **Attachment D** of this Exhibit.

### *Cost*

As with the selection of all BMPs, cost effectiveness is an important criterion to consider. When evaluating regional/watershed programs, it must be determined who will be responsible for funding the construction and/or upkeep of the regional/watershed control measures.

It is often most cost effective to utilize an existing treatment control near the development site. For instance, many Treatment Control BMPs can be incorporated into regional flood control detention/retention facilities with modest design refinements, and limited increased land requirements and cost. However, this type of alternative should be reviewed by the Orange County Flood Control District to check that both flood control and pollution control objectives are met.

Other potential issues that may affect cost include filling, dredging, and streambed alteration conditions; in which case, the project should be reviewed by the Army Corps of Engineers, the Regional Board, and the Department of Fish and Game.

### *Maintenance*

Proper maintenance is crucial for all BMPs. It is necessary to clearly state who will be responsible for the maintenance and upkeep of the regional/watershed Treatment Control BMPs, as the responsible party in a regional/watershed program is not as apparent as with an on-site treatment control.

### 7.II - 3.3.4 Treatment Control BMPs

Minimizing a development’s detrimental effects on water quality can be most effectively achieved using a combination of Site Design, Source Control and Treatment Control BMPs. Where projects have been designed to eliminate or reduce the introduction of expected pollutants of concern into the municipal storm drain system or the receiving waters through the

implementation of Site Design and Source Control stormwater BMPs, the development may still have the potential for pollutants of concern to enter the municipal storm drain system or receiving waters that must be addressed by Treatment Control BMPs.

Where acceptable regional or watershed management programs are available within the downstream watershed to address the pollutants of concern from new development and significant redevelopment, a project may participate in a regional or watershed program provided the program meets the criteria discussed in **Section 7.II-3.3.3**. Otherwise, Priority Projects shall be designed to remove pollutants of concern from the municipal storm drain system to achieve the appropriate standard, as specified in the Third Term Permits, through the incorporation and implementation of Treatment Control BMPs.

If on-site Treatment Control BMPs are necessary to meet the requirements in this section, Priority Projects shall implement a single or combination of stormwater treatment BMPs that will remove anticipated pollutants of concern from site runoff and achieve the appropriate standard, as specified in the Third Term Permits, as described by the procedure in **Section 7.II-3.2**. Treatment Control BMPs must be implemented unless a waiver is granted to the project by the Permittee, based on the infeasibility of any Treatment Control BMP (see **Section 7.II-6.0**).

#### ***QUANTITY DESIGN STANDARD FOR TREATMENT CONTROL BMPs***

All Priority Projects shall design, construct and implement structural Treatment Control BMPs that meet the design standards of this section and achieve the appropriate standard, as specified in the Third Term Permits, unless specifically exempted by the limited exclusions listed at the end of this section or the project is participating in an acceptable regional or watershed management program. Structural Treatment Control BMPs required by this section shall be operational prior to the use of any dependent development, and shall be located and designed in accordance with the requirements here in this section.

Unlike flood control measures that are designed to handle peak flows, stormwater Treatment Control BMPs are designed to treat the more frequent, lower-flow storm events, or the first flush portions of runoff from larger storm events (typically referred to as the first-flush events). Small, frequent storm events represent most of the total average annual rainfall for the area. The flow and volume from such small events is targeted for treatment. There is marginal water quality benefit gained by sizing treatment facilities to handle flows or volumes greater than the ones generated by small events.

The primary control strategy for designing Treatment Control BMPs is to treat the Stormwater Quality Design Flow (SQDF) or the Stormwater Quality Design Volume (SQDV) of the stormwater runoff. **Table 7.II-5** lists BMPs along with the basis of design, SQDF or SQDV, to be used for designing the BMP. **Attachment A** to this Exhibit provides detailed guidance and tools for determining the SQDV and SQDF for a project.

**Table 7.II-5 Basis of Design for Treatment Control BMPs**

Treatment Control BMP	Design Basis
Vegetated (Grass) Strips	SQDF
Vegetated (Grass) Swales	
Proprietary Control Measures	
Dry Detention Basin	SQDV
Wet Detention Basin	
Constructed Wetland	
Detention Basin/Sand Filter	
Porous Pavement Detention	
Porous Landscape Detention	
Infiltration Basin	
Infiltration Trench	
Media Filter	
Proprietary Control Measures	

*Stormwater Quality Design Volume (SQDV)*

Volume-based BMPs shall be designed to mitigate (infiltrate, filter, or treat) either:

1. The volume of runoff produced from a 24-hour 85th percentile storm event, as determined from the local historical rainfall record; or
2. The volume of runoff produced by the 85th percentile 24-hour runoff event, determined as the maximized capture urban runoff volume for the area, from the formula recommended in Urban Runoff Quality Management, WEF Manual of Practice No. 23/ ASCE Manual of Practice No. 87, (1998); or
3. The volume of annual runoff based on unit basin storage volume, to achieve 90 percent or more volume treatment by the method recommended in California Stormwater Best Management Practices Handbook – Industrial/ Commercial, (1993); or

4. The volume of runoff, as determined from the local historical rainfall record, that achieves approximately the same reduction in pollutant loads and flows as achieved by mitigation of the 85th percentile 24-hour runoff event.<sup>6</sup>

OR

*Stormwater Quality Design Flow (SQDF)*

Flow-based BMPs shall be designed to mitigate (infiltrate, filter, or treat) either:

1. The maximum flow rate of runoff produced from a rainfall intensity of 0.2 inch of rainfall per hour for each hour of a storm event; or
2. The maximum flow rate of runoff produced by the 85th percentile hourly rainfall intensity, as determined from the local historical rainfall record, multiplied by a factor of two; or
3. The maximum flow rate of runoff, as determined from the local historical rainfall record, that achieves approximately the same reduction in pollutant loads and flows as achieved by mitigation of the 85th percentile hourly rainfall intensity multiplied by a factor of two.

*Limited Exclusions:*

1. Proposed restaurants, where the land area for development or redevelopment is less than 5,000 square feet, are excluded from the Treatment Control BMP and numerical sizing criteria requirements.
2. Where significant redevelopment results in an increase of less than 50 percent of the impervious surfaces of a previously existing development, and the existing development was not subject to Project WQMP requirements, the Treatment Control BMP and numeric sizing criteria discussed in this section apply only to the addition, and not to the entire development.

***SELECTION OF TREATMENT CONTROL BMPs***

1. To select a structural Treatment Control BMP, each Priority Project shall compare the list of pollutants for which the downstream receiving waters are impaired (if any), with the pollutants anticipated to be generated by the project (as identified in **Table 7.II-2**).

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<sup>6</sup> This volume is not a single volume to be applied to all of Orange County. The size of the 85th percentile storm event is different for various parts of the County. The Permittees may calculate the 85th percentile storm event for each of their jurisdictions using local rain data pertinent to their particular jurisdiction. Data and procedures for determining an applicable 85<sup>th</sup> percentile, 24-hour storm event are presented in Attachment A.

Any pollutants identified by **Table 7.II-2**, which are also causing a Clean Water Act section 303(d) impairment of receiving waters of the project, shall be considered primary pollutants of concern. Priority Projects shall select a single or combination of stormwater Treatment Control BMPs, which address the particular primary pollutant(s) of concern. The Treatment Control BMP Selection Matrix (**Table 7.II-6**) should be used as a guide to assist in the selection of BMPs. BMPs are indicated in **Table 7.II-6** that are presumed to be adequate to address their specific pollutant(s) of concern, as these BMPs have been shown to have either medium or high effectiveness in removing these particular pollutants. The selected Treatment Control BMP(s) will address other pollutants in addition to the primary pollutant(s) as shown in **Table 7.II-6**.

If a comprehensive evaluation of site-specific conditions is completed, supported by scientific and engineering studies, the site-specific information may be used to modify the pollutants and BMPs identified in Tables 7.II-2 and 7.II-6 for that project. Any projects for which the pollutant list and/or BMPs are modified shall be reported by the Permittees to the Regional Board in the appropriate Annual Progress Report. Where toxicity is causing an impairment and the cause of that toxicity is not clearly identified, Treatment Control BMP selection should be made in consultation with Regional Board Staff.

2. Priority Projects that are not anticipated to generate a primary pollutant of concern, shall select a single or combination of stormwater Treatment Control BMPs from **Table 7.II-6**, that are designed to be effective in reducing pollutants of concern.
3. Alternative stormwater Treatment Control BMPs not identified in **Table 7.II-6** may be approved at the discretion of the Permittee, provided the alternative Treatment Control BMP is as effective in removal of pollutants of concern as other BMPs listed in **Table 7.II-6**.

#### ***LOCATE TREATMENT CONTROL BMPs NEAR POLLUTANT SOURCES***

Project-based (on-site) structural Treatment Control BMPs should be implemented close to pollutant sources to minimize costs and maximize pollutant removal prior to runoff entering receiving waters. Such Treatment Control BMPs may be located on- or off-site, used singly or in combination, or shared by multiple new developments, pursuant to the following requirements:

1. All structural Treatment Control BMPs shall be located so as to infiltrate, filter, and/or treat the required runoff volume or flow prior to its discharge to any receiving water.
2. Multiple post-construction structural Treatment Control BMPs for a single Priority Project shall collectively be designed to comply with the design standards of this section;

**Table 7-II-6  
Treatment Control BMP Selection Matrix<sup>(1)</sup>**

Pollutant of Concern	Treatment Control BMP Categories					
	Biofilters	Detention Basins <sup>(2)</sup>	Infiltration Basins <sup>(3)</sup>	Wet Ponds or Wetlands	Filtration	Hydrodynamic Separator Systems <sup>(4)</sup>
Sediment/Turbidity	H/M	M	H/M	H/M	H/M	H/M (L for Turbidity)
Nutrients	L	M	H/M	H/M	LM	L
Organic Compounds	U	U	U	U	H/M	L
Trash & Debris	L	M	U	U	H/M	H/M
Oxygen Demanding Substances	L	M	H/M	H/M	H/M	L
Bacteria & Viruses	U	U	H/M	U	H/M	L
Oil & Grease	H/M	M	U	U	H/M	L/M
Pesticides (non-soil bound)	U	U	U	U	U	L
<p>(1) Cooperative periodic performance assessment may be necessary. This Treatment Control BMP table will be updated as needed and as knowledge of stormwater treatment BMPs improves.(2) For detention basins with minimum 36-48-hour drawdown time.</p> <p>(3) Including trenches and porous pavement.</p> <p>(4) Also known as hydrodynamic devices and baffle boxes.</p> <p>L: Low removal efficiency H/M: High or medium removal efficiency U: Unknown removal efficiency</p> <p>Sources: Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (1993), National Stormwater Best Management Practices Database (2001), and Guide for BMP Selection in Urban Developed Areas (2001).</p>						

**Biofilters include:**

- Grass swales
- Grass strips
- Wetland vegetation swales
- Bioretention

**Detention Basins include:**

- Extended/dry detention basins with grass lining
- Extended/dry detention basins with impervious lining

**Infiltration Basins include:**

- Infiltration basins
- Infiltration trenches

**Wet Ponds and Wetlands include:**

- Wet ponds (permanent pool)
- Constructed wetlands

**Filtration Systems include:**

- Media filtration
- Sand filtration

**Hydrodynamic Separation Systems include:**

- Swirl Concentrators
- Cyclone Separators

3. Shared stormwater Treatment Control BMPs shall be operational prior to the use of any dependent development or phase of development. The shared BMPs shall only be required to treat the dependent developments or phases of development that are in use;
4. Interim stormwater Treatment Control BMPs that provide equivalent or greater treatment than is required by this section may be implemented by a dependent development until each shared BMP is operational. If interim BMPs are selected, the BMPs shall remain in use until permanent BMPs are operational.

For projects participating in a regional or watershed program in lieu of project-based BMPs, the BMPs must be located in accordance with the approved regional or watershed BMP program.

### ***RESTRICTIONS ON USE OF INFILTRATION BMPS***

Grading permits may limit or prohibit the use of infiltration BMPs in hillside or other special situations where slope stability and subsurface stability are of concern. Over time, infiltration may affect pre or post-development subsurface conditions, creating potential for instability.

It is also important to note that any drainage feature that infiltrates runoff poses some risk of potential groundwater contamination. Three factors significantly influence the potential for urban runoff to contaminate ground water. They are (i) pollutant mobility, (ii) pollutant abundance in urban runoff, (iii) and soluble fraction of pollutant. The risks associated with groundwater infiltration can be managed by:

- Designing landscape drainage features so that they promote infiltration of runoff, but do not inject runoff so that it bypasses the natural processes of filtering and transformation that occur in the soil. Taking reasonable steps to prevent the illegal discharge of wastes to drainage systems.

In general, designs that disperse runoff over landscaped areas or through permeable surfaces are the most effective, easiest to maintain and have the lowest initial cost. These designs also minimize the risk of illegal disposal because the surface is visible and the infiltration rate per unit area is relatively low.

- For some sites, it may be feasible to use detention basins to infiltrate additional runoff in a more compact area, but the designer must consider the potential for illegal disposal of chemical spills. Detention basins should not drain to, or be located near, work areas where wash-water or liquid wastes are generated or where hazardous chemicals are stored. Detention basins should be clearly marked with “no dumping” signs and should be inspected regularly.
- The Orange County Groundwater Basin and the San Juan Groundwater Basin are the primary managed drinking water basins for the county residents and must be protected as a source of safe drinking water. The Orange County Water District (OCWD) and the San Juan Basin Authority (SJBA) are the agencies responsible for managing the Orange County Groundwater Basin and the San Juan Groundwater Basin. Planning and possible

implementation of infiltration facilities must always be coordinated with OCWD and SJBA to make sure that proposed solutions to stormwater quality do not cause groundwater quality problems.

- The risk of contamination of groundwater may be reduced by pretreatment of urban runoff. A discussion of limitations and guidance for infiltration practices is contained in Potential Groundwater Contamination from Intentional and Non-Intentional Stormwater Infiltration, Report No. EPA/600/R-94/051, USEPA (1994).

To protect groundwater quality, each Permittee shall apply restrictions to the use of any Treatment Control BMPs that are designed to primarily function as infiltration devices (such as infiltration trenches and infiltration basins). As additional ground water basin data is obtained, Permittees, in coordination with OCWD and SJBA, may develop additional restrictions on the use of any BMPs that allow incidental infiltration.

At a minimum, use of structural Treatment Control BMPs that are designed to primarily function as infiltration devices shall meet the following conditions<sup>7</sup>:

1. Use of structural infiltration treatment BMPs shall not cause or contribute to an exceedance of groundwater water quality objectives.
2. Pollution prevention and Source Control BMPs shall be implemented at a level appropriate to protect groundwater quality at sites where infiltration structural Treatment Control BMPs are to be used.
3. Structural infiltration Treatment Control BMPs shall not cause a nuisance or pollution, as defined in Water Code Section 13050.
4. Urban runoff from commercial developments shall undergo pretreatment to remove both physical and chemical contaminants, such as sedimentation or filtration, prior to infiltration.
5. All dry weather flows shall be diverted from infiltration devices except for those non-stormwater discharges authorized pursuant to 40 CFR 122.26(d)(2)(iv)(B)(1): diverted stream flows, rising ground waters, uncontaminated ground water infiltration [as defined at 40 CFR 35.2005(20)] to municipal storm drain systems, uncontaminated pumped ground water, foundation drains, springs, water from crawl space pumps, footing drains, air conditioning condensation, flow from riparian habitats and wetlands, water line flushing, landscape irrigation, discharges from potable water sources other than water main breaks, irrigation water, individual residential car washing, and dechlorinated swimming pool discharges.

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<sup>7</sup> These conditions do not apply to structural Treatment Control BMPs which allow incidental infiltration and are not designed to primarily function as infiltration devices (such as grassy swales, detention basins, vegetated buffer strips, constructed wetlands, etc.)

6. The vertical distance from the base of any infiltration structural Treatment Control BMP to the seasonal high groundwater mark shall be at least 10 feet or as determined on an individual, site-specific basis by the Permittee. Where groundwater does not support beneficial uses, this vertical distance criterion may be reduced, provided groundwater quality is maintained. Reduction of vertical criterion should always be coordinated with OCWD and SJBA
7. The soil through which infiltration is to occur shall have physical and chemical characteristics (such as appropriate cation exchange capacity, organic content, clay content, and infiltration rate) that are adequate for proper infiltration durations and treatment of urban runoff for the protection of groundwater beneficial uses.
8. Infiltration structural Treatment Control BMPs shall not be used for areas of industrial or light industrial activity; areas subject to high vehicular traffic (25,000 or greater average daily traffic on main roadway or 15,000 or more average daily traffic on any intersecting roadway) unless a site specific evaluation is conducted; automotive repair shops; car washes; fleet or RV storage areas (bus, truck, etc.); nurseries; and other high threat to water quality land uses and activities as designated by each Permittee in their Local Implementation Plan (see **Appendix A, 2003 DAMP**).
9. The horizontal distance between the base of any infiltration structural Treatment Control BMP and any water supply wells shall be 100 feet or as determined on an individual, site-specific basis by the Permittee.
10. Any entity that implements a structural infiltration Treatment Control BMP shall be required to mitigate any groundwater contamination caused by the infiltration system.

Where infiltration Treatment Control BMPs are authorized, their performance shall be evaluated for impacts on groundwater quality. In developing the local WQMPs, Permittees may develop additional restrictions on the use of Treatment Control BMPs that are designed to primarily function as infiltration devices. Permittees under the San Diego Regional Board shall consider Permit Section D.1.g. requirements to control the contribution of pollutants from one portion of the watershed to another portion of the watershed through interagency agreements among the Permittees. In those instances where a Permittee determined that implementation of proposed infiltration Treatment Control BMPs within their jurisdiction has a potential impact to groundwater quality in another jurisdiction, Permittees may include a notification requirement be placed upon those proposing such use in addition to the above protection measures.

## **7.II - 4.0 NON-PRIORITY PROJECTS**

Non-Priority Projects for new development or significant redevelopment covered under this program shall perform the following steps for Project WQMP preparation using a process similar to that described for Priority Projects:

- Incorporate all applicable Source Control BMPs (routine non-structural and routine structural, including requirements applicable to individual project features). See **Section 7.II-3.3.2** for more details.
- Incorporate Site Design BMPs, as appropriate.

All non-priority new development and significant redevelopment projects shall incorporate and implement Site Design BMPs, as determined to be appropriate during the site planning and approval process. See **Section 7.II-3.3.1** for details. Permittees shall determine whether appropriate Site Design BMPs have been proposed in reviewing WQMPs.

## **7.II - 5.0 PROVIDE PROOF OF ONGOING STORMWATER BMP MAINTENANCE**

The Permittees shall not accept stormwater structural BMPs as meeting the WQMP requirements standard, unless an O&M Plan is prepared (see **DAMP Section 7.6.6**) and a mechanism is in place that will ensure ongoing long-term maintenance of all structural and non-structural BMPs. This mechanism can be provided by the Permittee or by the project proponent. As part of project review, if a project proponent is required to include interim or permanent structural and non-structural BMPs in project plans, and if the Permittee does not provide a mechanism for BMP maintenance, the Permittee shall require that the applicant provide verification of maintenance requirements through such means as may be appropriate, at the discretion of the Permittee, including, but not limited to covenants, legal agreements, maintenance agreements, conditional use permits and/or funding arrangements.

### **7.II - 5.1 Maintenance Mechanisms**

1. **Public entity maintenance:** The Permittee may approve a public or acceptable quasi-public entity (e.g., the County Flood Control District, or annex to an existing assessment district, an existing utility district, a state or federal resource agency, or a conservation conservancy) to assume responsibility for operation, maintenance, repair and replacement of the BMP. Unless otherwise acceptable to individual Permittees, public entity maintenance agreements shall ensure estimated costs are front-funded or reliably guaranteed, (e.g., through a trust fund, assessment district fees, bond, letter of credit or similar means). In addition, the Permittees may seek protection from liability by appropriate releases and indemnities.

The Permittee shall have the authority to approve stormwater BMPs proposed for transfer to any other public entity within its jurisdiction before installation. The Permittee shall be involved in the negotiation of maintenance requirements with any other public entities accepting maintenance responsibilities within their respective jurisdictions; and in negotiations with the resource agencies responsible for issuing permits for the construction and/or maintenance of the facilities. The Permittee must be identified as a third party beneficiary empowered to enforce any such maintenance agreement within their respective jurisdictions.

2. **Project proponent agreement to maintain stormwater BMPs:** The Permittee may enter into a contract with the project proponent obliging the project proponent to maintain, repair and replace the stormwater BMP as necessary into perpetuity. Security or a funding mechanism with a “no sunset” clause may be required.
3. **Assessment districts:** The Permittee may approve an Assessment District or other funding mechanism created by the project proponent to provide funds for stormwater BMP maintenance, repair and replacement on an ongoing basis. Any agreement with such a District shall be subject to the Public Entity Maintenance Provisions above.
4. **Lease provisions:** In those cases where the Permittee holds title to the land in question, and the land is being leased to another party for private or public use, the Permittee may assure stormwater BMP maintenance, repair and replacement through conditions in the lease.
5. **Conditional use permits:** For discretionary projects only, the Permittee may assure maintenance of stormwater BMPs through the inclusion of maintenance conditions in the conditional use permit. Security may be required.
6. **Alternative mechanisms:** The Permittee may accept alternative maintenance mechanisms if such mechanisms are as protective as those listed above.

#### **7.II - 5.2 Permit Closeout Requirements**

For discretionary projects, the Permittee-approved method of stormwater BMP maintenance shall be incorporated into the project's permit, and shall be consistent with permits issued by resource agencies, if any. Just as with all other aspects of a project's approved plans and designs, the Permittees will make a determination that all requirements of the Project WQMP have been satisfactorily completed prior to closeout of permits and issuance of certificates of use and occupancy (see **DAMP Section 7.6.6**).

For projects requiring only ministerial permits, the Permittee-approved method of stormwater BMP maintenance shall be shown on the project plans before the issuance of any ministerial permits. Verification will occur similar to discretionary projects.

In all instances, the project proponent shall provide proof of execution of a Permittee-approved method of maintenance, repair, and replacement (O&M Plan – See **DAMP Section 5.3**) before the issuance of construction approvals, permit closeout and issuance of certificates of use and occupancy. Permittees carrying out public projects that are not required to obtain permits shall be responsible for ensuring that a Permittee-approved method of stormwater BMP maintenance repair and replacement is executed prior to the completion of construction. For all properties, the verification mechanism will include the project proponent's signed statement, as part of the project application, accepting responsibility for all structural BMP maintenance, repair and replacement, until a Permittee-approved entity agrees to assume responsibility for structural BMP maintenance, repair and replacement or an alternative mechanism is approved by the Permittee regarding maintenance, repair and replacement of the structural BMP.

### **7.II - 5.3 Maintenance Requirements**

1. Operation & Maintenance (O&M) Plan: The Permittee shall ensure that a copy of an O&M plan, prepared by the project proponent satisfactory to the Permittee, is received prior to permit closeout and the issuance of certificates of use and occupancy. The O&M Plan describes the designated responsible party to manage the stormwater BMP(s), employee's training program and duties, operating schedule, maintenance frequency, routine service schedule, specific maintenance activities, copies of resource agency permits, and any other necessary activities. At a minimum, maintenance agreements shall require the inspection and servicing of all structural BMPs on an annual basis.

The project proponent or Permittee-approved maintenance entity shall complete and maintain O&M forms to document all maintenance requirements. Parties responsible for the O&M plan shall retain records for at least 5 years. These documents shall be made available to the Permittee for inspection upon request at any time.

2. Access Easement/Agreement: As part of the maintenance mechanism selected above, the Permittee shall require the inclusion of a copy of an executed access easement that shall be binding on the land throughout the life of the project, until such time that the stormwater BMP requiring access is replaced, satisfactory to the Permittee.

### **7.II - 6.0 WAIVER OF STRUCTURAL TREATMENT BMP REQUIREMENTS**

Permittees may provide for a Priority Project to be waived from the requirement of implementing structural Treatment Control BMPs (see **Section 7.II-3**) if infeasibility can be established. A Permittee shall only grant a waiver of infeasibility when all available structural Treatment Control BMPs have been considered and rejected as infeasible. The burden of proof is on the project proponent to demonstrate that all available measures are infeasible. Permittees shall notify the Executive Officer of the appropriate Regional Board by Certified Mail (with Return Receipt) within five (5) days after each waiver is issued and a copy of the waiver documentation shall include the name of the person granting each waiver and a copy of the Project WQMP.

Waivers may only be granted for structural Treatment Control BMP and structural Treatment Control BMP sizing requirements. Priority Projects, whether or not granted a waiver, may not cause or contribute to an exceedance of water quality objectives. Pollutants in runoff from projects granted a waiver must still be reduced through the use of applicable Source Control BMPS and Site Design BMPs, as appropriate, to achieve the appropriate standard, as specified in the Third Term Permits.

In considering a waiver the Permittees should review the CEQA documentation for the project to determine whether a significant unmitigated impact or cumulative impact was identified that was the subject of a statement of overriding considerations

Each Permittee that implements a waiver program must also develop a WQMP waiver mitigation program to require project proponents who have received waivers to use the savings in cost, or a proportionate share thereof, as determined by the Permittee, to undertake or contribute to activities consistent with the stormwater mitigation program. Each Permittee shall notify the Regional Board when its WQMP waiver mitigation program is developed pursuant to this Model WQMP. Further, details for any WQMP waiver mitigation program should be set out in the Local Implementation Plan (DAMP Appendix A), or in supplemental submissions if multiple Permittees establish a joint mitigation program for a region or watershed.

This Model WQMP does not preclude Permittees or groups of Permittees from imposing any other fees or charges on development projects that are permitted by law, or from managing or expending the monies received from such non-WQMP programs in any manner authorized by law.

## **7.II - 7.0       ALTERNATIVE APPROACHES FOR TREATMENT CONTROLS**

### **7.II - 7.1       Site Design Stormwater Treatment Credits**

Any Permittee may develop and submit for public review and Regional Board approval, a regional Model Site Design Stormwater Treatment Credits program that allows reductions in the volume or flow of stormwater that must be captured or treated on a project in return for the inclusion of specified project design features in the project. The Model Site Design Stormwater Treatment Credits program shall be deemed part of this Model WQMP following Regional Board approval.

Any such model program shall specify the conditions under which project proponents can be credited for the use of Site Design BMPs and low impact development techniques that can reduce the volume of stormwater runoff, preserve natural areas, and minimize the pollutant loads generated and potentially discharged from the site. Any Site Design Stormwater Treatment Credits program implemented by a Permittee within its jurisdiction shall be consistent and compliant with this model approved by the Regional Board.

## **7.II - 8.0       RESOURCES AND REFERENCES**

A list of resources for information is provided in **Attachment B**.

## **ATTACHMENT A**

### **DESIGN OF TREATMENT CONTROL BMPs USING THE STORMWATER QUALITY DESIGN FLOW(SQDF) OR THE STORMWATER QUALITY DESIGN VOLUME (SQDV)**

Unlike flood control measures that are designed to handle peak flow rates, stormwater Treatment Control BMPs are designed to treat the more frequent, lower-flow rate storm events, or the first flush portions of runoff from larger storm events (typically referred to as the first-flush events). Small, frequent storm events represent most of the total average annual rainfall for the area. The flow rate and volume from such small events is targeted for treatment.

The primary control strategy for designing Treatment Control BMPs is to treat the Stormwater Quality Design Flow (SQDF) or the Stormwater Quality Design Volume (SQDV) of the stormwater runoff. This section explains how to calculate the SQDF or the SQDV of the stormwater runoff. In addition, Treatment Control BMPs must be designed to safely convey or bypass peak design storms.

The methods presented in this appendix are intended to be used for sizing of project-based Treatment Control BMPs in Project WQMPs, or determining the required SQDV or SQDF contribution from an individual project in allocating capacity in a regional or watershed BMP program. Methods for estimating hydrology from larger watershed for the sizing of regional or watershed BMPs that address larger areas may require alternative approaches for determining appropriate sizing of BMPs.

#### **Stormwater Quality Design Flow (SQDF) Calculations**

The Stormwater Quality Design Flow (SQDF) is defined by the Permits as the maximum flow rate of runoff produced from a rainfall intensity of 0.2-inch of rainfall per hour<sup>8</sup>.

#### Calculation Procedure

1. The Stormwater Quality Design Flow in Orange County is defined as  $Q_{P, SQDF}$ .

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<sup>8</sup> As defined in Section XII.B.3.B of the California Regional Water Quality Control Board, Santa Ana Region, Waste Discharge Requirements for the County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County within the Santa Ana Region, Urban Stormwater Runoff Management Program, Orange County, Order No. R8-2002-0010, NPDES Permit No. CAS618030; and in Section F.1.b.(2)(c) of the California Regional Water Quality Control Board, San Diego Region, Waste Discharge Requirements for Discharges of Urban Runoff from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds of the County of Orange, the Incorporated Cities of Orange County and the Orange County Flood Control District within the San Diego Region, Board Order No. R9-2002-0001, NPDES CAS0108740

2. Calculate the stormwater quality design flow for the site (or each sub-drainage area that will discharge to a separate BMP) produced by 0.2-inch/hour rainfall by using the rational method equation:

$$Q_{P, SQDF} = C * I * A$$

Where:

C = runoff coefficient obtained from **Table A-1**.

I = rainfall intensity (0.2 in/hr)

A = area of the site or sub-drainage area in acres

**Table A-1**  
**C Values Based on Impervious/Pervious Area Ratios**

% Impervious	% Pervious	C
0	100	0.15
5	95	0.19
10	90	0.23
15	85	0.26
20	80	0.30
25	75	0.34
30	70	0.38
35	65	0.41
40	60	0.45
45	55	0.49
50	50	0.53
55	45	0.56
60	40	0.60
65	35	0.64
70	30	0.68
75	25	0.71
80	20	0.75
85	15	0.79
90	10	0.83
95	5	0.86
100	0	0.90

### **Example Stormwater Quality Design Flow (SQDF) Calculation**

The steps below show an example calculation for a 30-acre site with runoff coefficient of 0.45 (40% impervious).

*Step 1:*

$$\text{Design Flow} = Q_{P, \text{SQDF}} = C * I * A$$

*Step 2:*

Calculate the peak rate of flow

$$Q_{P, \text{SQDF}} = 0.45 \times 0.2 \times 30 = 2.7 \text{ cfs} = \text{Stormwater Quality Design Flow for the BMP.}$$

### **Stormwater Quality Design Storm Volume (SQDV) Calculations**

Hydrologic calculations for design of volumetric-based stormwater quality BMPs in Orange County shall be in accordance with one of the four following approaches specified in the permits:

- i. The volume of runoff produced from a 24-hour 85th percentile storm event, as determined from the local historical rainfall record<sup>9</sup>; or
- ii. The volume of runoff produced by the 85th percentile 24-hour runoff event, determined as the maximized capture urban runoff volume for the area, from the formula recommended in Urban Runoff Quality Management, WEF Manual of Practice No. 23/ASCE Manual and Report on Engineering Practice No. 87, (1998); or
- iii. The volume of annual runoff based on unit basin storage volume, to achieve 80 percent (Santa Ana Permit area), or 90 percent (San Diego Permit area) or more volume treatment by the method recommended in California Stormwater Best Management Practices Handbooks (1993), or
- iv. The volume of runoff, as determined from the local historical rainfall record, that achieves approximately the same reduction in pollutant loads and flows as achieved by mitigation of the 85th percentile 24-hour runoff event.<sup>10</sup>

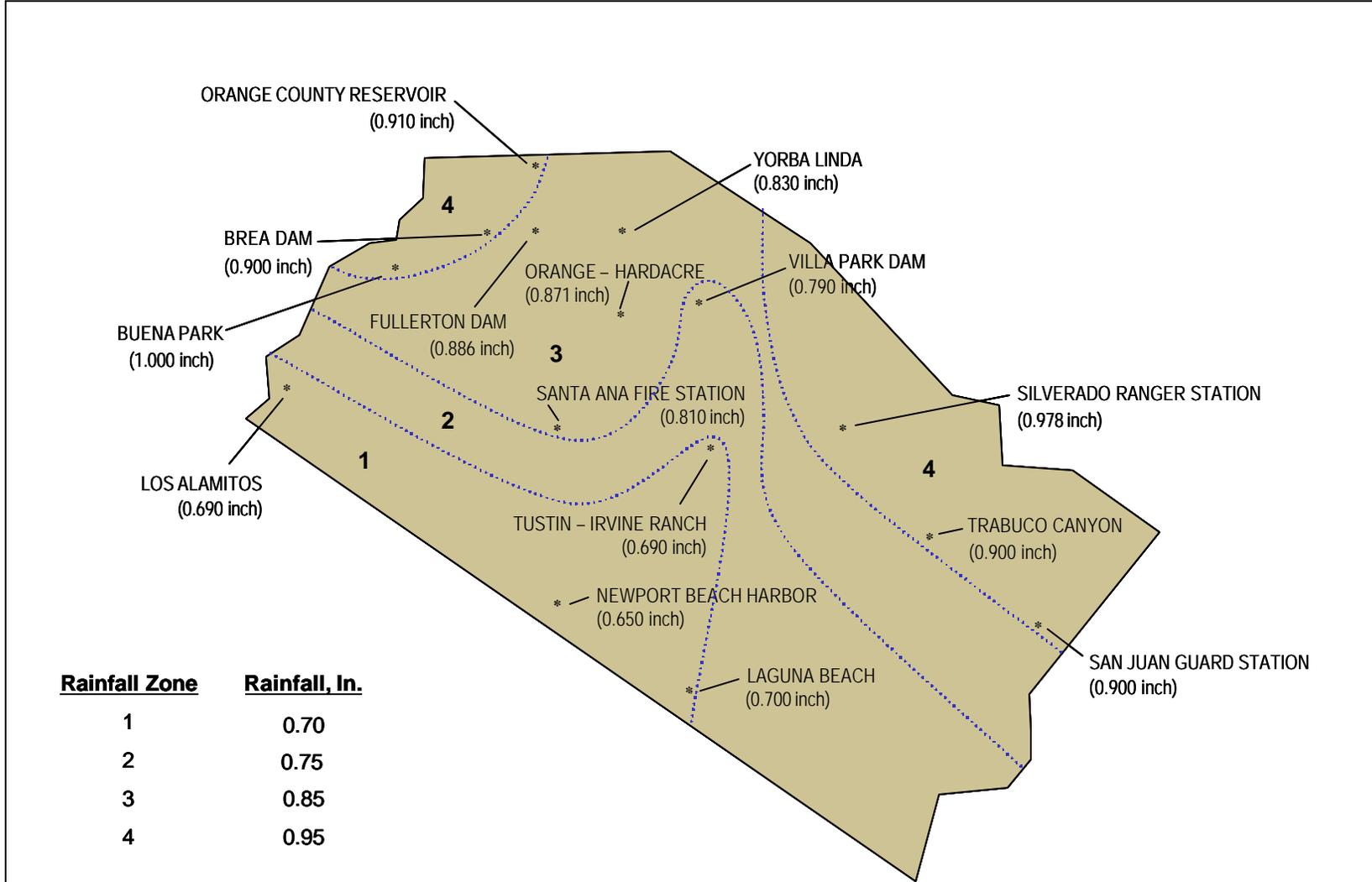
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<sup>9</sup> This volume is not a single volume to be applied to all of Orange County. The size of the 85<sup>th</sup> percentile storm event is different for various parts of the County.

<sup>10</sup> Under this volume criterion, hourly rainfall data may be used to calculate the 85<sup>th</sup> percentile storm event, where each storm event is identified by its separation from other storm events by at least six hours of no rain. If hourly rainfall data is selected, the Permittees shall describe the method for using hourly rainfall data to calculate the 85<sup>th</sup> percentile storm event in their local WQMPs.

Individual projects may evaluate and select any of the above approaches. Procedures, data specific to Orange County, and examples for applying approaches (i), (ii), and (iii) are presented herein.

Data and procedures for determining an applicable 85th percentile, 24-hour storm event are presented in **Table A-2** and **Figure A-1**. Rainfall depths for the 85th percentile 24-hour event have been calculated for a number of stations throughout Orange County as shown in **Table A-2**. Approximate contour lines of the 85th percentile depth have been developed based upon the data as shown in **Figure A-1**. Projects should use the 85th percentile value from the rainfall zone in which the project site is located.



**Figure A-1**  
**Orange County California**  
**Precipitation Stations**  
**24-hour, 85<sup>th</sup> percentile rainfall**

The project used to demonstrate the calculations has the following characteristics:

- Located in the City of Irvine
- Total project area,  $A_t$ , is 10 acres
- Impervious area,  $A_i$ , is 6 acres

Method (I):

The volume of runoff produced from a 24-hour 85th percentile storm event, as determined from the local historical rainfall record. The procedure is as follows:

1. **Review the area draining to the proposed BMP.** Determine the percentage of the drainage area that is considered impervious. Impervious area includes paved areas, roofs, and other developed, non-vegetated areas. Non-vegetated, compacted soil areas shall be considered as impervious area.
2. **Use Table A-1 to determine the Runoff Coefficient “C” for the drainage area** The runoff coefficients from this table are intended only for use in this procedure for design of volumetric-based stormwater quality BMPs.
3. **Find the depth of rainfall in inches of the 85th percentile storm event.** Use 0.75 inch based on the project location and **Figure A-1**.
4. **Calculate the Water Quality Design Volume of the BMP.** The Water Quality Design Volume of the BMP is then calculated by multiplying the total rainfall by the BMP’s drainage area and runoff coefficient. Due to the mixed units that result (e.g., acre-inches, acre-feet) it is recommended that the resulting volume be converted to cubic feet for use during design.

**Example Use of Runoff from 85<sup>th</sup> Percentile Storm Event for Sizing a Dry Detention Basin**

$$(A_i/A_t) * 100 = (6/10) * 100 = 60\%$$

From Table A-1, for 60% impervious,  $C = 0.60$

$$V_b = C * I * A_t$$

$$V_b = 0.60 * (0.75 \text{ in}) * (10 \text{ ac}) * (1 \text{ ft}/12 \text{ in}) * (43,560 \text{ ft}^2/\text{acre})$$

**Size the BMP for  $V_b = 16,335 \text{ ft}^3$  and a minimum 48-hr drawdown**

Method (II)

The volume of runoff produced by the 85th percentile 24-hour runoff event, determined as the maximized capture urban runoff volume for the area, from the formula recommended in Urban

Runoff Quality Management, WEF Manual of Practice No. 23/ASCE Manual and Report on Engineering Practice No. 87, (1998).

From WEF MOP 23/ASCE MREP 87:

$$P_0 = (a * C) * P_6$$

Where:

C = Runoff Coefficient =  $0.858 i^3 - 0.78 i^2 + 0.774 i + 0.04$

i = Watershed imperviousness ratio; namely, percent total imperviousness divided by 100 = 0.60

P<sub>6</sub> = mean storm precipitation volume, watershed inches. Using **Figure 5-3** in the manual, P<sub>6</sub> = 0.65 inches

a = Regression constant from least-square analysis. Using **Table 5-4** in the manual for 48-hours drain time, a = 1.963

P<sub>0</sub> = Maximized detention volume using either the volume capture ratio as its basis, watershed inches

$$C = 0.858 (0.60)^3 - 0.78 (0.60)^2 + 0.774 (0.60) + 0.04 = 0.409$$

$$P_0 = (1.963 * 0.409) * 0.65$$

$$P_0 = 0.522 \text{ inches}$$

$$V_b = 0.522 (10 \text{ acre}) (1 \text{ ft}/12 \text{ in}) (43,560 \text{ ft}^2/\text{acre})$$

**Size the BMP for V<sub>b</sub> = 18,949 ft<sup>3</sup> and 48-hour drawdown**

## Method (III) – Annual Runoff or Unit Basin Storage Volume Method

1. **Review the area draining to the proposed BMP.** Determine the percentage of the drainage area that is considered impervious. Impervious area includes paved areas, roofs, and other developed, non-vegetated areas. Non-vegetated, compacted soil areas shall be considered as impervious area.
2. **Use Table A-1 to determine the Runoff Coefficient “C” for the drainage area.** The runoff coefficients from this table are intended only for use in this procedure for design of volumetric-based stormwater quality BMPs. Alternately, obtain the Runoff Coefficient from the drainage design calculations for the project.
3. **Find the Unit Basin Storage Volume<sup>11</sup>.**

Obtain hourly rainfall data for the closest rain gage and develop capture curves using the Unit Basin Storage Volume method. Example storage curves have been developed using data from the Laguna Beach rain gage and the Silverado Ranger Station as shown in Figures A-2 and A-3.

Enter **Figure A-2** or **A-3** on the vertical axis at 80% Annual Capture for projects in the Santa Ana Regional Board region or 90% Annual Capture for projects in the San Diego Regional Board region.

Move horizontally to the right across the figure until the curve corresponding to the drainage area’s runoff coefficient (“C”) determined in Step 2 is intercepted. Interpolation between curves may be necessary. Move vertically down the figure for this point until the horizontal axis is intercepted. Read the Unit Basin Storage Volume along the horizontal axis. Recommended drawdown time for dry detention basins is 48 hours as discussed in the fact sheet.

OR

**Figure A-4** provides a direct reading of Unit Basin Storage Volumes required for 80% (Santa Ana Regional Board region) and 90% (San Diego Regional Board region) annual capture of runoff for values of “C” determined in Step 2 for projects using the Laguna Beach rain gage.

**Figure A-5** provides a direct reading of Unit Basin Storage Volumes required for 80% (Santa Ana Regional Board region) and 90% (San Diego Regional Board region) annual capture of runoff for values of “C” determined in Step 2 using the Silverado Ranger Station gage.

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<sup>11</sup> Figures A-1 – A-4 are based on Precipitation Gages 4650 and 8243, located at Laguna Beach and Silverado Ranger Station, respectively. Both of these gages have data records of approximately fifty years of hourly readings and are maintained by the National Weather Service. Figures A-1 through A-4 are for use only in the permit areas specified in Santa Ana Regional Board Order No. R8-2002-0010, NPDES Permit No. CAS618030; and San Diego Regional Board Order No. R9-2002-0001, NPDES CAS0108740.

Enter the vertical axis of **Figure A-4** (or **Figure A-5**) with the “C” value from Step 2. Move horizontally across the figure until the line is intercepted. Move vertically down the figure from this point until the horizontal axis is intercepted. Read the Unit Basin Storage Volume along the horizontal axis.

4. **Calculate the BMP volume.** The basin volume or basic volume of the BMP is then calculated by multiplying the Unit Basin Storage Volume by the BMP’s drainage area. Due to the mixed units that result (e.g., acre-inches, acre-feet) it is recommended that the resulting volume be converted to cubic feet for use during design.

**Example Use of Unit Basin Storage Volume Curves Sizing a Dry Detention Basin**

$$(A_i/A_t) * 100 = (6/10) * 100 = 60\%$$

From **Table A-1**, for 60% impervious,  $C = 0.60$

Use **Figure A-4**, and the line that provides a direct reading of Unit Basin Storage Volumes required for 80% (Santa Ana Regional Board region) annual capture of runoff for values of “C” determined from **Table A-2**, for the Laguna Beach rain gage.

Enter the vertical axis of **Figure A-4** with  $C = 0.60$ . Move horizontally across the figure until the line is intercepted. Move vertically down the figure from this point until the horizontal axis is intercepted. Read the Unit Basin Storage Volume ( $V_u$ ) along the horizontal axis.

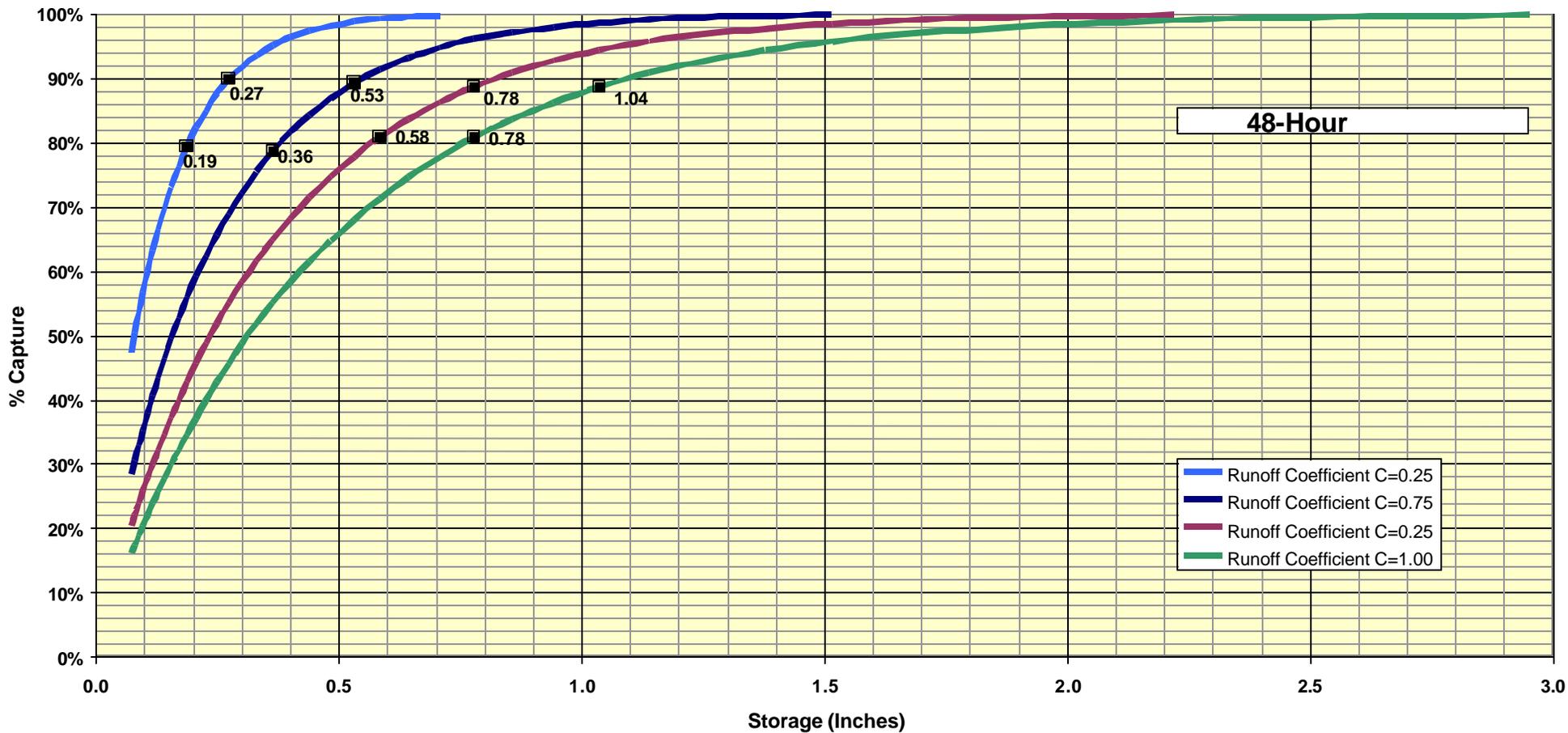
$$V_u = 0.46 \text{ inches}$$

The volume of the basin is then  $V_u \times A_t$

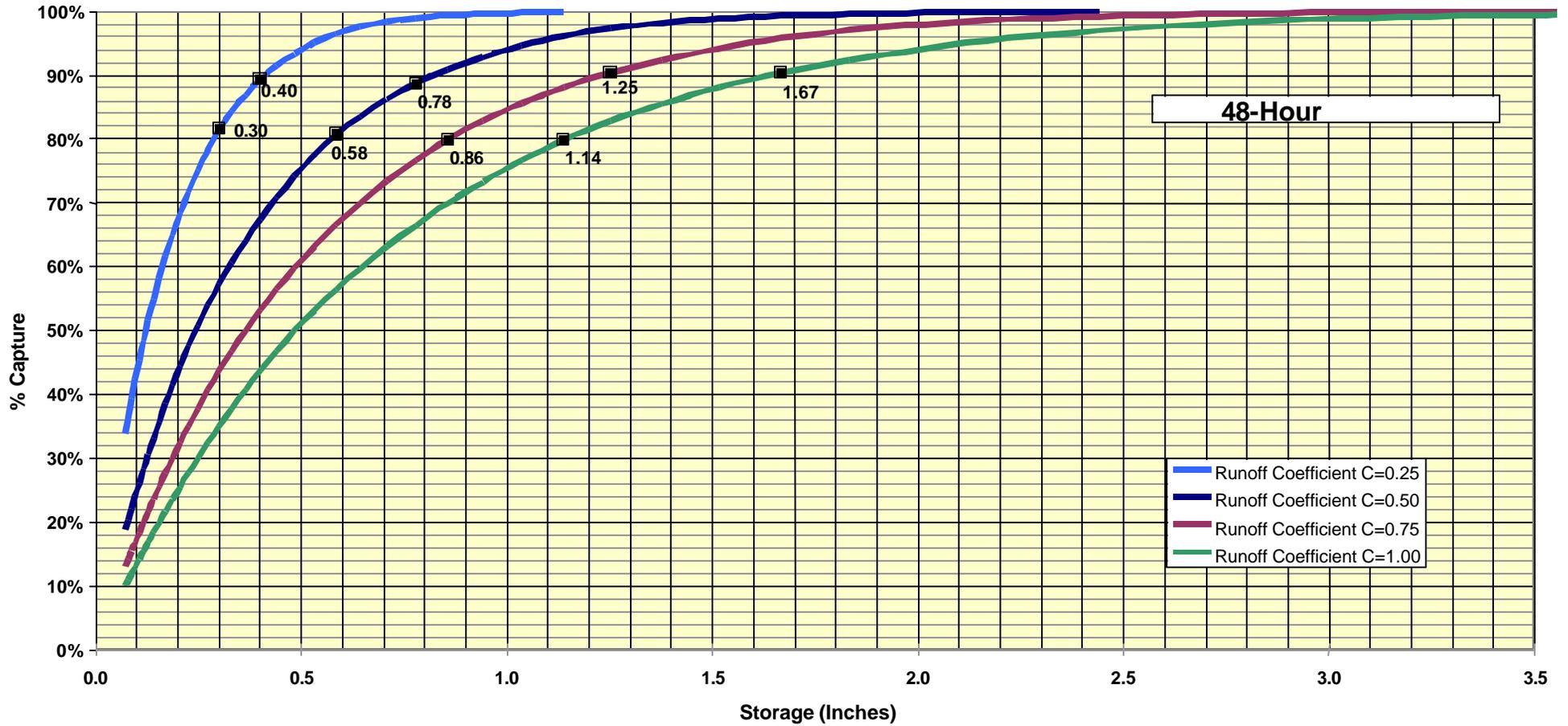
$$V_b = V_u \times A_t = (0.46 \text{ in}) (10\text{ac}) (1 \text{ ft}/12 \text{ in}) (43,560 \text{ ft}^2/\text{ac})$$

**Size the BMP for  $V_b = 16,698 \text{ ft}^3$  and 48-hour drawdown**

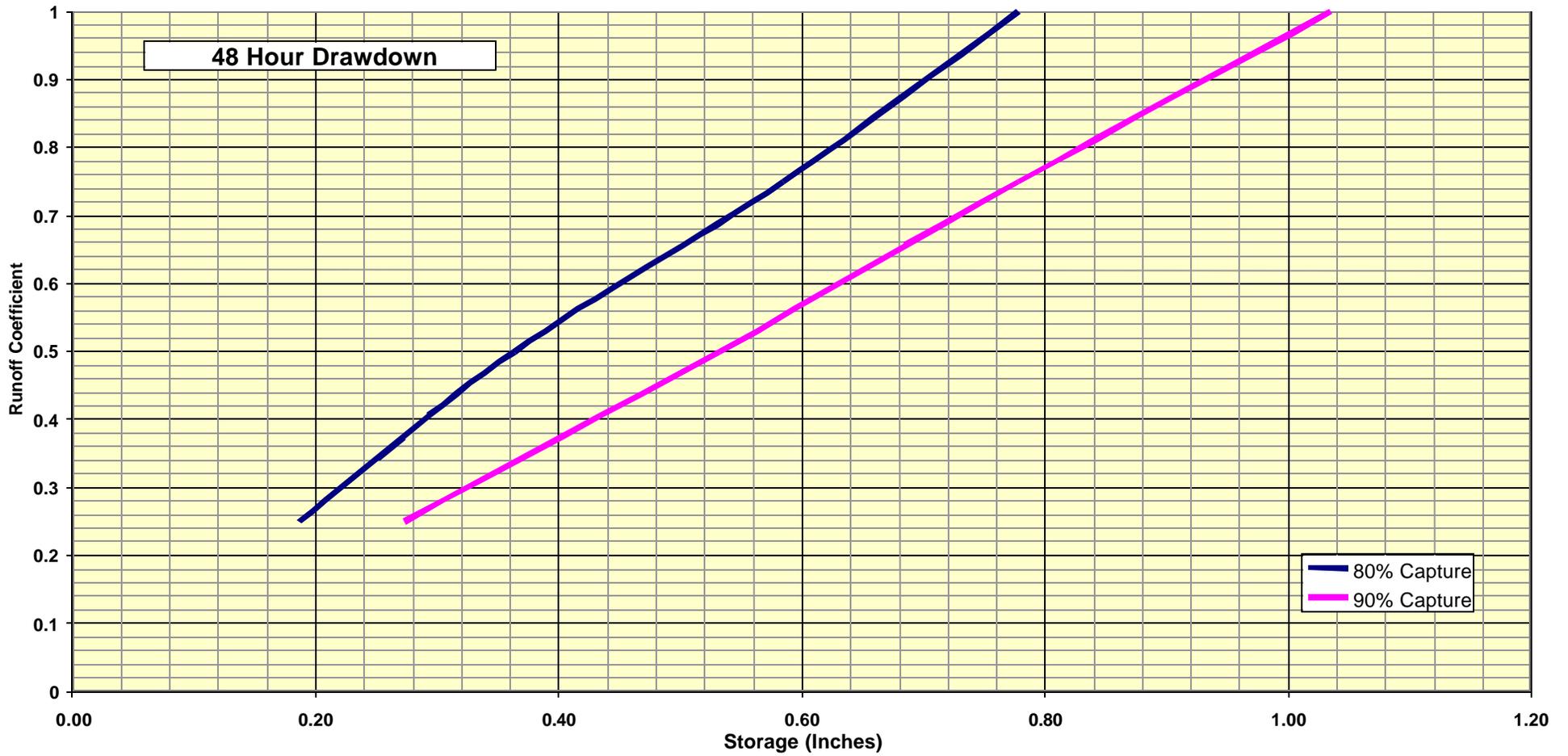
**Figure A-2**  
**Volumetric BMP Sizing Curves for**  
**Orange County Stormwater Quality Management Program**  
**Laguna Beach**



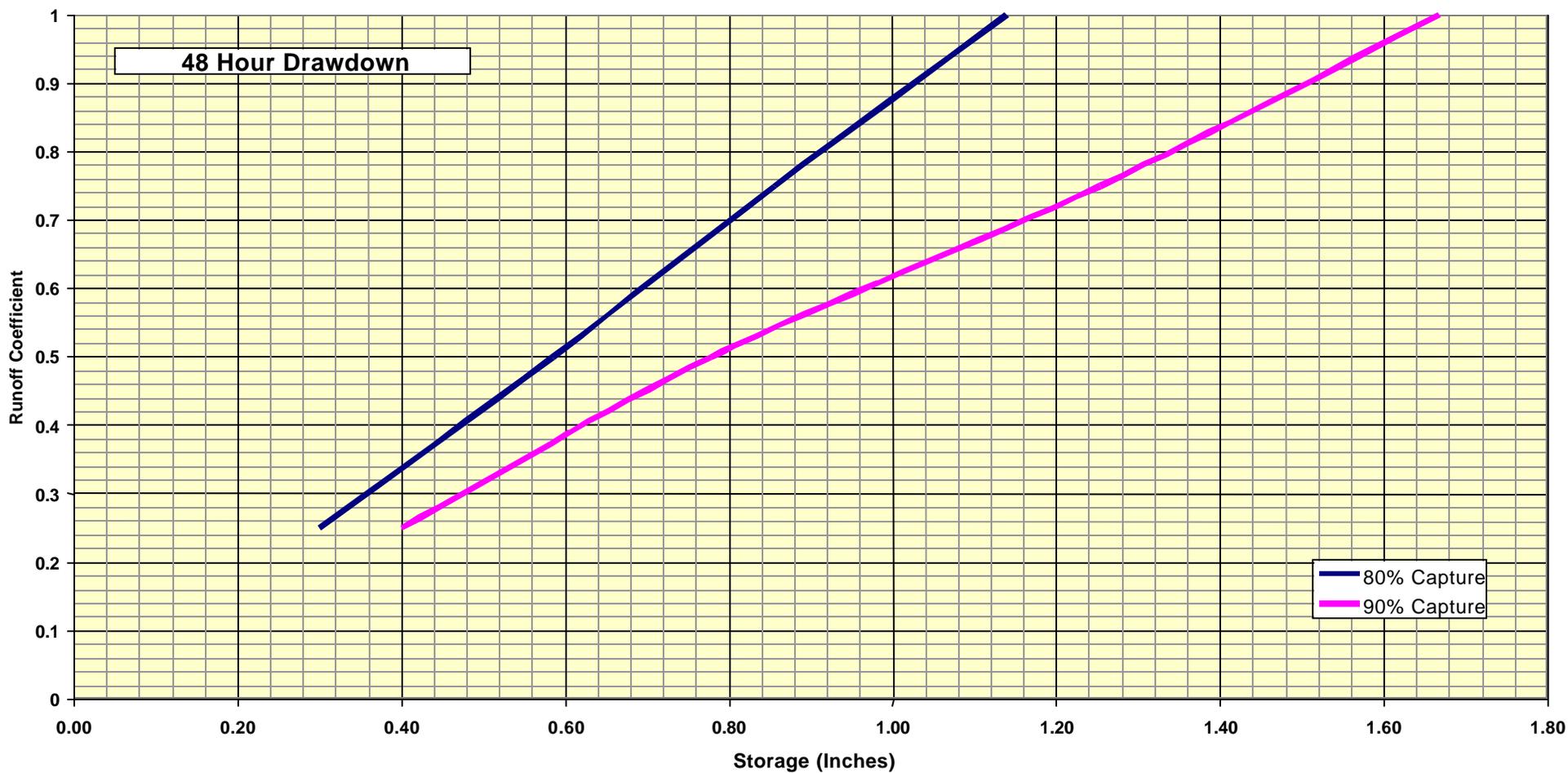
**Figure A-3**  
**Volumetric BMP Sizing Curves for**  
**Orange County Stormwater Quality Management Program**  
**Silverado Ranger Station**



**Figure A-4**  
**Volumetric BMP Sizing Curves for**  
**Orange County Stormwater Quality Management Program**  
**Laguna Beach**



**Figure A-5**  
**Volumetric BMP Sizing Curves for**  
**Orange County Stormwater Quality Management**  
**Program Silverado Ranger Station**



## **Peak Design Storm Hydrology**

While the treatment control BMPs must be designed to function at full treatment effectiveness up to SQDF or SQDV in accordance with accepted design practices, drainage systems must also be designed to safely pass the peak design storm flows. This can be accomplished either by designing the drainage system such that higher flows or runoff volumes that exceed the SQDF or SQDV bypass the treatment control BMP (“off-line”), or by designing the BMP to safely pass the peak design flow without impacting the treatment effectiveness for the lower flow rates (“in-line”).

Hydrologic calculations for determining peak design storm flows in Orange County shall be in accordance with the latest edition of the Orange County Hydrology Manual produced in January 1986, together with the procedure set forth herein. Where jurisdictions within Orange County have approved alternative hydrologic calculation methods, the alternative methods may be utilized if they have been approved by the jurisdiction for use in design of flow rate-based stormwater quality BMPs.

## ATTACHMENT B – Suggested Resources

SUGGESTED RESOURCES	HOW TO GET A COPY
<p>Better Site Design: A Handbook for Changing Development Rules in Your Community (1998)</p> <p>Presents guidance for different model development alternatives.</p>	<p>Center for Watershed Protection 8391 Main Street Ellicott City, MD 21043 410-461-8323 www.cwp.org</p>
<p>California Urban runoff Best Management Practices Handbooks (1993) for Construction Activity, Municipal, and Industrial/Commercial</p> <p>Presents a description of a large variety of Structural BMPs, Treatment Control, BMPs and Source Control BMPs</p>	<p>Los Angeles County Department of Public Works Cashiers Office 900 S. Fremont Avenue Alhambra, CA 91803 626-458-6959</p>
<p>Caltrans Urban runoff Quality Handbook: Planning and Design Staff Guide (Best Management Practices Handbooks (1998)</p> <p>Presents guidance for design of urban runoff BMPs</p>	<p>California Department of Transportation P.O. Box 942874 Sacramento, CA 94274-0001 916-653-2975</p>
<p>Design and Construction of Urban Stormwater Management Systems, American Society of Civil Engineers (ASCE) Manuals and Reports on Engineering Practice No. 77/ Water Environment Federation (WEF) Manual of Practice FD-20, 1992.</p>	
<p>Design Manual for Use of Bioretention in Stormwater Management (1993)</p> <p>Presents guidance for designing bioretention facilities.</p>	<p>Prince George's County Watershed Protection Branch 9400 Peppercorn Place, Suite 600 Landover, MD 20785</p>
<p>Design of Stormwater Filtering Systems (1996) by Richard A. Claytor and Thomas R. Schuler</p> <p>Presents detailed engineering guidance on ten different urban runoff-filtering systems.</p>	<p>Center for Watershed Protection 8391 Main Street Ellicott City, MD 21043 410-461-8323</p>
<p>Development Planning for Stormwater Management, A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), (May 2000)</p>	<p>Los Angeles County Department of Public Works <a href="http://dpw.co.la.ca.us/epd/">http://dpw.co.la.ca.us/epd/</a> or <a href="http://www.888cleanLA.com">http://www.888cleanLA.com</a></p>
<p>Florida Development Manual: A Guide to Sound Land and Water Management (1988)</p> <p>Presents detailed guidance for designing BMPs</p>	<p>Florida Department of the Environment 2600 Blairstone Road, Mail Station 3570 Tallahassee, FL 32399 850-921-9472</p>

SUGGESTED RESOURCES	HOW TO GET A COPY
Guidance Manual for On-Site Stormwater Quality Control Measures, Sacramento Stormwater Management Program.	City of Sacramento Department of Utilities and County of Sacramento Water Resources Division. January 2000.
Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (1993) Report No. EPA-840-B-92-002.  Provides an overview of, planning and design considerations, programmatic and regulatory aspects, maintenance considerations, and costs.	National Technical Information Service U.S. Department of Commerce Springfield, VA 22161 800-553-6847
Guide for BMP Selection in Urban Developed Areas (2001)	ASCE Envir. and Water Res. Inst. 1801 Alexander Bell Dr. Reston, VA 20191-4400 (800) 548-2723
Low-Impact Development Design Strategies - An Integrated Design Approach (June 1999)	Prince George's County, Maryland Department of Environmental Resource Programs and Planning Division 9400 Peppercorn Place Largo, Maryland 20774 <a href="http://www.co.pg.md.us/Government/DER/PPD/pgcounty/lidmain.htm">http://www.co.pg.md.us/Government/DER/PPD/pgcounty/lidmain.htm</a>
Maryland Stormwater Design Manual (1999)  Presents guidance for designing urban runoff BMPs	Maryland Department of the Environment 2500 Broening Highway Baltimore, MD 21224 410-631-3000
Methodology for Analysis of Detention Basins for Control of Urban Runoff Quality, Environmental Protection Agency (EPA-440/5-87-001).	
National Stormwater Best Management Practices (BMP) Database, Version 1.0  Provides data on performance and evaluation of urban runoff BMPs	American Society of Civil Engineers 1801 Alexander Bell Drive Reston, VA 20191 703-296-6000
National Stormwater Best Management Practices Database (2001)	Urban Water Resources Research Council of ASCE Wright Water Engineers, Inc. (303) 480-1700
Operation, Maintenance and Management of Stormwater Management (1997)  Provides a thorough look at stormwater practices including, planning and design considerations, programmatic and regulatory aspects, maintenance considerations, and costs.	Watershed Management Institute, Inc. 410 White Oak Drive Crawfordville, FL 32327 850-926-5310
Potential Groundwater Contamination from Intentional and Non-Intentional Stormwater Infiltration	Report No. EPA/600/R-94/051, USEPA (1994).

SUGGESTED RESOURCES	HOW TO GET A COPY
Preliminary Data Summary of Urban runoff Best Management Practices (August 1999)  EPA-821-R-99-012	<a href="http://www.epa.gov/ost/stormwater/">http://www.epa.gov/ost/stormwater/</a>
Reference Guide for Stormwater Best Management Practices (July 2000)	City of Los Angeles Urban runoff Management Division 650 South Spring Street, 7th Floor Los Angeles, California 90014 <a href="http://www.lacity.org/san/swmd/">http://www.lacity.org/san/swmd/</a>
Second Nature: Adapting LA's Landscape for Sustainable Living (1999) by Tree People  Detailed discussion of BMP designs presented to conserve water, improve water quality, and achieve flood protection.	Tree People 12601 Mullholland Drive Beverly Hills, CA 90210 (818) 623-4848 Fax (818) 753-4625
Site Planning for Urban Stream Protection, Department of Environmental Programs, Metropolitan Washington Council of Governments	
Start at the Source (1999)  Detailed discussion of permeable pavements and alternative driveway designs presented.	Bay Area Stormwater Management Agencies Association 2101 Webster Street Suite 500 Oakland, CA 510-286-1255
Stormwater, Grading and Drainage Control Code, Seattle Municipal Code Section 22.800-22.808, and Director's Rules, Volumes 1-4. (Ordinance 119965, effective July 5, 2000)	City of Seattle Department of Design, Construction & Land Use 700 5th Avenue, Suite 1900 Seattle, WA 98104-5070 (206) 684-8880 <a href="http://www.ci.seattle.wa.us/dclu/Codes/sgdcode.htm">http://www.ci.seattle.wa.us/dclu/Codes/sgdcode.htm</a>
Stormwater Management in Washington State (1999) Vols. 1-5  Presents detailed guidance on BMP design for new development and construction.	Department of Printing State of Washington Department of Ecology P.O. Box 798 Olympia, WA 98507-0798 360-407-7529
The Stormwater Manager's Resource Center. This is a comprehensive site with information on BMP design and sizing. <a href="http://www.stormwatercenter.com">http://www.stormwatercenter.com</a>	
Stormwater Pollution Control, Municipal, Industrial and Construction NPDES Compliance, Second Edition. Roy D. Dodson, P.E., 1999.	
Texas Nonpoint Source Book – Online Module (1998) <a href="http://www.txnpsbook.org">www.txnpsbook.org</a>  Presents BMP design and guidance information on-line	Texas Statewide Urban runoff Quality Task Force North Central Texas Council of Governments 616 Six Flags Drive Arlington, TX 76005 817-695-9150

SUGGESTED RESOURCES	HOW TO GET A COPY
The Practice of Watershed Protection by Thomas R. Shchuler and Heather K. Holland	Center for Watershed Protection 8391 Main Street Ellicott City, MD 21043 410-461-8323 www.cwp.org
Urban Runoff Quality Management, American Society of Civil Engineers (ASCE) Manual and Report on Engineering Practice No. 87/Water Environment Federation (WEF) Manual of Practice No.23, 1998.	
Urban Storm Drainage, Criteria Manual – Volume 3, Best Management Practices (1999)  Presents guidance for designing BMPs	Urban Drainage and Flood Control District 2480 West 26th Avenue, Suite 156-B Denver, CO 80211 303-455-6277

## **ATTACHMENT C**

### **Orange County Sanitation District, Guidelines for Preventing Sewer Discharge of Surface Runoff through Wash Pads**

#### **Purpose and Scope**

These guidelines are established pursuant to Section 203 of the Districts' Wastewater Discharge Regulations (Ordinance) as amended February 7, 1992. Section 203 provides that

No person shall discharge groundwater, surface runoff, or subsurface drainage to the Districts' sewerage facilities except as provided herein. Pursuant to section 305, et. Seq., the Districts may approve the discharge of such water only when no alternate method of disposal is reasonably available or to mitigate an environmental risk or health hazard.

The Guidelines presented herein are intended for the implementation of this policy as it applies to preventing surface runoff from entering the Districts' sewerage system through exposed wash pads.

#### **Application**

Two sources from which surface runoff can potentially enter the Districts' sewerage system are the exposed area around the wash pad and the wash pad itself.

**Exposed Area Around the Wash Pad:** Appropriate measures must be taken to insure that surface runoff from the exposed area around the wash pad (e.g. parking lot, storage areas) does not enter the sewer. Surface runoff must be directed away from the sewer. Appropriate measures include grading the open area to redirect surface runoff to the storm drain; berming around the wash pad; or trenching around the wash pad with grating over the trench, and directing the collected water to a storm drain in accordance with stormwater discharge requirements.

**The Wash Pad:** Appropriate measures must be taken to insure that surface runoff from the wash pad itself does not enter the sewer. Provided that local regulations are satisfied, roofing will be required for all exposed wash pads, which have a total area exceeding 150 square feet. If the roof structure does not include walls, then the roofs overhang must extend a minimum of 20 percent of the roofs height. All roof drains must be routed to a storm drain.

Where rooting of exposed areas is infeasible or prohibited by local regulations, the Districts may accept the use of an automated surface runoff diversion system. [Note: This diversion system will not substitute for the appropriate measures cited above for surface runoff from the exposed area around the wash pad]. In cases where a diversion system is installed, only the first 0.1-inch of rainwater will be allowed to enter the sewer. After the first 0.1 inch of rainfall, excess rainwater must be diverted to an appropriate drainage system by use of an automated diversion system. The diversion system is subject to acceptance by the Districts. Manual methods of diversion (e.g. manual gates, removable plugs) are not acceptable. Companies are

responsible for maintaining the automated diversion system in proper operating condition to ensure that no excess surface runoff from the wash pad is discharged to the sewer.

**ATTACHMENT D**

**ASCE/EPA Technical Memorandum titled “Development of Performance Measures”**

# Development of Performance Measures

## Task 3.1 – Technical Memorandum

### Determining Urban Stormwater Best Management Practice (BMP) Removal Efficiencies

Prepared by

**URS Greiner Woodward Clyde  
Urban Drainage and Flood Control District**

and

**Urban Water Resources Research Council (UWRRC) of ASCE**

In cooperation with

**Office of Water  
US Environmental Protection Agency  
Washington, DC 20460**

July, 2 1999



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## Scope of Memorandum

This memorandum is intended for use in this cooperative research effort as an outline and description of the methodology for Task 3.0, Data Exploration and Evaluation. Although the memorandum describes, in detail, methods to be used for analysis of stormwater best management practices, the discussion included here is not inclusive of all of the issues relevant to the subject and is not intended as a "guidance manual" of analysis techniques. The application of the approach should be limited to the current scope of this project until the methods and issues described have been further explored and reviewed by the Team, ASCE(UWRRC), and EPA.

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**ASCE/EPA  
Determining Urban Stormwater Best Management Practice (BMP) Removal  
Efficiencies  
May, 14 1999**

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**TECHNICAL MEMORANDUM - TASK 3.1  
Development of Performance Measures**

**1 Overview**

The purpose of this cooperative research effort between EPA and the American Society of Civil Engineers (ASCE) is to develop a more useful set of data on the performance and effectiveness of individual best management practices (BMPs), specifically by assessing the relationship between measures of effectiveness and BMP design. BMP monitoring data should not only be useful for a particular site, but should also be useful for comparing data collected in studies of both similar and different types of BMPs in other locations and with different design attributes. Almost all past BMP monitoring studies have provided very limited data that is useful for comparing BMP design and selection. This technical memorandum provides an overview of methods for evaluating the efficiency, performance, and effectiveness of best management practices (BMPs) through analysis of water quality, flow, and precipitation data for monitored storm events as well as BMP design attributes collected and stored in the National Stormwater (NSW) Best Management Practices Database. Furthermore, it provides a specific description of the methods that will be used to conduct the data exploration and evaluation, described under Tasks 3.2-3.4 of this project. These methods provide the basic techniques for analyzing data manually and a preliminary basis for integrated analysis tools to be built into the database in the future.

**1.1 Definition of Terms**

In order to better clarify the terminology used to describe the level of treatment achieved and how well a device, system, or practice meets its goals, definitions of some terms, often used loosely in the literature, are provided here. These terms help to better specify the scope of monitoring studies and related analyses.

- Best Management Practice (BMP) - A device, practice, or method for removing, reducing, retarding, or preventing targeted stormwater runoff constituents, pollutants, and contaminants from reaching receiving waters.
- BMP System - A BMP system includes the BMP and any related bypass or overflow. For example, the efficiency (see below) can be determined for a offline retention (Wet) Pond either by itself (as a BMP) or for the BMP system (BMP including bypass)
- Performance - measure of how well a BMP meets its goals for stormwater that the BMP is designed to treat.
- Effectiveness - measure of how well a BMP system meets its goals in relation to all stormwater flows
- Efficiency - measure of how well a BMP or BMP system removes pollutants.

The primary focus of the data exploration and evaluation will be to determine efficiency of BMPs and BMP systems and to elucidate relationships between design and efficiency. In addition, effectiveness and performance will be evaluated, acknowledging the limitations of existing information about the goals of specific BMP projects. Quantification of efficiency only evaluates a portion of the overall performance or effectiveness of a BMP or BMP system. Calculation of the efficiency, however, does help to determine additional measures of performance and effectiveness, for example the ability of a BMP to meet any regulatory goals based on percent removal. A list of typical goals and the current ability of the ASCE/EPA project to help evaluate them is shown in Table 1.1.

Table 1.1 Goals of BMP Projects and the Ability of the National Stormwater BMP Database to Provide Information Useful for Determining Performance and Effectiveness

Goals of BMP Projects		Ability to Evaluate Performance and Effectiveness
Category		
Hydraulics	<ul style="list-style-type: none"> <li>Improve flow characteristics upstream and/or downstream of BMP</li> </ul>	-
Hydrology	<ul style="list-style-type: none"> <li>Flood mitigation, improve runoff characteristics (peak shaving)</li> </ul>	✓
Water Quality (Efficiency)	<ul style="list-style-type: none"> <li>Reduce downstream pollutant loads and concentrations of pollutants</li> <li>Improve/minimize downstream temperature impact</li> <li>Achieves desired pollutant concentration in outflow</li> </ul>	✓ ✓ ✓
	<ul style="list-style-type: none"> <li>Removal of litter and debris</li> </ul>	-
Toxicity	<ul style="list-style-type: none"> <li>Reduce acute toxicity of runoff</li> <li>Reduce chronic toxicity of runoff</li> </ul>	✓ <sup>1</sup> ✓ <sup>1</sup>
Regulatory	<ul style="list-style-type: none"> <li>Compliance with NPDES permit</li> <li>Meet local, state, or federal water quality criteria</li> </ul>	- ✓ <sup>2</sup>
Implementation Feasibility	<ul style="list-style-type: none"> <li>For non-structural BMPs, ability to function within management and oversight structure</li> </ul>	-
Cost	<ul style="list-style-type: none"> <li>Capital, operation, and maintenance costs</li> </ul>	✓ <sup>1</sup>
Aesthetic	<ul style="list-style-type: none"> <li>Improve appearance of site</li> </ul>	-
Maintenance	<ul style="list-style-type: none"> <li>Operate within maintenance, and repair schedule and requirements</li> <li>Ability of system to be retrofit, modified or expanded</li> </ul>	✓ <sup>1</sup> ✓
Longevity	<ul style="list-style-type: none"> <li>Long term functionality</li> </ul>	✓ <sup>1</sup>
Resources	<ul style="list-style-type: none"> <li>Improve downstream aquatic environment/erosion control</li> <li>Improve wildlife habitat</li> <li>Multiple use functionality</li> </ul>	- - -
Safety, Risk and Liability	<ul style="list-style-type: none"> <li>Function without significant risk or liability</li> <li>Ability to function with minimal environmental risk downstream</li> </ul>	- -
Public Perception	<ul style="list-style-type: none"> <li>Information is available to clarify public understanding of runoff quality, quantity and impacts on receiving waters</li> </ul>	✓

✓ can be evaluated using the ASCE/EPA Database as information source

✓<sup>1</sup> will be able to be evaluated using the database as primary source of information after enough studies have been submitted

✓<sup>2</sup> can be evaluated using the database as the primary source of information combined with a secondary source of comparative data

- can be evaluated only qualitatively through included comments by reviewer or author, or are unable to be evaluated at this time

The term event mean concentration (EMC) is used throughout this memorandum. The EMC is a statistical parameter used to represent the flow-proportional average concentration of a given parameter during a storm event. It is defined as the total constituent mass divided by the total runoff volume. It is often estimated via the collection of multiple flow volume triggered grab samples that are composited for analysis. When combined with flow measurement data, the EMC can be used to estimate the pollutant loading from a given storm.

### 1.3 BMPs Types and Implications for Calculation of Efficiency

The issues involved in selection of methods for quantifying efficiency, performance, and effectiveness are complex. It would be difficult, at best, to find one method that would cover the data analysis requirements for the widely varied collection of BMP types and designs found in the NSW Database. When analyzing efficiency, it is convenient to classify BMPs according to one of the following four distinct categories:

- BMPs with well-defined inlets and outlets whose primary treatment depends upon extended detention storage of stormwater, (e.g., wet and dry ponds, wetland basins, underground vaults)
- BMPs with well-defined inlets and outlets that do not depend upon significant storage of water, (e.g., sand filters, swales, buffers, structural “flow-through” systems)
- BMPs that do not have a well defined inlet and/or outlet (e.g., retention, infiltration, porous pavement)
- Widely distributed BMPs that use reference watersheds to evaluate effectiveness, (e.g., catch basin retrofits; education programs)

Any of the above can also include evaluations where the BMP's efficiency was measured using before and after or paired watershed comparisons of water quality.

The difficulty in selection of measures of efficiency stems not only from the desire to compare a wide range of BMPs, but also from the large number of methods currently in use. There is much variation and disagreement in the literature about what measure of efficiency is best applied.

## 1.4 Relationship Between Monitoring Study Objective and Data Analysis

In developing a method for quantifying BMP performance or effectiveness, it is helpful to look at the objectives of previous studies seeking such a goal. BMP studies usually are conducted to obtain information regarding one or more of the following objectives:

- What degree of pollution control does the BMP provide under typical operating conditions?
- How does efficiency vary from pollutant to pollutant?
- How does efficiency vary with various input concentrations?
- How does efficiency vary with storm characteristics such as rainfall amount, rainfall density, antecedent weather conditions?
- How do design variables affect performance?
- How does efficiency vary with different operational and/or maintenance approaches?
- Does efficiency improve, decay, or remain stable over time?
- How does the BMP's efficiency, performance, and effectiveness compare relative to other BMPs?
- Does the BMP reduce toxicity to acceptable levels?
- Does the BMP cause an improvement or protect in downstream biotic communities?
- Does the BMP have potential downstream negative impacts?

The monitoring efforts implemented most typically seek to answer a small subset of the above questions. This often leaves larger questions about the efficiency, performance and effectiveness of the BMP, and the relationship between design and efficiency, unanswered. The goal of this document is to develop a recommended approach to utilize the National Stormwater BMP Database to evaluate BMP data that have been entered such that some or all of the above questions about BMP efficiency can be assessed where sufficient data is available.

## 1.5 Physical Layout and Its Effect on Efficiency and Its Measure

The estimation of the efficiency of BMPs is often approached in different ways based on the goals of the researcher. A BMP can be evaluated by itself or as part of an overall BMP system. The efficiency of a BMP not including bypass or overflow may be dramatically different than the efficiency of an overall system. Bypasses and overflows can have significant effects on the ability of a BMP to remove constituents and appreciably reduce the efficiency of the system as a whole. Researchers who are interested in comparing the efficiency of an offline wet pond and an offline wetland may not be concerned with the effects of bypass on a receiving water. On the other hand, another researcher who is comparing offline wet ponds with online wet ponds would be very interested in the effects of the bypass. Often detailed information about the bypass of the BMP is not available for analysis. In some cases, comprehensive inflow and outflow measurements allow for the calculation of a mass balance that can be used to estimate bypass flow volumes. Estimations of efficiency of a BMP system can be based on these mass balance calculations coupled with sampling data.

The efficiency of a BMP system or a BMP can be directly affected by the way in which an operator chooses to manage the system. This is the case where parameters of a design can be adjusted, (e.g., adjustments to the height of an overflow/bypass weir or gate). These adjustments can vary the efficiency considerably. In order to analyze a BMP or BMP system thoroughly, all static and state variables of the system must be known.

## 1.6 Relevant Period of Impact

The period of analysis used in an efficiency calculation is important. The period used should take into account how the parameter of interest varies with time. This allows for observation of relevant changes in the efficiency of the BMP on the time scale in which these changes occur. For example, in a wetland it is often observed that during the growing season removal efficiency increases for nutrients. The opposite effect may be observed during the winter months or during any period where decaying litter and plant material may contribute significantly to export of nutrients and, potentially, other

contaminants. Therefore, the efficiency calculations may need to be made based on data collected over a few months or seasonally. This variation of efficiency on a temporal scale is extremely important in understanding how BMPs function.

In addition to observing how factors, such as climate, affect efficiency as a function of time, it is important to relate the calculation period to the potential impact a given constituent would have on the receiving water. For example, it may not be useful to study the removal of a chlorinated organic for a short period of record when the negative impacts of such a contaminant are generally expressed over a long time scale. Likewise, some parameters (e.g., temperature, BOD, DO, pH, TSS and metals) may have a significant impact in the near term.

Toxicity plays a major role in evaluating what time period should be used to analyze efficiency. Specific constituents that are acutely toxic require a short-term analysis on an "intra-storm" basis. Where dilution is significant and/or a constituent is toxic on a chronic basis, long-term analysis that demonstrates removal of materials on a sum of loads or average EMC basis may be more appropriate. Many contaminants may have both acute and chronic effects in the aquatic environment. These contaminants should be evaluated over both periods of time. Similarly, hydraulic conditions merit both short and long term examination. Event peak flows are examples of short-term data, while seasonal variations of the hydrologic budget due to the weather patterns are examples of long-term data. Examples of water quality parameters and their relationship to the time scale over which they act are given in Table 1.2.

Table 1.2

<b>Time Scale for Analysis</b>	<b>Water Quality Parameter</b>
Short Term	BOD, DO
Long Term	Organics, Carcinogens
Both Short and Long Term	Metals, TSS, Nitrogen, Phosphorous, Temperature, pH, Pesticides

## 2 Example Study for Examination of Efficiency Calculation Methods

In order to discuss and contrast the various methods that have been employed for estimating the efficiency of BMPs, an example data set was utilized. The examples taken from this data set are based upon data from *Three Design Alternatives for Stormwater Detention Ponds*, (Rushton, Miller, Hull and Cunningham, 1997). The study was conducted by the Southwest Florida Water Management District (SWFWMD). The single pond studied with different design attributes was located at the SWFWMD Service office in Tampa. The following quote from the executive summary of the report describes the site:

*The drainage basin is 6.5 acres with about 30 percent of the watershed covered by roof tops and asphalt parking lots, 6 percent by a crushed limestone storage compound and the remaining 64 percent as a grassed storage area. The impervious surfaces discharge to ditches which provide some pre-treatment before stormwater enters the pond. During the first year of the study (1990), the pond was shallow and completely vegetated with a permanent pool less than one foot deep and an average wet season residence time of two days. In the second year (1993), the vegetated littoral zone covered 35 % of the pond area and the volume of the permanent pool was increased to include a five-day residence time by excavating the pond to five feet. For the final year (1994), the vegetated littoral zone was planted with desirable species, the depth of the pond was kept at five feet and the area of the permanent pool was enlarged for a calculated wet season residence time of 14 days.*

This example study was chosen due its comprehensive data set and its ability to demonstrate the effects of changes in efficiency based on design variations. The pond study also demonstrates the potential effects of average wet season residence time on the calculated performance of the BMP. All calculations included in this memorandum are based on the raw data provided in the report as stored in the National Stormwater Best Management Practices Database at this time. The values reported in the SWFWMD report are given in Table 2.1 for comparison. Two methods were used by SWFWMD to enumerate effectiveness, 1) the *Summation of Loads* and, 2) the *Efficiency Ratio*. Both of these methods are described in more detail in Section 3 of this memorandum.

Table 2.1

Method	TSS Percent Removal Reported by SWFWMD		
	1990	1993-1994	1994-1995
Efficiency Ratio (EMC)	61	69	95
Summation of Loads	71	67	94
<b>Other Information</b>			
Number of Rain Events (>0.05 in)	53	60	83
Percent Monitored	43	50	56
Average Depth of Monitored Storms	0.53 inch	0.57 inch	0.53 inch
Total Rainfall During Monitoring Period	28 inch	34 inch	44 inch

Differences between the values calculated for the examples given in this memo and the values reported in the SWFWMD report were checked thoroughly and it was determined that the cause for the difference in reported efficiencies is due to rounding of each flow weighted sample value in the SWFWMD report. All of the calculations in this memo were based on the digital data provided by SWFWMD, which were not rounded. SWFWMD also excluded some of the values in their final analysis of the BMP during the 1993-1994 water year due to a leaking water main and problems with the rain collector used on site. This change to the data set used for calculating performance had no net effect on the efficiency reported for TSS. The examples in this document use the entire data set.

### 3 Review of Commonly Used Efficiency Calculation Methods

A variety of pollutant removal methods have been utilized in BMP monitoring studies to evaluate efficiency. This section describes and gives examples of methods employed by different investigators. One of five methods are typically used by investigators for the calculation of BMP efficiency:

- Efficiency ratio
- Summation of loads
- Regression of loads
- Mean concentration
- Efficiency of individual storm loads
- Reference watersheds and before/after studies

Although these methods do present a summary of efficiency, they do not look at removal statistically, and thus, do not provide enough information to determine if the differences in inflow and outflow water quality measures are statistically significant. Previous studies comparing BMP efficiency for a number of BMPs statistically examined reported removal efficiencies that were based upon various efficiency calculation methods. The National Stormwater Best Management Practices Database allows for the consistent calculation of efficiencies for each of the BMPs based on event data. Calculating efficiency on this basis makes detailed statistical analysis possible. Section 4 of this memorandum describes and gives examples of the methodology that will be used in Tasks 3.2-3.4 of the project. This selected methodology, the Lognormal Statistical Efficiency (LSE) is an expansion of the efficiency ratio method (ER). The LSE method fully describes the statistical distribution of water quality upstream and downstream of BMPs and determines if differences in water quality are statistically significant.

### 3.1 Efficiency Ratio

#### Definition

The efficiency ratio is defined in terms of the average event mean concentration (EMC) of pollutants over some time period:

$$ER = 1 - \frac{\text{average outlet EMC}}{\text{average inlet EMC}} = \frac{\text{average inlet EMC} - \text{average outlet EMC}}{\text{average inlet EMC}}$$

EMCs can be either collected as flow weighted composite samples in the field or calculated from discrete measurements. The EMC for an individual event or set of field measurements, where discrete samples have been collected, is defined as:

$$EMC = \frac{\sum_{i=1}^n V_i C_i}{\sum_{i=1}^n V_i}$$

where,

- V: volume of flow during period i
- C: average concentration associated with period i
- n: total number of measurements taken during event

The arithmetic average EMC is defined as,

$$\text{average EMC} = \frac{\sum_{j=1}^m EMC_j}{m}$$

where,

- m: number of events measured

In addition, the log mean EMC can be calculated using the logarithmic transformation of each EMC. This transformation allows for normalization of the data for statistical purposes.

$$\text{Mean of the Log EMCs} = \frac{\sum_{j=1}^m \text{Log}(EMC_j)}{m}$$

Estimates of the arithmetic summary statistics of the population (mean, median, standard deviation, and coefficient of variation) should be based on their theoretical relationships (Appendix A) with the mean and standard deviation of the transformed data. Computing the mean and standard deviation of log transforms of the sample EMC data and then converting them to an arithmetic estimate often obtains a better estimate of the mean of the population due to the more typical distributional characteristics of water quality data. This value will not match that produced by the simple arithmetic average of the data. Both provide an estimate of the population mean, but the approach utilizing the log-transformed data

tends to provide a better estimator, as it has been shown in various investigations that pollutant, contaminant and constituent concentration levels have a log-normal distribution (NURP, 1983). As the sample size increases, the two values converge.

## Assumptions

This method

- Weights EMCs from all storms equally regardless of relative magnitude of storm. For example a high concentration/high volume event has equal weight in the average EMC as a low concentration/low volume event. The logarithmic approach tends to minimize the difference between the EMC and mass balance calculations.
- Is most useful when loads are directly proportional to storm volume. For work conducted on nonpoint pollution (i.e., inflows), the EMC has been shown to not vary significantly with storm volume. This lends credence to using the average EMC value for the inflow but does not provide sufficient evidence that outflows are well represented by average EMC. Accuracy of this method will vary based on the BMP type.
- Minimizes the impacts of smaller/cleaner storm events on actual performance calculations. For example, in a storm by storm efficiency approach, a low removal value for such an event is weighted equally to a larger value.
- Allows for the use of data where portions of the inflow or outflow data are missing, based on the assumption that the inclusion of the missing data points would not significantly impact the calculated average EMC.

## Comments

This method

- Is taken directly from non-point pollution studies and does a good job characterizing inflows to BMPs but fails to take into account some of the complexities of BMP design. For example, some BMPs may not have outflow EMCs that are normally distributed (e.g., a media filter that treats to a relatively constant level that is independent on inflow concentrations).
- Assumes that if all storms at the site had been monitored, the average inlet and outlet EMCs would be similar to those that were monitored.

## Example

The example calculations given below are for the Tampa Office Pond using arithmetic average EMCs in the efficiency ratio method.

Period of Record	Average EMC In	Average EMC Out	Efficiency Ratio
1990	27.60	11.18	0.59
1993-1994	34.48	12.24	0.64
1994-1995	131.43	6.79	0.95

## 3.2 Summation of Loads

### Definition

The summation of loads method defines the efficiency based on the ratio of the summation of all incoming loads to the summation of all outlet loads, or:

$$SOL = 1 - \frac{\text{sum of outlet loads}}{\text{sum of inlet loads}}$$

The sum of outlet loads are calculated as follows:

$$\text{sum of loads} = \sum_{j=1}^m \left( \sum_{i=1}^n C_i V_i \right) = \sum_{j=1}^m EMC_j \cdot V_j$$

### Assumptions

- Removal of material is most relevant over entire period of analysis.
- Monitoring data accurately represents the actual entire total loads in and out of the BMP for a period long enough to overshadow any temporary storage or export of pollutants.
- Any significant storms that were not monitored had a ratio of inlet to outlet loads similar to the storms that were monitored.
- No materials were exported during dry periods, or if they were, the ratio of inlet to outlet loads during these periods is similar to the ratio of the loads during the monitored storms.

### Comments

- A small number of large storms typically dominate efficiency.
- If toxics are a concern then this method does not account for day to day releases, unless dry weather loads in and out are also accounted for.
- Based on mass balance.

### Example of Summation of Loads for TSS Using the Tampa Office Pond

Period of Record	Sum of Loads In (kg)	Sum of Loads Out (kg)	SOL Efficiency
1990	134.60	39.67	0.71
1993-1994	404.19	138.44	0.66
1994-1995	2060.51	130.20	0.94

### 3.3 Regression of Loads (ROL), Martin and Smoot (1986)

#### Definition

The regression of loads method defines the regression efficiency as the slope of a least squares linear regression of inlet loads and outlet loads of pollutants, with the intercept constrained to zero. The equation for the ROL efficiency is:

$$\text{Loads out} = b \cdot \text{Loads in} = b - \frac{\text{Loads out}}{\text{Loads in}}$$

The percent reduction in loads across the BMP is estimated as:

$$\text{Percent Removal} = 1 - b = 1 - \frac{\text{Loads out}}{\text{Loads in}}$$

#### Assumptions

- The assumptions for this method are identical to the assumptions for the *Summation of Loads* method.

#### Comments

- A few data points often control the slope of line due to clustering of loads about the mean storm size. Regressions are best used where data is equally populous through the range to be examined. This is readily observed in the examples that follow (See Figures 3.1 and 3.3).
- The process of constraining the intercept of the regression line to the origin is questionable and in some cases could significantly misrepresent the data. It may be more useful to apply the *Regression of Loads* method over some subset of the data without requiring that the intercept be constrained to the origin. The problem with this alternative approach is that a large number of data points are required in order to get a good fit of the data. Often (See Figure 3.1) a meaningful regression cannot be made using the data that was collected. This is well illustrated by the very low  $R^2$  values in the table below. Forcing the line through the origin, in these cases, provides a regression line even where no useful trend is present.
- There is sufficient evidence that this first order polynomial (straight line) fit is not appropriate over a large range of loadings. Very small events are much more likely to demonstrate low efficiency where larger events may demonstrate better overall efficiency depending on the design of the BMP.

#### Example of ROL Efficiency Results for TSS in the Tampa Office Pond

Period of Record	Slope of Regression Line	$R^2$	Percent Removal
1990	0.21	0.06	0.79
1993-1994	0.18	-0.06	0.82
1994-1995	0.05	0.46	0.95

The regressions used to arrive at the above slopes are given in Figures 3.1-3.3.

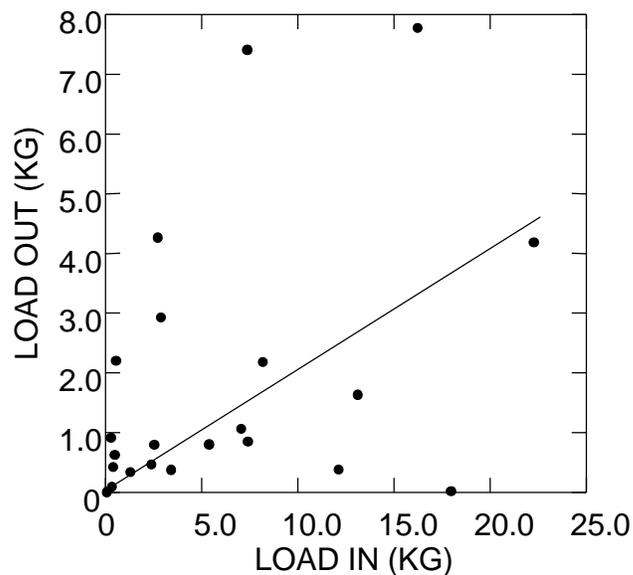


Figure 3.1 ROL Plot for use in Calculating Efficiency for TSS using the Tampa Office Pond (1990) (Slope = 0.2135,  $R^2 = 0.0563$ , Standard Error in Estimate = 2.176, one point is considered an outlier with a Studentized Residual of 3.304). All points were used for regression.

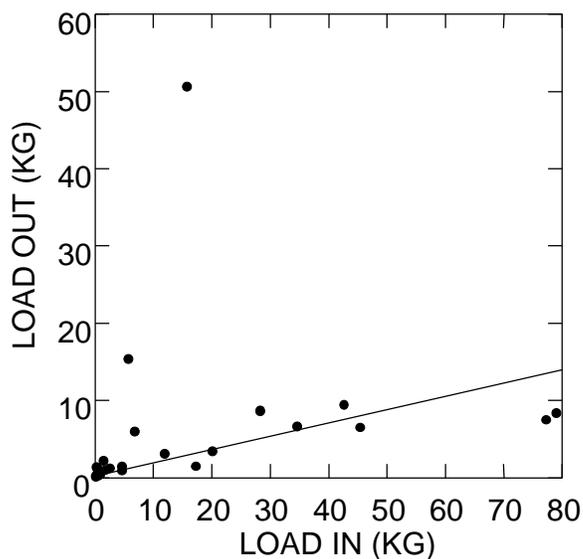


Figure 3.2 ROL Plot for use in Calculating Efficiency for TSS using the Tampa Office Pond (1993-1994) (Slope = 0.1801,  $R^2 = -0.0562$ , Standard Error in Estimate = 10.440, One point is considered an outlier with a Studentized Residual of 13.206 and one point has a high Leverage of 0.323). All points were used for regression.

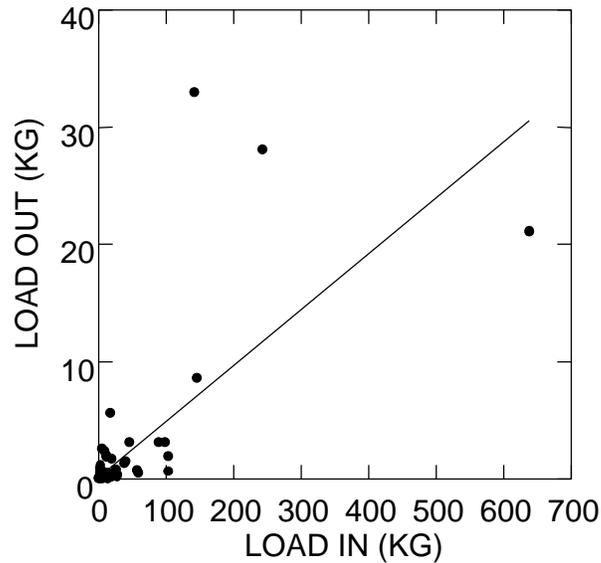


Figure 3.3 ROL Plot for use in Calculating Efficiency for TSS using the Tampa Office Pond (1994-1995) (Slope = 0.0492,  $R^2 = 0.4581$ , Standard Error in Estimate = 5.260, three points are considered outliers (Studentized Residuals of 3.724, 8.074, and -4.505, The point to the far right on the graph has large Leverage (0.724) and Influence, Cook Distance = 36.144). All points were used for regression.

### 3.4 Mean Concentration

#### Definition

The mean concentration method defines the efficiency as unity minus the ratio of the average outlet to average inlet concentrations. The equation using this method is, thus:

$$MC = 1 - \frac{\text{average outlet concentration}}{\text{average inlet concentration}}$$

This method does not require that concentrations be flow weighted. This method might have some value for evaluating grab samples where no flow weighted data is available or where the period of record does not include the storm volume.

#### Assumptions

- The flows from which the samples were taken are indicative of the overall event.

#### Comments

- This method may be useful for calculating BMP's effectiveness in reducing acute toxicity immediately downstream of the BMP. This is due to the fact that acute toxicity is measured as a threshold concentration value of a specific

constituent in the effluent at or near the point of discharge. If more than one sample per event is analyzed, this method would result in more information on potential toxicity reduction.

- Weights individual samples equally. Biases could occur due to variations in sampling protocols or sporadic sampling (i.e., collectively many samples close in time and others less frequently. The sample collection program specifics are not accounted for in the method and estimated efficiencies are often not comparable between studies.
- This method does not account for storage capacity. Typically BMP's will have an equal or lesser volume of outflow than of inflow, on a mass basis this affects removal, since volume (or flow) is used with concentration to determine mass for a storm event,

$$1 - \frac{C_{out} V_{out}}{C_{in} V_{in}} \geq 1 - \frac{\text{average outlet concentration}}{\text{average inlet concentration}}$$

where:

$C_{in}$ : Concentration In  
 $C_{out}$ : Concentration Out  
 $V_{in}$ : Volume In  
 $V_{out}$ : Volume Out

In this respect, it is often more conservative (i.e., lower removal efficiency stated) to use concentration rather than mass-based removal.

### 3.5 Efficiency of Individual Storm Loads

#### Definition

The Efficiency of Individual Storm Loads (ISL) method calculates a BMP's efficiency for each storm event based on the loads in and the loads out. The mean value of these individual efficiencies can be taken as the overall efficiency of the BMP. The efficiency of the BMP for a single storm is given by:

$$\text{Storm Efficiency} = 1 - \frac{\text{Load}_{out}}{\text{Load}_{in}}$$

The average efficiency for all monitored storms is thus:

$$\text{Average Efficiency} = \frac{\sum_{j=1}^m \text{Storm Efficiency}_j}{m}$$

where,

m: number of storms

#### Assumptions

- Storm size or other storm factors do not play central roles in the computation of average efficiency of a BMP.
- Storage and later release of constituents from one storm to the next is negligible.
- The selection of storms monitored does not significantly skew the performance calculation.

#### Comments

- The weight of all storms is equal. Large storms do not dominate the efficiency in this scenario. The efficiency is viewed as an average performance regardless of storm size.
- Some data points are not able to be used due to the fact that there is not a corresponding measurement at either the inflow or the outflow for a particular storm, and thus an efficiency cannot always be calculated on a storm by storm basis. This is not true for the ER method, however it is a limitation of the Summation of Load Method.
- Storm by storm analysis neglects the fact that the outflow being measured may have a limited relationship to inflow in BMPs that have a permanent pool. For example, if a permanent pool is sized to store a volume equal to the average storm, about 60 to 70 percent of storms would be less than this volume [from studies conducted using SYNOP (EPA, 1989)].

## Example of Efficiency of Individual Storm Loads for TSS in the Tampa Office Pond

Period of Record	Efficiency
1990	0.29
1993-1994	-0.02
1994-1995	0.89

### 3.6 Reference Watershed Methods

#### Discussion

Many BMPs do not allow for comparison between inlet and outlet water quality parameters. In addition it is often difficult or costly, where there are many BMPs being installed in a watershed (e.g., retrofit of all catch basins), to monitor a large number of specific locations. Often a reference watershed is used to evaluate the effectiveness of a given BMP or multiple BMPs of the same type. The database allows for a watershed and all associated data to be identified for use as a reference watershed. One of the primary reasons for using a reference watershed is that there is no clearly defined inlet or outlet point at which to monitor water quality. Such is the case with many non-structural BMPs, porous pavements, and infiltration practices.

The difficulty in determining the effectiveness of a BMPs using reference watersheds stems from the large number of variables typically involved. When setting up a BMP monitoring study, it is advantageous to keep the watershed characteristics of the reference watershed and the test watershed as similar as possible. Unfortunately, finding two watersheds that are similar is often quite difficult and the usefulness of the data can be compromised as a result. In order to attempt to determine the effectiveness of a BMP based on a reference watershed, an accurate accounting of the variations between the watersheds, operational, and environmental conditions is needed. The database explicitly stores some of the key parameters required for normalization of watershed and environmental conditions.

The most obvious parameter used to normalize watershed characteristics is area. If the ratio of land uses and activities within each watershed is identical in both watersheds then the watershed area can be scaled linearly. Additionally, the loads found at each downstream monitoring station, for each event, can be scaled linearly with area as well. Difficulty arises when land use in the reference watershed is not found in the same ratio. In this case, either the effects of land use must be ignored or a portion of the load found for each event must be allocated to a land use and then scaled linearly as a function of the area covered by that land use. In many cases, the differences in land use can be ignored, (e.g., between parking lots with relatively small, but different unpaved areas). The effect of the total impervious area is relevant and provided in the database in all cases and can be used to normalize the water quality data collected. The ratio of the total impervious areas can be used to scale event loads. Scaling the loads based on impervious areas would be best used where it is determined that the majority of pollutants are from runoff from the impervious areas (e.g., parking lots), or the contaminant of interest primarily results from deposition on impervious surfaces, (e.g., TSS in a highly urban area). Methods that attempt to determine BMP performance from poorly matched watersheds yield poor results at best. As the characteristics of the two watersheds diverge, the effect of the BMP is masked by the large number of variables in the system; the noise in the data becomes greater than the signal.

The analysis of BMPs utilizing reference watersheds also requires incorporation of operational details of the system, (e.g., frequency of street sweeping, type of device used, device setup). The database asks users to provide the frequency, extent, and other operational parameters for nonstructural BMPs. If the BMP is an alteration of the frequency of a certain practice, the system can be viewed in two ways, (1) as a control/test system, or (2) as a series of data aimed at quantifying the continuous effect of increasing or decreasing BMP frequency. In the first case the BMP can be analyzed in a manner similar to other BMPs with reference watersheds. In the second case, the loads realized at the monitoring stations need to be correlated with the frequency using some model for the effectiveness of the practice per occurrence.

### 3.7 Summary and Comparison of Methods from the Examples

The table below shows the results of the various methods shown above for calculation of efficiency for the Tampa Office Pond. It can be seen that the four methods demonstrated (mean concentration method was not applicable to data available from the Tampa Office Pond study) vary widely in their estimates of percent removal depending on the assumptions of each method as discussed above.

Design	Method			
	Efficiency Ratio (ER)	Summation of Loads (SOL)	Regression of Loads (ROL)	Efficiency of Individual Storms
1990	0.59	0.71	0.79	0.29
1993-1994	0.64	0.66	0.82	-0.02
1994-1995	0.95	0.94	0.95	0.89

## 4 Proposed Methods for Calculation of Efficiency

This section describes methods that will be used in Task 3.2 of the project to quantify efficiency of each BMP currently stored in the database. In order to assess efficiency, water quality data needs to be analyzed in a consistent manner. Background information on data preparation is provided in Section 4.1, procedures and techniques that will be used for graphical exploration of the data are demonstrated in Section 4.2, the proposed primary method for quantification of efficiency (the Lognormal Statistical Efficiency, LSE) is outlined in Section 4.3, and Section 4.4 describes an alternative method (the Relative Outflow Efficiency) for quantification of efficiency where outflow EMCs do not vary with respect to inflow concentrations.

### 4.1 Data Preparation

There are a number of types of water quality data stored in the database due to the varying methods used to conduct monitoring studies. In order to analyze the data, some degree of preparation of the data is required.

The water quality data stored in the database can be broken down into two principal types.

1. Event Mean Concentration Data
  - Discrete (manual or automatic) Sample Flow Weighted Composite EMCs
  - Discrete Sample Time Weighted Composite EMCs
  - Discrete Sample Composite EMCs Without Flow or Time Weighting
2. Discrete Water Sample Data
  - Grab Samples

The approach described and demonstrated in Sections 4.2 and 4.3 is based on EMC monitoring data. The use of grab samples for the calculation of removal efficiencies requires additional preparation of water quality sampling data. On a study by study basis, grab sampling programs will be examined. Numerical methods will be used to approximate EMCs for certain constituents (based on flow and/or time weighting), where this is possible. If EMCs cannot be calculated for a particular study, then estimations of efficiency will be based on the grab samples themselves (i.e., a statistical analysis of concentration data will be conducted to the extent possible). For some constituents and field parameters, a discrete sample approach is required. In calculating the ability for a BMP to improve field parameters such as temperature, a "grab" sample approach will need to be utilized even where EMCs were collected in a flow or time weighted manner.

In many of the BMPs currently stored in the database, the number of inflows does not necessarily equal the number of outflows. Although many BMPs have one inflow and one outflow, many do not, and in some cases, the layout of the BMP system is quite complicated. Best management practice designs containing multiple, inflows, outflows, bypasses, and BMPs in series and/or parallel are common and all analyses of BMPs and BMP systems should take these important design details into account.

For cases where more than one inlet and outlet are present, the concentration data will be composited based on flow weighting. This will be conducted by calculating a single EMC based on the total mass flowing into or away from the BMP and the associated total flow.

In some cases the flow into or out of a BMP is not directly measured, but can be calculated from the flows that are recorded. In these cases, mass balance equations will be used and checked against work conducted by the original author. In addition, total flow volumes can be estimated from runoff coefficients and the available rainfall data, where available.

## **4.2 Exploratory Data Assessment**

An initial exploratory data analysis will be conducted to provide a common starting point for quantification of efficiency, effectiveness and performance. Three initial sets of graphs will be produced for each BMP and constituent monitored as shown below:

1. A normal probability plot showing the log transform of both inflow and out flow EMCs for all storms for the BMP. If the log transformed data deviates significantly from normality, other transformations will be explored to determine if a better transformation exists. Examples for TSS for the three designs examined in Tampa Office Pond Study are shown in Figures 4.1-4.3

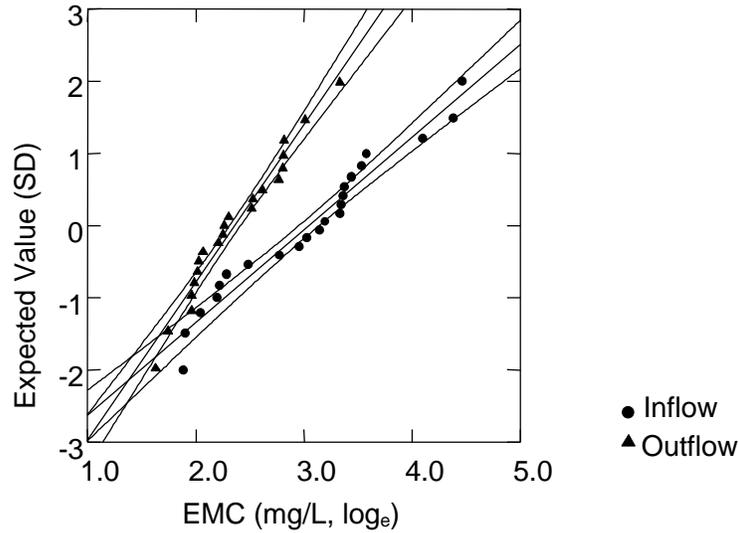


Figure 4.1 Normal Probability Plot for Log Transformed Inflow and Outflow Data for TSS for the Tampa Office Pond (1990), (0.95 confidence interval on the regression lines)

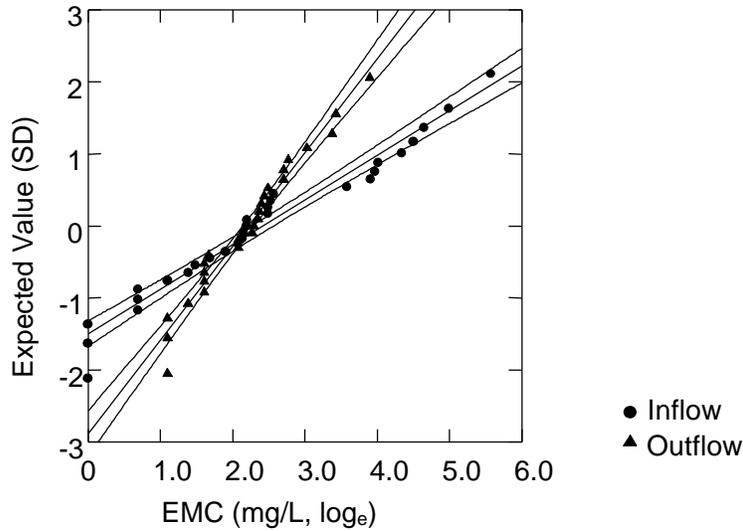


Figure 4.2 Normal Probability Plot for Log Transformed Inflow and Outflow Data for TSS for the Tampa Office Pond (1993-1994), (0.95 confidence interval on the regression lines)

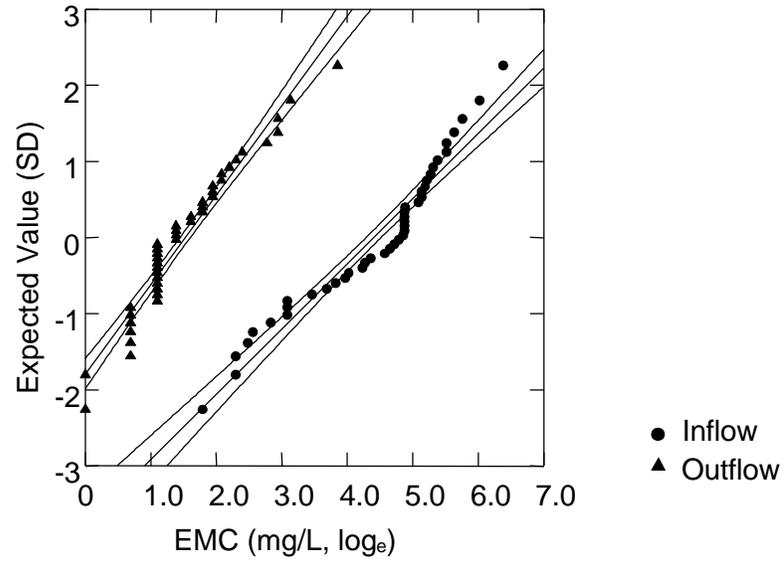


Figure 4.3 Normal Probability Plot for Log Transformed Inflow and Outflow Data for TSS for the Tampa Office Pond (1994-1995), (0.95 confidence interval on the regression lines)

2. A notched grouped box plot will be generated showing both inflow and outflow on the same plot. One plot will be generated based on transformed EMCs or grab sample concentrations and one will be generated based on transformed loads. Each box plot will include the standard deviation and selected percentiles and/or confidence intervals. Examples for TSS for the three designs examined in Tampa Office Pond Study are shown in Figure 4.4.

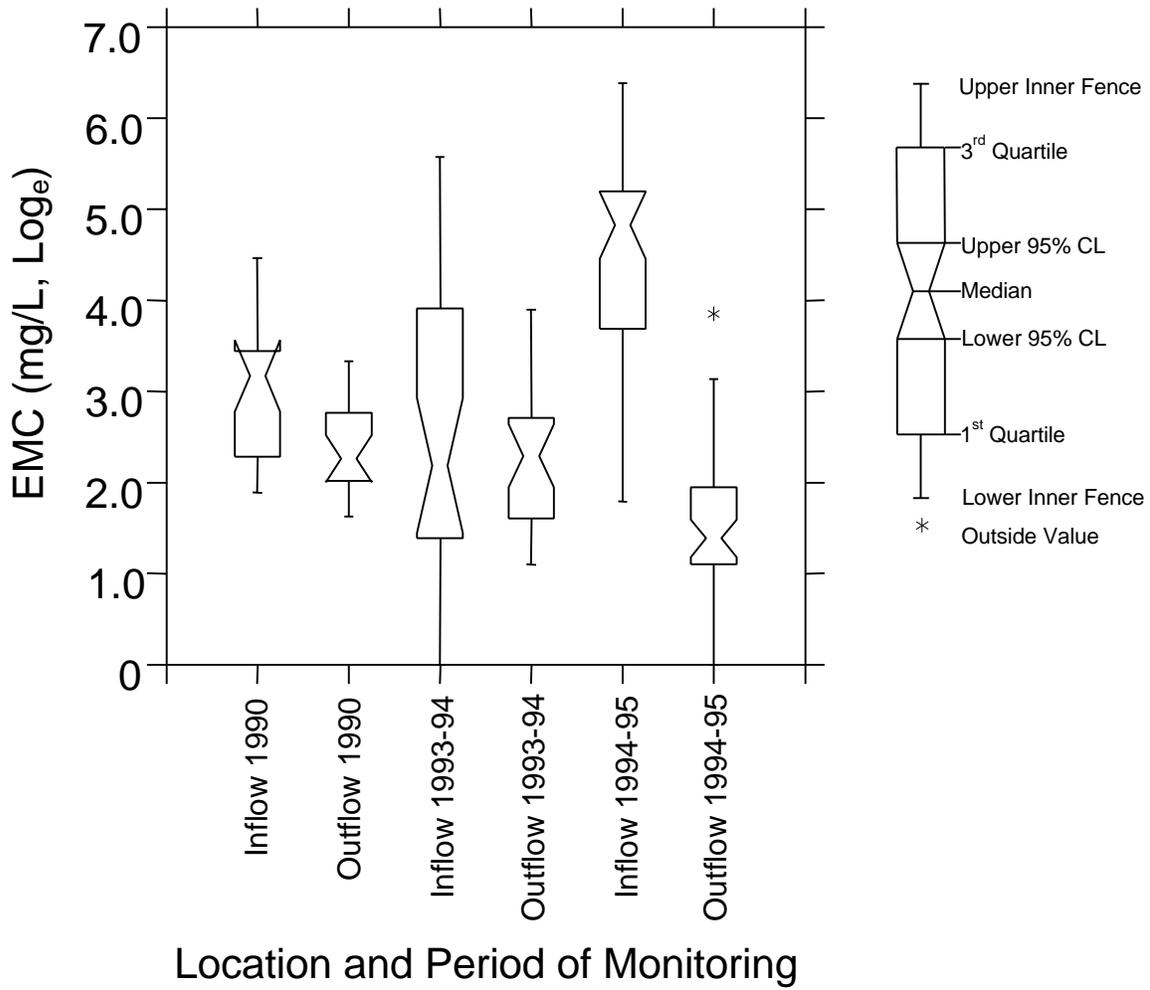
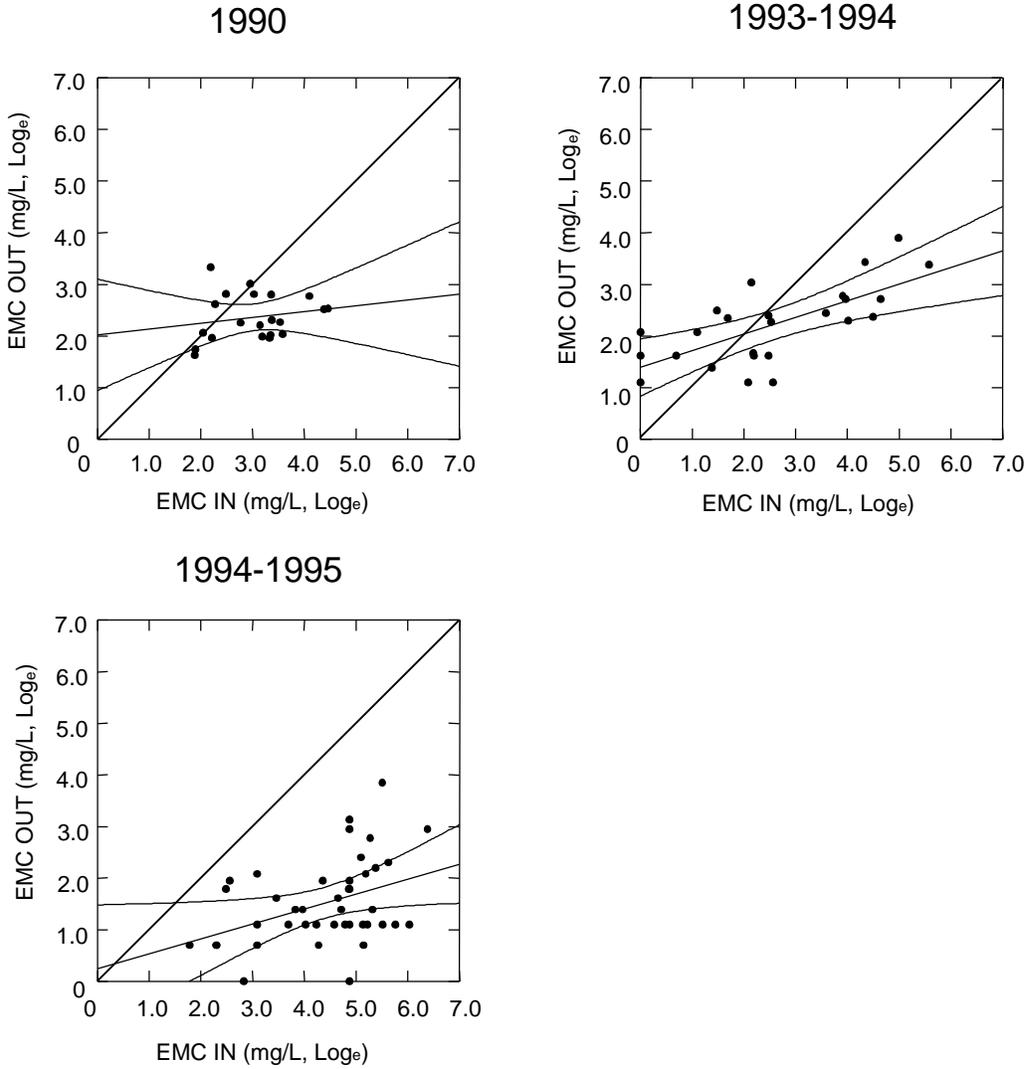


Figure 4.4 Notched Box Plot for Log Transformed Inflow and Outflow Data for TSS for the Tampa Office Pond (Boxes are narrow at the median and are full width at the lower and upper 95% confidence interval. The limits of the box show the range within which the central 50% of the values lie (also called the lower and upper hinge). The whiskers represent the upper and lower inner fences defined as:  $\text{hinge} \pm (1.5 * (\text{median} - \text{hinge}))$ ). Outside values are labeled as an asterisk and are defined as being between the inner and outer fence.

3. A scatter plot will be generated showing EMC out as a function of EMC in. This plot will allow for the visual inspection of the degree of "pairing" of EMCs at the inflow and outflow. The scatter plot will be produced with transformed data on both axes. If appropriate, a best-fit line will be plotted.



Figures 4.5-4.7 Scatter Plot for Log Transformed Inflow and Outflow Data for TSS for the Tampa Office Pond (0.95 confidence interval on the regression lines).

After an analysis of the graphical output for each of the above methods, decisions will be made about the best way to further analyze the data on a case by case basis. The paired t-test will be used and other paired and non-paired non-parametric tests will be explored as appropriate.

### 4.3 Data Analysis: Lognormal Statistical Efficiency

The graphical methods shown in Section 4.2 allow for the data to be explored. These methods help determine if a statistical approach to the data is appropriate and if any transformations of the data would improve interpretation. After data for a particular BMP are deemed appropriate for further analysis (i.e., there are enough data points available for a particular study and constituent to lend statistical significance to further analysis) the water quality data will be analyzed as described in this section.

The lognormal statistical efficiency (LSE) defines efficiency, not as a single value, but as a summary of the statistical characteristics of the inflow and outflow. An example of a full analysis using this method is shown in Table 4.1.

The test of statistical significance of the results takes as its hypothesis that the inflow and outflow values are derived from the same population. This null hypothesis allows the efficiency of the BMP to be evaluated by the probability that the BMP has no statistically relevant effect on the distribution of EMCs downstream of the BMP compared to upstream values. This hypothesis is best evaluated using the results of the one-way analysis of variance (ANOVA) test. The effect of the BMP will be considered significant if the probability (P-value) that the resulting F-ratio from the ANOVA could have been generated by chance is less than a chosen significance level (to be chosen after results are examined, typically 0.05). The overall efficiency will be summarized by reporting: the P-value, the percent difference between the arithmetic estimate of the mean log transformed EMCs at the outflow and the inflow along with the related confidence limit of the means, and the percent difference between specific percentile ranges (most likely the 10<sup>th</sup> and 90<sup>th</sup>). Note that using only the difference in the mean is identical to the Efficiency Ratio method described in Section 3.1, using the log transform of the data. Additional tests of the statistical relevance of the differences in population characteristics at the inflow and outflow will also be examined depending on the usefulness of parametric methods.

If the assumptions of the parametric ANOVA cannot be met or if the proportion of non-detects in the data set exceeds 15%, a Kruskal-Wallis nonparametric ANOVA (analogous to the parametric one-way analysis of variance) will be used to examine the hypothesis regarding significant differences in constituent concentrations at the inflow and the outflow. The nonparametric ANOVA evaluates the ranks of the observed concentrations at each location. Non-detects will be treated as tied values and are assigned an average rank. The two-sample Kolmogorov-Smirnov test will also be explored. In general, nonparametric methods are less powerful than their parametric counterparts, for distributions that are approximately log normal, reducing the likelihood that a "true" significant difference between treatments will be detected.

#### Example of the Lognormal Statistical Efficiency for TSS in the Tampa Office Pond

All supporting graphs for the NSE method are shown in Section 4.2 of the memorandum. Table 4.1 given below shows what typical results will be presented to define efficiency of each BMP in the database.

Table 4.1 Summary of Preliminary Analysis of Tampa Office Pond Using LSE Method

BMP Name	Constituent	Location	Mean (Log EMC), [Upper CL, Lower CL]	SD	Estimate of Arithmetic Mean EMC Based on Appendix A		10 <sup>th</sup> Percentile EMC <sup>1</sup>		90 <sup>th</sup> Percentile EMC <sup>1</sup>		Analysis of Variance (ANOVA)
					Value	Diff., [%]	Value	Diff. [%]	Value	Diff. [%]	
Tampa Office Pond 1990	TSS	Inflow	3.046 [3.382, 2.711]	0.757	28.009	16.282 [58.1]	7.82	0.72 [9.2]	57.15	40.45 [70.8]	N: 43 Multiple R: 0.488 Squared Multiple R: 0.239 Sum of Squares: 5.028 Mean-Square: 5.028 F-ratio: 12.850 <b>P-value: 0.001</b> Durbin-Watson D Statistic: 1.976 First Order Auto Correlation : -1.034
		Outflow	2.362 [2.566, 2.159]	0.447	11.727		7.10		16.7		
Tampa Office Pond 1993-1994	TSS	Inflow	2.413 [3.012, 1.814]	1.575	38.602	26.386 [68.4]	1.74	-1.26 [-72.4]	108.91	90.24 [82.9]	
		Outflow	2.220 [2.530, 1.909]	0.752	12.216		3.00		18.67		
Tampa Office Pond 1994-1995	TSS	Inflow	4.401 [4.753, 4.050]	1.128	154.037	147.591 [95.8]	12.69	10.69 [15.8]	248.60	231.75 [93.2]	
		Outflow	1.524 [1.781, 1.268]	0.824	6.446		2.00		16.85		

1. Calculated based on the difference between the EXP ( 10<sup>th</sup> percentile of the Log transformed data) for the inflow minus the outflow.

In looking at the results of the ANOVA test the criteria for the P-value (<0.05) is met in two of the three cases (1990 and 1994-1995). Inherent to the ANOVA test, the null hypothesis has been rejected, (i.e., there is less than a 5% chance that the two data sets were taken from the same population). In addition the two non-parametric tests (i.e., the Kruskal-Wallis test and the Two Sample Kolmogorov-Smirnov test) corroborate the ANOVA test (the probability for both the 1990 and 1994-1995 data are below 0.05). When looking at the 1993-1994 data (the P-value for the ANOVA test is 0.088), the criteria for all three tests is not met, it is apparent that even though the percent difference in the estimates of the mean values is quite large (68%), this information is not statistically relevant and therefore should be identified such. Although the analysis of the difference in the mean EMC values is statistically relevant, the statistically insignificant differences provide the best estimate of the efficiency of the BMP, though there is little confidence in the 1993-1994 records should be flagged to prevent misinterpretation of any resulting “percent removal” values. The 1990 and 1994-1995 results provide a statistically significant approximation of the efficiency of the BMP (for TSS), where the 1993-1994 data fail to do so.

#### 4.4 Relative Outflow Concentration

In addition to exploring the LSE, the relative outflow concentration will be examined as an alternative method for quantification of effectiveness where outflow EMCs do not vary significantly with respect to inflow concentrations. The relative outflow concentration examines the relationship between outflow EMCs for a number of separate BMPs, and explores the parameters that affect outflow water quality. The logarithmic transform of the EMC data will be used to statistically characterize the outflow. Descriptive statistics, identical to those methods used in Section 4.2, can be utilized to examine the relationship between outflow concentrations at a number of different BMPs of the same type. In this method, influent EMCs are viewed as one of the design parameters, along with environmental, and design factors. This focuses attention on the actual water quality levels the BMP is theoretically designed to provide and explicitly assumes that there may not be a functional, or at least an overriding, relationship between influent and effluent EMCs. Both multiple regression analysis and population testing can be used to determine the effects of each design parameter, including influent EMCs (see Section 11)

Due to the fact that the method relies on data from multiple BMPs of the same type, the data and studies used to establish the baseline information must be numerous enough to establish a reliable nationwide trend. The inflow concentration may not be the primary factor affecting the performance of a BMP. In some specific cases it is expected that outflow concentrations are independent of or only partially dependent on inflow concentrations (i.e., outflow EMCs often do not parallel inflow EMCs). Therefore, there should be less emphasis on the difference between inflow and outflow EMCs and measures, such as percent removal, when judging BMP effectiveness. In addition, the type of constituent and its associated removal mechanism are important when considering if influent EMCs have an effect on effluent EMCs.

### 5 Analysis of Rainfall Events

Analysis of rainfall data can often shed light on the factors that contribute to the performance of a given BMP. In order for the impact of non-structural BMPs and BMPs that lack an upstream gauging station to be properly evaluated, the rainfall for a particular event must be available for analysis. In most cases, it is sufficient to quantify the relationship between total flow at some downstream monitoring station and total rainfall depth in the BMP's tributary watershed. This can help quantify any effects the BMP may have on reducing the quantity of water that reaches the downstream monitoring location. This information is essential for comparing porous pavements, minimization of directly connected impervious areas, and many non-structural BMPs. In all cases where reference watersheds and/or temporal variation of BMP design are employed, rainfall is one of the key normalization parameters.

Analysis of storm rainfall data can also be very useful for quantifying the effects of bypass of the overall performance of a BMP. In some cases monitoring of bypass and overflows has not been conducted. In these cases, rainfall data provides the only potential means for determining the performance of the overall BMP system, where one is evaluating not only the effect on water quality of flow that pass through a BMP, but also how much the BMP can "treat". In some cases a theoretical hydrograph (which would introduce error) would be required in order to use the data stored in the database to approximate bypass or overflow for a particular event.

### 6 Number of Storms and Number of Samples

The number of storms used for any of the above analyses in Sections 3 and 4 directly impact the statistical relevance of the calculated performance, as evidenced in the ANOVA and confidence interval of the mean log-transformed value at a particular monitoring station. An analysis of the number of storms monitored in comparison to the number required to obtain statistically relevant results will be conducted.

### 7 Characteristics of Storms Monitored

In addition to confirming that the number of storms monitored is sufficient to yield statistically useful results, the types of storms monitored have a major impact on extrapolating the results obtained to determine the overall long-term performance. The relationship between storm size and storm frequency in most locations ensures that smaller storms are more prevalent in most stormwater flow records. This often presents a particular challenge. It must be ensured that the

methods inherent to the data collection effort do not unduly skew the results of the performance analysis or that this bias is taken into account or at least recognized. For many of the methods presented in Section 3 and 4, this requires restraint in extrapolation of results to areas of the record that are less populated by data. For example, the presence of a small number of large storms can dominate a summation of loads calculation.

## **8 Toxicity Determinations**

The concentrations of both inflow and outflow EMCs can be utilized to evaluate the potential toxicity reduction of BMPs. Although instantaneous grab samples provide a more accurate picture of toxicity at any given time, the EMC comparison will provide a measure of the average concentration during an event versus criterion values. In this effort we will utilize both EMC data and grab sample data (separately) to assess a BMP's potential to reduce toxicity, comparing the frequency and magnitude of the number of both EMCs and grab samples that exceed EPA published values.

## **9 Net Export of Contaminants (Negative Removal Efficiencies)**

In some cases, the performance of a given BMP is masked by the introduction of contaminants from within the BMP. This may be caused by significant levels of sorbed or particulate contaminants in the soil matrix, decaying matter within the BMP that exports significant quantities of nutrients, or sources such as ground water, rainwater, or airborne contaminants. If negative removal efficiencies are regularly observed during data analysis, for a contaminant, the causes for such a net export will be sought. Often net export of contaminants is observed where concentrations of the contaminant in the inflow to the BMP are quite low. When concentrations are very low, a slight shift in the quantity of contaminants could greatly affect the calculated efficiency.

## **10 Information Stored in the Database**

For each BMP type, and indeed each BMP, there exists an intimate and complex relationship between the environmental and design parameters and the mechanism for removal. An analysis of the relationship between environmental, design, and operational parameters requires an examination of factors that are most likely to observably influence the performance of particular type of BMP. We will explore both individual design attributes and carefully selected "groups" of design attributes to look for potential factors that affect performance. In order to define what information is available through the database, a list of each BMP type along with related design, environmental, and watershed parameters are shown in Table 10. A list of the types and number of BMPs that will be part of the initial data set contained in the database is shown in Table 10.1.

Table 10.1 Parameters to Report with Water Quality Data for Various BMPs

Parameter Type	Parameter	Ret. (Wet) Pond	Extended Detention (Dry) Basin	Wetland Pond Basin	Grass Swale/ Wetland Channel	Media Filter	Oil & Sand Trap/ Hydrodyn. Device	Infil. Basins and Trenches
Tributary Watershed	Area, average slope, average runoff coeff., length, soil types, veg. types	•	•	•	•	•	•	•
	Imperv. % and % hyd. connected	•	•	•	•	•	•	•
	Details about gutter, sewer, swale, ditches, parking, roads in watershed	•	•	•	•	•	•	•
	Land use types (res., com. ind. open)	•	•	•	•	•	•	•
General Hydrology	Date and times for monitored storms	•	•	•	•	•	•	•
	Runoff volumes for monitored storms	•	•	•	•	•	•	•
	Peak 1-hr intensity	•	•	•	•	•	•	•
	Design storm/flood recurrence intervals and magnitude	•	•	•	•	•	•	•
	Peak flow rate, depth, and Manning's roughness coeff. for the 2-year storm				•			
	Depth to seasonal high groundwater/impermeable layer		•		•			•
	Saturated hydraulic conductivity, infiltration rate, soil group				•			•
Average annual values for number of storms, precipitation, snowfall, min./max. temp.	•	•	•	•	•	•	•	
Water	Pollutant and constituent EMCs, and alkalinity, hardness and pH by event	•	•	•	•	•	•	•
	Water temperature	•	•	•	•	•	•	•
	Sediment settling velocity dist.	•	•	•	•	•	•	•
	Facility on- or off-line?	•	•	•	•	•	•	•
	Bypassed flows during events	•	•	•	•	•	•	•
General Facility	Facility Location (Lat./Long.), address, city, state, country, age of BMP, etc.	•	•	•	•	•	•	•
	Type and frequency of maintenance	•	•	•	•	•	•	•
	Types and location of instruments	•	•	•	•	•	•	•
	Inlet and outlet details, and number	•	•	•	•	•	•	•
Wet Pool	Media or granular material depth, type, storage volume, and porosity					•		•
	Volume, surface area, length of permanent pool	•		•		•	•	
	Littoral zone surface area	•						
Detention Volume	Solar radiation, days of sunshine, wind speed, pan evaporation	•	•	•	•			•
	Detention (or surcharge) and flood control volumes	•	•	•		•	•	•
	Basin's surface area and length	•	•	•		•	•	•
	Brimful and half-brimful empty time	•	•	•		•	•	•
Pre-Treatment	Bottom stage/infil. surface area, type			•	•			•
	Forebay volume, surface area	•	•	•		•	•	•
Wetland Plant	Relationship to other BMPs upstream	•	•	•	•	•	•	•
	Wetland/swale type, surface area, and length, side slope, bottom width			•	•			
	Percent of wetland surface between 0-12", 12"-24", and 24"-48"			•	•			
	Plant species and age of facility	•	•	•	•			

Based on Urbonas (1994,1995) and NSW database tables

## 11 Parameter Evaluation

This section discusses the selection process for parameters used to evaluate the relationship between, design and environmental conditions, and efficiency. Two methods are presented. The first of these methods is multiple regression analysis. The second is BMP group testing.

### 11.1 Selection of Parameters and Scalability

Parameters that are selected for evaluation must be present or consistently and reliably derivable from the data in the majority of BMP reports. Parameters that relate to sizing of a BMP that are selected as indicative of performance must be scalable. This scalability allows the results obtained from one set of BMPs to be compared with results from another set. As was mentioned in the Section 3, the correlation of the results from two different locations having varied conditions cannot be compared if all significant variables that are related to sizing are not scaled appropriately. Where conditions are significantly dissimilar or a small number of data points are available, scaling can introduce significant errors in analysis.

Parameters that can be calculated from a combination of database fields will be utilized for evaluating the relationship between static and state variables and efficiency. Parameters that correlate well with efficiency should be directly linked to the removal mechanism for that particular BMP type.

For example, in all BMPs that utilize settling as a primary removal mechanism, storm detention time is a key factor. The average detention time for a BMP during a given event is dependent on the design of the BMP and flow conditions during the event. For the general case, average detention time for an event can be calculated based on the average storage volume of the BMP and flows in and out, neglecting other losses; each of these may vary with time as shown in Equations 11.1-11.4.

The volume in the BMP,  $V(t)$ , at time  $t$  is given by:

$$V(t) = V_o + \int_{t_0}^t [Q_{in}(t) - Q_{out}(t)] \cdot dt \quad \text{Equation 11.1}$$

where,

t:	time
$V_o$ :	permanent pool storage volume of BMP
$Q_{in}$ :	volume flow rate into BMP
$Q_{out}$ :	volume flow rate out of BMP

In most cases, detention time is outflow dominated and thus can be approximated using the average volume flow rate at the outflow and the average total volume in the BMP.

The average volume flow rate,  $\overline{Q_{out}(t)}$ , on  $[t_0, t]$  is given by:

$$\overline{Q_{out}(t)} = \frac{1}{(t - t_0)} \int_{t_0}^t Q_{out}(t) \cdot dt \quad \text{Equation 11.2}$$

The average value of the total volume in the BMP,  $\overline{V(t)}$ , on  $[t_0, t]$  is:

$$\overline{V(t)} = \frac{1}{t - t_0} \int_{t_0}^t V(t) \cdot dt \quad \text{Equation 11.3}$$

Finally, an average detention time,  $\overline{t_{det}}$ , for the BMP on  $[t_0, t]$ , can be found from Equation 11.4:

$$\overline{t_{det}} = \frac{\overline{V(t)}}{\overline{Q_{out}(t)}} \quad \text{Equation 11.4}$$

For locations that do not have a significant change in detention volume with time during events (e.g., ponds with a large permanent pool and little surcharge detention volume) the volume of the pond can be assumed to be constant ( $V(t) = V_0$ , or  $Q_{in}(t) = Q_{out}(t)$ ) and the storm average detention time can be approximated as:

$$\overline{t_{det}} = \frac{V_0}{\left( \frac{V_{out}}{t} \right)} \quad \text{Equation 11.5}$$

If ‘intra-storm’ flow rate data is not available, (the database does not currently support ‘raw’ flow data, although it can be stored in generic attached data tables) and the storage volume in the BMP changes significantly over the course of an event, either an approximate average storage volume would need to be selected based on more detailed information about the system, or some theoretical hydrograph would need to be used based on rainfall and runoff characteristics, BMP design, and design of the outflow structure.

In addition to calculating the detention time for each storm event, an average detention time can be calculated for the BMP based on the historic average wet season rainfall rate for the area (Rushton et al, 1997). This method is applicable to BMPs that have effluent flows that continue for periods well in excess of the duration of the storm event and locations that have fairly steady rainfall rates over some specified wet season. Although the actual storm detention time calculated using this alternative method is not based on data from the monitoring period, it does provide a uniform means of comparing BMP design over a wide variety of locations based on average rainfall characteristics.

It is expected that detention time will be one of the primary parameters of interest for detention based BMPs. In addition to calculating the detention time for each storm event that was monitored, it will be useful to calculate a mean detention time, and a detention time for the mean storm based on the synoptic rainfall data stored in the database. Each of these factors will be assessed to determine if there is a correlation between these factors and the efficiency of removal.

In addition to examining design parameters that are directly stored in the database (e.g., surcharge detention volume), and standard calculated parameters (e.g., detention time), additional ratios composed of more than one factor will be examined. These ‘treatment factors’ allow for examination of other possibly important ratios between design parameters. For example, a ‘treatment volume factor’, which can be defined for BMPs that use storage as the primary treatment process, is shown in Equation 11.6.

$$\frac{f(\text{design volume})}{f(\text{runoff volume})} \quad \text{Equation 11.6}$$

For BMPs that are ‘flow-through’ in nature, a ‘treatment flow factor’ (Equation 11.7), will be examined.

$$\frac{f(\text{treatment flow rate})}{f(\text{runoff flow rate})} \quad \text{Equation 11.7}$$

These two “factors” are examples taken from a larger set of combinations of parameters that will be examined. The methods outlined in Sections 11.2 and 11.3 will be used for determining the usefulness of the parameters and factors described in this section.

## 11.2 Multiple Linear Regression

Multiple regression analysis systematically allows for examination of any relationships between the outcome of the performance measurements discussed in Section 3 of the memorandum and some design parameter or “factor” for a type of BMP.

For example, for dry detention ponds, the relationship between the design parameters length, depth, and draw down rate could be evaluated against the efficiency of the BMP for removing TSS.

Multiple linear regression can be used to see if there is a linear relationship between the parameters or “factors” of interest and efficiency. Multiple linear regression attempts to define a continuous linear relationship between the set of parameters and the resulting efficiency of the BMP. The method first assumes that each of the variables of interest are independent. In the example we can assume, for the sake of analysis, that length and depth meet this criteria. Multiple linear regression also assumes that a linear correlation exists between each independent variable and the dependent variable. It is always advisable to plot the dependent variable as a function of each independent variable in order to determine if there may be some transformation of the independent data that may allow for a linear relationship.

After linear regression is conducted, the correlation coefficient gives a measure of the goodness of fit for the regression line. In addition the F statistic can be used to determine if the results occurred by chance and the t-statistics can be used to determine the relative usefulness of each variable in the regression equation.

## 11.3 BMP Group Test Methods

Group testing methods use a “cutoff” value for a design or environmental parameter and report the effects of exclusion of BMPs based on this “cutoff”. Most likely, this would be done with a set of factors; a BMP to make the “cutoff” might have to meet 4 of 6 “good” design factors. This approach does not require that a continuous relationship between some parameter and performance exists. This method can therefore be applied to yes/no factors, (e.g., forebay volume >10% of the total volume of a wet pond; length to width ratio of 3:1, etc.) or factors that have a small set of discrete values. In addition, the group testing method follows the design process, where often a required value is specified in order to meet a certain performance goal. The group testing method will probably be a more successful approach, compared to multiple regression, due to the small number of data points available for any given BMP type.

## APPENDIX A

Table A.1

$T = \text{EXP}(U)$	$S = M * CV$
$M = \text{EXP}(U + 0.5 * W^2)$	$W = \text{SQRT}(\text{LN}(1 + CV^2))$
$M = T * \text{SQRT}(1 + CV^2)$	$U = \text{LN}(M / \text{EXP}(0.5 * WP))$
$CV = \text{SQRT}(\text{EXP}(W^2) - 1)$	$U = \text{LN}(M/\text{SQRT}(1 + CV^2))$

	Arithmetic	Logarithmic (ln)
Mean	M	U
Standard Deviation	S	W
Coefficient of Variation	CV	
Median	T	

Table A.1 presents transformations between logarithmic transformed population statistics and estimates of arithmetic population statistics.

## ATTACHMENT E – DEFINITIONS

**“Attached Residential Development”** means any development that provides 10 or more residential units that share an interior/exterior wall. This category includes, but is not limited to: dormitories, condominiums and apartments.

**“Automotive Repair Shop”** means a facility that is categorized in any one of the following Standard Industrial Classification (SIC) codes: 5013, 5014, 5541, 7532-7534, or 7536-7539.

**“Commercial and Industrial Development”** means any development on private land that is not exclusively heavy industrial or residential uses. The category includes, but is not limited to: mini-malls and other business complexes, shopping malls, hotels, office buildings, public warehouses, hospitals, laboratories and other medical facilities, educational institutions, recreational facilities, plant nurseries, car wash facilities, automotive dealerships, commercial airfields, and other light and heavy industrial complexes or facilities.

**“Commercial and Industrial Development greater than 100,000 square feet”** means any commercial or industrial development with a project footprint of at least 100,000 square feet.

**“Detached Residential Development”** means any development that provides 10 or more freestanding residential units. This category includes, but is not limited to: detached homes, such as single-family homes and detached condominiums.

**“Directly Connected Impervious Area (DCIA)”** means the area covered by a building, impermeable pavement, and/ or other impervious surfaces, which drains directly into the storm drain without first flowing across permeable vegetated land area (e.g., lawns).

**“Environmentally Sensitive Areas”** means areas that include, but are not limited to, all Clean Water Act 303(d) impaired water bodies (“303[d] water bodies”); areas designated as an “Area of Special Biological Significance” (ASBS) by the State Water Resources Control Board (1990 Water Quality Control Plan for Ocean Waters of California [Ocean Plan] and Water Quality Control Plan for the San Diego Basin (1994) and amendments); water bodies designated as having a RARE beneficial use by the State Water Resources Control Board (Water Quality Control Plan for the San Diego Basin (1994) and amendments), or areas designated as preserves or their equivalent under the Multiple Species Conservation Program (MSCP) within the Cities and County of Orange. The limits of Areas of Special Biological Significance are those defined in the 1990 Water Quality Control Plan for Ocean Waters of California (Ocean Plan) and the Water Quality Control Plan for the San Diego Basin (1994 and amendments). Environmentally sensitive area is defined for the purposes of implementing WQMP requirements, and does not replace or supplement other environmental resource-based terms, such as “Environmentally Sensitive Lands,” employed by Permittees in their land development review processes. As appropriate, Permittees should distinguish between environmentally sensitive area and other similar terms in their local WQMP’s.

**“Hillside”** means lands that have a natural gradient of 25 percent (4 feet of horizontal distance for every 1 foot of vertical distance) or greater and a minimum elevation differential of 50 feet, or a natural gradient of 200 percent (1 foot of horizontal distance for every 2 feet of vertical distance) or greater and a minimum elevation differential of 10 feet.

**“Hillside development greater than 5,000 square feet”** means any development that would create more than 5,000 square feet of impervious surfaces in hillsides with known erosive soil conditions.

**“Infeasibility Waivers”** means a Permittee-issued waiver from requirements for Treatment BMPs. The waiver requires a project proponent demonstrate Treatment BMP infeasibility and the Permittee to notify the Executive Officer of the applicable Regional Board of the waiver.

**“Infiltration”** means the downward entry of water into the surface of the soil.

**“Municipal Storm Drain System”** means public drainage facilities by which stormwater may be conveyed to Receiving Waters, such as: natural drainages, ditches, roads, streets, constructed channels, aqueducts, storm drains, pipes, street gutters, or catch basins.

**“Natural Flow Regime”** means the pre-development hydrologic conditions within a stream.

**“New Development”** means land disturbing activities; structural development, including construction or installation of a building or structure, the creation of impervious surfaces; and land subdivision.

**“Parking Lot”** means land area or facility for the temporary parking or storage of motor vehicles used personally, or for business or commerce.

**“Projects Discharging to Receiving Waters within Environmentally Sensitive Areas”** means all development and significant redevelopment that would create 2,500 square feet of impervious surfaces or increase the area of imperviousness of a project site to 10% or more of its naturally occurring condition, and either discharge urban runoff to a receiving water within an environmentally sensitive area (where any portion of the project footprint is located within 200 feet of the environmentally sensitive area), or discharge to a receiving water within an environmentally sensitive area without mixing with flows from adjacent lands (where the project footprint is located more than 200 feet from the environmentally sensitive area).

**“Project Feature”** means a project component or subpart that in and of itself, meets Priority Project criteria. For example, a greater than 5000 sq. ft. parking lot within a non-Priority Project.

**“Project Footprint”** means the limits of all grading and ground disturbance, including landscaping, associated with a project.

**“Receiving Waters”** means surface bodies of water, that receive discharges from new development and redevelopment projects, either directly, or indirectly through municipal storm drain systems or otherwise. Surface bodies of water include naturally occurring wetlands,

streams (perennial, intermittent and ephemeral [exhibiting bed, bank, and ordinary high water mark]), creeks, rivers, reservoirs, lakes, lagoons, estuaries, harbors, bays and the Pacific Ocean and such other waters as are considered waters of the United States and/or the State of California under applicable definitions. The Permittee shall determine the definition for wetlands and the limits thereof for the purposes of this definition, provided the Permittee definition is as protective as the definition utilized by the United States Army Corps of Engineers (US COE), the United States Environmental Protection Agency (US EPA) and/or the State of California. In some instances, constructed wetlands or other constructed BMPs may not be considered wetlands or receiving waters under this definition particularly if they are constructed outside of receiving waters, not for mitigation purposes, and are routinely maintained.

**“Residential Development”** means any development on private land that provides living accommodations for one or more persons. This category includes, but is not limited to: single-family homes, multi-family homes, condominiums, and apartments.

**“Restaurant”** means a stand-alone facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC code 5812).

**“Significant Redevelopment”** means development that would add 5,000 or more square feet of impervious surface on an already developed site. Significant redevelopment includes, but is not limited to: Expansion of a building footprint; Addition of a building and/or structure; Addition of an impervious surface that is not part of a routine maintenance activity such as construction of a new parking lot; Replacement of impervious surfaces, buildings and/or structures when 5000 or more square feet of soil is exposed during replacement construction. Replacement does not include routine maintenance activities, trenching and resurfacing associated with utility work, resurfacing and reconfiguring the surface of parking lots (unless 5000 or more square feet of impervious surface is added to the existing parking lot area) or reconfiguration of pedestrian ramps and replacement of damaged pavement.

**“Site Design BMP”** means any project design feature that reduces the creation or severity of potential pollutant sources or reduces the alteration of the project site’s natural flow regime. Redevelopment projects that are undertaken to remove pollutant sources (such as existing surface parking lots and other impervious surfaces) or to reduce the need for new roads and other impervious surfaces (as compared to conventional or low-density new development) by incorporating higher densities and/or mixed land uses into the project design, are also considered Site Design BMPs.

**“Source Control BMP (both structural and non-structural)”** means land use or site planning practices, or structures that aim to prevent urban runoff and stormwater pollution by reducing the potential for contamination at the source of pollution. Source Control BMPs minimize the contact between pollutants and urban runoff. Examples include roof structures over trash or material storage areas, and berms around fuel dispensing areas.

**“Stormwater Best Management Practice (BMP)”** means any schedules of activities, prohibitions of practices, general good house keeping practices, pollution prevention and educational practices, maintenance procedures, structural treatment BMPs, and other management practices to prevent or reduce to the maximum extent practicable the discharge of pollutants directly or indirectly to receiving waters. Stormwater BMPs also include treatment requirements, operating procedures and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. This Model WQMP groups stormwater BMPs into the following categories: Site Design, Source Control, and Treatment Control (pollutant removal) BMPs.

**“Streets, Roads, Highways, and Freeways”** means any project that is not part of a routine maintenance activity, and would create a new paved surface that is 5,000 square feet or greater used for the transportation of automobiles, trucks, motorcycles, and other vehicles. For the purposes of WQMP requirements, Streets, Roads, Highways, and Freeways do not include trenching and resurfacing associated with utility work; applying asphalt overlay to existing pavement; new sidewalk, pedestrian ramps, or bike lane construction on existing roads; and replacement of damaged pavement.

**“Treatment Control (Structural) BMP”** means any engineered system designed and constructed to remove pollutants from urban runoff. Pollutant removal is achieved by simple gravity settling of particulate pollutants, filtration, biological uptake, media adsorption or any other physical, biological, or chemical process.