

By: Donna Bodine, Senior Environmental Scientist, BASELINE Environmental Consulting

Stormwater Runoff: An Approach for Evaluating Long-Term Impacts and Identifying Mitigation Measures for Development Projects

This article discusses how to evaluate direct stormwater quality and hydromodification impacts and identify mitigation measures for the post-construction, or operational phase of a project. Included is a summary of stormwater requirements for new development and redevelopment projects, a discussion of the types of measures that need to be incorporated into these projects; what is considered to be the current state of the practice for performance standards; and a suggested methodology for evaluating impacts and identifying mitigation measures to reach a less-than-significant adverse impact conclusion for an EIR analysis.

New development and redevelopment may create impervious surfaces, introduce new pollutants into the environment, or increase amounts of existing pollutants associated with urban land uses. Consequently, stormwater and dry weather runoff (e.g., irrigation overflow) leaving a development can be considerably greater in volume, velocity, and pollutant load than the site's pre-development runoff.

Potential environmental impacts that can occur in a watershed from urban runoff include: (1) changes in the surface water flow regime and related effects on stream morphology, the floodplain, and stream ecology; and (2) water and sediment quality degradation and related effects on the composition and survival of aquatic species.

NPDES Permit Requirements for Development Projects

An amendment to the Federal Clean Water Act ("CWA") established the framework for regulating stormwater discharges and, in 1990, U.S. EPA ("EPA") began regulating stormwater and dry weather runoff from urbanized areas under the NPDES permitting program. Regulation occurred in two phases. Phase I permits regulated stormwater discharges associated with "industrial" activities, including construction activities that disturb five acres of land or more, and discharges from municipal separate storm sewer systems ("MS4s") serving populations of 100,000 people or more. Phase II was promulgated in 1999, and expanded the regulatory program to require NPDES permits for discharges from construction sites disturbing between one and five acres, from small MS4s that serve populations of less than 100,000 people, from some other governmental facilities, and from industrial facilities owned by small municipalities.

Phase I NPDES permits cover industrial facilities, construction projects disturbing five or more acres, and MS4s with 100,000 or more people.

Phase II NPDES permits cover construction activities disturbing one or more acres, MS4s with less than 100,000 people and some other governmental facilities.

Is simply stating the proposed project's compliance with NPDES regulations adequate for determining a less-than-significant adverse impacts conclusion when preparing the impact analysis for an EIR?

Stormwater permits allow for a variety of compliance options that enable the discharger to meet the "Maximum Extent Practicable"¹ ("MEP") performance standard in the regulations. Therefore, an impact analysis should demonstrate how the project will comply with the applicable National Pollutant Discharge Elimination System ("NPDES") permit to reduce significant impacts. This requires an assessment of the specific Best Management Practices ("BMPs") that will be incorporated into the project as Project Design Features ("PDFs"). If specific details of project PDFs are not available for the CEQA process, then the EIR will need to identify mitigation measures that will reduce impacts and meet the MEP performance standard.

In California, the NPDES permitting program is administered by the State Water Resources Control Board ("State Board") and the nine Regional Water Quality Control Boards ("Regional Boards"). Phase I permits are individual permits administered by the Regional Boards. The Phase II permit is a general, statewide permit that was adopted by the State Board in April, 2003 (Order No. 2003-0005-DWQ) (Phase II Small MS4 General Permit), and is overseen by the Regional Boards. The NPDES permits require an MS4 to develop and implement a Stormwater Management Plan ("SWMP"), which is a document that describes the activities the MS4 will conduct to comply with all aspects of the permit, including BMPs, performance standards, measurable goals, and an implementation schedule for program activities.

Phase I and Phase II permits require the MS4 to implement a program for certain categories of development, to minimize impacts from urban runoff. Specifically, the MS4 must implement a Standard Urban Stormwater Mitigation Plan² ("SUSMP") that identifies conditions of approval for development permits. Other terms, such as C.3 Provisions (used in the San Francisco Bay Area), have been used to define these requirements in Phase I MS4 permits, although all Phase I permits in California do not have identical SUSMP requirements. Municipalities must document in their SWMPs the programs and performance standards they will implement to comply with SUSMP requirements. Also, municipalities typically provide guidance to developers on how to comply with local requirements.

Regulated development and redevelopment³ projects in Phase I permit areas generally fall into the following categories:

- Residential, commercial and industrial development projects, and street, road and freeway construction projects that add or replace a certain amount of impervious area (e.g., a residential development adding 5,000 to 10,000 square feet of impervious surface is a typical trigger for a regulated project);
- Single-family hillside homes of a certain size (one acre is a typical trigger);
- Auto service facilities;
- Restaurants;
- Uncovered parking lots of a certain size; and
- Projects located in or discharging directly to an environmentally sensitive area.⁴

In the Phase II Small MS4 General Permit the regulated projects are similar to Phase I requirements. The trigger for a development project is one acre, or a project that is less than one acre but is part of a larger development project.

The performance standard for all activities required under MS4 NPDES permits is to implement control measures or BMPs to reduce pollutants in stormwater discharges to the MEP. MEP is a continuously evolving technology-based standard; the definition can be somewhat ambiguous in permits, but this ambiguity generally provides Phase I and Phase II MS4 operators the flexibility to determine what controls constitute the MEP. The MEP performance standard is established by the SWMP that is subject to the Regional Board's approval. To meet the MEP performance standard, MS4 operators must employ stormwater control measures that are technically feasible (i.e., are likely to be effective) and not cost prohibitive.

The SUSMP provisions require inclusion of BMPs in four general categories (described in more detail below): (1) site design, (2) source control, (3) treatment control, and (4) hydromodification control. Some Phase I permits are more prescriptive than others in terms of the types of site design measures that must be included. Also, some, but not all Phase I permits, prescribe source control BMP design standards for certain development categories or activities, such as retail gasoline outlets and vehicle maintenance areas. The Phase II Small MS4 General Permit has the following BMP design standard requirements:

- Control peak stormwater runoff discharge rates where increased peak discharge rates will result in increased potential for downstream erosion;
- Conserve natural areas by clustering development and other measures;
- Minimize pollutants of concern;
- Protect slopes and channels;
- Provide storm drain stenciling and signage;
- Properly design outdoor material and trash storage areas; and
- Provide proof of on-going maintenance for structural BMPs.

Except for numeric sizing criteria for treatment control BMPs, permits do not prescribe the treatment controls that should be included in a development project, nor do the permits prescribe which combinations of BMPs will meet the MEP performance standard. One challenge is that not all BMPs or combinations of BMPs are equally effective for minimizing a project's hydrologic impacts and pollutants of concern. And not all BMPs are appropriate for every project, because site constraints could preclude the use of certain BMPs altogether, or significantly reduce their effectiveness.

As an alternative compliance option, a Phase I permit may allow the discharger to participate in a regional or watershed program in lieu of implementing some of the BMP requirements on-site (this option is not available in the Phase II Small MS4 General Permit). Watershed or regional projects may be beneficial because they can reduce impacts from already developed areas in the watershed. For alternative compliance, there needs to be a watershed or regional plan developed among collaborating planning agencies, municipalities, and the development community, which defines the approach for satisfying the permit requirements, evaluating suitable regional controls and criteria for use of the controls, and identifying and coordinating cross-jurisdictional issues. The plan must also consider funding mechanisms for facility construction, operation and maintenance; facility design and construction responsibilities; program administration; and how the program will evaluate compliance with permit requirements. Typically, the development project sponsor would be responsible for installing the regional project and/or contributing funding to the project.

Finally, Phase I permits may require the MS4 to review its General Plan to identify development policies and other elements that should be revised to allow for implementation of SUSMP requirements, such as integration of water quality and watershed protection with water supply, flood control, habitat protection, groundwater recharge, and other sustainable development principles and policies. In addition, the MS4

may be required by its permit to revise its CEQA environmental review processes to adequately evaluate stormwater impacts and identify appropriate mitigation measures. This may entail developing additional thresholds of significance that supplement the Environmental Checklist in Appendix G of the CEQA Guidelines.

BMP and Performance Standard Requirements for Regulated Development Projects

In accordance with NPDES permit requirements for MS4s, certain development projects must include a combination of site design, source control, treatment control, and, if applicable, hydromodification BMPs. Incorporation of effective site design measures into a project will reduce or eliminate the increase in runoff resulting from the development, and will also minimize pollutants in runoff. Over the past decade there has been a paradigm shift in stormwater management and Low Impact Development ("LID"), which is essentially a site design principle, has emerged as a preferred management approach.

Rather than centralized, end-of-pipe treatment controls, LID relies on an integrated system of decentralized, small-scale control measures that attempt to preserve or mimic a site's pre-development hydrology. LID is designed to infiltrate, filter, store, evaporate, and detain runoff close to where it originates. Combined with other conservation and planning approaches such as smart growth⁵ and green building, LID can effectively mitigate long-term watershed impacts from development. Incorporation of LID measures can also reduce development infrastructure costs when compared to traditional stormwater management approaches.

LID is being promoted at both the state and federal level. In 2005, the State Board adopted sustainability as a core value for State Board and Regional Board activities and programs, recognized LID as a sustainable practice, and directed Regional Board staff to consider sustainability in all future policies, guidelines, and regulatory actions. Consequently, LID has been incorporated into an increasing number of new development and redevelopment requirements in Phase I permits. In addition, the Central Coast Regional Board also requires municipalities covered under the Phase II Small MS4 General Permit to incorporate LID into new and redevelopment ordinances and design standards, unless it can be demonstrated that conventional BMPs would be equally effective and/or result in substantial cost savings.

EPA issued a Statement of Intent in 2007 to promote the benefits of using "green infrastructure" to protect drinking water supplies and public health, mitigate overflows from combined and separate sewers, and reduce stormwater pollution. EPA intends to collaborate with organizations such as the National Resources Defense Council and the Low Impact Development Center in this effort, and the collaboration has published a Green Infrastructure Action Strategy.⁶

Implementing LID means using a combination of measures that may include:

- Reducing impervious surfaces, particularly directly connected impervious areas, and maximizing permeability;
- Creating "zero discharge" areas;
- Conserving native soils (keeping soils on-site and minimizing compaction during construction), vegetation, and stream buffers;
- Protecting slopes and channels to reduce the potential for erosion and to preserve natural sediment supply to stream channels;
- Selecting appropriate inert building materials that will not leach pollutants such as metals (e.g., architectural copper) into stormwater; and
- Incorporating features such as bioretention facilities (rain gardens), vegetated swales, green roofs, rain barrels, cisterns, and permeable paving materials.

continued on page 8

Stormwater Runoff

continued from page 7



This green roof installation on a commercial building is an example of LID. Photo courtesy of Peter Schultze-Allen, City of Emeryville, CA



This bioretention area in a new development is an example of LID. Photo courtesy of Tom Dalziel, Contra Costa Clean Water Program

LID is emerging as the MEP performance standard for meeting SUSMP requirements in California, and is being prescribed in either the NPDES permit itself, or in the SWMP performance standard requirements established by the MS4 to comply with the permit. Depending on site or watershed conditions, hard infrastructure and end-of-pipe measures may still be needed to satisfy SUSMP and/or flood control requirements, but a stormwater management plan that relies primarily on heavily engineered, end-of-pipe treatment may no longer meet the MEP standard.

Low Impact Development (LID) is becoming the performance standard for meeting stormwater management requirements for new development and redevelopment projects. LID relies on an integrated system of decentralized, small-scale control measures that attempt to preserve or mimic a site's pre-development hydrology.

As an example of the evolution in NPDES permit requirements, the Tentative Order for Ventura County issued in February 2009, which, when adopted will replace the current NPDES permit, requires regulated projects to reduce the effective impervious area⁷ to five percent or less through the use of site design features and other measures. In addition, C.3 Provisions in the Tentative Order for the Municipal Regional Permit for the San Francisco Bay Area, also issued in February 2009,



This detention basin serving a residential development is an example of a treatment control BMP. Photo courtesy of Donna Bodine

state that the goal of addressing pollutants and preventing increases in runoff flows from new development and redevelopment projects "is to be accomplished primarily through the implementation of low impact development (LID) techniques employing landscape-based treatment measures". The C.3 Provisions also require incorporation of specific LID elements.

Source control BMPs refer to activities, structural devices, prohibitions of practices, maintenance procedures, managerial practices, or operational practices that reduce the potential for pollutants to come into contact with stormwater. Treatment control BMPs are designed to remove pollutants from stormwater using one or several unit operations and processes.⁸ Treatment control BMPs that are distributed throughout a development and incorporate vegetation and soils for treatment, such as green roofs, swales, and bioretention areas, are also considered LID measures because they provide hydrologic control in addition to water quality treatment.

Hydromodification Control Requirements

Development can alter the velocity, volume, and duration of runoff entering a stream channel in a way that can adversely impact aquatic ecosystems, and cause streambank erosion and physical modifications. These changes are collectively referred to as hydromodification. Whether a development project would cause or contribute to hydromodification can be evaluated based on factors that include:

- Whether project runoff discharges to a relatively natural stream channel, as opposed to a hardened channel or storm drain system, in which case the permit requirements would not apply;
- The project size (one acre of development is often used as a trigger);
- Whether the project is an infill project in an already highly developed watershed, in which case the permit requirements would not apply;
- The increase in impervious area resulting from the project; and
- The project's potential to change the amount of natural sediment delivered to the stream, which can lead to similar impacts as those caused by a change in runoff.

Phase I permits may include a hydromodification performance standard in the form of an Erosion Potential (E_p) within streams, which cannot change significantly from pre-project conditions (i.e., $E_p = 1$), and requires implementation of controls to achieve the performance standard. The purpose of the hydromodification controls is to maintain pre-project stormwater runoff flow rates and durations⁹ to the extent feasible. Hydromodification controls fall into the following three general categories:

- *On-site controls.* LID can be a primary measure used to mitigate hydromodification impacts. On-site controls also include engineered controls designed to maintain pre-project flow durations, which are similar to treatment control BMPs.
- *Off-Site Regional Controls.* A regional flow control facility could serve the needs of multiple development projects, and construction of such a facility would require the coordination of multiple projects in close proximity.

- *In-Stream Controls.* In-stream controls are stream restoration methods that modify the stream channel slope and geometry to convey flows from urbanization in a way that reduces the potential for erosion and habitat impairment. For stable and ecologically healthy streams, on-site or regional controls are generally preferred to channel reconstruction, because these practices do not disturb the stream channel. As such, some municipalities only allow in-stream controls if the stream channel is already exhibiting hydromodification impacts. In-stream control projects require additional permitting such as a Streambed Alteration Agreement from the California Department of Fish & Game, a CWA Section 404 permit from the U.S. Army Corps of Engineers, and a CWA Section 401 certification from the Regional Board.

Water Quality Management Plan

An NPDES permit and/or the municipal performance standards may require the project sponsor to submit a Water Quality Management Plan (“WQMP”) or equivalent plan,¹⁰ to demonstrate the project’s compliance with SUSMP requirements, as part of the MS4’s development review process. Depending on local requirements, a WQMP may or may not be available for the CEQA review process.

The project sponsor may be required to follow a WQMP template or complete a checklist of required items developed by the MS4. In general, the WQMP should document the site design, source control, treatment control, and if applicable, hydromodification control BMPs that will be implemented for the project; show that the BMPs will be effective for the land uses, site constraints, pollutants and hydrologic conditions of concern; and describe the means by which long-term operation and maintenance of all structural BMPs will occur (which may require submittal of a separate Operations and Maintenance Plan).

A WQMP is a planning-level document, and therefore does not need to include detailed BMP design drawings and specifications. However, for on-site treatment/hydromodification control BMPs, the WQMP should demonstrate that the project, using appropriate hydraulic sizing criteria, can adequately accommodate the BMPs within the development envelope. For regional or watershed BMPs, the WQMP should clearly define the project sponsor’s role in the project and reference the applicable watershed planning document(s), if available.

Preparing the Impacts Analysis for an EIR

Certain municipalities have augmented the Environmental Checklist in Appendix G of the CEQA Guidelines, and require that the CEQA review process include additional evaluation of stormwater-related impacts. Sample additions to the checklist include:

- Would the project result in increased impervious surfaces and associated increased runoff?
- What is the potential for discharge of stormwater pollutants from areas of material storage, vehicle or equipment fueling, vehicle or equipment maintenance, waste handling, hazardous materials handling or storage, delivery areas, loading docks or other outdoor work areas?
- Would the project result in an increase in pollutant discharges to receiving waters (consider water quality parameters such as temperature, dissolved oxygen, turbidity and other conventional stormwater pollutants)?
- Is the project tributary to an already impaired waterbody, as listed on the CWA Section 303(d)? If so, will it result in an increase in any pollutant for which the waterbody is already impaired? Is the project tributary to other environmentally sensitive areas? If so, can it exacerbate already existing sensitive conditions?
- Would the project have a potentially significant adverse impact on groundwater quality?
- Would the project cause or contribute to degradation of beneficial uses for surface water or groundwater?
- Would the project impact aquatic, wetland, or riparian habitat?

- Would the project include new or retrofitted treatment control BMPs, the operation of which could result in significant environmental effects such as increased vectors and odors?

Irrespective of whether the impact analysis is based on the criteria in Appendix G or a modified Appendix G checklist, the impact analysis must assess how the selection and design of stormwater BMP combinations (considering the site opportunities and constraints) would be effective in reducing significant impacts of a project. If compliance with regulations is being used to make a less-than-significant impact determination, then the impacts assessment should evaluate the project’s compliance with regulations based on the WQMP. In most cases, implementation of an approved WQMP will reduce adverse impacts from a project to a less-than-significant level. However, if a WQMP is not available to document the PDFs, then mitigation measures need to be identified to conclude that adverse impacts would be less than significant.

If a WQMP is available for the EIR, the impact assessment should demonstrate how the selected BMPs would be effective for stormwater and dry weather pollutants of concern. Pollutants commonly associated with stormwater runoff from development may include sediment, trash, pathogens (e.g., bacteria, viruses, protozoa), heavy metals (e.g., copper, lead, and zinc), petroleum products and polynuclear aromatic hydrocarbons, synthetic organics (e.g., pesticides, herbicides, surfactants, and PCBs¹¹), nutrients (e.g., nitrogen and phosphorus fertilizers), and oxygen-demanding substances (e.g., decaying vegetation and animal waste).

Potential impacts from urban dry weather flows associated with development are just as important as stormwater runoff, particularly in arid and semi-arid climates where natural drainages are dominated by ephemeral¹² rather than perennial¹³ flows. Urban dry weather flows entering surface waters that previously only received wet weather flows can adversely affect water quality and riparian habitat. The primary sources of urban dry weather runoff include landscape irrigation, car washing, pavement washing, construction excavation dewatering, fire hydrant flushing, and swimming pool and decorative fountain draining. Dry weather flows tend to have less sediment than stormwater runoff, but may contain dissolved pollutants (in the form of salinity, metals, and pesticides), pathogens, and petroleum products.

If a WQMP is available, specific site design BMPs that will be incorporated into the project should be identified in the impacts analysis. For example, for General or Specific Plan EIRs, the consistency of policies and design standards with LID principles, such as standards for street width, the allowance of curb cuts to direct street runoff to a BMP, the allowance for permeable paving materials, and use of a native plant palette for common landscape areas to reduce pesticide and irrigation needs, should be evaluated. Development impacts that may be reduced through site design BMPs include:

- Mitigating downstream flooding impacts by controlling peak flow rates and reducing total runoff volumes;
- Protecting water quality by reducing pollutant loading due to runoff volume reductions achieved primarily via infiltration;
- Reducing stream channel hydromodification by preserving pre-development hydrology; and
- Reducing impacts on groundwater recharge through infiltration of runoff in LID facilities.

The impacts analysis should also evaluate the specific source control BMPs the project will incorporate, in accordance with the WQMP, including design and construction standards for fueling areas, loading docks, vehicle maintenance and washing facilities, and golf courses, if applicable. The impacts evaluation should also discuss operational procedures, which may include a spill contingency plan for certain types of building occupancies; activity restrictions, such as disallowing car washing except in approved areas; use of efficient

continued on page 10

Stormwater Runoff

continued from page 9

irrigation systems; and education of property owners, tenants, and employees on stormwater impacts that could result from their activities.

The impacts evaluation should disclose that the treatment BMPs are appropriate for the project pollutants of concern, based on the unit processes and operations inherent to the BMPs selected. The BMPs should be appropriate for site constraints, such as poorly infiltrative soils, steep slopes, geotechnical instability, shallow groundwater and/or bedrock, groundwater contaminant plumes, heavy vehicle or pedestrian traffic, or other safety concerns. Also, the evaluation should demonstrate that the project has the land area available to distribute LID-type BMPs within the development envelope, as needed, to treat the various drainage areas, or can allocate an even greater area of land for centralized BMPs, such as detention basins. All treatment BMPs should be sized according to NPDES permit requirements.

If a WQMP is available, the impacts evaluation should also discuss any on-site, off-site, or in-stream hydromodification controls that will be used for the project. LID can be used as the primary site design measure to reduce hydromodification impacts, and therefore, project site design measures that will control hydromodification should be identified. If centralized facilities are to be constructed, the impacts analysis should demonstrate that the project has adequate land area to accommodate the facilities. If the project cannot adequately reduce hydromodification impacts with on-site measures, off-site watershed and/or in-stream controls may be necessary. In such cases, the project sponsor's role in the project should be clearly defined. If in-stream restoration measures are needed, potential adverse impacts from disturbing the stream channel should also be addressed in the impacts analysis.

Another important benefit to having a WQMP available during the CEQA review process is that the PDFs are included in the project description and can be evaluated, as appropriate, in other portions of the EIR. Further, there is increased confidence that the site plan for the proposed development will not need to be modified later to provide adequate space for the PDFs and BMPs, reducing the likelihood of an additional CEQA process.

In the case where the project sponsor chooses to participate in a regional or watershed program for water quality treatment and/or hydromodification control purposes, potential on-site and off-site flooding impacts that may occur because on-site facilities that control peak flow velocities and total runoff volumes are not present, should be evaluated. Additional measures may be needed to mitigate flooding impacts.

The impacts analysis should describe how the structural treatment/hydromodification BMPs will be maintained. Inadequate maintenance of facilities is one of the main reasons why BMPs fail to function as designed. Typically the project sponsor is required to follow an Operations and Maintenance ("O&M") Plan, which may not be available for EIR preparation. Therefore, project O&M requirements should be included as a mitigation measure, as discussed below.

If a project discharges to an already impaired waterbody, such as a waterbody on the CWA 303(d) list, the impacts analysis should identify if the project would increase the concentration and/or loading of the pollutant causing impairment. An MS4 may have conditions of approval for projects discharging directly to 303(d)-listed waterbodies, which require post-development runoff to not exceed pre-development levels for listed pollutants. Most water quality objectives, such as those in Water Quality Control Plans ("Basin Plans") or the California Toxics Rule, do not apply to runoff from a development project, but to receiving waters. However, if an impaired receiving water has a total Maximum Daily Load ("TMDL") in place, the TMDL may stipulate a wasteload allocation¹⁴ for urban runoff. In such cases, the project sponsor may need to perform a quantitative analysis to demonstrate that stormwater discharges from the project will meet TMDL requirements. Such an analysis may consist of determining the pre- and post-project pollutant

concentrations and loading from the project area, and comparing the data to the municipal stormwater wasteload allocation in the TMDL.

Identifying Mitigation Measures

If a WQMP is not available for EIR preparation, mitigation measures will need to be developed to reduce adverse impacts to a less-than-significant level, if feasible. Some suggestions and examples are provided below. The PDFs are not really mitigation measures, because they are inherent features of the project, incorporated in accordance with the regulatory requirements, to reduce or avoid significant environmental effects. However, PDFs might be included as mitigation measures if requested by an agency or the public as a means to identify the party responsible for installing the PDFs.

A mitigation measure should be considered that would require the project sponsor to develop a WQMP, in accordance with the MS4's requirements, that describes site drainage and watershed characteristics, identifies BMPs/PDFs that will be incorporated into the project, including the design basis for treatment/hydromodification control BMPs, and identifies who is responsible for implementing non-structural BMPs. The mitigation measure should indicate at what phase in the project review and permitting process, as required by the municipality, the WQMP will be submitted by the project sponsor. BMPs should include a combination of site design, source control, treatment control measures, and if warranted, hydromodification control measures, which will be selected based on the site's hydrologic conditions of concern, pollutants of concern, and constraints. The BMPs/PDFs should be designed to meet the MEP standard established by the NPDES permit or MS4.

If the project includes a golf course or common open space, a mitigation measure should include the requirement for the project sponsor to develop a Landscape Management Plan and/or Golf Course Management Plan that relies on Integrated Pest Management (IPM).¹⁵ The Plan should include: (1) pesticide applicator certification requirements; (2) pest identification methods; (3) practices to prevent or reduce pest incidence and buildup; (4) monitoring to evaluate pest trends and to identify when controls are needed; (5) thresholds that trigger control actions; (6) cultural, mechanical, environmental, biological, and pesticide use control measures; (7) pesticide management and safety requirements including spill protection and groundwater and surface water protection measures; and (8) fertilizer management recommendations.

A mitigation measure may include that the project sponsor develops an O&M Plan that describes the long-term maintenance responsibility, mechanisms (including funding), and maintenance requirements for treatment/hydromodification control BMPs. The O&M Plan should discuss how the requirements and responsibilities are formalized for BMPs on private property and in the public right-of-way, such as with an inspection and maintenance agreement, conditions, covenants and restrictions, conditional use permits, or other legal agreements involving the local government and the project sponsor (or responsible party upon completion of the project, such as the Homeowners Association). The O&M Plan should identify procedures to ensure that the facilities in the private and public right-of-way function effectively and do not cause flooding, provide habitat for mosquitoes and other vectors, or otherwise become a nuisance or hazard. The O&M Plan should include as-built specifications and a detailed maintenance plan for all structural BMPs, including inspection checklists. The O&M Plan should identify training of O&M staff, and how the effectiveness of the O&M program will be evaluated.

In addition to the inspections identified in the O&M Plan, a mitigation measure may include development of a monitoring plan and implementation of performance monitoring for hydromodification and/or treatment control BMPs. This type of monitoring is not a requirement of the NPDES permit for development projects, but has been required by lead agencies for certain projects as a condition of approval to demonstrate the effectiveness of PDFs. Examples of

components that have been included in BMP performance monitoring plans include:

- Visual inspection and/or sampling and analysis during dry weather periods to identify whether dry weather flows are discharging from the BMPs, and to characterize the discharges.
- Collection of influent and effluent samples from treatment BMPs (such as a detention basin) during storm events and analysis for project pollutants of concern, or the sub-group of pollutants the BMP is designed to treat.
- Collection of in-stream water quality samples during storms at locations upstream and downstream of where the project runoff discharges into the receiving water, to evaluate if the project is adversely affecting receiving water quality and beneficial uses. A sediment and/or macroinvertebrate sampling program might also be needed to evaluate if the project is affecting beneficial uses of surface waters.
- Routine monitoring of in-stream hydrologic conditions to evaluate if there are changes in the hydrologic regime, stream stability, and geomorphology. Monitoring activities may include groundwater level monitoring, dry weather flow monitoring, evaluating stormwater peak flows, and monitoring of stream bed and bank conditions.
- Identification of the duration of each type of monitoring, and for wet weather sampling, identification of the number of events that will be targeted for each wet season.
- Identification of potential actions and corrective measures that may need to be initiated based on evaluation of the monitoring data.

The collection of influent, effluent, and/or receiving water samples usually requires the use of automated sampling equipment that can collect samples over the entire storm hydrograph,¹⁶ to obtain what is referred to as an Event Mean Concentration.¹⁷ The costs of installing such equipment and implementing the monitoring program are expensive compared to a grab sampling program, but the results can be significantly more meaningful.

In certain cases, implementation of an approved WQMP may not be sufficient to reduce adverse impacts associated with the project to a less-than-significant level. An example is the reduction of pathogens in urban runoff. Research demonstrates that pathogens are one of the most difficult stormwater pollutants to address, because of the many natural sources that can contribute to exceedances of water quality criteria, and because treatment by conventional treatment BMPs may not be adequate for meeting recreational water quality criteria.¹⁸ Consequently, even if the project BMPs meet the MEP performance standard established in the permit or by the MS4, pathogens may still cause an unavoidable significant adverse impact. An example of a mitigation measure that may be required to address elevated pathogen levels is posting of streams, lakes, or beaches into which the project discharges during and following storm events, to keep people and pets from coming into contact with water. The posting should be maintained until laboratory analytical results show pathogen levels have decreased back to “normal background” levels.

Finally, if the project involves dredge or fill activities that may result in a discharge to a surface water body, additional mitigation measures may need to be developed to comply with CWA Sections 401 and 404. Similarly, if the project could substantially divert or obstruct the natural flow, change the bed, channel, or bank of any river, stream, or lake, use materials from a streambed, or deposit or dispose of debris where it could be released into a surface waterbody, additional mitigation may be required to comply with California Department of Fish and Game Code Section 1602 (Lake or Streambed Alteration Agreement).

Evaluating post-construction impacts associated with new development and redevelopment is a challenging and evolving area in CEQA in terms of the level of detail that is required to satisfy CEQA

and lead agency requirements. Having an approved WQMP available for EIR preparation will facilitate the process, and reduce the likelihood that additional CEQA analyses will be needed as the project progresses. If a WQMP is not available for the EIR process, significantly more mitigation measures will need to be identified in the EIR to reduce impacts to a less-than-significant level.

- ¹ Section 402(p)(3)(B)(iii) of the Clean Water Act requires that a stormwater program “shall require controls to reduce the discharge of pollutants to the maximum extent practicable (MEP), including management practices, control techniques and system, design and engineering methods, and such other provisions as the Administrator or the State determines appropriate for the control of such pollutants.”
- ² The first SUSMP requirements were adopted by the Los Angeles Regional Board for Los Angeles County and cities in the County, on March 8, 2000. Subsequently, the State Board adopted Order WQ 2000-11 on October 5, 2000, which found that provisions in the Los Angeles SUSMP constitute the MEP, and also discussed areas where Regional Boards may exercise more discretion in specifying requirements for new development and redevelopment projects.
- ³ Regulated redevelopment projects are of a certain size and include activities such as expansion of a building footprint; addition to or replacement of a structure; or replacement of an impervious surface that is not part of a routine maintenance activity.
- ⁴ An environmentally sensitive area is an area “in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which would be easily disturbed or degraded by human activities and developments” (Reference: California Public Resources Code § 30107.5). Environmentally sensitive areas include CWA 303(d)-listed waterbodies in all reaches that are unimproved, all California Coastal Commission’s Environmentally Sensitive Habitat Areas as delineated on maps in Local Coastal Plans, and the Regional Board’s Basin Plan Rare, Threatened or Endangered Species and Preservation of Biological Habitats designated waterbodies.
- ⁵ Smart growth includes approaches such as locating development in already degraded land, designing more compact residential lots, reducing the width of streets and parking lot stalls, and clustering development by integrating retail, commercial, and residential uses.
- ⁶ American Rivers, Association of State and Interstate Water Pollution Control Administrators, National Association of Clean Water Agencies, Natural Resources Defense Council, the Low Impact Development Center, and U.S. EPA, 2008. *Managing Wet Weather with Green Infrastructure, Action Strategy 2008*. Available online at: http://www.epa.gov/npdes/pubs/gi_action_strategy.pdf.
- ⁷ Effective impervious area is impervious area that collects and drains runoff directly to a receiving water via pipes or sheet flow. It can also be referred to as directly connected impervious area. Conversely, impervious area that drains to landscaping, swales, parks and other pervious areas is considered “ineffective” because the water is allowed to infiltrate, without a direct connection to the receiving water.
- ⁸ Unit operations and processes include hydrologic and physical operations, and biological and chemical processes. Examples include infiltration, gravity settling, pollutant uptake and storage by plants, and chemical sorption onto soil or engineered media.
- ⁹ Flow duration means the number of times, or hours, that a certain runoff or stream flow rate occurs over an extended period of time (such as a 50-year record).
- ¹⁰ Other terms commonly used in California include Stormwater Management Plan, Stormwater Control Plan, and Post-Construction Stormwater Quality Plan.
- ¹¹ Polychlorinated biphenyls (PCBs) are a class of legacy pollutants that cause watershed and human health impacts by bioaccumulating in aquatic organisms. Urban runoff is an identified source of PCBs.
- ¹² A surface waterbody that flows only in direct response to precipitation or snowmelt.
- ¹³ A surface waterbody that has continuous flow year round under normal conditions.
- ¹⁴ The portion of the total load in a TMDL that is allocated to a point source.
- ¹⁵ Integrated Pest Management (IPM) is a strategy that focuses on long-term prevention or suppression of pest problems (i.e., insects, diseases and weeds) through a combination of techniques including using pest-resistant plants; biological controls; cultural practices; habitat modification; and the judicious use of pesticides when monitoring indicates pest populations exceed established thresholds.
- ¹⁶ A graphical representation of stage, flow, velocity, or other characteristics of water at a given point as a function of time.
- ¹⁷ American Society of Civil Engineers (ASCE) and EPA, 2002. *Urban Stormwater BMP Performance Monitoring, a Guidance Manual for Meeting the National Stormwater BMP Database Requirements*. Prepared by Geosyntec Consultants, Urban Drainage and Flood Control District and Urban Water Resources Research Council of ASCE in cooperation with EPA. April, 2002. Available online at: <http://www.bmpdatabase.org/docs/Urban%20Stormwater%20BMP%20Performance%20Monitoring.pdf>.
- ¹⁸ Clary, J.; Jones, J.E.; Urbonas, B.R.; Quigley, M.M.; Strecker, E.; Wagner, T. Can Stormwater BMPs Remove Bacteria? New Findings from the International Stormwater BMP Database. Stormwater, May 2008. Available online at: <http://www.stormh2o.com/may-2008/bacterial-research-bmps.aspx>.