New Jersey Stormwater
Best Management Practices Manual

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CHAPTER 3

Regional and Municipal Stormwater Management Plans

Regional Stormwater Management Plans

Regional stormwater management planning is a water resource management strategy that identifies and develops solutions to problems that can be managed most effectively on a regional basis. The product of this planning process, the regional stormwater management plan (RSWMP), spans the boundaries of individual properties, neighborhoods, municipalities, and even county borders. A plan may address an existing water quantity issue, such as localized flooding; an existing water quality issue, such as excess pollutant loading; or issues of water quantity and quality that may be generated by future development. Regional stormwater planning creates a combination of regulations and actions tailored to the specific needs of a drainage area, but it does not reduce environmental protection. Rather, it allows regulations more flexibility to match the concerns, conditions, and features of regions that are connected by a common drainage area.

Well-designed RSWMPs share common elements. First, they are collaborative. Adoption and implementation of an RSWMP depends on the cooperation of county and municipal governing bodies, regulatory agencies, and environmental organizations. Any plan designed without their active involvement and consent has dim prospects for adoption. Second, they focus on identifying and solving specific problems. Shared regional problems, such as recurring flooding, unswimmable lakes, reduced stream flows, or contaminated public water supplies, can drive the collaboration needed to trigger and sustain the planning and adoption process. Specific problems also lend themselves to specific, measurable, and quantifiable implementation steps. For example, an RSWMP can spell out the specific measures required to reduce pollutant loads determined by the TMDL (total maximum daily load) process. Third, an RSWMP's recommendations are based on sound engineering and science geared to local land use conditions. All measures included in an RSWMP must be supported by a rationale that includes a feasibility analysis for achieving specific objectives as well as a monitoring plan to gauge long-run effectiveness of each measure. Plans must be reviewed every five years at a minimum. Fourth and finally, RSWMPs include a strong emphasis on maintenance and monitoring to ensure long-term functioning of the structures, measures, and programs recommended by the plan.

Regional stormwater management planning represents a fundamental shift in thinking – and execution. Traditionally, stormwater has been planned for and managed on a site-by-site basis, with the combined effect of thousands of individual stormwater management decisions in one watershed creating unintended consequences. For example, a detention or retention basin may make perfect sense to manage stormwater for an individual property. Typically, these basins were designed to ensure that peak runoff rates from a site did not increase after the property was developed. However, when hundreds of such basins simultaneously retain and then release stormwater in a regional drainage area, they can actually increase flooding and downstream erosion by extending peak runoff rates and increasing non-peak flows. As development increase in a drainage area, this site-by-site planning failed to account for the increased volume of runoff caused by regional increases in development. To address these increased volumes, recent regulations, including the Stormwater Management Rules, require stormwater management plans to reduce peak flows leaving a site. The regulations are based on analyses that demonstrate how to prevent increases in the flows that cause both flooding and erosion. However, this statewide method for addressing flooding and erosion may not be the optimum solution for managing runoff for a specific drainage area. For example, an RSWMP may recommend longer detention times at the top of a watershed to release water more slowly into local streams, and the plan may call for reduced detention times in more urbanized sections of the watershed where storage space is limited.

RSWMPs optimize flexible use of stormwater management measures by providing the authority to create new, customized regulatory requirements and by setting priorities for actions that address the specific stormwater quality, quantity, and recharge objectives within the planning area. Although performance standards can be changed from those proposed in the Stormwater Management Rules, RSWMPs must avoid adverse impacts downstream of the planning area. Regional planning also creates more options for groundwater recharge. Local topography, geology, and soil conditions that restrict infiltration may present daunting design challenges for some sites and municipalities, while well-suited recharge sites may lie just up- or downstream. In each case, better solutions become available with regional planning.

Sizing an RSWMP

Determining the size of a drainage area is one of the first technical challenges in creating an RSWMP. Regional stormwater management is fundamentally a problem-centered planning process, so the size of an RSWMP drainage area may depend on the nature and location of previously identified local concerns such as water quality impairment, erosion damage, reduced stream flows, sedimentation, inadequate groundwater recharge, or flooding. RSWMPs are created to address existing problems or to anticipate and avoid future ones. Local interest groups may already have specific concerns that can be addressed with a regional plan. TMDL implementation plans may identify regional stormwater management plans as a long-term management measure to address impairment for a specific stream segment.

A build-out analysis may identify additional problems during the assessment portion of regional plan development. A regional plan developed for the Jackson Brook in Morris County, for example, was driven initially by flooding concerns, but it also proposes improvements to reduce pollutant loads projected under full development conditions. A regional plan proposed for the Mulhockaway Creek seeks to anticipate and address concerns about development in an environmentally sensitive area of the South Branch of the Raritan River. A plan proposed for the Cedar Grove Brook in Franklin Township is targeting water quality issues in an urbanized area just upstream from water supply intakes.

Available funding is a key variable in determining the size of a regional area for a plan. Budgets for developing RSWMPs typically exceed $100,000 because they often require extensive collection and complex analysis of field data. Those costs tend to limit the size of the drainage area to be studied, and the regional plans completed or proposed in New Jersey tend to fall between 5 and 20 square miles. The budget for a

12-square-mile drainage area around the Mulhockaway Creek drainage area, for example, is projected at $300,000. The budget to develop the plan for the 5-square-mile drainage area around Cedar Grove Creek was $200,000. The cost of implementing an RSWMP, of course, depends on its findings and recommendations. If writing a plan can easily run into six figures, implementing one can easily exceed $1 million if construction of large stormwater management structures is called for in the plan. These costs, however, are dependent on the goals and objectives of the plan and the specific conditions of the area; therefore, costs can vary significantly between regional stormwater management plans.

In New Jersey, with its history of municipal autonomy know as "home rule," smaller drainage areas tend to be more politically feasible. Regional stormwater planning requires municipalities to align their zoning and development standards with the plan, so drainage areas that involve three or four neighboring municipalities with a common concern may have a realistic chance of aligning development standards to solve their shared problem. That possibility would likely diminish dramatically if the regional plan involves tens of municipalities lacking a common, immediate problem.

Beginning the Process

By law and by definition, the development of a regional stormwater management plan is a participatory process. In fact, N.J.A.C. 7:8-3, the regulations authorizing optional regional plans require the creation of a broadly representative regional planning committee as the first step in the process. That committee then designates a lead planning agency to marshal the technical and administrative resources required to develop and implement a regional plan.

From a technical standpoint, plan development begins with characterizing and assessing the drainage area by gathering and reviewing all relevant water quality and quantity information currently available. This requires scouring for all available data from sources including:

- state and Federal Emergency Management Agency (FEMA) floodplain maps;
- hydraulic analysis and stream cross section data from stream encroachment permits;
- topographic data from aerial photos with two-foot contours;
- water quality data from New Jersey Pollution Discharge Elimination System (NJPDES) permits or intake waters from local water treatment facilities; and
- monitoring data from the U.S. Geological Survey, the Environmental Protection Agency's STORET database, the NJDEP, local health departments, environmental commissions, or watershed associations.

In New Jersey, local Soil Conservation Districts are a valuable source of field observations on streambanks, erosion, and scouring that can be collected only from walking along stream corridors. Additional information regarding local conditions may be available from the Division of Watershed Management and local environmental organizations. Recent watershed characterization studies, if available, also provide data to focus planning efforts on water quality issues.

If a watershed characterization study is not available, consider performing a relatively quick and inexpensive Geographic Information Systems (GIS) analysis that matches water supply sources with reported water quality degradations and potential pollutant sources.

The full range of steps and requirements for creating, implementing, and adopting an RSWMP are included in N.J.A.C. 7:8-3. A summary of those requirements is outlined in this chapter, including:

- a written statement from each public entity on the committee confirming the authority of each to develop and implement a stormwater management plan;
- a discussion of both the majority and minority positions, if portions of the plan do not represent a consensus of the committee;

- characterization and evaluation of the planning committee's drainage area;
- specific objectives for water quality, groundwater recharge, and water quantity for the planning committee's drainage area;
- specific performance standards for water quality, groundwater recharge, and water quantity for the committee's planning area; and
- stormwater management measures selected by the planning committee and an explanation of why they were chosen.

Steps to Create, Implement and Adopt an RSWMP

Planning the RSWMP Process

Because an RSWMP is both a technical planning procedure and a regulatory process, it requires active participation from organizations that would likely be affected by the plan. In fact, the first step in the RSWMP process is to create a regional stormwater management planning committee and select a lead planning agency for the express purpose of developing a regional plan. The committee is charged with soliciting information from the following interested groups and organizations:

- government agencies at all levels, including Soil Conservation Districts;
- local and regional environmental groups and organizations including lake associations, watershed associations, and environmental commissions;
- water supply and wastewater treatment utilities, authorities, and agencies, and watershed management planning agencies; and
- residents in the drainage area.

The planning committee must designate a lead planning agency to serve as the primary contact for the committee. The Lead Agency must submit a request for the recognition of the regional stormwater plan committee to the NJDEP. This request must include a draft work plan, schedule of activities, and the information used to invite organizations to participate in the planning committee. The NJDEP has 45 days to approve or deny the request or ask for more information.

Data Gathering and Priority Setting

Data gathering and priority setting can be the most expensive steps in the process because they often require time-intensive collection of field data on variables such as stream elevations, erosion hot spots, and water quality. To minimize the cost of gathering this data, the NJDEP encourages planners to make maximum use of existing information, including information on the department's GIS web site (www.state.nj.us/dep/gis) or developed through the watershed management process. This task is ideally suited for analysis and display on Geographic Information Systems, and all maps developed must meet New Jersey's digital data standards in N.J.A.C. 7:1D. The following items should be included in the assessment unless they are not pertinent to a specific analysis.

Maps

The maps must first clearly delineate the drainage area boundaries, showing both existing and projected land uses assuming full development under current zoning. The following layers of information should be included: soils, topography, flood hazard areas, well protection, and groundwater recharge areas. All water bodies designated as water quality-limited surface water as well as environmentally sensitive areas or special classifications should be identified, including river areas designated under the New Jersey Wild and Scenic

Rivers Act or the Federal Wild and Scenic Rivers Act. These maps must identify stormwater management structures, surface water intakes, and public water supply reservoirs in addition to features that are outside the regional planning areas but discharge or flow into the drainage area.

Key Stormwater Management Features

The assessment must include an inventory of all key stormwater management features, including slopes, swales, outfall structures, culverts, and impoundment areas pertinent to stormwater management and required for analyzing the drainage area. Often this data can be gathered only by physically walking stream corridors to record features such as stream widths, streambank conditions, pollutant sources, eroded areas, and other relevant data. This data collection requires trained eyes in the field and often accounts for a substantial portion of the cost of developing an RSWMP.

Modeling and Analysis

Analysis of the drainage area or a water quality, groundwater recharge and water quantity hydrologic and hydraulic model may need to be performed if new performance standards are being proposed. This analysis is critical to identifying the current or potential concerns that drive the entire plan. The analysis must include existing and projected land uses assuming full development under current zoning.

Relevant Current Regulations

The assessment must identify and evaluate existing municipal, county, state, federal, and other regulations related to stormwater management, groundwater recharge, and water quality and quantity, including programs to develop total maximum daily load (TMDLs).

Once the characterization and assessment of the drainage area is complete, the RSWMP must identify current stormwater-related water quality concerns and forecast future ones, assuming full development under current zoning. The inventory should include current and potential stormwater pollutant sources in the regional planning area including urban and suburban development, roads, storm sewers, agricultural or mining operations, and waterfront development. The New Jersey Integrated Water Quality Monitoring and Assessment Report (305(b) and 303(d)) (Integrated List) is required by the Federal Clean Water Act to be prepared biennially and is a valuable source of water quality information. This combined report presents the extent to which New Jersey waters are attaining water quality standards, and identifies waters that are impaired. Sublist 5 of the Integrated List constitutes the list of waters impaired or threatened by pollutants for which one or more TMDLs are needed.

Once identified, these water-quality concerns must be ranked based on criteria determined by the planning committee. They can include: threat to public health, safety and welfare; damage to water supplies; risk of damage to the biological integrity of water bodies; mosquito control; groundwater depletion; or impacts to the ecosystem, among others.

If a TMDL has been adopted for any part of a water body in the planning area, these water-quality objectives must incorporate the loading reductions established in the TMDL for stormwater runoff. If any part of a water body is on Sublist 5 of the Integrated List due to stormwater-related impacts, the plan's objectives must specifically address those pollutants of concern.

Regional stormwater management plans must also identify and rank issues of water quantity and groundwater recharge as well as water quality. Thus, the broad goal of the plan is to eliminate, reduce, or minimize stormwater-related impacts associated with current and future land use. The minimum standard of protection is the level that would be achieved by conforming to New Jersey's Design and Performance Standards for Stormwater Management Measures when implemented throughout the regional stormwater management planning area.

Designing Regional Stormwater Solutions

An RSWMP must include design and performance standards to meet the New Jersey water quality, water quantity, and groundwater recharge standards in N.J.A.C. 7:8-3.5. However, because an RSWMP addresses concerns on a regional basis, the design and performance standards need not be uniform throughout the planning area if they satisfy N.J.A.C. 7:8-5 when considered as a whole. Any alternative standards must be at least as protective when implemented throughout the regional stormwater management planning area.

Once the objectives and performance standards have been identified, an RSWMP must outline the stormwater management measures needed to achieve the objectives. The plan may include the following guidelines for new or existing land uses or other measures: design and performance standards for storm water quality, stormwater quantity, or groundwater recharge for new development; modifications to existing stormwater management structural controls; elimination of illegal or illicit discharges; prevention or minimization of the exposure of pollutants to stormwater; or control of floatables. The plan may also include measures to enhance, protect, or preserve land or water areas for purposes of flood control, water quality protection, or conservation of natural resources. And, because many stormwater management concerns can be traced directly to the lifestyle choices of watershed residents, a plan may choose to emphasize public education programs that address root causes of water quantity and quality impacts.

Whatever measures are selected, the plan must include two important additional features. First, the plan must explain the committee's rationale for including the selected measure. The rationale should include a feasibility and cost/benefit analysis, an estimate of reduction in pollutant loads, and a projection of performance longevity. Second, the plan must specifically address maintenance requirements for each stormwater management measure, including preventative and corrective maintenance, a long-term maintenance implementation schedule, and clear identification of the organization or entity responsible for implementation and maintenance.

Implementation and Evaluation Strategies

The implementation strategy begins by identifying the agency assigned to coordinate plan implementation, including long-term monitoring requirements. The plan must identify the agency appointed to implement and monitor each measure in the plan along with a timetable for implementation. It must include a process to evaluate the entire plan at least once every five years and should include a budget that projects both long- and short-term costs for each measure. The strategy should identify possible current and potential funding sources to implement the RSWMP.

The long-term monitoring program should provide information about land use, water quality, water quantity, groundwater, and riparian and aquatic habitat conditions. Monitoring data may include information from watershed management agencies and monitoring programs operated by other agencies, including volunteer programs.

Once complete, an RSWMP will be submitted for review to the NJDEP and, if applicable, to the designated water quality management planning agency as an amendment to areawide water quality management plans. If the plan is approved, the NJDEP will propose to amend the areawide water quality management plan as outlined in N.J.A.C. 7:15-3.4(g). Any performance standards developed under an RSWMP adopted by the NJDEP in effect supersedes the minimum design and performance standards in N.J.A.C. 7:8-5 of the Stormwater Management Rules. NJDEP will use the plan requirements to review stormwater management requirements for activities currently regulated by the Freshwater Wetland Protection Act, Coastal Zone Management Rules, Flood Hazard Area Control Act Rules, New Jersey Pollution Discharge Elimination System Rules, and Dam Safety Standards. Each municipality in the regional stormwater management planning area must incorporate the applicable provisions of the plan into a new or amended municipal stormwater management plan. In addition, the stormwater management review for residential developments, which are based on the Residential Site Improvement Standards, will be based on the regional stormwater management plan. The requirements of the plan apply only to stormwater management criteria of other regulatory programs; additional requirements may be imposed as necessary under each program.

Municipal Stormwater Management Plans

A municipal stormwater management plan (MSWMP) documents the strategy of a specific municipality to address stormwater-related impacts. MSWMPs provide the structure and process for addressing stormwater management in the municipality. They are required by the Environmental Protection Agency's Phase II Stormwater Permitting Rules; the mandatory elements of the plan are described in the Stormwater Management Rules.

The municipal plan must address and achieve the goals of stormwater management discussed in N.J.A.C. 7:8-2. For new development, the plan must incorporate the performance standards for water quantity, water quality, and groundwater recharge in the Stormwater Management Rules at N.J.A.C. 7:8-5. If alternate standards have been established by an adopted regional stormwater management plan (RSWMP), the MSWMP must be consistent with it. A copy of the ordinances incorporating the performance standards must be included in the plan.

The MSWMP must be coordinated and consistent with other regulations on stormwater management issues such as those of the Soil Conservation Districts and the Residential Site Improvement Standards. The MSWMP may also address existing stormwater issues such as those identified in an RSWMP. In addition to specific design criteria, maintenance and safety requirements are a critical component. Preventative and corrective maintenance strategies must be included in the plan to ensure long-term effectiveness of stormwater management facilities. Safety standards discussed in Subchapter 6 of the Stormwater Management Rules must also be included in the MSWMP.

The plan must provide a view of the impacts of existing zoning and environmentally constrained areas on the municipality's landscape. In addition, the plan must include: maps of existing streams, groundwater recharge, and wellhead protection areas; build-out conditions based on existing zoning; and an evaluation of the existing master plan and land use ordinances that identifies areas to be amended to enable the implementation of nonstructural stormwater management techniques identified in the Rules. In order for the municipality to grant variances or exemptions from the design and performance standards for groundwater recharge and stormwater runoff quality and quantity, the municipality must provide a mitigation strategy in the MSWMP. The municipality should use the information provided in the plan to ensure that stormwater management objectives are completely addressed in the implementation of the municipal plan and ordinances.

MSWMPs are subject to review by county planning agencies to determine whether they meet the standards required by the Stormwater Management Rules. A copy of the proposed plan must also be sent to the Department of Environmental Protection, Division of Watershed Management. The county must approve, conditionally approve, or disapprove the plan in writing within 60 days. Generally, the plan becomes effective upon approval by the county; however, in the case of conditional approvals, the plan becomes effective after the municipality meets the conditions of approval.

A sample municipal stormwater management plan is provided in Appendix C.

Mitigation

Municipal stormwater management plans must incorporate design and performance standards that are as protective as those outlined in the Stormwater Management Rules or alternative standards in an adopted regional stormwater management plan. These design and performance standards focus on three areas: maintaining groundwater recharge from proposed development, minimizing the proposed development's impact on flooding, and minimizing the proposed development's water quality impact on state waters. Some projects have unique, site-specific conditions that prevent them from strict compliance with the performance standards. In order for the municipality to grant a waiver or exemption from strict compliance

with the groundwater recharge and stormwater runoff quality and quantity requirements, the MSWMP must include a mitigation process documented in a mitigation plan contained within the larger MSWMP.

The mitigation plan must identify the measures required to offset any potential impact created by granting the variance or exemption to the performance standards. Several strategies can be used to mitigate a development project and its impacts. Applicants can: identify, design, and implement a compensating measure to mitigate impacts; complete a project identified by the municipality as equivalent to the environmental impact created by the exemption or variance; or, provide funding for municipal projects that would address existing stormwater impacts.

The preferred option is to identify a mitigation project within the drainage area that directly compensates for the projected impact of the variance or exception. For example, because of natural site constraints, a proposed development might be unable to fully meet the groundwater recharge criteria, with the projected impact being an annual net loss of 50,000 cubic feet of groundwater recharge volume. In this case, a mitigation plan might require recovery of the lost recharge volume by capturing existing runoff from an impervious area on a site within the same drainage basin. Applicants can be directed to identify potential properties suitable for the mitigation project and secure the easements necessary to implement the projects.

Municipalities can plan for mitigation by identifying property owned by the municipality or by securing easements, as conditions of planning and zoning board approvals, that would allow implementation of future mitigation measures. Municipalities should develop a list of projects that need to be implemented throughout the municipality that would compensate for groundwater recharge, stormwater quality, and stormwater quantity impacts. Project mitigation is simplified when the municipality identifies and ranks a series of projects an applicant can select, especially on land owned or controlled by the municipality. The selection process should be clearly stated so the applicant and the municipality have predictability in the mitigation process. In its mitigation plan, a municipality can assign credits for proposed projects that address groundwater recharge and stormwater runoff quantity and quality problems within the drainage area.

If direct mitigation for the projected environmental impact is not feasible, an MSWMP may permit a non-equivalent project mitigation. Using the development example above, a mitigation plan may require a project that helps alleviate an existing impairment, such as fecal contamination in local streams, rather than one that compensates for the loss of groundwater recharge. Non-equivalent mitigation projects allow a municipality to target issues of greatest concern within a drainage area and secure the resources to correct them. In this example, the non-equivalent mitigation option might be pursued if close examination of local water resources indicates that fecal impairment is a more critical parameter in the receiving stream than small losses in groundwater recharge and baseflow. Clearly, the non-equivalent mitigation option must be cautiously approached; in this example, the long-term impacts of cumulative losses in groundwater recharge on the aquifer and baseflow must be carefully considered before granting a variance or exception.

The third, and least preferred, mitigation option is to require funding for specific projects within the municipality that would retrofit existing groundwater recharge and stormwater quality or quantity issues. In urban redevelopment areas, funding projects that address stormwater impacts on a regional basis, such as the development or implementation of regional stormwater management plans, may be more effective than a project that provides direct compensation for the performance standard. Planners implementing this option should ensure that the funding results in projects that provide adequate protection to compensate for the impact created by failing to strictly comply with the performance standards in the Stormwater Management Rules.

All mitigation plans and reviews should consider the location of mitigation projects in relation to the property where the projected damage will occur. For example, if a project is unable to achieve the stormwater quantity performance standards upstream of an inadequate culvert, a mitigation project downstream of that culvert would not offer similar protection. If the groundwater recharge is the major contributor to a wetlands area, the new project should continue to provide recharge to the wetlands area. A municipality can develop a mitigation plan that includes any or all of the options discussed above. Plans can

be as simple or as complex as the municipality chooses, provided they afford sufficient protection of the water resources. However, mitigation should not be an option until it is clearly demonstrated that on-site compliance is not practical.

Mitigation requirements should include a hierarchy of options that clearly offset the effect on groundwater recharge, stormwater quantity control, and/or stormwater quality control that was created by granting the variance or exemption. Mitigation must occur within the same drainage basin as that of the proposed development so that it provides benefits and protection similar to those that would have been achieved if the stormwater and recharge performance standards had been completely satisfied. Because these problems span political boundaries, mitigation projects could be located in adjacent municipalities within the drainage area with the cooperation of the municipalities, especially if a regional stormwater management plan has been developed for the drainage basin. The mitigation planning and approval process must ensure that long-term maintenance is achieved by clearly assigning responsibility for maintenance and by securing the funding and resources required to perform it.

Mitigation plans can differ greatly from municipality to municipality. As part of the mitigation plan development, consideration should be given to a specific municipality's water resource needs and ability to implement the plan. The following text is an example of a mitigation plan.

If a proposed development requests a variance or exemption from strict compliance with the groundwater recharge, stormwater quantity and stormwater quality requirements outlined in the Municipal Stormwater Management Plan and ordinances, the applicant must provide mitigation in accordance with the following:

1. A mitigation project must be implemented in the same drainage area as the proposed development. The project must provide additional groundwater recharge benefits, or protection from stormwater runoff quality and quantity from previously developed property that does not currently meet the design and performance standards outlined in the Municipal Stormwater Management Plan.
   - The applicant can select a project listed on the Municipal Stormwater Management Plan to compensate for the deficit from the performance standards resulting from the proposed project.
   - The applicant can obtain the necessary agreements to create a project to compensate for the deficit from the performance standards resulting from the proposed project.
   - The applicant must ensure the long-term maintenance of the project including the maintenance requirements under Chapters 8 and 9.
2. If a suitable mitigation site cannot be located in the same drainage area as the proposed development, as discussed under Option 1, the municipality may allow the applicant to provide funding to the municipality for an environmental enhancement project that has been identified in this Municipal Stormwater Management Plan. *[This option would be available only if the MSWMP includes a list of environmental enhancement projects that provide groundwater recharge, control flooding, or control nonpoint source pollution.]* The funding must be equal to or greater than the cost to implement the mitigation outlined above, including the costs associated with purchasing the property or easement for mitigation and the costs associated with the long-term maintenance requirements of the mitigation measure.

Build-Out

A build-out analysis allows a municipality to project future development based on existing zoning and land-use regulations. It develops a picture, projected visually on a map, of what will happen if land is developed to the maximum extent allowed by law. A build-out analysis is not only useful for communities with undeveloped land. Areas with significant redevelopment potential should be considered in developing a build-out analysis. Many urban and older suburban municipalities contain properties that are not developed to the full extent allowed under current zoning. For example, properties zoned for industrial use may contain residential developments. Or, a developer might assemble several small residential and retail properties for demolition and redevelopment as an office complex. A build-out analysis can identify those properties and project impacts of their potential redevelopment.

Each municipal stormwater management plan is required to include a build-out analysis with information about the municipality based on the HUC14 boundaries. A hydrologic unit code 14 (HUC14) is a specific drainage area defined by the U.S. Geological Survey. For every individual HUC14 area in the municipality, the full development impervious cover and the anticipated pollutant loading based on full development must be determined.

A build-out analysis has two phases. The first visually depicts changes on a map and is best performed using a Geographic Information System (GIS), which is a computerized system for developing, analyzing, and displaying locational data. GIS allows planners to combine data sources such as zoning maps, tax maps, HUC14, and topographic maps, into "layers" that can be displayed on one map.

- Begin by constructing a base map of your community that includes the municipal boundary, existing roads, surface water bodies, HUC14 boundaries, impervious cover, existing development by land use types, groundwater recharge areas, and wellhead protection area layers. Existing GIS information sources may be helpful in the development of this plan, such as the NJDEP-GIS website at http://www.state.nj.us/dep/gis. Counties, watershed associations, and universities may also have information useful for the development of the base map.
- Identify and delineate land that cannot be developed because of legal restrictions, physical constraints, or environmental sensitivity. Examples include lands in permanently preserved open space, public ownership, deed restrictions, utility easements, steep slopes, wetlands, floodplains, and Category 1 Waters with the associated special water resource protection areas.
- Identify and delineate developable land under current zoning and land use regulations, as well as land that is not currently developed or restricted as discussed above. Identify and delineate developed areas within the municipality that have significant redevelopment potential and that have not been developed to the maximum allowed. For these undeveloped and underdeveloped areas, determine maximum future development by projecting the largest number of housing units allowed in residential zones and the largest number of buildings and most intensive land uses in commercial and industrial zones.

The second phase quantifies the impact of the changes based on information provided by the maps. This includes calculations of percentage of impervious surfaces, number of housing units and their density, and remaining farmland and open space acreage. GIS can also assist in this computation by providing values for specific sets of layers such as the combination of the municipality, HUC14, and impervious area layers. This set of variables can provide the impervious cover for each HUC14 required by the Stormwater Management Rules. Values can be exported to other programs from GIS for more comprehensive computations, including the pollutant loading calculations also required by the regulations.

The pollutant load computation is a planning tool that helps municipalities evaluate anticipated pollutant loads from future development. Nonpoint source pollutant loads from current conditions should be compared to build-out conditions. If BMPs are required for the development of undeveloped or

underdeveloped areas by regulation, the implementation of BMPs and their impacts on loading should be incorporated into the analysis.

To calculate pollutant loads from land uses for both current and build-out conditions, the table of values below for total suspended solids, nitrogen, and phosphorus can be used for a broad perspective on a municipal level. To utilize the table, relate the zones on the zoning map to the listed land uses. Other pollutant loading values may also be used provided that the values are a better depiction of the municipality. Pollutant loads are required for each HUC14 in the municipality. For each land use within the HUC14, multiply the total acreage by the assigned load factor, which is given in pounds per acre per year. The total pollutant load for the HUC14 will be the sum of the loads for each land use.

Table 3-1: Pollutant Loads by Land Cover

Land Cover	TP load (lbs/acre/yr)	TN load (lbs/acre/yr)	TSS load (lbs/acre/yr)
High, Medium Density Residential	1.4	15	140
Low Density, Rural Residential	0.6	5	100
Commercial	2.1	22	200
Industrial	1.5	16	200
Urban, Mixed Urban, Other Urban	1.0	10	120
Agriculture	1.3	10	300
Forest, Water, Wetlands	0.1	3	40
Barrenland/Transitional Area	0.5	5	60

Note: References for Table 3-1 are provided at the end of this chapter.

The build-out analysis can go further than the requirements in the regulations. In addition to pollutant loads and impervious surfaces, the analysis can be used to assess open space plans, and to project school population and demand on municipal services. The build-out analysis can greatly benefit a municipality by envisioning its future so that steps can be taken to prevent unwanted impacts or plan for future needs. Finally, the build-out analysis should include a summary with critical findings, conclusions, and recommendations.

It is important to note that, although the pollutant loads for agricultural lands are higher than those for low density residential for the parameters in Table 3-1, converting agricultural lands to residential typically results in an increase in pollutant loads for metals and petroleum hydrocarbons; it is recommended that each municipality calculate build-out pollutant loads for each. Also, the total load of suspended solids due to stormwater runoff may decrease due to the conversion of agricultural lands to low density residential, but the percentage of impervious surfaces increases dramatically. If increases in stormwater runoff flows, due to the increase of impervious surfaces, are not managed properly, these high flows will increase stream bank erosion, thereby increasing sediment loads to the receiving waters.

Evaluation of Master Plan and Municipal Ordinances

The master plan and ordinances of the municipality must be analyzed as part of the requirements for the municipal stormwater management plan. They must be assessed to determine which aspects of the master plan and ordinances limit the use of nonstructural stormwater management strategies, as discussed in N.J.A.C. 7:8-5.3. These strategies include minimum disturbance, disconnection and minimization of impervious surfaces, pollution prevention techniques, and minimization of lawns. Elements of the plan and ordinances to be evaluated can include items such as minimum parking spaces, curbing, minimum lawn areas, and landscaping. Recommendations for revisions to the master plan and ordinances should be included in the MSWMP.

To fulfill the requirement that nonstructural stormwater management strategies be incorporated into local regulations and plans, as outlined in N.J.A.C. 7:8-5.3(b), municipal engineers and municipal planners must work together. This allows the municipality to address the issue cost-effectively using expertise already on staff.

In essence, this task requires that municipalities review and update their master plans (including the land use plan element), official maps, and development regulations (including zoning ordinance) to implement the principles of the nine nonstructural stormwater strategies in N.J.A.C. 7:8-5.3(b). *Chapter 2: Low Impact Development Techniques* can assist municipalities in the review of these documents to determine where changes should be made. A checklist is also provided in *Appendix B: Municipal Regulations Checklist – A Checklist for Incorporating Nonstructural Stormwater Management Strategies into Local Regulations.*

References

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Database of Total Phosphorus, Total Nitrogen, and Total Suspended Solids Export Coefficients

A database of literature values was assembled that includes approximately 4,000 values accompanied by site-specific characteristics such as location, soil type, mean annual rainfall, and site percent-impervious. In conjunction with the database, the contractor reported on recommendations for selecting values for use in New Jersey. Analysis of mean annual rainfall data revealed noticeable trends, and, of the categories analyzed, was shown to have the most influence on the reported export coefficients. Incorporating this and other contractor recommendations, the NJDEP took steps to identify appropriate export values by first filtering the database to include only those studies whose reported mean annual rainfall was between 40 and 51 inches. From the remaining studies, total phosphorus, total nitrogen, and total suspended solids values were selected based on best professional judgment for eight land use categories.

The sources incorporated in the database include a variety of governmental and non-governmental documents. All values used to develop the database and the total phosphorus values in this document are included in the following reference list.

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