

2.8 Erosion and Sediment Control During Construction

BACKGROUND AND PURPOSE

The development process typically involves the removal of vegetation, the alteration of topography, and the covering of previously vegetated surfaces with impervious cover such as roads, driveways, and buildings. These changes to the landscape may result in the erosion of soil and the sedimentation of water bodies as soil travels to streams, rivers, and lakes in water runoff during storms at an increased velocity due to the lack of vegetative cover. The removal of vegetative cover and its roots system compromise the ability of vegetation to stabilize soil, reduce the velocity of runoff, shield the soil surface from rain, and maintain the soil's ability to absorb water.

Specific erosion and sedimentation impacts related to the loss of vegetation, pollution of the water supply, and alteration of topography are:

1. **Streambank erosion caused by an increase in stormwater runoff.** Eroded material may affect aquatic habitats and alter aquatic species' life cycle events by increasing turbidity, changing the water temperature, and changing the depth of water bodies.
2. **Alteration of existing drainage patterns.** This may affect abutting properties and roads, as well as water bodies.
3. **Destabilization of steep slopes.** Removal of trees and other vegetation may lead to erosion of soil on steep slopes.
4. **Reduced potential for groundwater recharge** due to coverage by impervious surfaces or drainage control methods that take stormwater off-site.
5. **Runoff of chemicals into water supplies.** Petroleum and other chemicals on construction sites may be included in non-point pollution that drains to water supplies during storm events.
6. **Runoff of nutrients into water supplies.** Nitrogen and phosphorus concentrations in surface water bodies can be dramatically increased by increased stormwater runoff resulting in accelerated eutrophication and the proliferation of non-native aquatic plant species.

There are several structural and non-structural methods and management and planning techniques that may be used to control erosion and sedimentation during the

RELATED TOOLS:

- Shoreland Protection
- Permanent (Post Construction) Stormwater Management
- Steep Slope and Ridgeline Protection

site development process. These methods differ from permanent, or post construction techniques. Methods used during construction are meant to deal with the increased amount of erosion and sedimentation that occurs as a result of grading and other land disturbance short-term activities during construction, and are not designed to be permanently in place. These methods, despite their temporary nature, when properly installed can be effective in preventing the erosion and sedimentation that may occur during construction, including during storm events.

These methods include:

- Developing work zones by consulting with a building contractor during design.
- Within the work zones, establishing the phases of construction.
- Within the phases, developing the sequence of construction and methods to be used.
- Preparing a schedule for earth moving and building construction activities.
- Requiring a narrative of daily activities.
- When all of the above has been completed, creating an erosion and sediment control plan utilizing practices that will support the daily schedule of construction activities while preventing erosion and controlling sediment movement to water bodies.

These methods utilize one or more of the following techniques:

- Compost filter sock and mulching
- Vegetated buffer strips
- Grassed swales
- Detention ponds
- Constructed wetlands
- Stabilization of steep slopes
- Infiltration practices
- Phasing of the removal of vegetation
- Silt fence and haybale barriers
- Stone check dams
- Tree clearing plans during development
- Vegetated buffer requirements

A thorough discussion of the environmental, public health, and welfare justifications for regulating stormwater management is given in the “findings” section of model regulations.

APPROPRIATE CIRCUMSTANCES AND CONTEXT FOR USE

The following regulations are appropriate for use during the pre-construction, construction, and short-term post construction phases of a development project.

Although permanent post-construction techniques for erosion and sediment control are addressed in the Permanent (Post-Construction) Stormwater Management chapter, the two topics must be considered hand-in-hand in the sense that the imple-

mentation of low impact development techniques for permanent or post-construction stormwater management will also aid in the effectiveness of techniques used during construction. For example, by designing the site with a smaller area of impervious surface, and incorporating a number of smaller permanent stormwater management techniques, the effects of erosion and sedimentation during construction may be lessened through thoughtful design. Also, methods for erosion and sediment control during construction can sometimes be integrated into more permanent measures. For example, a mulch barrier may become integrated into a more permanent erosion and sedimentation control structure. Riparian buffers maintained during construction will remain after construction has been completed.

Land disturbance is also regulated at the federal and state levels (see below, Legal Basis and Considerations for New Hampshire), but the threshold level of disturbance at the state and federal levels may be higher than that of many projects a municipality may wish to regulate, because significant environmental damage can occur at levels of disturbance below the acreage thresholds regulated at the state level.

The model regulations included here propose that the regulations apply where a cumulative disturbed area exceeds 20,000 square feet, or in disturbed critical areas.

Materials provided by the EPA describing the Municipal Separate Storm Sewer System (MS4) program state that municipalities can regulate areas as small as 2,000 square feet. One of the requirements of the MS4 program is that municipalities develop regulations to control erosion and sedimentation of water bodies during construction.

LEGAL BASIS AND CONSIDERATIONS FOR NEW HAMPSHIRE

ENABLING STATUTES

RSA 674:44, Site Plan Review Regulations, subpart II, states: “The site plan review regulations which the planning board adopts may: a) Provide for the safe and attractive development or change or expansion of use of the site and guard against such conditions as would involve danger or injury to health, safety, or prosperity by reason of: (1) Inadequate drainage or conditions conducive to flooding of the property of another; (2) Inadequate protection for the quality of the groundwater; (3) Undesirable and preventable elements of pollution such as noise, smoke, soot, particulates, or any other discharge into the environment which might prove harmful to persons, structures, or adjacent properties;

RSA 674:36, Subdivision Regulations, part II, states: “The subdivision regulations which the planning board adopts may: (a) provide against such scattered or premature subdivision of land as would involve danger or injury to health, safety, or prosperity by reason of the lack of water supply, drainage ... or necessitate the excessive expenditure of public funds for the supply of such services.”

STATE AND FEDERAL REQUIREMENTS

Federal law regulates small municipal separate storm systems, or MS4s, under Phase II of the National Pollutant Discharge and Elimination System (NPDES) for land disturbances greater than one acre. NPDES Stormwater Phase II applies to municipali-

ties, or MS4s, that are located in or near an urbanized area as defined by U.S. Census adjacent to a densely settled surrounding territory that together have a residential population of at least 50,000 and an average density of at least 1,000 square people per square mile. Forty-five New Hampshire communities must comply with Phase II requirements, which include a requirement to adopt a local level erosion and sediment control regulation. The NPDES Construction General Permit, applies to any construction activity disturbing more than one acre. This requirement applies statewide. More information on the DES permit process can be found at www.des.nh.gov.

New Hampshire law protects surface and groundwater quality from degradation as a result of significant alteration of terrain and activities in or on the border of surface waters of the state. RSA 485-A:17, RSA 485-A:17 Water Pollution and Waste Disposal/Terrain Alteration requires a permit from DES when more than 100,000 square feet of contiguous land area is to be disturbed (or 50,000 square feet if within the protected shoreland as defined by the Comprehensive Shoreland Land Protection Act). Other relevant state level controls include timber harvesting and excavation permits. Although these state level permits will be referenced herein, this chapter deals primarily with regulation at the local level.

Despite these protections at the federal and state level, many construction projects disturb a smaller area than 50,000 square feet, and thus local protection is necessary.

EXAMPLES AND OUTCOMES

Many New Hampshire towns, including Exeter, Portsmouth, and East Kingston have developed erosion and control regulations that typically deal with requirements for erosion and sediment control during and after construction. Numerous examples can be found in the subdivision and site plan regulations of most towns. These regulations are not fully effective however, if the pre-application clearing of land is not addressed, and if inspection prior to, during, and after construction is not addressed, as well as issues of maintenance during construction and after storm events.

Some towns, such as Exeter, have developed regulations addressing pre-application land clearing or grading by requiring the pre-cleared condition to be the basis of the stormwater calculation for pre-development conditions. Some towns, such as Newton, have begun to require construction sequencing plans and/or development agreements that consist of a written agreement between the board and developer that covers pre-construction meetings and inspection, during construction meetings, post storm and post construction inspections, maintenance schedules, and bonding of erosion and sediment control measures.

Land excavations are addressed at the state level by RSA 155-A but may also be addressed by municipalities, which may develop local level regulations under the authority granted to them by the state.

The best regulations will be ineffective without accompanying methods referenced for enforcement. The reader is encouraged to consult RSA 676:15, 17, and the publication “Guide to District Court Enforcement of Local Ordinances and Codes, available from the NH Bar Association at www.nhbar.org/legal-links/Local-ordinances-and-codes-guides.asp.

Model Language and Guidance for Implementation

The following regulation is based on several existing models and handbooks, including those prepared by DES and the N.H. Association of Conservation Districts. Model language for pre-application land disturbance was derived from a presentation entitled “Storm Water Phase II-Developing Construction & Post Construction Programs Fees and Funding” given by attorney Stephen C. Buckley, Hodes, Buckley, McGrath & LeFevre, PA, in the spring of 2005 at a workshop hosted by the US EPA, Region 1.

MODEL SUBDIVISION AND SITE PLAN REGULATION

EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

I. TITLE AND AUTHORITY

A. Title

The title of this Site Plan and Subdivision Regulation for the Town/City of [NAME], shall be known as the “Erosion and Sediment Control During Construction.”

B. Authority

This regulation is adopted pursuant to RSA 674:16, Grant of Power, RSA 674:17, Purposes of Zoning Ordinance, and RSA 674:21, Innovative Land Use Controls, Environmental Characteristics. The corresponding section of the Zoning Ordinance is found at section [_____].

II. PURPOSE

Based on the findings above, the purpose of this regulation is to develop standards for design, installation, and maintenance of stormwater management measures during construction for the following reasons:

- To control the quantity and quality of runoff.
- To prevent soil erosion and sedimentation resulting from site construction and development.
- To prevent the pollution of runoff from construction sites.
- To protect natural resources including wildlife habitat.
- To protect other properties from damage that could be caused by erosion and sedimentation or the quantity or quality of runoff.
- To reduce public expenditures in maintenance of stormwater drainage systems such as removing sediment from systems, repairing or replacing failed systems, restoring degraded natural resources, and to prevent damage to town infrastructure caused by inadequate controls.

Towns adopting these regulations should add a section to the zoning ordinance authorizing the adoption of stormwater regulations during construction based on the RSA sections listed above. The findings listed in this regulation should be considered for addition to the master plan natural resources chapter.

III. FINDINGS

The planning board has made the following findings concerning the need to address sediment and erosion control during construction.

A. Land development alters hydrologic response.

Land development projects and other land use conversions and their associated changes to land cover can alter the hydrologic response of local watersheds and increase stormwater runoff rates and volumes, which in turn increase flooding, stream channel erosion, and sediment transport and deposition, and decrease groundwater recharge by creating impervious surface such as pavement and buildings, and compacting pervious surfaces.

B. Small storms account for 90 percent of runoff.

Over 90 percent of runoff and associated pollutants loads result from very small storms, thus traditional methods of preparing stormwater control plans must be revisited take into consideration not only larger, less frequent storms, but also small storms to ensure that water supplies do not become polluted by these small storms and that designs for larger, less frequent storms resulting in large downstream flows can be reduced so as not to cause significant stream channel erosion and other environmental damage.

C. Cumulative effects.

The cumulative effects of several storms on a particular project, and the erosion and sediment contributions from several projects create a significant cumulative effect on water quality, hydrologic response of local watersheds, and alter or destroy wildlife habitat.

D. Land development contributes to increased nonpoint source pollution.

Land development projects and other land use conversions contribute to increased nonpoint source pollution and degradation of receiving waters due to the addition of petroleum products, fertilizers and pesticides, construction waste, and other substances to runoff from construction sites.

E. Land development causes significant environmental damage to wildlife and wildlife habitat.

Land development projects cause significant damage to trees and other wildlife habitat through compaction of soils due to construction vehicle traffic, stripping of vegetation during grading and other site preparation activities, and increased turbidity in water supplies that may damage the habitat of aquatic species.

F. Stormwater runoff related to development adversely affects health, safety, welfare, and the environment.

The impacts of stormwater runoff related to development can adversely affect public safety, public and private property, surface water supplies, groundwater resources, drinking water, aquatic and non-aquatic wildlife habitats, fish and other aquatic life, property values, and the potential for other uses of land and water.

G. Best management practices can minimize adverse impacts.

These adverse impacts can be controlled and minimized through the application of best management practices during construction activities, low impact

development practices post construction, and periodic inspections before, during and after construction to ensure that erosion and sediment control practices are functioning effectively.

H. Federal law requires regulations to manage stormwater runoff from construction sites.

Federal law requires small MS4 operators to develop, implement, and enforce a program to reduce pollutants in any storm water runoff from construction activities that result in a land disturbance of greater than or equal to one acre. Reduction of storm water discharges from construction activity disturbing less than one acre must be included in the program if that construction is part of a large common plan or development or sale that would disturb one acre or more.

It is therefore in the public interest of health, safety, welfare, and environmental protection to minimize the impacts associated with land development and to regulate stormwater runoff during construction in order to address the adverse impacts to public health, safety, welfare, and the environment detailed in the above section.

IV. APPLICABILITY

The requirements of this regulation shall apply to land disturbance, development, and or any construction activities in all zoning districts where the disturbance, development, or construction activity will disturb greater than 20,000 square feet or that is within a critical area as defined below.

V. DEFINITIONS

Best Management Practice (BMP): A proven or accepted managerial, structural, non-structural, or vegetative measure to prevent or reduce increases in stormwater volumes or flow; to reduce erosion, sediment, peak storm discharge, and point-source and non-point-source pollution; and to improve stormwater quality and protection of the environment.

Critical Areas: Disturbed areas of any size within 75 feet of stream, intermittent stream, bog, water body, or poorly or very poorly drained soils; disturbed areas of any size within 50 feet of a property line; disturbed areas exceeding 2,000 square feet in highly erodible soils; or disturbed areas containing slope lengths exceeding 25 feet on slopes greater than 15 percent.

Developer: Any person or legal entity that undertakes or proposes to undertake activities that cause land disturbance.

Development: Any activity involving land grading, or alteration of terrain or landscape, other than for agricultural purposes or silvicultural purposes where best management practices for agriculture or timber harvesting as defined by New Hampshire law are utilized.

Disturbed area: An area where the natural vegetation has been removed exposing the underlying soil or where vegetation has been covered by soil.

Drainage Area: A geographic area within which stormwater, sediments, or dissolved materials drain to a particular receiving waterbody or to a particular point along a receiving waterbody.

Effective Impervious Cover: Impervious surfaces that contribute to stormwater runoff leaving a site. Effective impervious cover can be reduced by capturing and directing stormwater runoff generated by the impervious surface to an on-site retention, treatment and infiltration management device or practice.

Erosion: The detachment and movement of soil or rock fragments by water, wind, ice, or gravity.

Highly Erodible Soils: Any soil with an erodibility class (K factor) greater than or equal to 0.43 in any layer or listed below or as found in Table 3-1 of the “Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire” Rockingham County Conservation District, 1992.

Impervious Surface: Land surface with a low capacity for soil infiltration, including but not limited to pavement, roofs, roadways, or other structures, paved parking lots, sidewalks, driveways (compacted gravel or paved) and patios. Total impervious surface cover shall be calculated by determining the total area of all impervious surfaces on a site as described above, regardless of whether the impervious surfaces are contiguous or non-contiguous.

Land Disturbance or Land Disturbing Activity: For the purposes of this regulation, refers to any exposed soil resulting from activities such as clearing of trees or vegetation, grading, blasting, and excavation.

Low Impact Development Techniques: Alternative designs for the treatment and management of stormwater that minimize disturbance to the natural drainage patterns on the landscape and require high standards for water quality discharge and recharge. These techniques include treatment of stormwater runoff on residential lots using low-maintenance methods such as vegetated swales, rain gardens and sub-surface infiltration devices.

Openness Ratio: A ratio calculated by dividing a culvert’s cross-sectional area by its length (OR = cross sectional area / length).

Owner: A person with a legal or equitable interest in a property.

Pervious Surface: Any material of structure on or above the ground that permits water to infiltrate into the underlying soil. Naturally pervious surfaces may become less pervious through the process of compaction.

Qualified Professional: A person knowledgeable in the principles and practice of stormwater management and erosion and sedimentation control, including Certified Professional in Erosion and Sediment Control (CPESC), Certified Professional in Storm Water Quality (CPSWQ), licensed soil scientist, licensed engineer, or someone with experience in the principles and practices of stormwater management and erosion and sedimentation control working under the direction and supervision of a licensed engineer and in consultation with a person qualified to construct a project as per design and in compliance with regulatory requirements.

Recharge: The amount of water from precipitation that infiltrates into the ground and is not evaporated or transpired.

Redevelopment: The reuse of a site or structure with existing man-made land alterations. A site which currently has 35 percent or more of existing impervious surface, calculated by dividing the total existing impervious surface by the size of the parcel and converted to a percentage before the project begins would be considered a redevelopment. *[Note: This definition is distinct from other requirements a town may have as to maximum impervious surface allowed in the completed project.]*

Regulated Substance: Oil, as defined pursuant to RSA 146-A or a substance listed in 40 CFR 302, with the following exclusions: ammonia, sodium hypochlorite, sodium hydroxide, acetic acid, sulfuric acid, potassium hydroxide, and potassium permanganate.

Sediment: Solid material, either mineral or organic, that is in suspension, is transported, or has been moved from its site of origin.

Sensitive Area: For the purposes of this regulation, lakes, ponds, perennial and intermittent streams, vernal pools, wetlands, floodplains, floodways and areas with highly erodible soils.

Sheet flow: Runoff that flows or is directed to flow across a relatively broad area at a depth of less than 0.1 feet for a maximum distance of 100 feet.

Site: The lot or lots upon which development is to occur or had occurred.

Stabilization: The condition in which all soil-disturbing activities at a site have been completed and a uniform, perennial vegetative cover with a density of 85 percent has been established or equivalent stabilization measures (such as the use of mulches or geotextiles) have been employed on all unpaved areas and areas not covered by permanent structures.

Stormwater: Water resulting from precipitation (including rain and snow) that runs off the land's surface, is transmitted to the subsurface, or is captured by separate storm sewers or other man-made or natural drainage facilities.

Stormwater runoff: The water from precipitation that is not absorbed, evaporated, or otherwise stored within the contributing drainage area.

Stream: Areas of flowing water that occur for sufficient time to develop and maintain defined channels but which may not flow during dry portions of the year. Includes but is not limited to all perennial and intermittent streams located on U.S. Geological Survey Maps.

Turbidity: A condition of water quality characterized by the presence of suspended solids and/or organic material.

Undisturbed Cover: A land surface that has not been significantly altered by human activity.

Vegetation: Is defined to include a tree, plant, shrub, vine, or other form of plant or fungal growth.

Water Supply Intake Protection Area: Designated protection area for a surface water intake used a source by a public water system.

Well Head Protection Area: As defined in RSA 485-C:2, the surface and subsurface area surrounding a water well or well field, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such well or well field.

VI. CONSTRUCTION INSPECTIONS, PHASING, AND THE PLANNING PROCESS

- A. **Inspections/Frequency.** Periodic inspections of stormwater management structures or techniques shall be conducted periodically by the town's engineering consultant or a qualified professional; the cost of such inspections shall be included in the escrowed funds paid by the developer for the purpose of reimbursement to the town for the payment of fees to town engineering and planning consultants reviews and inspections. At a minimum, inspections shall be conducted at the site prior to commencement of land clearing activities, after every storm event during construction, periodically during construction, at the completion of construction activities and removal of any temporary BMPs, and as specified thereafter in an agreed-upon inspection schedule proposed by the developer in consultation with either the contractor who will build the project or a consulting contractor and approved by the planning board and the planning board's consulting engineer, to insure that stormwater management structures or techniques are performing effectively.
- B. **Inspections/documentation.** All inspections shall be documented and written reports prepared by the town's compliance officer or compliance consultant that contain the following information:
1. Date and location of the inspection.
 2. Date of last storm event.
 3. Whether construction is in compliance with the approved stormwater management plan.
 4. Variations from approved construction specifications.
 5. Photographic documentation of each erosion and sediment control BMP and any other site level techniques employed pursuant to this regulation, such as but not limited to seeding of fill piles, marking of root zone areas of trees, disposal of construction debris, and implementation of any state or federal level record-keeping or reporting procedures related to erosion and sediment control.
 6. Recommended actions for replacement, repair, or substitution of BMPs, that are not functioning properly.
- Copies of reports and labeled photographs shall be provided to the planning board.
- C. **Phases of Inspection.** The schedule for inspections should include the following phases:
1. **Initial site inspection** prior to plan approval, which shall include a site walk by the developer or developer's engineer and contractor, the town's

- consulting engineer and/or compliance officer, and a member of the planning board.
2. **Erosion control inspection** to ensure erosion control techniques or structures have been properly installed, and are in accord with the developer's submitted plan.
 3. **During and post-storm event inspection.** The town's consultant shall inspect the site during and within 48 hours after the first storm event and subsequent storm events to ensure that erosion and sediment control techniques and drainage structures are functioning properly.
 4. **Stormwater management system inspection.** This inspection will include inspection of temporary measures to be employed only during construction, as well as semi-permanent and permanent measures designed to remain for some time period after construction is completed but which may be completed before all construction of the site is completed. The inspector will also note whether construction debris is being disposed of properly and whether other erosion and sediment control measures in addition to those in the approved plan must be instituted by the developer to protect water resources.
 4. **Final inspection and storm performance inspection.** The town's consultant shall inspect the system after the system has been constructed and before the surety has been released. This inspection shall also evaluate the effectiveness of the system during and after the first actual storm. No surety will be released until the inspector certifies both the final inspection and the storm performance inspection.
- D. **Phasing.** The developer shall submit a phasing plan to the planning board to be reviewed by the town's engineering consultant to ensure compliance with all applicable federal and state level laws and regulations pertaining to stormwater management. The phasing plan shall specify areas of the development to be completed in sequence and shall specify that all necessary infrastructure to support each phase shall be in place prior to the issuance of permits for certificates of occupancy for that phase.
- E. **The Planning Process.** All developers must adhere to the four-step process as set forth below and demonstrate this in writing in developing their stormwater management plan during construction and thereafter.
- Step 1:** Planning. Plan the development to fit the existing site features, including topography, soils, drainage ways, and natural vegetation.
 - Step 2:** Scheduling of Operations. Schedule grading and earthmoving operations to expose the smallest practical area of land for the shortest possible time.
 - Step 3:** Soil Erosion Control. Apply soil erosion control practice and any other techniques as specified in the stormwater management plan to achieve the purposes set forth in this regulation.
 - Step 4:** Inspections and Maintenance. Implement a thorough maintenance program and schedule inspections in conjunction with the town's consultant, to be reviewed by the planning board.

This section relates to federal law requirements for small MS4 operators to develop procedures to receive public input. Municipalities may wish to develop a standard form for such information.

VII. PROCEDURES FOR CONSIDERATION OF INFORMATION SUBMITTED BY THE PUBLIC

- A. The planning board shall consider any information submitted by the public concerning the stormwater management plan or site conditions or erosion and sediment control measures before and during construction. The board shall develop a short form to allow citizens to submit information concerning these measures. The board shall consider such information at a properly noticed public hearing even if the application to which the information relates has already been closed. All such information shall be either submitted in writing or as testimony in a properly noticed public hearing.

VIII. DESIGN STANDARDS

A. Strategies to Be Employed

To ensure that all sources of soil erosion and sediment on the construction site are adequately controlled, the following strategies shall be employed:

1. **Minimize the areas of disturbed soil.** Limit site preparation activities such as grading and clearing to where they are absolutely necessary and consistent with the phasing plan and the daily schedule of construction activities.
2. **Maximize the protection and on-site use of native vegetation.** Protect all vegetation not intended for removal by adequately marking, fencing around the drip line of trees, protectively wrapping and temporarily transplanting as necessary.
3. **Reduce the time that soil is left disturbed.** Utilize construction management and by phasing; soil disturbed by construction activities shall be stabilized within 14 days of ceasing disturbance.
4. **Stabilize soil** with seeding and mulch as soon as possible after disturbance. Minimize soil disturbance between October 15 and May 1.
5. **Control water at upslope site perimeters.** Prevent stormwater from entering areas of disturbed soil from outside the site and from other parts of the site. Utilize diversion swales and vegetated strips to reduce the amount of water entering a construction site.
6. **Control water on-site.** On the site water must be controlled and kept to low velocities so that erosion is minimal. This can be achieved through immediate seeding and mulching or the application of sod, as well as the use of structural measures including silt fences, check dams, mulch filter socks, and mechanical tracking of hillsides.
7. **Control sediment on site.** Reduce the amount of sediment produced from areas of disturbed soils, and control the sediment produced on site through seeding and mulching and structural measures.
8. **Control sediment at the down slope site perimeters.** Prevent the off-site transport of all sediment produced on the construction site using vege-

tated strips, diversion dikes, and swales, sediment traps and basins, stabilized construction entrances, and silt fences or mulch filter socks.

9. **Utilize biological or recyclable materials.** To the extent possible, developers should utilize natural biological materials or recyclable materials as temporary measures that can remain on-site after the completion of construction such as mulch berms or other methods as opposed to silt fences, which must be removed and disposed after the completion of construction activities in order to reduce waste and reduce costs of removal.

B. Design Standards

The following standards shall be applied in planning for stormwater management and erosion control:

1. Stormwater management and erosion control designs shall not conflict with minimum N.H. Department of Environmental Services requirements for Alteration of Terrain or other environmental permits required.
2. Measures shall be designed and installed to control the post-development peak rate of runoff so that it does not exceed pre-development runoff for the two-year, 10-year, and 25-year/24-hour storm event and for additional storm event frequencies as specified in the design criteria of the N.H. Stormwater Management Manual.
3. Emergency spillways and down slope drainage facilities shall have capacity to accommodate a 100-year/24-hour storm.
4. All measures in the plan shall meet as a minimum the best management practices set forth in the N.H. Stormwater Management Manual.
5. Stormwater management practices shall be selected to accommodate the unique hydrologic and geologic conditions of the site.
6. The use of low impact development techniques are preferred to intercept, treat, and infiltrate runoff from developed areas distributed throughout the site, as are techniques that restore, enhance, or protect natural areas such as riparian areas, stream channels, wetlands, and forests.
7. Stormwater management systems shall not discharge to surface waters, ground surface, subsurface, or groundwater within 100 feet of surface water within a water supply intake protection area.
8. Any contiguous area of disturbance, not associated with the installation of a roadway, shall be limited to 20,000 square feet.
9. Contiguous areas of disturbance shall be separated by at least 20 feet of area maintained at natural grade and retaining existing, mature vegetated cover that is at least 20 feet wide at its narrowest point.
10. Roadway and driveway crossings over streams shall meet the following design criteria to accommodate high flows, minimize erosion, and support aquatic habitat and wildlife passage:
 - a. Natural stream bottoms.

- b. Sized for 1.2 times bank-full stream width, i.e. the width of the stream during the 1.5-year flow event.
- c. Bridges and culverts shall have an openness ration of greater than or equal to 0.25 (calculated in meters) for perennial streams.
- d. Passageways under roads shall be designed to maintain water velocity at a variety of flows that is comparable to flows in upstream and downstream segments of the natural stream.
- e. Culverts shall have a trough or narrow channel in the bottom running the full length of the culvert to maintain sufficient water depth during low-flow periods to support fish passage.
- f. Round culverts must be imbedded at least 25 percent.

The above section is intended to provide some overlap with the chapter on Permanent (Post-Construction) Stormwater Management given that the use of techniques designed for the construction phase may overlap with other techniques that remain after construction activities are completed.

In some cases, design of culverts or other wildlife crossings that may be impacted by temporary or permanent stormwater control methods will require the review of such practices by a wildlife biologist who can assess the site's wildlife habitat and recommend practices that will minimize the adverse impact of stormwater control methods on existing wildlife crossing areas. The town may wish to add a provision allowing this limited review and providing for reimbursement of this expense by the developer. Alternatively, the Conservation Commission may appropriately provide information on the natural resources inventory of a town as well as site-level characteristics.

IX. CONSTRUCTION SITE METHODS

- A. **Responsibility of the applicant.** The applicant shall bear final responsibility for the installation, construction, inspection, and disposition of all stormwater management and erosion control measures required by the provisions of this regulation.
- B. **Daily log of installations, inspections, modifications, rainfall, and repairs or reinstallations.** Construction site operators shall be responsible to ensure erosion and sedimentation control measures approved for the site are installed as designed. A daily log of erosion control measures, inspections, modifications required, rainfall events and erosion observed shall be submitted weekly to the town's engineering consultant, or public works department, or the planning board, at the discretion of the planning board.
- C. **Estimate required.** A detailed estimate including unit pricing of temporary and permanent erosion control methods in a form acceptable to the planning board shall be submitted for review by the town's engineering consultant prior to any construction work.
- D. **Construction site inspections.** In addition to the general inspections outlined above, the qualified professional serving as the town's consultant shall verify proposed limits of site disturbance and limits of tree removal, including the marking of root zones of trees to be retained, the location of temporary parking of construction vehicles, the location of stockpiles of construction

materials, the location of earth stockpiles, and the proposed methods for daily removal of construction waste and debris from the site.

- E. **Test upgradient and downgradient waters for turbidity levels.** Both to ensure they meet allowable state and federal standards and to compare these levels in order to evaluate sediment capture through the site.
- F. **Pre-construction meeting.** A pre-construction meeting shall take place in which the applicant, town's consultant, site engineer, site contractor, road agent, and any other key town personnel as necessary attend to discuss the site, the development plans, and all aspects of site construction.
- G. **Pre-winter meeting.** A pre-winter meeting shall be held not later than September 15 of each year prior to the acceptable completion of site work, in order that town staff, the applicant, the contractor, the site engineer, the town's consultant, and other involved parties specify measures to secure the site for the winter season.
- H. **Documentation.** Copies of all required permits and permit applications relative to the site, such as Site Specific Permit, and the Stormwater Pollution Prevention Plan shall be provided to the planning board and shall be considered as necessary for any conditional approval.
- I. **Installation of erosion and sediment control devices.** Erosion and sedimentation control devices shall be installed prior to site disturbance or tree removal that would create erosion and sediment control issues.
- J. **Certification.** No building permit shall be issued by the town until the town's consultant has certified that the site construction has proceeded in accordance with stormwater management and erosion and sedimentation control standards, plans, and specifications, and that the relevant portion of the site has been reasonably stabilized, and until the town's consultant has certified that all utilities, drainage and stormwater management measures and roadway base course of paving have been satisfactorily installed on the site.
- K. **Surety.** An estimate shall be developed for the construction period, which shall include all erosion control costs. The applicant may request periodic release of such surety for work completed and verified by the town's consultant. At the completion of the construction and final acceptance by the town, the applicant may request up to 85 percent of escrow funds. The remaining escrow shall be held for two years after the completion of construction and acceptance by the town at which time the town's consultant will certify all temporary erosion controls that should be removed have been removed and all permanent measures have been installed and are functioning and have been maintained as intended. The site engineer shall develop and submit a maintenance plan for permanent erosion control and sedimentation and an estimate of annual maintenance costs. The plan shall include any necessary easements or other legal documents necessary to allow periodic inspection for a period of two years after completion of the project. Upon receipt of the certification and maintenance plan and legal review of easements or other legal documents as described herein, the town shall release the remaining funds.

X. CONSTRUCTION PRACTICES

- A. Natural vegetation shall be retained, protected or supplemented to the extent practical. The stripping of vegetation shall be done in a manner that minimizes soil erosion.
- B. Excavation equipment shall not be placed in the base of an infiltration area during construction. Excavation or other construction vehicles shall not be placed in the root zone areas of trees to be retained during construction.
- C. Construction equipment and materials shall be stored at a distance greater than 25 feet from drainage channels, streams, lakes or wetlands.
- D. Onsite wastes generated during the course of construction, including, but not limited to discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste shall be removed from the site daily to the extent feasible or at a regular interval as specified in the construction sequence and schedule of daily activities for the project and disposed of properly.
- E. No ground disturbed as a result of site construction and development shall be left as exposed bare soil. All areas exposed by construction, with the exception of finished building, structure, and pavement footprints, shall be decompacted (aerated) and covered with a minimum thickness of six inches of non-compacted topsoil, and shall be subsequently planted with a combination of living vegetation such as grass, groundcovers, trees, and shrubs, and other landscaping materials such as mulch, loose rock, gravel or stone. Native, non-invasive species as defined or listed on the New Hampshire DES Shoreland Protection List of Native Shoreland and Riparian Buffers Plantings in New Hampshire.

XI. REQUIRED SUBMISSIONS IN STORMWATER MANAGEMENT PLANS FOR APPLICATION REVIEW

- A. In addition to any information generally required by the town for subdivision or site plan application, the applicant must submit the following items to the planning board for review:
 - 1. Existing and proposed conditions including the following elements
 - a. Local map showing property boundaries.
 - b. North arrow, scale, and date of plan and plan amendments.
 - c. Surveyed property lines.
 - d. Structures, roads, utilities, earth stockpiles, equipment storage, and stump disposal.
 - e. Records of any timbering activities within the past five years.
 - f. Topographic contours at two-foot intervals.
 - g. Critical areas relating to natural resources as defined at a regional level, state level, or local level by a regional, state, or local level natural resource inventory.
 - h. Stockpile areas, and staging areas.

- i. Within the project area, within 400 feet of project boundary, and upgradient within the watershed or appropriate portions thereof, all surface waters, waterbodies, streams, intermittent streams, ephemeral streams, wetlands, vernal pools, and drainage patterns and watershed boundaries.
- j. Identified wildlife corridors if referenced in a local, regional, or state level natural resources plan
- k. Vegetation, including description of species.
- l. Extent of the 100-year flood plain when applicable.
- m. Soil information from a National Cooperative Soils Survey soil series map or a High Intensity Soil Map.
- n. Easements or covenants.
- o. Areas of soil disturbance or remediation areas.
- p. Areas of cut and fill.
- q. Areas of poorly or very poorly drained soils, including any portion to be disturbed or filled.
- r. Location of all structural, non-structural, and vegetative stormwater management and erosion control BMPs.
- s. Detail sheet showing each BMP.
- t. Phasing plan.
- u. Inspection schedule.
- v. Construction schedule.
- w. Earth movement and grading schedule.
- x. Construction Erosion and Sediment Control Plan that complies with the provisions of this regulation.
- y. An operations and maintenance plan.
- z. Spill prevention plan and emergency management plan for spills of potentially hazardous materials.
- aa. Surety.
- bb. Identification of alternatives in the drainage system design that provide for contingencies during storm events, for instance, and alternative for water flow in case a critical culvert becomes blocked by debris.
- cc. Design calculations for all temporary and permanent BMPs and a narrative description of each measure, its purpose, construction sequence, and installation timing.
- dd. Drainage report with inclusion of more frequent small storms as well as traditional calculations.
- ee. Landscaping Plan (unless required by other sections of the regulations).
- ff. Notation of soil types (unless required by other sections of the regulations).

XII. PRE-CLEARING

The applicant shall provide pre and post development peak flow rates in stormwater calculations. Any site that was wooded in the last five years must be considered undisturbed woods for the purposes of calculating pre-development peak flow rates.

XIII. ENFORCEMENT

The planning board may pursue any remedies authorized in the New Hampshire Revised Statutes Annotated for non-compliance with the specifications of an approved plan including revocation of the recorded plan.

REFERENCES

- EPA New England's NPDES Storm Water Permit Program Web Site. www.epa.gov/ne/npdes/stormwater/index.html.
- EPA's Storm Water Phase II Menu of Best Management Practices. www.epa.gov/npdes/menuofbmps/menu.htm.
- EPA Storm Water Phase II Compliance Assistance Guide. www.epa.gov/npdes/pubs/comguide.pdf.
- Maryland Cooperative Extension. Understanding the Science Behind Riparian Forest Buffers: Effects on Water Quality: Effects of Riparian Buffers on Sediment, Nutrients, and other Pollutants. www.ext.vt.edu/pubs/forestry/420-151/420-151.html.
- National Pollutant Discharge Elimination System (NPDES) Phase II: How to Select, Install, and Inspect Construction Site Erosion and Sediment control BMPs for NPDES Storm Water Permit Compliance” International Erosion Control Association. www.ieca.org and www.ieca.org/Chapter/northeast/northeasthome.asp
- New Hampshire Association of Conservation Districts. 1997. Model Stormwater Management and Erosion Control Regulation.
- N.H. Department of Environmental Services. 2008. *Stormwater Management Manual: Volume 1 Antidegradation and Stormwater; Volume 2 Post Construction Best Management Practices: Selection and Design; Volume 3 Construction Phase Erosion and Sediment Controls*.
- N.H. Department of Resources and Economic Development. *BMPs for Erosion Control on Timber Harvesting Operations in New Hampshire*. www.nhdf.org/info-plan-bureau/fi&p-waterqualitybmps.htm.