

Stormwater Regulations

2007 Tyngsborough Stormwater Management Bylaw

1.0 PURPOSE

The purpose of these Regulations is to protect public health, safety and welfare by establishing requirements for land disturbance, new development and redevelopment activities, which will manage stormwater and prevent water pollution, as provided by the Town of Tyngsborough By-Law for the Management of Stormwater and Discharges to the Storm Sewer System.

2.0 DEFINITIONS

Appendix A supplies definitions that apply to these Stormwater Regulations. Terms not defined in this appendix shall be construed according to their customary and usual meaning unless the context indicates a special or technical meaning.

3.0 AUTHORITY

These Regulations are adopted in accordance with the Tyngsborough By-Law for Management of Stormwater and Discharges to the Storm Sewer System. These regulations do not replace the requirements of any other By-law, regulation or code that may have been or may be adopted by the Town or the Commonwealth.

4.0 ADMINISTRATION

The Tyngsborough Conservation Commission shall administer these regulations. Any powers granted to or duties imposed upon the Commission may be delegated to employees or agents of the Commission.

5.0 APPLICABILITY

These Regulations apply to new development and redevelopment that is not exempt under the By-Law. Non-residential projects that disturb more than 5,000 square feet, or residential projects that disturb more than 1 acre of land must obtain a permit from the Conservation Commission. These regulations shall also apply to other activities that would increase the amount of stormwater runoff or pollutants from a parcel of land, or any activity that will alter the drainage characteristics of a parcel of land, unless exempt under the Stormwater Management Bylaw.

6.0 PERMIT PROCEDURES AND REQUIREMENTS

Projects requiring a Stormwater Management Permit (SMP) shall submit the materials specified in this section, and meet the stormwater management criteria specified in Section 7. Property taxes must be fully paid before the Conservation Commission will issue the SMP.

Applicants shall not receive any building or land development permits before the stormwater permit is issued. The project shall begin within 180 days after stormwater permit issuance. If the project does not begin within 180 days and the Conservation Commission finds that the approved Stormwater Management Plan is no longer valid, the applicant shall submit a modified Plan that requires approval prior to the commencement of land-disturbing activities.

A) Stormwater Management Permit (SMP) Application

1. The applicant shall file two (2) copies of an application for a Stormwater Management Permit. Permit issuance is required prior to any site altering activity. While the applicant can be a

representative, the permittee shall be the owner of the site. The SMP Application package shall include:

- a) A completed application form with original signatures of all owners;
- b) A list of abutters, certified by the Assessors Office, including abutters to the abutters within 300 feet of the property line of the applicant, including any in another municipality;
- c) Stormwater Management Plan and project description;
- d) Operation and Maintenance Plan;
- e) Payment of the application and review fees;
- f) Inspection and Maintenance agreement;
- g) Erosion and Sediment Control Plan;
- h) Surety bond, if required by the Conservation Commission

B) Entry

Filing an application for a permit grants the Tyngsborough Conservation Commission, or its agent, permission to enter the site to verify the information in the application and to inspect for compliance after issuance of the Stormwater Management Permit.

C) Fees

Fees established by the Conservation Commission are required to cover expenses for the review of the Stormwater Management Permit. The Conservation Commission is authorized to retain a Registered Engineer or other professional consultant to provide advice on the permit application.

1. Application Fee

A non-refundable application fee of \$0.0030 per square foot of the parcel, which shall be payable to the Town of Tyngsborough.

2. Engineering and Consultant Reviews and Fees

- a) The applicant shall pay a fee for expert engineering and other services needed by the Conservation Commission for the review of the permit application. This fee is called the "Engineering and Consultant Review Fee."
- b) Payment may be required at any point in the deliberations prior to a final decision.
- c) A permit application shall include a completed Engineering/Consultant Fee form.
- d) Consultant fees shall be determined at the time of project review based on a specific scope of work.
- e) The services for which a fee may be utilized include, but are not limited to, wetland survey and delineation, hydrologic and drainage analysis, wildlife evaluation, stormwater quality analysis, site inspections, as-built plan review, and analysis of legal issues.
- f) The Conservation Commission may require an applicant to pay a fee of \$30.00 per hour for any project filing that requires more than two (2) hours of review, inspection, and monitoring by a Town employee.
- g) Subject to applicable law, any unused portion of any fees collected shall be returned to the applicant within forty-five calendar days of a written request by the applicant, unless the Conservation Commission decides in a public meeting that other action is necessary.

- h) The Engineering and Consultant Review fees collected shall be deposited in a revolving account. The Conservation Commission shall include a full accounting of the revolving account as part of its annual report to the Town.

4. Revision of Fee Schedules and Regulations Governing Fees

The Conservation Commission may amend fee schedules and regulations. Amendments shall be preceded by a posted public hearing. A copy of the written decision will be filed with the town clerk within ten days after final action is taken.

D) Public Hearings

The Conservation Commission shall hold a public hearing for a Stormwater Management Permit application.

E) Actions

The Conservation Commission will take one of the following actions for a Stormwater Management Permit Application:

1. Approval of the Permit Application based upon determination that the proposed plan meets the Standards in Section 7 and will adequately protect the water resources of the Town and is in compliance with the requirements set forth in the Stormwater By-Law;
 2. Approval of the Permit Application subject to any conditions, modifications or restrictions required by the Conservation Commission, which will ensure that the project meets the Standards in Section 7 and adequately protects water resources, as set forth in the By-Law;
 3. Disapproval based upon a determination that the Permit Application does not meet the Standards in Section 7 or adequately protect water resources, as set forth in the By-Law.
 4. Withdrawal of the Permit Application "without prejudice" where an applicant does not submit requested additional information that in the Conservation Commission's opinion is needed to adequately describe the proposed project.
- F) A written report of the Permit Application decision shall be made. The failure of the Conservation Commission to take action within 60 days of receipt of a complete application shall be deemed approval of that application. Upon certification by the Town Clerk that the allowed time passed without action, the Conservation Commission must issue a Stormwater Management Permit.

G) Plan Changes

The permittee must notify the Conservation Commission in writing of any change or alteration in the system authorized in a Stormwater Management Permit before any change or alteration is made. If the Conservation Commission determines that the change or alteration is significant, based on the Standards in Section 7 and accepted construction practices, the Conservation Commission may require that an amended application be filed.

J) Appeals of Actions of the Conservation Commission

A decision of the Conservation Commission shall be final. Further relief of a decision by the Conservation Commission made under these Regulations shall be reviewable in the Superior Court in an action filed within 60 days thereof, in accordance with M.G.L. Ch 249. § 4.

K) Project Completion

Within 90 days of project completion, the permittee shall submit as-built record drawings of all structural stormwater controls and treatment best management practices required for the site. The as-built drawing shall show deviations from the approved plans, if any, and be certified by a Registered Professional Engineer.

L) Stormwater Management Plan Contents

1. A Stormwater Management Plan submitted with the Permit Application shall contain sufficient information to evaluate the environmental impact and effectiveness of measures proposed for reducing adverse impacts from stormwater runoff. This plan shall require the stamp and signature of a Registered Professional Engineer (PE) licensed in the Commonwealth of Massachusetts.
2. The Stormwater Management Plan shall fully describe the project in drawings, narrative, and calculations. It shall include:
 - a) Contact Information. The name, address, and telephone number of all persons having a legal interest in the property, and the tax reference number and parcel number of the property or properties affected;
 - b) A locus map;
 - c) The existing zoning, and land use at the site and abutting properties;
 - d) The proposed land use;
 - e) The location(s) of existing and proposed easements;
 - f) The location of existing and proposed utilities;
 - g) The site's existing & proposed topography with contours at maximum 2 foot intervals,
 - h) The existing site hydrology;
 - i) A description and delineation of existing stormwater conveyances, impoundments, and wetlands on or adjacent to the site or into which stormwater flows;
 - j) A delineation of 100-year flood plains, if applicable;
 - k) Estimated seasonal high groundwater elevation in areas to be used for stormwater retention, detention, or infiltration;
 - l) Existing and proposed vegetation and ground surfaces with runoff coefficients for each;
 - m) A drainage area map showing pre and post construction watershed boundaries, drainage area and stormwater flow paths, including municipal drainage system flows;
 - n) A description and drawings of all components of the proposed stormwater management system including:
 - i. Locations and cross sections of all brooks, streams, drainage swales and their method of stabilization;
 - ii. All measures for the detention, retention or infiltration of water;
 - iii. All measures for the protection of water quality;
 - iv. The structural details for all components of the proposed drainage systems and stormwater management facilities;
 - v. Notes on drawings specifying materials to be used, construction specifications, and expected hydrology with supporting calculations;
 - vi. Proposed improvements including location of buildings or other structures, impervious surfaces, and drainage facilities, if applicable;
 - vii. Other relevant information requested by the Conservation Commission.
 - o) Hydrologic and hydraulic design calculations for the pre and post-development conditions for the design storms specified in these Regulations. Such calculations shall include:
 - i. Description of the design storm frequency, intensity and duration;
 - ii. Time of concentration;

- iii. Soil Runoff Curve Number (RCN) based on land use and soil hydrologic group;
 - iv. Peak runoff rates and total runoff volumes for each watershed area;
 - v. Information on construction measures used to maintain the infiltration capacity of the soil where any kind of infiltration is proposed;
 - vi. Infiltration rates, where applicable;
 - vii. Culvert capacities;
 - viii. Flow velocities;
 - ix. Data on the increase in rate and volume of runoff for the specified design storms, and
 - x. Documentation of sources for all computation methods and field test results.
- p) Post-Development analysis of downstream areas, if deemed necessary by the Conservation Commission;
 - q) Soils Information from test pits performed at the location of proposed stormwater management facilities, including but not limited to soil descriptions, depth to seasonal high groundwater, depth to bedrock, and percolation rates. Soils information will be based on site test pits logged by a Massachusetts Registered Soil Evaluator, or a Massachusetts Registered Professional Engineer;
 - r) Landscaping plan describing the woody and herbaceous vegetative stabilization and management techniques to be used within and adjacent to the stormwater practice.

M) Operation and Maintenance Plan Contents

1. An Operation and Maintenance Plan (O&M Plan) shall be part of the Permit Application. The O&M Plan shall ensure there is ongoing compliance with the permit and the Massachusetts Surface Water Quality Standards in all seasons and throughout the life of the system.
2. The O&M Plan on file with the Conservation Commission shall be an ongoing requirement of the Stormwater Management Permit. The O&M Plan shall include:
 - a) The name(s) of the owner(s) for all components of the system;
 - b) A map showing the location of the systems and facilities including catch basins, manholes/access lids, main, and stormwater devices;
 - c) Maintenance agreements that specify:
 - i. The names and addresses of the person(s) responsible for operation & maintenance;
 - ii. The person(s) responsible for financing maintenance and emergency repairs;
 - iii. An Inspection and Maintenance Schedule for all stormwater management facilities including routine and non-routine maintenance tasks to be performed;
 - iv. A list of easements with the purpose and location of each;
 - v. The signature(s) of the owner(s).
 - d) Stormwater Management Easement(s) shall be provided by the property owner(s) as necessary for:
 - i. Access for facility inspections and maintenance;
 - ii. Preservation of stormwater runoff conveyance, infiltration, and detention areas and facilities, including flood routes for the 100-year storm event;
 - iii. Direct maintenance access by heavy equipment to structures requiring regular maintenance.

The purpose of each easement shall be specified in the maintenance agreement signed by property owner(s). Easements are required for all areas used for off-site stormwater control, unless a waiver is granted by the Conservation Commission. Easements shall be recorded with the Registry of Deeds prior to issuance of a Certificate of Completion by the Conservation Commission.
 - e) Changes to Operation and Maintenance Plans:
 - i. The owner(s) of the stormwater management system must notify the Conservation Commission of changes in ownership or assignment of financial responsibility.

- ii. The maintenance schedule in the Maintenance Agreement may be amended to achieve the purposes of this Regulation by mutual agreement of the Conservation Commission and the Responsible Parties. Amendments must be in writing and signed by all Responsible Parties. Responsible Parties shall include owner(s), persons with financial responsibility, and persons with operational responsibility.

N) Erosion and Sediment Control Plan Contents

1. An Erosion and Sediment Control Plan shall be part of the Permit Application. This plan shall require the stamp and signature of a Registered Professional Engineer, or a Certified Professional of Erosion and Sediment Control licensed in the Commonwealth of Massachusetts.

2. If a project requires a "NPDES General Permit for Storm Water Discharges from Construction Activities", the permittee shall submit a full copy of the Stormwater Pollution Prevention Plan (SWPPP). If the SWPPP meets the requirements of Section 3 of the NPDES General Permit, it will be considered equivalent to the Erosion and Sediment Control Plan described in this section.

3. The Erosion and Sediment Control Plan will include, at a minimum:

a) Legible site map, showing the entire site, identifying:

- i. Location of the site and waters of the United States within one mile of the site (e.g., a general locus map such as a USGS quadrangle map).
- ii. Locations of all bodies of waters including wetlands;
- iii. Direction(s) of stormwater flow and approximate slopes anticipated after major grading activities;
- iv. Areas of soil disturbance and areas that will not be disturbed;
- v. Locations where stabilization practices are expected to occur;
- vi. Locations where stormwater flows to wetland or water body (including all roads, drains and other structures).
- vii. Onsite locations for storage of materials, wastes, vehicles, equipment, soil, snow and other potential pollutants. Locations of off-site material, waste, borrow or equipment storage areas, if applicable.

b) Estimation of the total area expected to be disturbed by excavation, grading, or other construction activities, including dedicated off-site borrow and fill areas.

c) Description of appropriate erosion control measures, the general sequence during the construction process in which the measures will be implemented, and which operator is responsible for the control measure's implementation.

d) Description of structural practices to divert flows from exposed soils, retain/detain flows or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. The runoff calculations shall be in accordance with the DEP Stormwater Handbook.

e) Description of construction and waste materials expected to be stored on-site, and a description of controls, including storage practices, to minimize exposure of the materials to stormwater, and spill prevention and response practices.

4. New subdivisions and redevelopment projects shall also include the following in the Plan:

a) Description of interim and permanent bank stabilization practices for the site, including a schedule of when practices will be implemented. Existing vegetation should be retained where possible. The use of impervious surfaces for stabilization should be avoided.

b) The following records must be maintained:

- i. Dates when major grading activities occur;
- ii. Dates when construction activities temporarily or permanently cease on a portion of the site; and
- iii. Dates when stabilization measures are initiated.

- c) Description of the inspection schedule and the maintenance schedule for the erosion and sediment controls that will be installed.
- d) Description of measures to prevent the discharge of solid materials, including building materials, to waters of the United States, except as authorized by a permit issued under Section 404 of the Clean Water Act.
- e) Description of measures to minimize, to the extent practicable, off-site vehicle tracking of sediments onto paved surfaces and the generation of dust.
- f) Description of pollutant sources other than construction areas, such as stormwater runoff from dedicated asphalt plants and dedicated concrete plants (include a description of measures that will be implemented at those sites to minimize pollutant discharges).

7.0 POST-DEVELOPMENT STORMWATER MANAGEMENT CRITERIA

- A) All projects shall comply with stormwater management standards of the most recent version of Massachusetts Department of Environmental Protection (MA DEP) Stormwater Handbook, which include the following performance criteria.

- B) General Criteria

The following general performance criteria shall be applicable to all stormwater management plans, unless otherwise provided for in these Regulations:

- 1. No Untreated Discharges

All stormwater runoff generated from land development and land use conversion activities shall not discharge untreated stormwater runoff directly to a wetland, local water body, municipal drainage system, or abutting property, without adequate treatment.

- 2. Channel Protection

The post-development peak discharge rate from the 2-year storm event shall be equal to the pre-development rate in order to prevent stream bank and bed erosion and channel degradation, as required by the MA DEP Stormwater Management Standards.

- 3. Overbank Flooding Protection

The post-development peak discharge rate for the 10-year storm event shall be equal to the pre-development rate in order to protect downstream property, as required by the MA DEP Stormwater Management Standards.

- 4. Extreme Flooding Protection

Extreme flooding and public safety protection shall be provided by evaluating the peak discharges for the 100-year, 24 hour storm event to determine there will be no increased flooding impacts off-site. If this evaluation shows that increased off-site flooding will result for peak discharges from the 100-year 24-hour storms, BMPs must also be provided to attenuate peak discharges as required by MA DEP Stormwater Management Standards.

- 5. Recharge

Loss of annual recharge to groundwater shall be eliminated or minimized through the use of environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post- development site shall approximate the annual recharge from pre-

development conditions based on soil type. The stormwater management system shall be designed to infiltrate the recharge volume in accordance with the methods required in the most recent version of the Massachusetts Stormwater Handbook.

Recharge requirements shall apply to all activities within the jurisdiction of this Regulation unless waived by Conservation Commission, with the following exception: the recharge criterion is not required for any portion of a site designated as a Land Use with Higher Potential Pollutant Loadings. In addition, the Conservation Commission may relax or eliminate the recharge requirement at its discretion, if the site is situated on unsuitable soils or is in a redevelopment area with documentation of prior contaminated soils.

6. Structural Practices for Water Quality

All stormwater management systems shall be designed using the appropriate criteria from the most recent version of the Massachusetts Stormwater Handbook.

For structural stormwater controls not included in the DEP Stormwater Handbook, the effectiveness and pollutant removal of the structural control must be documented through prior studies or other means and receives approval from the Conservation Commission before being included in the design of a stormwater management system.

Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This standard is met when:

- a) Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;
- b) Structural stormwater BMPs are sized to capture the required water quality volume as determined in accordance with the Massachusetts Stormwater Handbook; and
- c) Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

7. Water Quality Volume

The required water quality volume equals 1.0 inch of runoff times the total impervious area of the post-development project site for a discharge

- a) from a land use with a higher potential pollutant load;
- b) within an area with a rapid infiltration rate (greater than 2.4 inches per hour);
- c) within a Zone II or Interim Wellhead Protection Area;
- d) near or to the following critical areas:
 - i. Outstanding Resource Waters,
 - ii. Special Resource Waters,
 - iii. bathing beaches,
 - iv. shellfish growing areas,
 - v. cold-water fisheries.

The required water quality volume equals 0.5 inches of runoff times the total impervious area of the post-development site for all other discharges.

8. Hydrologic Basis for Design of Structural Practices –

For facility sizing criteria, the basis for hydrologic and hydraulic evaluation of development sites are as follows:

- a) Impervious cover is measured from the site plan and includes any material or structure on or above the ground that prevents water from infiltrating through the underlying soil. Impervious surface is defined to include, without limitation: paved parking lots, sidewalks, roof tops, driveways, patios, and paved, gravel and compacted dirt surfaced roads.

- b) Off-site areas shall be assessed based on their "pre-developed condition" for computing the water quality volume (i.e., treatment of only on-site areas is required). However, if an offsite area drains to a proposed BMP, flow from that area must be accounted for in the sizing of a specific practice.
- c) Off-site areas draining to a proposed facility should be modeled as "present condition" for peak-flow attenuation requirements.
- d) The length of sheet flow used in time of concentration calculations is limited to no more than 50 feet for predevelopment conditions and 50 feet for post development conditions.
- e) Detention time for the one-year, 24-hour return frequency storm is defined as the center of mass of the inflow hydrograph and the center of mass of the outflow hydrograph.
- f) The models TR-55, TR-20 or approved equivalent will be used for determining peak discharge rates.
- g) The standard for characterizing pre-development land use for on-site areas shall be woods.
- h) For purposes of computing runoff, all pervious lands in the site shall be assumed prior to development to be in good condition regardless of conditions existing at the time of computation.
- i) If an off-site area drains to a facility, off-site areas should be modeled, assuming an "ultimate buildout condition" upstream.
- j) Flooding and channel erosion impacts to receiving streams due to land development projects shall be determined at each point of discharge from the development project and such determination shall include any runoff from the balance of the watershed which also contributes to that point of discharge.
- k) The specified design storms shall be defined as a 24-hour duration storm using a rainfall distribution as recommended by the United States Department of Agriculture, Natural Resources Conservation Service (NRCS) or the Northeast Regional Climate Center "Atlas of Precipitation Extremes for the Northeastern United States and Southeastern Canada."
- l) Proposed residential, commercial, or industrial subdivisions shall apply these stormwater management criteria to the land development as a whole. Individual lots in new subdivisions shall not be considered separate land development projects, but rather the entire subdivision shall be considered a single land development project. Hydrologic parameters shall reflect the ultimate land development and shall be used in all engineering calculations.

9. Land Uses with Higher Potential Pollutant Loads

For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If land uses with higher potential pollutant loads cannot be completely protected from runoff, the stormwater management system shall use the specific BMPs required in the Massachusetts Stormwater Handbook. Land uses with higher potential pollutant loads require at least 44% TSS removal prior to discharge to an infiltration BMP.

10. Critical Areas

Stormwater discharges near or to critical areas (e.g., swimming beaches, public water supplies, and cold-water fisheries) require the use of source control, pollution prevention measures and the specific structural stormwater best management practices as provided in

the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to a Zone I groundwater supply or a Zone A surface water supply are prohibited unless essential to the operation of a public water supply.

11. Redevelopment Projects

A redevelopment project is required to meet the criteria for 7.0 (B) to the maximum extents practicable. A redevelopment project shall comply with all other requirements of the Massachusetts Stormwater Handbook and improve existing conditions.

12. Construction Impacts

A plan to control construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

During land disturbance and construction activities, project proponents must implement controls that prevent erosion, control sediment movement, and stabilize exposed soils to prevent pollutants from moving offsite or entering wetlands or waters. Land disturbance activities include demolition, construction, clearing, excavation, grading, filling, and reconstruction.

13. Stormwater Credits

Better Site Design and nonstructural stormwater management measures are encouraged to reduce the requirements for structural stormwater BMPs. The use of such measures may allow for a reduction in the water quality treatment volume required and the stream channel protection volume required. The applicant may take credit for better site design practices to reduce some requirements specified in the criteria section of these regulations, if approved by the Conservation Commission. The site design practices that qualify for these credits and procedures for applying the credits are identified in Appendix B of these Regulations.

8.0 WAIVERS

- A) The Conservation Commission may waive strict compliance with any requirement of the Town of Tyngsborough Stormwater Bylaw or the regulations promulgated hereunder, where the waiver:
 - 1. Is allowed by federal, state and local statutes and/or regulations,
 - 2. Is in the public interest, and
 - 3. Is consistent with the purpose and intent of the Tyngsborough Stormwater Management By-Law.
- B) Any applicant may submit a written request for a waiver, accompanied by supporting information explaining how the waiver will comply with the purpose of the Stormwater Bylaw. All waiver requests shall be acted on within 60 days and the Conservation Commission will provide a written decision. If additional information is required, the Conservation Commission may extend the review period. If the applicant objects to an extension, or fails to provide requested information, the waiver request may be denied "without prejudice" by the Conservation Commission.

9.0 SURETY

The Conservation Commission may require the permittee to post a bond, cash, or other surety. The form of a bond shall be approved by town counsel, in an amount deemed sufficient to ensure work will be completed in accordance with the permit. If the project is phased, the Conservation Commission may release part of the bond as each phase is completed in compliance with the

permit. The bond shall not be fully released until the Conservation Commission has issued a Certificate of Completion.

10.0 CONSTRUCTION INSPECTIONS

- A) Notice of Construction Commencement. The applicant must notify the Conservation Commission in advance before the commencement of construction. In addition, the applicant must notify the Conservation Commission in advance of construction of critical components of the stormwater management systems.
- B) At the discretion of the Conservation Commission, periodic inspections of the stormwater management system construction shall be conducted by the Town or a professional engineer or the designee who has been approved by the Conservation Commission. All inspections shall be documented and written reports prepared that contain the following information:
1. The date and location of the inspection;
 2. Whether construction is in compliance with the approved stormwater management plan;
 3. Variations from the approved construction specifications; and
 4. Any other variations or violations of the approved stormwater management plan.
- C) The Conservation Commission or its designee shall inspect the project site at the following stages, at a minimum:
1. Initial Site Inspection: prior to approval of any plan;
 2. Erosion Control Inspection: to ensure installed practices are in accord with the filed plan;
 3. Inspection after any 5-year, 24 hour storm event;
 4. Stormwater Management System Inspection: An inspection of the completed stormwater management system, prior to the backfilling of any underground drainage or stormwater conveyance structures, unless waived by the Conservation Commission or their designee.
 5. Final Inspection
 - a) After the stormwater management system has been constructed and before surety is released, the permittee shall submit "as built" plans for any stormwater management facilities or practices within 90 days after construction is completed. The "as-built" plans submitted shall be on mylar along with electronic copies, and be certified by a Registered Professional Engineer. All changes to stormwater management system design should be recorded in red ink on the plans, including corrections in elevations.
 - b) The Conservation Commission or its designee shall inspect the stormwater system to confirm its "as-built" features. The inspector shall also evaluate the effectiveness of the system in an actual storm. If the inspection report finds the system to be adequate, the Conservation Commission will issue a Certificate of Completion.
- D) Inadequacy of System
1. If the system is found to be inadequate by virtue of physical evidence of operational failure, even if built as shown in the Stormwater Management Plan, it shall be corrected before the Certificate of Completion is issued. If the permittee fails to act, the Conservation Commission may use the surety bond to complete the work.
 2. If the Conservation Commission determines there is a failure to comply with the Stormwater Management Plan, the property owner shall be notified in writing of the nature of the violation and the required corrective actions. A Stop Work Order shall be issued until any violations are corrected and all work completed is approved by the Conservation Commission.

11.0 CERTIFICATE OF COMPLETION

- A) Upon completion, the permittee's Registered Professional Engineer shall sign, seal and certify that the completed project is in accordance with the approved plans and specifications.
- B) The Conservation Commission will issue a letter certifying completion upon approval of the final inspection reports and/or upon otherwise determining that all work required by the permit has been satisfactorily completed in conformance with this Regulation.

12.0 CONTINUING INSPECTION AND MAINTENANCE

A) Maintenance Responsibility

- 1. The Operation and Maintenance Plan requires an inspection and maintenance agreement in accordance with Section 6.M of these Regulations. Ongoing inspections of the stormwater management system shall document required maintenance and repairs to ensure compliance with the O&M Plan and this Regulation.
- 2. The owner of the property on which work has been done pursuant to this Regulation for private stormwater management facilities, or any other person or agent in control of such property, shall maintain in good condition and promptly repair and restore all grade surfaces, walls, drains, dams and structures, vegetation, erosion and sedimentation controls, and other protective devices. Such repairs or restoration and maintenance shall be in accordance with approved plans.

B) Maintenance Inspections

- 1. All stormwater management facilities must undergo inspections to document maintenance and repair needs and ensure compliance with the Tyngsborough Stormwater Management By-Law and the requirements of the Operation and Maintenance Plan, including the inspection and maintenance agreement, as described under Section 6.M of these regulations.
- 2. Annual inspections shall be performed by the end of October. In addition, the maintenance agreement between the permittee and the Conservation Commission, as described under Section 6.M, shall specify the responsible party for performing long-term inspections of privately-owned stormwater management systems.
- 3. Inspection reports shall be submitted to and maintained by the Conservation Commission for all stormwater management systems. Inspection reports shall include:
 - a) The date of inspection;
 - b) Name of inspector;
 - c) The condition of:
 - i. Pretreatment devices
 - ii. Vegetation or filter media
 - iii. Fences or other safety devices
 - iv. Spillways, valves, or other control structures
 - v. Embankments, slopes, and safety benches
 - vi. Reservoir or treatment areas
 - vii. Inlet and outlet channels and structures
 - viii. Underground drainage

- ix. Sediment and debris accumulation in storage and forebay areas (including catch basins)
- x. Any nonstructural practices
- xi. Any other item that could affect the proper function of the stormwater management system

d) Description of the need for maintenance;

C) Right-of-Entry for Inspection

The terms of the inspection and maintenance agreement as specified in Section 6.M of these regulations shall provide for the Conservation Commission or its designee to enter the property at reasonable times and in a reasonable manner for the purpose of inspection. The Conservation Commission, its agents and employees shall have authority to enter upon privately owned land for the purpose of performing their duties under this Regulation and may make or cause to be made such examinations, surveys, or sampling as the Conservation Commission deems necessary, subject to the constitutions and laws of the United States and the Commonwealth.

D) Records of Maintenance and Repair Activities

Parties responsible for the operation and maintenance of a stormwater management facility shall make records of the installation and of all maintenance and repairs, and shall retain the records for at least five (5) years. These records shall be made available to the Conservation Commission during inspection of the facility and at other reasonable times upon request.

E) Failure to Maintain

1. If a responsible person fails or refuses to meet the requirements of the inspection and maintenance agreement, the Conservation Commission, after sixty (60) days written notice (except, that in the event the violation constitutes an immediate danger to public health or public safety, 24 hours notice shall be sufficient), may correct a violation of the design standards or maintenance requirements by performing the necessary work to place the facility or practice in proper working condition. The Conservation Commission may assess the owner(s) of the facility for the cost of repair work which shall be a lien on the property.
2. After notification is provided to the person responsible for carrying out the maintenance plan of any deficiencies discovered from an inspection of a stormwater management system, the person responsible for carrying out the maintenance plan shall have 30 days or other time frame mutually agreed by the Conservation Commission and the person responsible for carrying out the maintenance plan to correct the deficiencies. The Conservation Commission shall then conduct a subsequent inspection to ensure completion of repairs.

13.0 ENFORCEMENT

A) The Conservation Commission or its authorized agent shall enforce the Tyngsborough Stormwater Management By-Law, regulations, orders, violation notices, and enforcement orders, and may pursue all civil, criminal and non-criminal remedies for violations.

B) Notices and Orders

1. The Conservation Commission or its authorized agent may issue a written notice of violation or enforcement order to enforce the provisions of the By-Law or the regulations thereunder, which may include requirements to:
 - a) Cease and desist from construction or land disturbing activity until there is compliance with the By-Law and the Stormwater Management Permit;

- b) Repair, maintain; or replace the stormwater management system or portions thereof in accordance with the operation and maintenance plan;
 - c) Perform monitoring, analyses, and reporting;
 - d) Fix adverse impact resulting directly or indirectly from malfunction of the stormwater management system.
2. If the Conservation Commission determines that abatement or remediation of adverse impacts is required, the order may set forth a deadline by which such abatement or remediation must be completed. Said order may further advise that, should the violator or property owner fail to abate or perform remediation within the specified deadline, the Town of Tyngsborough may, at its option, undertake such work, and the property owner shall reimburse the Town of Tyngsborough for expenses incurred.
 3. Within thirty (30) days after completing all measures necessary to abate the violation or to perform remediation, the violator and the property owner shall be notified of the costs incurred by the Town of Tyngsborough including administrative costs. The violator or property owner may file a written protest objecting to the amount or basis of costs with the Conservation Commission within thirty (30) days of receipt of the notification of the costs incurred. If the amount due is not received by the expiration of the time in which to file a protest or within thirty (30) days following a decision of the Conservation Commission affirming or reducing the costs, or from a final decision of a court of competent jurisdiction, the costs shall become a special assessment against the property owner and shall constitute a lien on the owner's property for the amount of said costs. Interest shall begin to accrue on any unpaid costs at the statutory rate provided in G.L. Ch. 59, § 57, after the thirty-first day at which the costs first become due.
- C) Any person who violates any provision of the Town of Tyngsborough Stormwater Management By-Law or regulation, order or permit issued thereunder, may be ordered to correct the violation and/or shall be punished by a fine of not more than \$300. Each day or part thereof that such violation occurs or continues shall constitute a separate offense.
 - D) Non-Criminal Disposition. As an alternative to criminal prosecution or civil action, the Town of Tyngsborough may elect to utilize the non-criminal disposition procedure set forth in G.L. Ch. 40, §21D. The Conservation Commission of the Town of Tyngsborough shall be the enforcing entity. The penalty for the 1st violation shall be up to \$100. The penalty for the 2nd violation shall be up to \$200. The penalty for the 3rd and subsequent violations shall be \$300. Each day or part thereof that such violation occurs or continues shall constitute a separate offense.
 - E) Appeals. The decisions or orders of the Conservation Commission shall be final. Further relief shall be to a court of competent jurisdiction.
 - F) Remedies Not Exclusive. The remedies listed in this Bylaw are not exclusive of any other remedies available under any applicable federal, state or local law.

14.0 SEVERABILITY

The invalidity of any section, provision, paragraph, sentence, or clause of these Regulations shall not invalidate any section, provision, paragraph, sentence, or clause thereof, nor shall it invalidate any permit or determination that previously has been issued.

Appendix A: Tyngsborough Stormwater Management By-Law Regulations Definitions, Abbreviations and Acronyms

ALTER: Any activity, which will measurably change the ability of a ground surface area to absorb water or will change existing surface drainage patterns. Alter may be similarly represented as “alteration of drainage characteristics,” and “conducting land disturbance activities.”

APPLICANT: A property owner or agent of a property owner who has filed an application for a stormwater management permit.

BEST MANAGEMENT PRACTICE (BMP): Structural, non-structural and managerial techniques that are recognized to be the most effective and practical means to prevent and/or reduce increases in stormwater volumes and flows, reduce point source and nonpoint source pollution, and promote stormwater quality and protection of the environment. “Structural” BMPs are devices that are engineered and constructed to provide temporary storage and treatment of stormwater runoff. “Nonstructural” BMPs use natural measures to reduce pollution levels, do not require extensive construction efforts, and/or promote pollutant reduction by eliminating the pollutant source.

BETTER SITE DESIGN: Site design approaches and techniques that can reduce a site’s impact on the watershed through the use of nonstructural stormwater management practices. Better site design includes conserving and protecting natural areas and greenspace, reducing impervious cover, and using natural features for stormwater management.

CERTIFICATE OF COMPLETION (COC): A document issued by the Tyngsborough Conservation Commission after all construction activities have been completed which states that all conditions of an issued Stormwater Management Permit (SMP) have been met and that a project has been completed in compliance with the conditions set forth in a SMP.

CONVEYANCE: Any structure or device, including pipes, drains, culverts, curb breaks, paved swales or man-made swales of all types designed or utilized to move or direct stormwater runoff or existing water flow.

CRITICAL AREAS: For the purposes of the DEP Stormwater Management Policy, critical areas are Outstanding Resource Waters (ORWs), shellfish growing areas, public swimming beaches, cold water fisheries, and recharge areas for public water supplies.

DEVELOPER: A person who undertakes or proposes to undertake land disturbance activities.

DEVELOPMENT: The modification of land to accommodate a new use or expansion of use, usually involving construction.

DISTURBANCE OF LAND: Any action that causes a change in the position, location, or arrangement of soil, sand, rock, gravel or similar earth material.

DRAINAGE EASEMENT: A legal right granted by a landowner to a grantee allowing the use of private land for stormwater management purposes.

EROSION CONTROL: The prevention or reduction of the movement of soil particles or rock fragments.

EROSION CONTROL PLAN: A plan that shows the location and construction detail(s) of the erosion and sediment reduction controls to be utilized for a construction site.

FLOOD CONTROL: The prevention or reduction of flooding and flood damage.

FLOODING: A local and temporary inundation or a rise in the surface of a body of water, such that it covers land not usually under water.

GRADING: Changing the elevation or shape of the ground surface.

GROUNDWATER: All water beneath any land surface including water in the soil and bedrock beneath water bodies.

LAND USES with HIGHER POTENTIAL POLLUTANT LOADINGS: Land uses or activities with higher potential pollutant loadings, such as auto salvage yards, auto fueling facilities, fleet storage yards, commercial parking lots with high intensity use, road salt storage areas, commercial nurseries and landscaping, outdoor storage and loading areas of hazardous substances, or marinas. Land uses with higher potential pollutant loads are defined in the DEP Stormwater Handbook (see Ch.1 V.1 Standard 5 for definition).

IMPERVIOUS SURFACE: Any material or structure on or above the ground that prevents water from infiltrating through the underlying soil. Impervious surface is defined to include, without limitation: paved parking lots, sidewalks, roof tops, driveways, patios, and paved, gravel and compacted dirt surfaced roads.

INFILTRATION: The act of conveying surface water into the ground to permit groundwater recharge and the reduction of stormwater runoff from a project site.

MASSACHUSETTS STORMWATER MANAGEMENT POLICY: The Policy issued by the Massachusetts Department of Environmental Protection (DEP), and as amended, that coordinates the requirements prescribed by state regulations promulgated under the authority of the Massachusetts Wetlands Protection Act G.L. c. 131 § 40 and Massachusetts Clean Waters Act G.L. c. 21, §. 23-56. The Policy addresses stormwater impacts through performance standards to reduce or prevent pollutants from reaching water bodies and control the quantity of runoff from a site. The performance standards and structural BMP specifications are in the Massachusetts Stormwater Handbook, Volumes 1-3.

MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) or MUNICIPAL STORM DRAIN SYSTEM: The system of conveyances designed or used for collecting or conveying stormwater, including any road with a drainage system, street, gutter, curb, inlet, piped storm drain, pumping facility, retention or detention basin, natural or man-made or altered drainage channel, reservoir, and other drainage structure that together comprise the storm drainage system owned or operated by the Town of Tyngsborough.

NEW DEVELOPMENT: Any construction or land disturbance of a parcel of land that is currently in a natural vegetated state and does not contain alteration by man-made activities.

NONPOINT SOURCE POLLUTION: Pollution from many diffuse sources caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into water resource areas.

OPERATION AND MAINTENANCE PLAN: A plan that defines the functional, financial and organizational mechanisms for the ongoing operation and maintenance of a stormwater management system to insure that it continues to function as designed.

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

PERSON: Any individual, group of individuals, association, partnership, corporation, company, business organization, trust, estate, the Commonwealth or political subdivision thereof to the extent subject to Town Bylaws, administrative agency, public or quasi-public corporation or body, the Town of Tyngsborough, and any other legal entity, its legal representatives, agents, or assigns.

PRE-DEVELOPMENT: The conditions that exist at the time that plans for the land development of a tract of land are submitted to the Tyngsborough Conservation Commission. Where phased development or plan approval occurs (preliminary grading, roads and utilities, etc.), the existing conditions at the time prior to the first plan submission shall establish pre-development conditions.

POINT SOURCE: Any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, or container from which pollutants are or may be discharged.

POST-DEVELOPMENT: The conditions that reasonably may be expected or anticipated to exist after completion of the land development activity on a specific site or tract of land. Post-development refers to the phase of a new development or redevelopment project after completion, and does not refer to the construction phase of a project.

RECHARGE: The replenishment of underground water reserves.

REDEVELOPMENT: Any construction, alteration, or improvement where the existing land use zoning is commercial, industrial, institutional, or multi-family residential.

RESOURCE AREA: Any area protected under including without limitation: the Massachusetts Wetlands Protection Act, or the Massachusetts Rivers Act.

RUNOFF: Rainfall, snowmelt, or irrigation water flowing over the ground surface.

SEDIMENTATION: A process of depositing material that has been suspended and transported in water.

SITE: The parcel of land being developed, or a designated planning area in which the land development project is located.

STORMWATER MANAGEMENT: The use of structural or non-structural practices that are designed to reduce storm water runoff pollutant loads, discharge volumes, and/or peak flow discharge rates.

STORMWATER MANAGEMENT PERMIT (SMP): A permit issued by the Tyngsborough Conservation Commission after review of an application, plans, calculations, and other supporting documents, which prevents the harmful effects of uncontrolled and untreated stormwater runoff.

STOP WORK ORDER: An order issued which requires that all construction activity on a site be stopped.

TSS: Total Suspended Solids.

WATER QUALITY VOLUME (WQ_v): The storage needed to capture a specified average annual stormwater runoff volume. Numerically (WQ_v) will vary as a function of drainage area or impervious area.

Appendix B: Tyngsborough Stormwater Management Bylaw Regulations

STORMWATER CREDITS

The DEP Massachusetts Stormwater Handbook requires the consideration of environmentally sensitive design and Low Impact Development (LID) techniques during project planning and design. Volume 3 of the Massachusetts Stormwater Handbook (page 42) describes DEP Credits for environmentally sensitive site design and LID techniques, which can minimize impervious surfaces and preserve natural hydrologic conditions. The Credits allow project proponents to reduce or eliminate structural BMPs that are required to meet Stormwater Standards 3 and 4, by the use of pervious surfaces for recharge and treatment¹.

The credits can reduce the *Required Recharge Volume* and the *Required Water Quality Volume* if the pervious surfaces used to treat and infiltrate stormwater runoff meet the following requirements.

To be eligible for the site design credit, the project proponent is required to:

- Comply with the requirements of Stormwater Standard 1 regarding new stormwater outfalls;
- Attenuate the peak discharge rate in accordance with Standard 2;
- Develop and implement a construction period pollution prevention (erosion and sedimentation control) plan; a long-term pollution prevention plan; and an operation and maintenance plan in accordance with Stormwater Standards 4, 5, 6, 8, and 9;
- Remove illicit discharges in accordance with Standard 10.

The application of these credits does not relieve the design engineer or reviewer from the standard of engineering practice associated with safe conveyance of stormwater runoff and good drainage design.

NOT ELIGIBLE FOR CREDIT:

The Low Impact Site Design Credit may not be applied to reduce the *Required Recharge Volume* and the *Required Water Quality Volume*:

- At sites in a Zone II for groundwater supply with impervious surfaces covering 15% of the site or 2500 square feet, whichever is greater;
- At sites where stormwater runoff is directed to non-permeable soils, such as bedrock and soils classified as Hydrologic Soil Group D; and
- At sites with urban fill soils, or soils classified as contaminated pursuant to the Massachusetts Contingency Plan (MCP), or soils with seasonal high groundwater (i.e., groundwater elevation within 2 feet of the land surface).

Sites of Land Uses with Higher Potential Pollutant Loadings (LUHPPL) are not eligible for Credit No. 1.

Sites with LUHPPL are eligible for Credits 2 and 3, provided that runoff with higher potential pollutant loads is not directed to the pervious surfaces used to receive the credit, and provided further that the proposal satisfies all the other requirements set forth herein.

Runoff from metal roofs is only eligible for Credit 2 when the metal roof is located outside a Zone II or Interim Wellhead Protection Area and the building is not used for industrial purposes.

Runoff from green roofs is not eligible for Credit 2.

¹ The credits are based on research published by Schueler 1994 and others indicating that the greater the impervious area, the more stream channel erosion, water quality impacts, and reductions in base flow. Schueler 1994 estimated that water quality is good in streams from watersheds with less than 10% impervious cover, degraded in watersheds with 10 to 25% impervious cover, and poor when impervious cover exceeds 25%. The credit system is also based on the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) Smart Growth Toolkit, Appendix A.

AVAILABLE CREDITS:

- CREDIT 1. Environmentally Sensitive Development
- CREDIT 2. Rooftop Runoff Directed to Qualifying Pervious Area
- CREDIT 3. Roadway, Driveway or Parking Lot Runoff Directed to Qualifying Pervious Area

“Qualifying Pervious Areas” are defined as natural or landscaped vegetated areas, fully stabilized, with runoff characteristics at or lower than the NRCS Runoff Curve Numbers in the table set forth below. The Qualifying Pervious Area may be located in the outer 50-foot portion of a wetland buffer zone. However, it must not be located in the inner 50-foot portion of a wetland buffer zone (that portion of the buffer zone immediately adjacent to a wetland).

Maximum NRCS Runoff Curve Numbers for Qualifying Pervious Area

Cover Type	Hydrologic Soils Groups		
	HSG A	HSG B	HSG C
Natural: Woods Good Condition	30	55	70
Natural: Brush Good Condition	30	48	65
Landscaped: Good Condition (grass cover > 75% or equivalent herbaceous plants)	39	61	74

CREDIT EXPLANATIONS

CREDIT 1: ENVIRONMENTALLY SENSITIVE DEVELOPMENT

This credit is given for environmentally sensitive site design techniques that “cluster development” or reduce development scale, and leave a significant amount of the site undisturbed in its natural state. If a site is designed, constructed, operated and maintained in accordance with the requirements of this credit, a project proponent need not develop and implement additional structural stormwater BMPs to meet the DEP Stormwater Standards 3 and 4.

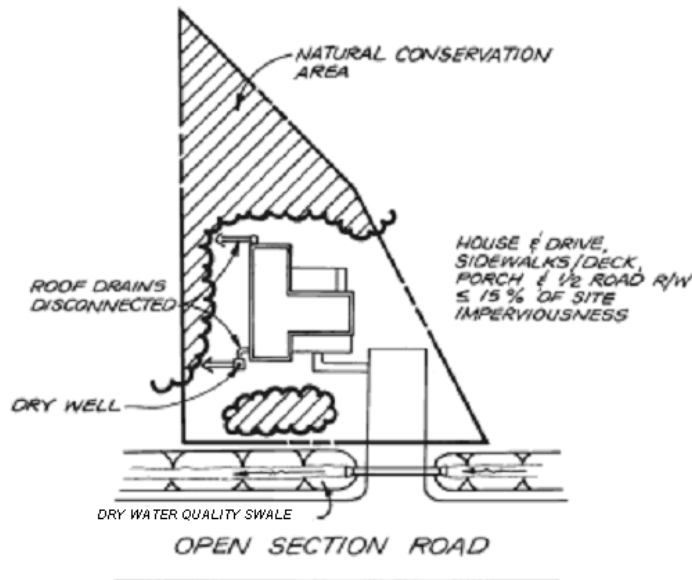


FIGURE 1: Credit No. 1 (Environmentally Sensitive Development) Example

Minimum Criteria for Credit - The *Required Recharge Volume* and the *Required Water Quality Volume* requirements are completely met without the use of structural practices in certain low density (less than 1 dwelling unit per acre) or cluster residential developments when the following conditions are met:

- ❑ The total impervious cover footprint must be less than 15 % of the base lot area. Because alterations are limited under the Wetlands Protection Act Regulations, 310 CMR 10.00, the following wetland resource areas may not be included in the base lot area used for purposes of determining compliance with this requirement: Bordering Vegetated Wetland (BVW), Isolated Vegetated Wetland (IVW), Land Under Water & Waterways; Bank; or 5,000 square feet or 10% of the Riverfront Area, whichever is greater.
- ❑ No alteration may occur in BVW or IVW.
- ❑ A minimum of 25% of the site must be protected as a natural conservation area. To qualify as a natural conservation area, an EEA Conservation Restriction must be placed on the protected area. Information on adopting conservation restrictions is available via the web at: <http://www.mass.gov/envir/dcs/restrictions/default.htm>. Because alterations are limited in these areas under the Wetlands Protection Act Regulations, 310 CMR 10.00, the Natural Conservation Area must not include the following resource areas: any vegetated wetlands (BVW, IVW); Land Under Water and Waterways; Bank; or more than 5000 square feet or 10% of the Riverfront Area, whichever is greater.
- ❑ Stream buffers must be incorporated into the design of any areas adjacent to perennial and intermittent streams on the site. A stream buffer is the inner 50 feet of the buffer zone adjacent to the bank. At a minimum, no work, including any alteration for stormwater management, may be proposed in the 50-foot-wide area in the buffer zone along any wetland resource area. The proposed project shall not include any impervious surfaces in the 50-foot-wide area in the buffer zone along any wetland resource area.
- ❑ The amount of impervious surface shall not exceed 40% of the area of the buffer zone between 50 and 100 feet from any resource area or the amount of existing impervious surface, whichever is greater.
- ❑ No work may be proposed in a buffer zone that:
 - Borders an Outstanding Resource Water,
 - Contains estimated wildlife habitat which is identified on the most recent Estimated Habitat Map of State-listed Rare Wetlands Wildlife prepared by the Natural Heritage and Endangered Species Program,
 - Contains slopes greater than 15% prior to any work
- ❑ Rooftop runoff must be disconnected in accordance with the requirements applicable to Credit 2.
- ❑ Qualifying pervious areas are used to convey runoff from roads and driveways instead of curb and gutter systems.

Environmentally Sensitive Development Credit Example

Given the following base data:

Site Data: a single-family lot that is part of an 8-acre low-density subdivision in a critical area

Lot Area = 2.5 ac

Conservation Area = 0.65 ac

Conservation Area and Site is 10% wetland resource area

Impervious Area = 0.35 ac = 14%

Site Soils Types: 100% Hydrologic Soil Group "B" Soil

F = 0.35 inches, where F is the Recharge Factor required for "B" soils

Original *Required Water Quality Volume* = $(1.0"/12 \text{ IN/FT}) (0.35 \text{ acres}) (43,560 \text{ SF/ACRE}) = 1,270.5 \text{ ft}^3$

Original *Required Recharge Volume* = $(2.5 \text{ acres}) (0.14) (0.35"/12 \text{ IN/FT}) (43,560 \text{ SF/ACRE}) = 445 \text{ ft}^3$

Environmentally Sensitive Development Credit (see Figure 1)

Required Recharge Volume is considered met by site design.

Required Water Quality Volume is considered met by site design.

Percent Reductions Using Environmentally Sensitive Development Credit:

- Required Water Quality Volume = 100%
- Required Recharge Volume = 100%

CREDIT 2: ROOFTOP RUNOFF DIRECTED TO QUALIFYING AREAS

This credit is available when rooftop runoff is directed to a qualifying pervious area where it can either infiltrate into the soil or flow over it with sufficient time and reduced velocity to allow for filtering. Qualifying pervious areas are flat locations, where the discharge is directed via sheet flow and not as a point source discharge. Dry water quality swales are not “qualifying pervious areas” for purposes of this credit. The credit may be obtained by grading the site to induce sheet flow over specially designed flat vegetated areas that can treat and infiltrate rooftop runoff.

If rooftop runoff is adequately directed to a qualifying pervious area, the rooftop area can be deducted from total impervious area, therefore reducing the *Required Water Quality Volume* and the size of the structural BMPs used to meet the TSS removal requirement of Standard 4. As more fully set forth below, redirected rooftop runoff can also be used to meet the recharge requirement as a non-structural practice.

Minimum Criteria for Credit

- The qualifying pervious area must be designed to prevent basement seepage. To prevent basement seepage, at a minimum, runoff must be directed away from the building foundation and be at least 10 feet away from the foundation.
- The rooftop area contributing runoff to any one downspout cannot exceed 1,000 ft².
- The rooftop cannot be a metal roof unless the building is located outside a Zone II or IWPA and the building must not be used for industrial purposes.
- The roof area contributing the runoff is not a “Green Roof.”
- The length of the qualifying pervious area (in feet) shall be equal to or greater than the contributing rooftop area (ft²) divided by 13.3 (e.g., for 1,000 ft² roof/13.3 = 75 ft).
- The width of the qualifying pervious area (in feet) shall be equal to or greater than the roof length. For example, if a roof section is 20 feet wide by 50 feet long (1,000 ft² roof), the width of the qualifying pervious area shall be at least 50 feet.
- Although they may abut, there shall be no overlap between qualifying pervious areas. For example, the runoff from two 1,000 square foot sections of roof must be directed to separate qualifying pervious areas. They may not be directed to the same area.
- The lot must be greater than 6,000 sq. ft.
- The slope of the qualifying pervious area shall be less than or equal to 5.0%.
- Where provided, downspouts must be at least 10 feet away from the nearest impervious surface to prevent reconnection to the stormwater management system.
- Where a gutter/downspout system is not used, the rooftop runoff must be designed to sheet flow at low velocity away from the structure housing the roof.
- Qualifying pervious areas should be located on relatively permeable soils (HSG “A” and “B”). A soil evaluation by a Competent Soils Professional is required to confirm the soil type. The soil evaluation shall also confirm that the depth to groundwater is 2 feet or more and that the long-term *saturated hydraulic conductivity* of the soil is at least 0.17 inches/hour. The soil evaluation must identify the soil texture, Hydrologic Soil Group and depth to groundwater. See Soil Evaluation section of this Chapter.

For *saturated hydraulic conductivity*, use Rawls Rates for the actual location where the qualifying pervious area is located.

- If a qualifying pervious area is located in less permeable soils (HSG "C"), the water table depth and permeability shall be evaluated by a Registered Professional Engineer to determine if a spreading device is needed to sheet flow stormwater over vegetated surfaces.
- The flow path through the qualifying pervious area shall comply with the setbacks established for structural infiltration BMPs (e.g., 50 feet away from any septic system components – such as a soil absorption system or leach field, 50 feet from vegetated wetlands and land under water).
- For those rooftops draining toward land under water (e.g., stream) or vegetated wetlands, the end of the flow path length must be at least 50 feet from the edge of a vegetated wetland and bank.
- To take credit for rooftop disconnection associated with a Land Use with Higher Potential Pollutant Loads, the rooftop runoff must not commingle with runoff from any paved surfaces or activities or areas on the site that may generate higher pollutant loads.
- To prevent compaction of the soil in the qualifying pervious area, construction vehicles must not be allowed to drive over the area. If it becomes compacted, the soil must be amended, tilled and revegetated to restore its infiltrative capacity once construction is complete.
- Ponding of water directed to the qualifying pervious area is not permitted.
- The Operation and Maintenance Plan required by Stormwater Standard No. 9 must include measures to inspect the qualifying pervious area at least yearly for evidence of ponding. The Plan shall incorporate measures to address any ponding that is observed during the inspection. The Plan shall also include measures to replace any soil eroded from the qualifying pervious area and to replace any vegetation detrimentally impacted by the drainage.
- The qualifying pervious area may not include any wetland resource areas other than Riverfront and Lands Subject to Flooding. Where a portion of the Buffer Zone is proposed to serve as part of the qualifying pervious area, the qualifying pervious area shall not extend into the inner 50 feet of the Buffer Zone.
- The qualifying pervious area must be owned or controlled (e.g., drainage easement) by the property owner.
- In locations where information is submitted during the public hearing or introduced by the Conservation Commission that there is a demonstrated history of groundwater flooding, the credit may not be utilized.

The rooftop areas contributing runoff to the qualifying pervious area can be deducted from the impervious surfaces used to calculate the *Required Water Quality Volume*.

The rooftop areas contributing runoff to the qualifying pervious area can also be used to reduce the *Required Recharge Volume* by calculating the *Required Recharge Volume* R_v using the "Static" Method and the *Recharge Area Requiring Treatment* Rea using the Percent Area Approach.

Derive equation from Equation 1.

$$R_v = F \times \text{Impervious Area}$$
$$R_v = (F)(\text{Site Area})(I)/12 \quad \text{Equation (14)}$$

R_v is the storage volume of a structural infiltration practice determined using the "Static" Method.

Where:

- R_v = Recharge volume (acre-feet)
- F = Recharge factor (dimensionless)
- A = Site area (in acres)
- I = Site imperviousness percentage (expressed as a decimal)

Table No.

Hydrologic Soil Group	Recharge Factor (F)
A	0.60 inches
B	0.35 inches
C	0.25 inches
D	0.10 inches

Rea = Recharge area requiring treatment (acres)

$$Rea = (F)(A)(I) \quad \text{Equation (15)}$$

F = Recharge factor based on Hydrologic Soil Group (HSG) (same values as above, but dimensionless)

A = Site area in acres

I = Site imperviousness percentage (expressed as a decimal)

The required recharge area (*Rea*) is equivalent to the recharge volume and can be achieved by a non-structural practice (e.g., filtration of sheet flow from redirected impervious surfaces).

1. Calculate both the *Rv* and *Rea* for the site;
2. The site impervious area draining to an approved nonstructural practice is subtracted from the *Rea* calculation from Credit Step 1, above;
3. The remaining *Rea* is divided by the original *Rea* to calculate a pro-rated² percentage that must be directed to structural infiltration BMPs;
4. The pro-rated percentage is multiplied by the original *Rv* to calculate a new *Rv* that must be met by an approved structural practice(s).

Credit 2 Rooftop Runoff Example

Given the following base data:

Site Data: 108 Single-Family Residential Lots (~ ½-acre lots)

Site Area = 45.1 ac

Original Impervious Area = 12.0 ac;

Site Soils Types: 78% "C", 22% "D"

Composite Recharge Factor, $F = .78 (0.25) + .22 (0.1) = 0.217$

Original Required Recharge Volume $Rv = [(0.217)(45.1 \text{ ac})(12\text{ac}/45.1 \text{ ac})] / 12 = 0.22 \text{ acre feet}$;

Recharge Area Requiring Treatment $Rea = (0.217)(45.1)(12/45.1) = 2.60 \text{ ac}$

Original Required Water Quality Volume = $1.0''/\text{impervious acre} = 1.0''(12.0 \text{ ac})/12 = 1.0 \text{ acre foot}$ (site is located near a critical area)

Rooftop Credit

42 houses disconnected

Average house area = 2,500 ft²

Net impervious area reduction = $(42)(2,500 \text{ ft}^2) / (43,560 \text{ ft}^2/\text{ac}) = 2.41 \text{ acres}$

New impervious area = $12.0 - 2.41 = 9.59 \text{ acres}$;

Required recharge area (*Rea*) is 2.60 acres and 2.41 acres were disconnected, therefore 0.19 ac of impervious cover need to be met by an approved structural practice.

New Required Recharge Volume $Rv = (0.19/2.60)(0.22 \text{ ac-ft}) = 0.016 \text{ ac-ft}$

New Required Water Quality Volume = $1.0'' (9.59)/12 = 0.80 \text{ acre-feet}$; or a 0.20 acre-foot reduction

² If the disconnected area is large enough, the Credit could meet the full Recharge and Water Quality Volumes required by Standards 3 and 4.

Percent Reductions Using Rooftop Disconnection Credit:

- Required Recharge Volume $R_v = (0.22 - 0.016) / 0.22 = 0.927 = 92.7\%$ Reduction
- Required Water Quality Volume = $(1.0 - 0.8) / 1.0 = 0.20 = 20.0\%$ Reduction

CREDIT NO 3: ROADWAY, DRIVEWAY OR PARKING LOT RUNOFF DIRECTED TO QUALIFYING AREA

Credit is given for practices that direct runoff from impervious roads, driveways, and parking lots to pervious areas where plants provide filtration (through sheet flow) and the ground provides exfiltration. This credit can be obtained by grading the site to promote overland vegetative filtering. This credit is available for paved driveways, roads, and parking lots associated with all land uses, except for high-intensity parking lots that generate 1,000 or more vehicle trips per day or runoff not segregated from Land Uses with Higher Potential Pollutant Loadings (LUHPPL).

Disconnected impervious areas can be subtracted from the site impervious area when computing the *Required Water Quality Volume*. In addition, disconnected impervious surfaces can be used to reduce the *Required Recharge Volume* as determined by calculating the *Required Recharge Volume: R_v* using the "Static" Method and the *Recharge Area Requiring Treatment: Rea* using the Percent Area Approach (See above example for Credit 2 - disconnection of rooftop runoff).

Minimum Criteria for Credit - The credit is subject to the following restrictions:

- The maximum contributing impervious flow path length shall be 75 feet.
- The length of the qualifying pervious area must be equal to or greater than the length of the contributing impervious area.
- The width of the qualifying pervious area shall be no less than the width of the contributing impervious surface. For example, if a driveway is 15 feet wide, the qualifying pervious area width shall be no less than 15 feet.
- The entire qualifying pervious area shall be on a slope less than or equal to 5.0%.
- The impervious area draining to any one discharge location cannot exceed 1,000 ft²;
- Qualifying pervious areas should be located on relatively permeable soils (HSGs A and B). A soil evaluation is required to confirm the soil type. The soil evaluation shall also confirm that the depth to groundwater is 2 feet or more, and that the long term *saturated hydraulic conductivity* of the soil is at least 0.17 inches/hour (see Soil Evaluation section in Stormwater Handbook Vol. 3, Ch. 1). For *saturated hydraulic conductivity*, use Rawls Rates for the actual location where the qualifying pervious area is located.
- In less permeable soils (HSGs C), the water table depth and permeability shall be evaluated by a Registered Professional Engineer to determine if a spreading device is needed to sheet flow stormwater over vegetated surfaces.
- For those non-rooftop areas draining toward land under water (e.g., stream) or vegetated wetlands, the end of the flow path length must be at least 50 feet from the edge of a vegetated wetland or bank,
- To prevent compaction, construction vehicles must not be allowed to drive over the qualifying pervious area. If compacted, the soil must be amended, tilled, and revegetated once construction is complete to restore its infiltrative capacity.
- Ponding of water directed to the qualifying area is not permitted.
- The Operation and Maintenance Plan required by Standard 9 must include measures to inspect the qualifying pervious area at least yearly for evidence of ponding, sediment deposition, and vegetation dieback. The Plan shall incorporate measures to remove any deposited sediment (e.g., sand from winter sanding operations), address any ponding, and replant any vegetation that has died (such as vegetation impacted by road salt applied during the winter). The Plan shall also include measures to replace any eroded soil from the qualifying pervious area. The Operation and Maintenance Plan shall not allow sealcoats containing coal-tar emulsions. The Operation and Maintenance Plan must

address how future scarifying and repaving operations will be conducted to ensure that stormwater contaminated during repaving operations will not detrimentally impact regulatory wetland areas and buffer zones.

- Runoff from driveways, roadways and parking lots may be directed over soft shoulders, through curb cuts, or level spreaders to qualifying pervious areas. Measures must be employed at the discharge point to the qualifying pervious area to prevent erosion and promote sheet flow.
- The flow path through the qualifying pervious area shall comply with the setbacks established for structural infiltration Best Management Practices (e.g., 50 feet away from any septic system components including soil absorption systems, 50 feet from vegetated wetlands, bank, and land under water.)
- The qualifying pervious area may not include any wetland resource areas other than Riverfront and Lands Subject to Flooding. Where a portion of the Buffer Zone is proposed to serve as part of the qualifying pervious area, the qualifying pervious area shall not extend into the inner 50 feet of the Buffer Zone.
- The qualifying pervious area must be owned or controlled (e.g., drainage easement) by the property owner.
- In locations where information is submitted during the public hearing or introduced by the Conservation Commission that there is a demonstrated history of groundwater flooding, the credit may not be used.

REFERENCES FOR CREDITS:

Center for Watershed Protection, 1998, Better Site Design: A Handbook for Changing Development Rules in Your Community. Ellicott City, MD.

Center for Watershed Protection, No date, Stormwater Design Manual Builder, Site Design Credits, Ellicott City, MD
http://www.stormwatercenter.net/Manual_Builder/Credits/SITE/Site%20Design%20Credits%20Intro.htm

Council T.B. et al, 2004, Tire-Wear Particles as a Source of Zinc to the Environment, Environmental Science and Technology, Vol. 38, pp. 4206-4214, WEB:
<http://tx.usgs.gov/coring/pubs/zinc%20and%20tires.pdf>

Georgia, State of, 2001 (First Edition), Georgia Stormwater Management Manual, Volume 2: Technical Handbook, Stormwater Better Site Design, Section 1.4, WEB: <http://www.georgiastormwater.com/vol2/1-4.pdf>

Lacey, J. and R. Arendt 1990. An Examination of Market Appreciation for Clustered Housing with Permanently Protected Open Space. Center for Rural Massachusetts, Amherst, MA.

Mahler, B.J., Metre P.C., Bashara T.J., Wilson, J.T., and Johns D.A., 2005, Parking Lot Sealcoat: An Unrecognized Source of Urban Polycyclic Aromatic Hydrocarbons, Environmental Science and Technology, Vol. 39, pp. 5560 – 5566, WEB:
<http://tx.usgs.gov/coring/pubs/parking%20lot%20sealants.pdf>

Maryland Department of the Environment, 2000, [Maryland Stormwater Design Manual, Volume I](#), Stormwater Credits for Innovative Site Planning, Chapter 5, WEB:
<http://www.mde.state.md.us/assets/document/chapter5.pdf>

Massachusetts Division of Conservation Services, 1991, Massachusetts Conservation Restriction Handbook. WEB: <http://www.mass.gov/envir/dcs/restrictions/default.htm>

Massachusetts Executive Office of Environmental Affairs, 2006, Smart Growth Toolkit, *Appendix A*, WEB: http://www.mass.gov/envir/smart_growth_toolkit/bylaws/LID-Bylaw.pdf

Minnesota Pollution Control Agency, Minnesota Stormwater Manual, Applying Stormwater Credits to Development Sites, Chapter 11, <http://www.pca.state.mn.us/publications/wq-strm9-17.pdf>

New Jersey Department of Environmental Protection, 2006, New Jersey Stormwater Best Management Practices Manual DRAFT revision, Development Design Credits and Total Suspended Solids Removal Criteria, Chapter 3, WEB: http://www.state.nj.us/dep/watershedmgt/DOCS/BMP_DOCS/chapter3.PDF

Puget Sound Action Team, 2005, Low Impact Development Technical Guidance Manual for Puget Sound, Washington Department of Ecology Low Impact Development Design and Flow Modeling Guidance, Chapter 7, WEB: http://www.psat.wa.gov/Publications/LID_tech_manual05/07_guidance.pdf.

Schueler, Thomas, 1994. The Importance of Imperviousness, *Watershed Protection Techniques*. 1:100-111, Center for Watershed Protection

Union County, Pennsylvania, 2003, Subdivision & Land Development Ordinance, Ordinance 2003-3, Stormwater Credits for Effective Site Planning, Appendix O, WEB: http://www.seda-cog.org/union/lib/union/appendix_o_-_stormwater_credits.pdf

Van Metre, P.C. and Mahler, B.J., 2003, The Contribution of Particles Washed from Rooftops to Contaminant Loading to Urban Streams, *Chemosphere*, Vol. 52, pp. 1727-1741, WEB: <http://tx.usgs.gov/coring/pubs/rooftops%20Chemosphere.pdf>

Vermont Agency of Natural Resources Geological Survey, 1999, Watershed Hydrology Protection and Flood Mitigation Project Phase II – Technical Analysis, Stream Geomorphic Assessment

Vermont Agency of Natural Resources, 2002 (5th Printing), Vermont Stormwater Management Handbook, Stormwater Treatment Standards, Section 3, WEB: http://www.vtwaterquality.org/stormwater/docs/sw_manual-vol1.pdf

Washington State Department of Ecology, 2005, Stormwater Management Manual for Western Washington, Volume III, Hydrologic Analysis and Flow Control Design/BMPs, WEB: <http://www.ecy.wa.gov/pubs/0510031.pdf>

Washington State Department of Ecology, Western Washington Hydrology Model (WWHM) VERSION 2.0, WEB: http://www.ecy.wa.gov/programs/wq/stormwater/wwhm_training/wwhm/wwhm_v2/instructions_v2.html