# **APPENDICES:**

- A. STREET DESIGN AND CONSTRUCTION STANDARDS
- B. STORMWATER MANAGEMENT AND EROSION CONTROL
- C. CRITERIA FOR DETERMINING REGIONAL IMPACT

# APPENDIX A: STREET STANDARDS

#### A. PURPOSE AND INTENT

The purpose of these standards is to provide design and construction guidance for both existing and new streets, whether public or private. These standards reflect the most up-to-date technical standards available at this time, as well as design standards that are intended to provide not only safe and efficient streets, but also streets that contribute to a sense of neighborhood and livability.

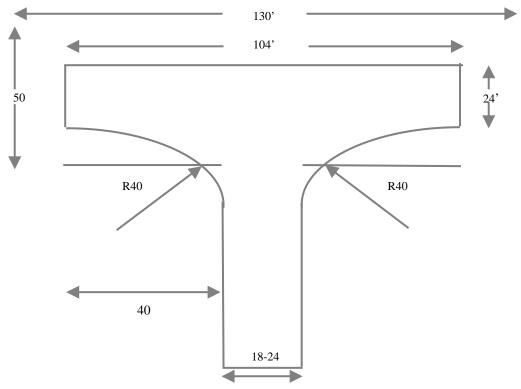
#### **B. GENERAL DESIGN STANDARDS**

(1) GENERAL STREET PLAN. Approval of the general development street plan is required before construction of any phase of the plan. The street plan shall conform to References (1), (3), and (6) except as described at the end of this document. Any other variation shall be justified by engineering judgment and approved by the Board.

# (2) STREET LAYOUT.

- General. All subdivisions shall have adequate provision for a safe and suitable access to a Class V or better road, or shall make provisions for the construction and dedication of a Class V or better road, to obtain safe and suitable access to the subdivision. Where the Board determines an existing access street to be substandard, it may require the upgrading of said street. Where traffic from a proposed subdivision will adversely impact a nearby street or intersection, provisions shall be made for the mitigation of said impacts. Proposed streets shall be of suitable location, width, grade, and improvement to accommodate prospective traffic and afford satisfactory access to police, fire fighting, emergency equipment, snow removal, sanitation, and road maintenance equipment. The arrangement and character of all streets in a subdivision shall conform to the Master Plan, and any and all other Town regulations, and shall compose a safe and convenient system in relation to other existing and planned streets, to topographic conditions, and to the proposed uses of land to be served by the street. Existing stonewalls shall be retained where possible or relocated and restored as required by the Board.
- <u>Access</u>. No subdivision shall be approved unless the property to be subdivided shall have frontage on from an existing Class V or better road, or a private road approved by the Planning Board. Each lot shall have a safe, independent and direct access.
- Arrangement. Streets shall be laid out so as to intersect at right angles as nearly as possible. No street shall intersect another street at less than 60 degrees. Streets shall be continuous and in alignment with existing streets as much as possible. All streets shall be integrated with the existing and proposed street system where possible. The Applicant shall provide for a circular terminus at the end of all proposed roads for all phases and situations where through streets are not provided in the design. Where extension of existing roadways is proposed, the existing turnaround shall be removed in its entirety.
- (3) DEAD-END (HAMMERHEAD) STREETS. Except where near-future connections may be probable, dead-end streets shall be avoided whenever possible. Said streets shall not exceed 600 feet, and shall be constructed according to the graphic on the following page. No other dead-end streets are permitted off of a dead-end street. Consideration shall always be given to potential future connections and, when a street cannot feasibly be connected to an existing street, every attempt shall be made to provide a loop road rather than a dead-end road.

Figure #1: Hammerhead Design



- (4) STREET NAMES. All streets shall be named to comply with the provisions of the "Enhanced 911 System" (RSA 106-H: 2 and RSA 106-H: 10), and shall be subject to the approval of the Fire Department and Selectmen.
- (5) STREET SIGNS. The location and type of sign to be installed shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD).
- (6) STREET LIGHTS. Street lights shall be provided if required by the Board.

## C. CONSTRUCTION STANDARDS

- (1) RIGHT-OF-WAY. The minimum width of right-of-way shall be 50 feet. A greater width may be required to construct roads and ditches of the widths as described in the attached "Geometric Cross Section Design." The Board may require greater right-of-way width where, in its judgment, the width is warranted due to present or future demands.
- (2) HIGHWAY RIGHT-OF-WAY BOUNDS. Highway bounds, of a type approved by the Board, shall be installed at each point of curvature (PC), point of tangent (PT), and changes in property at all intersection of streets, at all points of change in direction and at any other points the Board may deem necessary to designate the street lines.

#### • Type

a. Stone or Concrete Bounds shall be of concrete or stone, not less than thirty-six (36) inches in length, not less than four (4) inches square or five (5) inches in diameter, and marked on top with a cross, brass plug, iron rod, or other durable material securely imbedded.

b. Iron Pipes shall be at least thirty-six (36) inches long and seven-eights (7/8) inch in diameter or square.

## • <u>Location</u>

- a. Bound Locations. The external boundaries, rights-of-way lines, block corners, etc. of a subdivision shall be monumented on the field by bounds. These bounds shall be placed not more than 1,400 feet apart in any straight line and at all corners, at each end of all curves, at the point a curve changes its radius, at all angle points in any line, said points to be not less than twenty (20) feet from the bank of any river or stream.
- b. Iron Pipe Locations. The lines of all lots and any other points not monumented by bounds shall be monumented by iron pipes. Those iron pipes located along rivers and streams shall be located along the meander line.
- <u>Placement</u>. Bounds shall be set flush with finished grade. No permanent bounds shall be set until all construction that would disturb or destroy the monuments is completed. All bounds shall be set under the direction of a registered professional engineer or a registered land surveyor.

#### (3) ALIGNMENT AND GRADES. See Table #1.

- Exception. Where, in the opinion of the Board, and where it has been demonstrated to the satisfaction of the Board by the Applicant that adherence to the maximum grade specified in Table 1 will cause local streets to be constructed in what the Board considers to be excessive cuts or fills, a waiver from the above specified maximum grade may be granted, provided:
  - a. The maximum allowable grade is eight percent (8%);
  - b. The maximum length of such grade, measured between vertical points of intersection (PVI) is five-hundred (500) feet; and
  - c. No other such slope greater than six percent (6%) occurs within five-hundred (500) feet measured along the centerline of the road from PVIs.
- (4) PEDESTRIAN AND BICYCLE ACCESS. The Board may require construction of sidewalks for pedestrian access to schools, parks, shopping areas and transit stops or where population density and/or traffic volume conditions are such that the Board determines the construction of sidewalks to be prudent. In commercial and industrial districts, sidewalks may be required on both sides of the street. In residential districts, sidewalks may be required on one side of the street. Where the Board determines that a sidewalk is not practical, an area within the right-of-way will be kept clear of obstructions to allow for pedestrian and bicycle travel. Where practical, pedestrian and bicycle access within and between adjacent development should be provided.
- (5) BASE COURSE. The road base course shall be of suitable materials, and at least the widths and thicknesses indicated in the attached "Geometric Cross Section Design" (Figure #2). Crushed gravel shall conform to Pay Item 304.3 in State Specification Section 304. Gravel shall conform to Pay Item 304.2 in State Specification Section 304, except that the maximum size stones shall be 3 inches. All other provisions of State Specification Section 304 are part of these standards.
- (6) ASPHALT SURFACE. Where designated in the attached "Geometric Cross Section Design," "Asph. Surf Treated" surfaces shall be a two-layer Bituminous Surface Treatment in accordance with State Specification Section 410. "Hot Mix" surfaces shall be Hot Bituminous Pavement in accordance with State Specification Section 403. Widths and thicknesses shall be at least as indicated in "Geometric

Cross Section Design." At least a 44-foot wide pavement is required in areas where on-street parking is expected on both sides of the travel way. Angle parking is not allowed.

- (7) GRAVEL SURFACE. In cases of very low traffic volumes, defined herein as up to 50 vehicles per day, where the Board determines an asphalt surface is not required, the total usable roadway width may be a minimum of 18 feet with two feet of shoulders. Provision for a wider section should be considered to allow for future upgrading to an asphalt surface as recommended above. The gravel-wearing course shall conform to State Specification 304.2, except that the maximum size stones shall be 1½ inches. All other provisions of State Specification Section 304 are part of these standards.
- (8) GRAVEL SHOULDERS. Gravel shoulders, and their base courses, shall be at least the depths, widths, and thicknesses indicated in the attached "Geometric Cross Section Design." Gravel shall conform to State Specification 304.33. All other provisions of State Specification Section 304 are part of these standards.
- (9) BRIDGES. Bridges, as defined by State Law (RSA 234:2), are structures of 10.0 feet or greater clear span, and shall be designed to MS- 18 (HS-20) loading (AASHTO Specifications). The minimum roadway width shall be 24 feet Bridges shall be designed by a professional engineer, and constructed in accordance with that design.
- (10) ENVIRONMENTAL IMPACTS AND PERMITS. The Applicant shall be responsible for determining the applicability of any and all environmental regulations that apply to this project, for acquiring the necessary permits, for taking whatever action is necessary to comply with applicable regulations and permits, and, if necessary, for terminating the necessary permits. The applicable work could include, but not be limited to:
  - Any fill, dredge, excavation, etc that impacts wetlands or other jurisdictional areas;
  - All temporary and permanent measures and treatment devices necessary. to prevent erosion and control sediment during and after construction;
  - Any construction activity proposed to disturb, one (1) or more acre of land, as defined by US EPA National Pollutant Discharge Elimination System program.
  - Any disturbance of more than 100,000 square feet of terrain (50,000 sq. feet. if within the protected shoreland) as defined by NHDES rules for a "Site Specific" permit.
- (11) UTILITIES. Utility poles should be kept close to the right-of-way line, in no case closer than the ditch back slope and always well back of a curb. Water and sewer mains should be constructed outside the surface area, and preferably outside the ditch line.

#### D. PRIVATE ROADS

Private roads may be approved by the Planning Board, as allowed by the Zoning Ordinance, if the application meets the following criteria:

- (1) The application must be for a residential development.
- (2) A neighborhood association must be formed, consisting of all owners of properties that are accessed by the private road(s). The association shall have the responsibility of all repairs, maintenance and plowing of said roads and the responsibility for the repair and maintenance of the associated drainage system. The neighborhood association documents shall specifically state that the Town of Greenfield assumes no responsibility or liability for maintenance or repair of the private roads; that in the event that the homeowners wish to have the town take over the road(s), the neighborhood association is

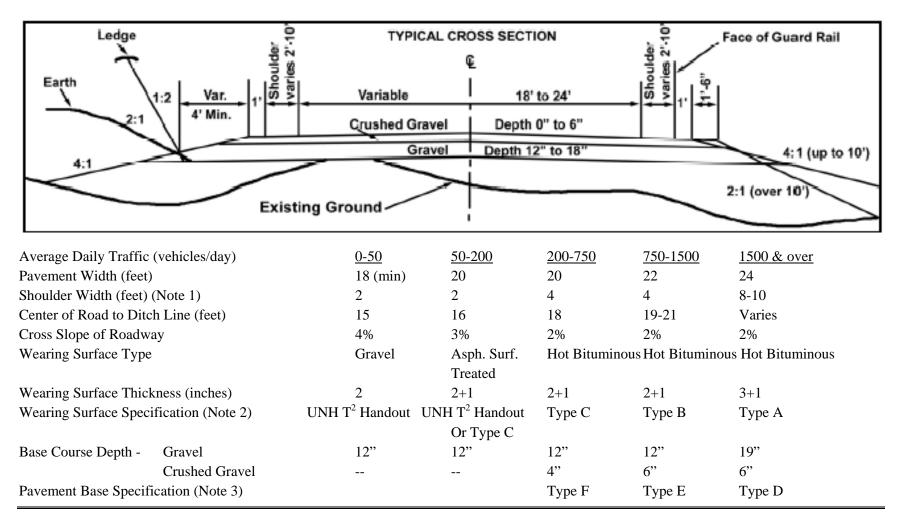
responsible for the total cost of rebuilding the road to meet the road construction specifications as stated in the Subdivision Regulations in effect at that time and that the town will not take action on the request until the improvements have survived one winter to the satisfaction of the Planning Board or its designee. No private road shall be approved by the Planning Board until Town Counsel has reviewed and approved the contents of the legal documents for the neighborhood association.

- (3) All private roads shall have access from public roads and internal circulation shall be designed to provide for vehicular and pedestrian safety and convenience, emergency and fire equipment, snow clearance and delivery and collection services. If necessary, turnout areas shall be provided to allow passing room for large vehicles. Parking shall be provided on each lot.
- (4) Private roads shall be constructed according to the standards of this section; however, the Planning Board may waive or modify these standards, as allowed by Article VII, B. of this Regulation.
- (5) Private roads shall be posted as such.

Table #1: Roadway Geometric Design Standards

<b>Note:</b> All standards should be considered minimums, except as otherwise noted.	Average Daily Traffic (vehicle trips per day)		
	0 - 200	200 - 1500	1500 and over
Right-of-way Width	50 feet	50 feet	60 – 80 feet
Traveled way Width	18 - 20 feet	20 - 22 feet	24 feet
Shoulder Width	2 feet	3 feet	4 - 10 feet
Minimum Grade	1%	1%	1%
Maximum Grade	8.0%	8.0%	8.0%
Maximum Grade within 100 feet of Intersections	2.0%	2.0%	2.0%
Angle of Intersection	75	75	75
Centerline Radii	200 feet	200 feet	300 – 600 feet
Intersection Radii: 0 – 200 ADT 200 – 1500 ADT 1500 and over ADT	30 feet 30 feet 30 feet	30 feet 30 feet 30 feet	30 feet 30 – 50 feet 50 feet
Rate of Super Elevation (Use AASHTO Chart)	.04 feet	.04 feet	.08 feet
Rate of Super Elevation through intersection	.04 feet	.04 feet	.04 feet
Cross Slope of Pavement	2%	2%	2%
Slope of Shoulder	5%	5%	5%

Figure #2: Geometric Cross Section Design Elements



Notes: 1. Gravel surface should be paved where steep grades occur.

- 2. For average daily traffic over 1,000 vehicles/day, paved shoulders should be considered.
- 3. "Type" is defined in Section 401 of NHDOT Standard Specifications for Road and Bridge Construction.

#### **APPENDIX A-1:**

#### STREET CONSTRUCTION INSPECTION SCHEDULE

The following is an inspection schedule for construction of all streets and roads in the Town of Greenfield. An inspection shall be performed for each item and documented by the Town's Engineer or designated representative, as part of an inspection checklist.

- 1. Pre-construction conference with the Town's Engineer, contractor, developer and Town Public Works Director.
- 2. Review of design engineer's layout and wetlands marking.
- 3. Inspection of clearing and grubbing and erosion control measures.
- 4. Inspection of fill placement. In place compaction testing of fill is required every 1,000 cubic yards, or as directed by the inspector:
- 5. Inspection of drainage piping and buried utilities. Full time inspection is required including the trench backfilling.
- 6. Inspection of subgrade and slope work.
- 7. Inspection of gravel grade. Compaction testing of the gravel course is required every 200 linear feet of roadway.
- 8. Inspection of crushed gravel grade. Compaction testing of the crushed gravel course is required every 200 linear feet of roadway.
- 9. Inspection of final ditch work, slope work, landscaping and erosion control measures.
- 10. Inspection of headwall construction.
- 11. Inspection of binder course paving. Full time inspection will be performed during the paving. After the binder course pavement and all work required prior to that point has been completed, the developer can request, in writing, a reduction of the roadway bond. The exact amount of the bond reduction is to be determined by the Planning Board.
- 12. Remaining work inspection by the Developer and Inspector.
- 13. Final walk through inspection by the Planning Board, Board of Selectmen and Town Engineer
- 14. Follow up inspection.

# APPENDIX B: STORMWATER MANAGEMENT AND EROSION CONTROL REGULATION

#### A. GENERAL

The purpose of this regulation is to control runoff and soil erosion and sedimentation resulting from site construction and development of one acre or greater. Subdivision and site plans shall include plans for managing stormwater and controlling erosion and sedimentation as provided below.

#### **B. DEFINITIONS**

- (1) Best Management Practice (BMP): A proven or accepted structural, non-structural, or vegetative measure the application of which reduces erosion, sediment, or peak storm discharge, or improves the quality of stormwater runoff.
- (2) Critical Areas: Disturbed areas of any size within 50 feet of a stream, bog, waterbody, or poorly or very poorly drained soils; 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.
- (3) Development: Any construction or land construction or grading activities other than for agricultural and silvicultural practices.
- (4) Disturbed Area: An area where the natural vegetation has been removed exposing the underlying soil, or vegetation has been covered.
- (5) Erosion: The detachment and movement of soil or rock fragments by water, wind, ice, or gravity.
- (6) Highly Erodible Soils: Any soil with an erodibility class (K factor) greater than or equal to 0.43 in any layer as found in Table 3-1 of the "Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire."
- (7) Project Area: The area within the subdivision or site plan boundaries.
- (8) Sediment: Solid material, either mineral or organic, that is in suspension, is transported, or has been moved from its site of origin by erosion.
- (9) Stabilized: When the soil erosion rate approaches that of undisturbed soils. Soils that are disturbed will be considered protected when covered with a healthy, mature growth of grass or a good covering of hay or straw mulch (2 tons/acre). Mulch is only a temporary measure; ultimately, the site needs vegetation.
- (10) Stormwater Runoff: The water from precipitation that is not absorbed, evaporated, or otherwise stored within the contributing drainage area.
- (11) Stream: Areas of flowing water occurring for sufficient time to develop and maintain defined channels but 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.

### C. APPLICABILITY

The applicant shall submit a stormwater management and erosion control plan to the Planning Board for

any tract of land being developed or subdivided, where one or more of the following conditions are proposed:

- (1) A cumulative disturbed area exceeding one acre.
- (2) Construction or reconstruction of a street or road.
- (3) A subdivision of more than three building lots.
- (4) Disturbed critical areas.

# D. MINIMUM REQUIREMENTS

- (1) The Planning Board may waive the requirement for all or part of a stormwater management and erosion control plan if it determines that a plan is unnecessary because of the size, character, or natural conditions of a site.
- (2) All requests for waivers and action thereon shall be made in writing by the applicant with supporting technical documentation to demonstrate minimal environmental impact.
- (3) The following minimum requirements apply to all projects, regardless of size:
  - (i) Site drawing of existing and proposed conditions:
  - (a) Locus map showing property boundaries
  - (b) North arrow, scale, date
  - (c) Property lines
  - (d) Easements
  - (e) Structures, utilities, roads and other paved areas
  - (f) Topographic contours
  - (g) Critical areas
  - (h) Surface water and wetlands, drainage patterns, and watershed boundaries
  - (i) Vegetation
  - (j) Soils information for design purposes or for determining highly erodible soils shall be determined from a National Cooperative Soil Survey (NCSS) soil series map. A High Intensity Soil Map of the site, prepared in accordance with SSSNNE Special Publication No. 1, can only be used for design purposes and not for determining highly erodible soils.
  - (k) Temporary and permanent stormwater management and erosion and sediment control BMPs
  - (1) Areas and timing of soil disturbance
  - (m) A schedule for the inspection and maintenance of all BMPs
- (ii) Narrative section including discussion of each measure, its purpose, construction sequence, and installation timing as they apply to the site.

## E. DESIGN STANDARDS

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

- (1) All measures in the plan shall meet as a minimum the Best Management Practices set forth in the "Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire," Rockingham County Conservation District, NH Department of Environmental Services, Soil Conservation Service (now the Natural Resources Conservation Service), August 1992, as amended.
- (2) Whenever practical, natural vegetation shall be retained, protected or supplemented. The stripping of vegetation shall be done in a manner that minimizes soil erosion.
- (3) Appropriate erosion and sediment control measures shall be installed prior to soil disturbance.
- (4) The area of disturbance shall be kept to a minimum. Disturbed areas remaining idle for more than 30 days shall be stabilized.
- (5) Measures shall be taken to control erosion within the project area. Sediment in runoff water shall be trapped and retained within the project area using approved measures. Wetland areas and surface waters shall be protected from sediment.
- (6) Off-site surface water and runoff from undisturbed areas shall be diverted away from disturbed areas where feasible or carried non-erosively through the project area. Integrity of downstream drainage systems shall be maintained.
- (7) Measures shall be taken to control the post-development peak rate of runoff so that it does not exceed pre-development runoff for the 2-year, 24-hour storm event and for additional storm event frequencies as specified in the design criteria of the "Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire."
- (8) Priority should be given to preserving natural drainage systems including perennial and intermittent streams, wetlands, swales, and drainage ditches for conveyance of runoff leaving the project area.
- (9) All temporary erosion and sediment control measures shall be removed after final site stabilization. Trapped sediment and other disturbed soil areas resulting from the removal of temporary measures shall be permanently stabilized within 30 days unless conditions dictate otherwise.

# F. COMPLETED APPLICATION REQUIREMENTS

The Planning Board shall require each of the following in the final plan unless the project is deemed of minimal impact.

- (1) Construction drawings
  - (a) Existing and proposed conditions:
    - (i) Locus map showing property boundaries
    - (ii) North arrow, scale, date
    - (iii) Property lines
    - (iv) Structures, roads, utilities, earth stockpiles, equipment storage, and stump disposal
    - (v) Topographic contours at two-foot intervals

- (vi) Critical areas, stockpile and staging areas
- (vii) Within the project area and within 400 feet of project boundary surface waters, wetlands, and drainage patterns and watershed boundaries
- (viii) Vegetation
- (ix) Extent of 100-year flood plain boundaries if published or determined
- (x) Soils information for design purposes from a National Cooperative Soil Survey (NCSS) soil series map or a High Intensity Soil Map of the site, prepared in accordance with SSSNNE Special Publication No. 1. Highly erodible soils shall be determined by soil series.
- (xi) Easements
- (xii) Areas of soil disturbance
- (xiii) Areas of cut and fill
- (xiv) Areas of poorly or very poorly drained soils including any portion to be disturbed or filled
- (xv) Location of all structural, non-structural, and vegetative stormwater management and erosion control BMPs
- (xvi) Identification of all permanent control BMPs
- (xvii) Tabulated sequence of construction

## (b) Other plan requirements:

- (i) Construction schedule
- (ii) Earth movement schedule
- (iii) A proposed schedule for the inspection and maintenance of all BMPs
- (iv) Description of temporary and permanent vegetative BMPs including seeding specifications
- (v) Description of all structural and non-structural BMPs with detailed drawings of each as appropriate

## (2) Report section including:

- (a) Design calculations for all temporary and permanent structural control BMP measures
- (b) A proposed schedule for the inspection and maintenance of all BMPs
- (c) Identification of all permanent control measures and responsibility for continued maintenance
- (d) Drainage report with calculations showing volume, peak discharge, and velocity of present and future runoff
- (e) When detention structures are planned to reduce future condition peak discharge the soil cover complex method shall be used to compute the runoff volume and peak discharge for designing the structure. The design will conform to the criteria outlined for those types of structures given in the "Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire".

## G. RESPONSIBILITY FOR INSTALLATION/CONSTRUCTION

- (1) 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.
- (2) The Planning Board may require a bond or other security in an amount and with surety conditions satisfactory to the Board, providing for the actual construction and installation of such measures within a period specified by the Planning Board and expressed in the bond or the surety.
- (3) Site development shall not begin before the stormwater management and erosion control plan receives conditional approval. Best Management Practices shall be installed as designed and scheduled as a condition of final approval of the plan.

## H. PLAN APPROVAL AND REVIEW

- (1) The Planning Board shall indicate approval of the stormwater management and erosion control plan, as filed, if it complies with the requirements and objectives of this regulation. Such approval shall be a component of subdivision or site plan approval. If disapproved, a list of plan deficiencies and the procedure for filing a revised plan will be given to the applicant.
- (2) Technical review of any stormwater management and erosion control plan prepared under this regulation shall be reviewed by a qualified professional consultant, as determined to be appropriate by the planning board, at the expense of the applicant.

# I. MAINTENANCE AND INSPECTION

- (1) A narrative description of on-going maintenance requirements for water quality measures required by stormwater management and erosion and sediment control plans after final planning board approval shall be recorded on the deed to the property on which such measures are located. The description so prepared shall comply with the requirements of RSA 478:4-a.
- (2) The purpose of this article is to enact locally the administrative and enforcement procedures set forth in RSA 676 of the existing planning and land use statutes.
- (3) The planning board may require routine inspections to verify on-going maintenance of water quality protection measures. Such inspections shall be performed by the designated agent at reasonable times to the landowner. Any costs incurred by inspections will be borne by the landowner.
- (4) If permission to inspect is denied by the landowner, the designated agent shall secure an administrative inspection warrant from the district or superior court under RSA 595-B.

# APPENDIX C: CRITERIA FOR DETERMINING REGIONAL IMPACT

Impact Criteria shall include, but not be limited to, the following items. These shall in no way be considered exhaustive, but rather guidelines for the Board to follow in making a determination of impact within the Region.

- A. RESIDENTIAL DEVELOPMENT: Proposals for lots or dwellings that would increase the existing housing stock of the town by more than 25%.
- **B.** COMMERCIAL DEVELOPMENT: Proposals for new or expanded space of 50,000 square feet or greater.
- C. INDUSTRIAL DEVELOPMENT: Proposals for new or expanded space of 100,000 square feet or greater.

#### D. OTHER FACTORS TO BE CONSIDERED:

- 1. Proximity to other municipal boundaries.
- 2. Traffic impacts on the regional road network.
- 3. Potential effect on groundwater, surface water and wetlands that transcend municipal boundaries.
- 4. The potential to disturb or destroy a significant or important natural environment or habitat.
- 5. The necessity for shared public facilities such as schools or solid waste disposal.
- 6. Anticipated emissions such as light, noise, smoke, odors, or particulates.
- 7. The potential for accidents that would require evacuation of a large area.
- 8. The generation and/or use of any hazardous materials.