Town of Milton, MA
Street Design and Parking Lot Guidelines: Feasibility of Green Infrastructure

MS4 PERMIT COMPLIANCE

Milton Department of Public Works
525 Canton Avenue, Milton MA 02186

2022

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Introduction

In 1987, the US Environmental Protection Agency (EPA) amended the Clean Water Act to require a two-phased national program to address water pollution from stormwater. Phase I, promulgated in 1990, addressed stormwater discharges in approximately 900 of the nation's largest cities. Phase II regulations were published in the Federal Register in 1999. The Phase II regulations require operators of municipal separate storm sewer systems (MS4s) located in urbanized areas with populations of fewer than 100,000 people to obtain a NPDES permit for their stormwater discharges. In Massachusetts, permits are issued jointly by EPA Region 1 and the Massachusetts Department of Environmental Protection (MassDEP).

In 2003, EPA Region 1 issued its Final General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MA Small MS4 General Permit). Milton was included under this permit's coverage as a Small MS4 operator in an urbanized area (as determined by US Census data). This permit expired on May 1, 2008 but remains in effect for authorized operators until the 2016 permit reauthorizes operators under new conditions.

EPA issued the 2016 Massachusetts Small MS4 General Permit in 2016 with an effective date of July 1, 2017. Due to multiple requests for judicial review of the permit, the EPA determined that justice would require postponement of the effective date until July 1, 2018. In order to remain consistent with EPA policy, MassDEP also postponed the permit's effective date to July 1, 2018.

Under the guidelines of the US EPA and MassDEP, the entire Town of Milton is an automatically designated MS4 area and the town must obtain a Phase II permit.

More information about the Massachusetts Small MS4 General Permit may be found at https://www.epa.gov/npdes-permits/massachusetts-small-ms4-general-permit.

The 2016 Massachusetts Municipal Separate Storm Sewer Systems (MS4) General Permit regulates discharges to stay in compliance with the Clean Water Act. The Town of Milton falls under the National Pollutant Discharge Elimination System (NPDES) Phase II Rule, meaning a small MS4 with a population less than 100,000. The 2016 MS4 Permit which came into effect on July 1, 2018, requires permittees to implement Best Management Practices (BMPs) for six minimum control measures. The Town of Milton has been executing its 2003 NPDES Phase II obligations for fifteen years and served as the e base for the expanded 2018 SWMP. Some of these measures include:

- Public Education and Outreach – maintenance of a stormwater page on the town website; television programming about stormwater education; partnerships with the Neponset River Watershed Association to assist with river cleanups and provide other technical assistance.

- Illicit discharge detection and elimination – regulatory oversight by the Health Department to ensure compliance with Title 5 regulations; removal of sewer underdrains; maintenance of town-wide GIS drainage map; digital recording of catch basin cleanings and conditions
- Construction site runoff control – Stormwater ordinance that requires sediment and erosion controls; cluster development regulations
- Post-construction runoff control – Planning Board rules and regulations require the Statement of Development Effect to include estimated increase of peak runoff caused by altered surface conditions, and methods to be used to return water to the soil
- Pollution prevention/good housekeeping – the Town sweeps all streets twice per year; follows smart salting procedures; holds a household hazardous waste drop-off day annually for residents; and replaces street trees when trees are removed. In addition, the Town passed a stormwater bylaw and regulations that created a stormwater utility to fund NPDES compliance.

More information about Milton's previous stormwater programming is available at https://www.townofmilton.org/stormwater-management/pages/npdes-annual-reports

Permit Requirements

According to section 2.3.6.b and c of the General MS4 Permit,

"b. Within four (4) years of the effective date of this permit, the permittee shall develop a report assessing current street design and parking lot guidelines and other local requirements that affect MA MS4 General Permit 47 the creation of impervious cover. This assessment shall be used to provide information to allow the permittee to determine if changes to design standards for streets and parking lots can be made to support low impact design options. If the assessment indicates that changes can be made, the assessment shall include recommendations and proposed schedules to incorporate policies and standards into relevant documents and procedures to minimize impervious cover attributable to parking areas and street designs. The permittee shall implement all recommendations, in accordance with the schedules, contained in the assessment. The local planning board and local transportation board should be involved in this assessment. This assessment shall be part of the SWMP. The permittee shall report in each annual report on the status of this assessment including any planned or completed changes to local regulations and guidelines.

c. Within four (4) years from the effective date of the permit, the permittee shall develop a report assessing existing local regulations to determine the feasibility of making, at a minimum, the following practices allowable when appropriate site conditions exist: i. Green roofs; ii. Infiltration practices such as rain gardens, curb extensions, planter gardens, porous and pervious pavements, and other designs to manage stormwater using landscaping and structured or augmented soils; and iii. Water harvesting devices such as rain barrels and cisterns, and the use of stormwater for non-potable uses. The assessment should indicate if the practices are allowed in the MS4 jurisdiction and under what circumstances are they allowed. If the practices are not allowed, the permittee shall determine what hinders the use of these practices, what changes in local regulations may be made to make them allowable, and provide a schedule for implementation of recommendations. The permittee shall implement all recommendations, in accordance with the schedules, contained in the assessment. The permittee shall report in each annual report on its findings and progress towards making the practices allowable. (Information available at: EPA NPDES Water Permit Program and MAPC Low Impact Development Toolkit.

Regulation Assessment

Regulations consulted that address impervious cover in Milton were Subdivision Rules and Regulations (denoted as RR), Zoning Bylaws amended in 2009 (ZB), Zoning Bylaws amended in 2017 Unofficial Planning Board Edition (ZBU), and Massachusetts State

Plumbing Code. Also consulted were the Chapter 21 Stormwater Bylaw and Milton Stormwater Utility Regulations, which address excavation and impervious cover for fee purposes.

The regulations were assessed in two ways. The Neponset River Watershed Association used the Local Bylaw and Regulation Assessment Tool developed by MassAudubon to rate regulations in three levels: conventional, better, and best. The Town in conjunction used the Pioneer Valley Planning Commission checklist to complete the code review assessment. The key areas of assessment were the overall site design, the project design and layout standards in relation to Low Impact Development (LID), and maintenance and operations or mechanisms for enforcement.

Review of Regulations

SUBDIVISION REGULATIONS

Street and Roadway Standards

The minimum right of way width is not to be less than 50 feet (RR 6.6.10). Street cross sections must only provide one typical cross section and do not require how elements of a right of way might vary contextually (RR 7.4.1). Clearing within the right of way is not limited. Street shade trees are required at the developer's expense on each side of every street. They must be a minimum of 12 feet tall and 3 inches wide (RR 7.4.6.3).

Parking lanes are never mentioned to be allowed to serve as traffic lanes. Narrower pavement widths are not mentioned or reductions in frontage distances to increase number of homes and minimize street length. Developers are not encouraged to explore alternative street layouts in code. Permeable pavement is at the discretion of the developer and not codified. Streets must take into account the existing terrain and landscape and not have extreme cuts or fills (ZB VI.J.15.B.c).

Utilities

Utilities are allowed to be placed under the paved section of the right of way but must be inspected by the Board or a representative (RR 10.7) (Appendix A).

Cul-de-Sacs

Dead ends are not discouraged by regulations. Landscaped and bioretention islands are allowed (but not in code) in the center of the cul-de-sac, however the minimum radius must be 50' (RR 6.1.12). Cul-de-sacs fall under the definition of a dead end street, which included any street that only has one public vehicular access whether it ends in a circle or cul-de-sac, an intersection with streets that have no other access, a loop, or any other configuration with only one public access (RR 6.1.12).

Sidewalks

Sidewalks of width 4'6" are mostly required on both sides of the street unless it is waived (RR 7.4.5.1). Permeable pavement is at the discretion of the developer and not codified. Alternative pedestrian network layouts are not mentioned in the regulations, however there is no strict restriction on placement in the right of way. Sidewalks are not mentioned as being attached to the stormwater system of curbs and gutters.

Curbs

Curbs are set to the standards in "Standard Specifications for Highways and Bridges", which are required on both sides of all roadways. Along with catch basins and manholes they must be located as required to control runoff and surface flow accumulation (RR 8.3).

Soil Permeability

Regulations require a description of the estimated increase of peak runoff and methods used to avoid increase in runoff (RR 11.6.1.7). While regulations do not require retaining the same infiltration characteristics that already existed, they do require a description of methods used to control erosion and sedimentation including any areas subject to flooding or ponding (RR 11.6.1.1).

Stormwater

Drainage systems are installed for the adequate disposal or surface and subsurface water. It is necessary to be applicable to a 100-year storm. Addressed in the regulations are pipe materials and width, catch basins and curb inlets, and continuity of systems (RR 8.0). Zoning bylaws also require Flood Plain Districts to be designed to minimize flood damage and reduce exposure to flood hazards by providing adequate drainage (ZB IV.C.4.c).

Green Infrastructure Feasibility

Green roofs are permitted by the Building Department provided that they are structurally sound. Rain gardens, curb extensions, planter gardens, and other stormwater management designs are not mentioned in any regulations but are allowed on a residential basis. Water harvesting is acceptable however Milton follows MA State Plumbing Code for all potable and non-potable uses, which requires exceptions to have special permission by the Board (248 CMR 10 7.J.2).

ZONING

Residence AA districts are defined as greater than 80,000 square foot lots, A districts are defined with greater than 40,000 square foot lots, B indicates greater than 20,000 square feet, and C indicates greater than 7,500 square feet. No building in these districts may be commercial, manufacturing, or shopping related. D districts are those lots set for the elderly with more than 100,000 square feet with development covering less than 25% of the lot. D1 is for elderly or handicapped with greater than 20 acres, and D2 is greater than 25 acres.

Parking Ratios

There are no parking maximums in the zoning code, however the minimum requirements vary on type of parcel. Parking is based on lot size and not proximity to alternate methods of transportation. Parking is required to address drainage and wetland areas. Trees and other landscaping are required for screening if there is more than 25,000 square feet of parking on one parcel of land (ZB VII.H). The minimum requirement for business, banks, and professional offices is one parking space per 250 square feet of gross floor (ZB VII.C.2). Theaters, restaurants, and other miscellaneous uses require a specification from the Board of Appeals to deem the appropriate number of parking (ZB VII.C.5). Housing for elderly will have one space per unit, and parking for elderly or handicapped will have one space

per two units (ZB VII.I.1). Detached one family dwellings of districts AA, A, and B must have 2 parking spots, while C districts must have 1 spot. Religious areas, municipal areas, and mixed areas have site specific requirements (ZB VII.B).

Parking Lots and Driveways

The standard parking space must be 8.5' in width and 19' in length, unless there is a planted space that allows for overhang. Parallel parking spaces on aisles or driveways must be 22 feet in order to not require movement of other cars in order to move in and out of the space (ZB VII.G.4, VII.G.5). Off-street parking *may* be designed with up to 25% of the lot to be used by compact cars which would be denoted as 8' by 16'. Residence D districts only may have common driveways (ZB VI.I.2.c).

Dimensions and Density

Clustering of buildings and greater protections of open space areas are included in the Great Estate Planned Unit Development (ZB III.Q), Cluster Developments (ZB VI.J), Attached Cluster Developments (ZB VI.K), and Condominium Conversion (ZB VI.L). The submittal and review requirements for these developments are greater than conventional developments and must be obtained through special permit.

Setbacks have required minimums based on parcel size. Residences AA, A, and D require 30-foot setbacks, B requires 25 feet, and C requires 20 feet. Frontages also have minimums based on districts with AA, A, and D1 requiring 150 feet of frontage, B requiring 100, and C requiring 75. D districts minimum frontage must be greater than 50 feet and D2 must be greater than 300 (ZB VI.B).

Landscaping

Based on usage of the site the Board of Appeals may impose conditions to protect the area against erosion, lack of drainage, lack of lateral support, changes in surface water runoff, and impairment of ability to support plant life. These conditions may include method of removal, times of operation, transportation routes, specifications of excavation, slope steepness, distance between modifications and adjacent properties or ways, drainage both permanent and temporary, posting of a security bond, establishment of permanent ground levels or grades, boulders and tree stump dispositions, permanent establishment of not less than six inches of topsoil over the site, and permanent planting of the area to suitable cover (ZB IV.A.4)

Development Policies in Zoning Regulations

Certain special permits refer to stormwater regulations. Open space includes open vegetated areas, landscaped areas, and areas left in their natural conditions which could apply to bioretention areas and constructed wetlands. Cluster Developments are encouraged to preserve as much of the existing terrain as possible, along with the trees and landscaping (ZBU SP 15.VI.J.B).

Open Space Residential Design in Cluster Developments

Open Space is under special permit (ZBU Special Permit 15.VI.J). Most developable land is zoned residential (ZBU SP 15.VI.J.3). At least 35% of the total land area of these Cluster Developments are residential and 35% of the non-wetland area (ZBU SP 15.VI.J.9). Cluster Developments can only be constructed on parcel sizes 5-10 acres. Open Land may be owned by the Town of Milton, conservation non-profits, or a corporation or trust. When the Open Land is not conveyed to the Town of Milton it is granted and recorded as a perpetually open and natural state (ZBU SP 15.VI.J.12). The dimensional standards of an open space cluster development is specified to be less than for a standard subdivision (ZBU SP 15.VI.J.4). The quality of the open space conserved may be considered as encouraging low impact design in that developers must include specific identification of natural features of which site design must take into account and identify on plans (ZBU SP 15.VI.J.15.B). Unless the open land required in cluster developments is owned by the Town or open to public use, no more than 20% is able to be used for non-commercial outdoor recreational purposes. Underground utilities, septic systems, and structures or pipes are subject to approval by the Board of Health but can be allowed. Temporary storm drainage may be approved by the Planning Board, as can structures to increase the usability such as lights, benches, etc. (ZBU SP 15.VI.J.8).

OTHER CODES

Board of Health

Subsurface sewage disposal systems are regulated up to 10,000 gallons at the local level, at which point the DEP takes over responsibility. Title 5 requirements apply to all septic systems. Stormwater reusage for non-potable uses is under the Massachusetts Plumbing Code.

Wetland Bylaws

The Wetland Protection Act requirement of a 100-foot buffer zone is used as standard.

Municipal Policies and Programs

The municipality has constructed and maintained several best management practices (BMPs) over the years. One BMP has been constructed behind the police station at 40 Highland Street. Another is as of 2022 being pursued behind the Colicott/Cunningham School and will be constructed in the near future based on future MS4 guidelines. Additionally, the Town requires stormwater management for any development that increases runoff from the site. Milton works with the Neponset Stormwater Partnership to fulfill the requirements of MS4 permit section 2.3 to provide information to homeowners describing rainwater harvesting and stormwater management techniques. The Engineering Department hopes to include an array of BMP options associated with future reconstruction of roads.

Recommendations

Recommendations are based on those of the assessment methods to encourage and require low impact development processes in the Town of Milton. This would increase the use of natural methods of stormwater management.

SUBDIVISION REGULATIONS

Street and Roadway Standards

Requirements for right of way widths are less useful than using considerations of context and the effective use of the right of way or road width. The Town has different types of roads that will have different needs. MassAudubon recommends wide, medium, narrow, and alley categories with 20-24' the widest for 2 travel lanes, 18-20' for low traffic residential neighborhood plus 2' shoulders. Street cross sections can do the same by accommodating modes of transportation with objectives of reducing impervious surfaces to improve stormwater management. Minimizing clearing within the right of way (along with specification that the tree belt can be used for stormwater management and bioretention areas) will help to encourage developers to use LID methods.

Permeable pavement in road shoulders, parking lanes, and sidewalks as compatible with the Americans with Disabilities Act is desirable for minimizing the impervious right of way. Exploring alternate street layouts to increase the number of homes per unit length to minimize the length of the roadways should also be encouraged.

Cul-de-Sacs

Reducing the number of dead ends and keeping the Town connected is key especially for non-vehicular transportation and emergency response time. When a dead end or cul-de-sac is built, the turnaround island should serve as a stormwater bioretention area.

Sidewalks

For lower density areas sidewalks would not be needed on both sides. Permeable pavement should be in the rules and regulations as an option. Planning for pedestrian utility by connecting common areas and shared open spaces rather than parallel to the road would be best.

Curbs

Curbs and gutters do not need to be required if street standards can allow for LID stormwater approaches such as swales or other BMPs with criteria for proper design.

Soil Permeability

The site design process should include soil erosion with sedimentation control measures at a minimum. If possible, require minimization of site disturbance, reduction of construction waste, written procedures for site inspection, and enforcement of the same.

Post-construction could require the area to resemble pre-existing conditions of volume, velocity, quality, and location as nearly as possible as well as require LID to the maximum extent possible.

Green Infrastructure Feasibility

Green roofs, water harvesting, infiltration practices, and the use of green infrastructure should be promoted as, at minimum, a written option within the subdivision regulations. This could include a site analysis checklist to maximize design of LID strategies. The best management for rooftop runoff is to require directing clean roof runoff to landscaped or naturally vegetated areas capable of absorption and/or infiltration. With these plans a stormwater management operation and management plan is highly recommended.

ZONING

Parking

Codes relating to parking can be inspired by the Massachusetts Smart Parking Model Bylaw, which seeks to reduce the standards for required parking, provide innovative solutions for shared and off-site parking, and address parking area design. Parking maximums will prevent surplus spaces which creates unnecessary development and generates more vehicle trips. Banks, businesses, and offices are separated into the parking schedule. This model Bylaw should be incorporated as much as possible into Town development.

Dimensions and Density

Setback areas could explicitly allow stormwater management practices. Regulations that allow reduction in frontages would allow for reduced paved areas. Small minimums of frontage and area, or a flexible lot size, would individualize lots and ensure efficient and applicable use.

Landscaping

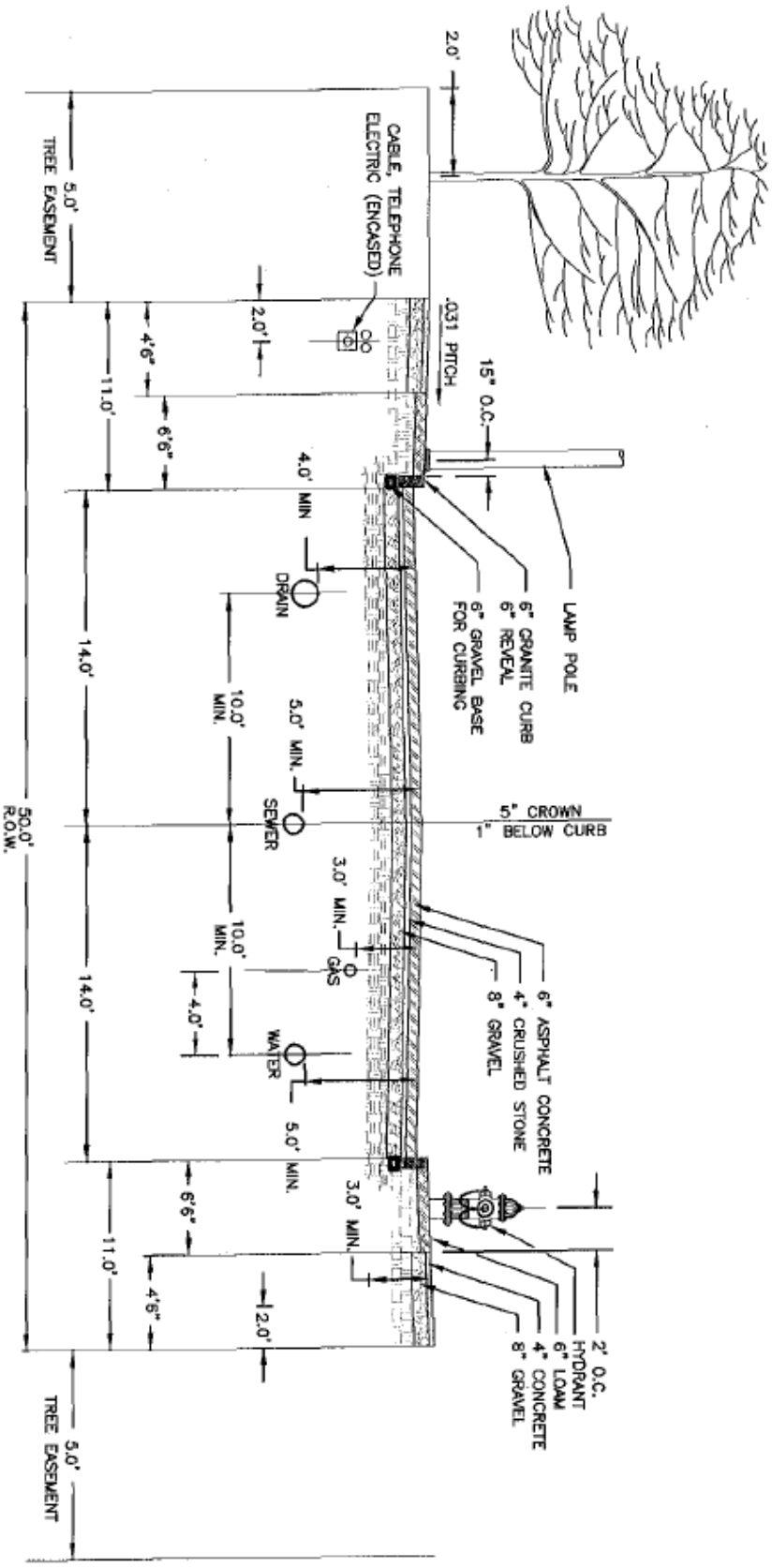
A minimum of 75% of vegetation and trees should be native species. Impervious cover limits tailored to the community and district type will benefit the stormwater systems. Allowing easy siting of LID features on common open space or road right of ways would increase likelihood of these features being implemented.

Open Space Residential Design in Cluster Developments

Mandatory open space regulations ensure larger areas of natural stormwater management. Best practice of the minimum required open space is greater than 75%. Required contiguity of open space would enable wildlife movement as well as dispersed stormwater infiltration. This open space should be monitored by the Town or a conservation organization at specific intervals.

Appendix

APPENDIX A
TYPICAL 50' ROADWAY CROSS SECTION DETAIL



TYPICAL 50' ROADWAY CROSS SECTION DETAIL

NOT TO SCALE

APPENDIX B
SMART PARKING MODEL BYLAW

Smart Parking Model Bylaw

The following bylaw provisions for implementing smart parking strategies are designed to address three distinct issues relative to off-street parking: 1) Reducing the standards for required parking; 2) Providing innovative solutions for shared and off-site parking; and 3) Parking area design.

The language for reducing parking requirements relies on two strategies. The first is to establish maximum parking requirements that closely mirror or are slightly less than what many communities use as their minimum parking requirements. The second strategy is to provide a minimum parking requirement that is anywhere from 20-80% of the maximum depending on the associated use. Using a minimum and maximum effectively creates a range of acceptable parking requirements thereby providing the development community a chance to be more flexible and efficient in their design.

The language provided in this bylaw for shared parking uses three strategies. The first focuses on opportunities to share parking between competing and non-competing uses on the same site (mixed use). The second strategy focuses on locating parking off-site on other privately owned lots or public parking facilities. Finally, language for using a "fee-in-lieu" approach is also included for those communities serious about using private contributions to support public parking facilities, programs, and strategies.

Parking lot design considerations are divided into two categories with the thought that some communities would be primarily interested in aesthetic improvements while others would be more interested in implementing aesthetic improvements along with Low Impact Development (LID) techniques to reduce stormwater runoff and associated water contamination. The model bylaw therefore provides two distinct sets of standards depending on what a community wishes to accomplish in regard to parking lot design. This particular model bylaw structure requires LID implementation, but allows an applicant to demonstrate that LID techniques are not feasible under certain physical constraints.

In the parking lot design provisions, this bylaw uses Site Plan Review as the primary review mechanism. These provisions can be used in conjunction with an existing Site Plan Review process in any community as long as the triggers for the review are consistent. In this model, development of more than 10 parking spaces requires Site Plan Review.

DEFINITIONS:

Angled Parking: Any parking space that is not parallel or perpendicular to the curb or aisle.
Bikeway: Any road, street, path, or way, all of a portion of which is in some manner specifically designated for bicycle travel, regardless of whether such facilities are designed for the exclusive use of bicycles or are to be shared with other transportation modes.
Large Scale Retail: Single retail sales facility that has greater than 20,000 square feet of gross floor area and is contained in a single building.
BMPs (Best Management Practices): structural, vegetative, or managerial practices designed to treat, prevent, or reduce degradation of water quality due to stormwater runoff and snow-melt.
Free Standing Retail: Single retail sales facility of up to 20,000 square feet in size that is situated independently on a building lot and for which associated parking serves exclusively that facility.
Greenscapes: a developed landscape that incorporates a compilation of practices to reduce water usage, encourage groundwater recharge, protect water supplies and reduce stormwater pollution.
Gross Floor Area: The total floor area of a building.
Impervious Surface: A ground cover such as cement, asphalt, or packed clay or rock through which water cannot penetrate.
Indoor Recreation Facilities: Uses such as bowling alleys, billiard parlors, and skating rinks.
Industrial Plant: Structure or complex of structures used for manufacturing, assembling, fabricating, warehousing, and related activities.
Low Impact Development: An approach to environmentally friendly land use planning. It includes a suite of landscaping and design techniques that attempt to maintain the natural, pre-developed ability of a site to manage rainfall. LID techniques capture water on site, filter it through vegetation, and let it soak into the ground where it can recharge the local water table rather than being lost as surface runoff.
Mixed Use: A development that provides multiple compatible uses in close proximity to one another. It also refers to a land use pattern that seeks to increase concentrations of population and employment in well-defined areas with a mix of diverse and compatible land uses.
Off-Street Parking: Parking spaces provided outside of the right-of-way of a street or highway.
On-Street Parking: Parking spaces provided within the right-of-way of a street or highway.
Outdoor Recreation Facilities: Uses such as golf courses, amusement parks, miniature golf courses, and water slide parks.
Parking Area: That portion of a lot set aside, marked, posted, or intended for parking. This includes circulation areas, loading and unloading areas, parking spaces and aisles, landscaped areas, bikeways, and walkways.
Parking Stall or Space: A space in which a single car may be parked.

Personal Services: Establishments primarily engaged in providing services involving the care of a person or a person's personal goods or apparel. This category includes uses such as barber shops, beauty salons, shoe repair shops, and dry cleaners.
Pervious Surface: Ground cover through which water can penetrate at a rate comparable to that of water through undisturbed soils.
Shared Parking: When parking spaces are shared among different structures or uses, or among mixed uses, and can include properties with different owners.
Sight Distance: The distance visible to a driver from his/her position to other objects or vehicles, when at a point of turning or when stopping a vehicle.
Travel Lane: The driving portion of the parking area. The aisle provides access to each space.
Walkway: Any path or way, which is specifically designated primarily for pedestrian travel.

These definitions can be added in the body of this section or can be incorporated into the larger "Definitions" section found in most bylaws/ordinances.

1. Purpose

The purpose of this Article is to establish standards ensuring the availability and safe use of parking areas. It is intended that any use of land involving the arrival, departure, or temporary storage of motor vehicles, and all structures and uses requiring the delivery or shipment of goods as part of their function, be designed and operated to:

A. Promote traffic safety by assuring adequate places for storing of motor vehicles off the street, and for their orderly access and egress to and from the public street;
B. Prevent the creation of surplus amounts of parking spaces contributing to unnecessary development and additional generation of vehicle trips, resulting in traffic congestion and traffic service level deterioration on roadways;
C. Reduce hazards to pedestrians and increase pedestrian connectivity between and within sites;
D. Reduce unnecessary amounts of impervious surface areas from being created;
E. Protect adjoining lots and the general public from nuisances and hazards such as:

    1) noise, glare of headlights, dust and fumes resulting from the operation of motor vehicles;
    2) glare and heat from parking lots; and
    3) lack of visual relief from expanses of paving.

F. Increase the mobility and safety for bicyclists; and
G. Reduce other negative impacts such as carbon output.

2. Applicability

No building permit or certificate of occupancy shall be issued for the erection of a new building, the enlargement or increase in the net floor area of an existing building, the development of a use not located in a building, or the change from one type of use to another, unless off-street parking spaces, loading bays and bicycle parking are provided in accordance with this bylaw.

3. Off-Street and On-Site Parking Calculations

Calculations for off-street parking requirements may involve two basic calculations. First, a baseline number of parking spaces shall be calculated in accordance with the parking schedule found in Section 5. Second, the number of off-street parking spaces and/or on-site spaces required under Section 5 may be reduced through any individual technique or combination of techniques found in Section 6. Proposed reductions in the baseline number of spaces to be provided off-street and/or on-site may be approved or required by the Planning Board in connection with the approval of a Site Plan under [INSERT LOCAL SITE PLAN REVIEW SECTION REFERENCE] and Section 4.

This model is designed to be used with a relatively comprehensive administrative Site Plan Approval process applicable to all or nearly all non-residential and mixed use developments.

4. Site Plan Review Standards for On-Site Parking

To ensure the overall efficiency of parking development in [CITY/TOWN/DISTRICT] Applicants proposing more than [ten (10)] spaces associated with non-residential, residential or mixed-use developments shall include with their applications for Site Plan Approval under [INSERT EXISITNG SITE PLAN REVIEW SECTION REFERENCE] an analysis of the opportunities to reduce parking requirements using any of the applicable reduction strategies in Section 6, the design specifications in Section 7, and landscaping design standards pursuant to Section 8. The Planning Board may approve these submittals according to the following provisions:

A. The Planning Board shall require the maximum reduction available under Section 6.A. unless it determines that:

   1) A surplus of spaces on a particular site will benefit the District as a whole by providing off-site sharing opportunities for other sites in the District; or
   2) The techniques for reduction of the number of off-street or on-site parking spaces available to the applicant are infeasible or would impose an undue hardship on the applicant.

B. The Planning Board shall require that all applicable design criteria are followed for LID Parking Area Design as defined in Sections 8.B of this

bylaw unless it determines, upon petition from the applicant, that the successful implementation of a LID Parking Area Design is infeasible or would impose an undue hardship on the applicant. Where the Planning Board determines that LID Parking Area Design is infeasible, applicant shall comply with those specifications for Conventional Parking Area Design listed in Subsection 8.A. Evidence that may be used by an applicant to demonstrate the infeasibility of implementing LID techniques on a site may include, without limitation:

1) The presence of subsurface geologic conditions such as ledge or large quantities of poor fill;

2) Applicant does not own existing lot to be used for off-site parking allowances;

3) The presence of soil contamination; and/or

4) Existing topography or site geometry.

5. Baseline Number of Required Parking Spaces

Parking requirement calculations shall be made in the amounts specified in the Parking Schedule per 1,000 square foot (sf) of Gross Floor Area (GFA) unless otherwise indicated. Where mixed use developments are proposed, the baseline parking requirement shall be calculated as the sum of the requirements for each use. Reductions in the overall number of required off-street on-site spaces can be calculated using the standards in Section 6 of this bylaw.

Parking Schedule

Land Use	Maximum	Minimum
Bank	3	2
Large Scale Retail	4	2
Drive-Thru Restaurant	6	2
Free Standing Retail	3	1
General Office Building	4	2
Industrial Plant	2	1
Medical Office Building	8	2
Nursing Home	3	2
Restaurants	10	6
Shopping Centers	4	3

Bed and Breakfast	1.2 spaces per guest room or suite	1 space per guest room or suite
Personal Services	3	2
Day Care Centers	1 space per 4 children at max. capacity	1 space per 8 children at max. capacity
Churches and Places of Worship	1 space per 3 seats in portion of the building used for services	1 space per 5 seats in the portion of the building used for services
Museums and Libraries	2	1
Social, Fraternal Clubs and Organizations	4	3
Public and Private Educational Institutions	1 space per 3 seats in the classroom	1 space per 5 seats in the classroom

Provision of all off-street parking areas shall comply with the latest standards associated with the Americans with Disabilities Act (ADA).

The table above is by no means an exhaustive list of parking requirements as they relate to various land uses. Indeed, many communities have several pages of minimum parking standards in their Zoning Bylaws to account for the wide variety of uses in their Land Use Table. The table should provide a representative sampling of the more common land uses and how they might apply a minimum and maximum value. The most important issues illustrated in the Table above are:

1. *Providing a range of parking requirements allows developers to apply their experience with a particular use to the permitting process. Many developers will welcome the chance to build a smaller number of spaces as this can significantly increase the development potential of their site.*
2. *Providing a maximum number of parking spaces keeps developers from creating enormous surpluses of parking and associated impervious surfaces.*
3. *The minimum parking requirements that many communities use today often represent the maximum amount of parking a particular use could ever need. Today's parking requirements are therefore using "worst case" scenarios to design for everyday needs. Communities should feel confident in using many so-called "minimum" standards as a maximum and, subsequently, using 1/3 to 1/2 of that number for the new minimum value as a rule of thumb.*

6. Special Off-Street Parking Provisions

A. Shared Parking

1) Shared On-Site Parking

To implement shared on-site parking, the applicant shall provided analyses as part of Site Plan Review to demonstrate that proposed uses are either competing or non-competing.

a) Non-competing Uses. In mixed-use developments, applicants may propose a reduction in parking requirements based on an analysis of peak demands for non-competing uses. Up to [75%] of the requirements for the predominant use may be waived by the Planning Board if the applicant can demonstrate that the peak demands for two uses do not overlap. An applicant may use the latest peak demand analyses published by the Institute of Traffic Engineers (ITE) or other source acceptable to the [Planning Board].

Peak use analysis is a common technique for determining if proposed uses in a mixed use context can share parking. The specificity of these analyses can differ depending on how precise the permitting authority wishes to be. An example of a more sophisticated approach can be found in the Zoning Ordinance for the City of Lowell (http://www.lowellma.gov/depts/dpd/permitting).

b) Competing Uses. In mixed-use developments, applicants may propose a reduction in parking requirements where peak demands do overlap. In these cases, the Planning Board may reduce the parking requirements of the predominant use by up to [30%].

2) Off-Site Parking

Separate from, or in conjunction with Shared Parking provisions, an applicant may use off-site parking to satisfy their parking requirements. As part of Site Plan Review, the applicant shall provide the necessary information to comply with the following standards:

a) Off-site parking shall be within [five hundred (500)] feet of the property for which it is being requested.

Standards for how far away off-site allowances should be will differ depending on existing conditions and the political climate of a particular municipality. Typical values in existing codes range from 350 to 1,000 feet.

b) Off-site parking may only be provided if the off-site lot has an excess number of spaces or if the applicant can demonstrate that the on-site and off-site uses have non-competing peak demands.

c) The amount of required parking spaces being reduced on-site shall be equal to the amount being provided off-site and can account for up to 100% of the minimum required on-site parking.

d) Off-site parking spaces provided by a separate private property owner shall be subject to a legally binding agreement that will be presented to the Planning Board during the Site Plan Review process or as a condition of approval. If the conditions for shared parking become null and void and the shared parking arrangement is discontinued, this will constitute a zoning violation for any use approved expressly with shared parking. The applicant or property owner must then provide written notification of the change to the Zoning Enforcement Official and, within 60 days of that notice, provide a remedy satisfactory to the Commission to provide adequate parking.

e) Off-site parking provided by means of a public parking facility shall be limited to [50%] of the overall parking requirement [for daytime peak uses].

The amount of public parking allowed to count toward private requirements will be a direct function of the community's capacity to provide that parking. If a community has plans to develop a parking structure, then this percentage could be as high as 100%. If public parking is limited to a few small pocket lots throughout a district, then this number will need to be much lower.

f) On-street parking spaces that [intersect or] are completely contained within the frontage of the property may be counted toward the minimum parking requirements.

g) Uses sharing a parking facility shall provide for safe, convenient walking between uses and parking, including safe, well marked pedestrian crossings, signage, and adequate lighting.

B. Fees-In-Lieu of Parking

If the [CITY/TOWN/DISTRICT] has established a Reserve Account or Revolving Fund to be used for expenses (land acquisition,

design/engineering services and construction costs, but not maintenance costs) related to adding parking spaces, improving the utilization of existing parking spaces, or reducing the need for new parking to serve the [CITY/TOWN/DISTRICT], an applicant may pay a fee-in-lieu of parking space development for a portion or all off-street on-site parking. The fee to be paid shall be [$2,000] per parking space, and shall be paid into such Fund.

This technique for providing fees-in-lieu of parking is generally best suited to an existing downtown or village center. This approach offers an alternative to providing parking on-site and thus facilitates the infill development of oddly shaped or constrained lots. The funds accumulated through fees-in-lieu of parking can be used for construction of strategically located parking lots that best meet the overall downtown or village center needs as opposed to meeting parking needs for one business at a time.

The primary benefit of this system is the enhanced ability of the community to incorporate parking into the downtown or village center in a manner that is consistent with desired goals for the character of the area. In addition, there is a greater level of municipal control over the cumulative area of impervious parking surface in the community. The challenges associated with this technique include the need for a coordinated parking plan for the community to make use of the accumulated fee, and uncertainty about when a municipal parking facility can be constructed. It may be that the development providing a fee-in-lieu of parking will have an immediate need that cannot be met by existing parking available or planned for near term construction elsewhere.

An additional challenge to this strategy is that municipal finance laws impose strict limits on the circumstances in which receipts may be dedicated to special accounts without appropriation by the city's or town's legislative body. In the case of revolving funds established under G.L. c. 44, § 53E½, the fund must be reauthorized annually. For that reason, the above provision is written to be inoperative unless there is an authorized special revenue fund in place at the time of the application.

7. Parking Lot Design

A. Compact Cars

Applicant may design up to 30% of their parking spaces for compact cars in accordance with the dimensions listed in Section 7.B of this bylaw. Compact car spaces shall be grouped together to the greatest possible extent in areas clearly designated for compact cars. Parking lots shall have a system of signs beginning at the entrance that clearly indicates the location of compact car spaces.

B. Parking Space and Travel Lane Dimensions

For the purposes of this bylaw, minimum parking space width shall be measured perpendicular to the center line of the parking space. For standard cars the minimum parking space width shall be nine (9) feet. For compact cars, the minimum parking space width shall be eight (8) feet. Travel lanes and associated module widths shall conform to the following minimum standards;

Parking Angle	Parking Stall Width[1]		Travel Lane (one way)		Travel Lane (two way)	
	Standard Space	Compact Car	Standard Space	Compact Car	Standard Space	Compact Car
Parallel	9’	8’	12’	12’	24’	22’
45°	18’	16’	14’	12’	24’	22’
60°	21’	17.5’	16’	14’	24’	22’
75°	22’	19’	19’	16’	24’	22’
90°	20’	17’	22’	19’	24’	22’

[1] Measured from the inner most point on the parking space centerline perpendicular to the edge of the Travel Lane.

The requirements for parking lot design included here are drawn from professional publications and common requirements found in a wide range of existing zoning regulations. Many bylaws and subdivision codes researched for this model included several specifications for angles of parking not included above. Although adding angles (e.g. 30, 55, 70, etc.) may provide some site specific benefits, engineering practices have demonstrated that 90-degree and 60-degree are generally the most efficient configurations.

The ratio of parking space angles to aisle widths and flow are drawn from The Parking Handbook for Small Communities (J. Edwards, National Trust for Historic Preservation, 1994). The specifications in the zoning regulations for parking lot design should be accompanied by language under the section on Site Plan requirements requiring the applicant to show all proposed parking lot design features on the site plan including surface types, all parking space and aisle dimensions and slope, access drives, landscaping, stormwater management system, sidewalks, bicycle access and parking, handicap parking, loading areas, and transit stop areas.

8. Landscaping Standards for Parking Lot Stormwater Management:

Landscaping is required for all parking lots and may be designed in one of two ways as related to stormwater management pursuant to the requirements in Section 4: 1) Low Impact Development (LID) Parking Area Design; or 2) Conventional Parking Area Design. LID Landscaping Plans shall denote a drainage design where [75% or more] of

the [first half inch] of stormwater runoff from impervious surfaces is treated for water quality by a combination of LID techniques in accordance with the most recent version of the *Massachusetts DEP Stormwater Management Manual*. Conventional Parking Area Design shall denote a parking lot landscape design that does not meet the criteria for LID Parking Area Design.

Acceptable LID techniques shall include vegetated swales, rain gardens or bioretention facilities, permeable pavers, infiltration facilities and constructed wetlands. Cisterns and grey water systems that recycle stormwater runoff may also be included in these calculations.

For parking areas that will contain fewer than [ten (10)] spaces, compliance with the design standards set forth in this bylaw shall be determined by the Zoning Enforcement Officer.

A. Conventional Parking Area Design Standards

The landscaping requirements in this section are intended to provide a baseline set of standards toward reducing the visual impacts of large areas of pavement, improving the overall environment or parking areas by providing areas for shade and heat reduction, and enhancing the overall aesthetic appeal of parking areas. The following standards shall apply to all Conventional Parking Lot Design as defined in this bylaw.

1) Amount. Developments with proposed parking areas of [ten (10)] spaces or more shall provide a minimum of 10% of the total parking area as landscaped open space.

2) Buffers. Landscaping shall be required between non-residential uses or mixed use developments and existing or future residential development areas. Buffer zones shall be a minimum of [twelve (12) feet] in width and shall substantively screen the site from view through the use of evergreen vegetation at least six feet in height. Fences may be used as part of screening but shall not include chain link fences. These requirements shall not apply to non-residential or mixed use development that are designed to integrate existing or future neighboring residences into the site through the use of walkways, bicycle paths or other pedestrian amenities.

3) Parking Lot Entrances. Parking lot entrances shall be landscaped minimally with a combination of trees and shrubs. These areas may also be used for signage in compliance with [INSERT REFERENCE TO SIGNAGE SECTION OF BYLAW]. No trees or shrubs shall be planted in a way to obstruct sight lines of motorists.

4) Parking Aisles. The ends of parking aisles that are more than [fifteen (15) spaces] in length shall incorporate landscape islands at either end of the row. Where the length of parking aisles exceeds [twenty-five (25)] spaces, an intermediary landscaped island shall be installed a regular intervals. This interval shall not be more than every [thirteen (13)] spaces. Landscape islands used at the end of parking aisles shall enclose. The width of landscaped islands at their ends shall not be less than [four (4)] feet and not less than [eight (8)] feet at their midpoint.

5) Plant Selection. No tree, shrub or plant shall be proposed for use within a parking area that has been identified as an Invasive Species by the Massachusetts Plant Advisory Group in the latest version of *The Evaluation of Non-Native Plant Species for Invasiveness in Massachusetts (with annotated list),* has been identified as invasive or banned on the *Massachusetts Prohibited Plant List* as periodically updated by the Massachusetts Department of Agricultural Resources, or in any other reputable scientific publication that may be acceptable to the Board. All size and location design elements shall comply with the following specifications:

a) Shade or canopy trees shall be three (3) inches DBH with a height of not less than twelve (12) feet above grade;
b) Small or minor shade trees shall be two and one-half (2.5) inches DBH with a height of not less than nine (9) feet above grade;
c) Ornamental or flowering fruit trees shall be two (2) inches DBH with a height of not less than seven (7) feet above grade;
d) Evergreen trees used for screening shall be not less than six (6) feet in height above grade. Fencing may be used in conjunction with vegetated screening [but chain link fence shall not be allowed];
e) Shrubs shall be not less than one and one-half (1.5) feet in height above grade.
f) Turf may be used but shall not be installed in strips less than six (6) feet in width.

B. LID Parking Area Design Standards

The purpose of these standards is provide the Zoning Enforcement Officer or the parties involved with Site Plan Review the opportunity to review plans for a lower impact approach to managing stormwater in parking areas. The following information is therefore required of an applicant choosing to treat any portion of a parking lot with LID stormwater management techniques. This information

shall be prepared by a Massachusetts registered Professional Engineer and shall comply with the design and implementation guidelines provided in the latest version of the *Massachusetts DEP Stormwater Management Manual.* Where portions of the parking lot are not using acceptable LID techniques, the standards for Conventional Parking Lot Design in Section 8.A shall apply.

1) Delineation of all drainage areas inclusive of areas outside of the parking envelope that will contribute stormwater runoff to the parking area;

2) Proposed topography at two-foot contour intervals;

3) Site Plan showing drainage pathways and locations of proposed BMPs;

4) Typical profiles of BMPs;

5) Sizing calculations for BMPs that demonstrate adequate conveyance and/or water quality treatment of the [first half inch of stormwater runoff from impervious surfaces];

6) Sizing calculations for BMPs that illustrating proposed management of runoff resulting from 2-year, 10-year, and 100-year event;

7) List of plantings associated with vegetated BMPs;

8) Location of areas reserved for snow storage;

9) Location of any screening between residential and non-residential properties. Buffer zones shall be a minimum of [six (6) feet] in width and shall substantively screen the site from view through the use of evergreen vegetation at least six feet in height. Fences may be used as part of screening but shall not include chain link fences. These requirements shall not apply to non-residential or mixed use development that are designed to integrate existing or future neighboring residences into the site through the use of walkways, bicycle paths or other pedestrian amenities.

10) Location of test pits, depth to seasonal high ground water and soil percolation rates for those areas designated for recharge;

11) Schematic diagrams of any gray water or cistern systems proposed for the parking area;

12) An Operation and Maintenance (O&M) Plan shall be submitted by the applicant to the Zoning Enforcement Officer or the [Planning Board] that conforms to the standards for O&M Plans detailed in the most recent version of the *Massachusetts DEP Stormwater Management Manual.*

The LID requirements listed above are designed to mirror the Massachusetts stormwater policy. It should be noted that the Massachusetts Stormwater Policy requires the first one inch of runoff to be treated in critical areas such as drinking water supply zones or recharge areas to shellfish beds. Depending on where these standards are being applied, the language of the bylaw may need to reflect this increased level of treatment.

It should be noted that the LID requirements deal almost exclusively with plan submittal requirements and far less with aesthetic standards than the conventional standards in Section 8.A. This approach acknowledges that overly-prescriptive landscaping standards may make it difficult for engineers to site vegetative BMPs while trying to comply with the standards listed in the bylaw. Engineers need the flexibility to optimally site LID practices in way that maximizes their capture of sheet flow and enhances their overall effectiveness. These designs may require asymmetrical landscaping patterns that will often not comply with more standardized approaches to parking lot landscaping.

9. Severability

If any provision of this bylaw is held invalid by a court of competent jurisdiction, the remainder of the bylaw shall not be affected thereby.

APPENDIX C
PIONEER VALLEY PLANNING COMMISSION ASSESSMENT

INTRODUCTION

ASSESSMENT OF STREET DESIGN AND PARKING LOT GUIDELINES AND FEASIBILITY OF ALLOWING GREEN INFRASTRUCTURE

Town of Milton

Pioneer Valley Planning Commission, February 2022

Introduction

The United States Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts (MS4) (with modifications effective on January 6, 2021) requires the development of two local assessments within four (4) years of the effective date of the permit as follows:

2016 Massachusetts Small MS4 General Permit, Section 2.3.6.b: Assessment of Street Design and Parking Lot Guidelines

Within four (4) years of the effective date of this permit, the permittee shall develop a report assessing current street design and parking lot guidelines and other local requirements that affect the creation of impervious cover. This assessment shall be used to provide information to allow the permittee to determine if changes to design standards for streets and parking lots can be made to support low impact design options. If the assessment indicates that changes can be made, the assessment shall include recommendations and proposed schedules to incorporate policies and standards into relevant documents and procedures to minimize impervious cover attributable to parking areas and street designs. The permittee shall implement all recommendations, in accordance with the schedules, contained in the assessment. The local planning board and local transportation board should be involved in this assessment. This assessment shall be part of the SWMP. The permittee shall report in each annual report on the status of this assessment including any planned or completed changes to local regulations and guidelines.

2016 Massachusetts Small MS4 General Permit, Section 2.3.6.c: Assessment of Feasibility of Allowing Green Infrastructure

Within four (4) years from the effective date of the permit, the permittee shall develop a report assessing existing local regulations to determine the feasibility of making, at a minimum, the following practices allowable when appropriate site conditions exist: i. Green roofs; ii. Infiltration practices such as rain gardens, curb extensions, planter gardens, porous and pervious pavements, and other designs to manage stormwater using landscaping and structured or augmented soils; and iii. Water harvesting devices such as rain barrels and cisterns, and the use of stormwater for non-potable uses. The assessment should indicate if the practices are allowed in the MS4 jurisdiction and under what circumstances are they allowed. If the practices are not allowed, the permittee shall determine what hinders the use of these practices, what changes in local regulations may be made to make them allowable, and provide a schedule for implementation of recommendations. The permittee shall implement all recommendations, in accordance with the schedules, contained in the assessment. The permittee shall report in each annual report on its findings and progress towards making the practices allowable.

Compliance Recommendation: Pre-Application Meeting with Developers

Requiring project applicants to participate in a pre-application meeting with local officials can be one of the most important and cost-effective strategies to limiting impervious cover and ensuring best stormwater management approaches. For this pre-application meeting, an applicant can be asked to take some first steps in thinking about the site through a Low Impact Development lens that involves analysis of site resources, soils, and a sketch plan informed by those considerations. (See link below to PVPC checklist for developer use in preparing for this meeting). The pre-application meeting then enables a preliminary conversation about the site, stormwater management and erosion control considerations, and concept plan prior to investing in extensive professional design efforts. This pre-application meeting can be included as part of stormwater management permitting and site plan review in zoning if there are smaller projects (under 1 acre) that a municipality wishes to include.

https://thinkblueconnecticutriver.org/wp-content/uploads/2020/12/10.-LID-Checklist-for-Preapplication-Meeting-PVPC-Model.docx

Benefits of Impervious Cover Reduction and Use of Green Infrastructure

While the MS4 permit requirements are aimed at water quality improvements, impervious cover and encouraging green infrastructure stormwater management can also reduce localized flooding, improve groundwater recharge, enhance neighborhood aesthetics, and reduce summer heat. Please refer to the resources provided below for additional information.

A Word About Stormwater Management in Drinking Water Supply Protection Areas

For drinking water supply protection areas--particularly recharge areas for public water supplies, but also where there is reliance on private wells for supply--it is important to carefully consider the impervious surfaces from which stormwater flows will be managed. For example, flows from non-metal rooftops could be managed to infiltrate directly into soils. The likelihood of contamination in such flows is typically low and thus the likelihood of eventual harm to groundwater sources for drinking is also low. A parking or loading area, however, is very different. In such circumstances, best practice would be to ensure that the perimeter area is curbed so that flows go through a pretreatment device prior to infiltration. The pretreatment facility should also include an emergency shutoff valve that can be activated in case of a spill to keep contaminated flows contained within the parking area and from reaching the infiltration facility. Note that the current 2008 MassDEP Stormwater Handbook does not allow for the location of any stormwater bmps in Zone 1 areas, unless necessary to manage stormwater from essential drinking water facilities.

How to Use This Checklist

This checklist can be used as a method of documenting review of existing local code for requirements that affect the creation of impervious cover and feasibility of allowing green infrastructure and it contains some notes and recommendations for potential policy and language changes. This checklist could also serve as the submission to EPA once code review assessment has been completed with additions in the column headings, "changes recommended" and "proposed schedule to incorporate changes." Best practice for review of code and potential revisions occurs through conversations with relevant boards and departments, such as the Planning Board, Public Works, Conservation Commission, Board of Health, and Fire Department.

Relevant Local Documents / Code to Review

Assuming that local stormwater bylaw/ordinance and regulations have been updated to comply with new pre and post construction MS4 permit standards, including promoting a Low Impact Development approach and advancing green infrastructure stormwater management, other key places within municipal code for review are as follows:

Subdivision Rules & Regulations	Wetland Protection Bylaws / Rules & Regulations	Local Building Codes
Zoning Bylaws	Board of Health Bylaws / Rules & Regulations	Local Plumbing Codes
General Bylaws		

Citations / Resources

Author	Title	Web Link
American Planning Association - Massachusetts Chapter and Homebuilders Association of Massachusetts	Sustainable Neighborhood Road Design: A Guidebook for Massachusetts Cities and Towns	https://www.apa-ma.org/wp-content/uploads/2018/12/NRB_Guidebook_2011.pdf
Casey Trees and Davey Tree Expert Co.	National Tree Benefit Calculator	http://www.treebenefits.com/calculator/
Center for Watershed Protection	The Code & Ordinance Work sheet: A Tool for Evaluating the Development Rules in Your Community	https://owl.cwp.org/mdocs-posts/better-site-design-code-and-ordinance-cow-worksheet-2017-update/
Commonwealth of Massachusetts, Executive Office of Energy and Environmental Affairs	Smart Growth / Smart Energy Toolkit: Smart Parking Model Bylaw	https://www.mass.gov/files/documents/2017/11/03/Smart%20Parking.pdf
Massachusetts Association of Conservation Commissions	MACC Wetlands Buffer Zone Guide Book	https://www.readingma.gov/conservation-division/files/macc-wetlands-buffer-zone-guidebook
Metropolitan Area Planning Council	Massachusetts Low Impact Development Toolkit: Low Impact Development - Do Your Local Codes Allow It? A Checklist for Regulatory Review	https://www.mapc.org/resource-library/do-your-local-codes-allow-lid/
Metropolitan Area Planning Council	Low Impact Development Toolkit	https://www.mapc.org/resource-library/low-impact-development-toolkit/
Metropolitan Area Planning Council	Once is Not Enough: Guide to Water Reuse in Massachusetts	http://www.mapc.org/wp-content/uploads/2017/11/3-1-Once-is-Not-Enough-Guide-to-Water-Reuse-10-05.pdf
Minnesota Pollution Control Agency	Overview for Stormwater and Rainwater Harvest and Use/Reuse	https://stormwater.pca.state.mn.us/index.php/Overview_for_stormwater_and_rainwater_harvest_and_use/reuse
Pioneer Valley Planning Commission	Low Impact Development Checklist	https://thinkblueconnecticutriver.org/wp-content/uploads/2020/12/10.-LID-Checklist-for-Preapplication-Meeting-PVPC-Model.docx
Pioneer Valley Planning Commission	Green Infrastructure Fact Sheets	http://www.pvpc.org/content/green-infrastructure-toolkit
Pioneer Valley Planning Commission	Pioneer Valley Sustainability Toolkit	http://www.pvpc.org/plans/pioneer-valley-sustainability-toolkit
U.S. Environmental Protection Agency	Water Quality Scorecard: Incorporating Green Infrastructure Practices at the Municipal, Neighborhood, and Site Scales	https://www.epa.gov/sites/default/files/2014-04/documents/water-quality-scorecard.pdf
U.S. Environmental Protection Agency	Assessing Street and Parking Design Standards to Reduce Excess Impervious Cover in New Hampshire and Massachusetts	https://www3.epa.gov/region1/npdes/stormwater/assets/pdfs/ImperviousAssessment.pdf
U.S. Environmental Protection Agency	General Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts Authorization to Discharge under the National Polluntant Discharge Elimination System (with modifications effective January 6, 2021)	https://www3.epa.gov/region1/npdes/stormwater/ma/2016fpd/final-2016-ma-sms4-gp-mod.pdf
U.S. Environmental Protection Agency	Overcoming Barriers to Green Infrastructure	https://www.epa.gov/green-infrastructure/overcoming-barriers-green-infrastructure
U.S. Environmental Protection Agency	Incorporating Low Impact Development into Municipal Stormwater Programs	https://www3.epa.gov/region1/npdes/stormwater/assets/pdfs/IncorporatingLID.pdf
U.S. Environmental Protection Agency	Encouraging Low Impact Development: Incentives Can Encourage Adoption of LID Practices in Your Community	https://www.epa.gov/sites/default/files/2015-09/documents/bbfs7encouraging.pdf
U.S. Environmental Protection Agency	Soak Up the Rain Outreach Tools	https://www.epa.gov/soakuptherain/soak-rain-outreach-tools
U.S. Forest Service	The Sustainable Urban Forest Guide: A Step-by-Step Approach	https://urbanforestrysouth.org/resources/library/ttresources/the-sustainable-urban-forest-guide-a-step-by-step-approach/at_download/file

Acronyms/Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
ADT	Average Daily Trips
BMP	Best Management Practice
EPA	Environmental Protection Agency
LID	Low Impact Development
LUHPPL	Land Uses with Higher Potential Pollutant Loading
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
ROW	Right of Way

Within Subdivision Regulations, standards for the following are critical for consideration: right of ways; utilities; roadway widths and lengths; cul-de-sacs; curbs; sidewalks; and bus waiting areas.

Street Standards in Subdivision Regulations

Right of Ways

Y/N	Checklist Item	Location in code and any standards	Language	Example Language/*Notes (shown in italics)*
N	Is the minimum right of way width less than 45 feet for a residential street? (For 500 ADT, between 33 and 36 feet?)	Rules and Regulations 6.1.10: not less than 50 feet	Design Standards: Right of Way Widths: Except as hereinafter provided, streets shall be not less than fifty feet (50') in width and there shall be sidewalks within the limits of such streets not less than four and one-half feet (4 1/2') in width.	*See table from Sustainable Neighborhood Road Design Guidebook for MA provided in this workbook at Tab 5 - Reference Tables and Figures.*
				Good design has not so much to do with the width of the right of way itself, but considerations of context and what makes for efficient and effective use of the right of way. What makes sense for the elements of a right of way on a busy suburban road will likely not make sense for a low volume rural road.
N	Are street cross sections provided to show how elements of a right of way might vary given different contexts?	RR 7.4.1: only one typical cross section provided	Cross Sections: Streets shall be constructed when required in accordance with the following specifications and in accordance with the appropriate Typical Cross-Section Plan.	*Such drawings can provide a clear understanding about objectives and efficient and effective use of the right of way area in different contexts, bringing together "complete streets" considerations of accommodating different modes of transportation with "green streets" objectives of reducing impervious surface and improving stormwater management.*
N/A	Do the regulations limit clearing and grubbing within the right-of-way to the minimum necessary?	not mentioned		Developers are encouraged to limit clearing within the right-of-way to the minimum necessary to construct the roadway, drainage, sidewalk, and utilities, and to maintain site lines. Under this approach, it is not required to clear and grub the entire right-of-way.
Y	Are street trees required for new streets?	RR 7.4.6.3	Required Improvements: Standards of Construction: Planting Space: Street shade trees of a variety appropriate for the specific location as approved by the Tree Warden shall be planted at the developer's expense on each side of every street in such development in an 18" depth of loam. All trees thus installed shall be a minimum of 12 feet in height and a minimum of 3 inches in diameter measured one foot above the ground and spaced approximately 50 feet apart and approximately 3 feet behind the street line within an easement of 5 feet in width shown on the plan as a "5' easement reserved for shade trees." The Board may in some cases choose to locate the shade trees in the grass strip adjacent to the traveled way. Proposed street shade trees are to be shown on the subdivision plan for approval by the Board.	*In addition to requiring the planting of street trees, it is a good idea to specify that the tree belt can be designed for stormwater management. Tree belts may include bioretention areas or other vegetated stormwater systems. Bioretention areas should utilize noninvasive species (not on any Massachusetts invasive plant list) that can tolerate cycles of drought and inundation.*

Utilities

Y/N	Checklist Item	Location in code and any standards		Example Language/*Notes (shown in italics)*
Y	Does the code allow utilities to be placed under the paved section of the ROW?	RR 10.7: No water main, drain, catch basin, toad subgrade or foundation can be paved over until inspected by Board/representative. Also, see Typical Cross Section		Utilities (electric, telephone, cable TV, fiber optic, and all other conduits) may be located under the roadway or immediately adjacent to the roadway so as to optimize use of the right of way area for swales and other stormwater management facilities, sidewalks, and street trees.
Y	Does the code allow utilities to be placed immediately adjacent to the paved section of the ROW?			
				Often there is concern that such placement of utilities under the road will result in traffic delays and additional costs to utility companies. In the Rhode Island LID Site Planning and Design Guidance for Communities, however, authors from the Horsley Witten Group note that the reality is, "The amount of pavement needed to be removed during such operations can be decreased through better diagnostic tests and trenchless technologies for utility construction and repair." If the idea of putting utilities under the road edge is too great a concern for Departments of Public Works, then the next best strategy is to place utilities directly abutting roadway pavement, within 1 to 2 feet.

Roadway Widths and Lengths

Y/N	Checklist Item	Location in code and any standards		Example Language/*Notes (shown in italics)*
N/A	Is paved roadway width between 18 and 22 feet in low density residential developments with no bicycle lanes present? Low density residential neighborhoods are those with less than 400 average daily trips according to AASHTO, 2001.	not mentioned		*Refer to table from Sustainable Neighborhood Road Design Guidebook for MA provided in this workbook at Tab 5 - Reference Tables and Figures.*
				Many existing standards are based on universal application of guidelines for highways or very large-scale subdivisions planned more than 50 years ago. Revised standards should involve the minimum required pavement width and derive from careful considerations with public works and emergency response officials of traffic volume, on-street parking (where required), and passage of emergency vehicles and school buses.
N/A	At higher densities, are parking lanes allowed to also serve as traffic lanes (i.e., queuing streets)?	not mentioned		
N/A	Are narrower pavement widths allowed on road sections were there are no houses, buildings, intersections, or on-street parking spaces?	not mentioned		*Revise local street standards to consider design speed, street type, and traffic volume on arterial and residential roads to allow for more compact roadways and intersections.* *If not currently permitted, allow for curb extensions such as pinchpoints, gateways, and chicanes to narrow roadways and utilize street space for pervious pavement or bioretention.*
N	Are reductions in frontage distances allowable where appropriate (i.e. open space developments, around cul-de-sacs, and along outside sideline of curved streets) to increase number of homes per unit length and to minimize street length?			Reduce street length in residential neighborhoods to minimize overall impervious cover creation and land disturbance.
N	Are developers encouraged to explore alternative street layouts to increase the number of homes per unit length and minimize the length of the roadway?			Exploration of alternative street layouts to increase the number of homes per unit length and minimize the length of the roadway is encouraged.
N/A	Can permeable paving be used for residential roads, shoulders, and parking lanes?	not mentioned		Where appropriate, use of permeable paving is allowed for road shoulders/parking lanes in residential neighborhoods and for sidewalks as compatible with Americans with Disabilities Act and Massachusetts Architectural Advisory Board design standards.

				This approach could involve combining a traditional asphalt surface for the travel lanes and an adjacent porous surface for the shoulder/parking lanes or bike lane area. Snow and ice management for the roadway must avoid sand so as to avoid clogging of the porous shoulder area.
Y	Do alignments specify: Streets ought to be located in order to protect important natural features, avoiding low areas and steep slopes in particular?	Zoning Section VI.J.15.B.c: only applicable to Cluster Developments	The Site Plan shall be prepared in conformity with the purpose and specific requirements of this subsection including the following design standards: Street layouts shall take account of the existing terrain and landscape features, and there shall be no extreme or ill designed cuts or fills. The width, construction and lighting of streets shall be appropriate for their intended use	Streets shall be located and designed to minimize: 1. disturbance of the site's natural features and environmentally sensitive areas, including low areas and steep slopes, native vegetation, and trees with a trunk diameter measured at 4.5' DBH (Diameter at Breast Height), breast height of 8 inches or more; 2. cut and fill, thereby reducing disturbance of native soils; 3. unnecessary contouring of the site to preserve natural topography.
				Another possible consideration here (though unrelated to MS4 permit) : Street lay out along east-west or north-south axes is encouraged. This allows building siting to take advantages of passive solar heat gain and accommodate future solar electric installations on south-facing roofs.

Cul-de-Sacs

Y/N	Checklist Item	Location in code and any standards		Example Language/*Notes (shown in italics)*
N	Are dead ends discouraged by the regulations? (e.g. by encouraging or requiring connected streets or one-way loop streets)?			A connected road network is of great importance to functioning and efficient road network, reducing response time for public safety officials. Dead-end streets are discouraged. An applicant should make every effort to avoid the creation of dead-end streets and should connect proposed subdivisions to existing dead end streets wherever reasonable and practicable. An applicant may demonstrate that a dead end street is appropriate when they can demonstrate that a future connection to an existing street is not possible or practicable, or when the surrounding property will never need a street connection because of extremely sensitive or permanently protected natural resources.
N/A	Are landscaped/bioretention islands allowed in the center of cul-de-sacs?	not mentioned		All dead-end streets with turnaround islands may be planted with trees and/or other vegetation or left with natural tree growth in lieu of paving the entire area of the island. The maintenance of the inner circle shall be the responsibility of developers, their successors and assigns, or a homeowners' association.
N/A	If curbing for cul-de-sacs is required, is it allowed to be perforated or notched to enable the flow of stormwater into the island area?	not mentioned		Where soils are conducive to infiltration (Natural Resource Conservation Service hydrologic soils group A or B), the center island may serve as a stormwater bioretention area with notched or perforated curbing to allow for entry of storm flows. Invisible curbing, where granite curbing forms an at-grade edge with the asphalt, may also be permitted in this situation.
N	Is minimum required radius for a cul-de-sac set for LID purposes?	RR 6.1.12: radius must be 50'	Dead end streets shall terminate in a 50 foot radius where the street is unlikely to be extended or a temporary 50 foot radius where there is a possibility of an extension.	*Sustainable Neighborhood Road Design recommends 50-foot outside radius with vegetated center island.* *Massachusetts Fire Code 527 CMR requires 20-foot drive lanes and minimum inside turning radius of 25 feet.*
Y	Are alternative turnarounds such as hammerhead allowed on short streets in low density residential developments?	RR 6.1.12: dead ends can include a circle/cul-de-sac, intersection, loop, etc.	For the purpose of this Section, a dead end street shall be deemed to include any street which has only one outside public vehicular accss notwithstanding whether such street ends in (1) a circle or cul-de-sac, (2) an intersection with a street, streets or combination of streets, of which none has another outside public vehicular access, (3) a loop, or (4) any other confiduration without another outside public vehicular access.	*Hammerheads use less pavement overall than cul-de-sacs. Example below is per Sustainable Neighborhood Road Design:* *A hammerhead turnaround having a thirty (30) foot minimum curb radii; forty-five (45) foot minimum center lane radii, a head adequate for three point turn maximum, and a (length to accommodate local firefighting vehicle).*

Sidewalks

Y/N	Checklist Item	Location in code and any standards		Example Language/*Notes (shown in italics)*
N	In lower density residential contexts, are sidewalks allowed on just one side of a street? (As opposed to always required on both sides of residential streets.)	RR 7.4.5.1 requires sidewalks to be 4.5' on both sides of the road.	Unless not required by the Board there shall be a sidewalk with a width of four feet six inches (4'6") on each side of the street.	*For low density neighborhoods, consider allowing sidewalks on just one side of street.*
				See table from Sustainable Neighborhood Road Design Guidebook for MA provided in this workbook at Tab 5 - Reference Tables and Figures.
N/A	Is permeable paving allowed for sidewalks?	not mentioned		If the site permits infiltration, sidewalks may be constructed of permeable paving materials. If using permeable materials, the developer must work in consultation with the Department of Public Works and an engineer with experience in this field, and materials must be evaluated at regular intervals as they age. Pervious asphalt should be based on specifications such as those found in the University of New Hampshire Stormwater Center Design Specifications for Porous Asphalt Pavements and Infiltration Beds. Sidewalks or pedestrian areas may also be constructed to direct stormwater runoff to a swale or other BMP. Permeable pavements provide increased traction when wet because water does not pool, and the need for sal and plowing is reduced during winter due to low/no black ice development. Compared to traditional paving methods, long-term maintenance costs may be lower in cold climates since permeable pavements resist cracking and buckling in freeze-thaw conditions. Nevertheless, permeable paving requires regular maintenance including: annual inspection of paver blocks for deterioration; periodic replacement of void material (gravel, etc.) if part of the facility; and annual industrial vacuuming of pavements to unclog sand and debris that have accumulated on the surface over time.
N/A	Are alternative pedestrian network layouts allowed (rather than placement in ROW)?	not mentioned		For certain developments, it may be more sensible for pedestrian circulation to make use of common areas rather than street right of ways.
N	Is sidewalk width standard set for LID purposes?	RR 7.4.5.1 requires sidewalks to be 4.5' on both sides of the road.		*LID standard = 4 feet or less*
N/A	Where curb and gutter streets are required for stormwater drainage, are sidewalks allowed to be disconnected from the stormwater drainage system?	not mentioned		Grading of impervious sidewalk surfaces should be done so as to direct stormwater runoff to bioretention areas or other such facilities to eliminate or keep flow out of the municipal storm drain system.

Bus waiting areas

Y/N	Checklist Item	Location in code and any standards		Example Language/*Notes (shown in italics)*
N/A	Do bus waiting areas require use of permeable paving unless infeasible?	not mentioned		*Permeable paving must be used for bus waiting areas in locations where soils are indicated to be in Natural Resource Conservation Service hydrologic soils group A or B.*

Curbs

Y/N	Checklist Item	Location in code and any standards		Example Language/*Notes (shown in italics)*
N	Do street standards allow for LID stormwater management approaches (i.e. swales or other such BMPs instead of curb and gutter)? Or are curbs and gutters REQUIRED improvements?	Curbs are required (see typical cross section)		*In low or medium density developments where topography, soils, and slope permit, allow conveyance and treatment of stormwater runoff in the street right-of-way via vegetated open channels that incorporate runoff reduction practices such as dry swales, bioretention, biofilters, or vegetated swales, rather than requiring the use of curb and gutter stormwater conveyances.*

N/A	Where curbs are necessary/required, are curb cuts/perforated curbs that allow runoff into swales or other stormwater BMPs allowed?	not mentioned		*Where curbing is needed, think about specifying granite curbing as a way to help keep roads narrow overall. (With asphalt curbing it is hard to plow to the curb since material can be easily damaged. The tendency is to account for this extra width needed in winter months.* *If pursuing LID design standards, curbs should either be eliminated or, when deemed necessary to protect the roadway edge, they should be interrupted or invisible. Interrupted curbs are curbs with gaps that allow stormwater to move from the street through to a stormwater management facility, such as planters, swales, rain gardens, or tree filter boxes. Invisible curbs are buried along the street edge so as to allow stormwater to flow over into a stormwater management facility. All LID curb options should be implemented in connection with stormwater management facilities. In shared streets, curbs should either be eliminated or be invisible.*
N/A	Does the town have criteria for design of roadside swales?	not mentioned		*Refer to the design standards presented in the Massachusetts Stormwater Management Handbook: Volume Two.* *Potential design considerations / limitations:* *- Depending on land use and soil type, each grassed swale can treat a relatively small drainage area of a few acres. Large areas should be divided and treated using multiple swales.* *- Swales are impractical both in areas with steep slopes and with very low slopes.* *- Soil compaction can reduce infiltration capacity.* *- Pre-treatment practices may be required in areas with higher potential pollutant loading.*
N	Where curb and gutter systems are installed, are inlets / drains required to have a notice regarding discharge to receiving waters?	NepWRA is doing it, but not required		*Could require that developers install standard signage indicating that waters drain to _____ River, etc.*
			Ensuring Soil Permeability	
Y/N	**Checklist Item**	**Location in code and any standards**		**Example Language/*Notes (shown in italics)***
				<u>Important note</u> : These suggested standards on ensuring soil permeability might serve better under standards required for a stormwater management permit/and or under the zoning bylaw/ordinance - site plan review for projects that do not trigger stormwater permit requirements. They are included here to underscore the importance of soils in performance of infiltration facilities, but also in ensuring that runoff curve numbers used in calculations remain as accurate as possible post construction.
N	Is it clear that topsoil removal from the site should not diminish the infiltration characteristics of the site?			Applicants must describe how their project will minimize and limit topsoil removal from the site.
N	Is it clear that any new soils brought on site should not diminish the infiltration characteristics of the site?			Applicants must describe how they will ensure that any new fill or soils brought to the site will not diminish the infiltration characteristics of the site.
N	Is there any mention of avoiding compaction of soils by construction vehicles and restoring permeability of soils for infiltration if compacted?			Ensure that all work is planned and executed so as to avoid compaction of topsoil and subsoils, including such best practices as reducing the number of trips required over area of disturbance, laying down soil protective mats for trafficked areas, and avoiding work after rain or snowmelt that soaks soils. For construction equipment, best practices should include using vehicles with low axle loads, reduced tire pressures, and use of flotation tires, doubles, radial tires, and/or large-diameter tires. For areas where such practices are not possible and soils are to be compacted by heavy equipment, subsurface restoration must occur prior to final landscaping activities .
			Green Infrastructure Feasibility	
Y/N	**Checklist Item**	**Location in code and any standards**		**Example Language/*Notes (shown in italics)***
	Are the following practices allowable when appropriate site conditions exist:			
Y	Green roofs	Green roofs are permitted provided they are structurally sound.		*Green roofs are particularly appropriate for structures with a wide roof area, and typically are installed on flat or low angle rooftops. Design and maintenance considerations are described in more detail in PVPC's Green Infrastructure Fact Sheet on "Green Roofs." See:*
				http://www.pvpc.org/content/green-infrastructure-individual-fact-sheets
N/A	Infiltration practices such as rain gardens, curb extensions, planter gardens, porous and pervious pavements, and other designs to manage stormwater using landscaping and structured or augmented soils.	not mentioned in regulations Milton had a rain garden program at one point to encourage use.		*Rain gardens, also referred to as bioretention areas, use soil, plants and microbes to treat stormwater before it is infiltrated or discharged, and function effectively on small sites or on large sites divided into multiple small drainages. Common applications include parking lot islands, median strips, and traffic islands. Limitations, design considerations, and maintenance requirements are described in more detail in PVPC's Green Infrastructure Fact Sheets on "Bioretention Areas," Green Streets," and "Tree Box Filters." See:*
				http://www.pvpc.org/content/green-infrastructure-individual-fact-sheets
				Porous/pervious paving is appropriate for pedestrian-only areas and for low- to medium-volume, low-speed areas such as overflow parking areas, residential driveways, alleys, and parking stalls. If the underlying soils have a permeability of less than 0.3" per hour, use of an underdrain will be required. Permeable paving is not ideal for high traffic/high speed areas because it generally has lower load-bearing capacity than conventional pavement. Design and maintenance requirements are described in more detail in PVPC's Green Infrastructure Fact Sheet on "Porous Asphalt." See:
				http://www.pvpc.org/content/green-infrastructure-individual-fact-sheets
				Encourage both preservation of existing stands of trees and mature trees on site as well as plans that incorporate trees into stormwater management practices. This can be done through specific requirements and through a system of credits. Calculating stormwater benefits of certain species based on size can be done through the National Tree Benefit Calculator. See calculator at:
				http://www.treebenefits.com/calculator/
				Allow for bioretention areas or other vegetated stormwater facilities within treebelt areas and to count toward other required landscaping features, including site, parking or perimeter screening. This creates areas that function on several levels, including aesthetics and stormwater management.
Y/N	Water harvesting devices such as rain barrels and cisterns, and the use of stormwater for non-potable uses.	Water harvesting is allowed, but Milton uses MA plumbing code for all potable and non-potable uses. Rain barrels are permitted.		*Cisterns and rain barrels are used to store rooftop runoff for later use for landscaping and other non-potable uses such as car washing. Water stored in cisterns is even used in some cases for toilet flushing and/or irrigation of planters within buildings. Cisterns and rain barrels can be used in most commercial and residential properties where rooftop runoff is directed to a gutter and downspout. Design and maintenance requirements are described in more detail in PVPC's Green Infrastructure Fact Sheet on "Rain Water Harvesting." See:*
				http://www.pvpc.org/content/green-infrastructure-individual-fact-sheets

	If no, please describe impediments: _____	MA state plumbing code 248 CMR 10 7.J.2 states exceptions are required to have special permission by the Board.		
N	If yes, are there developer incentives for utilizing green infrastructure practices?			*The use of green infrastructure practices can be encouraged by offering incentives such as stormwater utility fee discounts or credits, waived or reduced permit fees, recognition programs for successful green infrastructure sites, and/or exemptions from portions of the local stormwater permitting requirements. For additional ideas on types of incentives and implementation, please refer to the EPA's Encouraging Low Impact Development Fact Sheet:*
				https://www.epa.gov/sites/default/files/2015-09/documents/bbfs7encouraging.pdf
Development Policies in Subdivision Regulations				
Y/N	**Checklist Item**	**Location in code and any standards**		**Example Language/*Notes (shown in italics)***
N	Does the preliminary plan processes promote an LID approach?			*At the outset, encourage developers to undertake a Low Impact Development (LID) approach in their projects by requiring an LID plan for preliminary subdivision applications. The City/Town could help by providing a developer with a standard site analysis checklist that will help during the early stages of the project to maximize design and functionality of LID strategies and stormwater management practices. As part of this analysis and reporting, the applicant could identify proposed LID strategies and stormwater BMPs. Use of PVPC checklist could be part of this early review. See:*
				https://thinkblueconnecticutriver.org/wp-content/uploads/2020/12/10.-LID-Checklist-for-Preapplication-Meeting-PVPC-Model.docx
				Important note : It is best to include this early review element as part of stormwater management permit requirements for larger projects and site plan review requirements for smaller projects, but good to reinforce that process in Subdivision Regulations.
				Under Preliminary Plan/General: To the fullest extent reasonable and practicable, all subdivisions shall be designed and constructed to incorporate the most recent LID and stormwater management design standards, best practices, policies and design elements. *To include in Preliminary Plan Contents (some of these elements go beyond the PVPC LID checklist, but are worthwhile considerations for this stage of subdivision review):* *Location and limits of soil types consistent with the soils classification maps prepared by the Natural Resources Conservation Service.* *Areas where the depth of natural soil to bedrock is four (4) feet or less.* *The extent of any Interim Wellhead Protection Areas and Recharge Areas.* *Delineation of slopes of twenty-five percent (25%) or greater.* *Areas delineated as "BioMap Core Habitat" or "Supporting Natural Landscape" on the Massachusetts BioMap Project developed by the Massachusetts Natural Heritage & Endangered Species Program.*
N	Is the definitive plan process coordinated with the stormwater management and erosion and sediment control permit process requirements?			*Define a process that combines submissions for stormwater management permits with Definitive Plans to avoid duplication.* *Possibly state:* An Application for a Stormwater Management and Erosion and Sediment Control Permit, in accordance with Section ___ of the _____ , along with all required plans and supporting information and documentation, must be included as part of the submission for a Definitive Subdivision Plan. No work shall commence on the construction of a Definitive Subdivision Plan until a Stormwater Management and Erosion and Sediment Control Permit has been approved and issued.
Y	Is there a section within the subdivision regulations that addresses drainage?	RR 8.0 Storm Drainage (IV.C.4.c VI.I.2a,c)		*Consider removing specific stormwater management language from subdivision regulations and referring out to standards in the stormwater management ordinance/bylaw and regulations is recommended. It is best not to describe requirements in subdivision regulations to avoid conflict and inconsistencies as standards are updated from time to time.*
N	Do the site development standards explicitly permit LID stormwater management approaches?			*Review any additional standards carefully to ensure they enable LID stormwater management approaches and do not present barriers to such development strategies.*

Within Zoning, the following elements are critical considerations: parking ratios; parking lots and driveways (stall sizes, travel lanes, landscaping, etc.); dimensions and density; and landscaping.

Parking Ratios

Y/N	Checklist Item	Location in code and any standards	Example Language/*Notes (shown in italics)*
N	Are parking maximums used in any instances (to prevent too much parking)?		*Consider the following:* *1. Establishing both minimum and maximum parking ratios to provide adequate parking while reducing excess impervious coverage. Parking reductions could be allowed for factors such as: mixed land uses, access to alternative transportation, demographics, and utilization of Transportation Demand Management (TDM) Programs including subsidized mass transit and parking cash out programs. Flexibility is a key component to providing adequate but not excessive parking.*
			2. Requiring a Special Permit for an increase in maximum parking allowance. Some onsite parking requirements could be met off-site particularly in redevelopment sites and compact mixed use centers.
			For useful language on parking, see the MA Smart Parking Model Bylaw at: https://www.mass.gov/files/documents/2017/11/03/Smart%20Parking.pdf
Y	Does zoning require more than 3 **off street parking spaces** per 1,000 sq. ft. of gross floor area for office uses?	Section VII.C.2: For businesses and professional offices, there shall be one parking space for each 250 square feet of gross floor area.	*For recommended parking requirements per 1,000 sq ft of Gross Floor Space, see table provided in this workbook at Tab 5 - Reference Tables and Figures.*
N	Does zoning require more than 4.5 off street parking spaces per 1,000 sq. ft. of gross floor area for shopping centers?		
N	Does zoning **vary parking requirement by zone** to reflect places where more trips are on foot or by transit?		
N	Does zoning have reduced off-street parking requirements for its downtown zoning district?		
N	Does zoning have lower parking requirements for properties near transit stops?		
N	Does zoning allow reduced parking requirements for properties within walking distance to multiple services?		
Y	Does zoning have lower parking requirements for properties in the more densely developed residential districts?		
N	Does zoning allow **alternative measures** such as custom parking demand calculations, transportation demand management or in-lieu payments to reduce required parking?		
Y	Does zoning have provisions allowing for **shared parking** to reduce parking requirements?	Section III.I: Milton Village/Central Avenue Business District Planned Unit Development allows shared parking	*Refer to the Smart Parking Model Bylaw for bylaw language around three strategies for shared parking: opportunities to share parking between competing and non-competing uses on the same site, locating parking off-site on other privately owned lots or public parking facilities, and/or for using a "fee-in-lieu" approach. See:*
N	Are shared parking provisions by right?		https://www.mass.gov/files/documents/2017/11/03/Smart%20Parking.pdf
N	Does the municipality provide model shared parking arrangements for private use?		*See model for shared parking here:*
N	Does zoning require more than 2 **off-street parking spaces per residential** unit?		https://www.gardinermaine.com/sites/g/files/vyhlif611/f/news/appendix_d_sampleparkingagreement_0.pdf
Y	Does zoning require 2 off-street parking spaces per residential unit?	Section VII.B.1: Detached one–family dwelling. For each detached one–family dwelling in a Residence AA, A or B district there shall be at least two parking spaces. For each detached one–family dwelling in a Residence C district there shall be at least 1 parking space	
Y	Does zoning require less than 2 off-street parking spaces per residential unit?	Section VII.B.1: Detached one–family dwelling. For each detached one–family dwelling in a Residence AA, A or B district there shall be at least two parking spaces. For each detached one–family dwelling in a Residence C district there shall be at least 1 parking space	
N/A	Does zoning require more than 1 off-street parking space for an accessory dwelling unit?		
N	Does zoning have lower parking requirements for smaller residential units?		

Parking Lots and Driveways

Y/N	Checklist Item	Location in code and any standards	Example Language/*Notes (shown in italics)*
N	Is the requirement for standard parking lot stalls consistent with LID purposes?	Section VII.G.5: Each parking space, except for spaces for compact cars, shall measure at least 8 ½ feet in width and 19 feet in length, provided that a space may measure no less than 16.5 feet in length if suitable provision is made for front or rear overhang of the parked vehicle over a planted area and further provided that parallel parking spaces on any aisle or driveway shall be at least 22 feet in length	*LID Standard = 9 feet or less by 18 feet or less*
N	Is the requirement for drive lane width consistent with LID purposes?	Section VII.G.4: The minimum width of maneuvering aisles within parking areas shall be 20 feet for two–way traffic and 12 feet for one–way traffic.	*LID Standard = 9 feet wide for one lane / 18 feet wide for two lanes*
Y	For larger parking lots, are there provisions requiring compact car spaces?	Section VII.G.3: Off–street parking areas may be designed to allow up to a maximum of 25% of the total number of parking spaces to be used by compact cars. Compact car spaces shall not be less than 8 feet by 16 feet.	

N	If yes, are at least 30% of parking spaces required to have smaller dimensions for compact cars?		
N	Is there a minimum percentage of a parking lot required to be landscaped?		
N/A	Do **landscaping** requirements for parking areas allow for vegetated areas with bioretention functions?	not mentioned	If landscaped islands are located in an area with existing soils classified in the NRCS hydrologic soil groups A/B, such that the existing soils are suitable for infiltration stormwater runoff, the internal landscape areas may/shall be installed at a lower grade than the parking lot pavement, and curbing shall allow drainage from the pavement to enter and percolate through the landscaped areas while simultaneously protecting the landscape materials.
N/A	Do landscaping requirements for parking areas encourage vegetated areas with bioretention functions?	not mentioned	
N/A	Is the use of **pervious surfacing materials** allowed for parking stalls, spillover parking areas, shoulders, etc.?	Section VI.G.3: In the front yard set–back area of a lot, as required in Section VI, Subsection B, Paragraphs 1, 2,and 3 for lots in Residence AA, A, B, and C districts, no more than 40 percent of the set back area shall be paved or covered with an impervious surface	Pervious materials such as porous asphalt or concrete, porous pavers, and reinforced grass blocks may be allowed in lower volume stalls or overflow parking areas. Note that snow storage should not coincide with these areas as plow piles may include sand, which will clog pervious pavement and prevent infiltration.
N	Is the use of pervious surfacing materials encouraged for parking stalls, spillover parking areas, shoulders, etc.?		
Y	Are pervious materials for **single family driveways** (porous pavers, paving stones, pervious asphalt or concrete), and/or use of two-track design for residential driveways allowed?		
N	Does zoning allow for **common or shared driveways**?		*Example from Hadley – through special permit:* *The Planning Board may issue a special permit permitting a common driveway (a single curb cut and driveway providing vehicular egress/access to more than one lot) when, in its judgment, such action is in the public interest and not inconsistent with the intent of this Zoning Bylaw, provided:* *5.7.1. Said common driveway shall not service more than three residential lots. In the case of commercial/retail and industrial/manufacturing uses in Business and Industrial zoned Districts a common driveway may serve more than three lots, but the total shall be set by the Planning Board in the issuance of their special permit.* *5.7.2. Said common driveway shall provide the only vehicular egress/access to the lots being serviced by it, and this shall be so stated in the deeds to the subject lots.* *5.7.3. Said common driveway shall not be eligible for maintenance by the Town or for acceptance by Town Meeting as a street, and this also shall be so stated in the deeds to the subject lots.* *5.7.4. The grade, length and location of the common driveway shall be of suitable construction, in the opinion of the Planning Board, for the access and turnaround of the number and types of vehicles, including moving vans, ambulances, fire and police, which will be utilizing such driveway.* *5.7.5. For common driveways servicing commercial/retail and industrial/manufacturing uses in Business and Industrial zoned Districts, the design and construction standards of said common driveway shall be set by the Planning Board in the issuance of their special permit.* *5.7.6. Common driveways servicing residential properties shall comply with all of the following:* *5.7.6.1 Shall have a length of no more than 500 feet; and* *5.7.6.2. Shall have a width of at least 15 feet; and* *5.7.6.3. Shall have passing turnouts providing a total width of at least 20 feet along a distance of at least 25 feet, spaced with no more than 300 feet between turnouts, and with the first such passing turnout being located at the driveway connection to the street; and* *5.7.7. All common driveways must:* *5.7.7.1. Meet the prior approval of the Highway Division and the Fire Department; and* *5.7.7.2. Conform to all other driveway requirements of the Zoning Bylaw.* *5.7.8. Where applicable, easements and easement plans must be submitted with the special permit application*
	If yes, are they allowed by right?		

Dimensions and Density

Y/N	Checklist Item	Location in code and any standards	Example Language/*Notes (shown in italics)*
Y	Are there any special districts or flexible design opportunities that enable clustering of buildings and greater protection of open space areas on a site?	Section III.Q: Great Estate Planned Unit Development, Section VI.J: Cluster Developments, Section VI.K: Attached Cluster Development, Section VI.L: Condominium Conversion	*Open Space Residential Development (OSRD), Open Space Design (OSD), Conservation Development and Natural Resource Protection Zoning (NRPZ) are the current zoning models for what was previously called cluster or flexible development. These models reverse the typical subdivision planning process by utilizing LID site design strategies for conserving natural hydrologic functions and reducing impervious surfaces for preventing runoff, and integrating green infrastructure as a fundamental design element. Resulting development plans typically retain native vegetation and natural areas, and structure site layout to greatly reduce street infrastructure. It has been noted that the open space set aside should be based on resource values, not by formula such as X% of the development.*
N	Is this type of development allowed by right?		*Permit such development as a "by right" form of development, where no special permit is required.*
Y	Are the submittal or review requirements for such developments greater than for conventional development?		
N	Are there any other regulations that allow for reductions in dimensional requirements to increase flexibility in building placement?		*Allow flexible site design criteria such as reduced setbacks and smaller lot sizes.* *Reductions in frontages would allow for reduced road length/paved area, perhaps where appropriate such as in open space residential developments, at the outside sideline of curbed streets, and around cul-de-sacs.*
N/A	Is the use of bioretention and other stormwater practices allowed in setback areas?	not mentioned	*Explicitly allow bioretention areas, rain gardens, filter strips, swales, and constructed wetlands within required setback areas for front, rear, and side yards based on site-specific conditions such as soils, depth to groundwater table and slope.*
			In a mixed-use district, setbacks should include enough space for a substantial vegetated buffer adjacent to the residential use as screening that can also serve as stormwater green infrastructure.

Landscaping

Y/N	Checklist Item	Location in code and any standards	Example Language/*Notes (shown in italics)*
N/A	Is the use of bioretention and other stormwater practices allowed within landscaped areas for parking lots (versus requirement for curb and gutter management of stormwater)?	not mentioned	Edging and curbing in parking lots can be notched or perforated to allow stormwater flows into infiltration and bioretention areas. For larger parking lots, parking rows may be separated with planting strips that function to manage stormwater. Shade tree requirements in planting strips should also take into consideration stormwater treatment. Note that shade in parking lots will also help to reduce the "heat island" effect.
N	Does language on screening and buffers indicate that these areas could be used for stormwater management?		Depending on site-specific conditions such as soils, depth to groundwater table and slope, buffer and landscaped areas may include bioretention areas and other green infrastructure stormwater management facilities.

N	Is the use of bioretention and other stormwater practices explicitly allowed within landscaped areas?		
			Consider also including design standards for landscaping and screening that encourage the use of green stormwater management infrastructure facilities. In the same way that architectural design standards serve a town, design standards for landscaping can support placemaking within neighborhoods and across a community.
			<u>Important note</u> : Suggested standards on ensuring soil permeability below serve best under standards required for a stormwater management permit/and, but they may also be appropriate under zoning bylaw/ordinance - site plan review for projects that do not trigger stormwater permit requirements. They are included here to underscore the importance of soils in performance of infiltration facilities, but also in ensuring that curve runoff numbers used in calculations remain as accurate as possible post construction.
N	Is it clear that topsoil removal from the site should not diminish the infiltration characteristics of the site?		Applicants must describe how their project will minimize and limit topsoil removal from the site.
Y	Is it clear that any new soils brought on site should not diminish the infiltration characteristics of the site?	Section IV A.4: In granting an application for a permit for the removal of earth materials or for the deposit of fill, the Board of Appeals, consistent with the applicant's reasonable use of the site, may impose reasonable conditions to protect the impacted area and adjoining property against potential erosion or silting, potential lack of suitable drainage, potential lack of adequate lateral support, potential destructive increases or deviations in surface water runoff, and potential impairment of the site's ability to support plant life. [[NOTE THRESHOLDS FOR SPECIAL PERMIT AT START OF SECTION]]	
N	Is there any mention of avoiding compaction of soils by construction vehicles and restoring permeability of soils for infiltration if compacted?		Ensure that all work is planned and executed so as to avoid compaction of topsoil and subsoils, including such best practices as reducing the number of trips required over area of disturbance, laying down soil protective mats for trafficked areas, and avoiding work after rain or snowmelt that soaks soils. For construction equipment, best practices should include using vehicles with low axle loads, reduced tire pressures, and use of flotation tires, doubles, radial tires, and/or large-diameter tires. For areas where such practices are not possible and soils are to be compacted by heavy equipment, subsurface restoration must occur prior to final landscaping activities.

Development Policies in Zoning Regulations

Y/N	Checklist Item	Location in code and any standards	Example Language/*Notes (shown in italics)*
Y/N	Are standards and requirements within the zoning code consistent with the Stormwater Management Bylaw/Ordinance and Regulations?	Certain special permits refer to stormwater regulations	*A best practice for eliminating conflicting standards is to reference the local stormwater bylaw or regulation within needed sections of the zoning code for appropriate drainage standards, thereby keeping all drainage standards and specifications in one section of the local code. All zoning standards for drainage should be consistent with the purpose and standards identified in any local stormwater management bylaw, regulation or policy to provide a seamless process for promoting LID site planning. Conserving the natural hydrologic function of a site, reducing impervious surfaces and preventing runoff are key principles in ensuring post development peak flows do not exceed predevelopment peak flows. Green infrastructure facilities should be explicitly encouraged for treatment, attenuation, and infiltration of stormwater at decentralized locations around a site to capture stormwater at its source.*
N	Does the site plan approval process promote and enable an LID approach?		*Critical to effective implementation of green infrastructure facilities is the site inventory and analysis process which should occur before any design work. Existing site conditions may offer opportunities to minimize impacts as well as the costs of stormwater management and can be identified through careful site analysis. Local zoning and permitting can promote a thoughtful process by defining the planning process and providing standards for green infrastructure, especially for smaller projects that do not trigger review for a stormwater management permit.*
	What elements count toward meeting open space requirements? (indicate all that apply)	Section VI.F: "...open space shall mean a portion of a lot or of adjacent lots in common ownership exclusive of any building or buildings and/or their associated driveways and parking areas and shall include parks, lawns, gardens, landscaped areas, terraces, patios, areas left in their natural condition, athletic fields, open air athletic courts, playgrounds, open air swimming pools, and any open vegetated areas."	*Consider allowing applicants to count <u>green infrastructure</u> stormwater management facilities as open space, especially if their project goes above and beyond requirements for stormwater management.*
Y	Bioretention areas		
Y	Constructed wetlands		
N	Green roofs		

OTHER CONSIDERATIONS

ASSESSMENT OF STREET DESIGN AND PARKING LOT GUIDELINES AND FEASIBILITY OF ALLOWING GREEN INFRASTRUCTURE

Y/N	Checklist Item	Location in code and any standards	Example Language/*Notes (shown in italics)*
Board of Health Bylaw and Regulations			
N	Do regulations exceed Title 5 requirements, requiring oversized septic systems or larger setback distances?		*Regulations should not require additional setbacks or classify stormwater structures so as to increase minimum setback distances (e.g. some towns require dry wells and bioretention areas to meet the same setbacks as a septic system).*
	Do regulations allow the use of stormwater for non-potable uses?	See Massachusetts Plumbing Code.	*The type of and quantity of pollution in stormwater depends on the composition of the surfaces over which stormwater runoff flows and the activities within the drainage area that generate pollution. The water quality requirements of common beneficial uses of stormwater and the level of treatment needed for various types of harvested stormwater to meet these requirements are summarized in the Minnesota Stormwater Manual's Water Harvesting and Use System Matrix:*
			https://stormwater.pca.state.mn.us/index.php?title=Water_harvesting_and_use_system_matrix
Wetlands Bylaw and Regulations			
N	Do regulations increase the required buffer above or beyond what is required by the Wetlands Protection Act and/or establish more protective standards for buffer zones?		*Increased wetland buffer zones improve sediment filtration and nutrient removal from stormwater, and decrease potential flooding by providing additional opportunities for stormwater infiltration. However, the Wetlands Protection Act does not include performance standards for the buffer zone, and not all resource areas are afforded a buffer zone under the definitions of the Wetlands Protection Act. Through local wetlands bylaws and/or regulations, municipalities can claim jurisdiction over the 100-foot Buffer Zone (or larger areas) as a Resource Area in and of itself; expand the definition of Buffer Zone to include buffer zones to resource areas not currently included in the Wetlands Protection Act; and/or extend the 200-foot Riverfront Area to intermittent streams, brooks, and ponds.* *Additional information regarding the science behind the importance of buffer zones and bylaw/ordinance considerations can be found in the MACC Wetland's Buffer Zone Guidebook (link provided below), which includes a standard Burden of Proof statement that can apply to Buffer Zones if such areas are defined as within the local Conservation Commission's area of jurisdiction:* *The applicant for a permit shall have the burden of proving by a preponderance of the credible evidence that the work proposed in the permit application will not have unacceptable significant or cumulative effect upon he resource area values (i.e., ecosystem services and functions) protected by this bylaw. Failure to provide adequate evidence to the Conservation Commission supporting this burden shall be sufficient cause for the Commission to deny a permit or grant a permit with conditions.*
			https://www.readingma.gov/conservation-division/files/macc-wetlands-buffer-zone-guidebook
Municipal Policies and Programs			
N	Does the municipality have a plan for water efficiency that includes reuse?		*MAPC's Guide to Water Reuse in Massachusetts includes limitations, benefits, and design considerations for different types of water reuse systems. See:*
			http://www.mapc.org/wp-content/uploads/2017/11/3-1-Once-is-Not-Enough-Guide-to-Water-Reuse-10-05.pdf
Y	Does the municipality have a program to address stormwater runoff and/or LID?	Several BMP systems have been constructed and are maintained over the years by the Town. One BMP has been constructed behind the police station at 40 Highland Street. Another is being pursued behind the Colicott/Cunningham School and will be constructed in the near future based on future MS4 guidelines. Additionally, the Town requires stormwater management for any developed area that increases runoff from the site.	

Y	Does the municipality provide information brochures / manual for homeowners describing rainwater harvesting and stormwater management techniques?	Milton works with the Neponset Stormwater Partnership to fulfill the requirements of MS4 permit Section 2.3.	*PVPC's Green Infrastructure fact sheets include a guide to Rainwater Harvesting:* http://www.pvpc.org/sites/default/files/files/PVPC-Rain%20Water%20Harvesting.pdf
N	Does the municipality have policies that promote complete streets or LID considerations within capital improvement plans or in ranking road construction projects?		
N	Do municipal policies require new street trees as part of road reconstruction projects?	Street trees are common practice, but not mandated.	*Trees are effective in capturing and promoting absorbtion of stormwater. For more information, see the US Forest Service Report, entitled The Sustainable Urban Forest Guide: A Step-by-Step Approach at:*
N	Do capital improvement plans include tree planting as part of project budgets?		https://urbanforestrysouth.org/resources/library/ttresources/the-sustainable-urban-forest-guide-a-step-by-step-approach/at_download/file
N	Has there been any review of emergency services policies or building and fire regulations to ensure that they allow LID techniques?		
Local Building / Plumbing Codes			
Y	Do local building codes allow the use of permeable paving, narrow driveways, green roofs or other LID techniques?	Not prevented, allowed provided they are structurally sound.	
	Do local building codes allow the use of harvested rainwater for interior non-potable uses?	Milton uses the MA state plumbing code, which requires potable water for drinking, bathing, culinary use, and the processing of food, medical, and pharmaceutical products.	
	Do local plumbing codes allow the use of harvested rainwater for interior non-potable uses such as toilet flushing?		

ASSESSMENT OF STREET DESIGN AND PARKING LOT GUIDELINES AND FEASIBILITY OF ALLOWING GREEN INFRASTRUCTURE

Pioneer Valley Planning Commission, February 2022

Example of Parking Requirements per 1,000 sq ft of Gross Floor Space from *Assessing Street and Parking Design Standards to Reduce Excess Impervious Cover in New Hampshire and Massachusetts*

Land Use	Maximum	Minimum
Bank	3	2
Large Scale Retail	4	2
General Office Building	4	2
Medical Building	8	2
Nursing Home	3	2
Restaurants	10	6
Shopping Centers	4	3
Bed and Breakfast	1.2 spaces per guest room or suite	1 space per guest room or suite
Personal Services	3	2
Churches and Places of Worship	1 space per 3 seats in the service portion of the building	1 space per 5 seats in the service portion of the building
Museums and Libraries	2	1
Public and Private Educational Institutions	1 space per 3 seats in the classroom	1 space per 5 seats in the classroom

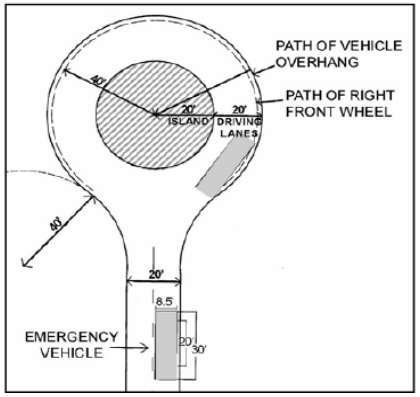
General Parameters for Residential Road Design from *Sustainable Neighborhood Road Design: A Guidebook for Massachusetts Cities and Towns*

Parameter	Single Use Residential Wide	Single Use Residential Medium	Single Use Residential Narrow	Single Use Residential Alley
Traveled Way				
Typical ADT	4,999 < 1,500	1,499 < 400	399 < 0	100 < 0
Design Speed	25 - 30 mph	20 mph	20 mph	15 mph
Operating Speed	20 - 25 mph	20 mph	15 - 20 mph	15 - 20 mph
Number of Through Lanes	2	2	2	1
Lane Width	10 - 12 feet	10 - 12 feet	10 feet	9 - 10 feet
Shoulder	2 feet	2 feet	2 feet	2 feet
Bike Lanes	Shared road or 6 feet wide	Shared road	Shared road	Shared road
Utility Easement Width	--	--	10 feet	10 feet
Range of ROW Width	40 - 50 feet	36 - 40 feet	33 - 36 feet	20 feet

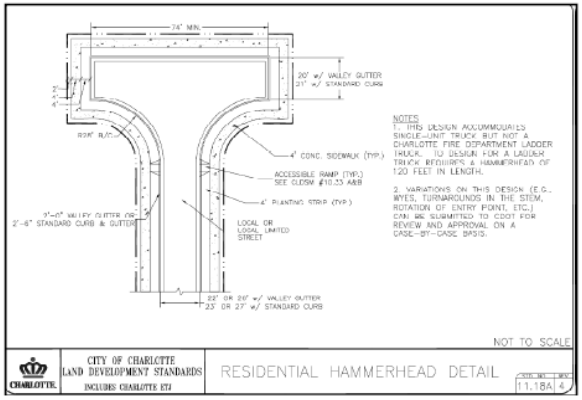
Parameter	Single Use Residential Wide	Single Use Residential Medium	Single Use Residential Narrow	Single Use Residential Alley
Roadside				
Desirable Roadside Width (pedestrian, swale, and planting strip)	5.5 - 12 feet	5.5 - 10 feet	5.5 feet	None
Grass Plot / Planting Strip	0 - 6 feet	0 - 6 feet	0 - 6 feet	None
Minimum Sidewalk Width	4 feet; one side OK	4 feet / shared road	Shared road	Shared road
Street Lighting	At intersections and pedestrian-scale lighting at residential driveways	At intersections and pedestrian-scale lighting at residential driveways	At intersections and pedestrian-scale lighting at residential driveways	At intersection with road
Intersections				

Traffic Control	Stop signs, 4-way yield	4-way yield	4-way yield	Yield exiting alley
Curb Radii	15 - 25 feet	15 - 25 feet	15 - 20 feet	15 feet

Example of Cul-de-Sac Designs and Dimensions, from *Sustainable Neighborhood Road Design: A Guidebook for Massachusetts Cities and Towns*



a. Cul-de-sac with vegetated island



b. Hammerhead turnaround design

APPENDIX D
MASSAUDUBON LOCAL BYLAW AND REGULATION ASSESSMENT TOOL

Supporting LID in Your Community

How to Compare Local Land Use Regulations with Best Practices

Key Areas of Analysis

The following analysis framework is designed to assist communities in Massachusetts in applying cost-effective Low Impact Development (LID) techniques. Specifically, this template enables you to evaluate local land use regulations in relation to models and examples from the Commonwealth of Massachusetts' Smart Growth/Smart Energy Toolkit and other sources in relation to the use of LID and Green Infrastructure (GI) techniques. The focus is primarily on residential development, but the concepts are also applicable to other forms of development and redevelopment.

Best practices minimize the alteration of natural green infrastructure such as forests; reduce creation of impervious surfaces; support retention of naturally vegetated buffers along wetlands and waterways; minimize grading and alterations to natural flow patterns; and support the use of LID techniques as the preferred, most easily permitted methods for managing stormwater.

Get more details on LID's many cost-savings and other benefits at: www.massaudubon.org/LIDCost.

Local coordination across municipal boards and permits is also important for supporting LID. Application of these practices can result in significant savings in infrastructure maintenance costs, as well as improved water quality and protection of water supplies, while supporting property values and overall quality of life. Sustainable development through the application of LID in all aspects of land and water management is a multi-faceted issue that can only successfully be addressed by working together among different departments and perspectives.

Key Areas of Analysis

1. **Overall site design**: Open Space Residential Design (OSRD) vs. conventional subdivisions
2. **Project design and layout standards in relation to LID**: road layout and width, curbing, drainage, sidewalks, parking, landscaping
3. **Maintenance and operations, mechanisms for enforcement**: Who is responsible for maintaining drainage/LID (municipal or homeowner); easements, homeowner association option; municipal inspection and administration systems (this is needed regardless of who is responsible)

Mass Audubon

Open Space Residential Design (OSRD) Overview

This section reviews how local bylaws for cluster, Open Space Residential Design (OSRD), or Natural Resource Protection Zoning (NRPZ) compare to the state's recommended best practices. Communities may currently have multiple bylaws that cover this in different residential areas, in which case they can each be compared to the model regulations. However, in most cases, we would encourage simplification and the use of a single OSRD bylaw with local priorities clearly defined.

Communities may also have no cluster, OSRD, or NRPZ bylaws on the books. In this case, the state's best practice model (see resources below) can be used to create one. If the community closely follows the model, they'll meet the characteristics described within the analysis. However, the analysis still provides a quick checklist.

Some of the most important aspects of OSRD in any community include: the four-step review process that carefully considers the natural landscape before drawing lot lines; the minimum amount of open space protected; the incorporation of LID practices; and allowing this type of development by right instead of special permit.

Zoning, Subdivision, Site Plan Review, and Stormwater Overview

This section reviews not only the individual bylaws and regulations, but also how they work together and how consistent they are. Communities often update portions of bylaws or regulations in a piecemeal way over decades, leading to inconsistencies among various provisions. This color-coded analysis provides a quick overview of not only which rules are out of date and not meeting best practices for LID and preservation of Green Infrastructure, but also how certain topics (such as siting of LID) may be inconsistent between different parts of land use rules.

Not all factors (such as road width, siting of LID, limits on clearing and grading, or allowing common drives) may be addressed in each of the sections considered (Zoning bylaws, Subdivision Rules and Regulations, Site Plan Review (SPR), and Stormwater/LID bylaw). Where that factor is not usually included within a regulation or bylaw, you'll notice that "*(Not Applicable)*" will appear in that box. For example, setbacks and frontage requirements are addressed under Zoning, but often not under other bylaws or regulations. Those boxes are available for editing where desired. The sections identified for review may also need to be adjusted for your analysis, and you may need to add or remove columns to reflect the unique set of bylaws and regulations applicable in your community.

This review may also help towns identify best practices that comply with MS4 permit requirements, issued by EPA and Mass DEP, though it is not comprehensive in relation to the permit requirements and additional actions may be needed. Consultation with EPA and/or DEP is strongly recommended. Visit www.mass.gov/guides/municipal-compliance-fact-sheet-stormwater for more info.

The analysis is broken into five goals, each with factors that address the goal:

Goal 1: Protect Natural Resources and Open Space
The focus of this section is to limit clearing and grading and encourage soil management, the use of native species, and revegetation of disturbed areas. Often, communities have language such as "due regard shall be shown for natural features" without any specific limitations or guidelines that can be used by local boards to ensure developers are following the true intent of the community. The retention of natural vegetation and soils is the single most efficient means of reducing development impacts on water resources, avoiding costs associated with piping and other "grey" stormwater management features as well as the need for irrigation. There are also many other benefits – including habitat for birds and pollinators, trees for shade and clean air, and protection of natural scenery that contributes to property values and a high quality of life.

Goal 2: Promote Efficient, Compact Development Patterns and Infill
Often, making dimensional requirements such as setbacks, lot size, and frontage more flexible as well as allowing common drives will help allow the community to encourage efficient, compact designs. These help to decrease the amount of impervious surfaces and increase infiltration, while still supporting new development.

Goal 3: Smart Designs that Reduce Overall Imperviousness
This section reviews site design such as street location, road width, cul-de-sac design, curbing, roadside swales, and sidewalk design and location. There are many opportunities for communities to minimize impervious surfaces and allow for infiltration through curb cuts, swales, and cul-de-sacs with bioretention, among other things.

Goal 4: Adopt Green Infrastructure Stormwater Management Provisions
This section looks to explicitly discuss LID as a preferred method, such as requiring roof runoff to be directed into vegetated areas, and a preference for infiltration wherever soils allow or can be amended. Bylaws and/or regulations should clearly specify what LID is and which BMPs are preferred or required. Communities should also require an operations and maintenance plan to encourage effective use of LID methods. Adopting a specific LID bylaw can help clearly define and incorporate LID as a preferential stormwater management technique. Defining LID within this bylaw also decreases the need to explain LID throughout each of the Zoning bylaws, SPR, and subdivision rules and regulations and reduce the potential for any conflict between regulations and bylaws. This section also includes additional stormwater management considerations relevant to the MS4 permit.

Goal 5: Encourage Efficient Parking
Parking accounts for a large amount of impervious surface within new and redevelopment projects and offers an enormous opportunity for using LID. By reducing the amount of required parking - or even including parking *maximums* instead of *minimums*, communities can drastically reduce their impervious surfaces and runoff. Many communities already require landscaping in parking areas, which also offers an opportunity to allow curb cuts and infiltration in these

Additional Notes and Recommendations

Stormwater Calculations
Ensure your regulations reference the most updated data on storm intensities from the Northeast
Climate Center at http://www.nrcc.cornell.edu/

Landscaping and Recommended Trees
Ensure your local landscaping regulations require native, pollinator friendly species such as those here: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_015043.pdf

Additional Considerations

Funding and Maintenance:

- Ensure sufficient funding for DPW to perform maintenance of stormwater management facilities, whether conventional or LID.
- Consider reduced costs of paving, plowing, salt when comparing LID maintenance costs with conventional designs
- Create mechanisms for enforcement of maintenance agreements; establish regulations/fines for property owners who fail to maintain stormwater facilities.

Training, Demonstration Projects, and Public Education:

- Provide opportunities for and encourage municipal staff and committee/board members to participate in LID workshops or conferences.
- Implement LID demonstration programs at city or town hall, schools, DPW, etc.

Nonpotable Uses of Clean Stormwater:

- Local plumbing codes should allow the use of clean (e.g. rooftop) rainwater for landscape irrigation and interior non-potable uses such as toilet flushing.

MA Open Space Residential Design Best Practices Factors	Conventional	Better	Best Practice	Community's OSRD
Permit Type	Special Permit	By Right	Mandatory	Special Permit (Zoning Bylaw Appendix Special Permit 15, Section VI, Subsection J)
Land area to which the zoning is applicable	Only a small amount of developable land	Land of particular environmental sensitivity	All developable land zoned residential	most developable land zoned residential. (Zoning Bylaw Appendix Special Permit 15, Section VI(J)(3))
Minimum Open Space	50-65%	65-75%	≥ 75%	35% (Zoning Bylaw Appendix Special Permit 15, Section VI(J)(9))
Yield Calculation	Full plan with full percolation tests	Sketch plan with selected percolation test(s)	By formula	Specifically identified. (Zoning Bylaw Appendix Special Permit 15, Section VI(J)(4))
Minimum parcel size	≥ 10 acres	5-10 acres	None	5-10 acres (Zoning Bylaw Appendix Special Permit 15, Section VI(J)(2))
Review Process	No detailed analysis of site characteristics in relation to design	Cluster layout	Flexible "OSRD" 4 Step	cluster layout.
Ownership of Open Space	Appropriate to the resources present. For example, agricultural land by the farmer, watershed land by a water dept. or district, habitat land by the conservation commission, or recreational open space by a parks and recreation commission or homeowners association.			Ownership conveyed to town or nonprofit or trust. (Zoning Bylaw Appendix Special Permit 15, Section VI(J)(12))

Dimensional Standards; area, frontage, etc.	Specified, < than for standard subdivision	Formulaic reduction with specified minimums	None set or small minimums	specified less than for standard subdivision. (Zoning Bylaw Appendix Special Permit 15, Section VI(J)(4))
Quality of open space conserved: Specificity of local priorities for natural, cultural, and historic resource conservation	No indication of local conservation priorities, or language that refers only to regulated resource areas.	Lack of specificity regarding local conservation priorities; no map of priority locations	Local priorities clearly and unambiguously stated and mapped for use in site design.	Local priorities not enumerated, but plan must include specific identification of natural features and site design must take into account. (Zoning Bylaw Appendix Special Permit 15, Section VI(J)(15))
Contiguity of open space; relationship to previously protected open space	No contiguity requirement	Contiguity required within subdivision	Contiguity required; adjacent land considered	no contiguity required.
Quality of open space conserved: Allowed uses of open space	Allowed use of open space not addressed	Vague language regarding use of conserved open space	Clear list of allowed uses consistent with conservation and recreation goals	Allowed uses identified. (Zoning Bylaw Appendix Special Permit 15, Section VI(J)(8))
Quality of open space conserved: Submission requirements - GIS maps, data, etc. to inform the review process	Vague or no language regarding submission of information on site resources and no specified process for the use of the data submitted	General non-comprehensive data and mapping requirements; vague process for the application of the data to site design and open space conservation	Specific plans, maps, & comprehensive data regarding natural, cultural, and historic resources required and used as the basis for open space conservation	Resources must be identified on the site plan and must be taken into account through design of project. (Zoning Bylaw Appendix Special Permit 15, Section VI(J)(15))
Relationship to Plans	Relationship to plans not discussed	Optional consideration of open space goals of OSRP, master, and/or regional policy plan	Required consideration of open space goals of OSRP, master, and/or regional policy plan	Relationship to plans not discussed.

Low Impact Design	Not addressed	Encouraged	Required	Encouraged. (Zoning Bylaw Appendix Special Permit 15, Section VI(J)(15)(B))
Density bonus for enhanced public benefit(s)	No bonus offered	Bonus by special permit	Automatic or formulaic bonus	Planning Board can approve bonus for subsidized housing. (Zoning Bylaw Appendix Special Permit 15, Section VI(J)(6))
Review Entity	ZBA, council or selectmen as special permit authority	Planning Board	Planning Board	Planning Board (Zoning Bylaw Appendix Special Permit 15, Section VI(J)(2))
Flexibility re: open space protection to facilitate wastewater treatment facilities	No flexibility provided	Aggregate calculations allowed by board of health	If necessary, required open space may be reduced by < 10% to accommodate; disposal area deed restricted; aggregate calculations allowed by BoH, etc.	open space may be used for septic and stormwater retention. (Zoning Bylaw Appendix Special Permit 15, Section VI(J)(8))
Monitoring of open space	No specified monitoring requirements and no requirements that would assist the party responsible for monitoring	Loose provisions to facilitate, municipal monitoring, or no specificity regarding monitoring interval	Specific provisions to aid endowed monitoring by a conservation org at stated intervals	no specified monitoring.

Factors	Conventional	Better	Best	Community's Zoning	Community's Subdivision Rules & Regulations	Community's Site Plan Review	Community's Stormwater/LID Bylaw/Regulations
GOAL 1: PROTECT NATURAL RESOURCES AND OPEN SPACE							
Soils managed for revegetation	Not addressed	Limitations on removal from site, and/or requirements for stabilization and revegetation	Prohibit removal of topsoil from site. Require prep of soils compacted during construction	*(Not applicable)*	not addressed	not addressed	not addressed
Limit clearing, lawn size, require retention or planting of native vegetation/naturalized areas	Not addressed or general qualitative statement not tied to other design standards	Encourage minimization of clearing/ grubbing	Require minimization of clearing/grubbing with specific standards	Board of appeals has discretion to condition earth removal. (Zoning Bylaw Section IV A)	not addressed	not addressed	not addressed
Require native vegetation and trees	Require or recommend invasives	Not addressed, or mixture of required plantings of native and nonnative	Require at least 75% native plantings	not addressed	not addressed	not addressed	not addressed
GOAL 2: PROMOTE EFFICIENT, COMPACT DEVELOPMENT PATTERNS AND INFILL							
Lot size	Required minimum lot sizes	OSRD/NRPZ preferred. Special permit with incentives to utilize	Flexible with OSRD/NRPZ by right, preferred option	Specified minimums. (Building Department Setback Requirements)	*(Not applicable)*	*(Not applicable)*	*(Not applicable)*
Housing density	Multi-family housing not allowed, or only in/adjacent to commercial and industrial uses	Multi-family and cluster developments allowed by special permit	Multi-family housing allowed by right in most residential areas; cluster developments encouraged with density bonuses for LID features and no maximum lot coverage	Cluster developments allowed by special permit. (Zoning Bylaw Appendix Special Permit 15, Section VI(J))	*(Not applicable)*	*(Not applicable)*	*(Not applicable)*
Setbacks	Required minimum front, side, and rear setbacks	Minimize, allow flexibility	Clear standards that minimize and in some instances eliminate setbacks	required minimums. (Building Department Setback Requirements)	*(Not applicable)*	*(Not applicable)*	*(Not applicable)*
Frontage	Required minimum frontage for each lot/unit	Minimize especially on curved streets and cul-de-sacs	No minimums in some instances, tied into other standards like OSRD design and shared driveways.	required minimums. (Building Department Setback Requirements)	*(Not applicable)*	*(Not applicable)*	*(Not applicable)*

Common driveways	Often not allowed, or strict limitations	Allow for 2-3 residential units	Allow for up to 4 residential units, preferrably constructed with permeable pavers or pavement	Specifically allowed for Elderly housing developments, but otherwise not mentioned. (Zoning Bylaw Section VI(I)(2)(c))	not addressed.	not addressed	*(Not applicable)*
GOAL 3: SMART DESIGNS THAT REDUCE OVERALL IMPERVIOUSNESS							
Impervious cover limits and infiltration rates	Not usually addressed in zoning and subdivision regs for rural/suburban residential	Require no net increase in site run-off from pre- to post-development	Impervious cover limits tailored to the commuity and district type (i.e. <10% total impervious cover in rural districts, but higher in urban and redevelopment districts); post-development infiltration should be equal to or greater than pre-development. Following best practice may also help communities comply with MS4 permit requirements	not addressed	not addressed.	not addressed	*(Not applicable)*
Street location	Numeric and geometric standards based primarily on vehicular travel and safety, with basic pedestrian requirements e.g. sidewalks	Flexibility in applying standards, to reduce area of impact, grading, avoid key natural features	OSRD design preferred by-right. Require locating streets to minimize grading and road length, avoid important natural features	*(Not applicable)*	Based primarily on traffic and pedestrian safety. (Subivision Regs. Section 6.1)	*(Not applicable)*	*(Not applicable)*
Road width	Major and minor categories, 24-30'	Wide, medium, narrow categories. 22-24' max, plus 2' shoulders	Wide, medium, narrow, and alley categories. 20-24' widest for 2 travel lanes, 18-20' low traffic residential neighborhood, plus 2' shoulders. Allow alleys and other low traffic or secondary emergency access and all shoulders to use alternative, permeable materials.	*(Not applicable)*	Not sure. Typical Cross section includes 28' roadway. (Subdivision Regs. Appendix A)	*(Not applicable)*	*(Not applicable)*
Road ROW width	50-75', fully cleared and graded	40-50', some flexibility in extent of clearing	20-50'depending on road type	not addressed.	50' minimum. (Subdivision Regs. Section 6.1.10)	not addressed	not addressed

Access Options	No common drives allowed, dead end allowed with limit on length and # of units	Allow dead end with limit on length and # of units. Allow common drives up to 2-3 units	Allow one way loop streets. Allow common drives up to 4 units, and alleys and rear-loading garages where suitable.	*(Not applicable)*	Dead end allowed with limit on length. (Subdivision Regs Section 6.1.12)	*(Not applicable)*	*(Not applicable)*
Dead Ends/Cul-de-sacs	120 ft or more minimum turnaround	Minimize end radii – 35 ft	Allow hammerhead turnaround	*(Not applicable)*	End radius 50' (Subdivision Regs. Section 6.1.12)	*(Not applicable)*	*(Not applicable)*
Cul-de-sacs	Full pavement standard	Encourage center landscaping with bioretention	Require center landscaping with bioretention	*(Not applicable)*	not addressed.	*(Not applicable)*	*(Not applicable)*
Curbing	Curbing required full length both sides of road	Allow curb breaks or curb flush with pavement to enable water to flow to vegetated LID features	Open drainage with roadside swales and no curbs preferred	*(Not applicable)*	both sides of road. (Subdivision Regs Section 7.4.4.2)	not addressed	not addressed
Roadside Swales	Allowed as an option	Preferred over closed drainage	Preferred, with criteria for proper design. Adoption of technical specifications and design templates for green infrastructure recommended	*(Not applicable)*	not specifically addressed.	not addressed	not addressed
Utilities	Off sets required contributing to wide road ROWs	Not specified, flexible	Allow under road, sidewalks or immediately adjacent to roads to enable placement of roadside swales.	*(Not applicable)*	Utilities within ROW. (Subdivision Regs, Appendix A, Roadway Cross Section Detail)	not addressed	*(Not applicable)*
Sidewalks	Concrete or bituminous	Some flexibility in material and design	Prefer permeable pavement or permeable pavers	*(Not applicable)*	Concrete. (Subdivision Regs Section 7.4.5.3)	not addressed	*(Not applicable)*
Sidewalk location	Required both sides of road	Allow on only 1 side of road especially in low density neighborhoods	Prefer siting with land contours and for best pedestrian utility (e.g. connect with common areas and shared open spaces) – not necessarily immediately parallel to road.	*(Not applicable)*	Both sides of street. (Subdivision Regs Section 7.4.5.1)	not addressed	*(Not applicable)*
Sidewalk drainage	Drains to road closed drainage system	Not addressed	Disconnect drainage from road system – e.g.adjacent green strips or within vegetated areas that can absorb sheet flow	*(Not applicable)*	not addressed.	not addressed	*(Not applicable)*
GOAL 4: ADOPT GREEN INFRASTRUCTURE STORMWATER MANAGEMENT PROVISIONS							

Rooftop runoff	Prohibit directing clean roof runoff into closed municipal drainage systems.	Allow clean roof runoff to be directed to landscaped or naturally vegetated areas capable of absorbing without erosion, or infiltration	Require directing clean roof runoff to landscaped or naturally vegetated areas capable of absorbing, or infiltration	*(Not applicable)*	not addressed.	not addressed	not addressed
Overall stormwater design; piping and surficial retention vs. LID	Conventional stormwater system design standards	Encourage LID features and BMPs; design standards often not specified	LID design standard encouraging infiltration, allowing surficial ponding of retained runoff for up to 72 hours; systems designed for larger volume storms, accounting for future precipitation predictions; credit for green roofs towards stormwater requirements. Following best practice may also help communities comply with MS4 permit requirements	*(Not applicable)*	not addressed	not addressed	not addressed
Site Plan/Design Requirements	LID not addressed	Encourage use of LID features in site design - such as reduced imperviousness, maintaining natural hydrology, preserving open space, and rainwater reuse	Include bioretention and other vegetated LID features in site landscaping/open space requirements. Following best practice may also help communities comply with MS4 permit requirements. See section 2.3.5 of the MS4 permit for more information	*(Not applicable)*	not addressed	not addressed	not addressed
Allow easy siting of LID features (bioretention, swales, etc.)	Often not addressed, may require waivers from subdivision standards	Encouraged along road ROW	Allowed on lots, common open space, or road ROW, easement recorded. For commercial development, allow an increase in floor area ratio or other developmental incentives for green roofs	not addressed	not addressed	not addressed	*(Not applicable)*

Permeable paving	Often not addressed, may require waivers from subdivision standards	Allowed on private residential lots for parking, patios, etc.	Allowed for residential drives, parking stalls, spillover parking spaces, emergency access ways (with proper engineering support for emergency vehicles) Two track design allowed for driveways and secondary emergency access ways (where required)	*(Not applicable)*	not addressed	not addressed	not addressed
Stormwater management O&M plan	Typically only addressed if municipality has a stormwater or LID bylaw, or for areas subject to wetlands permitting	Required	Required, contents specified in alignment with current MassDEP Stormwater Handbook. Following best practice may also help communities comply with MS4 permit requirements	*(Not applicable)*	not addressed	not addressed	not addressed
Construction Erosion and Sedimentation Plan, and stormwater control	Basic general requirements	Required, contents specified - the site design process should include soil erosion and sedimentation control measures	Goes beyond minimum NPDES requirements. Requires minimization of site disturbance, reduction of construction waste, control measures not removed until proof of soil stabilization or reestablishment of vegetation. Written procedures for site inspection and enforcement included. Following best practice may also help communities comply with MS4 permit requirements. See section 2.3.5 of the MS4 permit for more information	*(Not applicable)*	Definitive plan must include. (Subdivision Regs. Sections 5.4.2.2 and 5.4.2.3)	Required. (Subdivision Regs. Section 11.6.1)	not addressed.

Stormwater discharge detection & elimination	Not addressed	Discharges and connections noted and/or limits set on quantity and quality	Illicit discharges and connections are prohibited and enforced. Following best practice may also help communities comply with MS4 permit requirements. Find more information in section 2.3.4.a of the MS4 permit	*(Not applicable)*	*(Not applicable)*	*(Not applicable)*	Prohibited and enforced. (Stormwater Bylaw Sections 4 and 7)
Post- construction stormwater management and drainage patterns	Not addressed	Allow LID	Resemble pre-existing conditions of volume, velocity, quality and location, as nearly as possible, requiring LID to the max extent feasible. Retain vol of runoff >1in. per sq.ft. of impervious surface and/or remove 90% TSS post-construction & 50% TP generated on the site for new development, or >0.8in. per sq.ft and/or remove 80% TSS and 50% of TP load for redevelopment. Following best practice may also help communities comply with MS4 permit requirements.	*(Not applicable)*	not addressed	not addressed	not addressed
As-built surveys	Not addressed	Recommended	Required, with written instructions for process; electronic submittal allowed	*(Not applicable)*	not addressed	not addressed	not addressed
Intra-departmental communication and coordination	Not addressed	Informally or loosely occurring	Required for plan review and/or permit approvals				
Enforcement	No	Yes	Yes with fines. Same entity should oversee permit approvals and enforcement				
GOAL 5: ENCOURAGE EFFICIENT PARKING							

Parking	Specific minimums set based on projected maximum use times	Encourage minimum # needed to serve routine use (e.g. 2/residential unit with any additional/visitors parking behind in driveway or on street).	Establish Maximum Parking spaces allowed. Do not require more than 2/residence. Allow tenants separate, optional lease agreements for parking.	specific minimums. (Zoning Bylaw Section VII(B))	*(Not applicable)*	not addressed	*(Not applicable)*
Commercial Parking	Specific minimums set based on projected maximum use times adding all on-site uses together.	Some flexibility to reduce minimums based on street or other available nearby parking or transit.	Allowed shared parking for uses with different peak demand times. Provide model agreements/deed restrictions. Reduce parking requirements near transit. Limit parking stall size (9ftx18ft max), with up to 30% smaller for compact cars	Specific minimums based on use. (Zoning Bylaw Section VII(C)). Up to 25% of parking stalls may be smaller for compact cars. (Zoning Bylaw Section VII((H)(3))	*(Not applicable)*	not addressed	*(Not applicable)*
LID in Parking Areas	Often not addressed, may require waivers e.g. for planting islands to drain down rather than built up surrounded by curbs	Allow LID/bioretention within parking areas.	Require landscaping within parking areas, as LID/bioretention, at a minimum of 10% of the interior area landscaped and a minimum of 25 square feet for island planting areas.	*(Not applicable)*	not addressed	not addressed	not addressed

Common Acronyms

BoA	Board of Appeals
BoH	Board of Health
BMP	Best Management Practice
CC	Conservation Commission
CR	Conservation Restriction pursuant to MGL 184, S.31-33
DPW	Department of Public Works
GI	Green Infrastructure
HA	Homeowner's Association
LID	Low Impact Development
MS4	Municipal Separate Storm Sewer System
NRPD	Natural Resource Protection Development
NRPZ	Natural Resource Protection Zoning
OS	Open Space
OSRD	Open Space Residential Design
PB	Planning Board
ROW	Right of Way
RS	Residential Single
RG	Residential General
SPR	Site Plan Review
SP	Special Permit
SPGA	Special Permit Granting Authority

Resources and Model Bylaws/Regulations

For additional information on best practices, model LID and OSRD bylaws and regulations, case studies, and other related resources see:

www.massaudubon.org/LIDCost
- Five free fact sheets on Cost-Effective LID
- Presentations and other resources

Additional resources
- Massachusetts Smart Growth/Smart Energy Toolkit, including case studies and model bylaws: www.mass.gov/envir/smart_growth_toolkit/

- Massachusetts Smart Growth Model Open Space Design/Natural Resource Protection Zoning: www.mass.gov/files/documents/2017/11/03/Open Space Design (OSD)-Natural Resource Protection Zoning (NRPZ)_0.pdf

- Metropolitan Area Planning Council's (MAPC) LID Toolkit
  www.mapc.org/resource-library/low-impact-development-toolkit/

  MAPC's Environmental Planning Services:
  https://www.mapc.org/our-work/expertise/environment/

- MA-APA *Neighborhood Road Design Guidebook*
  https://www.apa-ma.org/wp-content/uploads/2018/12/NRB_Guidebook_2011.pdf

- EPA's Water Quality Scorecard, which was reviewed and incorporated into this analysis framework in July 2017, including using the 5 goals listed:
  www.epa.gov/smartgrowth/water-quality-scorecard

- MassDEP's Stormwater Program and MS4 compliance resources:
  www.mass.gov/guides/municipal-compliance-fact-sheet-stormwater

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NEIWPCC New England Interstate Water Pollution Control Commission

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CAPE COD COMMISSION

Contact Us

For questions regarding this analysis or how to implement LID in your community, please feel free to contact us:

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