

3.5 Lighting Plan

A. Introduction

This Section covers the intent and design of lighting in connection with the subdivision of land within NAS South Weymouth, for streets, open spaces, buildings, parking lots and other miscellaneous uses that require lighting.

Plans and designs for all lighting plans and fixtures in connection with the subdivision of land in NAS South Weymouth shall be approved by the Applicable Subdivision Board.

This outdoor lighting guideline was created to develop general guidelines for redevelopment in NAS South Weymouth. These guidelines provide general direction for outdoor public and private lighting installations and include recommendations for:

- Luminaire requirements
- Hours of operation
- Street and pedestrian lighting requirements
- Lighting plan
- Waivers
- Exemptions

The recommendations are based upon recommended practices developed by the IESNA.

This lighting guideline also provides recommendations for outdoor lighting for the following other uses:

- Parking area and buildings areas
- Subdivision lots
- Other lighting types

B. Purposes and Goals

Outdoor lighting provides illumination for a variety of needs. The purpose of public street lighting is to illuminate the public streets so as to define them for safe travel by vehicular traffic. A secondary purpose is to illuminate especially hazardous spot locations such as pedestrian crosswalks and public safety devices such as fire alarm boxes and fire hydrants.

Quality outdoor lighting involves selecting the correct equipment, not over lighting, providing uniform lighting and minimizing glare and other forms of non-productive light.

Outdoor lighting installed on private property by the Applicant shall also conform to the design criteria of this document. Buildings may be illuminated at night for reasons of safety and recognition. Architectural lighting can include floodlighting, outlining and spotlighting. New or substantial replacement of outdoor lighting of public buildings will be in conformance with these design criteria. This policy is not intended to supersede the requirements of the Massachusetts State Building Code.

These Regulations provide further guidance to Applicants in implementing minimum requirements for lighting for development. Inappropriate and poorly designed or installed outdoor lighting causes unsafe and unpleasant conditions, limits residents' ability to enjoy the nighttime sky and results in unnecessary use of electric power. However, some outdoor lighting is appropriate in areas such as civic, commercial and industrial centers. The following regulations aim to ensure appropriate lighting where needed while minimizing its undesirable side effects.

C. Outdoor Public Lighting

Outdoor Public Lighting shall refer to any lighting that is within the right-of-way. Any lighting not within the right-of-way shall be considered private outdoor lighting.

(1) General Guidelines for Public Improvements

- Design outdoor public lighting to provide a uniform distribution of light without compromising safety and security.
- Design roadway lighting systems in accordance with IESNA RP-8 (ANSI)—Roadway Lighting and Chapter 22 in the IESNA Lighting Handbook, as the same may be amended.
- Select high-efficiency light fixture whenever possible.
- Select light fixtures that are comparable in height and frequency with other public street lights in the area.
- For public pedestrian walkways and plazas (where required by the Applicable Subdivision Board), use lights in three (3) foot to four (4) foot bollards. The Applicable Subdivision Board will determine if the bollard lights are required at the time of review.

- Outdoor public lights shall be located to avoid conflict with driveways, loading docks, accessibility ramps or other physical improvements where the light fixture would be in conflict with the intended use of the physical improvement.
- Minimum ADA pedestrian access clearance shall be maintained with outdoor public light placements.

(2) General Installation

- When an outdoor public lighting installation is being modified, extended, expanded or added to, the entire outdoor lighting installation shall be subject to the requirements of this Section.
- Expansion, additions, or replacements to outdoor public lighting installations shall be designed to avoid harsh contrast in color and or lighting levels, and conform to existing lighting design.
- Electrical service to outdoor public lighting fixtures shall be underground and installed in a conduit system.
- Proposed lighting installations that are not covered in this section may be approved by the Applicable Subdivision Board as needed.
- All lighting installation work and equipment shall conform to the requirements of all applicable codes.

(3) Luminaire Requirements

(a) Control of Glare

- Light levels shall not exceed 0.5 Foot Candles at any property line. This subsection does not apply if any property line that separates two or more lots or parcels under common ownership or similar adjacent uses, including:
 - (i) Multiple and single lots held in common ownership and separate ownership that are subject to a common site plan approval, and
 - (ii) Contiguous parcels, with or without an approved site plan (common to both or separate), that share common access or parking.
- Any luminaire with a lamp or lamps rated at a total of MORE than 1800 lumens, and all flood or spot luminaries with a lamp or lamps rated at a total of MORE than 900 lumens, shall not emit more than two and one-half percent (2.5%) direct light above a horizontal plane through the lowest direct-light-emitting part of the luminaire.

- Any luminaire with a lamp or lamps rated at a total of MORE than 1800 lumens, and all flood or spot luminaries with a lamp or lamps rated at a total of MORE than 900 lumens, shall be mounted at a height equal to or less than the value $3 + (D/3)$, where D is the distance in feet to the nearest property boundary. The maximum height of the luminaire shall not exceed forty (40) feet.
- Street lighting should meet or provide lower light levels and Uniformity Ratios than those recommended in the IESNA Recommended Practice Manual: Lighting for Exterior Environments (RP-33).
- Street lighting should be designed such that all exterior luminaries with more than 1,000 lumens are shielded and all luminaries with more than 3,500 initial lumens shall meet the Cutoff IESNA Classification.

(4) Light Shielding Requirements

(a) Luminaries

- Regardless of lumen rating, luminaries shall be equipped with whatever additional shielding, lenses, or cutoff devices are required to eliminate light trespass onto any abutting lot or parcel and to eliminate glare perceptible to persons on abutting land.
- Flood or spot luminaries shall be Cutoff if they are 900 lumens or more and shall not be aimed greater than forty-five (45) degrees from horizontal.

(b) Lamps

- Lamp types shall be selected for optimum color rendering as measured by their color rendering index (CRI), as listed by the lamp manufacturer. Lamps with a color rendering index lower than fifty (50) are not permitted. This paragraph shall not apply to temporary decorative lighting which may include colored lamps, such as holiday lighting. Commercial Lighting shall meet minimum IESNA illumination levels while not exceeding IESNA Uniformity Ratios and average luminance recommendations.
- Any temporary outdoor lighting that conforms to the requirements of this Section is permitted.

(5) Hours of Operation

- Public street lighting shall use photoelectric control for operation. Lighting shall automatically turn on when ambient natural lighting becomes less than 1.6 times the illuminance design value or 1.5

foot-candles, whichever is higher, and is automatically turned off when sufficient daylighting is available or the lighting is no longer needed.

(6) Street and Pedestrian Lighting Requirements

(a) Lighting Types

There are three basic lighting types for streets and ways in NAS South Weymouth:

(i) Street Lighting shall have street light fixtures that are pole-mounted lights a maximum of forty (40) feet tall, spaced as required to meet light level standards as specified herein ("Street Lighting").

(ii) Village Center District lighting shall have light fixtures that are post-top or multi-lamp mounted metal halide at fifteen (15) to twenty-five (25) feet tall, spaced as required to meet light level standards as specified herein ("Village Center Lighting").

(iii) Pedestrian Lighting shall have light fixtures that are post-top mounted metal halide at twelve (12) to fifteen (15) feet tall, spaced as required to meet light level standards as specified herein ("Pedestrian Lighting").

- Street light poles shall be rated to carry the fixtures, supports, and appurtenances in an eighty (80) mph wind with 1.3 gust factor.

(b) Lighting Type Placement

- The Parkway, Shea Boulevard, the Truck Connector and the Access Road shall have Street Lighting.
- On the Parkway, Shea Boulevard, and the Truck Connector, Pedestrian Lighting shall be located on the planting strip adjacent to the paved pedestrian portion of the sidewalk. The lights should not be placed along the center of the planting strip, but instead on the side located furthest from the roadway, immediately adjacent to the paved, pedestrian portion.

- Main Street shall have Village Center Lighting located along the center of the curb zone.
- All Secondary Streets shall have Pedestrian Lighting located along the center of the curb zone/planting strip.
- Street lights shall not be located in corner clear zones.

The following lighting levels shall be provided for each roadway classification:

Street Type	Minimum Average Foot Candles	Average/Minimum Uniformity Ratio	Minimum Spacing (in feet)	Maximum Spacing (in feet)
Parkway	1.0	3:1	75	150
Main Street	1.0	3:1	50	100
Shea Boulevard	.6	4:1	75	150
Secondary Streets	.4	6:1	100	200

Lighting for each street type shall be staggered on both sides of the street at the spacing specified for the street type.

(7) Intersection Lighting Design Parameters

A street light shall be installed at each intersection to provide adequate light. The following regulations shall apply:

- Street lights shall be single fixture units providing sufficient light to adequately illuminate the intersection and any marked crosswalks.
- Sodium Vapor or Mercury Vapor lamps shall not be used.
- Light posts shall be located a minimum of two (2) feet from the edge of pavement, but in no case should light poles be located in ditch lines, impede pedestrian or vehicular travel or conflict with traffic signals.

Per the IESNA guidelines (as published in ANSI/IESNA, RP-8-00 - American National Standard Practice for Roadway Lighting, 2000, as the same may be amended), intersection lighting design should provide the following:

- (a) Major/Major Intersection Classification with Low Pedestrian Traffic:
- Average maintained horizontal illuminance should be at least 1.8 foot-candles; and
 - Average to minimum Uniformity Ratio should be no more than 3.0.

- (b) Major/Collector Intersection Classification with Low Pedestrian Traffic:
 - Average maintained horizontal illuminance should be at least 1.5 foot-candles; and
 - Average to minimum Uniformity Ratio should be no more than 3.0.

- (c) Major/Local Intersection Classification with Low Pedestrian Traffic:
 - Average maintained horizontal illuminance should be at least 1.3 foot-candles; and
 - Average to minimum Uniformity Ratio should be no more than 3.0.

- (d) Collector/Collector Intersection Classification with Low Pedestrian Traffic:
 - Average maintained horizontal illuminance should be at least 1.2 foot-candles; and
 - Average to minimum Uniformity Ratio should be no more than 3.0.

- (e) Collector/Local Intersection Classification with Low Pedestrian Traffic:
 - Average maintained horizontal illuminance should be at least 1.0 foot-candles; and
 - Average to minimum Uniformity Ratio should be no more than 3.0.

- (f) Local/Local Intersection Classification with Low Pedestrian Traffic:
 - Average maintained horizontal illuminance should be at least 0.8 foot-candles; and
 - Average to minimum Uniformity Ratio should be no more than 3.0.

(8) Light Loss Factor

In designing a lighting system it is the standard practice to use a factor to reduce the amount of initial lumens that a new lighting system will generate. Factors such as dirt depreciation and lumen depreciation are taken into account, so the lighting design will more accurately simulate the lighting conditions that can be expected over a period of time. The Authority has identified the following light loss factor for use on intersection lighting systems:

- Light Loss Factor (LLF) = 0.81.

D. Lighting Plan

(1) General

- Within all subdivisions, street and pedestrian light stanchions shall be located at the entrance to and at all intersections within subdivisions and shall be installed in accord with the procedures required by the applicable utility provider.
- All multifamily, mixed use and Nonresidential Development subdivisions shall provide additional street and pedestrian light stanchions spaced in accordance with standards routinely used by the applicable utility provider.
- Public streetlights shall be installed as required by the Applicable Subdivision Board. If not specified, the Applicable Subdivision Board will determine the locations of public street lights. Public street lighting shall be provided by the Applicant and be in full operation before the first building or residence is occupied. The construction and operating costs of said public street lights are to be borne by the Applicant until acceptance of the street as a public way.

(2) Public Lighting Plans

The Applicant shall submit to the Applicable Subdivision Board sufficient information, in the form of an overall public street lighting plan, to enable the Applicable Subdivision Board to determine that the applicable provisions will be satisfied. The lighting plan shall include at least the following:

- A vicinity map showing the general location of the site drawn to the required scale and a street lighting plan showing the locations of public street lights. The scale of the lighting plan shall be no less than 1-inch=100-feet for ease of reading. The lighting plan shall include a table that indicates the location of the light on the street relative to the closes cross street, the voltage of the street light and the type of street light being proposed.

- Specification (details) for all proposed lighting fixtures including photometric data, designation as IESNA Cutoff fixtures, Color Rendering Index (CRI) of all lamps (bulbs), and other descriptive information on the fixtures.
- Proposed Mounting Height of all street lighting fixtures and operation hours.
- Analyses and luminance level diagrams showing that the proposed installation conforms to the lighting level standards in this Section.
- Location of proposed power source.
- Size conduits considering all conductor adjustment factors required.
- Lighting branch circuit voltage shall not be greater than 277VAC
- Use copper conductors that have been sized with consideration to adjustment factors for voltage drop, ambient temperature, raceway fill, harmonics, and future loading. Aluminum conductors are not acceptable.
- Use minimum No. 12 AWG for lighting branch circuit wiring.
- Provide individual fusing for each luminaire. Use “breakaway” type fused connectors located in the pole handhole.
- Identify all lighting branch circuit conductors at each accessible location using color-coding that is consistent with that on the site.
- Provide lighting circuit voltage drop calculation. Maximum voltage drop from power source to the furthest light shall not exceed three percent (3%).

If any subdivision proposes to have installed street or common or public area outdoor lighting, the final subdivision definitive plan shall contain a statement certifying that the applicable provisions of these Regulations shall be adhered to.

No changes or modifications in approved street lighting plans may be proposed without the specific written approval of the Applicable Subdivision Board, as provided for in Article 2.7N.

Should any public street light fixture or the type of light source therein, be changed after the permit has been issued, a change request must be submitted to the Applicable Subdivision Board, or a designee of the Applicable Subdivision Board, for his/her approval, together with adequate information to assure compliance with these Regulations, which must be received prior to substitution.

(3) Outdoor Private Lighting Plans

(a) General Guidelines for Private Improvements

- All outdoor private lights and illuminated signs shall be designed, located, installed and directed in such a manner as to prevent objectionable light trespass, and glare across,

the property lines and or Disability Glare at any location on or off the property. The “maintained horizontal luminance recommendation” and design calculation procedures set by the IESNA shall be observed.

- Design outdoor private lighting to provide a uniform distribution of light without compromising safety and security.
- The total cutoff of light should be no more than 0.5 ft candles at the property lines of the parcel to be developed. Adjacent to residential property, no direct light source will be visible at the property line at ground level or above.
- Select lighting levels and fixtures that are complementary to the general architectural style of the development and surrounding neighborhood.
- Light fixtures should be compatible in scale to proposed or surrounding buildings.
- Lighting should not conflict with shade trees within landscaped islands, planting strips, and open spaces.
- For private pedestrian walkways and plazas, lights in three foot to four foot high bollards should be used where appropriate. The Applicable Subdivision Board will determine if the bollard lights are required at the time of review. Pedestrian scale lights should be shatter resistant and vandal proof. Lights should not emit excessive heat to cause burns.
- Lights shall be located to avoid conflict with tree canopy. Select lower Mounting Heights of less than twenty (20) feet or below the canopy of trees, rather than high mounted fixtures which may create shadows or dark spots.
- Lights shall be located to avoid conflict with driveways, loading docks, accessibility ramps or other physical improvements where the light fixture would be in conflict with the intended use of the physical improvement.
- Except for lighting of loading areas, service areas, and for architectural emphasis, floodlighting is prohibited. Floodlights are not permitted for the illumination of parking or outdoor product display areas.

(b) General Installation

- When an outdoor private lighting installation is being modified, extended, expanded or added to, the entire outdoor lighting installation shall be subject to the requirements of this Section.
- Expansion, additions, or replacements to outdoor private lighting installations shall be designed to avoid harsh contrast in color and or lighting levels, and conform to existing lighting design.

- Electrical service to outdoor private lighting fixtures shall be underground.
- All outdoor private lighting equipment should be kept outside of the right-of-way.
- Proposed lighting installations that are not covered in this Section may be approved if the Applicable Subdivision Board finds that they are designed to minimize glare, do not direct light beyond the boundaries in excess of 0.5 foot-candles of the area being illuminated or onto adjacent properties or streets, and do not result in excessive lighting levels. The Applicable Subdivision Board will determine what constitutes excessive light levels are for each subdivision.
- All lighting installation work and equipment shall conform to the requirements of all applicable codes.

(c) Luminaire Requirements:

(i) Control of Glare

- Light levels shall not exceed 0.5 Foot Candles at any property line. This subsection does not apply at any property line that separates two or more lots or parcels under common ownership or similar adjacent uses, including:
 - (a) Multiple and single lots held in common ownership and separate ownership that are subject to a common subdivision definitive plan approval, and
 - (b) Contiguous parcels, with or without an approved site plan (common to both or separate), that share common access or parking.
- Any luminaire with a lamp or lamps rated at a total of MORE than 1800 lumens, and all flood or spot luminaires with a lamp or lamps rated at a total of MORE than 900 lumens, shall not emit more than two and one-half percent (2.5%) direct light above a horizontal plane through the lowest direct-light-emitting part of the luminaire.
- Any luminaire with a lamp or lamps rated at a total of MORE than 1800 lumens, and all flood or spot luminaires with a lamp or lamps rated at a total of MORE than 900 lumens, shall be mounted at a height equal to or less than the value $3 + (D/3)$, where D is the distance in feet to the nearest

property boundary. The maximum height of the luminaire shall not exceed twenty-five (25) feet.

(d) Light Shielding Requirements

(i) Luminaries

- Regardless of lumen rating, luminaries shall be equipped with whatever additional shielding, lenses, or cutoff devices are required to eliminate light trespass onto any street or abutting lot or parcel and to eliminate glare perceptible to persons on abutting land.
- Flood or spot luminaries shall be Cutoff if they are 900 lumens or more.

(ii) Lamps

- Lamp types shall be selected for optimum color rendering as measured by their color rendering index (CRI), as listed by the lamp manufacturer. Lamps with a color rendering index lower than 50 are not permitted. This paragraph shall not apply to temporary decorative lighting which may include colored lamps, such as holiday lighting. Commercial lighting shall meet minimum IESNA illumination levels while not exceeding IESNA Uniformity Ratios and average luminance recommendations.
- Any temporary outdoor lighting that conforms to the requirements of this Section is permitted.

(e) Hours of Operation

- Private street lighting may use photoelectric control for operation. Lighting shall automatically turn on when ambient natural lighting becomes less than 1.6 times the illuminance design value or 1.5 foot-candles, whichever is higher, and is automatically turned off when sufficient daylighting is available or the lighting is no longer needed.
- Private outdoor lighting shall not be illuminated between 11:00 p.m. and 6:00 a.m. with the following exceptions:

- (a) If the use is being operated, such as a business open to customers, or where employees are working or where an institution or place of public assembly is conducting an activity, normal illumination shall be allowed during the activity and for not more than one hour after the activity ceases;
 - (b) Low level lighting sufficient for the security of persons or property on the lot may be in operation between 11:00 p.m. and 6:00 am, provided the average illumination on the ground or on any vertical surface is not greater than 0.5 Foot Candles.
- When private outdoor lighting installation or replacement is part of a development proposal for which site plan approval is required under the By-Laws or any regulations of the Authority, the applicable reviewing board shall review and approve the lighting installation as part of its site plan approval.

(4) Waivers

Pursuant to Article 2.7K, the Applicable Subdivision Board may waive or modify the requirements to add or remove lighting, provided it determines that such modification is consistent with the objectives set forth in these Regulations, in the following cases:

- Where an Applicant can demonstrate, by means of a history of vandalism (three or more occurrences in one year) or another objective means, that an extraordinary need for security exists.
- Where an Applicant can show that conditions hazardous to the public, such as steep embankments or stairs, may exist in traveled ways or areas due to poor lighting.
- Where a minor change is proposed to an existing nonconforming lighting installation, such that it would be unreasonable to require replacement of the entire installation.
- Where it can be demonstrated that for reasons of the geometry of a lot, building, or structure, complete shielding of direct light is technically infeasible.

(5) Exemptions

The following types of lighting are exempt from this Section of the Regulations:

- State or Federal regulated lighting such as airports, towers requiring lighting, highway signage and traffic signals, etc.
- Low wattage temporary decorative lighting used for holidays, festivals and special events, provided they do not pose a safety or nuisance problem due to light trespass or glare.
- Continuous colored tube lighting (neon lighting), except that it shall not remain on after a business has closed or as regulated under and signage regulations.
- Temporary holiday lighting during the months of November, December, and January shall be exempt from the provisions of this Section, provided that such lighting does not create dangerous glare or distraction on adjacent streets or properties.

E. Neighborhood Alleys and Pedestrian Lighting Requirements

(1) Lighting Types

There are two basic lighting types for Neighborhood Alleys in NAS South Weymouth:

- (a) Private Street and Pedestrian Lighting shall be pole-mounted, metal halide lights of a maximum of fifteen (15) feet tall, spaced as required to meet light level standards as specified herein ("Private Street Lighting").
- (b) Private Village Center Lighting light fixtures shall be post-top or multi-lamp mounted metal halide at 15-25 feet tall, spaced as required to meet light level standards as specified herein ("Private Village Center Lighting").

(2) Lighting Type Placement

- Light stanchions and lights shall not be nearer than twenty-five (25) feet from the intersection of two streets, measured from the intersection of the tangents of the intersecting street curb lines.
- Street lights shall not be located in corner clear zones.
- Placement is subject to approval of the Applicable Subdivision Board
- Sodium Vapor lamps shall not be used.
- Light posts shall be located a minimum of two (2) feet from the edge of pavement, but in no case should light poles be located in ditch lines, impede pedestrian or vehicular travel or conflict with traffic signals.

(3) Lighting Plan

(a) General:

- Within all subdivisions, street and pedestrian light stanchions shall be located at the entrance to and at all intersections within subdivisions and shall be installed in accord with the procedures required by the electric utility provider.
- All multifamily, mixed-use and Nonresidential Development subdivisions shall provide additional street and pedestrian light stanchions spaced in accord with standards routinely used by the electric utility provider.

(b) Private Lighting Plans:

The Applicant shall submit to the Applicable Subdivision Board sufficient information, in the form of an overall outdoor private lighting plan, to enable the Applicable Subdivision Board to determine that the applicable provisions will be satisfied. The lighting plan shall include at least the following:

- A site plan, drawn to the required scale, showing all buildings, landscaping, parking areas, all proposed outdoor private lighting fixtures.
- Specification (details) for all proposed lighting fixtures including photometric data, designation as IESNA Cutoff fixtures, Color Rendering Index (CRI) of all lamps (bulbs), and other descriptive information on the fixtures.
- Proposed Mounting Height of all outdoor private lighting fixtures.
- Analyses and luminance level diagrams showing that the proposed installation conforms to the lighting level standards in this section. Off-site lighting should be considered in the analyses.
- Drawing of all relevant building elevations showing the fixtures, the portions of the walls to be illuminated, the luminance levels of the walls, and the aiming points for any remote light fixtures.
- Size conduits considering all conductor adjustment factors.
- Lighting branch circuit voltage shall not be greater than 277VAC.
- Use copper conductors that have been sized with consideration to adjustment factors for voltage drop, ambient temperature, raceway fill, harmonics, and future loading. Aluminum conductors are not acceptable.
- Use minimum No. 12 AWG for lighting branch circuit wiring.

- Provide individual fusing for each luminaire. Use “breakaway” type fused connectors located in the pole handhole.
- Identify all lighting branch circuit conductors at each accessible location using color-coding that is consistent with that on the site.

No changes or modifications in approved street lighting plans may be proposed without the specific written approval of the Applicable Subdivision Board, as provided for in Article 2.7N.

Should any outdoor light fixture or the type of light source therein, be changed after the subdivision has been approved, a change request must be submitted to the Applicable Subdivision Board or the designee of the Applicable Subdivision Board for his approval, together with adequate information to assure compliance with these Regulations, which must be received prior to substitution.

F. Parking Area and Building Area Lighting Requirements

- All parking area lighting will be Full Cutoff type fixtures.
- Parking lots should be designed to provide the minimum lighting necessary to facilitate the safe movement of pedestrians and vehicles within parking areas and prevent vandalism, auto theft and personal crime.
- Light sources internal to parking structures should not be visible from outside the structure.
- Full Cutoff type fixtures must be installed in a horizontal position as designed, or the purpose of the design is defeated, and Disability Glare will result.
- Areas of high pedestrian and vehicle use should maintain a minimum foot-candle of 1.0 measured four (4) feet above the ground surface at the point of least illumination and a maximum foot-candle of 7.0, measured four (4) feet above ground surface directly beneath the light source.
- The intensity of light fixtures should be restricted to a maximum of 250 watts, with metal halide lamps recommended for parking areas.
- Parking areas should have light fixtures that have a total cutoff of all light at less than ninety (90) degrees and a beam cutoff of less than seventy-five (75) degrees.
- Attached building or wall pack lighting should be screened by the buildings architectural features or contain a forty-five (45) degree cutoff shield.
- Spacing of light poles in parking areas should be staggered rather than aligned, to maintain a uniform distribution of light.
- In all cases, light poles should be located within landscaped islands for safety and aesthetic reasons.
- Building facades may be illuminated with soft lighting of low intensity that does not draw inordinate attention to the building. The light source for the building facade illumination shall be concealed. Building entrances may be illuminated using recessed lighting in overhangs and soffits, or by

use of spotlighting focused on the building entrances with the light source concealed (i.e., in landscaped areas). Direct lighting of limited exterior building areas is permitted when necessary for security purposes. On security lighting systems use “instant re-strike” lamps or “hot re-strike igniters” and standby power sources to maintain illumination in the event of power interruptions.

- Externally lit signs, display, building and aesthetic lighting must be shielded to prevent direct glare and/or light trespass in excess of 0.2 foot-candles. Top-mounted spot/flood light should be used instead of ground-mounted spot/flood light where practical. The lighting must also be, as much as physically possible, contained to the target area. Internally lit signs are acceptable provided that they meet the requirements of the By-Laws and any other regulations of the Authority. Back lighting of signs shall not be used.
- All building lighting for security or aesthetics will be Full Cutoff type fixtures or a shielded type, not allowing any upward distribution of light. Flood lighting is discouraged, and if used, must be shielded to prevent:
 - (1) Disability Glare for drivers or pedestrians;
 - (2) Light trespass beyond the property line; and
 - (3) Light above a ninety (90) degree, horizontal plane. Unshielded wallpack type fixtures are not acceptable.
- No colored lights may be used in such a way as to be confused with or construed as traffic control devices
- Parking lot and building lighting shall not be on the same electrical circuit as street lights.

G. Lighting within Subdivisions of Single Family Houses

All subdivisions comprised of Single Family Houses (up to 5,000 sq. ft. lot) and Single Family Houses (5,000 to 10,000 sq. ft. lot) should have a pole lantern, however in cases where the layout of the lots within such a subdivision will result in unlighted distances greater than two hundred (200) feet, the Applicable Subdivision Board reserves the right to require additional lighting.

Each lot in such a subdivision should have a pole lantern installed in the front yard equipped with a photo-sensitive device which automatically activates the lantern at the times the street lights are activated.

H. Requirements for Other Lighting Types

(1) Signage

Any luminaire intended to illuminate a sign or billboard shall be shielded so that its direct light is confined to the surface of such sign or building. The average level of illumination on the vertical surface of the external or internal illuminated sign shall not exceed 3.0 foot-candles, and the ratio of average to maximum luminance shall not exceed 2:1. Off-premise signs, if permitted, shall be turned off upon closing, or 10:30 p.m., whichever is earlier. Lights that flash, rotate, move, or simulate motion on a sign are not permitted.

(2) Sports Lighting

Sports venue lighting is exempt from any lumens per acre standards for the playing field only. Cutoff fixture design is required and light trespass requirements apply. No lighted outside sporting or entertainment event shall start after 10:00 p.m. or extend beyond 11:00 p.m.

(3) Searchlights

The use of temporary or permanent searchlights, except by civil authorities for public safety, is prohibited.

(4) Communications Towers

The nighttime use of white or white strobe lighting is prohibited unless written proof of an FAA requirement is provided to the Applicable Subdivision Board.

I. Prohibited Lighting

Laser lights, searchlights, mercury vapor bulbs, and any other type of lamp capable of producing comparable levels of ultraviolet radiation per watt are prohibited.

3.6 Stormwater Management

A. Introduction

This Section covers the design of the storm drain system in connection with the subdivision of land within NAS South Weymouth, including hydrology, street drainage and inlets, alignment and curvature, culverts, open channels, EPA requirements for a general permit and stormwater management requirements. In compliance with EPA requirements, a reduction of the impervious footprint of the site will occur where feasible.

All storm drain plans in connection with the subdivision of land within NAS South Weymouth shall be approved by the Applicable Subdivision Board.

B. Planning

The facilities described in this Section will be designed to implement the By-Laws in connection with the subdivision of land in NAS South Weymouth. In addition, a Drainage Plan has been prepared for the EIR submitted to MEPA (the "Drainage Plan"). Design of stormwater facilities must be in substantial conformance with the Drainage Plan. Both the Drainage Plan and these Regulations will be consistent with all by-laws, rules and regulations adopted by the Authority and regulations of MADEP.

The evaluation of site hydrology and incorporation of stormwater management should be included early in the project design process and to the maximum extent feasible attempt to:

- Avoid and minimize impacts to wetland resource areas.
- Keep impervious surface area consistent with the Authority's regulations.
- Keep peak flow rates below existing condition levels.
- Use vegetated swales and medians.
- Utilize and/or improve existing drainage systems.
- Preserve water quality and minimize erosion.

C. Stormwater Design/Hydrology

Hydrologic analysis should conform to this Section and the Drainage Plan. Applicants should follow the MHD Project Development and Design Manual, the MADEP Storm Water Handbook and the MHD Drainage Manual.

D. Design Storm Frequency

The Applicant must select a design frequency to calculate the peak rate of runoff. Exhibit 5-1 provides required design frequencies.

Exhibit 5-1

Required Design Flood Frequency

Street Classification	Type of Installation		
	Cross Culverts	Storm Drain System ¹	Open Channels ²
Parkway Main Street/Shea Blvd. Trotter Road	50-yr	10-yr	50-yr
Standard/Main Neighborhood Narrow Neighborhood	25-yr	5-yr	25-yr

¹This includes pavement drainage design.

²This includes any culverts which pass under intersecting roads, driveways or median crossings.

Source: HEC #1, March 1969. Design of Highway Pavements, pp. 12-5 to 12-6. Note: HEC #12 – Revised, March 1984.

Note: 100-year requirements must be checked if the proposed street is in an established regulatory floodway or floodplain, or resource area is defined by the April 1983 revisions to M.G.L. Chapter 131, Section 40.

The MADEP Storm Water Management Policy states that the 2-year and 10-year, 24-hour storms must be used in sizing peak discharge controls. It also states that the 100-year, 24-hour storm must also be evaluated to demonstrate that there will not be increased flooding impacts offsite, if peak discharge controls are required. The emergency spillway for detention facilities should be designed for the 100-year storm.

E. Peak Discharge Control

Peak discharge rates for the 2-year, 10-year and 100-year 24-hour storm events will not exceed the peak discharge rates from the NAS South Weymouth (this is defined as the existing or pre-development condition).

Each definitive subdivision plan shall demonstrate that this condition is met. This requirement may necessitate construction of channel and/or detention storage facilities beyond the subdivision boundaries. Generally, peak discharge control will be provided by a facility shown on the Drainage Plan. Discharge control is not required with each lot.

F. Method of Estimating Peak Discharge

Exhibit 5-2 and 5-3 presents a summary of two hydrologic methods to be used: the Rational Method; and the Natural Resource Conservation Service (NRCS) method, formerly the Soil Conservation Service (SCS) Method. Each method will provide the estimated discharge (in cubic feet per second (cfs)) expected at a specific location for a given design frequency, drainage area, and set of hydrologic conditions.

Exhibit 5-2

Rational Method

Basic Source	FHWA-NH1-01-021 "Urban Drainage Design Manual," Hydraulic Engineering Circular No. 22 (HEC #22), August 2001
Developed by	Kuichling, 1889
Applicability	
Size of Drainage Area	Should only be applied to drainage areas smaller than 50 acres
Type of Structures	Pavements, storm drains, open channels, culverts
Status	Use to determine pavement discharge and for other surface runoff calculations
Basic Approach	Calculates peak discharge for design frequency directly from rainfall data, drainage area size and runoff curve numbers
Parameters Incorporated	Rainfall intensity (in/hr) Drainage Area (acres) Runoff curve numbers

Exhibit 5-3

Natural Resource Conservation Service (NRCS) Method

Basic Source	Technical Release No. 55 "Urban Hydrology for Small Watersheds," Revised 2003 "Guidelines for Soil & Water Conservation in Urbanizing Areas of Mass.," App. B, Oct. 1977 Technical Release No. 20 "Computer Program for Project Formulation-Hydrology" 1983
Developed by	NRCS (formerly SCS), U.S. Department of Agriculture
Applicability	
Size of Drainage Area	Less than 2,000 acres
Type of Structures	Storm drains, open channels, culverts, detention storage facilities
Status	Use as a check for Rational Method. Use for design of detention storage facilities.
Basic Approach	Calculates peak discharge for design frequency directly from rainfall data, drainage area size and runoff curve numbers
Parameters Incorporated	Rainfall intensity (in/hr) Drainage Area (acres) Runoff curve numbers

If a subdivision consists of drainage areas that are all less than fifty (50) acres and detention storage facilities are not required, then the Rational Method may be used. Subdivisions with drainage areas greater than fifty (50) acres and/or detention storage facilities must use the NRCS Method.

G. Street Drainage

Roadway drainage and inlet design are critical components of a stormwater drainage system. The surface drainage system must be consistent with the capacity of the storm conveyance system immediately downstream. The design of roadway drainage and inlets is guided by the following principles:

- Promote the safe passage of pedestrian and vehicular traffic, and maintain public safety and manage flooding during storm events.
- Minimize capital and maintenance costs of the drainage system.

This Section summarizes the general design criteria for roadway drainage and inlet design and describes the methods to apply when designing these drainage systems.

(1) Design Criteria

The capacity of surface drainage system (street capacity and inlet interception capacity) must be consistent with that of the stormwater conveyance system immediately downstream. The roadway conveyance capacity is constrained by the width, depth, and velocity of flow.

(2) Roadway Drainage

Roadway cross-sections must have the capacity to convey the peak discharge from the design events, outlined in Exhibit 5-1 within constraints on flow width, depth, and velocity.

H. Drainage

The standard depth of catch basins shall be four (4) feet below the invert of lowest drain. Manholes shall be constructed to the required depth at each junction point and as shown on the plan. Pipe culvert and pipe drains shall be in conformity with the requirements of MDPWSS for installation of pipes.

Cross drains under pavements shall be installed according to the size and materials as shown on the plans. All drainage trenches shall be filled with clean gravel borrow in accordance with MDPWSS, Section 7.00 or suitable reclaimed material.

Where sub-drains are required they shall be constructed in conformance with MDPWSS.

Where adjacent property is not subdivided or where all the property of the Applicant is not being subdivided at the same time, provisions shall be made for the extension of the utility system by continuing the mains the full length of streets and to the exterior limits of the subdivision, at such grade and size which will, in the opinion of the Applicable Subdivision Board, permit their proper extension at a later date. Storm sewers shall extend to adjacent undeveloped land if future continuation into such land is feasible.

I. Street Inlets

(1) Mandatory Inlet Locations

Storm drain inlets must be placed at prescribed locations in order to protect the public safety and provide a minimally functional storm drainage system. These locations include:

- Locations where flow in roadway cross-section exceeds limitations;
- Low points in the roadway profile, such as sumps;
- On the upstream side of super-elevated roadway cross-sections (located in a manner such that no more than 0.1 acre contributes to flow crossing traffic lanes); and
- At intersections where flow is directed towards the intersection without relief from a cross gutter.

J. Storm Drains

Underground conduits operate in conjunction with surface drainage to maintain public safety and manage flooding during storm events. Storm drainage systems must have the capacity to convey the peak discharge from a 100-year design event without affecting property located adjacent to the right-of-way. Street drainage systems shall meet the criteria regarding the maximum flow width, depth, and velocity. To satisfy these criteria, it is often necessary to supplement surface drainage with underground conveyance. This Section summarizes the general design criteria for underground drainage conduits and describes the methods to apply when designing these systems.

(1) Hydraulic Capacity

When storm drains are part of drainage systems that serve 1.0 square mile (640 acres) of tributary area or less, they shall have the capacity to convey the peak discharge from a 10-year or 5-year design event (see Exhibit 5-1). Storm drains conveying flow across a public road (i.e., across the centerline of a roadway) shall have the capacity to convey the peak discharge from a 10-year or 5-year design event (see Exhibit 5-1). The conduit shall convey the design flow with the hydraulic grade line (HGL) maintaining a minimum freeboard of 1.0 ft below the ground surface or gutter flow line during the design event. At a minimum, storm drains within the right-of-way shall not be less than twelve (12) inches in diameter, with three (3) feet minimum depth of cover. The cross-sectional area of the pipe shall not decrease when proceeding down gradient within the storm drain system. Diversion of drainage is not allowed (i.e., the discharge point and all inlets of a storm drain system shall be within the same watershed). This Section references its design criteria and procedures to storm drain conduit with a circular cross-section. These criteria and procedures can be adapted to other cross-section shapes (e.g., arches, other non-circular or non-rectangular shapes) with due care. It is important to note that cross-section shapes must be compared using their section factor ($AR^2/3$), and not simply on the basis of cross-sectional area and perimeter.

(2) Manning Roughness Coefficient

Manning's Roughness coefficient shall be consistent with design charts for open channel flow, HDS #3, FHWA 1973.

K. Alignment and Curvature

(1) Horizontal Alignment

The horizontal alignment of a storm drain system shall maintain a minimum horizontal clearance from potable water mains and sanitary sewer lines. The distance between the outside diameter of a storm drain and the outside diameter of other wet utilities shall not be less than five (5) feet without prior approval by the Applicable Subdivision Board.

The material type, length of pipe segments and bevel of joints limit the curvature of the storm drain.

When designing the junction of two storm drain pipes, priority shall be given to the larger of the connecting storm drains. Flow from the lateral (i.e., the smaller storm drain pipe) shall not oppose the flow in the main line, without prior approval from the Applicable Subdivision Board. Specifically, when the angle of confluence (j) is measured from the centerline of the main line, the angle of confluence shall be less than or equal to ninety (90) degrees at all times. Figure 5-1 illustrates the definition of angle of confluence used in these Regulations. The angle of confluence shall be further limited to sixty (60) degrees in cases where:

- (a) The lateral is thirty-six (36) inches in diameter or larger; or
- (b) The lateral flow is greater than or equal to ten percent (10%) of the main-line flow

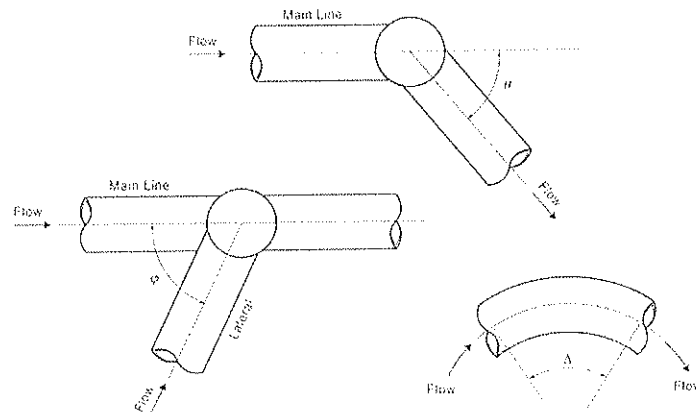


Figure 5-1 Definition Sketch for Angle of Deflection (q), Angle of Confluence (j), and Bend Radius (D)

(2) Vertical Alignment

The vertical alignment of a storm drain systems shall: (1) maintain a depth of cover to sufficient to avoid damage to the facility from overhead traffic loads; (2) minimize conflicts with other underground utilities; and (3) minimize potential buoyancy problems (in cases where a groundwater table is present). The minimum grade of storm drain pipe shall be 0.5 percent. The Applicable Subdivision Board may approve flatter grades where no other practical solution is available. Storm drain conduits shall be protected from surface disturbances and displacements with soil or other cover. The minimum soil cover above a storm drain facility depends on storm drain material type and strength, size of the conduit, cover material, bedding conditions, and traffic loading. For practical purposes, the range of these conditions cannot be delineated fully in these Regulations. The required cover shall be determined based on project conditions, maintaining a minimum soil cover of thirty-six (36) inches. The maximum soil cover above a storm drain facility depends on storm drain material type and strength, size of the conduit, cover material, bedding conditions and traffic loading. The Applicant may specify alternate materials with prior approval by the Applicable Subdivision Board and demonstration that the material is adequate for the design load. The Applicant shall confirm that the design strength of the conduit will be adequate for the soil loading conditions. When there is more than fifteen (15) feet of soil cover, special design conditions may apply.

Best design practice for the vertical alignment within cleanouts, junction structures or equivalent drainage structures is to provide a minimum of 0.1 foot of fall across the structure. When increasing the pipe diameter in the downgrade direction, the standard practice is to match the crowns (soffits) of the incoming and outgoing storm drain pipes when possible. The Applicant may vary from this practice in consultation with the Applicable Subdivision Board.

(3) Cleanouts

Cleanouts shall be manhole structures that allow access for maintenance for a storm drain facility. The Applicant shall specify manholes at prescribed locations within a storm drain facility and at specific locations in relation to the horizontal and vertical curvature of a pipe alignment. Maximum spacing for storm drain access is three hundred (300) feet (inlets, headwalls or manholes).

L. Culverts

Culverts are hydraulically short conduits typically used to convey surface water through a highway or railroad embankment or other type of obstruction. Culverts are usually designed to take advantage of submergence in order to increase the capacity of the conduit. These Regulations provide only a basic level of information on culvert design criteria and design procedures. The Federal Highway Administration's *Hydraulic Design of Highway Culverts* (Hydraulic Design Series No. 5, April 2012), as the same may be amended, provides further information on culvert design.

(1) Hydraulic Criteria

Culverts shall be designed to convey the peak 50-year design flow, depending on the street classification. Whenever practical, the culvert shall maintain a minimum gradient of 0.5 percent, or a flow velocity of four (4) feet per second when flowing one-quarter ($\frac{1}{4}$) full. When outlet velocities exceed permissible velocities for the outlet channel, suitable outlet protection (e.g., energy dissipation or channel lining) shall be provided. For culvert facilities within the right-of-way, the minimum culvert size shall be an eighteen (18) inch diameter round pipe. Multiple barrel culverts are acceptable, so long as each barrel meets minimum gradient and velocity criteria. Culvert headwater elevations shall maintain a freeboard of at least one foot below the roadway crest and the finished floors of structures within the zone influenced by the culvert headwater. Figure 5-2 provides a definition sketch for a typical culvert installation. A culvert headwall or other slope protection is required when the headwater elevation exceeds the top of the culvert conduit.

Culverts shall follow the alignment and grade of the natural channel whenever possible. In cases where the barrel cannot be aligned with the channel flow line, the angle of flow approaching the inlet shall be less than ninety (90) degrees and the additional head loss due to approach angle shall be accounted for at the entrance of the culvert.

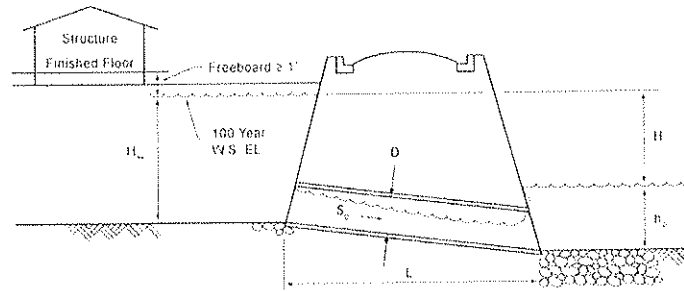


Figure 5-2 Definition Sketch for Culverts

The Applicant may complete a culvert analysis using computer programs (e.g., U.S. Army Corps *HEC-RAS River Analysis System*, FHWA *HY-8 Culvert Analysis*, and proprietary programs), as the same may be amended, or they may use the graphical procedure outlined in the Federal Highway Administration's *Hydraulic Design of Highway Culverts* (Hydraulic Design Series, April 2012), as the same may be amended.

- (2) Special Culvert Considerations
- (a) Pipe Material

There is a wide variety of materials that may be used for construction of a drainage system, including: reinforced concrete pipe, cast-in-place concrete conduit, corrugated steel pipe, corrugated aluminum pipe, high-density polyethylene, and other materials. The specified material shall be approved by the Applicable Subdivision Board and have a minimum design life of sixty (60) years. Where field conditions dictate the use of one pipe material in preference to others (e.g., corrosive soil conditions or presence of a groundwater table), the reasons shall be clearly presented in the plans and specifications.

(b) Debris Considerations

When a culvert is anticipated to pass significant amounts of debris, the design shall maintain or accelerate the velocity of flow approaching the culvert rather than creating a pond at the entrance, and the design flow shall be increased by an appropriate bulking factor to account for the debris. Multiple barrel culverts have an increased susceptibility to clogging due to debris and sediment. When two or more barrels are used at a culvert crossing, the culvert design shall provide for sufficient maintenance access from the upstream side of the crossing.

(3) Deep Cover Culverts

When the culvert is under cover of twenty-five (25) feet or more, the culvert shall be oversized by six (6) inches in diameter in order to provide for future interior repairs or re-lining.

(4) Pipe Abrasion

In cases where a culvert is expected to carry a large amount of debris or abrasive sediment material, it shall be outfitted with protective measures to provide sufficient design life for the facility. When protection is warranted, the invert of the pipe (i.e., the bottom ninety (90) degrees of the pipe) shall be protected on all straight-aways, and the invert and walls (i.e., the lower one hundred eighty (180) degrees of the pipe) shall be protected on all curves. The pipe material will dictate the type and degree of protection required.

M. Open Channels

This Section presents general hydraulic design standards that are applicable to all improved channels. The specific requirements for a particular type of channel may be more strict than the general design criteria outlined in this Section.

(1) Hydraulic Capacity

All open channels shall be designed, at a minimum, to safely confine and convey the runoff from the 50-year or 25-year design event (see Exhibit 5-1).

(2) Manning Roughness Coefficient

Selection of an appropriate channel roughness value for a given channel section is important for the hydraulic capacity analysis and design of open channel. The roughness value can vary significantly depending on the channel type and configuration, density and type of vegetation, depth of flows, and other hydraulic properties. The Massachusetts Highway Design and Procedures Manual, Chapter 8 Drainage and Erosion Control, as the same may be amended, provides recommended values for the Manning roughness coefficient for various channel and overbank types and conditions.

(3) Uniform Flow

Open channel drainage systems shall be designed assuming uniform flow conditions.

Open channels shall have a minimum longitudinal gradient of 0.5 percent whenever practical. Flatter grades may be approved with prior consultation with the Applicable Subdivision Board. Open channels with grades flatter than 0.5 percent shall have provisions for the drainage of nuisance low flows. Horizontal alignment changes of two (2) degrees or less may be accomplished without the use of a circular curve for subcritical flow designs ($FR < 1.0$, see 5.10.3). Curves must be used for supercritical flow designs ($FR > 1.0$), no matter the degree of change in horizontal alignment. Curved channel alignments shall have super-elevated banks. Spiral transition curves shall be used upstream and downstream of curves for supercritical channel designs with reverse curves or horizontal alignments with consecutive circular curves. Spiral curves may also be used to reduce required superelevation allowances and cross-wave disturbances.

(4) Maximum Permissible Velocity

The design of open channels shall be governed by maximum permissible velocity. This design method assumes that a given channel section will remain stable up to a maximum permissible velocity, provided that the channel is designed in accordance with the standards presented in these Regulations. Regardless of these maximum permissible velocities, the channel section shall be designed to remain stable at the final design flow rate and velocity. The design flow may not always yield the highest flow velocity. Therefore, best practice is to confirm channel section stability during events smaller than the design flow. This may be accomplished by evaluating flows of specific more frequent storm events (e.g., 10-year, 2-year, etc.), or testing successive fractions (e.g., one-half, one-quarter, and further if necessary) of the design flow. However, only calculations for the full design flow are required to be submitted for review.

Additional geotechnical and geomorphological investigation and analyses may be required for natural channels or improved unlined channels to verify that the channel will remain stable based on the maximum design velocities.

N. Stormwater Management Requirements – Permanent BMPs

The MADEP Stormwater Policy Handbooks (Volumes 1 and 2) shall guide the Applicant through the selection, design, and incorporation of stormwater BMPs into the project's design plan. Reference should be made to the Stormwater Management Policy and Stormwater Policy Handbooks for detailed stormwater pollution background information and legal or regulatory requirements associated with stormwater pollution control.

Stormwater management standards apply to industrial, commercial, institutional, residential and roadway projects (refer to MADEP Stormwater Management Policy for exceptions).

If practicable, it is recommended that the Applicant direct roof drainage to pervious areas and/or infiltration basins for reuse and or recharge. This practice will reduce the directly connected impervious area and could reduce the water quality volumes to be treated.

MADEP recommends that Applicants submit a Stormwater Management Form with the Notice of Intent to the conservation commission for review. If a particular stormwater management standard cannot be met, the Applicant must demonstrate how adequate water quality and water quantity protection will be provided as described above.

O. NPDES Requirements

The EPA promulgated rules establishing Phase I of the NPDES stormwater program. Phase I rules address discharges from large municipal separate storm sewer systems and certain industrial activities, including construction activities disturbing five acres or more of land. EPA issues a Construction General Permit to cover discharges from construction activities. Coverage under this permit requires filing of a notice of intent with the EPA Region 1 office and preparation of a SWPPP. This general permit is applicable to highway projects involving disturbance of five acres or more. In 1999, the EPA issued the Phase II rule of the NPDES stormwater program. The Phase II Rule, which became effective on May 1, 2003, reduces the threshold for soil disturbance at construction sites from five acres down to one acre. Construction projects that exceed the soil disturbance threshold must file a notice of intent with the EPA under the Construction General Permit and prepare a SWPPP. In addition to affecting construction activities, the NPDES Phase II rule applies to the Authority or the Towns as an “operator of MS4s” (as defined under the Phase II Rule). A MS4 Permit needs to be issued to the Authority or the Towns by EPA and MADEP and a SWPPP needs to be prepared by the Authority or the Towns to comply with the permit provisions. Phase II requires implementation of the following six minimum control measures:

- Public education and outreach;
- Public participation/involvement;
- Illicit discharge detection and elimination;
- Construction site runoff control
- Post-construction runoff control; and
- Pollution prevention/good housekeeping.

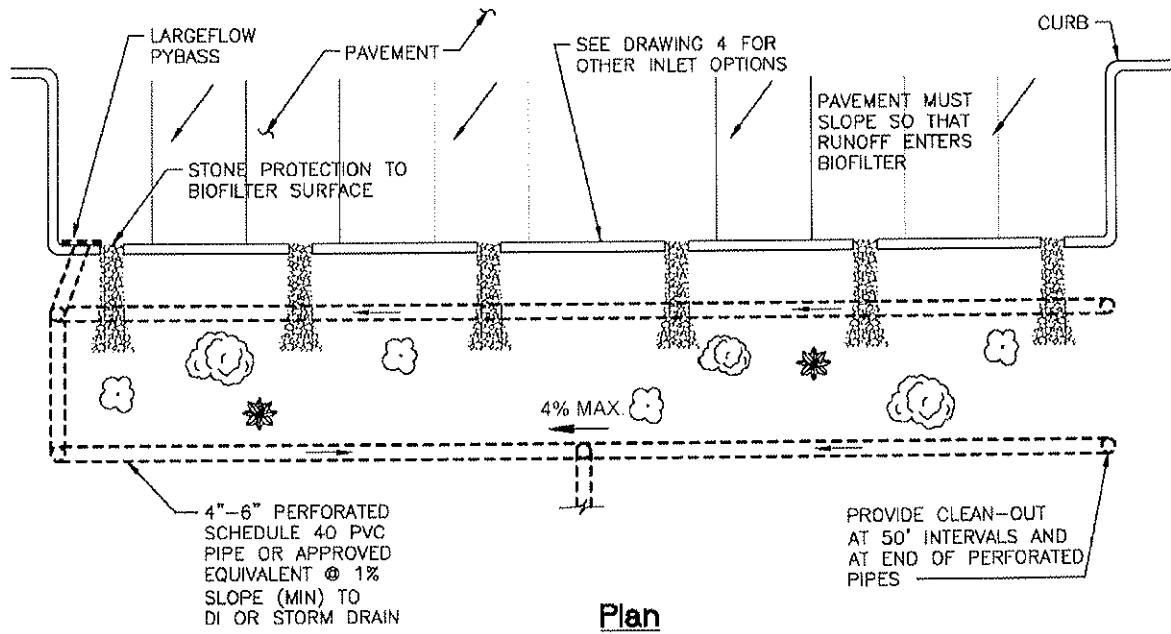
This Section provides the controlling guidance relative to compliance with the NPDES Phase II Rule and the MADEP Stormwater Management Policy. The Applicant should coordinate with the Authority or the Towns regarding the SWPPP and any additional requirements under NPDES regarding impacts on endangered and threatened species, stressed drainage basins or impaired water bodies.

In addition, the Applicant must provide a PPP, which describes all construction BMPs to be implemented during construction to reduce/eliminate discharges of pollutants to the storm drain conveyance system. The PPP shall include, but not be limited to, erosion and sediment control BMPs, good housekeeping measures and site and materials management. The components of a PPP are detailed in *Stormwater Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices* (EPA-832-R-92-005), as the same may be amended.

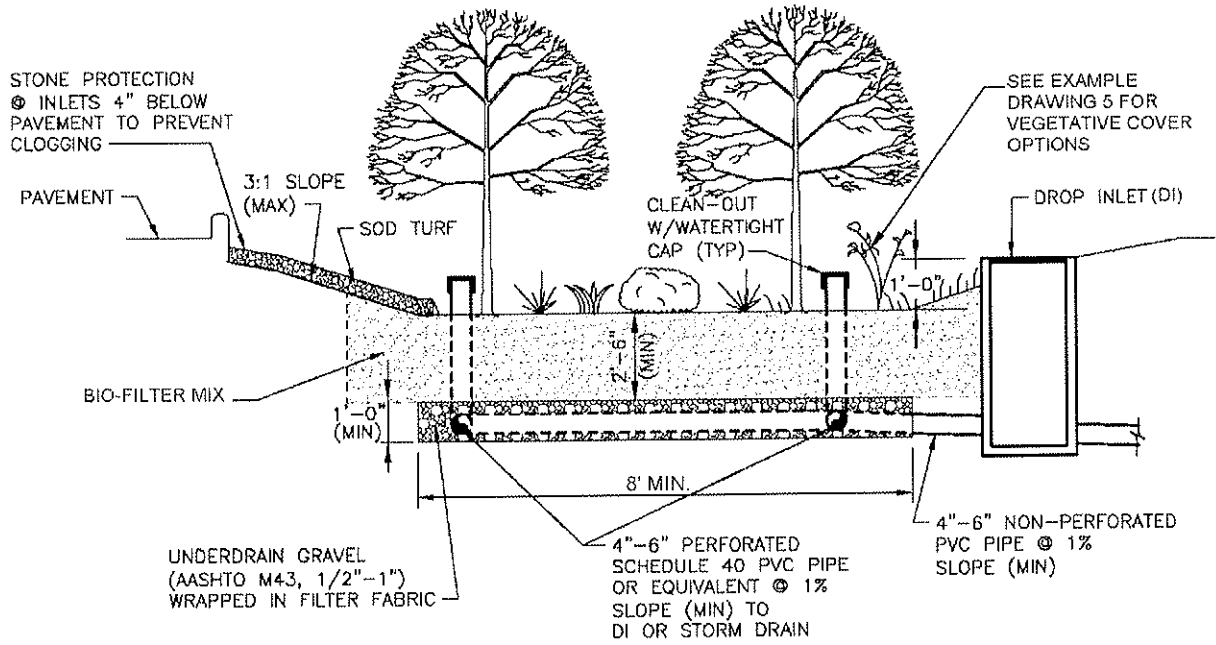
P. Stormwater Management Example Drawings

The following drawings are examples of stormwater management, yet do not detail specific requirements for stormwater management.

N.A.S. South Weymouth / Village Center Plan



Plan



Cross Section

NOTE: EXHIBIT FOR ILLUSTRATIVE PURPOSES ONLY.

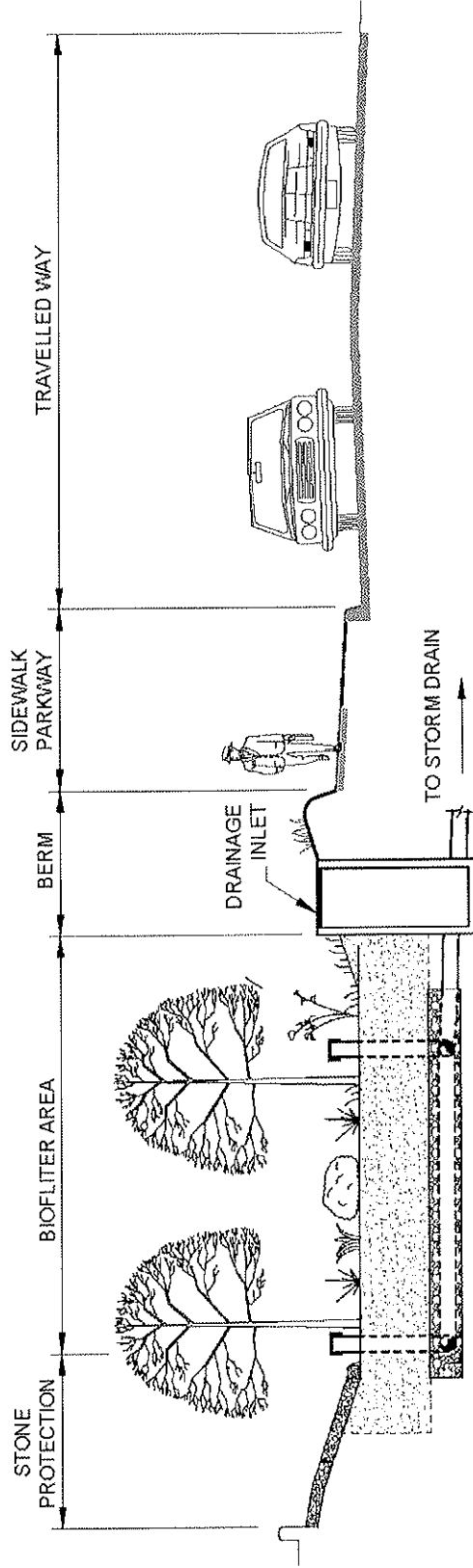
Figure 5-3

Biofilter

Stormwater Management Example Drawing 1

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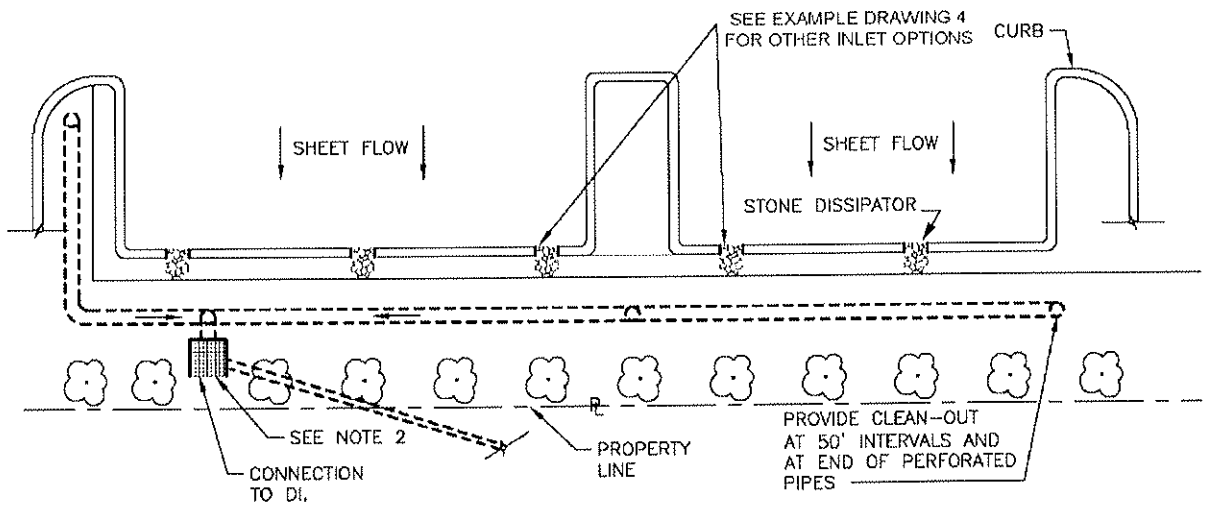
N.A.S. South Weymouth / Village Center Plan



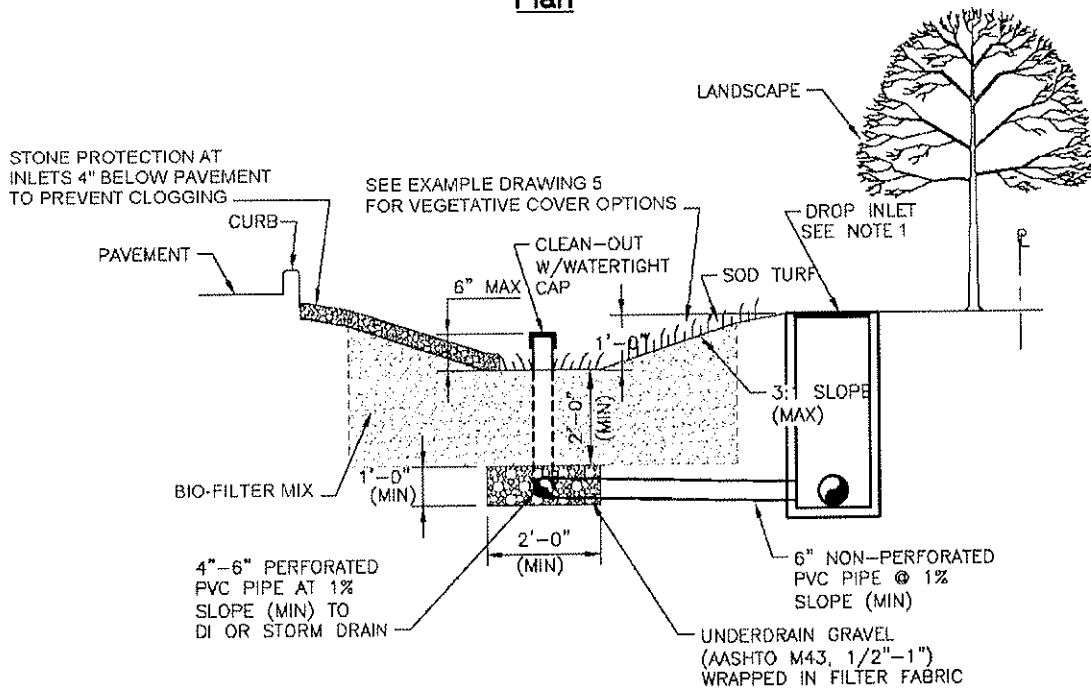
NOTE: EXHIBIT FOR ILLUSTRATIVE PURPOSES ONLY.

Figure 5-4

Biofilter Adjacent To Roadway
Stormwater Management Example Drawing 2



Plan



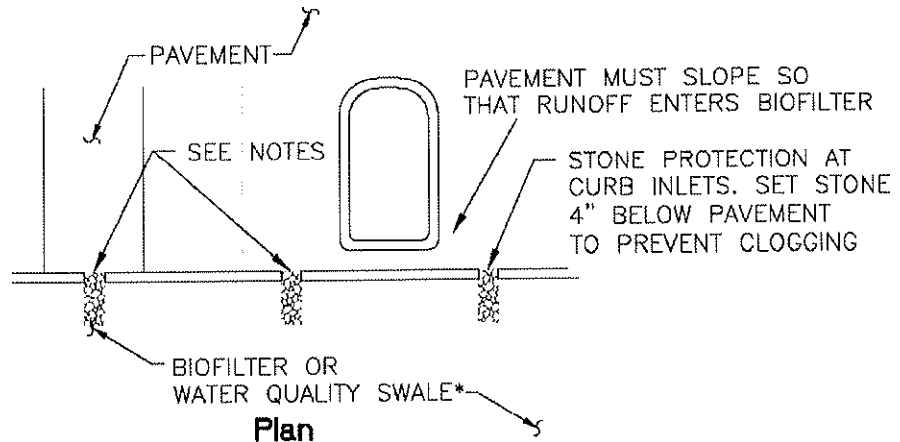
Cross Section

NOTE: WATER QUALITY SWALES ARE ALSO APPROPRIATE TO ACCEPT RUNOFF FROM ROADWAYS.

NOTE: EXHIBIT FOR ILLUSTRATIVE PURPOSES ONLY.

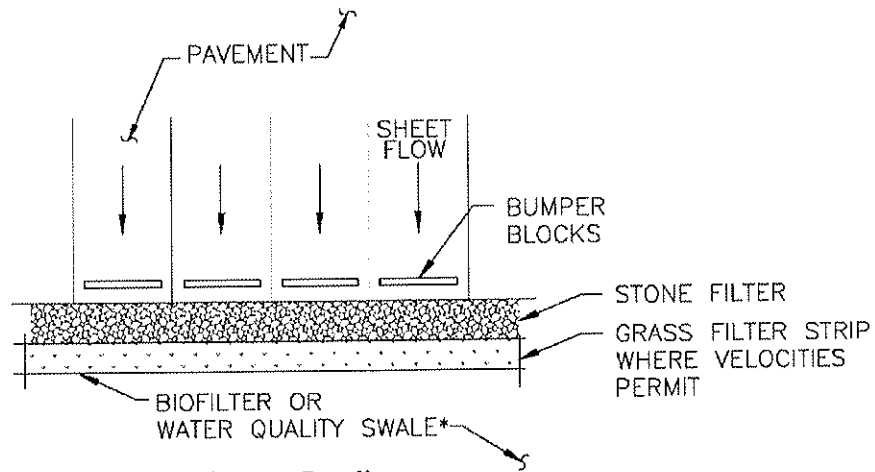
Figure 5-5
Water Quality Swale
Stormwater Management Example Drawing 3

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- Plan**
- NOTES:**
- 1. CURB OPENINGS SIZED AND SPACED TO PASS THE PEAK FLOW FROM A TWO YEAR FREQUENCY STORM. MAXIMUM CURB OPENING WIDTH OF 1'-0", MAXIMUM CURB OPENING SPACING 20'-0".
 - 2. TEMPORARILY BLOCK DURING CONSTRUCTION FOR EROSION AND SEDIMENT CONTROL. UNBLOCK OPENINGS AFTER FINAL STABILIZATION.

Openings Through Curb



- Cross Section**
- NOTES:**
- 1. PROVIDE SHEET FLOW, EVENLY DISTRIBUTED ACROSS PAVEMENT. AVOID CONCENTRATING FLOWS.
 - 2. PROVIDE SILT FENCE OR TEMPORARY DIVERSION AT EDGE OF PAVEMENT DURING CONSTRUCTION. REMOVE AFTER FINAL STABILIZATION.

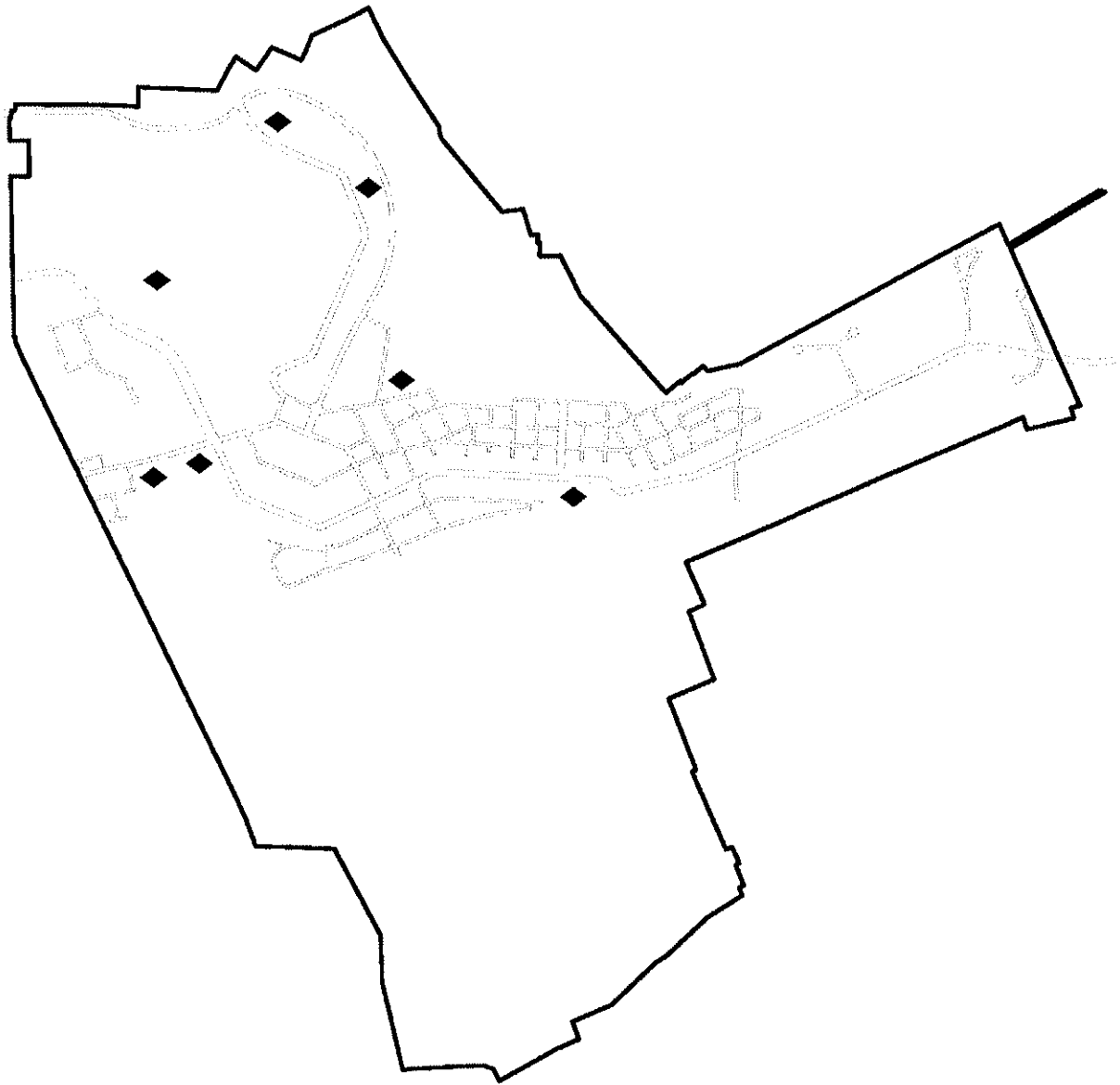
NOTE: EXHIBIT FOR ILLUSTRATIVE PURPOSES ONLY.

Figure 5-6
Inlet Options For Biofilters and Water Quality Swales
Stormwater Management Example Drawing 4

N.A.S. South Weymouth / Village Center Plan

LEGEND

◆ POTENTIAL DETENTION /
CONSTRUCTED WETLAND



NOTES:

1. EXHIBIT FOR ILLUSTRATIVE PURPOSES ONLY.
2. THIS EXHIBIT IS INTENDED TO SHOW PLANNED DETENTION STORAGE FACILITIES. ACTUAL LOCATION MAY VARY.
3. DETENTION BASINS PROVIDE PEAK DISCHARGE CONTROL AND STORMWATER TREATMENT.



Not to Scale

Figure 5-8

Potential Detention /
Constructed Wetland

3.7 Utility Systems

A. Introduction

All of the new utilities shall be placed underground. All of the existing utilities on previously occupied land shall be maintained throughout or replaced with underground utilities.

B. Planning

The facilities described in this Section will be designed to implement the By-Laws in connection with the subdivision of land in NAS South Weymouth. Design of utilities shall ensure that all land uses proposed in connection with the subdivision of land in NAS South Weymouth can be served with adequate capacity. The Applicant should consult with the utility provider early in the project development process. These Regulations will be consistent with all by-laws, rules and regulations adopted by the Authority and the regulations of MADEP.

C. Non-municipal Utilities

All utilities, including electricity transformers, telephone, television cable, and other communication lines, both main and servicing connections, servicing new developments shall be provided by underground wiring within easements or within the proposed dedicated public rights-of-way, installed in accordance with the prevailing standards and practices of the utility or other companies providing such services.

Lots that abut existing easements or proposed public rights-of-way where overhead electric or telephone distribution supply lines and service connections have previously been installed may be supplied with electric and telephone service from those overhead lines, but the service connections from the utilities' overhead lines shall be installed underground. In the case of existing overhead utilities, should a road widening, or an extension of service, or other such condition occur as a result of the subdivision and necessitate the replacement or relocation of such utilities, such replacement or relocation shall be underground.

Where overhead lines are permitted as a waiver by the Applicable Subdivision Board, the placement and alignment of poles shall be designed to lessen the visual impact of overhead lines. Alignments and pole locations shall be carefully routed to avoid locations along horizons; clearing swaths through trees shall be avoided by selective cutting and a staggered alignment of trees shall be planted in open areas and at key locations to minimize the view of the poles and the alignments; and the alignments shall follow rear lot lines and other alignments.

The looping of utilities shall be encouraged.

Connections for all utilities from the main structures to the exterior line of the way shall be constructed for each lot whether or not there is a building thereon.

Where adjacent property is not subdivided or where all the property of the Applicant is not being subdivided at the same time, provisions should be made for

the extension of the non-municipal utility system by continuing mains the full length of streets to the exterior limits of the subdivision at such grade and size which will, in the opinion of the Applicable Subdivision Board, permit their proper extension.

A separate plan showing the location of telephone, electric, and other utility wires, and showing provisions for wiring to accommodate planned street lighting shall be furnished to the Applicable Subdivision Board.

D. Municipal Utilities

All utility services, including drains, shall be installed to a point two (2) feet beyond the street sideline prior to placement of asphalt concrete course. A plan showing the location of utility stubs shall be provided.

Installation and materials, unless otherwise specified, shall conform to the standard specifications.

Excavation for structures, including foundations for sewers and water pipes, walls and other structures shall be made to the depth as indicated on the subdivision definitive plan or established by the Applicable Subdivision Board and shall be removed as directed by the Applicable Subdivision Board.

All drain, sewer, gas and water pipes, underground utilities, and other structures shall be installed to the right-of-way line upon the completion of roadway sub-base, to insure that the minimum required cover is over all utility lines.

Connections for all utilities from the main structures to the exterior line of the way shall be constructed for each lot whether or not there is a building thereon.

Where adjacent property is not subdivided or where all the property of the Applicant is not being subdivided at the same time, provisions should be made for the extension of the municipal utility system by continuing mains the full length of streets to the exterior limits of the subdivision at such grade and size which will, in the opinion of the Applicable Subdivision Board, permit their proper extension.

3.8 Grading

A. Introduction

This Section covers the intent and design of grading. Grading designs will be implemented in connection with the subdivision of land within NAS South Weymouth. All work needs to be based on plans and the respective project's Geotechnical Report by a Massachusetts registered civil engineer.

B. Planning

The facilities described in this Section will be designed to implement the By-Laws in connection with the subdivision of land in NAS South Weymouth. Design for grading and demolition must be in substantial conformance with the By-Laws. These Regulations will be consistent with all by-laws, rules and regulations adopted by the Authority and the regulations of MADEP.

C. Grading Standards

Each preliminary subdivision plan and definitive subdivision plan needs to demonstrate consistency with these Regulations.

D. Grading Plan Development Standards

- (1) All grading activities shall be in substantial conformance with the approved Preliminary Subdivision Plan or development permit and shall implement any grading-related mitigation measures outlined in the EIR for NAS South Weymouth.
- (2) All grading activities must incorporate the recommendation contained in the geotechnical report. The respective project's Geotechnical Report must be on file with the Applicable Subdivision Board prior to the start of grading.
- (3) Prior to any development within any area of NAS South Weymouth, a grading plan for the portion in process shall be submitted for approval by the Applicable Subdivision Board. The grading plan for each area shall be used as a guideline for subsequent grading plans for individual stages of development.

- (4) All streets shall have a gradient not exceeding use minimums and maximums established by the Authority.
- (5) A precise grading plan shall be prepared prior to any on-site grading for individual projects.
- (6) The Applicant shall be responsible for installation and maintenance of all planting and irrigation systems on manufactured slopes until those responsibilities are assumed by the Authority or other parties.
- (7) To the extent that it is feasible, the overall shape, height, and gradient of any cut and fill slope shall be designed to be consistent with the existing natural contours and scale of the natural terrain.
- (8) Potential brow ditches, terrace drains, or other minor swales, determined necessary at future stages of project review, shall be concealed, as feasible and possible, with landscape plantings, earth berms, and similar features.
- (9) Graded but undeveloped pads shall be maintained weed-free, with appropriate erosion control measures within ninety (90) days of completion of grading, unless building permits are obtained from the Authority or the Towns, as applicable. Appropriate desiltation basins are required for graded areas.
- (10) Cut and fill slopes shall be constructed at inclinations of no steeper than three horizontal feet to one vertical foot (3:1), unless otherwise approved by the Applicable Subdivision Board. Detention basins will have a three to one (3:1) maximum slope. Cut and fill slopes with a vertical height of ten (10) feet or less may be constructed at a two to one (2:1) slope with Applicable Subdivision Board approval. This applies to roadway and development pad fills. Variable slope ratios will be used to avoid abrupt changes from the pads to the slopes.
- (11) All newly created slopes exceeding ten (10) feet in vertical height shall be landscaped with a permanent irrigation system approved by the Applicable Subdivision Board prior to final acceptance. Landscaping shall be consistent with these Regulations.
- (12) Grading operation must be consistent with all aspects of the project design and permitting, including but not limited to SWPPPs, protection of open space etc.
- (13) Grading shall not be permitted to commence prior to approval of grading permits for any proposed development. Mass grading will only occur for those areas undergoing development, or for those areas specifically identified as borrow or disposal sites.

- (14) Grading operations shall conform to these Regulations.
- (15) Project grading design shall make reasonable efforts to balance cut and fill on site to avoid the need for excessive importing or exporting of soil.
- (16) Prior to start of grading, any hazardous material remediation needs to be completed consistent with approved plans.
- (17) A demolition plan, a waste management plan and a material reuse plan shall be prepared if appropriate.

E. Grading Plan Roadway Standards

- (1) Improvements to minimize adverse environmental impact shall be installed in accordance with the details as shown on the approved definitive plan. In the absence of details on said plans, environmental controls shall follow procedures contained in MADEP's "Erosion and Sedimentation Control Guidelines" or procedures acceptable to the Applicable Subdivision Board.
- (2) Clearing and grubbing of the entire area of such street or way shall be performed to remove all stumps, brush, roots and like material which may exist upon the surface. Strip available topsoil and stockpile for use within the subdivision.
- (3) Roadway earth excavation shall remove all materials encountered down to the true surface of the subgrade, or to suitable material in areas where unsuitable material exists, in preparation for foundation of roadway, sidewalks, driveways and berms. Approved materials obtained from the excavation may be used in fills as required if, in the opinion of the Applicable Subdivision Board and the geotechnical consultant observing the grading, they are suitable.

- (4) When in the opinion of the Applicable Subdivision Board and the geotechnical consultant observing the grading suitable material is not available within the limits of the roadway location to form the subgrade or sub-base, the Applicant shall obtain such additional material other sources in accordance with this Section and as may be approved by the Applicable Subdivision Board.
- (5) All soft or spongy material below the subgrade surface shall be removed to a depth determined by the Applicable Subdivision Board and the geotechnical consultant observing the grading, and the space thus made shall be filled with special gravel borrow, containing no stones over six (6) inches in their largest diameter.
- (6) Recycled pavement for the base course may be permitted as determined by the Applicable Subdivision Board. Materials and construction methods shall comply with MDPWSS, Section 403, Reclaimed Base Course, or special provisions provided by the Applicant. Reclaimed material from crushing the taxiways and runways will be utilized for base, sub base or trench backfill as determined by the Applicable Subdivision Board.
- (7) Final grading, rolling and finishing, including the shaping, trimming, rolling and finishing of the surface of the sub-base prior to application of gravel for surfacing of the roadway and base courses for walks or loam for berms, shall be in accordance with this Section and as directed by the Applicable Subdivision Board.
- (8) Embankments within or adjoining the right-of-way shall be evenly graded and pitched at a slope of not greater than two (2) horizontal to one (1) vertical in fill and two (2) horizontal to one (1) vertical in cuts. Where cuts are made in ledge, other slopes may be determined with the approval of the Applicable Subdivision Board. Where terrain necessitates greater slopes, retaining walls, terracing, fencing, or rip-rap may be used either alone or in combination to provide safety and freedom from maintenance, but must be done in accordance with plans filed with and approved by the Applicable Subdivision Board. Whenever embankments are built in such a way as to require approval by the Applicable Subdivision Board, the Applicant must furnish to the Applicable Subdivision Board duly recorded access easements free of encumbrances for maintenance of the slopes, terraces or retaining walls. All such slopes shall be landscaped in accordance with the Landscape Plan contained in these Regulations for the area between the roadway and sidewalk or roadway and boundary of the right-of-way.
- (9) At the conclusion of this step the roadway shall be staked in all locations where permanent monuments are to be installed.

- (10) A landscape plan is required for areas disturbed by such grading to ensure slope stabilization, revegetation, restoration of natural features and minimization of erosion. Such plans shall be subject to approval by the Applicable Subdivision Board as to location, quantity, species and design and should conform to the Landscape Plan in these Regulations.
- (11) A bench swale to collect stormwater runoff and prevent erosion shall be provided for every twenty (20) feet in vertical height of a fill or cut slope. The design of the swales shall be shown to adequately handle the runoff flowing to them. The swales shall connect to drain inlets, or other approved measures so that a concentrated flow of runoff does not flow across the sidewalk or into a roadway area.

3.9 Miscellaneous

A. Abandonment of Existing Mains

The abandonment of existing water mains, sewer main and utilities, and appurtenant structures shall require approval of the Authority and/or the Towns, as applicable, and shall be in accordance with the standard specifications. Abandoned utility mains and appurtenances should be removed from the ground where feasible. If removal is not feasible, a plan which accurately locates the position of such abandoned utility components shall be created and filed with the Applicable Subdivision Board. Services to existing facilities that are to remain shall not have interruption in service.

B. Easements

When no suitable alternatives exist, easements for utilities, drainage systems or pedestrian or bicycle paths shall be provided. Such easements shall be at least fifteen (15) feet in width or twenty (20) feet in width if paved access roads are included. If multiple utilities are present, ten (10) feet in width should be added for each additional utility. Whenever possible, easements shall be centered on rear or side lot lines, rather than across lots. Access easements shall be required where deemed desirable to provide circulation or access to abutting streets, schools, playgrounds, parks, shops, transportation, open/spaces and or community facilities.

Where a subdivision is traversed by a water course, drainage way, channel or storm drain, the Applicable Subdivision Board may require the Applicant to provide a stormwater easement or drainage right of way of adequate width to conform substantially to the lines of such water courses, drainage way, channel or stream, and to provide for construction or other necessary purposes. Slope easements shall be provided where necessary to ensure lateral support and protection of streets and other construction features.

C. Access through another Municipality

In case access to a subdivision crosses land in another municipality, the Applicable Subdivision Board may require a certification from appropriate authorities in that municipality, that such access is in accordance with

requirements of such municipality and that a legally adequate performance bond has been duly posted or that such access is adequately improved to handle prospective traffic.

D. Lot Frontage at Cul-de-sac

The allowable street frontage for a lot fronting on a cul-de-sac shall be measured along the side line of the street approaching the cul-de-sac as though the street line continued through the cul-de-sac uninterrupted, and not along the outside radius of the cul-de-sac. For lots across the end of a cul-de-sac in a permanently dead-end way the frontage shall be measured along the arc of the street line intersection with the side lot lines.

E. Further Subdivision

In the event a tract is subdivided into larger parcels than ordinary building lots, such parcels shall be arranged so as to allow the logical and economic extension of streets, utility easements, drainage ways and public areas into such parcels. Adjacent parcels shall also be considered for logical, economical extensions of streets, sidewalks and utilities, etc.

F. Resubdivision

The resubdivision of all or part of land covered by an existing plan shall be governed by these Regulations. Such resubdivision plans shall show clearly that area or areas which are being resubdivided and shall show all previous plans of these same areas with dates of recording information.

G. Road Bounds and Lot Markers

Concrete or granite bounds five (5) inches by five (5) inches by three (3) feet with a three-eighths (3/8) inch drill hole in the center are to be set flush with finished grades. With approval from the Applicable Subdivision Board, the concrete bounds may be installed so as to protrude one (1) or two (2) inches. Concrete or granite bounds shall be set on both sidelines of all points of change of direction or curvature of streets, and points of tangency, and at the intersection of the sideline and sidelines of existing streets. In locations where installation of concrete or granite bounds is not feasible, alternate monumentation (i.e. brass disks, etc.) may be installed subject to approval from the Applicable Subdivision Board or its designee. In addition, all lot corners shall be delineated with three (3) foot high iron pins of No. 8 re-bar and protrude a nominal three (3) inches above finished grade. Lot corner iron pins should be fitted with plastic protective caps which facilitate locating of the pins.

All concrete or granite bounds and iron pins along the right-of-way sidelines shall be set flush with the ground.

H. List of Suggested Resources

Suggested Resources	How to Get a Copy
Low-Impact Development Design Strategies - An Integrated Design Approach (June 1999)	Prince George's County, Maryland, Department of Environmental Resource, Programs and Planning Division, 9400 Peppercorn Place, Largo, Maryland 20774, http://www.co.pg.md.us/Government/DER/PPD/pgcounty/lidmain.htm
National Stormwater Best Management Practices (BMP)	American Society of Civil Engineers, 1801 Alexander Bell Drive, Reston, VA 20191
Massachusetts Highway Department, Standard Specifications for Highways and Bridges	MassDOT-Highway Division, 10 Park Plaza, Suite 3170, Boston, MA 02116
Massachusetts Highway Department, Construction and Traffic Standard details	MassDOT-Highway Division, 10 Park Plaza, Suite 3170, Boston, MA 02116
Zoning and Land Use Bylaws 2014	Southfield Redevelopment Authority, 223 Shea Memorial Drive, South Weymouth, MA 02190
Stormwater Policies and Guidance (Management Policy and Handbook)	Department of Environmental Protection, One Winter Street, Boston, MA 02108, http://mass.gov/dep/water/laws/policies.htm#storm
Water and Sewer Regulations	Department of Environmental Protection, One Winter Street, Boston, MA 02108
Proposed "Green Deconstruction" and Materials Management at South Weymouth	CH2M Hill, 25 New Chardon St., Boston, MA 02114 September 8th, 2005
American Water Works Association, Water Standards	American Water Works Association (AWWA), http://www.awwa.org
Uniform Plumbing Code	Uniform Plumbing Code, www.constructionbook.com
Weymouth Fire Department	Weymouth Fire Department, 636 Broad St., E. Weymouth, MA 02189
Weymouth Department of Public Works	Weymouth Department of Public Works, 120 Winter Street, Weymouth, MA 02188

Suggested Resources	How to Get a Copy
Environmental Impact Report	Southfield Redevelopment Authority, 223 Shea Memorial Drive, South Weymouth, MA 02190
Massachusetts Department of Environmental Protection	MADEP, One Winter Street, Boston, MA 02108, Wastewater Facilities Information, http://www.mass.gov/dep/water/wastewater/wastewat.htm
Massachusetts Department of Environmental Protection	MADEP, One Winter Street, Boston, MA 02108, Residuals Management Program Information http://www.mass.gov/dep/water/wastewater/residual.htm
Massachusetts Department of Environmental Protection	MADEP, One Winter Street, Boston, MA 02108, Industrial Wastewater Management Program, http://www.mass.gov/dep/water/wastewater/industri.htm
Federal Highway Administration's Hydraulic Design of Highway Culverts (Hydraulic Design Series No. 5, April 2012)	Federal Highway Administration. Hydraulic Design of Highway Culverts. Hydraulic, Design Series No. 5, Report No. FHWA-1P-85-15. Washington, D.C. http://www.fhwa.dot.gov/
US Army Corps HEC-RAS River Analysis System, FHWA HY-8 Culvert Analysis	US Army Corp of Engineers, http://www.usace.army.mil/
Stormwater Management Policy	Department of Environmental Protection, One Winter Street, Boston, MA 02108, www.mass.gov/dep/water/laws/2103ch.pdf
Stormwater Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices (EPA-832-R-92-005).	(EPA-832-R-92-005), www.epa.gov
Department of Environmental Protection, Stormwater Management, Volume 1: Stormwater Policy Handbook, March 1997	Department of Environmental Protection, One Winter Street, Boston, MA 02108, http://www.mass.gov/dep
Department of Environmental Protection, Stormwater Management, Volume 2: Stormwater Technical Handbook, March 1997	Department of Environmental Protection, One Winter Street, Boston, MA 02108, http://www.mass.gov/dep
Urban Stormwater Management	American Public Works Association, Urban Stormwater Management, Special Report No. 49 (1981)
Design and Construction of Urban Stormwater Management Systems	American Society of Civil Engineers, Design and Construction of Urban Stormwater Management Systems, ASCE Manual of Practice No. 77/WEF Manual of Practice No. FD-20, 1801 Alexander Bell Drive, Reston, VA 20191
Urban Drainage Design Manual	U.S. Department of Transportation, Federal Highway Administration, Urban Drainage Design Manual, 2nd Edition, Hydraulic Engineering Circular No. 22, FHWA-NHI-01-021, August 2001

Suggested Resources	How to Get a Copy
Hydraulic Design of Highway Culverts	U.S. Department of Transportation, Federal Highway Administration, Hydraulic Design of Highway Culverts, Hydraulic Design Series No. 5, 2nd Edition, FHWA-NHI-01-020, September 2001
Hydraulic Design of Stilling Basins and Energy Dissipaters	U.S. Department of the Interior, Bureau of Reclamation, Hydraulic Design of Stilling Basins and Energy Dissipaters, A.J. Peterka, EM 25. Denver, CO, 1978
Handbook of Hydraulics	Handbook of Hydraulics, Brater and King, McGraw-Hill Book Co., 6th Ed, 1976
Open Channel Hydraulics	Open Channel Hydraulics, Chow, V.T., McGraw-Hill, 1959
A study of the shape of channels formed by natural streams flossing in erodible material: M.R.D. Sediment Series No. 9	A study of the shape of channels formed by natural streams flossing in erodible material: M.R.D. Sediment Series No. 9, Lane, E.W., US Army Engineer Division, Missouri River, Corps of Engineers, Omaha, NE, 1957
Hydraulic Design of Flood Control Channels	U.S. Army Corps of Engineers, Hydraulic Design of Flood Control Channels. EM 1110-2-1601, July 1991
Hydraulic Design of Flood Control Channels	U.S. Army Corps of Engineers, Hydraulic Design of Flood Control Channels. EM 1110-2-1601, Washington, D.C. July 1994
Urban Hydrology for Small Watersheds	Technical Release No. 55, Urban Hydrology for Small Watersheds, U.S. Soil Conservation Service, Revised 2003.
Design Charts for Open Channel Flow	Design Charts for Open Channel Flow, Hydraulic Design Series No. 3 (HDS #3), Federal Highway Administration, 1973
Hydraulic Design of Highway Culverts	Hydraulic Design of Highway Culverts, Hydraulic Design Series No. 5 (HDS #5), Federal Highway Administration, September 1985
Design of Stable Channels With Flexible Linings	Design of Stable Channels With Flexible Linings, Hydraulic Engineering Circular No. 15 (HEC #15), Federal Highway Administration, October, 1975.
Hydraulic Charts for the Selection of Highway Culverts	Hydraulic Charts for the Selection of Highway Culverts, Hydraulic Engineering Circular No. 5 (HEC #5), Federal Highway Administration, June, 1980

Suggested Resources	How to Get a Copy
Capacity Charts for the Hydraulic Design of Highway Culverts	Capacity Charts for the Hydraulic Design of Highway Culverts, Hydraulic Engineering Circular No. 10 (HEC #10), Federal Highway Administration, November, 1972.
Design and Construction of Sanitary and Storm Sewers	WPCF Manual of Practice No. 9, Design and Construction of Sanitary and Storm Sewers, Water Pollution Control Federation and the American Society of Civil Engineers, 1969
Temporary Erosion and Pollution Control Measures	Temporary Erosion and Pollution Control Measures, Federal Highway Administration (Region 1), February, 1972.
Best Management Practices of Erosion and Sediment Control	Best Management Practices of Erosion and Sediment Control, Federal Highway Administration (Region 15), December, 1978
The Mass Highway Drainage Manual	The Mass Highway Drainage Manual, Massachusetts Highway Department, Metric Edition 2002
The Mass Highway Stormwater Handbook for Highways and Bridges	The Mass Highway Stormwater Handbook for Highways and Bridges, Massachusetts Highway Department, May, 2004
Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas	Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas, Prepared by Franklin, Hampden, Hampshire Conservation Districts, North Hampton, MA for the MA Department of Environmental Protection, 1997
Hydrology Handbook	Hydrology Handbook, MA Department of Environmental Protection
Erosion Control Handbook	Erosion Control Handbook, MA Department of Environmental Protection
American With Disabilities Act Accessibility Guidelines	American With Disabilities Act Accessibility Guidelines, (ADAAG), Department of Justice; Title II, "State and Local Government Programs and Services," and Title III, "Public Accommodations and Commercial Facilities"

Suggested Resources	How to Get a Copy
A Policy on Geometric Design of Highways and Streets	A Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials (AASHTO)
Manual on Uniform Traffic Control Devices	Manual on Uniform Traffic Control Devices, (MUTCD), Federal Highway Administration

ARTICLE IV - LANDSCAPE PLAN

4.1 Introduction

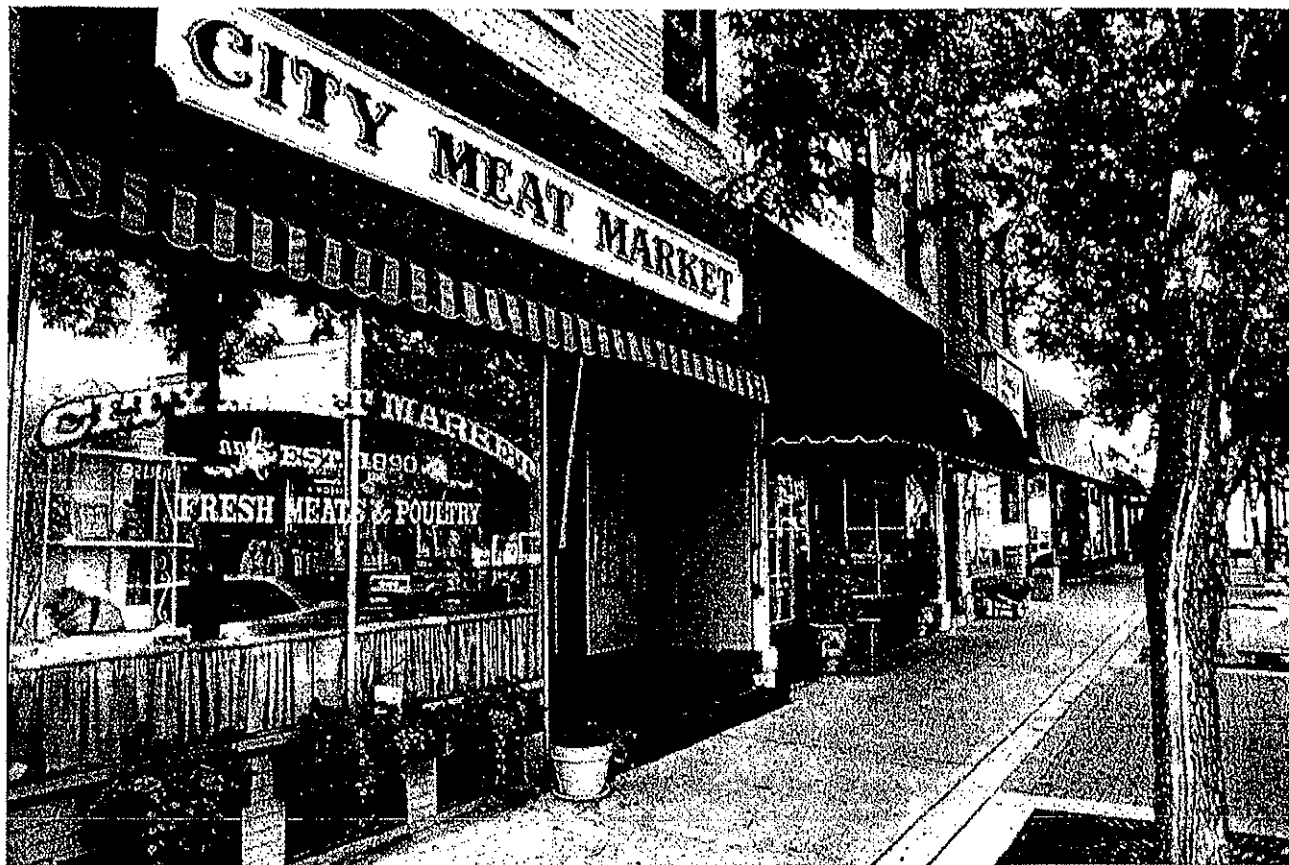
Some common features that create a memorable urban character often mark successful traditional communities. These elements include attractive architectural detail at a human scale, buildings oriented to the sidewalk, a comfortable street space and a pedestrian-friendly public realm. Attractive and safe streets, well-used public squares and open spaces, a pleasant walking environment, convenient, barrier-free routes and meaningful destinations significantly contribute to a community and are essential to pedestrian activity and walkability. The plants and surfaces that form or complement these spaces and ways are important supporting components of a quality pedestrian environment. They are the living elements of our civic infrastructure that clean the air, provide shade in summer, absorb water and confer aesthetic benefits on our streetscapes.

The landscape design guidelines in this landscape plan cover the intent and design of landscape and open space components in connection with the subdivision of land in NAS South Weymouth, including landscape approaches and guidelines for a variety of streets, parks, and residential areas. Plans and designs for all landscape and open space areas in connection with the subdivision of land in NAS South Weymouth require the approval of the Applicable Subdivision Board.

4.2 Purpose and Goals

Landscape design guidelines are a link between the By-Laws and their implementation. Implementing the By-Laws involves numerous landscape design decisions made by a wide variety of development entities and the oversight of the Applicable Subdivision Board. These guidelines will help coordinate the landscape design decisions made by the different participants and will provide limits within which design choices are made. These guidelines establish limits, but do not stifle creativity or constrain an Applicant's flexibility. These guidelines recognize the talents and insights that designers bring to their work and encourage innovative design solutions to each location.

A successfully implemented Landscape Plan will create an exterior environment that promotes visual continuity from neighborhood to neighborhood while fostering a unique sense of place that celebrates the distinct character of each location within the unified whole envisioned by the By-Laws. See Figure 1: Commercial Street Example. These guidelines will also establish an overall standard of design quality and will protect property owners from sub-standard installations on adjacent properties or in the public realm that could have a negative impact on district property values.



NOTE:
1. EXHIBIT FOR ILLUSTRATIVE PURPOSES ONLY.

Landscape Plan — Figure 1
Commercial Street Example

4.3 Sustainability

At the heart of this Landscape Plan is a commitment to a sustainable environment. A sustainable landscape is more than an arrangement of plants designed to shape outdoor spaces for human use and enjoyment. Sustainability refers to principles of construction, operation and maintenance that meet the needs of present users without compromising the interests of adjacent or future users regarding natural resources. A sustainable landscape approach seeks to create a balance between the resources expended – in both construction and maintenance – and the landscape achieved. It is a landscape that makes the most efficient use of water, fertilizer, building materials and labor.

These guidelines are organized around a series of principles that are intended to protect the unique natural features of the site while incorporating as many of these elements and other features of the regional context in the built environment.

- Landscaping should be compatible with the natural conditions of the specific site and the region.
- Landscape choices and maintenance operations should conserve water, energy and topsoil.
- Open spaces and the drainage system should be organized to the extent practicable to protect the land's ability to absorb, clean and store storm water and should be designed to minimize storm water runoff.
- To the extent possible, landscaping should enhance wildlife habitat and provide habitat continuity.
- BMPs such as integrated pest management techniques should be utilized to minimize use of pesticides.

4.4 Organization of the Landscape Plan

These guidelines have been prepared to help property owners and designers develop landscape plans that are consistent with the community's visions as expressed by the By-Laws. They are also intended to assist in plan review by the Applicable Subdivision Board. These guidelines are a supplement to other laws, rules and regulations already in place. Anyone involved in the design or the review of a subdivision should consult these guidelines in combination with other relevant materials that document the community's general development regulations and specific policies. Each preliminary subdivision plan and definitive subdivision plan needs to demonstrate consistency with these Regulations. Under no circumstances shall a landscape plan contain any of the plants listed in Appendix A: Prohibited Plant List. All plants shall be installed according to Appendix B: Landscape Installation.

The guidelines have been divided into two types of requirements:

1. *General aesthetic guidelines* that provide direction on subjective or qualitative issues such as the character of a location, types of surfaces, orientation and treatment of spaces and relationships among elements. These types of requirements are open to interpretation and allow a variety of solutions that support the general design intentions of the guidelines

and the By-Laws. They are expressed as performance requirements in terms such as “emphasize”, “minimize”, “mitigate”, “should be” and “may consist of”. They are illustrated with descriptive sketches and images of similar elements from other locations.

2. *Specific development controls* that govern quantitative landscaping issues such spacing and size of plants, systems, specifications and details. These types of controls are usually fixed and non-negotiable. They are expressed in terms like “must”, “will” and “shall be” and are illustrated with diagrams that show precise dimensions or fixed limits within the proposed design solution must fall.

4.5 Circulation Ways and Public Spaces

A. Streets

(1) Town Gateways

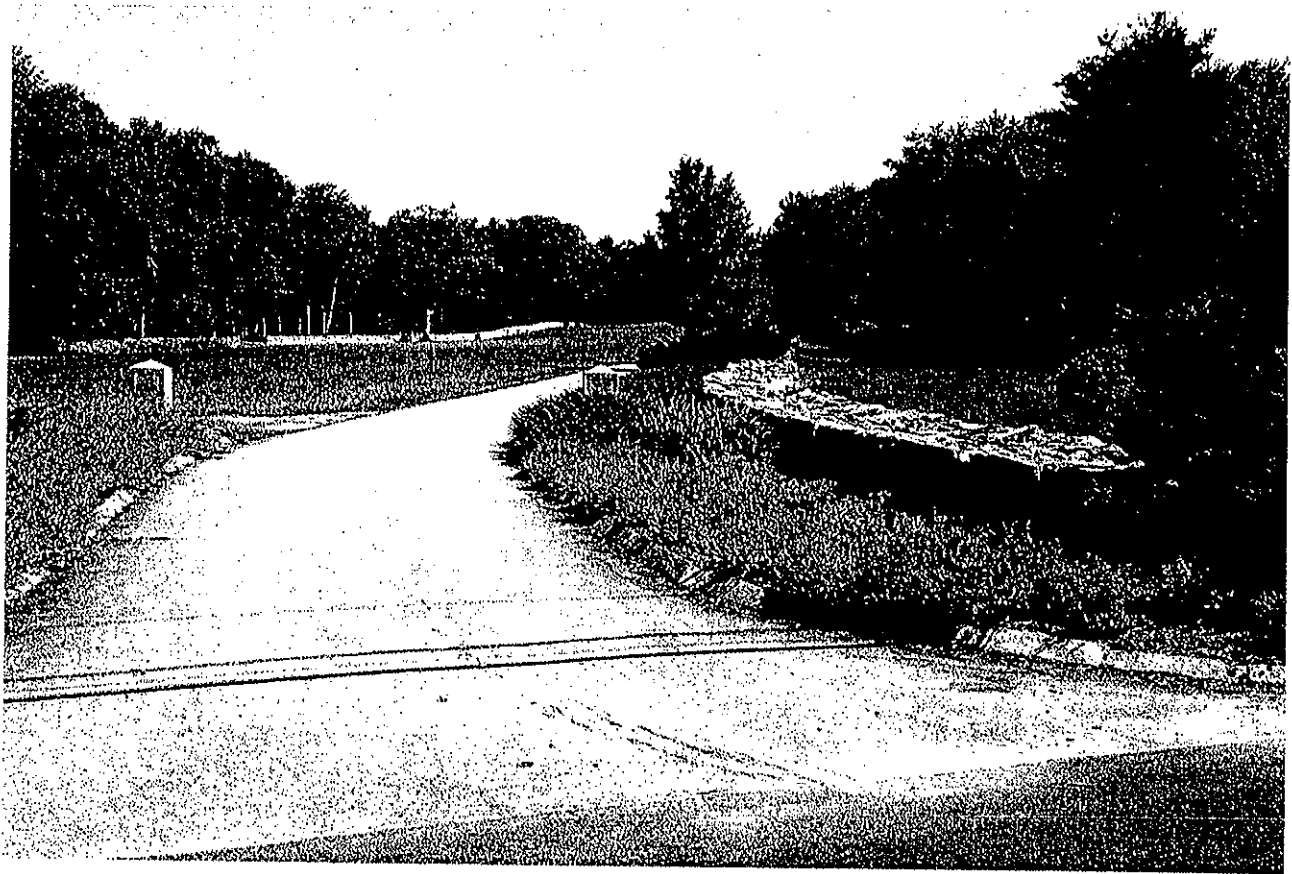
Town gateways are entrances to NAS South Weymouth at Primary Streets and other major corridors, such as the Parkway. These gateways include: Shea Memorial Drive at Route 18, the Parkway intersections with Route 18 and Weymouth Street, Main Street at Route 18. See Figure 2: Entry Stone Wall Example

Organizing Principles

- Gateway design should preserve and enhance the natural features of the site and create a clear landmark that communicates a memorable sense of arrival into NAS South Weymouth.
- Gateways should project a simple, understated quality reflecting the New England heritage of the location, rather than a ‘designed’ ornamental landscape.

Gateway design should emphasize existing landscape elements and plants to create a land mark event and identify a special community flavor.

Landscape treatment should be aesthetically compatible with both the built environment and local natural landscape of the community. Forms and materials of the landscape, plants, fencing, and walls should be recognizably rooted in the local context.



NOTE:
1. EXHIBIT FOR ILLUSTRATIVE PURPOSES ONLY.

Landscape Plan — Figure 2
Entry Stone Wall Example

- Where existing forest cover is not available, the design should organize plants into spatial volumes at the gateway.
- Landscape development should largely use regionally-appropriate plants native to the eastern United States. Species native to New England should be used in sites located within the Public Benefit Conveyance (PBC) or within the one hundred (100) foot wetland buffer.

(2) District Gateways (Neighborhood)

District gateways are entrances to subdivisions at Primary Streets and Main/Standard Neighborhood Streets.

Organizing Principles

- Emphasize existing landscape elements, view opportunities, plants and natural materials to create a landmark event and identify a community.
- Preserve natural landmarks that create a special community identity.
- Require landscaping zone between Parkway and residential and non-residential developments to buffer the visual impact of the parkway and enhance community character.

At the Parkway, the district gateway event can be shaped by constricting the parkway corridor as the motorist passes through the forest and dramatically expanding the space as the parkway enters the gateway location.

To mitigate the visual impact of Primary Streets, the gateway designs should provide a landscaped buffer between residential and non-residential areas. These buffers should consider sight distance for vehicles and site-specific security issues.

The gateways should provide dramatic changes in spatial scale – narrow forest corridor followed by larger space accented with stone walls suggesting emergence into historic New England farm field.

Where existing forest cover is thin or not available, installed plants should be organized to shape spatial volumes at gateway locations. Recreation fields and other open space resources should be utilized to create district gateway events.

The ground plane should be attractive, but not dominant, uniform and uncluttered, generally consisting of turf grass with supplemental drifts

of shrub plantings to reinforce space shaping or to screen objectionable elements.

(3) Parkway

The Parkway is the integral east-west connection through NAS South Weymouth. The design of the Parkway involves an environmental review process and is subject to review and change by MASSDOT. The alignment of the Parkway is generally indicated in these Regulations; it shall extend from east to west through NAS South Weymouth. *See* Figure 3: Woodland Parkway Character Example, Figure 4: Open Parkway View, and Figure 5: Parkway Trees Example

Organizing Principles

- Link the movement experience on the Parkway to the rich variety of environments, spatial experiences and districts in the community.
- Provide a pleasant driving experience and an easily-understood route to the different district in the community.
- The Parkway should be “greener” than other roads. The planted median and the parallel natural corridor indicate that it functions beyond simple transport between two points. With a sensitive response to the terrain and existing landscape regime, the parkway can reveal and enhance the landscapes through which it moves.

Parkway landscaping should ensure a substantial canopy cover to reduce road glare and heat build-up, contribute to visual continuity between neighborhoods, buffer adjacent development, enhance the approach to important outdoor spaces, reduce storm water runoff and provide a memorable experience of moving through the landscape.

The Parkway design should be rooted in the regional environment. The Parkway should maintain and emphasize existing natural forest cover to the extent possible. Where existing forest cover is not available, tree and shrub species reflecting the local environmental regime should be emphasized.

Parkway landscaping should reflect local history, natural environment and cultural elements in a way that will create a unique community flavor. A pastoral field character on the edge of a forest is a desirable character for much of the Parkway alignment.

Parkway planting should reduce the visual impact of the road on adjacent development. Particular care should be taken to provide an effective landscape buffer/screen where a curved parkway alignment causes headlights to sweep over adjacent residential areas.

The role plantings can play in framing scenic views, providing wind breaks and reducing snow drift should be considered.

Trees should be planted in a regular pattern on both sides of the street and in the median. Parkway trees should be planted at no more than forty (40) feet on center. The tree plantings may be interrupted adjacent to 'pastoral' areas and may be planted more intensely in built-up areas.

Parkway trees should be present in sufficient numbers to allow the motorist to understand the alignment of the parkway ahead. Ornamental trees and shrub mass plantings can provide a supplementary space-shaping role to the Parkway trees and should be planted in substantial masses.

Median and shoulder plantings should be designed to reduce headlight glare and to provide storm water storage and infiltration capacity. Shrub plantings in the median should be attractive 'drifts' that do not dominate, are uniform and relatively low in height. Median shrubs should be planted in a staggered row or linear mass at no more than four feet on center. Shrubs should form a continuous, unbroken mass between trees, except where interrupted for views, bio-swales or safety reasons.

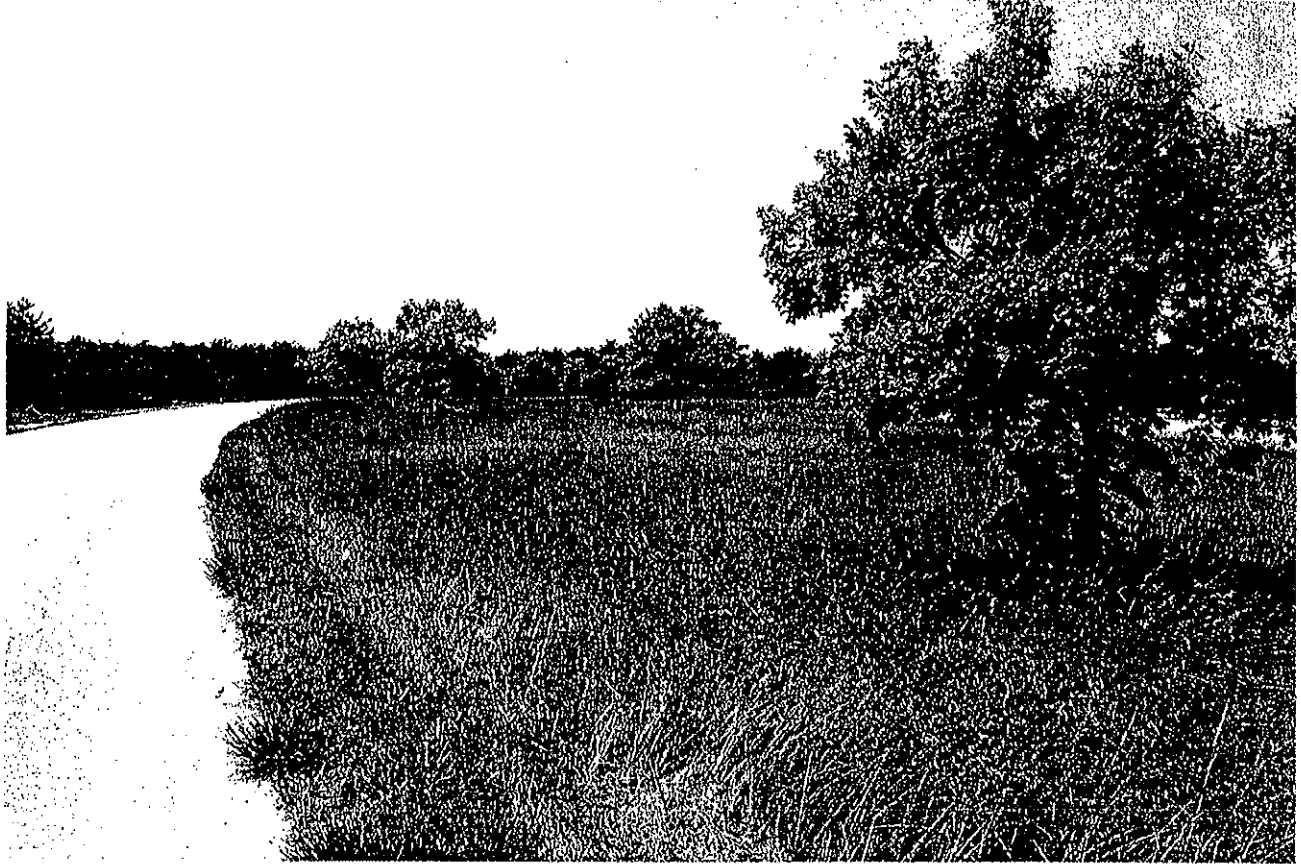
Parkway trees should consist of large shade trees. Shade tree and ornamental tree species selection should include those listed for the Parkway in Appendix A: Approved Plant List.



NOTE:
1. EXHIBIT FOR ILLUSTRATIVE PURPOSES ONLY.

Landscape Plan — Figure 3

Woodland Parkway Character Example



NOTE:
1. EXHIBIT FOR ILLUSTRATIVE PURPOSES ONLY.



NOTE:
1. EXHIBIT FOR ILLUSTRATIVE PURPOSES ONLY.

Landscape Plan — Figure 5

Parkway Trees Example

The Parkway alignment of pedestrian and bikeway routes should be laid out to facilitate convenient access between neighborhoods, recreation destinations and the surrounding communities while taking best advantage of natural features and views.

At Parkway intersections or vehicle access points, no plants with a mature height of more than two (2) feet should be planted within a sight triangle measuring twenty (20) feet along the boundary of each of the intersecting roadways, measured from the point of intersecting curb lines, except as indicated otherwise in these Regulations.

(4) Shea Boulevard

Shea Boulevard is a Primary Street that connects Route 18 to Shea Village Commercial District, community facilities and ultimately to the Village Center District. The road shares many characteristics with the Parkway and supports truck traffic access.

Organizing Principles

- Create a landscaped environment that links a variety of land uses and spaces on the corridor.
- Provide an easily-understood route to destinations for service vehicles and first time visitors.

Shea Boulevard treatment should preserve and maintain existing natural forest cover where feasible. Shade tree species to be planted on the road should reflect the local forest environment.

A continuous tree canopy should be provided on the boulevard to contribute to visual continuity and enhance the approach to the Shea Village Commercial District. Shade tree plantings should 'telegraph' the alignment of the road ahead to motorists and reinforce the sense of a landscape of motion.

Trees shall be planted on both sides of the street between forty (40) feet and eighty (80) feet apart, depending on tree species, street light spacing and driveways, in order to create a continuous tree canopy along the street. The tree plantings may be interrupted adjacent to attractive views, interesting recreational activities and shall be supplemented with additional screen plantings adjacent to parking lots. Shrubs in mass plantings should be installed at no more than four feet on center. At least one (1) shrub should be provided for each three (3) linear feet of curb line.

Shea Boulevard trees should consist of large shade trees. Shade tree and ornamental tree species should include those listed for Shea Boulevard in Appendix A: Approved Plant List.

The pedestrian and bikeway routes paralleling Shea Boulevard should be laid out to facilitate convenient access to recreation destinations and the surrounding communities while taking advantage of a pleasant route and enjoyable views.

At intersections and at vehicle access points, no plants with a mature height of more than two (2) feet should be planted within a sight triangle measuring twenty (20) feet along the boundary of each of the intersecting roadways, measured from the point of intersecting curb lines, except as indicated otherwise in the infrastructure guidelines.

(5) Main/Standard Neighborhoods Streets

In traditional neighborhoods, streets serve multiple purposes. They allow a variety of travel modes, unify and organize adjacent buildings and provide zones for public congregation. The perceived desirability of a neighborhood as a place to live can be strongly influenced by the alignment and landscape character of its principal streets. In addition, subtle variations in the streetscape treatments are an opportunity to provide an added level of individuality to each neighborhood area.

Organizing Principles

- Provide safe, attractive, walkable residential streets for pedestrians, bicyclists and motorists, especially along sidewalks and at crosswalks.

Views along the street to important local landmarks and destinations should be emphasized.

Street trees should be present in sufficient numbers to be perceived as the primary form-giving element of the corridor. Shrub mass plantings can provide a complementary role to street trees where space allows.

Trees shall be planted on both sides of the street between thirty-five (35) feet and fifty (50) feet apart, depending on tree species, street light spacing, and driveways, in order to create a continuous tree canopy along the street.

Shade tree and ornamental tree species should include those listed for Neighborhood Streets in Appendix A: Approved Plant List.

Single tree species may be planted on each street (different species required on parallel and perpendicular streets). Alternately, a single species may be planted between intersections of a single street (species

may alternate on the same street at intersections only). Trees on one side of the street should be set opposite to trees on the opposite side.

Tree pits should be as large as practical to insure tree health and longevity. An optimal tree pit is six (6) feet by six (6) feet. Four (4) foot by six (6) foot tree pits may be utilized where sidewalk space is limited. The soil depth should be as deep as the tree ball. Planting soil should be A-horizon topsoil – un-compacted, free of foreign debris, with a minimum organic content of five percent (5%) and an appropriate pH level for the species being planted. Tree pits should include perforated pipe loops and risers to facilitate irrigation and aeration.

(6) Narrow Neighborhood Streets

Narrow Neighborhood Streets serve as a secondary circulation system for the community and feed traffic from the Primary Street system to the neighborhoods. *See* Figure 6: Narrow Neighborhood Street Example.

Street trees of an intermediate size or ornamental species should be provided to underscore the intimate scale of the street corridor.

Shrub plantings are encouraged in the planting strips to further shape and define sidewalk spaces. Sufficient areas for pedestrian passage should be provided to allow access to parked cars.

Trees shall be planted on both sides of the street between 30-40 feet apart, depending on tree species, street light spacing, and driveways, in order to create a continuous tree canopy along the street. Ornamental trees should be spaced at no more than 30 feet apart.

Shade tree and ornamental tree species should include those listed for Narrow Neighborhood Streets in Appendix A: Approved Plant List.

Street trees should be planted as close to the centerline of the planting strip as possible. In no case shall the tree or shrubs be planted closer than two and one half (2 ½) feet from the face of the curb. Shrubs in the planting strip shall be no more than two and one half (2 ½) feet tall at maturity to insure safe sight distance.



NOTE:
1. EXHIBIT FOR ILLUSTRATIVE PURPOSES ONLY.

Landscape Plan — Figure 6

Narrow Neighborhood Street Example

(7) Main Street/Trotter Road

Main Street/Trotter Road is the principal connection between the MBTA commuter rail train station and the Village Center District. It is also the central shopping street in the community. On-street parking will slow vehicle traffic and the area will be the locus of considerable pedestrian activity. *See Figure 7: Mixed-Use Main Street Example.*

The streetscape should be designed to provide pedestrians with shade and visual interest.

Views along the street to civic squares, local landmarks and open space destinations should be emphasized in the streetscape design

Trees and shrubs of several types should be planted along the length of the street. Continuity is not provided by the continuous repetition of single species, but by the occasional repetition of a dominant tree form. Single tree species may be planted on each street segment.

Trees shall be planted on both sides of the street between forty (40) feet and sixty (60) feet apart, depending on tree species and street light spacing in order to create a continuous tree canopy along the street.

Shade tree and ornamental tree species should include those listed for Primary Streets in Appendix A: Approved Plant List.

Tree pits should as large as practical to insure tree health and longevity. Multiple small trees and shrubs may be installed in a continuous planter to create an optimum growing environment for trees. Eight (8) in-ground planters of at least four (4) feet by twelve (12) feet should be provided per side on each block to allow merchants the opportunity to plant small storefront gardens. Groups of shrubs with a mature habit of less than thirty inches should be installed in these planters (at thirty-six (36) inches on center) and should be supplemented with seasonal plants.

Where installation of a continuous planter is not practical, trees may be planted in individual planting pits. The individual tree planting pit should be covered with a cast iron tree grate after backfilling.

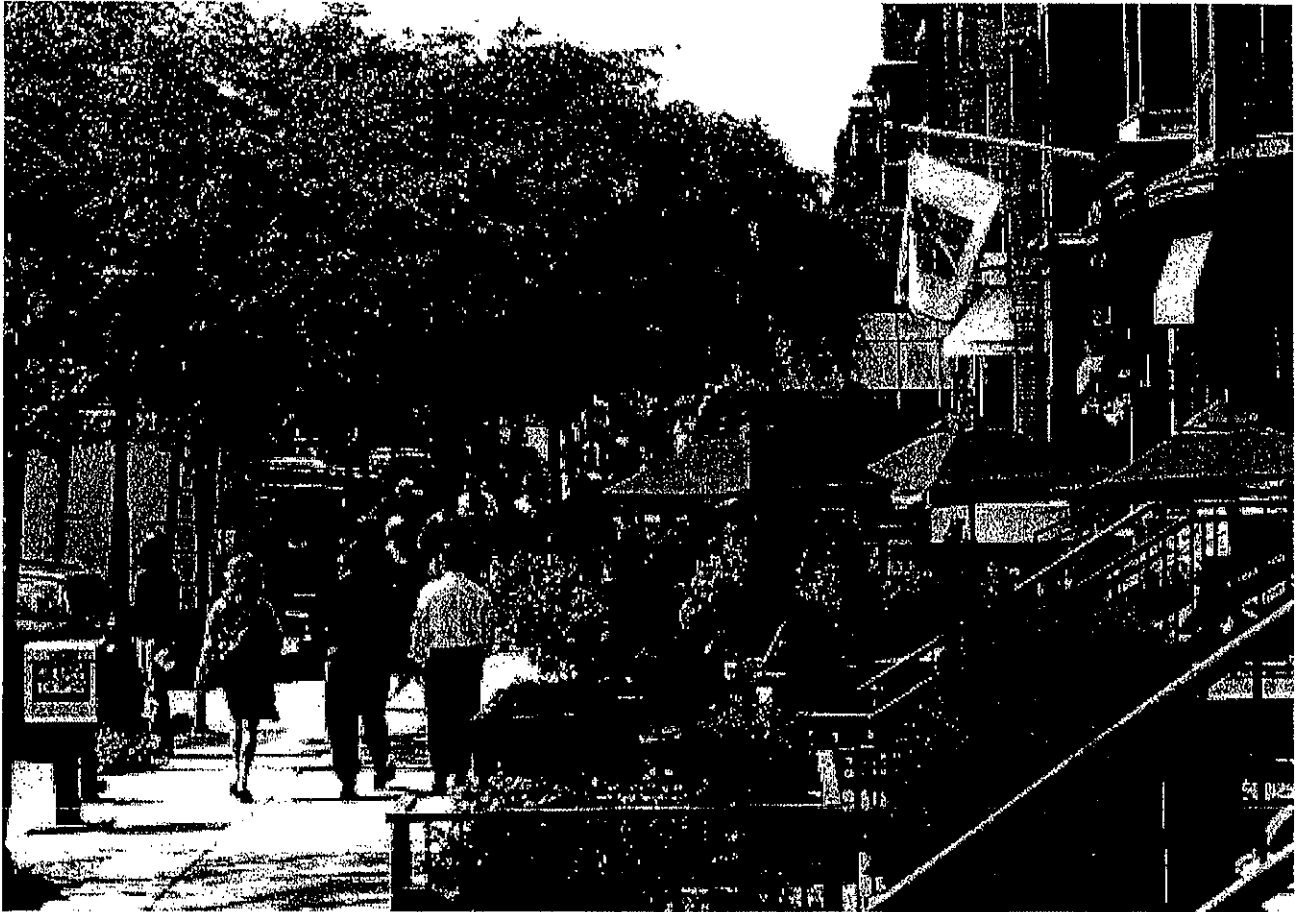
Selective thinning in accordance with wetland regulations should be considered to allow long transverse views at the wetland crossing. Tree and shrub planting at the forested edge of the wetland are encouraged to create a graceful transition from the forest to open areas. Installed plants should be self-sustaining and tolerant of local conditions.



NOTE:
1. EXHIBIT FOR ILLUSTRATIVE PURPOSES ONLY.

Landscape Plan — Figure 7

Mixed Use Main Street Example



NOTE:
1. EXHIBIT FOR ILLUSTRATIVE PURPOSES ONLY.

Landscape Plan — Figure 8

Sidewalk Cafe Example
