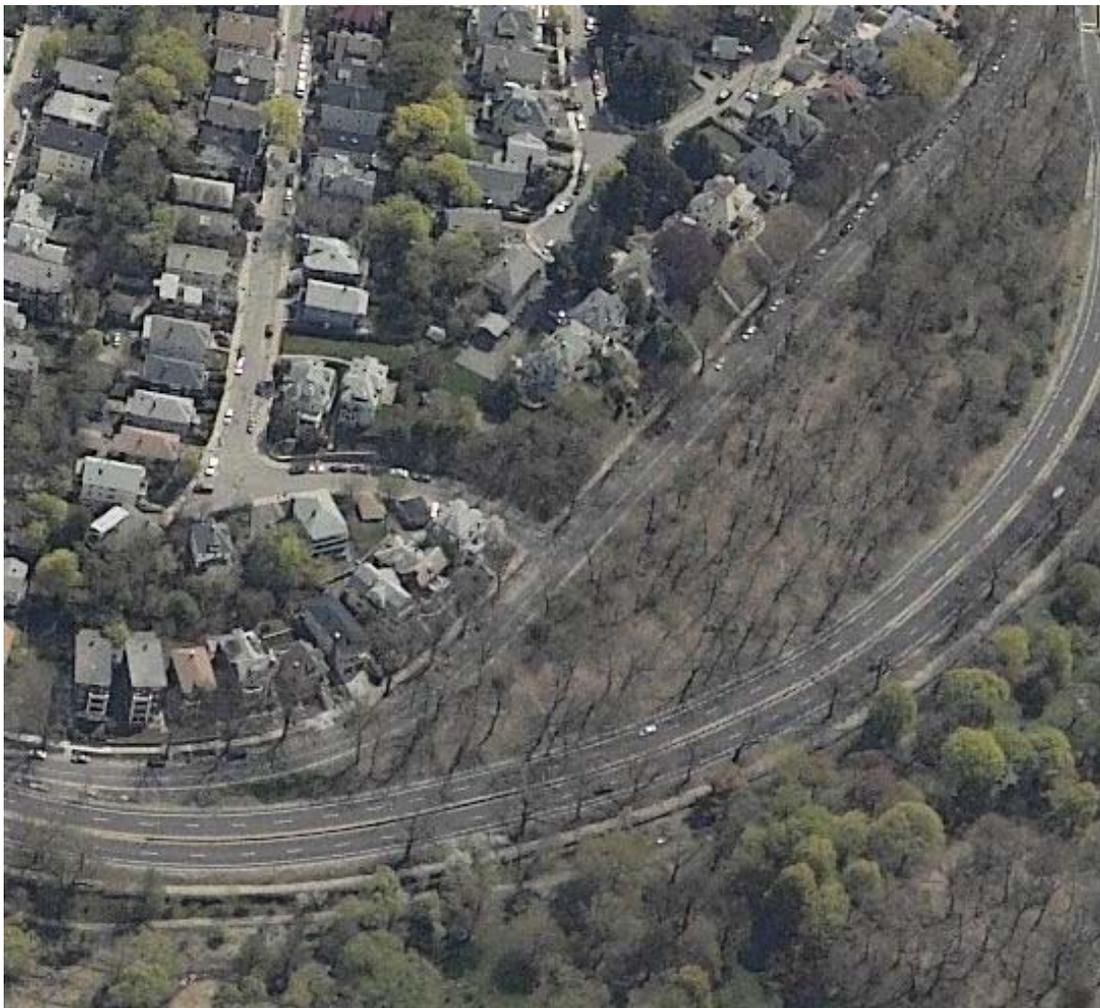




Vegetation Management Plan
Arborway Hillside
Boston, Massachusetts



September 2008

Massachusetts Department of Conservation and Recreation
Bureau of Planning and Resource Protection
Resource Management Planning Program



VEGETATION MANAGEMENT PLAN

Arborway Hillside

September 2008

Massachusetts Department of Conservation and Recreation

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Introduction

The “Arborway Hillside” is a small, wooded, open-space area located between the main Arborway parkway and the Upper Arborway. Owned and managed by the Massachusetts Department of Conservation and Recreation (DCR), it provides a natural open space and vegetated buffer between these two roadways and complements the Arnold Arboretum on the opposite side of the Arborway. The area is frequently used by local residents for its walking paths. The area is mainly characterized by a dense understory of native and invasive plants species set under a relatively mature stands of oaks, maples, and other trees, although there is an area of mown grass at the base of hill and alongside the roadways.

Without a clear vegetation management strategy, recent efforts by the DCR to clear out and cut back some of the existing vegetation was met with concern by some of the local citizens. This Arborway Hillside Vegetation Management Plan (from now on known as the VMP) is intended to set forth a concise plan that will guide horticultural maintenance practices and activities on the hillside for DCR staff, DCR partners, and local volunteers in a manner consistent with the natural and historical intent as well as strengthening the DCR public/private cooperation along the Arborway. This VMP is also designed to complement the April 2004 Arborway Master Plan as prepared by Rizzo Associates and Pressley Associates for the Boston Parks and Recreation Department and the recently completed July 2008 Arborway Treatment Plans as prepared by Pressley Associates. This VMP shall work in close relationship with the more general DCR Five Year Vegetation Management Plan 2006 -2011. The DCR division of Urban Parkways has developed the Five Year Vegetation Management Plan to establish a comprehensive strategy for managing vegetation along its roadways, trails, parks, and other land holdings to create a safe environment for the general public. Per the Five Year Vegetation Management Plan, any vegetation on DCR property that grows in such a way as to create an unsafe condition or threaten the welfare of the general public will be considered undesirable and will be subject to control and management by the DCR.

Contained within this VMP is an overall description of the site, along with a listing of the identified species and the general vegetation character. This is followed by a set of vegetation management and maintenance guidelines intended to improve the quality of Hillside vegetation. This VMP proposes dividing the site into vegetation management areas based on diversified vegetative characteristics and habitats. Invasive plants are a particular problem so the VMP establishes management strategies for their control. A list for new plantings is provided. A planting plan is also offered to establish new plants on a relatively bare area of the Hillside along the Upper Arborway, atop the large Casey Overlook retaining wall.

The goals of the Arborway Hillside Vegetation Management Plan are:

- **To build upon the guidelines established in the DCR Five-Year Vegetation Management Plan.**
- **To enhance the historic and natural landscape along this part of the Arborway.**
- **To provide guidelines for basic horticultural practices to ensure consistency between DCR staff and volunteer work.**
- **To improve the overall quality of the native vegetation and habitat.**

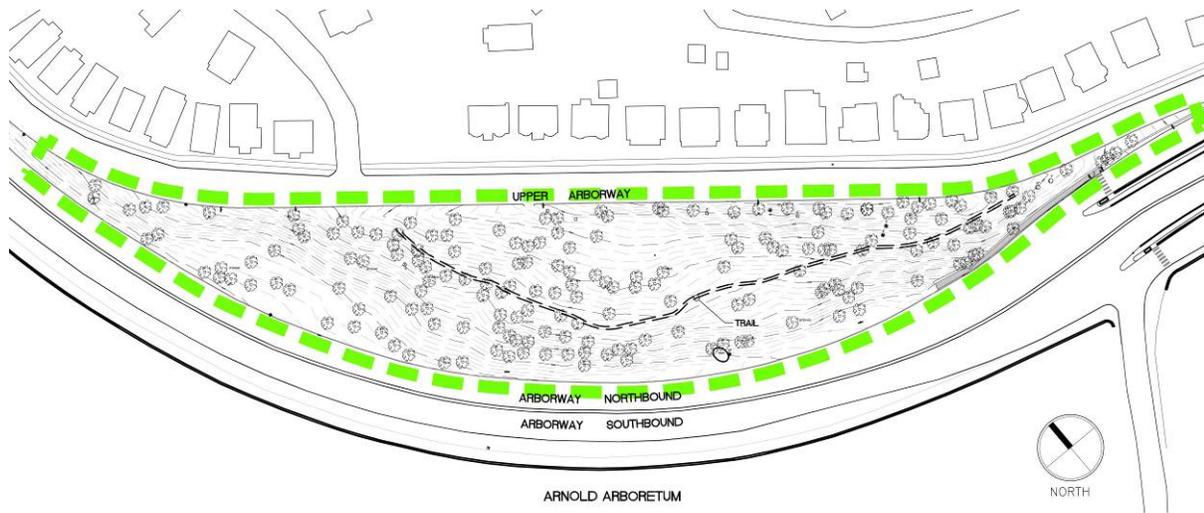
Site Description

Located within the City of Boston, the Arborway Hillside is rather steeply-sloping, open space parcel located between the Upper Arborway and the main Arborway roadway. As a part of the Arborway parkway system, the Hillside is owned by the state of Massachusetts and controlled by the DCR. Its southwestern exposure along with the steepness of the slopes creates a relatively well-drained, upland habitat. Slopes vary from 12% to 50% with a relatively flat area at the northwestern part. To the north, the Hillside area terminates as it narrows to a 12-foot wide median between the two roadways. At the southern end, the Hillside is steadily squeezed in between the large retaining wall over the Casey Overpass and the Upper Arborway. The approximate total size of the Hillside is 3.4 acres.



Aerial View of the Arborway Hillside (Windows Live website)

In Spring 2008, a topographical survey of the hillside was conducted by Bryant Associates, Inc. The survey was produced at a 1"=20' scale with one (1) foot contours. The survey located all trees of six-inch caliper and greater. With the survey in hand, staff members from Pressley Associates conducted field walks of the site from early spring to mid-summer of 2008 to determine use patterns, existing plant species, overall health of the plants, density of understory and overstory vegetation, and existing site maintenance.



Bryant Associates Topographical Survey. The thick dashed line indicates extent of the Arborway Hillside. All trees over 6” caliper are indicated by the tree symbols.

Site Use

Use of the site appears to be mostly by local residents and other pedestrians going north or south along the Upper Arborway. It was observed that some people go directly down the hillside and then illegally “jaywalk” across the Arborway over to the sidewalk running along the eastern boundary of the Arnold Arboretum. There is a single well-established, narrow dirt trail going north to south across the middle portion of the Hillside with both ends connecting to the Upper Arborway. In several areas, this trail goes through some rather dense woodland and understory areas with vegetation growing right up the trails edge and with limbs hanging down from overhead thus creating obstructions along the trail. In sunnier and less dense areas, grass grows within and adjacent to the trail.



Trail through an open, grassy area of the Hillside.

Existing Plant Species

Vegetation on the Hillside is well represented by overstory and understory trees, woody shrubs and vines, herbaceous perennial wildflowers and groundcovers, and grasses. The native vegetation is mainly plants found within the upland oak-hickory plant association, the prevalent plant association in eastern Massachusetts. No endangered or rare plant species were observed. Trees include red oak (*Quercus rubra*), white oak (*Quercus alba*), pin oak (*Quercus palustris*), red maple (*Acer rubrum*), black cherry (*Prunus serotina*), hawthorne (*Crataegus* spp.), boxelder (*Acer negundo*), Amur maple (*Acer ginnala*), green ash (*Fraxinus pennsylvanica*), shagbark hickory (*Carya ovata*), crabapple (*Malus* spp.), white pine (*Pinus strobus*), white mulberry (*Morus alba*), and gray birch (*Betula populifolia*). Shrubs and vines include low-brush blueberry (*Vaccinium angustifolium*), forsythia (*Forsythia* spp.), brambles (*Rubus* spp.), staghorn sumac (*Rhus typhina*), hedge maple (*Acer campestre*), poison ivy (*Rhus toxicodendron*), honeysuckle (*Lonicera* spp.), grape (*Vitis* spp.), greenbrier (*Smilax rotundifolia*), Virginia creeper (*Parthenocissus quinquefolia*), moonseed (*Menispermum candense*), and chokecherry (*Prunus virginiana*). Herbaceous plants include nightshade (*Solanum* spp.), lily of the valley (*Convallaria majalis*), pokeweed (*Phytolacca americana*), Solomon seal (*Polygonatum commutatum*), false Solomon seal (*Smilacina racemosa*), lambsquarters (*Chenopodium album*), milkweed (*Asclepias syriaca*), asters (*Aster* spp.), evening primrose (*Oenothera* spp.), daylily (*Hemerocallis* spp.), and whorled loosestrife (*Lysimachia quadrifolia*). Grasses occurring in the mowed and sunnier areas seem to be mostly finely-leaved fescues intermixed with typical lawn weeds. Poison ivy occurs along roadside and trail areas as a low-growing groundcover, as an upright shrub, and as a climbing vine that winds around trees along roadside and trail areas.

Interspersed among these plants are also a good number of plants considered invasive. These invasive plants are amur corktree (*Phellodendron amurense*), burning bush (*Euonymus alatus*), Oriental bittersweet (*Celastrus orbiculatus*), Norway maple (*Acer platanoides*), porcelain berry (*Ampelopsis brevipedunculata*), black swallowwort (*Cynanchum louiseae*), European and glossy buckthorn (*Rhamnus cathartica*, *Rhamnus frangula*), garlic mustard (*Alliaria officinalis*), multiflora rose (*Rosa multiflora*), Tree-of-Heaven (*Ailanthus altissima*), and black locust (*Robinia pseudoacacia*).



European buckthorn, one of the most common invasive plants on the Hillside. This plant is especially common in the middle part of the Hillside, sprouting up from cut stumps.

Existing Vegetation Areas

Based on site observations, there are three distinct vegetation communities on the Hillside. First is the mown grassy area with a scattering of overstory trees along the base of the Hillside. Amongst the mown grass, there are isolated areas of herbaceous vegetation and some woody shrubs, mostly brambles, low-brush blueberry, and invasive buckthorn. The second community is the densely wooded area that dominates most of the southern portion of the Hillside. This area is characterized by large shade trees (oaks, maples, and hickories) with an open understory comprised of a mix of small trees, woody shrubs, and vines. The third community is an area that was cleared several years ago by the DCR. The density of the trees here is about the same as the wooded areas of the Hillside but the understory is a mix of grasses and large patches of dense understory shrubs, vines, and tree seedlings. There are many sprouts coming from the cut trunks, mostly oaks and buckthorn. There are some extensive and dense patches of poison ivy are found here.



Mown grass area at the base of the Hillside, along the Arborway. The overstory trees in this area are mostly a mix of red and pin oaks.



The densely wooded area of the Hillside.



Looking up towards the area of the Hillside cleared two years ago.



Another view of cleared area. Notice the resprouted trees and seedlings amongst the grass and overstory trees.



In the area between the Casey Overpass retaining wall and the Upper Arborway, there is a fairly barren area (aside of some weedy vines and grasses). Cut stumps here indicate that small tree or large shrubs were once here. An opportunity exists here for a new planting area.

Existing Condition and Health of Vegetation

Most of the plants are as healthy as one would expect in a natural and mostly unmanaged woodland situation, with some plants exhibiting disease, rot, and pest problems, along with competition from the invasive plants. Several trees along the roadsides and trail need dead limb removal and some structural pruning. There are a few scattered dead trees that probably offer habitat to a number of mammal and bird species. Some of these trees are located rather close to the trail and thus may pose a hazard if a limb or the whole tree were to fall.



Example of a tree with multiple dead branches that may pose a threat to pedestrians or vehicles.

It does appear that the large number of invasive plants may be displacing and out-competing the native vegetation thus impacting the success of the native ecosystem. Trees such as the amur corktree, Tree of Heaven and Norway maple were once commonly planted as street and landscaping plants, but now threaten to take over portions of the Hillside. Oriental bittersweet, a woody twining vine, has spread over several of the overstory trees. The additional weight of these vines could threaten to pull the trees down during storms. European buckthorn is quite prevalent everywhere on the Hillside (outside of the densest parts of the woodland) and tends to outcomplete the native understory shrubs. Porcelainberry vines, sometimes easily confused with grape vines, dominate an area at the lower part of the Hillside close to the Casey Overpass on ramp. The density of the porcelainberry seems to be preventing the regeneration of the natural woodland trees by shading out any potential seedlings.



A rather large patch of vines comprised of invasive porcelainberry exists on the Arborway side of the Hillside near the Casey Overpass.

Existing Site Maintenance

According to the DCR, the only maintenance currently occurring on the Hillside is regular mowing of the flat grass area at the northwestern part of the site and along a narrow strip along the roadways. To some observers, the site may seem to be functioning well “as is”, but the concern here should be the sheer number of invasive plants present and their future possible spread, maintenance of the existing and desired plants, clearance along the trail, and hazardous trees along the trail and the roadways.

Vegetation Management and Maintenance

This section contains both general and specific vegetation management and maintenance guidelines for the Arborway Hillside. Four distinct vegetation management areas are also established. An illustrative plan is contained in Appendix A showing these specific management areas and highlights locations for new plantings, invasive plant control, and hazardous tree removal.

Note: Poison ivy occurs throughout the Hillside area. Any individual involved in any management or maintenance activities should be alert for poison ivy, know how to correctly identify the plants in its many forms, how to protect themselves from the allergic toxins of the plant, and how to properly treat themselves if exposure does occur.

General Vegetation Management and Maintenance Guidelines

Management and maintenance for new and existing vegetation should be based upon the requirements of plant material and the time and abilities of park staff, work crews and volunteers, equipment available, and budgets.

General vegetation maintenance guidelines for the Arborway Hillside can be divided into six categories:

- Grass Areas
- New Plantings
- Existing Vegetation
- Hazardous Tree Removal
- Pest and Disease Management
- Invasive Plant Management

Following these guidelines is a detailed description of the four proposed vegetation management areas

Arborway Hillside Grass Areas

Mowing

Without mowing, most turf grasses will grow to heights of two or three feet. Mowing is the most common required maintenance for grass but must be properly done within public open spaces. Limiting grass to only two to two and one-half (2-2.5) inches puts tremendous stresses on the plant and increases the level of necessary inputs, especially watering and fertilizer. Turf that is cut higher (four inches) is better able to withstand the pressures of foot traffic, equipment traffic, and drought. Proper mowing practices and equipment minimize this stress. Grass clippings should be left on all turf areas if they are cut on a regular basis. This practice will decrease fertilizer requirements, increase the health of the turf's root system, and eliminate the need for disposal or composting of grass clippings. But grass clippings that are too long (due to delayed mowing; 6 inches or longer) should be collected and removed as these clippings greatly add to the thatch layers, allow for fungus or other disease to infect the grass leaves or roots, and may possibly smother the living grass underneath.

Grass must be mown on a regular basis to keep it from growing too long. No more than one-third of the grass height should be cut off or the grass may be damaged. The exception to this is in the early Spring and mid- to late-Fall when cutting lower should not typically harm the cool-season grass as much as in warmer times of the year. Grass growth should be monitored and mowing frequency increased in order to avoid removing more than one-third of the grass blade. Mowing patterns should be alternated to avoid ruts and compacted soils. Mowing should not be done when the grass is wet. Trimming, only as needed, should be coordinated with the mowing schedule. Trimming should be done with string trimmers.

Fertilization

There should be no need for additional fertilization of the grass area except as needed to established newly seeded areas.

Reseeding

Reseeding of the grass will only be necessary if there is significant and large-scale die back of the existing grass due to disease, drought, or fire or in order to prevent erosion of the soil. In New England, reseeding of bare and thin spots in lawn areas is best done in the early fall (September - October). Reseeding should be done in time for the grass to become established before the winter cold. Per the July 2008 Arborway Treatment Plans completed in coordination with this VMP, there are two types of grass mixes specified for the hillside – a slope seed mix for all slopes three to one (3:1) or steeper and a lawn seed mix for flatter areas.

Lawn seed mix: shall be composed of the following varieties which shall be mixed in the proportions and shall test to minimum percentages, purity and germination specified.

<u>Common Name</u>	<u>Proportion</u>	<u>Germination Minimum</u>	<u>Purity Minimum</u>
Creeping Red Fescue or Chewing's Fescue	50%	85%	95%
Kentucky Bluegrass (Fylking)	20%	90%	90%
Manhattan Perennial Rye	25%	90%	90%
Red Top	5%	85%	92%

*** Annual ryegrass shall not exceed 5%**

Seeding Rate: 8 pounds per 1000 square foot.

Slope seed mix (3:1 or steeper slopes): shall be composed of the following varieties which shall be mixed in the proportions and shall test to minimum percentages, purity and germination specified.

<u>Common Name</u>	<u>Proportion</u>	<u>Germination Minimum</u>	<u>Purity Minimum</u>
Creeping Red Fescue (Festuca ruba)	28%	85%	95%
Canada Wild Rye (Elymus Canadensis)	27%	90%	90%
Perennial Ryegrass (Lolium perenne)	13%	90%	90%
Little Bluestem (Schizachyrium scoparium)	5%	90%	90%
Blue Grama (Bouteloua gracilis)	5%	85%	92%
Indian Grass (Sorghastrum nutans)	4%	90%	90%
Rough Bentgrass (Agrostis scabra)	2%	85%	90%

Upland Bentgrass (Agrostis perennans)	1%	85%	90%
Annual Ryegrass (Lolium multiflorum)*	15%	85%	92%

*** Annual grasses shall not exceed 15%**

Seeding Rate: 35 pounds per acre.

Weed control

Using the proper cultural practices outlined above, a healthy lawn is usually able to outcompete most weeds. In the natural situation of the Arborway Hillside, a certain amount of weed growth, particularly non-invasive herbaceous plants, can be tolerated. However if an area of lawn becomes overrun with excessive weed growth and/or invasive plants that seriously affects the appearance of the grass, a plan using integrated pest management (IPM) techniques should be put into effect. IPM combines cultural practices with minimal and judicious amounts of chemicals to control weed and pest problems.

Leave raking

In order to prevent smothering the grass and to prevent fungal diseases, the leaves should ideally be raked off of the grass. The schedule for will vary depending on the amount and timing of leaf fall, but should preferably be done at least two different times so the leaves never get too deep. At the discretion of the DCR maintenance staff, leaves raked from this area can actually be **spread** to more wooded of the Hillside to act as mulch. If this practice is implemented, the leaves should be spread out and not allowed to stay in a pile.

Arborway Hillside New Plantings

As most of the Hillside is already well vegetated with a good mix of overstory trees, understory trees and shrubs, and an herbaceous layer along the ground, there is little need for new plantings. Exceptions lie where large areas of invasive plants are killed or removed (via mechanical or chemical measures; see the Invasive Plant Management section below). These areas would need to be replanted with appropriate native plant. Another area for new plants is at the southern end of the Hillside between the Upper Arborway and the Casey Overpass retaining wall. This VMP calls for the replanting of this bare area with trees, shrubs, and grass in order to improve the appearance, buffer the Arborway, restore native plantings, and prevent potential erosion issues. Appendix B contains a suggested planting plan for this area. Any of the existing weedy vegetation in this area should be removed completely and any invasive plants treated prior to the installation of the new plants. Care should be exercised to prevent damage to the existing mulberry trees. Following plant installation, pre-emergent herbicides may need to be applied in the early Spring to prevent the weeds from returning.

In addition, Appendix C contains planting details for tree, shrub, and lawn installations and Appendix D contains a list of recommended species for new plantings. The new plant listing is composed mostly of plants that are native to this type of habitat, are tolerant of the relatively dry site conditions that may periodically occur on the Hillside, and are contained within the Emerald Necklace Plant List (as prepared by the Boston Parks and Recreation Department). The Emerald Necklace Plant List was compiled from several historic plant lists from plans designed by the Olmsted firm for projects within the Emerald Necklace.

Planting can be accomplished either by contractors hired by the DCR or through public and volunteer efforts. Either way, it is important to not only properly install the plant material but to care for the plants during the establishment period which can last anywhere from one to three years after initial planting depending on the plant species, weather conditions, and level of care.

It is recommended the DCR require a two-year maintenance period for any new planted areas installed by contractors. Two years is typically the time necessary for most plants to become established, no matter how well suited they are for the site. The number one item required for establishment is regular and appropriate watering. Once a plant is properly established, its chances of surviving through full maturity are greatly increased and maintenance and water demands are decreased. During this two-year establishment period, the contractor, not the DCR, should be responsible for the establishment of the plants. The contractor, following the completion of plant installation, will be responsible for:

- Watering
- Fertilizing
- Weeding and removal of invasive and weedy plants
- Mulching
- Disease and pest control
- Replacement of any dead or severely declined plants

Following the completion of the two-year maintenance period, responsibility for the plants will be handed over to the DCR.

Watering

Plants can suffer from excessive as well as insufficient amounts of water. Watering is critical in the first two seasons after planting and especially if any drought conditions arise. After that period, many plants, if properly selected for the site conditions, should be able to survive with only natural rain water.

Fertilizing

The type and amount of fertilizer to use during the two-year establishment period should be based on both a soil test and the species of plant. Ideally, properly selected plant material for the site will require little to no fertilizer once established.

Weeding and removal of invasive and weedy plants

Due to soil disturbance in newly planted areas, weeds and invasive plants may readily start growing in newly planted areas from seed stock buried in the soil. Any and all weeds and other undesirable plants sprouting near the new planting should be removed, preferable through manual methods, on a regular basis. Invasive plants should be immediately controlled as some invasive species can quickly establish, take over newly planted areas, and undermine the success of the new plants.

Mulching

Newly planted shrub and groundcover areas should be maintained with a two to three inch layer of mulch throughout the two-year establishment period. As well as helping to retain soil moisture, an organically-based mulch will break down and provide nutrients to the plant. Mulch is best applied in the early spring but can also be applied in the late fall to protect plant roots as the soil freezes and thaws. After the plant is properly established, mulching will most likely not be required. Instead the natural leaf fall should be allowed to stay on the ground around the plants to provide a natural mulch.

Disease and pest control

If a disease or pest problem arises during the establishment period for newly planted areas, the problem should be dealt with immediately to prevent any loss of installed plants. It is recommended that IPM techniques be employed. See the Pest and Disease Management

section below for more information.

Replacement of any dead or severely declined plants

If the plants were installed by paid contractors, the contractor will be responsible to replace any dead or severely declined plant during the establishment period. Replacement plants shall be the same species and size as originally installed.

Arborway Hillside Existing Vegetation

Management of Woodland Areas

The woodland association typical of upland areas of eastern Massachusetts is the oak/hickory association. In this association, the canopy is dominated by northern red, white, black, scarlet and chestnut oaks along with shagbark hickories, tulip poplars, and basswoods. In the lower layers are small trees and shrubs; dogwoods, hop hornbeams, sassafras, serviceberries, witch-hazels, winterberries, pinxterbloom azaleas, lowbush blueberries, and several species of viburnums. The herbaceous layers are represented by asters, wood anemones, columbine, lady's slipper, mayflower, wild geranium, Solomon's seal, goldenrod, and a number of ferns including christmas fern, wood fern, and shield fern.

Some of the above species are well represented within the woodland areas of the Hillside; others are not. Through the maintenance program, the DCR should encourage the continued growth and regeneration of native trees throughout the Hillside. More than any other landscape element, trees provide the most prominent visual component in the landscape. Tree preservation and management involves the protection of the canopy, trunk, and roots. Whereas the Hillside does not receive the amount of intense public use more typical of public parks, pedestrian use of the Hillside does affect the natural ecosystem of the Hillside. Over time, pedestrian use can have some of the following impacts:

1. Compaction and lack of soil fertility begins to change the soil both physically and chemically.
2. Rainwater begins to run off (causing soil erosion) rather than percolating down through the soil and to the plants' roots.
3. Understory plants are lost or damaged.
4. Exotic and/or invasive species begin to seed in the woodlands and the character of the woodland begins to deteriorate.
5. Native shrubs and native understory trees are lost to invasives and to overuse of the areas.
6. Older native trees cannot compete for nutrients and water and begin to decline; tops die back.
7. Areas become so impacted or over-used that users begin to seek other locations.

Individual trees are a very visible part of the landscape and efforts should be focused on maintaining the health and good form of these trees. These practices will be typically used on individual trees but not normally used in more natural woodland situations.

The control of invasive species in woodlands areas is an intensive and recurring task. It is important to correctly identify invasive plants and plan for control strategy. Smaller groupings of invasive plants can be hand pulled but larger and more intense areas will need more thorough removal and control methods. With deliberate management, those portions of the understory dominated by invasive species can be replaced with an understory comprised of sustainable native woody and herbaceous species.

By using best urban forestry management practices, the woodland area should be a sustainable and self-

regenerating forest. Age diversity in the canopy layer is a long-term goal. Ideally the trees should be of all ages with every stage present from newly established plants to those past maturity. There should be a selective removal (thinning) of young trees to allow for improved growth of select young trees. Thinning allows for less competition for light, air, and nutrients. Thinning greatly improves the health of individual trees and the woodland as a whole. Maintaining an active and healthy forest layers is imperative for a healthy ecosystem. An ideal, healthy urban forest, much like a forest in more natural situations, should be composed of several vertical layers: overstory canopy, intermediate canopy, tall shrub understory, low shrub understory, and herbaceous/groundcover layer. Leaf fall should not be removed in woodland areas but should be allowed to accumulate and decay on the woodland floor. Leaf litter and fallen dead twigs and branches left in place provide nutrients for the soil, prevent erosion, provide forage and habitat for wildlife, and necessary for a self-regenerating woodland.

Ideally, all trees, but especially the most visible individual trees, will be inspected annually and treated, as needed, according to the integrated pest management (IPM) techniques (described later in this section).

Regular Maintenance

Dumped trash should be picked up on a regular basis. Signs and posters should never be allowed to be hung on any tree. Benches, trash cans, bicycles, and other objects should never be chained to any tree. Extreme caution is a must when using string trimmers and mowers around tree trunks and roots to avoid damage to the bark. Vehicles or other heavy equipment should never be allowed to park under trees as soil compaction can seriously affect the long-term health of trees and other plants. Salt and de-icing use along the Upper Arborway should be used judiciously as these chemical affect the soil's chemical balance and can damage or cause decline to plants.

Pruning

Tree pruning applies to both existing and any new trees. Periodic removal of dead and broken branches improves the appearance and structure of trees, but more importantly removes hazards to users of the Hillside. Shrub and understory pruning may be necessary to control growth along the pedestrian trail and along the roadside areas.

Many of the existing trees need pruning to re-establish a more healthy form and to remove dead limbs. Tree thinning and the removal of crossing branches also help to create desirable and healthy tree form. Several other trees are either dead or in a state of such poor health that they pose a threat to public safety and warrant complete removal. At the discretion of the DCR, dead trees that are sufficiently located away from pedestrian and vehicular areas can remain to provide bird and other wildlife habitat. An experienced and licensed Arborist shall perform or supervise all pruning operations. Pruning work should be performed to all current arboricultural standards.

Pruning and removals shall conform to the following:

- American National Standards Institute (ASNI): Standard A300, latest edition, Standard Practices for Tree Care Operations – Tree, Shrub and Other Woody Plant Maintenance.
- American National Standards Institute (ANSI): Standard Z-133.1. latest edition, Safety Requirements for Tree Care Operations – Pruning, Trimming, Repairing, Maintaining, and Removing Trees, and Cutting Brush.

Types of Tree Pruning

- 1) **Crown raising** consists of the removal of the lower branches of a tree in order to provide clearance over walks and drives.
- 2) **Crown reduction** consists of heading back or removing branches to clear buildings and other

structures.

- 3) **Crown restoration** improves the structure, form and appearance of trees, which have been severely headed, vandalized, or storm damaged.
- 4) **Crown thinning** is the selective removal of branches to increase light penetration, air movement, and to reduce weight.
- 5) **Hazard reduction pruning** consists of removing visible hazards in a tree, including all dead, diseased, and weak wood over two (2") inches in diameter.
- 6) **Vista pruning** is selective thinning of framework limbs or specific areas of the crown to allow a view of an object from a vista point

Standards for Tree Pruning

- 1) All pruning shall be performed by or under the supervision of a certified arborist and in a manner which maintains the natural aesthetic characteristics of the species and variety of trees. No topping or dehorning of trees or stubbing back of branches shall be permitted. All cuts shall be made to a lateral branch a minimum of one-third (1/3) the size of the branch being removed.
- 2) The use of climbing spurs or spiked shoes shall not be permitted for pruning trees.
- 3) All cuts shall be made sufficiently close to the parent stem so that wound closure can be readily stated under normal conditions. However, cuts shall never be made through the branch collar. Slab cuts and rip cuts will result in cancellation of the contract.
- 4) Pruning performed on this project shall include the provision of proper clearance over street, walkway, and woodland path surfaces to at least the following minimum specifications:
- 5) Street/Roads – All branches shall be pruned to allow a minimum fifteen (15) foot clearance over street surface.
- 6) Sidewalk/Walkway/Paths – All branches shall be pruned to allow a minimum eight (8) foot clearance over walkway surfaces.
- 7) Building – All branches shall be pruned to allow a minimum of five (5) foot clearance away from buildings, or if possible ten (10) foot clearance where trees will not be severely disfigured due to crown reduction.
- 8) All limbs over two inches in diameter to be removed shall be pre-cut to prevent splitting. Any branches that would injure the tree or other objects by falling shall be lowered to the ground by proper rigging and rope procedures.
- 9) Remove one of the two crossed or rubbing branches where practical so the removal will not leave large holes in the general outline of the tree.
- 10) On trees known to be diseased, tools are to be disinfected with alcohol after each cut between trees and where there is known to be a danger of transmitting the disease on tools.
- 11) Lateral branches as well as occasional branch suckers may be retained. Complete removal of secondary laterals and branch suckers resulting in the stripping of major limbs, shall not be permitted.

Shrub Pruning

Pruning of shrubs requires knowledge of the growth patterns and flowering times. Many types of shrubs on the Hillside will not require pruning and should be allowed to reach their natural growth patterns and sizes. Shrub pruning will probably only be necessary if the plants encroach with the clear area along the trail and the roadsides (see below). Shrub pruning should always work to emphasize the natural form of the plant and the plant shall never be pruned into a shape such as a ball or cone. No shearing of shrubs should ever occur. Hand pruning is always preferred in order to maintain the natural character of the plant species.

Trail Clearance and Pruning

To allow for proper clearance along the existing trail, all existing **woody** vegetation should be removed to a

minimum of two (2) feet from both edges of the path. Grasses and low herbaceous plant can remain. Lower branches of existing trees adjacent to the path should be removed to a minimum of seven to eight (7-8) feet above the surface of the path. The cleared and pruned areas should be annually maintained to prevent growth into the paths. Poison ivy is present along some parts of the trails. Clearing of poison ivy should be a minimum of four to five (4-5) feet away from the edge of the trail as it can grow quite quickly. In addition, take note of any poison ivy growing as vines on trees adjacent to the trail and remove any of these vines hanging over the trail.

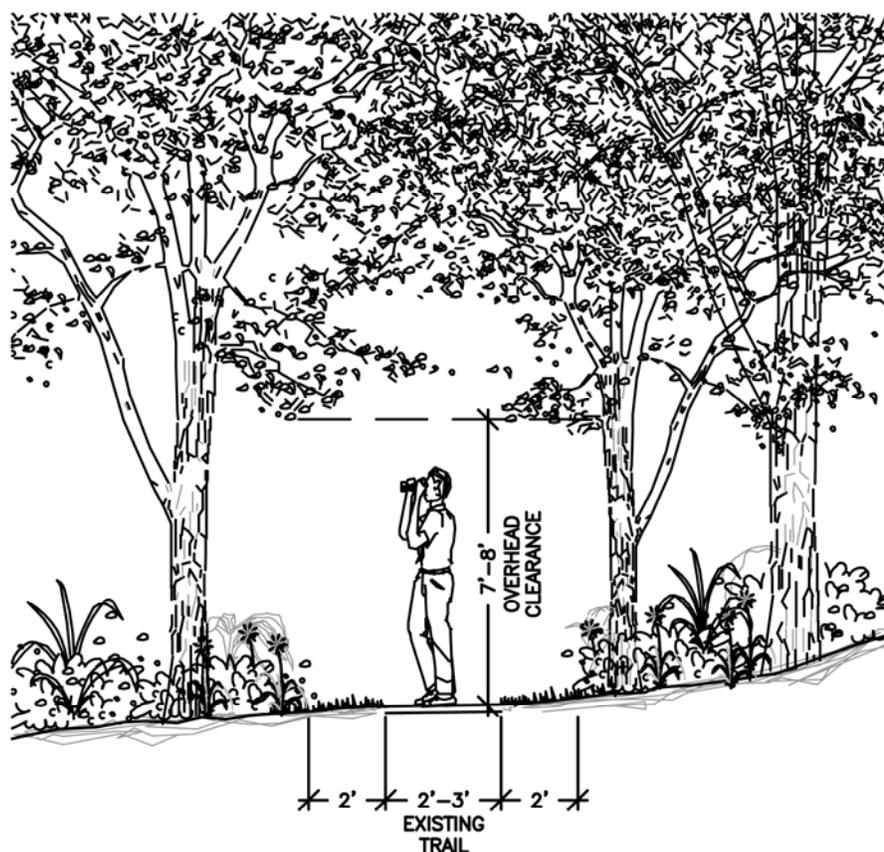


Diagram of standard trail clearance

Hazardous Tree Removals

Dead trees and those trees with dead or diseased branches that are located close to the trail and the roadway should be considered hazardous trees. The plan in Appendix A shows the location of trees currently considered hazardous by Pressley Associates but others may exist. After the DCR fully reviews hazardous trees in the field, the DCR should consider the removal of the fully dead trees as well as implement a hazard reduction pruning program to remove dangerous branches in these areas. Although dead trees provide ideal habitat for a number of wildlife species, the liability of harm to vehicles and pedestrians may outweigh the natural benefit of dead tree habitat (commonly referred to as “snags”).

As defined by the U.S. Forest Service, a hazard tree is a “tree with structural defects likely to cause failure of all or part of the tree, which could strike a target” such as a vehicle or pedestrian¹. Dead trees and branches are

¹ United State Forest Service, How to Recognize Hazardous Defects in Trees, Brochure NA-FR-01-96

unpredictable and can break and fall at any time thus should be removed immediately where there is a threat of personal or property damage. Dead branches are nicknamed “widow makers” for a reason. Falling trees and branches may also damage or pull down other healthy trees nearby.

Trees throughout the Hillside should be periodically inspected by the DCR using licensed arborists. All parts of the tree should ideally be examined including the main trunk, branches, branch unions, and visible roots along with an overall assessment of the tree’s health. Conditions to look for include:

- 1) cracks in the trunk or branches
- 2) weak branch unions where branches are not strongly attached to the main stem of the tree
- 3) decay usually indicated by soft or crumbly wood, open cavities, or fungus growing from the base of the tree or on branches or exposed roots
- 4) cankers created by wounds or disease
- 5) leaning trunks resulting from root damage or dieback
- 6) poor tree architecture resulting from storm damage, difficult growing conditions, or poor pruning

Pruning of branches should be performed by a licensed arborist using the standards described previously. Trees should never be topped (removal of large upright branches or the top of the trunk) as this may lead to decay in the exposed part of the tree and/or will lead to a mis-shaped tree that will again be a problem in the future. Cabling or bracing is also not an appropriate solution as it does not cure the problem but only extends the time that the tree is safe. The Forest Service does not recommend cabling or bracing unless the tree has a significant landscape or historic value. Also cabling or bracing if done incorrectly may create a more serious safety problem than before. Full removal of any dead or seriously diseased tree, like pruning, should only be performed by a skilled and licensed arborist to insure that nearby trees to remain are safe during the removal process.

Pest and Disease Management

A certain level of plant pests and disease can be accepted in the Hillside due to the natural area of the site. However some pests and disease problems may get out of control and could eventually seriously affect larger areas or target certain plant species. Any major problem should be monitored and attempts should be made to manage it at a tolerable level. A description and control measures for all pest and disease problems possible is too lengthy for this document and will require consultation of a professional with relevant horticultural pest and disease management practices to diagnose and treat these problems.

Successful management of pest and disease problems requires the knowledge of the symptoms and causes. Once the problem is diagnosed, a staff member or contractor properly trained in control measures should instigate a control program. Certain pest problems can be managed through cultural practices, but some cases may require the use of pesticides. Integrated pest management (IPM) should always be used to reduce the amount of pesticides used. As defined by the U.S. Environmental Protection Agency, IPM is “an effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment.”²

Traditional IMP programs usually involve four basic steps:

- 1) Set Action Thresholds – Determining the level at which pests represent enough of an impact to the plant to warrant additional action.

² EPA website - <http://www.epa.gov/opp00001/factsheets/ipm.htm>

- 2) Monitor and Identify Pests – Be sure that the pest will actually cause enough harm to the plant and determine the appropriate control techniques
- 3) Prevention – Implementing appropriate maintenance practices to reduce the threat of a pest
- 4) Control – Once all of the previous threshold are exceeded and prevention methods are not effective, start a control program that first uses the least risky control measures first such as natural chemicals or mechanical controls (trapping, weeding, etc.). Monitor the control program and only apply additional control methods, such as pesticides, as needed.

Additional information on IPM techniques can be found at the University of Massachusetts Extension Office website, the University of Minnesota's IPM World Textbook (<http://ipmworld.umn.edu>), Penn State's Woody Ornamental Guide (<http://woodypestguide.cas.psu.edu/Default.htm>), and within the DCR Five-Year Vegetation Management Plan. All pesticide application must be performed under Massachusetts Pesticide Control Act of 1978. In addition, Massachusetts pesticide law requires that all persons who apply pesticides in public areas must be in possession of a valid license or certification issued by the Massachusetts Department of Agricultural Resources.

Invasive Plant Management

The multitude of highly invasive plants on the Hillside is arguably this area's biggest problem from a vegetation standpoint. Invasive plant species are generally defined as non-native plants that have aggressively invaded naturally occurring plant communities and tend to out-compete other vegetation. Invasive plants can be considered weeds, but not all weeds are as aggressive as invasive plants. As invasive plants are non-native and grow outside of their natural range, they are not controlled by natural predators, diseases, or competition from other plants and are highly adaptable to a wide range of habitat and soil conditions. Invasive plants usually have aggressive qualities such as rapid growth and spread as well as abundant seed productions and dispersal. Many invasive plants were once, and sometime still are, planted as ornamental plants but have escaped into native habitats. Invasive plants can spread into new areas via winds, wildlife droppings, seeds caught on pets or clothing, and by the dumping of garden waste and leaves.

The invasive plants occurring on the Hillside where listed in the Site Description section. Wherever invasive plants are found throughout the Hillside, some type of management program should be implemented. Certain invasive plants and areas of the Hillside are more problematic than others, affecting the appearance, health, and habitat of the natural woodland habitat. The key to invasive plant management is "control." Given the amount of invasive plant material and the limited resources for this area, it would be virtually impossible to completely eliminate all invasive plants from the Hillside. Through proper control techniques, along with regular monitoring, that limits the spread and total amount of invasive plants to a tolerable level, the native plant community can have a better chance of being the dominant plants. Invasive plant management can be possible through a combined force of DCR maintenance staff, volunteer groups, and possibly contractors. Given limited physical and financial resources, it may be best to tackle only one area or one type of invasive plant at a time. Once that plant or area is controlled successfully, move on to the next area. Invasive species control and removal will need to be followed by native vegetation replanting to try to prevent the invasive plant(s) from becoming re-established. Always monitor the controlled area to ensure the continued success of a native plant community.

Poison ivy, although not technically an invasive species but rather a species native to the eastern United States and is an important food plant for some wildlife, is a particular problem along the trail and should be controlled in this area to prevent affecting trail users. Poison ivy is a nuisance due to the human allergic reaction to the oils present on the surface of the plant. Dogs can even pick up these oils on their fur which can later be transmitted to humans through petting. Thus poison ivy is considered a noxious plant worthy of management and control.

A brief description and identification guide of each of the known invasive and noxious plants in the Hillside is listed in the Appendix E along with maintenance options and biological, manual, and/or chemical controls. In addition several other common invasive plants to the Northeast are noted in case they ever show up on the Hillside in the future. New invasive plants are always a possibility as many invasive plants are spread by bird droppings and wind thus new invasive plant colonies can show up miles away from the parent plant.

As with all vegetation management practices, the control efforts must balance the needs of the natural community along with the disruption caused by the invasive plant management. In all recommendations, this VMP assumes it is always best to take the least environmentally damaging approach that will affect the desired control of an invasive or noxious plant.

Invasive and Noxious Plant Species Control Guidelines

Invasive species control will require a number of techniques and a long term management and monitoring strategy:

- 1) **Biological control** is the control of undesirable vegetation through natural means. This is done through natural plant competition, predators, and disease; this control method is accomplished manipulating the environment in such a way that you create, or jump-start, the natural biological control. An example would be encouraging low growing shrubs to out compete tall growing species, using imported beetles to feed on invasive species, or create conditions for disease to attack a plant.
- 2) **Manual and mechanical techniques** such as hand and tool pulling, hand cutting, mowing, girdling, brush-cutting, mulching, and tilling can be used to control some invasive plants, particularly for relatively small populations. But these techniques will usually not kill well-established and deep rooted plants. Regrowth will occur from stumps, underground rootstocks or creeping underground stems. Cutting alone often results in a greater number of sprouts or excessive branching. Non-chemical control of well-established, deep-rooted plants will require either digging up the entire root system (clearing and grubbing) or repeatedly cutting the top growth over several years.
- 3) **Chemical control techniques** involve the use of herbicides that kill or otherwise impair an individual plant's competitive ability. If dealt with early enough, invasive plant problems can often be eliminated by non-chemical methods. However as a last resort, an herbicide-based approach may be required to control an infestation that has become well established or widespread. With certain invasive species, control is almost impossible without the use of chemical herbicides. Application methods include foliar application by spraying, application to cuts in the stem or trunk, and undiluted application to cut stems and stumps. Foliar treatment is applying herbicides directly to the leaves and stems of the plant. This is the best method for large areas and for plants such as poison ivy that are noxious. The problem with foliar application is that it can be accidentally oversprayed or winddrifted over to plants that are not being managed. The cut stem and stump treatment method is the application of herbicides, via squirt bottle, brush, or sponge, to a freshly cut part of the plant to prevent resprouting. This method is more time consuming but poses less risk to other plants in the area.
- 4) **Replant and re-seed** areas of invasive species removal in order to promote a native understory. As with all new plantings, the replacement plants should be native and suited for the site conditions. Use plants contained within the VMP's Plant List.
- 5) **Conduct routine invasive species maintenance and monitoring.** Follow-up monitoring of problematic species ideally should be conducted on an annual basis.

Herbicides

The use, type, and extent of chemical herbicide control should be the decision of the DCR based on their experience with such controls and available resources at the time of application.

The herbicides most commonly used for control of invasive plants are glyphosate (found in Roundup, Accord, and Rodeo), and triclopyr (found in Ortho Brush-B-Gon, Garlon, and Crossbow). Chemically, glyphosate and triclopyr have different properties and knowledge of these properties is essential in determining the appropriateness of their application. Both are systemics in which the chemical is absorbed into the plant foliage or stems. Although both glyphosate and triclopyr have low oral toxicity to humans and other animals, glyphosate is the least toxic. Care must be taken with both chemicals to avoid contact with plants that are to be retained.

Glyphosate is a broad spectrum herbicide meaning that it is capable of killing a broad range of woody and herbaceous plants. When applied to foliage or stems, the chemical moves within the plant to growing points and roots where the chemical inhibits the synthesis of the amino acids needed for plant growth. Complete death of the plant typically takes two weeks. Treatment for woody plants is best in late summer or fall. Glyphosate is only effective on its immediate application. The chemical is readily biodegraded by micro-organisms in the soil into carbon dioxide, water, nitrogen, and phosphorus and thus does not persist as an herbicide in the environment. It should be noted that glyphosate does not prevent seed germination. Triclopyr is used primarily for the control of broadleaf woody and herbaceous plants but has no effect on grasses or sedges if applied at normal rates. Triclopyr has a more rapid effect on plant than glyphosate with death usually occurring within a few days of application. Triclopyr is also typically more effective in the control of many woody species. The chemical interferes with the normal expansion and division of plant cells. Unlike glyphosate, triclopyr could potentially leach into groundwater or run off into surface waters, especially if the chemical is over applied.

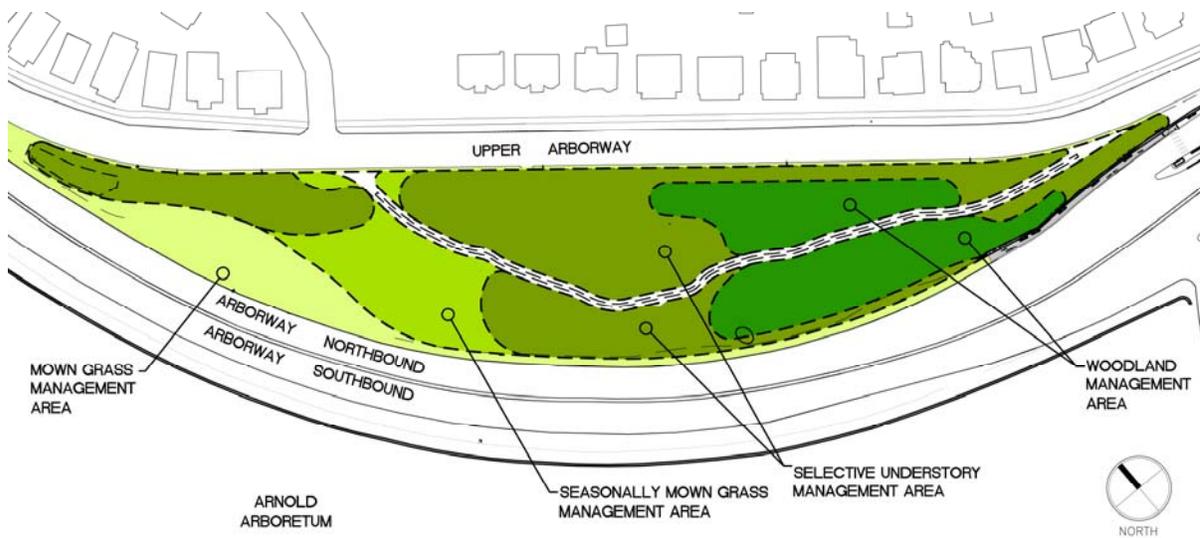
All chemical applications must be documented and applied by a staff member or contractor with a Massachusetts pesticide license.

Vegetation Management Areas

Based upon an evaluation of existing vegetation communities on the Hillside, this VMP proposes the establishment of four vegetation management areas (VMAs). These four VMAs are:

- 1) Mown Grass Management Area
- 2) Seasonally Mown Grass Management Area
- 3) Selective Understory Management Area
- 4) Woodland Management Area

The outlines for the VMAs shown on the plan are only for graphic purposes only. Actual delineation of the VMAs should be conducted in the field using a careful evaluation of the existing plant species, topography, views, and other physical features. Nor should the delineation be hard-edged but rather the VMA's merge into one another gradually so there are no sharp boundaries between areas.



Vegetation Management Plan Management Areas

It may be noticed that these four VMAs seem to resemble and generally follow the outlines of the existing vegetation communities described in the previous section. The existing communities, although impacted by invasive plants, already provide interesting and diverse habitats. The denser woodlands provide visual buffers between the Upper Arborway homes and busy Arborway, while providing cover for certain types of woodland wildlife. Different plants and wildlife exist in areas where the understory plants are more dominant. The mown grass areas, as well as the cleared understory areas, allow for views both into and out from the Hillside. Along the roadways, it is standard road maintenance for the DCR to maintain a strip of mown grass and pruned woody plants to prevent overreaching vegetation from blocking vehicles sightlines. All of these vegetation communities provide a different type of habitat for other wildlife species. The common elements throughout the Hillside are the large overstory trees but there are only a few good quality small and medium sized overstory trees. These younger trees will be needed to naturally replace the older trees when they eventually die.

By roughly following the delineation of the existing vegetation communities for the four VMAs, implementation and maintenance of the VMAs is more realistic given the somewhat limited resources for the Hillside. It will be far easier to keep the existing areas and improve the quality of vegetation within them rather than attempting to convert an area of vegetation into some different.

Mown Grass Management Area

This management area is primarily established along the northwestern part of the Hillside. Mown grass shall also occur along the roadside approximately five to six feet from the back of the curb. This proposed total area is approximately 30,000 square feet or 20% of the Hillside. The desired long-term character of this area is to be defined by regularly cut, park-like grass with shade trees.

This VMA is to be mowed to height of four inches every seven to twelve working days during the active grass growing season. During the hot and dry part of the summer when some of the grasses go dormant, the time between mowing cycles can increase at the discretion of the DCR maintenance crew. Soil tests in selected areas should be performed on a regularly basis once every few years. In accordance with soil testing results, limestone should be applied if recommended. Limestone adjusts the balance of the soil pH to allow the grass to better take up the natural nutrients already contained in the soil. Unless the soil test indicates severe nutrient deficiencies, no fertilizer treatments are recommended. Turf renovation (overseeding) is carried out only as needed during the months of late August through September if necessary. When turf is renovated, a snow fence is erected to protect the grass. Some weeds and bare spots are acceptable but a control program will be necessary for any invasive plant. Control of invasive plants is simple in this area as the plants can be controlled through the mowing regimen.

Along with the overstory trees, there are some isolated examples of desirable, native woody shrubs and herbaceous plants within this VMA. These plants should be protected and mowed around.

As mowing in this area prevents any tree seedlings, there is the issue of providing for the next generation of shade trees. When any of the existing trees die or are removed for another reason, a new tree (using the Plant List in this VMP) should be planted to ensure that there will always be a tree overstory. Trees ideally should be installed at a minimum size of two and half (2.5) inch caliper and up to six (6) inch caliper

Seasonally Mown Grass Management Area

This management area is established along the northern middle portion of the Hillside uphill of the main area of the Mown Grass Management Area and west of the trail. Part of this VMA is within the area that was cleared several years ago. The total area is approximately 17,500 square feet or 12% of the Hillside. The desired character for this VMA is an area dominated by high grasses, herbaceous perennials, and some select native woody shrubs along with the overstory trees, much like a meadow at the edge of a woodland. To achieve this character, this area should only be mowed once (Fall) or twice (mid-Spring and Fall) a year. Mowing will cut back any vegetation counter to the desired character, allowing for the grass and the perennials to be the dominate vegetation. This area will act as a transition between the mown grass and understory areas.

When mowed, the mower should be set as high as possible. Given the topography of this area, line trimmers may be the best tool for cutting the grass. Cut plant material should be removed. This VMA requires no fertilizer or irrigation. Weeds that are not considered invasive can be tolerated. Native shrubs and herbaceous plants to remain should be protected from mowing. Invasive plants can be controlled the through the seasonal mowing program along other appropriate mechanical or chemical controls as recommended in Appendix E. Any dead or removed tree should be replaced with a new tree per the requirements described in the Mown Grass VMA.

To supplement the existing grass, two native tall grasses can be installed either as seed or as containerized plants. These two grasses are northern sea oats (*Chasmanthium latifolium*), that grows three to four (3-4) feet high, and bottlebrush grass (*Hystrix patula*), growing two to five (2-5) feet high. Both of these grasses are considered “woodland” grasses that can tolerate both sun and shade. They naturally occur along woodland edges and perform well under the light shade of oaks and hickories.

Selective Understory Management Area

This management area is established along the middle portion of the Hillside with additional areas at both the northern and southern ends. Most of this VMA is within the area that was cleared several years ago. The total area is approximately 69,000 square feet or 46% of the Hillside. The preferred character of this VMA is an open overstory tree canopy over a dense, mixed understory of native woody shrubs and herbaceous perennials. There is little grass in this VMA except immediately alongside the trail. Select understory trees scattered around this area are also desired. The shrub and herbaceous layer will be denser than in adjacent woodland area due to more sunlight. Invasive plants, a critical problem in this area, will need to be aggressively managed along with poison ivy.

The oaks and other trees that are currently resprouting as multiple stems from cut trunks will never become the stately trees that they once were and are prone to disease and pest problems. As well, invasive buckthorn aggressively resprouts whenever it is cut back. Buckthorn further spreads by seed. The tree and buckthorn sprouts should be periodically cut back and the DCR should consider treating the stumps with a herbicide to prevent future re-sprouting.

This area, more so than the other VMAs, may need to be planted with a mix of native plants recommended in Appendix D, especially in areas where invasive plants and oak sprouts are eliminated. Installing these new plants will help to give this VMA a “jump start” and will encourage a more healthy and native understory. Hopefully native overstory tree seedlings (oak, maple, hickory, ash, etc.) will grow in this area, allowing for the next generation of large trees. These seedling and young trees should be protected. Sometimes there may be a large number of these seedlings in one location. In this case, competition between these young trees can be reduced through skillful tree thinning.

Woodland Management Area

This management area is established along the southern and steepest part of the Hillside. The total area is approximately 33,000 square feet or 22% of the Hillside. The general idea for this VMA is to promote an active and sustainable woodland habitat using the guidelines described previously for woodland management. In this VMA, the understory is more dominated by understory trees and young overstory trees along with a few understory shrubs and vines. There are fewer herbaceous perennials here as the dense shade restricts their numbers. Seedlings of native oaks, maples, ashes, hickories, and other native overstory trees should be protected and allowed to potentially grow into large trees.

Aside from the area of porcelain berry vines near the Casey Overpass, invasive plants in this VMA are not as critical as the Selective Understory VMA. Over time, trees will fall due to storms, disease, or natural "old-age" death and leave gaps in the woodland. These openings in the canopy can be allowed to go through natural succession but these openings can also be an opportunity for invasive plants to take hold and prevent natural woodland regeneration. One way to prevent invasive plants and to help restore the woodland is to install native plants within the opening (per the Appendix D plant list).

Appendices

Appendix A: VMP Graphic Plan

Appendix B: Upper Arborway Site Planting Plan

Appendix C: Planting Installation Details

Appendix D: Recommended Plant Species List

Appendix E: Invasive and Noxious Plant Species Description, Site Location, and Control Measures

Appendix F: Massachusetts Prohibited Plant List

Appendices

Appendix A: VMP Graphic Plan

Appendix B: Upper Arborway Site Planting Plan

Appendix C: Planting Installation Details

Appendix D: Recommended Plant Species List

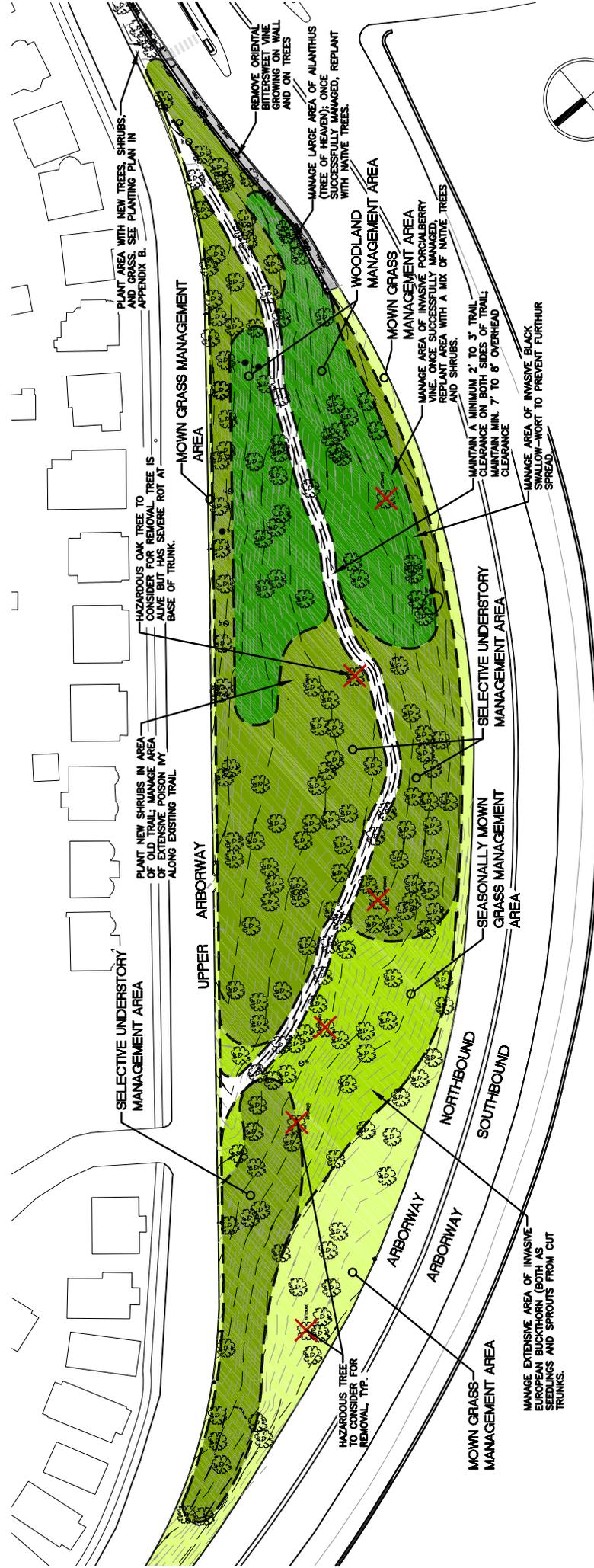
Appendix E: Invasive and Noxious Plant Species Description, Site Location, and Control Measures

Appendix F: Massachusetts Prohibited Plant List

Appendix A

VMP Graphic Plan

The following plan illustrates some of the vegetation management recommendations and areas for the Arborway Hillside.



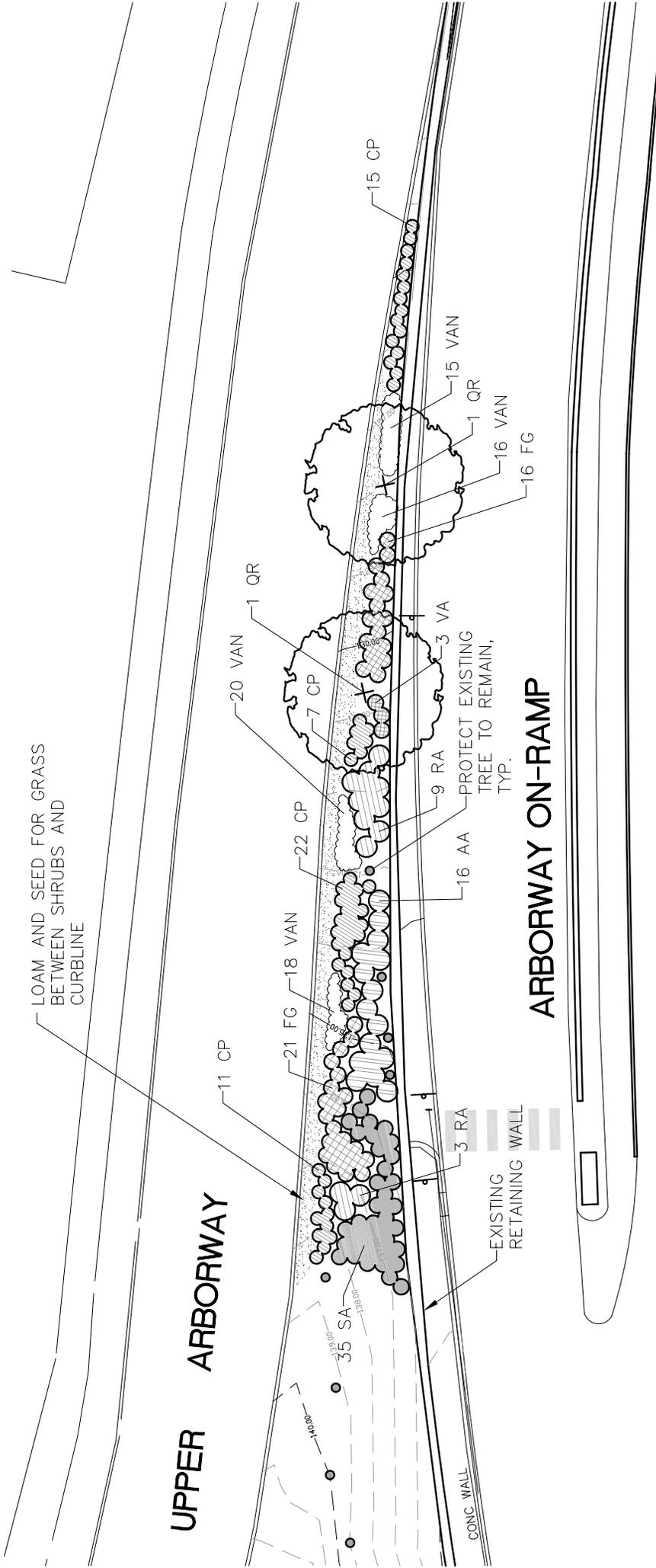
NORTH
NOT TO SCALE

ARNOLD ARBORETUM

Appendix B

Planting Plan

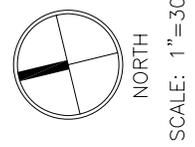
The following planting plan is for the southern end of the Hillside between the Upper Arborway and Casey Overpass retaining wall.



ARBORWAY (CASEY OVERPASS)

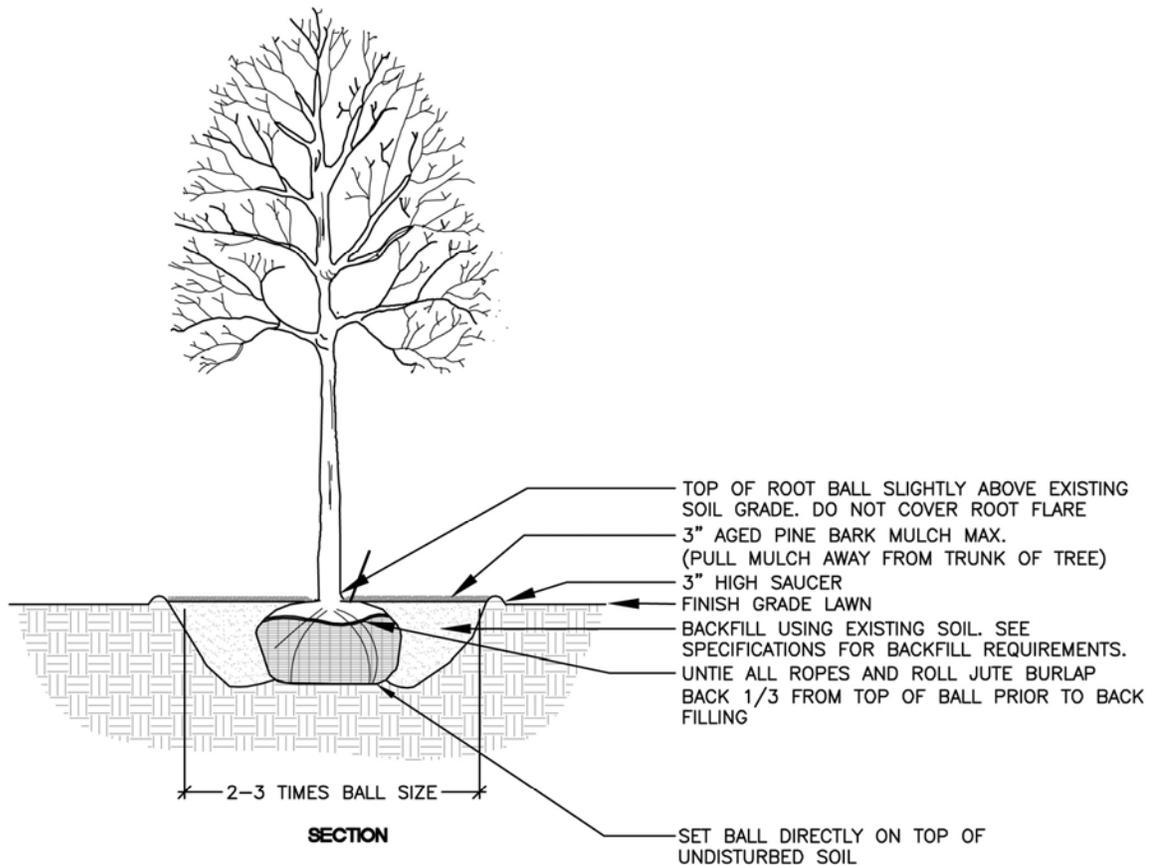
Plant Schedule

SYMBOL	QUANTITY	SCIENTIFIC NAME	COMMON NAME	SIZE	COMMENTS	SPACING
AA	16	<i>Aronia arbutifolia</i> 'Brilliantissima'	Brilliant Red Chokeberry	#5 cont	CONT	4' OC
CP	55	<i>Comptonia peregrina</i>	Sweetfern	#1 cont	CONT	2.5' OC
FG	37	<i>Fothergilla gardenii</i>	Dwarf Fothergilla	#3 cont	CONT	2.5' OC
QR	2	<i>Quercus rubra</i>	Red Oak	3" - 3 1/2" cal.	B&B	-
RA	12	<i>Rhus aromatica</i>	Fragrant Sumac	#3 cont	CONT	4' OC
SA	35	<i>Symphoricarpos alba</i>	Snowberry	#3 cont	CONT	3' OC
VA	3	<i>Viburnum acerifolium</i>	Mapleleaf Viburnum	#3 cont	CONT	3' OC
VAN	69	<i>Vaccinium angustifolium</i>	Lowbush Blueberry	#3 cont	CONT	1.5' OC



Appendix C Planting Installation Details

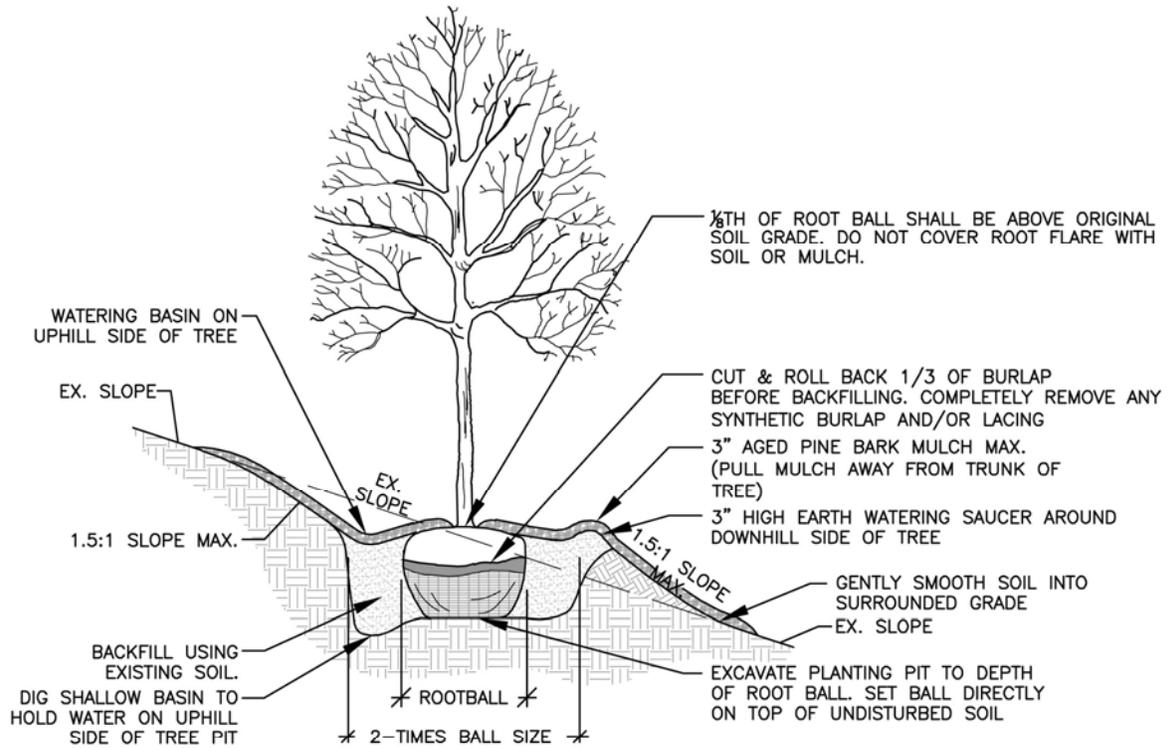
The following planting details should be used along the planting plan presented in Appendix B and for any new plantings installed elsewhere on the Hillside.



NOTES

- 1) WATERING SAUCER SHALL BE FLOODED TWICE DURING THE FIRST 24 HOURS AFTER PLANTING.
- 2) DO NOT CUT LEADER. TREE WRAP SHALL NOT BE USED.
- 3) CLEANLY PRUNE ALL DAMAGED BRANCHES.
- 4) TREE SHALL HAVE STRAIGHT TRUNK AND BE PLUMB AFTER SETTLEMENT.
- 5) PLANT MATERIAL SHALL NOT BE BROUGHT TO THE SITE IN WIRE BASKETS OR IN POLY-BURLAP.

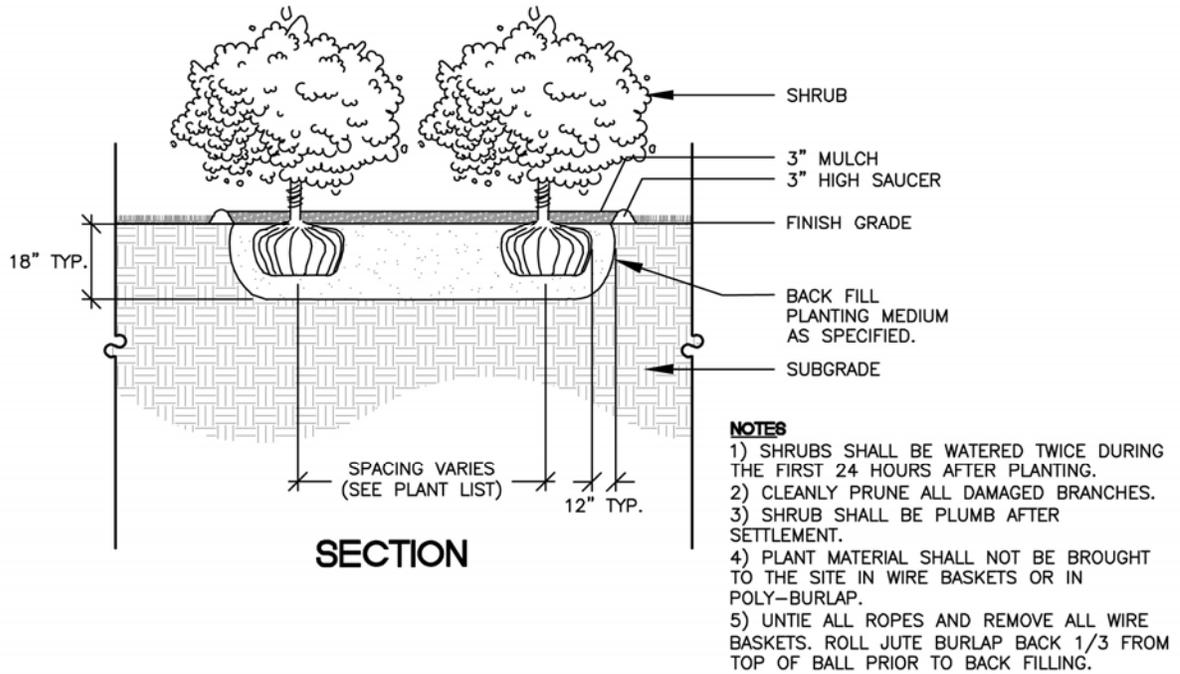
Standard Tree Installation



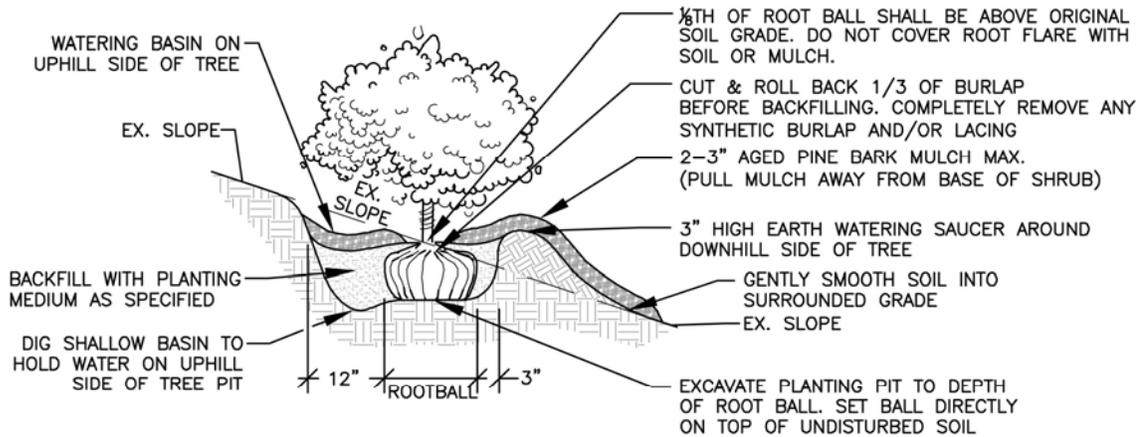
NOTES

- 1) WATERING SAUCER SHALL BE FLOODED TWICE DURING THE FIRST 24 HOURS AFTER PLANTING.
- 2) DO NOT CUT LEADER. TREE WRAP SHALL NOT BE USED.
- 3) CLEANLY PRUNE ALL DAMAGED BRANCHES.
- 4) TREE SHALL HAVE STRAIGHT TRUNK AND BE PLUMB AFTER SETTLEMENT.
- 5) PLANT MATERIAL SHALL NOT BE BROUGHT TO THE SITE IN WIRE BASKETS OR IN POLY-BURLAP.
- 6) REMOVE ALL TREE WRAP FROM TRUNK OF TREE..

Hillside Tree Installation

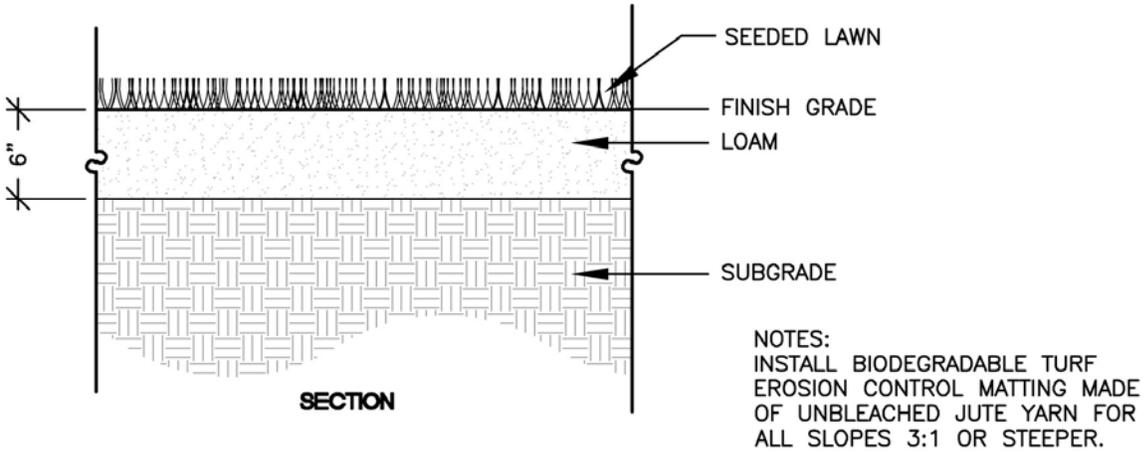


Standard Shrub Installation



- NOTES**
- 1) SHRUBS SHALL BE WATERED TWICE DURING THE FIRST 24 HOURS AFTER PLANTING.
 - 2) CLEANLY PRUNE ALL DAMAGED BRANCHES.
 - 3) SHRUB SHALL BE PLUMB AFTER SETTLEMENT.
 - 4) PLANT MATERIAL SHALL NOT BE BROUGHT TO THE SITE IN WIRE BASKETS OR IN POLY-BURLAP.

Hillside Shrub Installation



SLOPE SEED MIX (FOR LAWN AREAS WITH 3:1 AND STEEPER SLOPES):
 SHALL BE COMPOSED OF THE FOLLOWING VARIETIES WHICH SHALL BE MIXED IN THE PROPORTIONS AND SHALL TEST TO MINIMUM PERCENTAGES, PURITY, AND GERMINATION SPECIFIED.

COMMON NAME	PROPORTION	GERMINATION	PURITY
		MINIMUM	MINIMUM
CREeping RED FESCUE (FESTUCA RUBRA)	28%	85%	95%
CANADA WILD RYE (ELYMUS CANADENSIS)	27%	90%	90%
PERRENIAL RYEGRASS (LOLIUM PERENNE)	13%	90%	90%
LITTLE BLUESTEM (SCHIZACHYRIUM SCOPARIUM)	5%	90%	90%
BLUE GRAMA (BOUPELOUA GRACILIS)	5%	85%	92%
INDIAN GRASS (SORGASTRUM NUTANS)	4%	90%	90%
ROUGH BENTGRASS (AGROSTIS SCABRA)	2%	85%	90%
UPLAND BENTGRASS (AGROSTIS PERENNANS)	1%	85%	90%
ANNUAL RYEGRASS (LOLIUM MULTIFLORUM)*	15%	85%	92%

* ANNUAL GRASSES SHALL NOT EXCEED 15%

SEEDING RATE: 35 POUNDS PER ACRE.

LAWN SEED MIX (FOR LAWN AREA LESS THAN 3:1 SLOPE):
 SHALL BE COMPOSED OF THE FOLLOWING VARIETIES WHICH SHALL BE MIXED IN THE PROPORTIONS AND SHALL TEST TO MINIMUM PERCENTAGES, PURITY, AND GERMINATION SPECIFIED.

COMMON NAME	PROPORTION	GERMINATION	PURITY
		MINIMUM	MINIMUM
CREeping RED FESCUE OR CHEWING'S FESCUE	50%	85%	95%
KENTUCKY BLUEGRASS (FYKING)	20%	90%	90%
MANHATTAN PERENNIAL RYE	25%	90%	90%
RED TOP	5%	85%	92%

* ANNUAL RYEGRASS SHALL NOT EXCEED 5%

SEEDING RATE: 8 POUNDS PER 1000 SQUARE FOOT.

Seeded Lawn Installation