

City of Annapolis Forest Conservation Technical Manual

First Edition

This document has been adapted from the Third edition of the Maryland “State Forest Conservation Manual”, dated 1997.

City of Annapolis Forest Conservation Technical Manual
First Edition, March 2019

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Chapter 1

Introduction

Contents:

- 1.0 Protecting Forests and Sensitive Areas Through Site Planning
 - 1.0.1 What Are the Basic Planning Requirements?
 - 1.0.2 Using the Manual
 - 1.0.3 Site Planning Considerations

1.0 Protecting Forests and Sensitive Areas through Site Planning

From the western mountains of Garrett County to the Chesapeake Bay and the shores of the Atlantic Ocean, forests contribute greatly to the quality of life in Maryland. Air quality is enhanced by forests, which reduce atmospheric carbon dioxide through photosynthesis, filter particulates, and absorb nitrates. They provide habitat for numerous plants and animals and recreational opportunities and resources for people. Forests along waterways play a particularly crucial role in maintaining water quality and a healthy balance of terrestrial and aquatic flora and fauna by moderating water temperature fluctuations and buffering streams from runoff filled with sediments and other pollutants. In addition, the forest products industry represents a major industry in the State and Maryland's economic health depends heavily on its contributions. **Figure 1.1** summarizes many of the benefits of conserving forest

At the beginning of this century, much of Maryland's forest cover had been cleared for agriculture or cut for fuel, timber, or charcoal. Since then, many rural and urban areas have been reforested with the guidance and assistance of long-standing State and federal programs. (Information about these programs is available from the DNR-Forest Service, Tawes State Office Building, E-1, Annapolis, MD 21401.)

Today, loss of forest cover in Maryland occurs primarily as a result of construction activities associated with increased urban development. Unlike forest clearing for agriculture, once development occurs, the regeneration potential of forests is often lost.

The Maryland Forest Conservation Act was passed by the General Assembly in 1991 and subsequently amended to conserve the State's forest resources during development activities. The Act requires identification of existing forest stands, protection of the most desirable forest stands, and establishment of areas where new forests can be planted. Forest conservation planning occurs during the initial design or site planning of a proposed development.

The Forest Conservation Act establishes standards for local authorities to enforce during the development process. It is intended to protect not only forests and trees in developing areas, but also any sensitive areas identified during the local planning or comprehensive land use plan adoption process. Standards established in the Act for identification, retention, and replanting include those areas designated as sensitive areas under the Growth Management, Resource Protection and Planning Act of 1992. These include nontidal floodplains, streams and their buffers, steep slopes, and critical habitats.

Identification and mapping of these areas may occur during development review and approval of a Forest Stand Delineation. Protection of these areas may occur through establishing long-term protection methods as part of locally approved Forest Conservation Plans. In addition, sensitive areas located offsite may provide opportunities for replanting, preservation, and protection under a local comprehensive plan or when approved as a technique for afforestation or reforestation.

Successful forest conservation planning requires collaboration between professional foresters, planners, landscape architects, engineers, surveyors, and developers, as well as effective communication between applicants and plan approval authorities. Throughout the development process, the professionals and landowners should act in accordance with the priorities and standards established by State and local law

for forest conservation. This planning requires integration of specific forest protection measures with local land use objectives and the aims of individual landowners. Protected forest areas may be used for recreation, wildlife habitat areas, aesthetics, energy savings, or for timber production. The use and enjoyment of these areas by future residents, as well as preservation of identified priority sensitive areas, will maintain and enhance Maryland's overall quality of life.

1.0.1 What Are the Basic Planning Requirements?

The Maryland Forest Conservation Act of 1991 requires that prior to the approval of any public or private subdivision, project plan, grading permit, or sediment control permit on a unit of land 40,000 square feet or greater, applicants shall submit a **Forest Stand Delineation (FSD)** and a **Forest Conservation Plan (FCP)**. These plans shall be approved by the local authority, under a locally adopted forest conservation program or the Department of Natural Resources where no local program is in effect, before other approvals are given.

The provisions of the Forest Conservation Act of 1991 may be found in the Annotated Code of Maryland (Natural Resources Article, Title 5, Subtitle 16) and the Code of Maryland Regulations (COMAR Title 08, Subtitle 19, Forest Conservation). Any references in this Manual to the Natural Resources Article are from the Annotated Code of Maryland.

A **Forest Stand Delineation** is an inventory of existing site conditions and forests and shall be used during the preliminary review process to determine the most suitable and practical areas for forest conservation during development.

A **Forest Conservation Plan** details the amount of the forest which will be retained, reforested, or afforested; the locations where this will occur; proposed protection measures taken during development, such as location of devices and limits of disturbance; construction scheduling; maintenance and monitoring procedures; long term protection measures; and other measures which may be required .

The Forest Conservation Technical Manual outlines submittal requirements for Forest Stand Delineations and includes required information for the approval of Forest Conservation Plans such as specific forest conservation criteria and protection techniques.

1.0.2 Using the Manual

To assist local authorities in development of local forest conservation programs, the Department of Natural Resources has adopted regulations which set the requirements and standards of performance for submitting Forest Stand Delineations and Forest Conservation Plans. In addition, DNR exercises review authority of all Forest Stand Delineations and Forest Conservation Plans for local projects where no local program is in effect and for State-funded projects under the State Forest Conservation Program.

This Technical Manual is cited as the City of Annapolis Forest Conservation Technical Manual according to 21.71.040 of the City Code.

This manual establishes standards and instructs and assists those professionals responsible for conducting the field work and preparing plans required by the Forest Conservation Act. It is organized around the two major submittal requirements: the Forest Stand Delineation and the Forest Conservation Plan. With certain exceptions, any person making application for subdivision, project plan, grading, or sediment control approval on units of land 40,000 square feet or greater shall submit these two items. Both elements shall be prepared and approved before any permits are approved or commencement of any site work associated with the proposed construction activity.

Chapter 1, Introduction, covers the basic requirements of the Act and site planning considerations.

Chapter 2, Forest Stand Delineations (FSD), covers the first submittal requirement. FSD's describe the existing forest and environmental features as defined in the Act and Regulations. There are three levels of FSD's beginning with a simplified version. At a minimum, a map is submitted which shows the extent, description, and location of forest areas, streams and their buffers, nontidal floodplain, steep slopes, and critical habitats on and closely adjacent to a development site. If forest will be cleared, additional

information will be required.

Chapter 3, Forest Conservation Plans (FCP), discusses the second submittal requirement, FCP's, and step-by-step procedures for their preparation. These plans show the proposed forest retention areas, how much forest is retained or replanted, the plans for replanting, and the forest protection measures during and after construction. The main chapter elements include Determination of Priority Forests and Priority Areas, Forest and Tree Protection, Forest and Tree Planting, Maintenance and Monitoring, and Enforcement.

Chapter 4, Linear Projects, discusses conditions and requirements for special projects such as linear utilities.

Appendix A contains sample site plan illustrations.

Appendix B is a Glossary of Terms.

Appendix C contains examples of data collection and analysis worksheets that demonstrate the step-by-step process shown in Chapters 2 and 3. These may be used directly or adapted. While they have been tested by field reviewers and include all elements required for analysis, applicants may desire to revise them for convenience.

Appendix D contains examples of forest protection and planting specifications and details which may be used directly or adapted. Wherever possible, these are consistent with other construction specifications; however, as additional research is performed or as new methods are introduced, these may be changed. Applicants may wish to verify them with standards contained in the American Standard for Nursery Stock (ANSI) and other horticultural sources. Some of these are listed in Appendix E.

Appendix E is a list of references used in the Manual.

Appendix F is a list of invasive exotic plant species common in Maryland.

1.0.3 Site Planning Considerations

To illustrate the requirements and procedures of preparing Forest Stand Delineations and Forest Conservation Plans, a sample development site plan has been prepared. The sample site is 193 acres in size and contains approximately 34 acres of forest. The site, a medium density residential area, is shown in **Figure 1:1**.

The amount of existing forest on this site is modified in the following chapters to demonstrate the varying conditions and proposals affecting submission requirements for FSDs and FCPs. Sample site plan illustrations are found in Appendix A.

Site planning is a complex, interdisciplinary process that must consider a variety of issues and regulations -- local comprehensive plans, ordinances, and subdivision regulations; infrastructure, such as roads and utilities; state and local regulations that protect wetlands, streams and their buffers, steep slopes, critical habitats; and, of course, the wishes of the developer. Now, subdivision and development also requires coordination of the Forest Conservation Act with all the other needs. This section suggests ways to accommodate site and development constraints while meeting forest conservation requirements.

Forest conservation planning can achieve better community design. A Forest Stand Delineation aids in identifying areas of a property that are most suitable for natural resource conservation. Often, high priority forest areas are likely to coincide with other sensitive areas protected by the state and local regulations. Therefore, retaining priority forests may also satisfy requirements for preserving wetlands, steep slopes, and other sensitive areas. A good FSD may result in significant cost savings by identifying site development constraints before design commences.

Forest conservation is a key element in the site planning process. The forest conservation consultant works with the developer, contractor, site planner, engineer, wetland consultant, and other specialists on the team to ensure that forest conservation requirements are integrated into plans as they evolve from concept to final plan. An initial concept plan should incorporate sensitive area and Forest Stand Delineation information. A Forest Conservation Plan is an integral part of the final subdivision or site plan. Retention and planting can effectively contribute to other planning objectives, such as screening unattractive views, buffering incompatible land uses, and enhancing wildlife habitats.

Although local ordinances and approval processes vary across the state, certain elements are common to most site development proposals. This section outlines site design issues that may affect forest conservation and suggests ways of minimizing potential conflicts between forest conservation planning and other regulations or requirements. The feasibility of implementing these suggestions varies among local and State authorities; therefore, before site design proceeds, local planning departments, departments of public works and relevant State agencies should be contacted.

Residential Design

Common methods for retaining forests and priority retention areas in residential communities involve minimizing the total area of disturbance by using smaller lots, clustering lots, and changing lot configurations. By reducing impacts to priority forest retention areas and related sensitive natural resources, lengthy and expensive regulatory processes may be avoided. Some of these methods are:

- Minimize clearing and grading around proposed development features (**Appendix A, Figure A:1**). Avoid mass clearing and grading. Estimate carefully the amount of clearing needed for walkout elevations on slopes.
- Minimize impervious surfaces and related disturbance through design techniques such as shared driveways or reduced road widths, so long as required setbacks, construction specifications, and fire safety regulations are satisfied. Where these conflict with high priority forest retention areas, a variance to local regulations may be possible where safety is not affected.
- Cluster where possible (**Figure A:2**). Residential development can be concentrated in areas most suitable for construction with the remainder reserved as open space. Cluster subdivisions often allow smaller or alternative lot and housing sizes or layouts with a proportional increase in open space. The example in **Figure A:2** has more lots than in the unclustered example.
- Land preserved in open space retains sensitive natural resources and provides areas for community recreation use. Many preserved open spaces are suitable for long-term retention of

forest and locations of proposed open space can be designed using a Forest Stand Delineation. High priority areas should be retained, connecting corridors should be preserved, and unnecessary forest fragmentation avoided.

Site Grading and Drainage

Local site grading requirements vary. In many jurisdictions, the maximum permitted grade for a constructed slope is 3:1 (1 foot of vertical rise for 3 feet of horizontal distance) and this specification often results in greater areas of site disturbance than is necessary or desirable (see **Figure A:3**). To avoid excessive grading:

- Preserve natural grades, retain existing drainage patterns and minimize grading of steep areas.
- Seek variances to site grading requirements if needed to protect high priority forest retention areas.
- Consider retaining walls to limit the extent of site grading (see Section 3.2 on forest protection).

Roadway Design

Road rights-of-way and impervious paving can have significant effects on forests. Wide roadways and extensive cuts and fills for construction may fragment forest habitat and impose significant alterations to forest hydrology. To limit adverse impacts on existing forests:

- Locate roads with reference to natural grades and environmental features.
- Avoid road alignments that disturb high priority forests wherever possible. When roads must be adjacent to high priority forest retention areas, consider using retaining walls to limit the extent of road grading.
- Use minimum road width standards and minimum setbacks from rights-of-way to preserve existing forests. Variances to local standards may be appropriate means to meet forest conservation objectives.

Utilities

A maze of essential utilities crosses most urban and suburban developments and their design criteria vary widely. The layout of these sewer, telephone, cable, electric, gas and other lines, and the timing of their construction can affect forest areas. Utility companies often require that exclusive easement areas be reserved for the construction and maintenance of the utilities. Many utilities prohibit forest retention or planting within easement or right-of-way areas.

- Investigate modifying utility line specifications to permit reforestation of easements or planting lower growing trees and shrubs under power lines. If forests must be prohibited within these areas, the right-of-way or easement areas may not be credited as a retention, afforestation, or reforestation area.
- Reduce right-of-way width or use common trenching when possible. Disturbance within the right-of-way should be the minimum necessary to install and maintain the utility.

Stormwater Management

Stormwater management facilities pose special problems for forest conservation even though they play crucial roles in the protection of stream quality and aquatic habitat. These facilities are often located at low points of a site and correlate with high priority forest retention areas, stream buffers, floodplains, non-tidal wetlands, and drainage swales.

- Avoid locating stormwater management areas in high priority forest retention areas whenever possible.
- Plan stormwater management facilities to minimize forest disturbance.
- Design stormwater management areas and outfalls to avoid major changes to the hydrology of a retained forest area.
- If permitted, plant forest in stormwater management facilities.

Some forest areas may be suitable for water quantity treatment. Where forests are in hydric and hydric inclusion soils, an embankment may be used to impound water in the forest and slowly release it. The impoundment should be for very brief periods as forested wetlands are tolerant of standing water for limited periods of time (**Figure A:4**).

- Consider bioretention for water quality and quantity treatment. These are specially engineered planted areas which combine particular drainage and nutrient uptake characteristics.
- Investigate waivers to stormwater management quantity control when needed to achieve forest retention objectives, particularly when forest retention areas provide stormwater infiltration benefits.

Erosion and Sediment Control

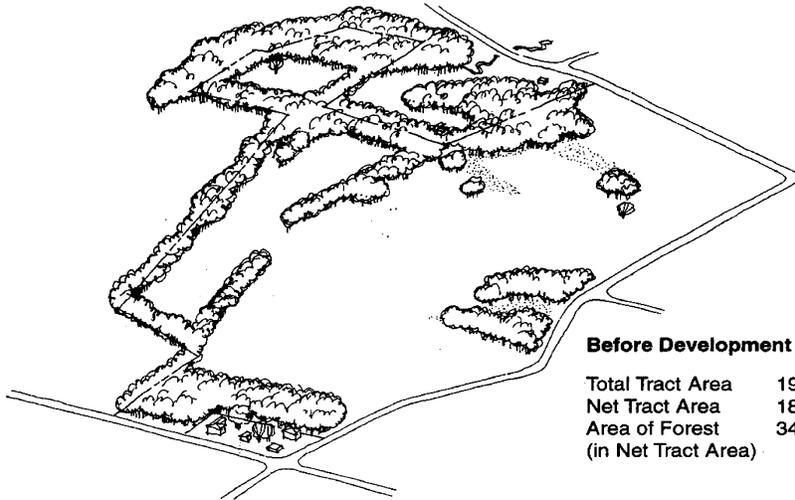
Designing and constructing erosion and sediment control structures should be closely coordinated with forest conservation planning. Protecting retained forests and planted areas requires enforcing defined limits of disturbance and controlling sediment losses from construction sites.

- Do not clear forests to accommodate construction of temporary sediment and erosion control devices or temporary stormwater management devices. Locate them in areas that will be disturbed for later development.
- Design and install forest protection devices prior to or with sediment control devices. Adapt silt fencing and other measures used for erosion and sediment control for forest protection when outside of retention or planting areas. Locate perimeter berms outside of critical root zones. Forest conservation areas may need added protection, such as flagging or signs as specified in Section 3.2.
- Do not direct untreated runoff into forest retention, afforestation, or reforestation areas. Retained forests should be protected from short-term hydrologic changes and excessive sedimentation that often result during construction. However, if existing hydrology permits, retained forests may be appropriate for handling partially treated runoff. The use of existing forests and future afforested areas to serve as additional treatment areas should be considered as part of best management practices for sediment and erosion control.

Wetlands

Wetlands protection, as specified by State and federal regulations, should have few conflicts with the Forest Conservation Act. Identifying and delineating wetlands when preparing a Forest Stand Delineation will assist site design and avoid costly or lengthy construction delays.

- Identify forested nontidal wetlands which are priority for retention.
- Report soils, vegetation, and hydrology information collected when a wetland delineation is required in a Forest Stand Delineation.
- Reforest disturbed wetlands or their buffers. Verify that local, State, and federal regulatory requirements for replanting will be satisfied first. Deduct land area permitted to be disturbed under state and federal regulations from calculations for Forest Conservation Act reforestation.

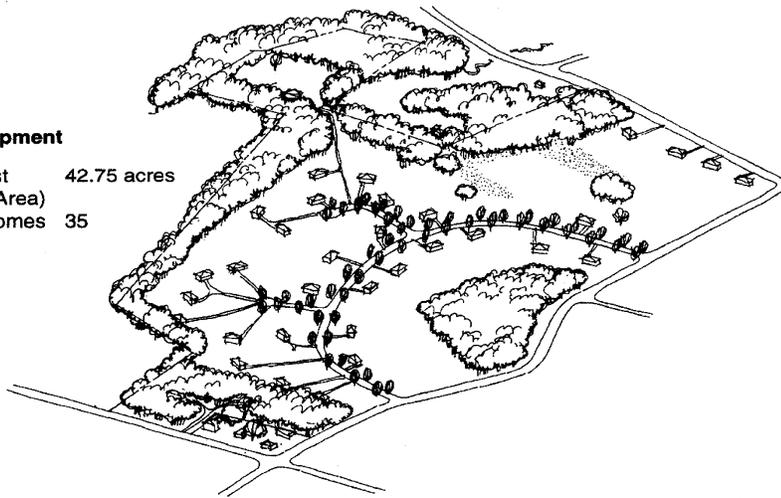


Before Development

Total Tract Area	192.70 acres
Net Tract Area	189.70 acres
Area of Forest (in Net Tract Area)	34.35 acres

After Development

Area of Forest (in Net Tract Area)	42.75 acres
Number of Homes	35



Case Study: Before and After Development

**Figure
1:1**

Chapter 2

Forest Stand Delineations

Contents:

- 2.0 Purpose and Use of the Forest Stand Delineation
 - 2.0.1 Who May Prepare a Forest Stand Delineation?
- 2.1 What Type Of Forest Stand Delineation Is Required?
- 2.2 Required Elements for the Different Types of FSD's
 - 2.2.1 Simplified Forest Stand Delineation Requirements
 - 2.2.2 Full FSD Requirements

2.0 Introduction

The purpose of a Forest Stand Delineation (FSD) is to determine the most suitable and practical areas for forest conservation during the preliminary design and review stages of development. It uses a combination of resource mapping and field assessment to inventory and describe existing forest and locate priority areas for retention, reforestation, or afforestation on the site.

Approved Forest Stand Delineations are required elements of approved Forest Conservation Plans. An approved FSD is valid for five years. To remain valid thereafter, it shall be updated and re-approved every five years unless it becomes part of a single approved Forest Conservation Plan encompassing the entire property.

While reforestation or afforestation may occur on a development site after the approval of a Forest Stand Delineation and before Forest Conservation Plan approval, the approved FSD shall determine the amount of existing forest on the site. Any areas reforested or afforested after the FSD approval date and retained in forest, protected, and placed under maintenance and long-term protective agreements may be included and credited to any required reforestation or afforestation.

This chapter is divided into sections which cover the type of Forest Stand Delineation required (Section 2.1) and the requirements and suggested procedures for preparing Forest Stand Delineations (Section 2.2). Program requirements are listed for two types of forest stand delineations. The level to be used depends on the site conditions and proposed development. The suggested procedures are oriented toward the complete requirements of a full FSD.

2.0.1 Who May Prepare a Forest Stand Delineation?

A Forest Stand Delineation may only be prepared by a Maryland Licensed Forester, Maryland Licensed Landscape Architect, or other Qualified Professional. A stamp or other certification by the preparer shall appear on the submission.

Qualified Professionals are approved by the Department of Natural Resources - Forest Service, or, for local applications, approved by an adopted and approved local forest conservation program, according to criteria adopted in COMAR 08.19.06. Lists of DNR Qualified Professionals, applications, and criteria are available upon request of the State Forest Conservation Coordinator.

2.1 What Type Of Forest Stand Delineation Is Required?

Two different levels of forest stand delineations may be used. The conditions and requirements for these follow and are summarized in **Figure 2:1**.

Simplified Forest Stand Delineations

Simplified FSD's may be used when:

- No forest currently exists on the site; or

- None of the existing forest on the site will be cut, cleared, or graded for the proposed use and all of the forest on the site will be retained and protected under a long term protection agreement (Section 3.2).

Approval of the Simplified FSD shall require meeting either of these two conditions. If the applicant is unable to meet either condition for any reason, including, for example, the uncertainty of future development plans, then a Full FSD must be submitted. If a Simplified FSP may be used, a Forest Conservation Plan does not have to be prepared.

Full Forest Stand Delineations

Full FSD's shall be required for all submissions where the conditions of a Simplified FSD will not be met.

<p align="center">EXISTING FOREST CONDITIONS or PROPOSED LAND USE DEVELOPMENT CHARACTERISTICS</p>	<p align="center">FOREST STAND DELINEATION REQUIREMENTS</p>
<p>Application for subdivision, grading, or sediment control permits on areas less than 40,000 square feet</p>	<p>EXEMPT – No delineation required.</p>
<p>Activities that clear less than 40,000 square feet of forest on a single lot</p>	<p>EXEMPT – No delineation required.</p>
<p>Application for subdivision, grading, or sediment control permits for areas equal to or greater than 40,000 square feet where NO FOREST EXISTS</p>	<p>SIMPLIFIED FOREST STAND DELINEATION Preliminary Forest Conservation Plan may be submitted at the same time as the FSD.</p> <ul style="list-style-type: none"> • No sampling required • No narrative required
<p>Site has EXISTING FOREST, but</p> <ul style="list-style-type: none"> • Forest will NOT BE IMPACTED by clearing or grading and • Forests will be fully protected by a long-term protective agreement 	<p>SIMPLIFIED FOREST STAND DELINEATION Preliminary Forest Conservation Plan may be submitted at the same time as the FSD.</p> <ul style="list-style-type: none"> • No sampling but field verification required • No narrative required
<p>Site has EXISTING FOREST and</p> <ul style="list-style-type: none"> • All high priority areas are retained • The retained forest, including all high priority areas, will be placed under a long-term protective agreement 	<p>FULL FOREST STAND DELINEATION Separate submittal of Forest Stand Delineation and Forest Conservation Plan required.</p> <ul style="list-style-type: none"> • Limited field sampling • Narrative may be included as notes on FSD Map
<p>All other development sites where</p> <ul style="list-style-type: none"> • Priority forests will be cleared • Forests will be cleared below the afforestation threshold 	<p>FULL FOREST STAND DELINEATION Separate submittal of Forest Stand Delineation and Forest Conservation Plan required.</p> <ul style="list-style-type: none"> • Sampling required • Analysis and narrative • Forest Stand Summary required
<p>Forest Stand Delineation Decision Matrix</p>	

**Figure
2:1**

2.2 Required Elements for the Different Types of FSD's

Forest Stand Delineations shall be submitted for the net tract area in most instances, this will be the land parcel of record for which the application for subdivision, grading, or sediment and erosion control will be submitted. The elements required in an FSD are based on existing forest conditions and proposed development, both of which may be determined based on preliminary site reconnaissance and factors such as existing zoning.

Forest is defined in 21.71.202 of the City Code as a biological community dominated by trees and other woody plants covering a land area of 10,000 square feet or more, having a minimum density of 100 trees per acre and a minimum of 50 percent of those having diameters of at least 2 inches at breast height (DBH). Forest also includes areas which have been cut but not cleared (where stumps remain).

2.2.1 Simplified Forest Stand Delineation Requirements

Simplified FSD's shall contain the following minimum elements:

- An **Application** signed by the applicant. The applicant shall be an authorized signatory as specified in 21.71.020 of the City Code. Application forms are available on request.
- A **Site Vicinity Map**. This map (**Figure A: 5**) shows the location of the site within approximately one square mile or more, including forested and sensitive areas adjacent to the site. A minimum scale of 1" = 2,000' (1:24,000) is recommended. This map may be an inset on the Environmental Features or FSD Map.
- A **Forest Stand Delineation**. This shall be prepared at approximately the same scale as the proposed development plan and shall sufficiently indicate all of the required features where applicable. (Examples of these maps are in Section 2.2 and **Figures A:6 and A:7**) Environmental features may be identified and located by using maps or aerial photography for a simplified FSD, although they should be verified for use in later site planning. A walk-through survey to verify locations is required for a Full FSD. A simplified Forest Stand Delineation shall include a natural resources inventory. The natural resources inventory is a compilation of natural site features which shall include:

Forest delineation

Sensitive Areas including:

- Critical Habitat Areas designated by the State or local authorities.
- Watershed data including floodplains, water resources including surface water, ground water and wetlands.
- 100-year nontidal floodplains in watersheds 400 acres or larger, or for Class III streams.
- Intermittent and perennial streams and their buffers. A buffer is up to 100 feet and not less than 50 feet wide measured from the top of the normal bank.
- Nontidal or tidal wetlands and their buffers.

Topography

- Topographic contours and interval. These may be based on USGS 7-1/2" quadrangles, aerial data, or ground surveys. The topographical map shall include intermittent and perennial streams and their buffers.
- Steep slopes of 15% or more.

Geological data

Soils

- Soils series and properties
- Soils w K factors of .35 or greater,
- Hydric soils, erodible soils on slopes of FIFTEEN % or more and soils with structural limitations may be classified using USDA Soil Surveys or other local information.

In addition to the environmental features listed above, the Simplified FSD shall show:

- Field verified forest boundaries (tree lines) using the maximum aerial extent of the canopy. Where these tree lines extend offsite, they shall be shown for at least 100 feet. Total area in acres of adjacent contiguous forested areas shall be indicated on the map. Forested areas onsite shall be indicated by a dominant species type.
- A proposed limit of disturbance line.
- Proposed areas of long-term protection, if applicable.

Requirements for Simplified FSD's are summarized in the checklist in **Figure 2:2**. Sample delineation and sample plan maps using this option are shown in **Figures 2:3** and **2:4**.

SUBMITTAL REQUIREMENTS

1. Site Vicinity Map

- location of the project site and surrounding area within one square mile
- major roads
- political boundaries
- north arrow
- adjacent land uses
- forested areas
- minimum scale of 1"=2000' (1:24,000)

2. Environmental Features Map

- property boundaries (tax maps, plats, or surveyed boundaries)
- north arrow
- title, date, revisions, scale, and legend
- certification by Qualified Professional or stamp of a Maryland Licensed L.A. or Forester
- topographic contours and intervals (USGS 7 ½ minute quad or spot elevations)
- steep slopes greater than FIFTEEN % (on areas greater than or equal to 10,000 square feet)
- 100-year nontidal floodplain (watersheds of 400 acres or larger or Class III streams)
- intermittent and perennial streams (USGS 7 ½ minute quads of SCS Soil Surveys)
- stream buffers (50-foot width)
- soil classifications (SCS Soil Surveys) indicating soils with
 - structural limitations
 - hydric properties
 - K value greater than 0.35 on slopes greater than or equal to 15%
- nontidal or tidal wetlands and buffers (National Wetlands Inventory or Maryland Department of the Environment)
- proposed limits of disturbance
- areas proposed for long-term protection (if forest exists)
- past and present management of
 - forested areas
 - unforested areas
- adjacent land uses
- forested areas and unforested areas including tree lines extending offsite
- size and location of adjacent forested areas
- forest type (dominant species)

3. Application

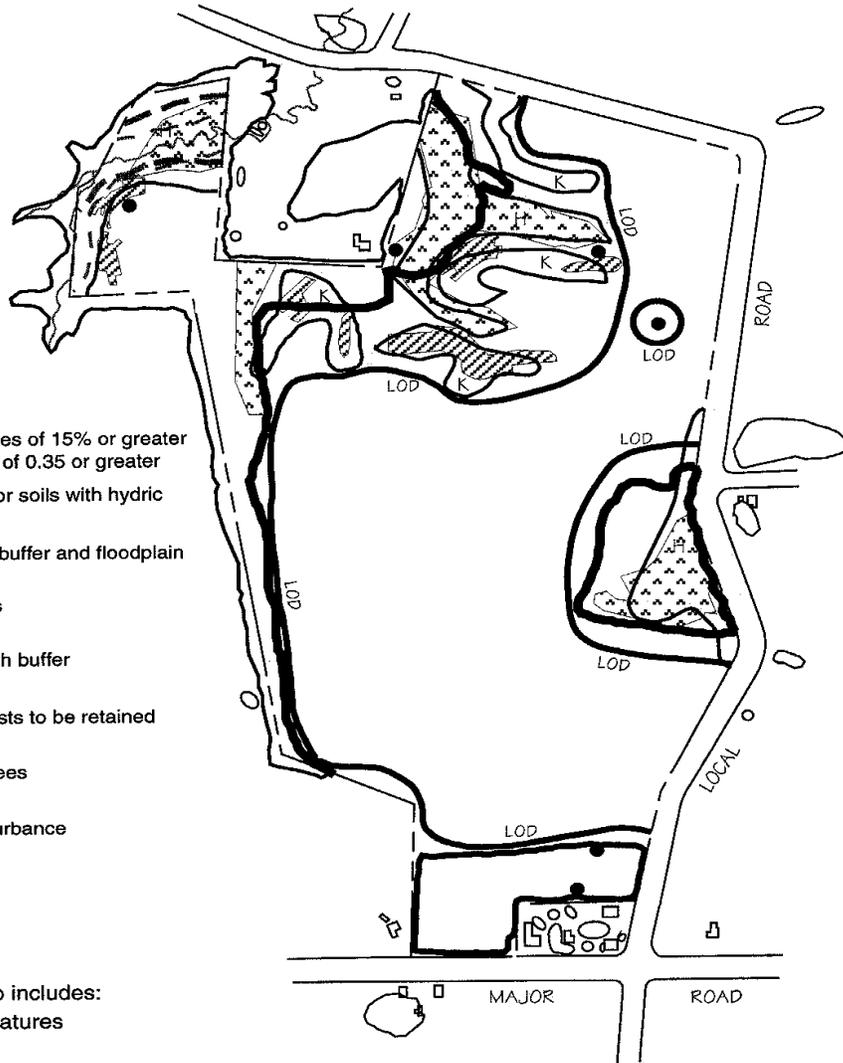
- complete information including signature

Simplified FSD Checklist

**Figure
2:2**



North



Legend

-  Soils on slopes of 15% or greater with K factor of 0.35 or greater
-  Hydric soils or soils with hydric inclusions
-  Stream with buffer and floodplain
-  Steep slopes
-  Wetlands with buffer
-  Existing forests to be retained
-  Specimen trees
-  Limit of Disturbance

Notes

- Simplified FSD map includes:
1. Environmental features
 2. Priority areas
 3. Tree line

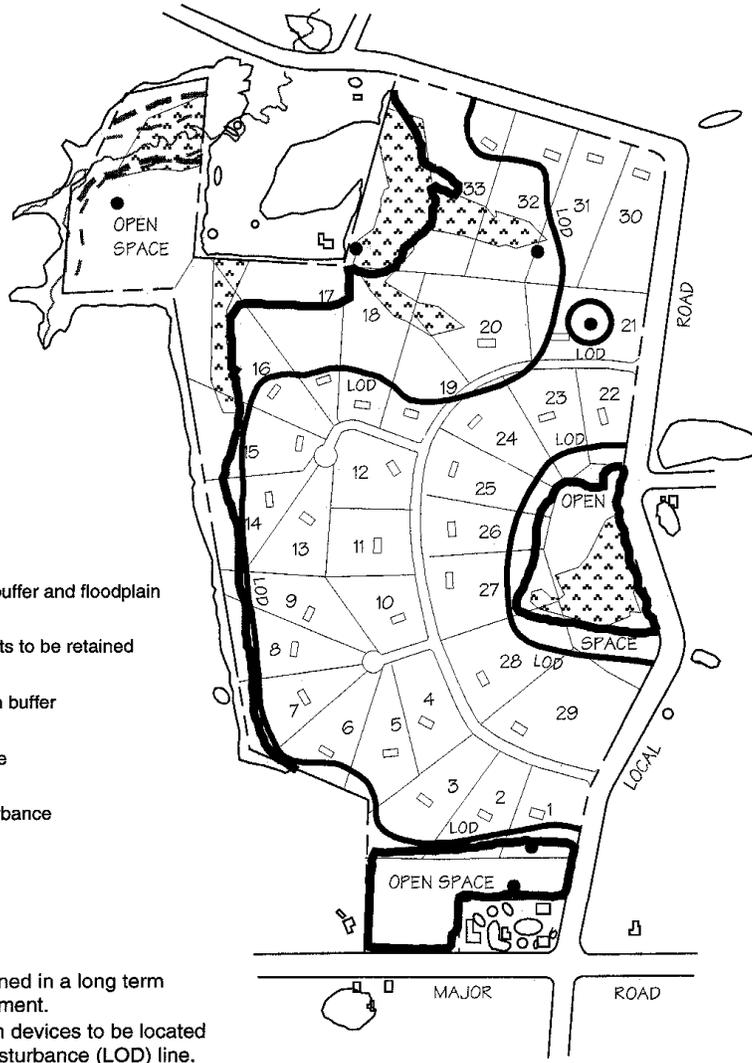
Source: UMCP

Simplified FSD Map

Figure 2:3



North



Legend

-  Stream with buffer and floodplain
-  Existing forests to be retained
-  Wetlands with buffer
-  Specimen tree
-  Limit of Disturbance

Notes

1. All forest is retained in a long term protection instrument.
2. Forest protection devices to be located along Limit of Disturbance (LOD) line.

Source: UMCP

Simplified FSD Plan

Figure 2:4

2.2.2 Full FSD Requirements

Full FSD requirements are summarized in the checklist in **Figure 2:5**. The following is a suggested step-by-step procedure for preparing a Full FSD. It corresponds with the flow chart in **Figure 2:6** which outlines the process and the maps for the sample site in **Figure 2:10 and A:6-- A:8**.

Step 1. Prepare Preliminary Map for Field Verification

It is helpful to prepare a preliminary Forest Stand Map or Natural Resources Inventory map before doing any field verification or sampling. These maps use site characteristics such as soils and hydrology to make a preliminary determination of the location of forest stands on the site. This step is suggested for organizing data which may be useful in the later development of a Forest Conservation Plan, as well as fulfilling the requirements of a Forest Stand Delineation. The site features are important in deciding which areas shall be retained and which unforested areas may be targeted for afforestation or reforestation if planting is required.

a. Create base map

Using recent aerial photography, soils surveys, topographic maps, nontidal wetlands maps, and information from a preliminary field visit, the preparer may locate on a preliminary Forest Stand Map many abiotic, and some large scale biotic, site characteristics (**Figure A:6**). Environmental features will include:

- topographic contours or spot elevations
- ephemeral, perennial and intermittent streams and their buffers
- 100-year floodplains
- steep slopes
- wetlands
- adjacent land uses, cultural features such as roads, structures, and disposal areas, property boundaries, and other features which will be required for the Final Forest Stand Map may be drawn in, especially if they will require field verification
- any other important information the preparer feels may be helpful to evaluate the site

Information should also be obtained about the likelihood of trees, shrubs, or plants which are on federal or State lists of rare, threatened or endangered species, and critical habitats. This may be obtained from map information available through the Maryland Department of Natural Resources, Natural Heritage Program. .

b. Add soils

Soils are added to the base map using the USDA Soil Survey (**Figure A:7**). These soils may be further delineated, interpreted, or classified as:

- hydric
- soils containing hydric inclusions, or poorly drained soils
- erodible soils
- well-drained
- other classifications useful in determining location of forest stands, or in later determination of locations for reforestation or afforestation

Another useful source of information is the Natural Soil Groups Technical Report (Maryland Department of State Planning, 1973). This may help to correlate USDA soils map units with soil characteristics.

SUBMITTAL REQUIREMENTS

1. Site Vicinity Map

- location of the project site and surrounding area within one square mile
- major roads
- political boundaries
- north arrow
- adjacent land uses
- forested areas
- minimum scale of 1"=2000' (1:24,000) double check this

2. Natural Resources Inventory:

- property boundaries (tax maps, plats, or surveyed boundaries)
- north arrow
- title, date, revisions, scale, and legend
- certification by Qualified Professional or stamp of a Maryland licensed L.A. or Forester
- topographic contours and interval (USGS 7 ½ minute quad or spot elevations)
- steep slopes greater than FIFTEEN % (on areas greater than or equal to 10,000 square feet)
- 100-year nontidal floodplain (watersheds of 400 acres or larger or Class III streams)
- Ephemeral, intermittent and perennial streams (USGS 7 ½ minute quads of SCS Soil Surveys)
- stream buffers (50-foot width)
- soil classifications (SCS Soil Surveys) indicating soils with structural limitations, hydric properties, or K value greater than 0.35 on slopes greater than or equal to 15%.
- nontidal or tidal wetlands and buffers (National Wetlands Inventory or Maryland Department of the Environment)
- Critical Habitat Areas
- forested areas and unforested areas including tree lines extending offsite
- priority afforestation area
- priority retention areas
- field sampling locations
- location, description, and size of forest stands
- location of trees or stands which have trees that are:
 - rare, threatened, and endangered species of plants (MD Natural Heritage Program)
 - part of an historic site or associated with an historic structure
 - designated by MD DNR or local authority as a champion tree for that species
 - significant trees of 24" dbh or greater
 - trees with at least 75% of the diameter of the State champion tree of that species

3. Forest Stand Analysis

- site description
- methodology
- summary for each stand describing stand composition, stand structure, stand condition, retention potential relating to proposed development, existing or proposed management recommendations, stand function (water quality benefits, specific wildlife habitat value, and other land use objectives, including recreation, timber management, etc.)
- recommendations for specific areas such as specimen trees
- field sampling data sheets, if required, including property name, name of person collecting data, date of data collection, and complete data for each sample plot
- forest stand summary sheets including property name, location, name of person preparing summary, date of preparation, and summary for each forest stand

4. Application

- complete information including signature

Full FSD Checklist

**Figure
2:5**

Step 1

Data Collection:
Preliminary Forest Stand Map
and Natural Resources Inventory
Map



Step 2

Field Survey



Step 3

Final Forest Stand Map and
Natural Resources Inventory
Map
Analyze Forest Stand Attributes



Step 4

Combine Finalized Maps into
One Forest Stand Delineation
Map

c. Add forest boundaries

Using either satellite-derived maps or aerial photography, add the outlines of existing forest on the site and adjacent to the site. Depending on the source map scale and resolution, distinctions may be made between different stands using criteria such as evergreen or deciduous, past management practices, or relative canopy height and cover.

d. Start preliminary delineation

Begin the preliminary delineation of forest stands by determining possible stand boundaries using the forest cover information from (c) above and the various abiotic factors noted in (a) and (b). Sketch the stand boundaries on the preliminary forest stand map.

Forest stands are relatively homogenous areas of forest usually one acre or larger. They occur because of similar growth conditions e.g. soil nutrients; soil drainage patterns, aspect, and similar management or past conditions; selective thinning in recent years; abandonment of agricultural lands; and other causes.

Step 2. Assess Forest Stands and Environmental Features

This step describes the forest stands and verifies the environmental features on the site.

a. Determine methodology

On the basis of an initial survey, but before beginning sampling, determine how to adequately describe each stand. This may be done by sample plots or by nonplot methods. Appendix E contains references on different methods.

This example (**Figure A:8**) shows a plot sampling method using randomly located 1/10 acre plots. Because statistical precision requires a certain minimum number of plots per stand and forested area, the following sampling criteria should be used to estimate the number of sample plots required:

- one plot per 4 acre of forest stand area;
- two plots minimum per stand; and,
- three plots minimum for the total forested area of the site.

This will produce a description of each stand that should satisfy the minimum 67% confidence level. Using these guidelines, there will always be at least three sample plots for the entire forested area on the site and at least two sample plots for each stand. If there is only one stand on the site and it is less than four acres, it will still require three sample plots.

b. Measure preliminary stand size

Using a planimeter, dot grid, or other means, estimate the size of each stand and the number of plots required. In the example, plots are located on the Forest Stand Map (**Figure A:8**).

c. Collect field data

Locate plot centers and flag or stake locations. Locations of plots may be verified by reviewers prior to FSD approvals. Record desired data with plot and stand identification.

Throughout the sampling process, examine the surrounding forest to note any additional features which should be shown on the final map. Areas which contain historic, Champion, or trees greater than twenty four inch DBH should be noted or flagged. Nontidal wetlands which have not been delineated or for which a jurisdictional determination is required should also be assessed at this time.

The example uses the Forest Sampling Data Worksheet (**Figure 2:7**) to record data on basal area, density of trees by size class, percent of canopy closure, percent of invasive cover, understory, herbaceous species, and other information. Further information on how to obtain this

data and how it is described is available in Appendix E.

Step 3. Analyze the Field Data and Summarize in a Written Narrative.

The objective of this step is to evaluate each individual forest stand for potential retention. This evaluation will be used when preparing a Forest Conservation Plan and will be useful to subsequent designers and engineers planning the site.

a. Summarize stand characteristics

The first step is to create a stand summary description using the Forest Stand Summary Sheet (**Figure 2:8**). For each forest stand, a list of pertinent characteristics is compiled and described using the plot data collected. An average of numeric measures is used for the stand summary, such as for basal area. Guidelines for completing these data and summary sheets may be found in Appendix C.

- Stand composition. This is derived from species specific data, such as density, diversity and basal area; and species composition, dominant species, size classes, common understory species, successional stage, and other factors which may be appropriate.
- Stand structure. Density, basal area, cover percentages, and species composition in canopy and understory levels may be contrasted to cover percentages and species composition in 0-3' and 3'-20' understory layers, as appropriate.
- Stand condition. Regeneration potential and potential to recover from natural and development disturbances and other factors, as appropriate. Measures which may be used are basal area, canopy and understory cover, understory tree species, and presence/absence of insects, fungi, and disease. Past and present management and the effects of invasive exotic plant species, if present, should also be included.
- Stand function. Such measures as presence or absence of standing dead trees, duff or litter layer, structural measures, species composition, and others should be used to provide a description of functional value. Three functions should be addressed: Water Quality Protection; Wildlife Habitat; and, at least one other objective such as timber management, aesthetics, and recreation.

b. Compare forest stands

Forest stands are compared and contrasted for ranking by priority for retention.

1. Stands which contain Priority Retention Areas are ranked as Priority 1 Stands.
2. Stands which contain priority areas identified by a local land use plan, local forest conservation program, or other criteria adopted by a local forest conservation program are ranked as Priority 2 Stands.
3. All other stands are ranked as Priority 3. Each Priority 3 stand will be compared and ranked in order of its functional value relating to water quality protection, wildlife habitat, and at least one other objective such as timber management, aesthetics, or recreation.

Property: _____ Prepared By _____																		
Stand #: <u>F-1</u> Plot #: <u>3</u> Plot Size: <u>1/10 - acre</u> Date: _____																		
Basal Area in sf/acre: 180	Size class of trees > 20' height within sample plot																	
Tree Species	# of Trees 2-5.9" dbh			# of Trees 6-11.9" dbh			# of Trees 12-19.9" dbh			# of Trees 20-29.9" dbh			# of Trees > 30" dbh			Total		
	Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD		Other	
Chestnut Oak			2	4	4	2	2	1									15	
Striped Maple			5		2	2											7	
Scarlet Oak		2	8		2	4		1									17	
Black Oak						2		1									5	
Black Cherry						1											1	
Total Number of Trees per Size Class	7			23			5									45		
Number & Size of Standing Dead Trees				8" 9"												2		
List of Common Understory Species 3'-20': Black Cherry Black Gum							% of Canopy Closure						Percent of Invasive Cover per Plot (All Layers): 0			Plot Successional Stage: Mature Upland		
							C	N	E	S	W	Total						
							Y	Y	Y	Y	Y	100%						
List of Herbaceous Species 0'-3': Lycopodium Early Low Blueberry Poison Ivy							% Understory Cover 3'-20'											
							C	N	E	S	W	Total						
							N	N	N	N	N	0						
							% of Herbaceous Cover 0'-3'											
							C	N	E	S	W	Total						
							N	N	Y	Y	N	40%						
Comments																		
Sheet <u>1</u> of <u>14</u>																		
Forest Sampling Data Worksheet													Figure 2:7					

Property Name: _____

Location: _____
(Town, County, ADC Map#, and Grid Coordinates)

Prepared By: _____ Date: _____

Stand Variable	Stand # F-1/8.5 acres	Stand# F-7/0.7 acres
1. Dominant species/Codominant species*	Chestnut Oak Scarlet/Black Oak	Red Maple Black Cherry
2. Successional stage	Mature Upland	Immature Bottomland
3. Basal area in s.f. per acre	160	120
4. Size class of height dominant species	12" – 19": dbh	2" – 5.9": dbh
5. Percent of canopy closure	87%	60%
6. Number of trees per acre	8	5
7. Common shrubs per acre	Striped Maple Black Cherry Black Gum Sassafras	Multiflora Rose Black Cherry Red Maple
8. Percent of understory cover 3' to 20' tall	60%	60%
9. Number of woody plant species 3' to 20' tall	8	7
10. Common herbaceous species 0' to 3' tall	Lycopodium Early Low Blueberry Poison Ivy Spotted Touch-Me-Not	Japanese Honeysuckle Sedge species Goldenrod species
11. Percent of herbaceous & woody plant cover 0' to 3' tall	60%	80%
12. List of major invasive plant species & percent of cover	0 – None U – Multiflora Rose 15% H – Jap. Honeysuckle 40%	0 – Norway Maple 13% U – Multiflora Rose 60% H – Jap. Honeysuckle 60%
13. Number of standing dead trees 6" dbh or greater	10	2
14. Comments Sheet _____ of _____	Good general condition	Thin forest stand with Multiflora Rose and Japanese Honeysuckle
Forest Stand Summary Worksheet		Figure 2:8

c. Written Narrative

The analytical narrative should begin with a brief introduction describing overall site conditions including the sampling method used, forest association or species composition and condition, any past or present management, presence or absence of rare, threatened, and endangered species, historic sites, critical habitats, disease, insects, or exotic plant invasion on the site.

Following this description, the stand composition, structure, condition, and function of each individual stand should be described. A suggested approach is:

- **Stand composition**

Are there species and individuals present which will not withstand development stresses? What management methods should be considered to mitigate such stresses? How will species composition be altered by disturbances within the stand? How will the presence of invasive species within the stand affect potential reforestation or afforestation areas? How may these species or their effects be controlled if appropriate?

Individual specimen trees located outside of forested areas are also discussed in the Forest Stand Summary Analysis. Their location, condition, recommendations, and justification for retention or removal are noted.

Measures include: dominant and codominant species, common understory and herbaceous species, specimen trees.

- **Stand structure**

Is the current structure likely to be impacted by disturbance or stress? How may this affect certain habitat types and stand functions?

Measures include: basal area, density, canopy closure, presence or absence of multiple layers.

- **Stand condition**

Is the stand healthy and regenerating? What are the observed disease or pest infestation problems which may be exacerbated by development stress or disturbance?

Measures include: density and basal area, understory species, successional stage.

- **Stand function** (Different measures from which functional values may be deduced appear in **Figure 2:9**).

#1 Maintaining or enhancing existing water quality protection benefits.

Where is the stand in relation to sensitive areas located on the site? Does it serve a buffering function to surface runoff or groundwater flow between, for example, a stream and an agricultural area or proposed developed area? How is the stand configured to serve this function? How is the stand accomplishing these benefits? Does the present soil or litter appear to be eroded or increasing in organic matter? Does a complex stand structure mitigate soil erosion and sediment losses? Does the successional status of the stand affect nutrient uptake or loss?

#2 Maintaining or enhancing existing habitats.

What wildlife species are currently using this stand as habitat? Where are these habitats located? What is the size and configuration of these habitats? Where is the stand in relation to other commonly used habitats? Is the stand a corridor or a patch? How is the stand currently functioning i.e. will a small increase in size or infill afforestation be beneficial to this habitat?

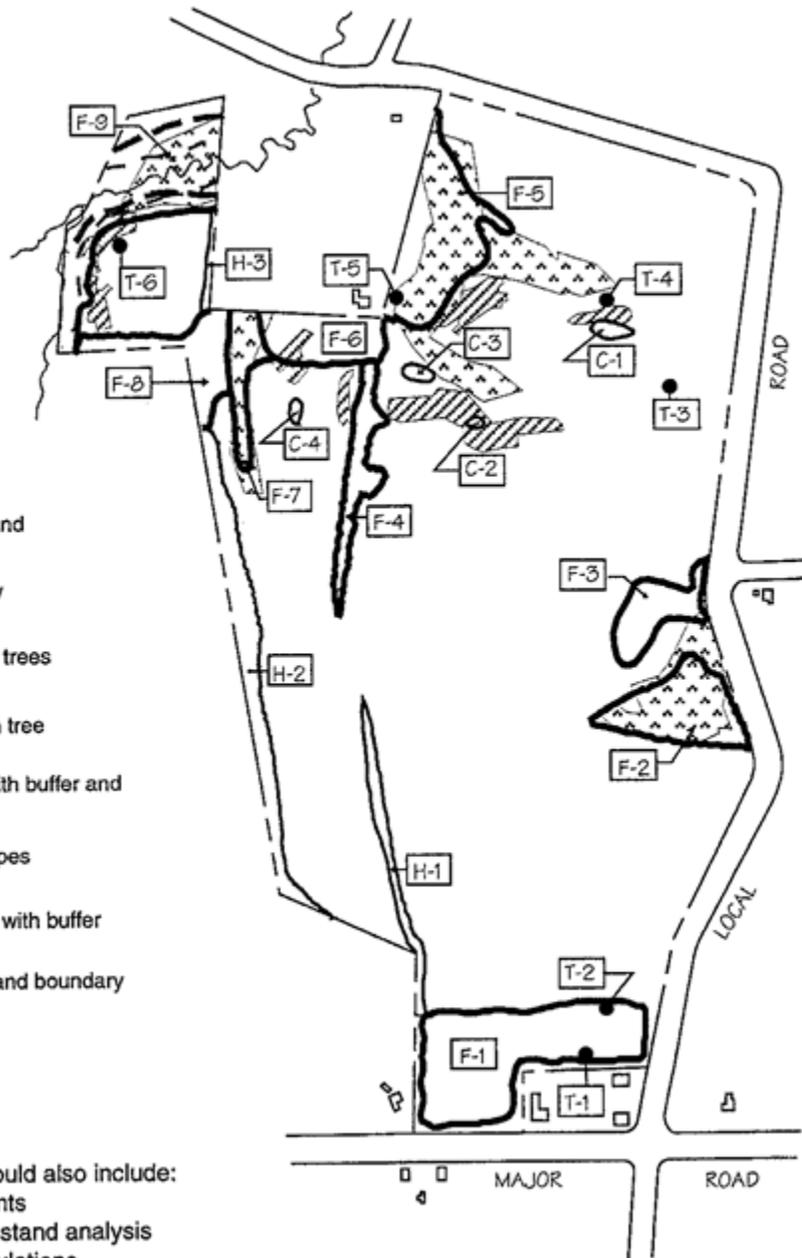
#3 Accomplishing landowner or other special local program objectives. Sample objectives may include: timber management, recreation, education, research, visual screening, etc.

Step 4. Create Final FSD Map

All preliminary field maps are compiled into one final map for submittal (**Figure 2:10**). If too much information is to be shown on one map, use a second map of the same scale.

The FSD map may include certain elements of the narrative to correlate stand descriptions and stand priority for retention with the location of each stand and the environmental features. Priority locations for reforestation or afforestation should also be noted (Section 3.1).

<p>Water Quality</p> <ul style="list-style-type: none"> • Roughness is a factor used in calculating probability and amounts of surface runoff. This is equivalent to the amount and type of vegetation present on a site. Forest vegetation is considered more “rough” than grassland. • Water absorption potential of soils and vegetation • Water retention of vegetation, soils and topography • Nutrient removal from surface and subsurface flows <p>Wildlife Habitat</p> <ul style="list-style-type: none"> • Available food - often species specific, e.g. gray squirrel consumes hard mast (nuts) • Available cover - provides shelter from predators or environment (shade, warmth, special needs during breeding) • Available water - often obtained from surface water. • Available space is needed, especially for predator range, but also to sustain breeding populations. Usually species specific and may want to use largest predator rule if possible to cover maximum extent possible. <p>Landscape Uses</p> <ul style="list-style-type: none"> • Shelter from environmental conditions such as wind or noise • Absorption of particulates and pollutants • Visual buffer or screen 	<p>Measures</p> <p>Y Canopy cover, understory and herbaceous cover type and amount</p> <p>– Presence of woody plants and perennial grasses, or species composition with deep or tough roots. Annual plants generally are not well rooted and therefore do not provide good soils retention.</p> <p>Y Canopy, understory and herbaceous cover</p> <p>Y Structural diversity (Many layers absorb falling water drops and slow their velocity)</p> <p>Y Organic matter accumulation on top of and in first soil layers.</p> <p>Y Presence of wetlands, swales, ravines - Density and structural diversity of vegetation of areas will enhance water retention.</p> <p>Y Drainage classification of subsoil - Poorly drained soils have different chemical properties than well drained soils</p> <p>Y Width and connectivity of forest buffers adjacent to streams and other water bodies</p> <p>Measures</p> <p>Y Species composition which provides: forage, browse, mast, fruits, grasses, etc.</p> <p>Y Structure, density, presence or number of snags (standing dead trees), species composition.</p> <p>Y Presence of streams, riparian buffer zones and wetlands (consider adaptation of constructed retention/detention systems)</p> <p>Y Contiguous corridors, large patches, landscape scale matrix of forested and related habitat.</p> <p>Y Lack of fragmentation,</p> <p>Y Presence/absence of linear corridors or barriers</p> <p>Measures</p> <p>Y Location, species composition, structure</p> <p>Y Location, species composition</p> <p>Y Location, species composition, deciduous vs. coniferous</p>
<p>Assessing the Priority 3 Stands</p>	<p>Figure 2:9</p>



Legend

- F-1 Forest stand
- H-1 Hedgerow
- C-1 Cluster of trees
- T-1 Specimen tree
- Stream with buffer and floodplain
- Steep slopes
- Wetlands with buffer
- Forest stand boundary

Notes

- Full FSD map should also include:
1. Sampling points
 2. Reference to stand analysis
 3. Acreage calculations

Source: UMCP

Full FSD Map

Figure
2:10

Chapter 3

Forest Conservation Plans

Contents:

- 3.0 Introduction
 - 3.0.1 Minimum Elements Required in All Forest Conservation Plans
 - 3.0.2 Who May Prepare a Forest Conservation Plan?
- 3.1 Determining Priority Forests and Priority Areas
 - 3.1.1 Forest Conservation Plan Requirements
 - 3.1.2 Sample Procedure for Locating Forest Retention Areas
 - 3.1.3 Calculation of Retention, Reforestation, and Afforestation
- 3.2 Forest and Tree Protection
 - 3.2.1 Planning, Design, and Protection
 - 3.2.2 Construction Techniques
 - 3.2.3 Long-Term Protection Instruments
- 3.3 New Forest and Tree Planting
 - 3.3.1 When and Where It Is Necessary
 - 3.3.2 Planting Plan Requirements
- 3.4 Maintenance and Monitoring
 - 3.4.1 Elements Required in Maintenance Agreements
 - 3.4.2 Suggested Implementation Guidelines
 - 3.4.3 Special Planting Site Suggestions
 - 3.4.4 Reinforcement Planting Provisions
- 3.5 Enforcement of Forest Conservation Plans
 - 3.5.1 Inspections
 - 3.5.2 Penalties for Violation
 - 3.5.3 Appeal of Enforcement Action
 - 3.5.4 Amending a Forest Conservation Plan

3.0 Introduction

The Forest Conservation Plan (FCP) is a planning and construction document that provides specific plans for retaining and protecting existing forested areas, particularly in priority areas, during subdivision or construction. The FCP also includes details for replanting selected areas when necessary. No changes may be made to an approved FCP without the approval of the reviewing authority.

This chapter provides the requirements and suggests a process for developing a plan that meets the intent of the Forest Conservation Act and is divided into five principal topics:

- **Determining Priority Forests and Priority Areas** – Section 3.1 discusses how to determine where priority areas are located and how much forest to retain.
- **Retained Forest and Tree Protection** -- Section 3.2 covers protection through planning and design, construction techniques, and long-term protection agreements.
- **Forest and Tree Planting** -- Section 3.3 covers afforestation and reforestation plans, information on when and where planting is required, and how planting should occur.

- **Maintenance and Monitoring** – Section 3.4 discusses maintenance agreements and their implementation.
- **Enforcement** -- Section 3.5 outlines Forest Conservation Plan enforcement.

3.0.1 Minimum Elements Required in All FCP's

Figure 3:1 summarizes requirements for phased submissions of preliminary and final FCP's. All FCP's submitted for approval shall contain the following minimum elements:

- **Application** form signed by the applicant.
- **Approved** Forest Stand Delineation.
- **Forest conservation map.** This map is drawn at the same scale as the grading or subdivision plan submitted for approval. It locates and describes forest retention, reforestation, or afforestation areas either on or off the site. It shall show the limits of disturbance and the location of protection devices for forest retention areas. Further information about locating retention and planting areas follows in Section 3.1. Section 3.2 contains information about protection during construction.
- **Forest retention, reforestation or afforestation calculations.** These may be submitted in the form of the suggested worksheet in Appendix C. Further information may be found in Section 3.1.
- The **means for long-term protection** of forest retention areas and planting areas. Further information about long-term protection agreements is in Section 3.2.

3.0.2 Who May Prepare a Forest Conservation Plan?

A FCP must be prepared by a Maryland Licensed Forester, Maryland Licensed Landscape Architect, or other Qualified Professional. A stamp or certification by the preparer shall appear on the submission.

Qualified Professionals are approved by the Department of Natural Resources-Forest Service as set forth in criteria adopted in COMAR 08.19.06. Lists of DNR Qualified Professionals, applications, and criteria are available upon request from the DNR - Forest Service.

FCP's and other construction and subdivision documents use engineering, surveying, land planning, landscape architecture, biology, forestry, soil sciences, and legal skills. FCP's should be developed and implemented in conjunction with an interdisciplinary design and construction team to maximize effective and efficient resource protection and site development.

Submission of Forest Conservation Plan Elements	Forest Stand Delineation		Forest Conservation Plan		Record Plat	Amended FCP/ Enforcement
	Simp	Full	Prelim	Final		
Application	*	*	*			
Table Showing: Parcel size and ID	*	*	*	*	*	*
Total tract area			*	*		*
Net tract area			*	*		*
Total existing forest area	*	*	*	*		*
Land use category, threshold % and area			*	*		*
Area of proposed clearing			*	*		*
Area of retention			*	*	*	*
Area for planting			*	*	*	*
Stand Summary Analysis		*				
Map	*	*	*	*		
Vicinity Map	*	*	*	*		
Environmental Features Map	*	*	*	*		
Location/description of existing forest area	*	*	*	*		*
Stamp/Certification by preparer	*	*	*	*		*
Priority Areas		*	*	*		
Priority retention areas		*	*	*		
Priority planting areas		*	*	*		
Limits of Disturbance/Building Restriction Lines	*		*	*		*
SRA, utility easements, stormwater mgmt			*	*		
Stockpile areas				*		
Forest Retention Areas			*	*		
Forest Protection Devices/amended Sediment/erosion control plan			*	*		
Location			*	*		
Specifications/Details			*	*		
If 0-30% of CRZ is disturbed, forest and tree protection measures and/or practices			*	*		
Construction Sequence			*	*		
Demonstration that priority areas cannot be retained, if applicable			*	*		
Location/Protection	*		*	*		
Submission of FCP Elements						Figure 3:1

Submission of Forest Conservation Plan Elements (continued)	Forest Stand Delineation		Forest Conservation Plan		Record Plat	Amended FCP/ Enforcement
	Simp	Full	Prelim	Final		
Map (continued) Planted areas Offsite planting requires			*	*		
Site/Vicinity Map			*	*		
Legal right to plant/maintain			*	*		
Planting Plan Specifications, site prep, planting Schedule w/species, stocking (number, spacing or distribution) size, condition, plant source			*	*		*
Construction/planting sequences			*	*		*
Management and Monitoring			*	*		
Protection			*	*		*
Reinforcement planting			*	*		*
Binding agreement				*		
Financial security				*		
Location/Protection			*	*		*
Long-Term Protection Agreement between parties			*	●	*	
Description of allowed activities			*	*		
Specifications/Details for protection (signs)			*	*		
Location of Retention and Planting Areas			*	●	*	
Survey description/metes and bounds					*	
Recorded/tracked Cross-reference approved FCP				●	*	
Areas not subject to FCP must contain restrictive note for later applications				●	*	
Mitigating Measures/Enforcement Added Forest and Tree Protection Measures						*
Added Planting						*
Submission of FCP Elements						Figure 3:1

3.1 Determining Priority Forests and Priority Areas

This section provides a framework for retaining priority forests and priority retention areas located on a development site using the Forest Stand Delineation and the requirements established below. This section also contains a suggested procedure and examples designed to assist site planning for these areas. Information about calculating the required size of retention areas is also contained in this section.

3.1.1 Forest Conservation Plan Requirements

In order to rank and compare forest stands for potential priority for retention, one must determine if priority areas exist on the proposed development site and where they are located. Forest Retention Areas may be entire forest stands which are identified as priority forests in the Forest Stand Delineation or portions of stands. The overall process for forest retention is shown in **Figure 3:2**. The following describes how to identify Priority Areas for forest retention:

1. Identify forest stands in the priority areas referenced in 21.71 of the City of Annapolis Code such as sensitive areas...

... in 100-year floodplains which are in a watershed of 400 acres or more, or which include Class III waters.

... in intermittent and perennial streams and their buffers. Stream buffers are measured from the top of the normal bank and are at least 50 feet wide on each side. Streams include coastal bays (not subject to Chesapeake Bay Critical Area Criteria)

... trees, shrubs, and plants on steep slopes.

... trees, shrubs, and plants located in critical habitats.

... in contiguous forest that connects the largest undeveloped or most vegetated tracts of land within and adjacent to the site. Contiguous forest is either 100 acres or larger, or is 300 feet or more in width and connects to forest area located offsite that is 100 acres or more.

... trees, shrubs, and plants listed on the State (DNR) or Federal (U. S. Fish and Wildlife) lists of rare, threatened or endangered species.

... trees associated with an historic site or structure, Champion Trees, trees with a diameter which is 75% of the State Champion of that species, or 24" or larger. When such trees are found in a stand that is located in a Retention Area, the precise location of each tree is not needed.

Nontidal wetlands are priority areas for retention and planting. If forested nontidal wetlands have been identified through delineation or jurisdictional determination, they are credited in the forest retention area if they are not disturbed. Any forested nontidal wetland permitted to be cut or cleared and required to be mitigated under the regulations shall be located on the FCP map and subtracted on an acre-for-acre basis from the total amount of forest to be cleared for the purpose of calculating reforestation. In other words, subtract the area of disturbance regulated under wetlands regulations from the area of disturbance regulated under the Forest Conservation Act before computing the Act's reforestation requirements.

2. Locate the critical root zone of any individual trees or clusters of trees, shrubs or plants not located in a mapped forest stand but identified as having priority for retention. Critical Root Zones are described in Section 3.2. No more than 30% of the critical root zone may be disturbed during construction. Stress reduction, extended maintenance, or other measures may be required (Section 3.4).

3. If the areas located in (1) through (2) above are within the proposed limits of disturbance, the applicant must demonstrate that:

- a. All techniques for retention of these areas have been exhausted;

- b. Why these areas cannot be left undisturbed; and,
- c. How reforestation will be accomplished, and, where on the site in priority areas, afforestation or reforestation will be located, if required (see Section 3.1.3 for explanation of afforestation and reforestation threshold requirements).

This demonstration shall contain:

A statement addressing these questions signed by the applicant and appended to or on the FCP map, and

Certification by the preparer of the FCP

If contiguous forest will be disturbed, the applicant must identify the retention priority of its composite stands according to water quality, wildlife habitat benefits (Section 2.2), and landowner objectives.

Disturbance of priority areas for a driveway access to Lot 19 on the example site plan in **Figure A:9** requires such a demonstration.

- 4. If the requirements of (1) through (3) are satisfied and additional retention area is required (Section 3.3), additional Retention Areas may be located by the applicant according to an evaluation of forest stands for water quality, wildlife habitat, or other objectives, as determined in the recommendations in the approved Forest Stand Delineation. They will be identified on the FCP map with the appropriate objective.

If the FSD recommendations include preserving trees which are not priority for retention as identified in the City Code (21.71), these trees may be designated for protection. But, these non-priority trees or clusters of trees may be preserved only if all priority areas are protected in Retention Areas, a minimum 10,000 square foot protection zone is specified, and all critical root zone area is included in the protection area.

Retained trees, shrubs or plants may be incorporated into afforestation and reforestation plans (illustrated in **Figure A:10** and discussed in Section 3.2)

3.1.2 Sample Procedure for Locating Forest Retention Areas

The overall process for forest retention is shown in **Figure 3:2**. The following is a suggested procedure for locating forest retention areas and corresponds to the maps shown in **Figures A:11 through A:14**.

For the example site, the step-by-step process begins by locating priority areas and forest stands followed by locating and identifying significant trees. It continues in Section 3.2 with guidance for delineating the exact line of disturbance with a tree by tree evaluation before construction or final FCP approval.

Step 1 Determine Preliminary Retention Requirements

This may be determined by an initial analysis or preliminary worksheet calculations for a Forest Stand Delineation. Section 3.1.3 contains details about the retention area thresholds and calculations-

Step 2 Locate and Protect Priority Areas Identified from the FSD.

These areas must appear on the FCP with site improvements; therefore, a current site plan or subdivision plan will be required for this step. If no site plan has been prepared, ensure that site planning objectives include protection of these priority areas.

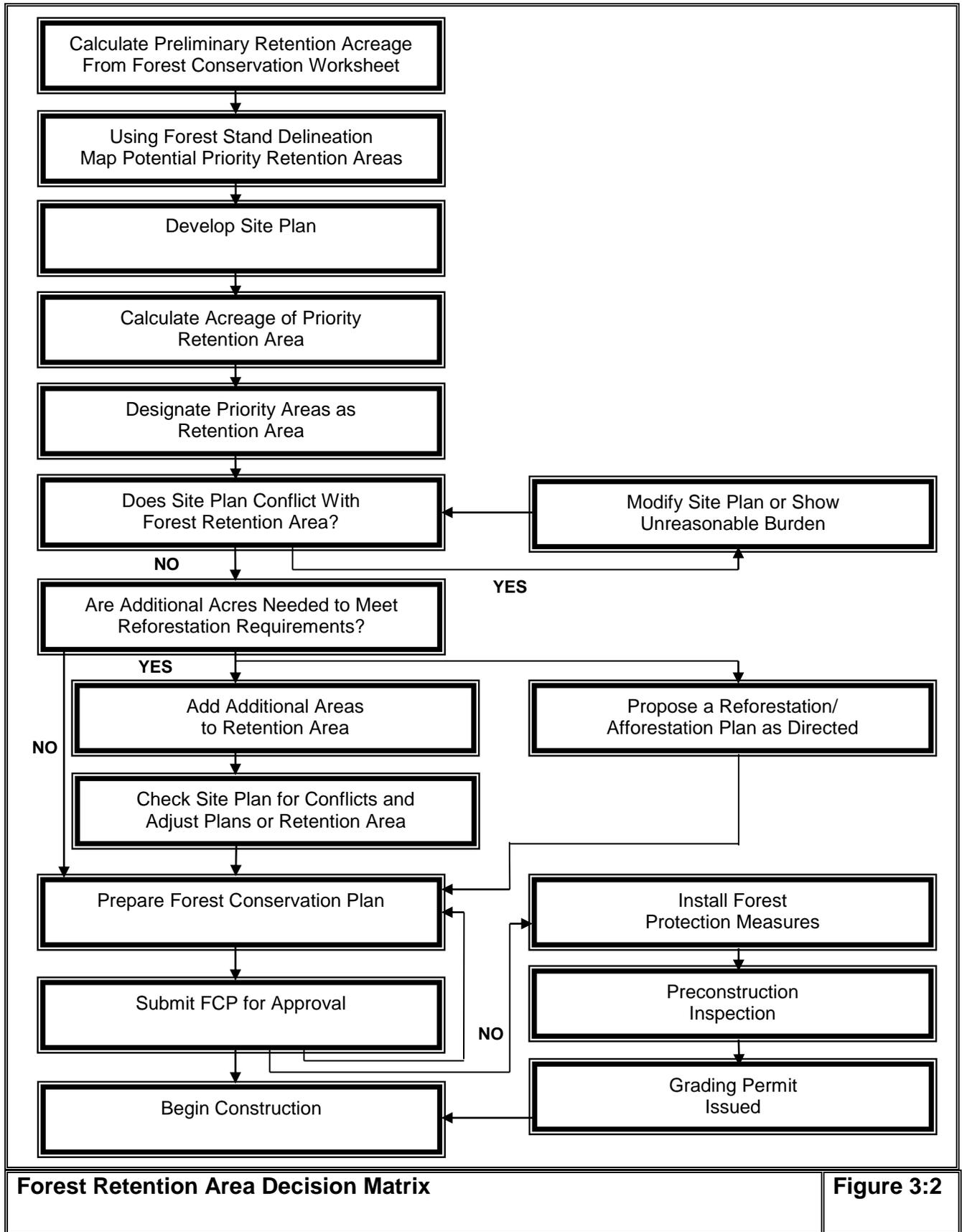
If a site or subdivision plan has already been prepared prior to preliminary approvals, ensure that no conflicts exist between protecting priority areas and other site objectives such as public safety, active open space recreation, stormwater management, adequate parking areas, or utility access. If conflicts

exist, investigate alternative designs. Information about uses for Forest Retention Areas is found in Section 3.2. If alternative designs are not feasible to protect priority areas, investigate alternative means to protect or mitigate priority areas from disturbance.

Once all priority areas have been designated for protection or adequate demonstration is made concerning disturbance of these areas, identify means to protect or, if necessary, improve additional forest areas to meet planning objectives.

Step 3 Prepare FCP Map

Locate all protected priority areas and additional protected forest retention areas or significant trees on the FCP Map.



3.1.3 Calculation of Retention, Reforestation, and Afforestation

The Forest Conservation Act provides guidelines for the amount of retention, reforestation, or afforestation appropriate to protect priority forests and priority areas, as well as additional forested areas on development sites. The amount of forest which is retained or planted will be determined by the land use category of the development site, its size, and the total amount of forested area located on the site. In addition, the area of the site may be reduced by that area where forest clearing is restricted by another local ordinance or program.

As well as determining the amount of retention or planting, the standards include built-in incentives for retention. The forest conservation thresholds are not established minimum limits for forest retention, but are instead points at which the penalty for clearing increases two-fold.

The objective of the FCP in site planning is to maintain or increase forest cover, while protecting all priority forests and sensitive resource areas on the development site.

Information required to calculate the retention, reforestation or afforestation for a site includes:

- **Total Tract Area.** This is the total area of the property subject to the application for subdivision, grading or sediment and erosion control approval. This may not necessarily include the entire parcel of record when the remainder is not the subject of the application and when, at least, a simplified Forest Stand Delineation has been approved for the entire parcel.

This area may also be defined as the area of a master plan, planned unit development, or phased development plan subject to an application for grading or sediment and erosion control plan approval.

- **Area of Land Use Change.** Applicable only on land zoned agricultural, this is the portion of the tract for which land use will be changed or will no longer be used for primarily agricultural activities and where at least a simplified forest stand delineation is approved for the entire parcel of record. If this area will be deducted, the final FCP approval shall require a note restricting this area from changes in land use, development or redevelopment, unless a FCP is submitted.
- **Land Use Category (Figure 3:3).**
- **Conservation and Afforestation Threshold Percentage (Figure 3:3).**
- **Existing Forest Cover.** This is measured to the nearest 1/10 acre and determined from the current approved Forest Stand Delineation (Section 2.2).

Afforestation and reforestation requirements are discussed starting in Section 3.3.

The Forest Conservation Worksheet (Appendix C) may be completed and appended to the plan. Computer software is available and may be operated from many standard spreadsheet programs.

Size of Retention Area

Forest Retention Areas shall contain a minimum of 10,000 square feet (.23 acres) of continuous forest cover. This 10,000 square foot minimum area may include critical root zones.

Alternatively, where there are trees which are identified as priority for retention, the retention area shall contain the critical root zone of the individual tree or trees, but the 10,000 square foot minimum is not a requirement.

Requirements for FCP's

Each FCP map shall contain a table showing the elements and amounts to the nearest 1/10 acre required for the retention, reforestation, or afforestation calculations. These include (although some may not be applicable to the development proposal):

- Total parcel area
- Total Tract Area
- Area in 100-year nontidal floodplain
- Net Tract Area
- Land Use Category, pertinent threshold percent and area
- Total area of existing forest cover
- Total area of proposed forest clearing
- Total area of reforestation
- Total area of afforestation
- Total area in retention areas

Nontidal wetlands are priority areas for retention. If forested nontidal wetland have been identified through delineation or jurisdictional determination, they are credited in the forest retention area if they are not disturbed. Any forested nontidal wetland permitted to be cut or cleared and required to be mitigated under regulations shall be located on the FCP map and subtracted on an acre-for-acre basis from the total amount of forest to be cleared for the purpose of calculating reforestation.

During final site planning, the forest retention area proposed in an earlier preliminary FCP may require adjustment subject to final grading or sediment and erosion control plans. In addition, field determination of the retention area boundaries will require inclusion or exclusion of specific trees along the boundary if critical root zones are affected. The result will be a staked limit of disturbance. This construction phase of the FCP is discussed with Critical Root Zones in Section 3.2.1.

All Retention Areas shall be protected by a long-term protection agreement (Section 3.2).

Land Use Type	Conservation Threshold	Afforestation Threshold
Agricultural and Resources Areas	50%	20%
Medium Density Residential Areas	25%	20%
Institutional Development Areas	20%	20%
High Density Residential Areas	20%	20%
Mixed Use and Planned Unit Development Areas	20%	20%
Commercial and Industrial Use Areas	20%	20%

Agricultural and Resource Areas – undeveloped areas zoned for densities of less than or equal to one dwelling unit per five acres.

Medium Density Residential Areas – areas zoned for densities greater than one dwelling unit per five acres and less than or equal to one dwelling per acre, including both existing and planned development and their associated infrastructure, such as roads, utilities, and water and sewer service.

Institutional Development Areas – areas zoned to allow the inclusion of schools, colleges and universities, military installations, transportation facilities, utility and sewer projects, government offices and facilities, golf courses, recreation areas, parks, and cemeteries as is applied in the Annapolis City Code.

High Density Residential Areas – areas zoned for densities greater than one dwelling unit per acre, including both existing and planned development and their associated infrastructure, such as roads, utilities, and water and sewer service.

Mixed Use Development Areas – a single, high density development project which includes two or more types of uses, more specifically described and delineated in City Code [Section 21.48.030](#),

Planned Unit Development Areas – a development comprised of a combination of land uses or varying intensities of the same land use in accordance with an integrated plan that provides flexibility in land use design approved by the City with at least twenty percent of the land permanently dedicated to open space in residential planned developments and at least five percent of the land permanently dedicated to open space in commercial, mixed use and other planned developments.

Commercial and Industrial Areas – manufacturing operations, office complexes, shopping centers, and other similar uses and their associated storage areas, yards, and parking areas.

Land Use Thresholds **Figure 3:3**

3.2 Forest and Tree Protection and Resource Management

This chapter has focused on site planning during which priority forests and priority retention areas are located. The next sections focus on specific protection mechanisms for the retained forest. Many of these protection mechanisms will also be used in planted forest after construction. While using this section, remember that all forest for retention shall have a long-term protection agreement in place at all times after development project completion. Further information about these long-term protection agreements may be found in Section 3.2.3.

3.2.1 Planning and Design

Forests which are retained and protected not only maintain forest functions, but also serve new residential communities or businesses by providing passive recreation. These forests can also be managed to enhance resource values on private or public property by providing a clean watershed for a municipal water supply.

Using calculations based on the net tract area, a development proposal may be phased to allow clearing for the current phase while allowing forest to remain. Forest areas left on the site may therefore continue to contribute valuable functions in preserving water quality or habitat. A Forest Stand Delineation which has been approved for the entire parcel may be renewed and updated if needed during this phased construction.

Construction activities may not occur in Forest Retention Areas. Temporary forest disturbances may require reforestation or afforestation according to the approved Forest Conservation Plan. Therefore, any utility lines, access roads, temporary parking areas, storage areas, and associated grading shall be located outside of Forest Retention Areas.

Contiguous forest requires protection through planning. For example, protection measures for large areas of contiguous hardwood forested habitat may include:

- Minimize disturbances during the May-August breeding period. Such disturbances include vehicular traffic, intensive public use, construction noise and others.
- Minimize habitat fragmentation by developing or disturbing existing edges, and restricting creation of new edges or openings. Where possible, use alternative site design techniques (Section 1.3).
- Minimize fragmentation by retaining continuous canopy and understory cover. For example, narrow private drives and road rights-of-way may meander to maintain existing trees and their canopies.
- Maintain existing habitat, such as standing dead trees which are nesting and feeding areas.
- Minimize long-term disturbance by restoring temporarily disturbed areas to pre-disturbance conditions, such as reforestation in native vegetation.
- Minimize long-term alterations in forest species composition or structure.

The recommended measures above do not necessarily apply to coniferous forested areas when the objective of preserving habitat for forest interior dwelling birds (FIDB) is sought, since threatened FIDB species in Maryland generally inhabit hardwood forests. However, these or other protection measures in coniferous forests may be appropriate to protect habitats of other wildlife species.

Forest Protection Requirements in the Forest Conservation Plan

The Final FCP map shall locate and describe any protection mechanisms to be installed to protect Retention Areas during and after construction. These mechanisms shall be field located and approved by

inspection prior to the start of construction.

Any clearing, grading or construction within 50 feet of the Retention Area depending on field conditions will require protection devices, including but not limited to, fencing or adapted sediment and erosion control devices and signs as indicated in the approved Forest Conservation Plan. All protection devices shall remain in place until construction completion, final inspection, and an occupancy permit, unless waived by the approving authority. More information on protection devices can be found in Section 3.2.2).

Furthermore, the edge of the Retention Area will need to be staked by the applicant and approved by the approving authority prior to clearing. This field edge should be adjusted along the Critical Root Zones of trees in the proposed Retention Area (**Figures A:15 and A:16**).

Critical Root Zones

The Critical Root Zone of a tree is the zone in which most of the roots live. Ninety-five percent of the roots of most trees will be found in the upper 12-18" of the soil. Most of the roots that supply the nutrients and water to the tree are found just below the soil surface. The total amount of a tree's roots are generally proportional to the volume of the tree's canopy. Therefore, if the roots only penetrate a thin layer of soil, then the roots must spread far from the tree, beyond the extension of the canopy. When delineating forest retention lines in the field, consider not only the visible portion of the tree, the trunk and canopy, but the below ground portion as well.

The true size of the critical root zone is related to the species and size of the tree and the condition of the soils, including texture and average moisture. It is difficult to generalize for all trees but also difficult to field examine the root systems of all of the trees in question. There are several ways to estimate the size of the critical root zone without examining the roots in the field. The following calculation should be used unless other methods are demonstrated to protect the complete root zone:

- For the edges of stands, the Critical Root Zone shall be a circle around each edge tree with a radius of 1.0 foot for each 1.0 inch of Diameter of Breast Height; the minimum radius should be 8 feet.
- For Retention Areas less than 10,000 square feet and isolated specimen trees, the Critical Root Zone should be a circle around each edge tree with a radius of 1.5 feet for each 1.0 inch of DBH.

Inclusion of a specific tree inside the retention area will require an evaluation of its resistance to disturbance. This will require an examination of pest or disease infestation, tree decay, susceptibility to windthrow, and soil compaction.

Forest Protection Procedures

Forest protection procedures discussed in this and the following sections are summarized in **Figure 3:4**.

Step 1 Field locate the proposed retention boundary as shown on the FCP.

Step 2 Field locate the proposed limit of disturbance. If this does not agree with the preliminary approved retention area, revise the FCP map and calculations to show adjusted retention areas if needed..

Step 3 Evaluate tree conditions and critical root zones.

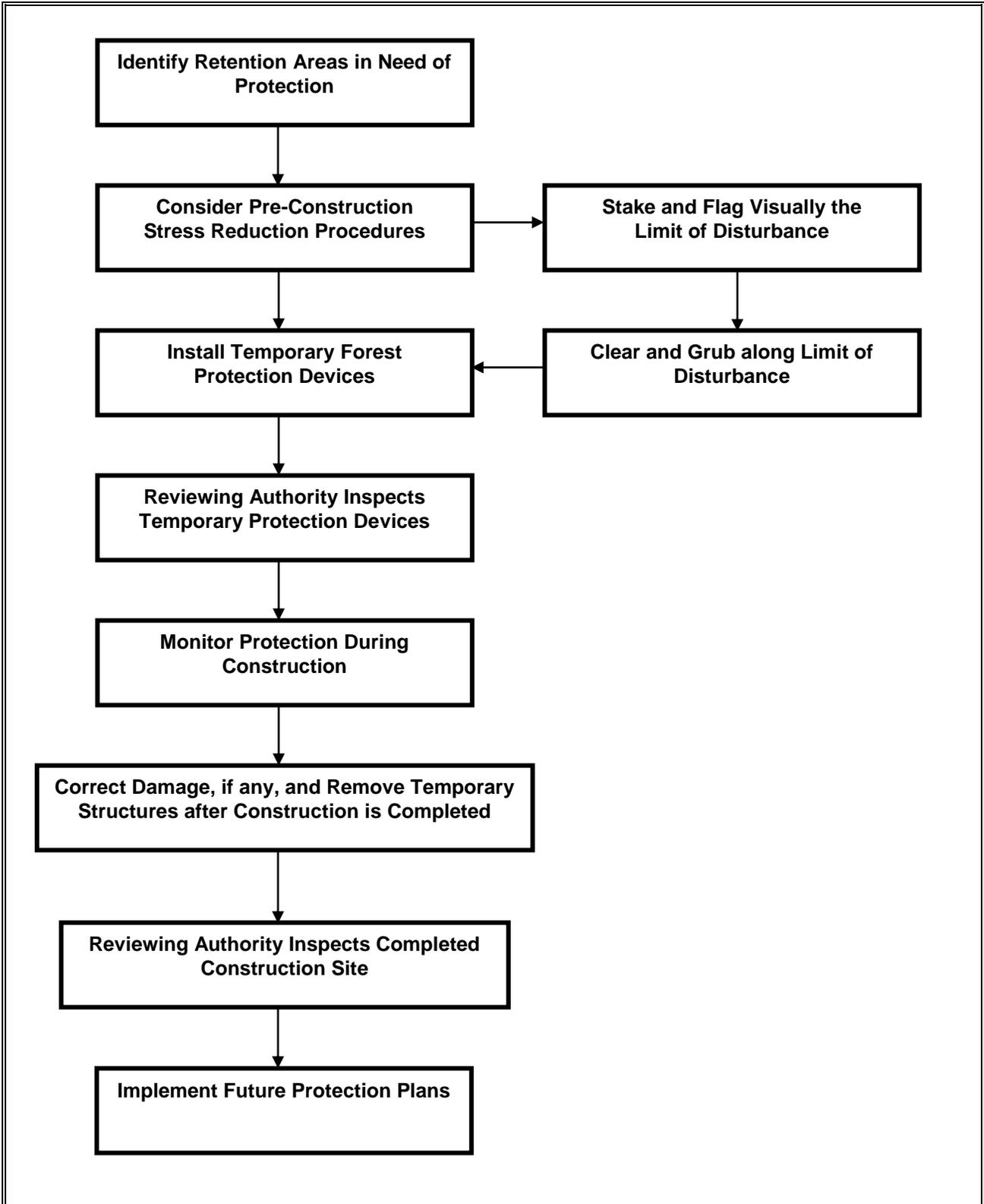
Step 4 Field adjust and stake the retention boundary. In general, if more than 30 percent of the critical root zone is to be disturbed, the tree should not be included in the Retention Area. Some soil disturbance may be mitigated by selective stress reduction pruning or other methods. These methods are discussed in Section 3.2.2.

Step 5 Obtain final FCP approval, if not obtained earlier. Notify approving authority for inspection

approval of installed devices.

Step 6 Proceed with construction subject to final approvals.

Step 7 Notify approving authority following completion of construction for final inspection.



Forest Protection Procedures

Figure 3:4

3.2.2 Construction Techniques

The FCP not only locates the forest retention boundary but also includes details and specifications for forest protection. As a construction document, it directs construction contractors and others in the correct design, installation, timing, and placement of specific protection devices and protection measures.

This section guides the applicant through the construction phase of a project, ensuring that construction activities will not adversely affect the Forest Retention Areas. Examples of details or specifications are referenced in this section and located in Appendix D. A Maryland Licensed Tree Expert or Certified Arborist will also be able to provide information about specific tree protection strategies.

Effects of Disturbance

Throughout planning and construction, applicants should monitor the effect of the proposed activities on the forest retention areas (**Figure A:17**). Effects may result from:

- **Soil and root compaction** – Avoid unnecessary compaction wherever and whenever possible. Soils and roots may be aerated when needed. Compacted soils may require additional treatment before planting is conducted.
- **Root injury** – Avoid affecting any critical root zone of retained areas. Roots may be pruned when needed to reduce effects of damage to uptake or support functions. Special machinery or techniques may be required. Another mitigating activity for root injury or soil disturbance is limited crown reduction to reduce water loss through transpiration.
- **Limb or trunk injury** – This will affect not only the appearance of retained trees, but their ability to take up nutrients and water through the cambium layer just under the bark and, when more extensive, their support. Avoid whenever possible, or prune before construction activities affect tree canopies.
- **Too much water** – Excess soil moisture will drown the tree, limiting the ability of roots to absorb oxygen. Do not allow standing water for more than 2 days.
- **Too little water** – Grading will alter the soil moisture regimes in the Critical Root Zone, particularly in grade cuts. Lowered water table levels should be compensated for by additional monitoring and watering when needed. Avoid grade cuts around a Forest Retention Area when this is likely.
- **Disease** – Nearby disturbances may weaken tree resistance to insects, fungi or other pests. Additional water, fertilizer and other protection strategies may be advisable to reverse decline.

Some species of trees or individual trees may not be suitable for retention at the retention boundary without certain treatments. Reasons for this include:

- **Susceptibility to windthrow** – Individual trees which grow in a forest are protected from prevailing winds or sudden gusts. Trees growing in conditions which limit adequate structural root development, such as hydric soils, or species which adapt by shallow rooting may not be appropriate in a new edge condition.
- **Sunscald** – Canopies which are opened and allow more sunlight during the growing season may create drought stress conditions for certain shade tolerant species. Generally, this may be avoided by limiting cutting to the dormant season.

Susceptible trees may require removal or trimming. Plant communities located in interior forest conditions protected by a forest 'edge' from extreme sun, wind, or temperature fluctuations, may require treatment to adapt to the proposed relocated edge. Selective clearing and replanting methods as discussed in Section

3.3 Forest and Tree Planting, are a means to mitigate this type of disturbance.

Protection Requirements in the Forest Conservation Plan

Forest Protection During Construction

Following are requirements for all FCP's which propose forest clearing:

- The **locations** of all protection devices shall be referenced on the FCP map.
- **Details and specifications** required to implement the proposed protection measures shall be included.
- A **construction sequence** which includes clearing, grading or installation of sediment and erosion control measures; installation and removal of protection devices; inspections; and, other activities that may be required to implement the proposed protection measures.
- **Equipment**, vehicles, machinery, dumping or storage, or other construction activities, burial, burning, or other disposal of construction materials, must not be located inside forest retention areas.
- Any **fires** permitted in the construction area shall conform with state and local regulations for fire control and must be a minimum of 100 feet from the retention area or its canopy.
- Forest Retention Area **protection devices** shall be:
 - visible;
 - well-anchored;
 - approved in the field prior to clearing, grading, or when construction commences; and,
 - remain in place and maintained until construction completion, final inspection, and an occupancy permit is issued, unless waived by the approving authority.

Field adjustments may be made subject to approval of an amended FCP. Suggested specifications are summarized in **Figure 3:5**.

Critical Root Zone Protection

When 30 percent or less of a Critical Root Zone in a Forest Retention Area is disturbed by clearing, grading, or construction, the following additional protection measures shall be required unless waived by the approving authority.

When warranted by disturbance to the Critical Root Zone of a Retention Area, the FCP must contain plan specifications for pre-construction stress reduction:

- root pruning
- crown reduction or pruning
- watering
- fertilizing
- mulching
- other measures which may be needed

Evaluation criteria and implementation guidelines for these techniques are summarized in **Figure 3:6**.

Special construction techniques may include, but are not limited to:

- tree wells
- retaining walls
- root aeration systems

- raised sidewalks with aeration over roots
- pier wall supports over Critical Root Zone
- tunneling through Critical Root Zone

Appendix D contains sample specifications and details for these techniques. Additional references are found in Appendix E.

Post-Construction Protection Measures

When warranted by damage to the Retention Area during construction, the following may be required:

- stress reduction measures as above;
- tree or limb removal; or,
- replacement planting.

An amended FCP which addresses additional reforestation may be required for the final inspection approval or to satisfy enforcement requirements.

When more than 30 percent of the Critical Root Zone is disturbed by grading, clearing or construction, the FCP and Retention Area calculations will require modifications to reflect the disturbances and show that these areas are no longer acceptable as Forest Retention Areas.

A protection checklist such as in **Figure 3:7** may be used by contractors to ensure that forest retention areas will be protected.

Suggested Specifications for Temporary Protection during Construction

- Combine forest protection devices with sediment and erosion control devices when possible.
- Avoid injuring roots when installing anchor posts.
- When using fencing, it should be at least 4' high.
- Attach highly visible flagging.
- Fences or devices should be securely anchored, at least 1/5 of the anchor post should be below ground level.
- Signs should be posted at all retention areas clearly identifying the area.

For Forest Protection Only (see also Appendix D)

- Highly visible signs (see Figure D-4),
- Blaze orange plastic mesh fencing (Figure D-5),
- Two to three strand wire fence with highly visible flags (Figure D-6),
- Snow fencing with highly visible flags on anchor posts (Figure D-7).

For Combined Forest Protection and Silt Fencing in Accordance with Established Best Management Practices or Sediment and Erosion Control Standards

- Filter cloth on wire mesh
- Silt fence with wire strand and highly visible flags (Figure D-8),
- Perimeter dike or swale. Construction of this device will be inside the limits of disturbance only. Highly visible flags will be placed along the dike and will be maintained throughout the construction phase of the project (Figure D-9).

Permanent or Constructed Protection Devices Include:

- Raised sidewalks (Figure D-10)
- Root aeration system (Figure D-11)
- Tree wells (Figure D-12).
- Retaining walls (Figure D-13).
- Reinforced pier and panel wall (Figure D-14).
- Tunnels through Critical Root Zone where ditches are used (Figure D-15).

Forest Protection Devices

**Figure
3:5**

<u>PRACTICE</u>	<u>IMPLEMENTATION GUIDELINES</u>
<p>Root Pruning - Will the critical root zone be affected by construction activities such as grade changes, digging for foundations, roads, or utility construction?</p>	<p>Prune before construction disturbance as shown in Appendix D, Figure D: 1.</p> <p>Cut cleanly using well-maintained pruning equipment.</p> <p>Cover exposed roots immediately with topsoil, peat moss, or other suitable material.</p> <p>For trees with Diameter of Breast Height greater than 15 inches, conduct root pruning up to one entire growing season before construction disturbance.</p> <p>Monitor for signs of stress and apply water if needed.</p>
<p>Crown Reduction or Pruning – Has the root system been significantly reduced (more than 30%) or are there dead, damaged, or diseased limbs?</p>	<p>Prune at optimal time of the year for the type of plant:</p> <p><i>For ornamental flowering trees, after flowering and before bud set</i></p> <p><i>For non-ornamental flowering trees, in late winter, early spring, or mid-summer.</i></p> <p>No more than 1/3 of the crown should be removed at one time (Figure D-2)</p> <p>Monitor for signs of stress.</p>
<p>Watering - Will construction activities alter the hydrology of the site? Has or will root pruning occur?</p>	<p>Water only as necessary. Monitor to ensure that overwatering does not frequently occur.</p> <p>Monitor for signs of stress and re-evaluate method</p>
<p>Fertilizing - Is or will the tree be stressed? Has or will root pruning occur?</p>	<p>Use low nitrogen and slow release fertilizers and apply in late fall or early spring (Figure A:18)</p> <p>For small trees (less than 3" caliper or DBH), broadcast methods may be appropriate.</p> <p>For larger trees, avoid root injury while using punch hole method or pressurized injection method (Figure D:3). Do not apply fertilizer closer than 3 feet from tree trunk for pressurized injection method.</p> <p>Monitor for sign of stress and re-evaluate method.</p>
<p>Forest and Tree Protection Practices Figure 3:6</p>	

Step 1: Pre-Construction Phase

Stress Reduction, if needed

- Root pruning
- Crown reduction or pruning
- Watering
- Fertilizing
- Mulching

Temporary Forest Protection Devices

- Forest protection fences or
- Combined sediment control and tree protection
- Forest Retention Area signs

Permanent Forest Protection Devices

- Tree wells
- Root aeration system
- Retaining walls

Include On Site Plan

- Forest Retention Areas
- Isolated specimen trees
- Employee parking areas
- Equipment staging areas

Pre-Construction Meeting

- Discuss penalties
- Inspect installed protection devices

Step 2: Construction Phase

Monitor

- Soil compaction
- Root Injury
- Trunk wounds
- Limb injury
- Flooded conditions
- Drought conditions

Step 3: Post-Construction Phase

Stress Reduction

- Root pruning
- Crown reduction or pruning
- Watering
- Fertilizing
- Mulching

Repair of Tree Damage

- Root repair
- Removal of dead limbs
- Soil aeration

Other

- Removal of dead or dying trees posing an immediate safety hazard
- Removal of temporary tree protection structures
- On-site inspection by approving authority

- Amended FCP, if needed

Forest and Tree Protection Checklist

**Figure
3:7**

3.2.3 Long-term Instruments

Every FCP must provide for long-term protection of Forest Retention Areas and areas covered by a Planting Plan using the long-term protection agreements approved by the approving authority. These agreements shall at minimum:

- Limit uses in retention and planting areas to ones that are consistent with forest conservation, including passive recreational activities, wildlife management, and forest management practices that are consistent with a forest conservation program;
- Preserve all priority forests and priority areas specified in the FCP;
- Be binding on all parties; and
- Be in place at all times after development completion. Long-term protection for planted areas may be instituted at the release of a bonding requirement.

Some types of long-term protection agreements may provide for re-assignment to a different party, renewal of terms, and other periodic evaluation and replacement, with notice to and approval by the approving authority. Each may require periodic monitoring and inspections. A long-term protection agreement may be one or more of the following, as approved by the approving authority:

- Conservation easement
- Deed restrictions
- Covenants running with the land
- Legally binding Forest Management Plan
- Forest Conservation and Management Agreement

Conservation Easements

These convey interest, usually in perpetuity, in the property to another party who is designated as the easement holder through an executed deed. The easement holder, as a third party, monitors and enforces the terms of the easement. Easement holders may include local non-profit land trusts, the Maryland Environmental Trust, and local jurisdictions.

Voluntary easements that satisfy federal and state requirements may provide certain benefits – lower estate and inheritance taxes due to reduced development potential of the property and a 15-year property tax credit on the unimproved portions of the property.

Further information on easements is available from:

The Maryland Environmental Trust
100 Community Place
Crownsville, MD 21032-2023
410-514-7900

Deed Restrictions and Covenants

These instruments vary principally in their method of enforcement, but are generally binding on the land purchaser. Restrictions and covenants for forest areas shall be recorded in the land records for that property. Graphic indication of the forest retention areas must be shown on the record plat for the property and cross-indexed with the land records.

Restrictions, when applied by an approving authority as a condition of a plan approval, are enforced by that authority through building inspections e.g. setbacks such as those established for buffers. Covenants are enforced by landowners as a party to the covenant, which is usually recorded with a deed or title.

Proper recordation in land records and title search disclosure will ensure that future landowners are informed of these restrictions for individual lots or common open space.

Legally Binding Forest Management Plan

This is a Forest Management Plan which is prepared by a professional forester licensed by the State of Maryland, approved by the Maryland Department of Natural Resources-Forest Service, and, includes an agreement that the Forest Management Plan will be followed. This agreement is recorded in the local land records with a process for renewal or reassignment similar to the recordation of Forest Conservation and Management Agreements described below. The DNR forester assigned to the City where the property is located will review the plan to ensure that it is complete and consistent with the state or local program. The approved Forest Management Plan may be submitted as part of a preliminary FCP prior to signature and final agreement and before approval of the final FCP.

Tree species, solids, topography, tree age, property location, and other factors are evaluated with landowner objectives and, when used as a forest conservation instrument, the protection requirements of the law. A forest management or stewardship plan contains a detailed schedule or management practices to be accomplished and their proposed completion dates.

For further information about Forest Management or Stewardship Plans and the process of recording these, contact:

Maryland Department of Natural Resources-Forest Service
Tawes State Office Building, E-1
Annapolis, MD 21401
410-260-8531

Forest Conservation and Management Agreements

A Forest Conservation and Management Agreement is a binding contract between a landowner and the City of Annapolis. It freezes the assessed value of forested areas if the property is managed according to sound forest conservation principles. A Forest Management Plan, written by a forester licensed by the State of Maryland, is required and must be approved by the DNR.

Any owner of five or more contiguous acres of forest land may be qualified to enter a Forest Conservation and Management Agreement. Open land that was recently planted to forest may be included, usually after one year. The agreement does not apply to the assessment on house sites, other structures, crop land, mining, and other non-forested open space.

The contract is written for a minimum of fifteen years, although longer terms may be specified. As a long-term protection agreement, it will require periodic renewal, or reversion to another protection instrument. A memorandum of the contract and any subsequent changes are recorded in local land records. The contract can be renewed indefinitely if forest conservation practices are approved and are accomplished. The contract can be assigned and transferred to a new owner of the property if the buyer agrees to assume the obligations of the agreement. The property will be reassessed and a roll-back tax applied if the agreement ends, the agreement is terminated, or the property is transferred without assumption of the plan obligations by the new owner. An administrative fee is charged to the owner upon entering the contract, when changes to the agreement are made, and for each five-year inspection.

Forest Conservation and Management Agreements entered for the purpose of ensuring long-term protection will require notification to the approving authority upon termination or transfer. Upon termination, an alternative long-term protection instrument will be required to maintain compliance with the FCP for the site.

Further information may be obtained from the City of Annapolis Department of Planning and Zoning.

3.3 Forest and Tree Planting

This chapter has reviewed planning and protection of forest retention areas on development sites. The Forest Conservation Act also requires that FCP's include an afforestation or reforestation plan when appropriate. After techniques for retaining forest on a site have been exhausted, afforestation and reforestation may be required on the site or, if demonstrated as necessary, off the site. A final alternative may be a fee-in-lieu paid to the Forest Conservation Fund of the approving authority if an applicant demonstrates that the requirements for reforestation or afforestation onsite or offsite cannot be reasonably accomplished.

When afforestation or reforestation is required, the FCP shall contain a planting plan. When the afforestation or reforestation is to occur off the site, the planting plan shall contain certain information about the proposed planting site. Planting plans are discussed in detail in Section 3.3.2.

3.3.1 When and Where Is Planting Necessary

Afforestation

For sites with little or no existing forest as verified in a Forest Stand Delineation, the Forest Conservation Act sets standards for afforestation depending on the zoning category and the size of the tract.

Afforestation is the establishment of tree cover on areas from which it has always or very long been absent, or the planting of open areas which are not currently in forest cover. This planting may include urban forestry planting practices, such as establishing tree lawns in urban areas as discussed in Section 3.3.2.

Afforestation is required on a tract which has less forest than the designated afforestation threshold for that land use. For example, tracts in medium density residential areas which have less than 20 percent of the net tract area in forest cover shall be afforested up to 20 percent of the net tract area.

Reforestation

Reforestation is the creation of a biological community dominated by trees and other woody plants containing at least 100 trees per acre with at least 50 percent of those trees having the potential of attaining a 2 inch or greater diameter measured at 4.5 feet above the ground (DBH) within 7 years. Reforestation also includes landscaping under an approved landscaping plan that establishes a forest that is at least 35 feet wide and covers an area at least 2,500 square feet.

If reforestation is required, the amount will be determined by the amount of clearing either above or below the conservation threshold, since the ratio changes from 1 acre planted to 2 acres planted for each acre cleared.

Priority Areas for Afforestation and Reforestation

Forest Stand Delineations locate the environmental features which are priority afforestation and reforestation areas. Reforestation or afforestation shall occur in priority areas. If the applicant demonstrates that this cannot be reasonably accomplished, planting may occur in other areas on the site, in offsite priority areas, or through payment of a fee-in-lieu. Planting locations shall be approved by the reviewing authority under an approved FCP. Methods for planting are discussed in Section 3.3.

Priority areas are:

- **Stream buffers**

Forest buffers are to be established to widths of at least 50 feet from the top of each normal bank of intermittent and perennial streams. These streams may be located by USGS 7 ½ minute quadrangle maps, or as designated or defined in a local forest conservation program. These

streams include any tidal waters not included in the Chesapeake Bay Critical Area.

- **Forested corridors**
Forested corridors shall be established to connect existing and protected forests within or adjacent to the site. A width of at least 300 feet is desirable to facilitate wildlife movement.
- **Buffers for Critical Habitats**
These areas may be designated by the Department of Natural Resources or by a local forest conservation program. A forested buffer shall be established as appropriate for these habitats. Information on critical habitats may be obtained from the DNR-Natural Heritage Program.
- **Stabilized slopes**
Steep slopes of 25 percent or greater and slopes of 15 percent or greater with erodible soils having a K value of 0.35 or greater in the top layer which require stabilization shall be reforested. These slopes also include ravines and natural depressions.
- **Land use buffers**
Afforestation or reforestation shall be used to establish buffers between differing or conflicting land uses where appropriate, or adjacent to highways or utility rights of way.
- **Total contiguous forest cover**
Reforestation or afforestation shall be established in areas adjacent to retained forests on a development site where appropriate (**Figure A:13**).

Additional priority areas may be designated by a local authority in either a locally adopted land use plan or local forest conservation program.

Additional areas may be appropriate for reforestation or afforestation, but will require approval by regulatory or permitting authorities. For example, unforested nontidal wetlands and their buffers, and 100-year nontidal floodplains may be appropriate for water quality protection benefits; however, the applicant must verify any conditions or requirements with the MD Department of the Environment. Areas susceptible to coastal flooding or areas located in the Chesapeake Bay Critical Area are also often appropriate; however, applicants should verify requirements with local, State, or federal authorities.

When Will Afforestation and Reforestation Be Conducted?

The following steps outline a procedure for determining if afforestation or reforestation is required and where it is appropriate.

Reforestation

1. Determine if required forest retention, especially in priority areas, will be accomplished as shown in the preliminary FCP or the current site plan. If not, assess if the site plan may be modified to retain more forest on the site.

If existing forest is more than the conservation threshold, reforestation is required

If existing forest on the site is less than the conservation threshold, but more than the afforestation threshold, reforestation is required if any forest is cleared.

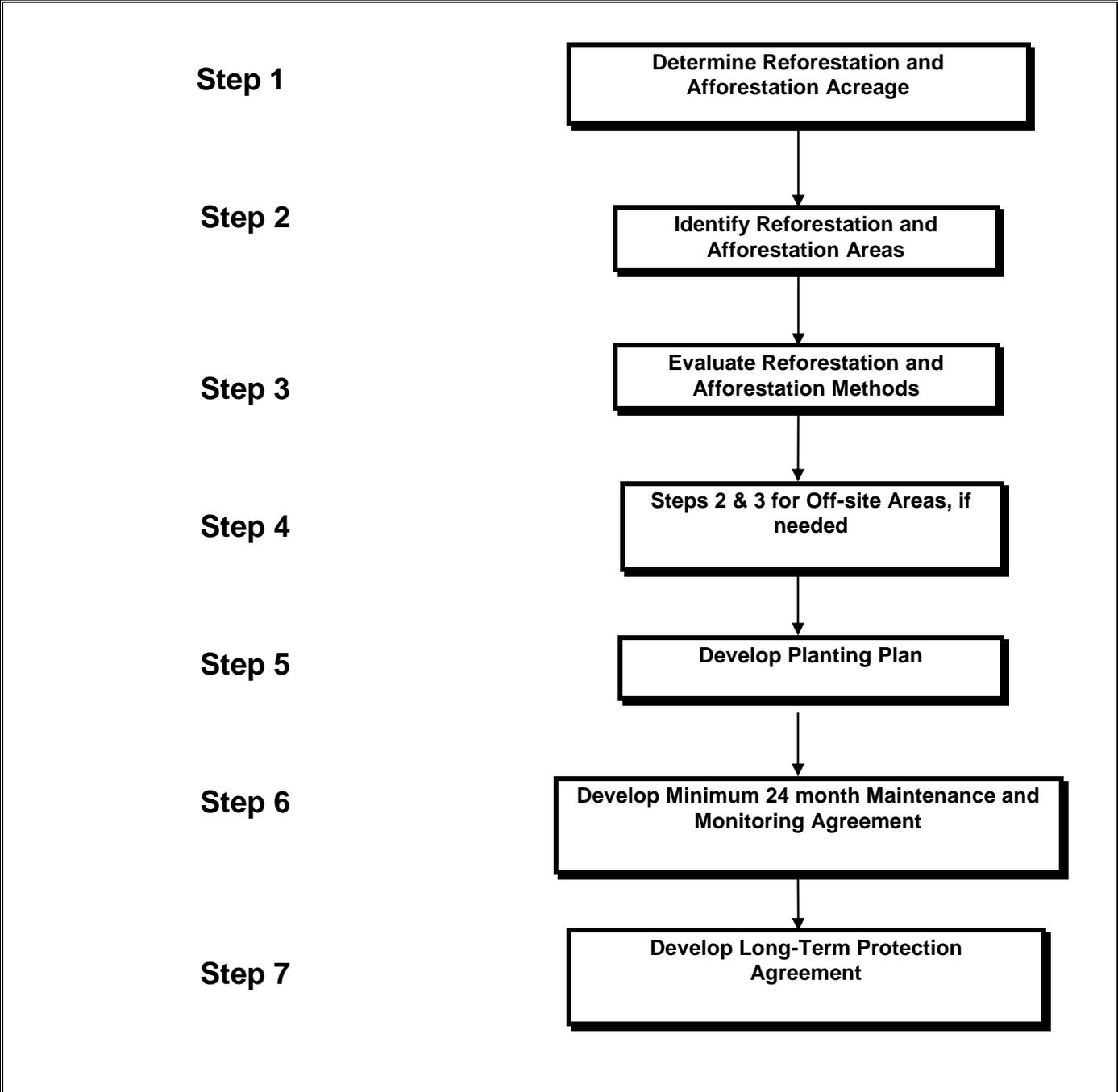
2. If the site plan cannot be modified to retain forest and reforestation is required, determine if priority areas for reforestation can be utilized. The Forest Stand Delineation should contain information about onsite environmental features which are priority planting areas. Investigate modifying the site plan to plant these areas. In addition, investigate reforestation of forest areas which are disturbed temporarily during construction and will be appropriate for long-term protection.

Afforestation

1. Determine if existing forest area on the site is less than the afforestation threshold required. If so, and if any of this forest will be disrupted by clearing, reforestation of 2 acres for each acre cleared will be required. Calculate how much additional planting will need to be accomplished to meet the afforestation threshold.
2. Determine if the necessary planting may be accomplished in priority areas as shown in a Forest Stand Delineation. Modify the site plan if needed.

If onsite planting in priority areas cannot be reasonably accomplished, investigate priority offsite areas as alternatives.

These procedures are summarized in **Figure 3:8**. The comprehensive procedural checklist in **Figure 3:9** may assist the preparer of FCP's in reforestation and afforestation evaluations. Information about planting plans is in Section 3.3.



Reforestation and Afforestation Procedures

Figure 3:8

Step 1: Determine Reforestation and Afforestation Plan

Forest Conservation Worksheet

Step 2: Identifying Priority Reforestation and Afforestation Areas

Locate reforestation and afforestation areas from priority areas on FSD

Step 3: Evaluate Various Reforestation Methods

Preferred Sequence for Afforestation and Reforestation

- Onsite afforestation or reforestation
- Offsite afforestation or reforestation
- Alternate sequence for certain specific projects

Afforestation or Reforestation Methods

- Selective clearing and supplemental planting to enhance existing forest
- Forest creation using:
 - transplanted or nursery stock
 - whip and seedling stock
 - natural regeneration
- Landscaping
- In a priority funding areas:
 - street trees
 - offsite protective easement for existing forest

Step 4: Developing a Planting Plan

Site Assessment

- Past and future land uses
- Soils evaluation
- Species selection
- Plant material selection
- Stock specifications

Pre-Planting Considerations

- Planting site preparation
- Planting period
- Plant material storage
- Onsite inspection

Planting Specification

- Planting pattern
- Equipment
- Techniques

Post-Planting Considerations

- Soil stabilization
- Protection devices

Step 5: Minimum 2-Year Maintenance and Monitoring Agreement

- Watering
- Fertilizing
- Competing vegetation

- Protection from pests, diseases, mechanical injury
- Reforestation planting plans for mortality after year one
- Name of company or individual responsible for tree care
- Schedule of site visits
- Areas with special maintenance concerns

Reforestation and Afforestation Checklist

Figure 3:9

3.3.2 Planting Plan Requirements

The preceding section discussed the priority locations for afforestation and reforestation and when these activities are required. This section discusses how planting may be accomplished and the requirements for Planting Plans in FCP's. A Planting Plan shall be required in a FCP when afforestation or reforestation is proposed.

The Planting Plan shall include:

- **Locations** of afforestation or reforestation areas. These will be shown on the FCP map. When these areas are located offsite, the planting plan shall also include a map of the proposed planting site showing:
 - location of the site (vicinity map);
 - soils classifications; and
 - environmental features which are priority areas as shown for a simplified Forest Stand Delineation.
- **Specifications** for conducting the afforestation or reforestation activities. A planting schedule table will be included which lists:
 - species;
 - number of plants, spacing or distribution of proposed planting;
 - size of plants;
 - condition;
 - recommended sources of plant materials; and,
 - other requirements for certain planting techniques as noted below.
- How the proposed afforestation or reforestation activities are included in the **construction sequence**, providing for notification to and inspections by the approving authority. Afforestation or reforestation planting shall be finished within one year or two growing seasons after development project completion.

A binding maintenance and monitoring agreement to ensure protection and survival requirements for the planting areas is required for reforestation or afforestation. Specific requirements for these are discussed in Section 3.4. This agreement shall contain financial security as specified by the approving authority. This agreement shall be in place for a minimum of two years or two full growing seasons, whichever is longer, after the planting is finished.

Selecting Planting Techniques

The Forest Conservation Act lists several techniques for accomplishing reforestation and afforestation which must be considered during the development of a planting plan. The following criteria shall be used to evaluate methods appropriate for a planting site.

Selective Clearing and Supplemental Planting (Woodlot Improvement)

Disturbances near Forest Retention Areas create new environmental conditions inside the Forest Retention Area. Selective clearing and supplemental planting mitigates the effects of nearby clearing on Forest Retention Areas so that they will withstand the changes in the modified environment. Modifying or creating a new forest edge, selective thinning to reduce safety hazards from unstable trees, and limiting competition from invasive exotic plants are included.

This technique may be used only when management of the Forest Retention Area as a result of nearby clearing is recommended in the approved Forest Stand Delineation and when it meets one or more of the following conditions:

- Shade tolerant plants located in the Forest Retention Area will not survive competition from undesirable shade intolerant species colonizing the area after disturbance. Appropriately selected (see Planting Plan Elements below) shade intolerant species may be added to the Forest Retention Area and measures taken to control competition.
- If located in a priority sensitive area, the functions of a Forest Retention Area will be enhanced by additional planting. This may include additional plants to create higher structural diversity, increase total density up to optimum stocking levels, or retard surface water runoff.
- The height of existing individual trees in the Forest Retention Area exceeds the width of the retention area or species susceptible to windthrow, such as Virginia pine (*Pinus virginiana*), are located within one tree height of a structure, and these individuals will pose a safety hazard. These trees may be removed or pruned and appropriately selected trees planted in the retention area. Natural regeneration may be a planting alternative if understory densities of appropriate species exceed optimum stocking levels.
- The average cover of invasive exotic plant species in the Forest Retention Area as identified in the Forest Stand Delineation exceeds 50 percent. These may be eliminated and replaced with an appropriately selected non-invasive species of equivalent size in the same stratum.

Planting requirements for this technique shall include:

- Trees in Forest Retention Areas proposed for removal are field located and approved by the approving authority before removal;
- Best Management Practices shall be used;
- All clearing and planting activities shall be monitored under a minimum 2-year maintenance and monitoring agreement; and,
- Stocking levels shall be determined by approved forestry methods.

Invasive Exotic Plants

Exotic plants are plant species that are not native to the area where they are growing. Some exotic species are native to the United States but are now distributed outside their natural range due to transportation by humans or due to human-caused breakdown of natural barriers to dispersal. A good example is long-braced beggar-ticks (*Bidens polylepis*), native to the midwestern U.S. but not to Maryland, which recently invaded Maryland wetlands and may now be the most common *Bidens* species in Maryland.

Hundreds of exotic plants occur in the wild in Maryland. Most plants used in horticultural applications are not native to Maryland, and many can escape into the wild. However, most exotic species do not pose a serious threat to native vegetation in undisturbed areas.

Invasive exotic plants are pests because they displace native species and can change the structure and composition of natural communities. They lack the predators, competitors, diseases, or parasites that help control their populations in their native habitat. They compete successfully against existing native species. Examples of such exotic species which are also invasive in native plant communities are Norway maple (*Acer platanoides*), tree of heaven (*Ailanthus altissima*), bush honeysuckles (*Lonicera* species), multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*), kudzu (*Pueraria lobata*), and common reedgrass (*Phragmites australis*). A list of invasive species appears in Appendix E.

The presence of exotic species usually indicates a history of site disturbance and may indicate a degraded natural community. Many species of exotic plants, particularly woody vines, can retard forest regeneration. The worst species are those that cause damage, are easily established, and readily

dispersed, such as Japanese honeysuckle (*Lonicera japonica*) and devil's tearthumb (*Polygonum perfoliatum*). Some species, such as kudzu (*Pueraria lobata*) and bamboos, are extremely persistent and destructive, but are unlikely to become established unless planted. English ivy (*Hedera helix*), climbing euonymus (*Euonymus fortunei*), burning bush (*Euonymus alatus*), Japanese honeysuckle, and Norway maple (*Acer platanoides*) are particularly pernicious in forested environments because they are adapted to low light conditions and can invade high quality forests with closed canopies. Bird-dispersed species such as Japanese honeysuckle can readily invade the interior of forested habitats by colonizing light gaps caused by fallen trees. Some species, such as wisteria (*Wisteria* species) and Japanese honeysuckle, can rapidly invade the shady interior of a forest from a sunny forest edge. They send out ground level vines that are subsidized by the rapidly photosynthesizing portions of the plants growing in full sun. Other species, such as tall fescue (K31 fescue) (*Festuca elatior*), sericea lespedeza (*Lespedeza cuneata*), and crown vetch (*Coronilla varia*), although not strongly invasive, should not be planted in or adjacent to natural areas because they are extremely persistent and are unlikely to be naturally replaced by native species.

Extreme caution is warranted when using any exotic species for natural resource management. Managers should assess objectives and minimize likely future effects on natural plant communities.

Use of Transplanted or Nursery Stock Greater than 1.5 Inches DBH

This is a preferred reforestation or afforestation technique when sites are monitored and managed adequately to ensure maximum survival beyond an initial 2-year agreement. Installed irrigation or a landscape contract may be added to the planting plan.

Proper planting details and specifications in the FCP are essential to the successful implementation of this technique. Examples of these are located in Appendix D. Nursery or collected transplant stock and planting specifications shall comply with the current American Standards for Nursery Stock (American National Standards Institute). Container stock is usually preferred over bare root or balled and burlapped stock, particularly for spring period planting.

Mulching is highly recommended to a depth of 2 to 4 inches. Alternatively, a planted ground cover may be added.

Staking or guying is not recommended except in areas of high wind and when trees are taller than 8 feet. Movement which does not shift the root ball strengthens the trunk. Temporary staking shall be removed by the end of the management and monitoring agreement period.

Wrapping shall also be removed from trees by the end of the management and monitoring agreement period.

Transplant stock may require additional treatment such as root pruning. Species and individuals should be chosen carefully and root disturbance minimized. A type of transplant technique which may be considered when appropriate is transplanting plugs from existing forested areas proposed for disturbance.

Use of Whip and Seedling Stock

This technique may be desirable when sites will not be carefully monitored. Some mortality is expected, but no fewer than 55 percent of plants must remain from a minimum planting density of 700 plants per acre at the end of a 2-year monitoring period. A longer term management and monitoring agreement may be used to ensure that forest will be established. Management during this period will usually require control of competition and predation.

Standards for hardwoods and conifers vary. Hardwood seedlings shall be 1/4 to 1/2 inch caliper with roots 8 inches or longer. Conifer seedlings must be 1/8 to 1/4 inch caliper with roots 8 inches or longer and top growth 6 inches or more. Roots must not be planted in a "J". Root disturbance and desiccation shall be minimized through appropriate packaging and handling. Suggested storage and planting

specifications and details may be found in Appendix D.

While sometimes desirable to control predation and speed growth rates, the use of tree shelters with seedling stock on the planting site should be evaluated and monitored to ensure detrimental impacts to wildlife or plants will not occur. In most cases only 100 tree shelters per acre are used.

Approved Landscaping

This technique may be used for onsite areas which are 2,500 square feet or larger, and at least 35 feet wide, and which are landscaped according to the following criteria:

- The planting plan includes long-term management measures to ensure survival of the landscaped area, such as measures to control competition, limit predation, and ensure watering.
- The planting plan must include a canopy, understory, and ground cover, unless criteria for street trees are met.
- Cultivars of species native to the physiographic region may be used along with other species and cultivars as approved by the approving authority.
- When the site is located in a municipality with a tree management plan, or other area as designated in an approved local forest conservation program, the planting plan may specify street trees which are planted in tree lawns appropriate to the planting site and which meet the criteria below. A tree management plan may include a tree care protection ordinance or a master plan for trees planted in public rights-of-way.

Street Trees

Trees planted with plenty of space for root growth survive longer. Tree lawns credited for planting require long-term protection measures, including protection of areas from street widening and other infrastructure improvements. This may be accomplished by adopting and implementing a local tree management policy.

Urban soils are generally poor growth media because poor fertility, texture, and structure reduce growth rates and stunt trees. Street trees are also subject to stress from drought and pollution. Limited root space further restricts tree growth and longevity. Because roots feed and water the tree, most roots are located within the top two feet of soil. Roots of large trees may occupy up to twice the volume of the tree crown, extending up to 3 canopy diameters from the tree trunk. Many typical street tree planting holes have been less than 20 cubic feet or 3.5 square feet, whereas, a mature 25-inch tree may require at least a 1200 cubic foot or 400 square foot planting space.

However, this does not require that only one tree shall be planted in this area or that the space may not be narrow and linear if necessary to accommodate sidewalks, utilities, and curbs. As a landscape technique, the purpose is to achieve screening, noise attenuation, buffering, air cooling, and particulate filtering. Street trees may be planted in tree lawns under the following conditions:

- A minimum tree lawn width shall be established by mature tree size. Small trees (less than 30 feet tall) will require a tree lawn at least 2.5 feet wide; medium trees (30-45 feet tall) at least 4 feet wide; and large (taller than 45 feet) at least 5 feet wide.
- Spacing intervals of trees should ensure that a continuous canopy will be maintained at or before maturity.
- Only small trees may be planted in tree pits surrounded by impervious pavement. Tree pits for small trees must be a minimum of 4 feet by 4 feet. If larger trees are desired for tree pits, these should be surrounded by pervious surfaces approved by the reviewing authority.

- Credit for planted areas shall be calculated by the size of the mature tree canopy as described for each species and cultivar by Gerhold et al, eds. Street Tree Factsheets, 1993 (see Appendix E).
- Use of an appropriate size shall be determined by site constraints, such as overhead utilities and soil conditions.
- The planting plan, maintenance agreement, and long-term protection shall ensure that a continuous canopy will be maintained by maturity.

Naturally Regenerated Plant Communities

Relatively undisturbed soils, including some areas in past agricultural use, which have a suitable seed bank or other sources of propagules are appropriate for this technique when:

- Seventy-five percent of the proposed planting area is located within 50 feet of adjoining forest or the proposed planting area is a forest opening less than one acre, and
- The adjoining forest may not be covered by more than 20 percent cover of invasive exotic species.

The 2-year monitoring and management agreement must include supplemental planting to ensure a density at the end of the period of at least 350 tree seedlings per acre. Alternatively, the agreement period may be extended to ensure that tree density will be 100 stems per acre after 7 years. Measures for controlling competition and predation when appropriate must also be included.

In addition to this method, broadcast seeding of appropriate tree species may be used.

Additional Planting Techniques

In some circumstances, under an approved maintenance and monitoring agreement, planted and naturally regenerated areas may be carefully managed to promote long-term forest creation. Structural composition of a forest as well as species composition is important. A forest canopy will determine the microclimatic conditions for understory growth. Techniques for creating a forest structure may include:

- Plant canopy trees in ultimately desired densities and proportions; mulch the ground beneath and around the trees; plant desired midstory and understory trees immediately.
- Plant and mulch canopy trees, plant drought-tolerant ground cover or let weeds grow, and add or encourage natural invasion by woodland understory and midstory as shade develops.
- Plant trees in savanna distribution patterns (less than ultimately desired densities) with savanna understory, as in serpentine barrens, rock outcrops, wiregrass communities, and other areas with less than ideal soils. As shade develops, gradually plant additional trees and finally plant or manage for the natural invasion of desired understory and midstory species.
- Plant trees in greater than ultimately desired densities and either thin or allow self-thinning as the canopy develops. Add midstory and understory species later and manage for natural invasion.
- Plant non-invasive, short-lived, fast-growing trees or tall shrubs as a cover crop and, as this develops, underplant with slow growing, shade-tolerant, long-lived trees that will become site dominants. Upgrade the understory as the canopy progresses, thinning the cover crop species as necessary to reduce competition with the eventual dominants.
- Do not plant, allowing woody species to invade, and selectively remove those which are not desired. Treat the understory and midstory in a similar fashion.

Basic Planting Plan Elements

Species Selection

Species native to the physiographic region of the state should be used unless a planting plan using landscaping techniques specifies cultivars or alternatives approved by the approving authority. Alternatively, plant selection may be established under an approved Forest Stewardship Plan or other forest management plan. Locally acclimated and genetic stock is preferred for hardiness and disease resistance as well as to conserve existing local genetic stock. Selection may be based on the forest association for the planting site, using the information collected in the Forest Stand Delineation or through adjacent forest communities. Forest associations have been described by Brush et al (1980) and by Eyre (Society of American Foresters, 1980).

Plant Stocking

Minimum densities at planting and at the release of the 2-year maintenance and monitoring agreement for types of stock are shown in **Figure A:17**. When planting a combination of sizes and stock types, these requirements may be prorated. The densities and spacing calculations do not imply that plants should be installed in a grid pattern. Plants grouped in clusters, random, or associated patterns may imitate natural forest establishment. Suggestions for mixing stock and sizes include:

- Plants larger stock around the perimeter in order to protect interior smaller stock.
- Mix stock sizes when no mechanized equipment is proposed for use onsite.
- Mix stock sizes when seedlings are thoroughly mulched.
- Use smaller stock for understory trees and larger stock for overstory in random patterns.
- Use larger stock and maintenance in areas to be affected by human activity.

Site Preparation

Proper installation in undisturbed soils may not require extensive site preparation. When soils have been compacted, or organic or topsoil layers have been removed by grading, treatment will be necessary. Reserve topsoil should be replaced in the planting area. If supplemental fill is required, it may be mixed with the reserved topsoil. Nutrient, organic matter, soil texture, and other analyses may be required to evaluate soil amendments or treatments. Prevailing soil moisture conditions and changes in hydrology should also be evaluated for the proposed planting techniques. The proposed grading plan, prior site analysis, and onsite assessment will be important to this evaluation.

In disturbed soils, a planting field should be prepared for each plant. A planting field with a radius of 3 to 5 times the diameter of the root ball is recommended for nursery stock. In areas of steep slopes or erodible soils, soil disturbance should be limited to a planting field with a radius of 2.5 times the diameter of the root ball for nursery stock. Disturbed soils should be treated by incorporating composted organic material within the top 12 inches and other amendments as determined by a soils analysis. If fill material is used at the planting site, it should be clean fill topped with a minimum of 12 inches of organic-topsoil. Stockpiling of native top soils should not compact or damage the remaining seed bank.

Planting Times

Recommended times for planting and other practices are summarized in **Figure A:18**. Plants which are not planted within a day after delivery should be protected from desiccation through shading, watering, shielding, from wind, or other methods. Bare root stock may be heeled in. Transplanted or delivered materials may be stored in tree banks if necessary in undisturbed areas. Appendix D, **Figure D:17**, contains specifications for plant material storage.

Suggested Planting Specifications

Following are some suggested specifications for planting plans. Detail drawings may be found in Appendix D, **Figures D-16 through D-20**.

Onsite Inspection

Prior to planting, inspect planting stock. Plants not conforming to the American Standard For Nursery Stock specifications for size, form, vigor, or roots or compromised due to trunk wounds, insects, and disease should be replaced.

Seedlings/Whips

Planting small stock, such as seedlings and whips, can be done manually. For larger areas, planting machines are occasionally used, but may result initially in linear, plantation-type forests. Extreme care should be taken to ensure plant roots retain moisture. While planting seedlings and whips, use a moist carrying container to further prevent desiccation. For greater protection, plant some seedlings with tree shelters. Areas planted with seedlings or whips should be mulched after planting.

Container Grown Stock

Successful planting of container grown stock requires careful site preparation and inspection of the root system. Caution is recommended when selecting plants grown in a soils medium differing from that of the planting site. The plant should be removed from the container and the roots gently loosened. If the roots encircle the root ball or if "J"-shaped or kinked roots are present, replace the plant. After preparation of a planting field, backfill stockpiled soils. Rake soils evenly over the planting field and cover with 2 to 4 inches of mulch.

Balled and Burlapped Trees

Trees greater than 2-inch caliper are usually planted using tree spades. This is particularly useful when transplanting onsite or with local plant materials. For trees larger than 6-inch caliper, specialized equipment is recommended. Balled and burlapped trees must be handled with care while planting. Do not pick up trees by the trunk or drop them as this will tend to separate the trunk from the root ball. Prior to planting, root balls should be kept moist. Water the planting field to settle soil backfilled around trees. Rake soils evenly over the planting field and cover with 2 to 4 inches of mulch.

Soil Stabilization

For area of large-scale disturbance, stabilize soils with a non-turf-building ground cover or engineering fabric.

Protection Devices

To prevent damage to planted areas, erect fencing and post all reforestation and afforestation sites with appropriate signs (Appendix D). Construction equipment must not enter planting areas.

3.4 Maintenance and Monitoring

Newly planted trees and forest plant communities, regardless of the planting technique used, have some basic needs, primarily water and nutrients. They also need protection from competing vegetation and damaging agents such as predators, pests, and diseases. Some of these needs can be met by existing site conditions, others may require human intervention. The basic maintenance regime should be evaluated using baseline site environmental conditions, especially soil structure, nutrients, and rainfall. Understanding these factors and the specific needs of the species and size of plants used will result in a healthy forested area at the end of the maintenance period. These needs are illustrated in **Figure 3:10**.

Each Planting Plan shall include a binding minimum 2-year maintenance and monitoring agreement. This should detail how planted areas under the approved FCP will be maintained or monitored to ensure protection and satisfactory establishment, subject to inspection by the approving authority, by the end of

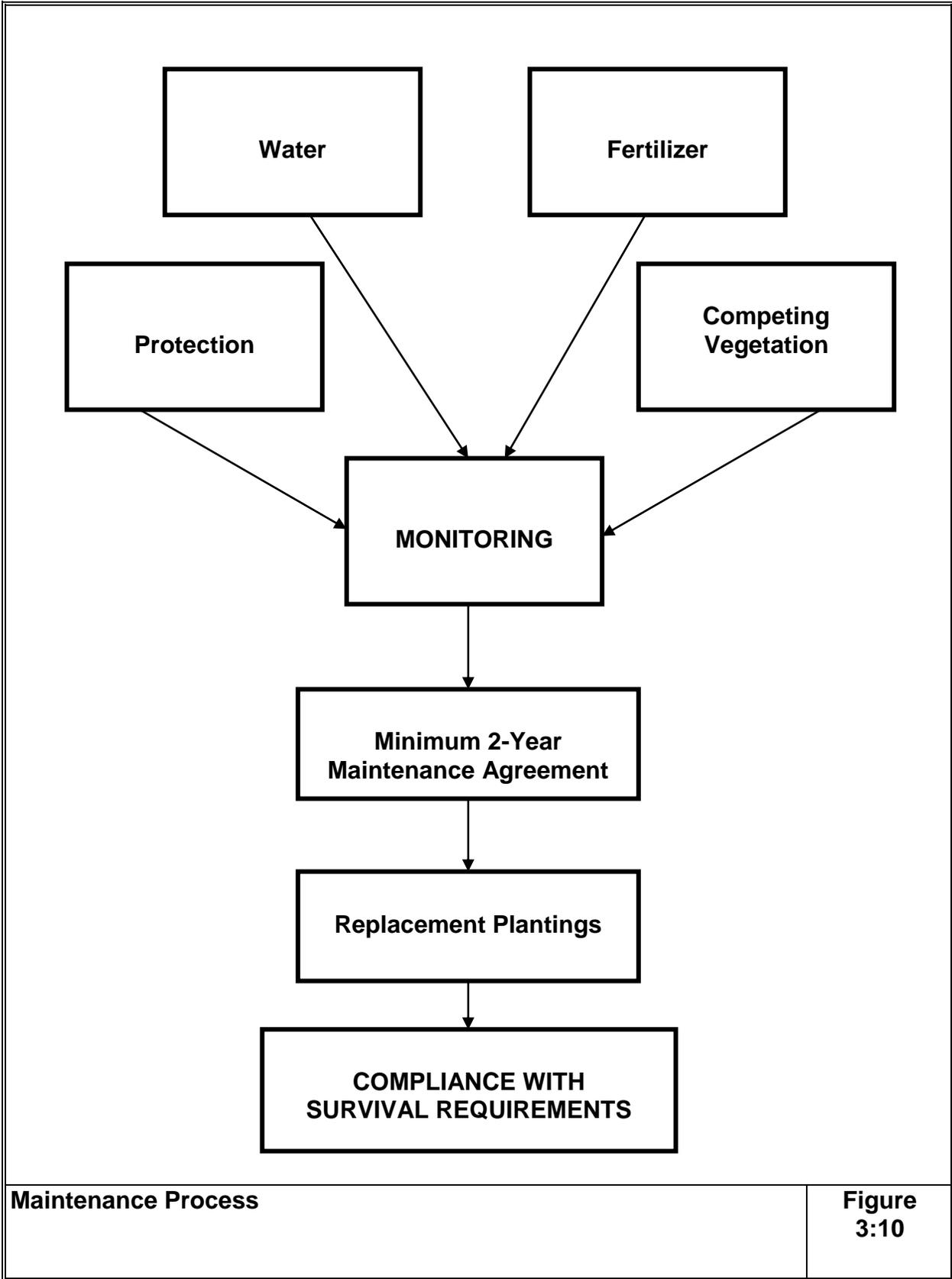
the term of the agreement.

3.4.1 Elements Required in Maintenance Agreements

Each maintenance agreement shall include:

- An **assessment** of existing conditions and needs for:
 - water
 - nutrients
 - control of competing vegetation
 - protection from disease, pests, predators and mechanical injury
 - reinforcement planting provisions if survival falls below required stocking levels, and
 - other treatments if required for specific planting techniques.
- A **plan** to conduct the needed treatments and monitor results.
- **Evidence** of legal right to implement the agreement on the selected planting site.
- **Certification** or agreement by a party responsible for care and monitoring. This certification is required for final FCP approval and shall be binding on the parties concerned. The applicant may be listed if a contractor is not listed.
- The **approving authority** as a signatory or third party beneficiary of the agreement.
- Provision for **access and inspection** by the approving authority.
- **Financial security** as approved by the approving authority.

Release of the agreement and financial security will require evidence that a long-term protection agreement (Section 3.2) is in place for the site.



Maintenance Process

Figure 3:10

3.4.2 Suggested Implementation Guidelines

This discussion suggests guidelines for assessing water, nutrients, control of competitors, pests and other needs when developing a maintenance and monitoring plan. Additional information may be found in Appendix D or references listed in Appendix E as well as by contacting professional arborists.

How Often to Water: A watering plan should compensate for inadequate local rainfall and soil moisture. Newly planted trees may need water as much as once a week for the entire growing season. During the next two years, they may require watering only a few times a year, usually more frequently during July and August. After that, trees should only need water during severe drought. Dormant bare root transplants, as opposed to balled and burlapped material, if sufficiently watered during planting, may not need water for several weeks.

Soil and Watering: Soil texture influences retention capability of soil. Soils with more clay tend to easily saturate; soils with more sand drain quickly and need to be watered more often.

If the soil is well prepared before planting with plenty of organic matter, drainage problems will be minimized. If there is restricted downward flow of water, the soil may have been compacted during construction and not aerated before planting or there may be a clay hardpan. Untreated hardpan will ultimately restrict root growth.

How to Water: Water deeply and slowly using a garden hose, a soaker hose, or drip irrigation. On larger trees start by watering the root ball thoroughly and then expand the watered area to include the whole root zone after the tree becomes established. A layer of mulch not thicker than 4 inches around newly transplanted trees insulates surface roots from drying too quickly while still providing air movement to the roots.

What Nutrients to Apply? Three major nutrients, nitrogen, phosphorus, and potassium, and a host of other minor ones (or micronutrients), such as calcium, magnesium and iron are critical for plant growth. In most undisturbed soils, the micronutrients are abundantly available. If the soil is very acidic or basic, these may not be available to the plant and soil pH should be adjusted. Of the major nutrients, nitrogen is usually most needed. Nothing should be added to the soil without testing first.

When to Fertilize: Do not add nitrogen within the first growing season after planting. Too much nitrogen may cause a spurt of canopy growth for which the roots cannot supply enough water. It is best to wait until after the end of the first growing season and apply either in the early fall or early spring.

What Type of Fertilizer? Fertilizers are numbered by the relative amounts of nitrogen, phosphorus, and potassium available for release. A 12-6-4 fertilizer has 12 parts nitrogen (N), 6 parts phosphorous (P), and 4 parts potassium (K). The nitrogen may consist of several forms, such as nitrates or ammonium, and its form will affect release rates and amounts. Slow release fertilizers, especially organic fertilizers, often minimize effects on adjacent systems where fertilizer is not desired.

Control of Competing Vegetation

In some cases, unwanted vegetation, especially exotic vines and shrubs, growing near newly planted trees can take over the site. The extent to which this problem is controlled depends on the ability of the desired plant material to compete for available sun, soil moisture, and nutrients. More control is usually required for smaller trees, although some shade tolerant species survive among the overgrowth and subsequently shade it out when they reach a greater height. As a preventive measure, consider the potential for growth of invasive species (Appendix F) when choosing a reforestation or afforestation area.

Mulch is one of the best deterrents to competitors gaining a foothold. Spread a 2- to 4-inch layer of mulch over the root area of the newly planted tree avoiding direct contact with the trunk, a prime spot for fungal growth. Mulch helps maintain soil moisture levels and provides a buffers from construction and mowing equipment.

Mechanical removal or topping of competing plants, such as mowing, may be desirable. The frequency and timing of removal will affect the composition of the plant community. Controlling competing vegetation with herbicides should be carefully assessed so that effects on desirable plants, including those that self-seed or colonize the site, soils, and surface waters are carefully monitored and minimized.

Protection: Pests, Diseases, and Mechanical Injury

An Integrated Pest Management (IPM) program is one of the most effective and safe approaches for maintaining a healthy forest. IPM's include proper species selection for the site, effective pruning, mulching and fertilizing, regular monitoring, and proper timing of necessary sprays. Good cultural practices will minimize the amount of spraying. Professional IPM programs have reduced pesticide use by 90%. An IPM program may include:

- Elimination of some low vegetation before planting. This will help control the rodent population which thrives in brushy environments.
- Use of tree shelters to protect the trunks of seedlings or whips from animal damage. The shelters act as mini-greenhouses to speed growth. These trees need more water than those planted without tree shelters. Tree shelters require monitoring and timely removal to ensure wildlife impacts are minimized. Wildlife impact (e.g. bird kill) may be minimized with mesh tops.
- Mulching around trees to minimize trunk damage from mowers. Wounds provide an entry point for pests.
- Pruning dead and diseased branches cleanly to prevent spreading of disease.

Sunscald is a problem common to thin-barked young trees. Nursery tree wrap is used for protection, but eventual insect infestation and disease is likely. An alternative is to allow small noncompetitive branches, commonly pruned, to grow along the sunny side of the trunk to help shade the trunk.

Newly planted trees usually do not have the structural roots to provide adequate support during high winds. If stakes and guys wires are used in high wind prone areas, they should be removed after one growing season or damage to the tree may result as it grows larger.

3.4.3 Special Planting Site Suggestions

Certain areas, especially priority planting areas such as stream buffers, floodplains, and steep slopes may require precautions before planting or during the term of the maintenance and monitoring agreement.

Stream Buffers

Borders of streams and other waterways may have been damaged before planting and may need restoration before planting can be successful. When work is performed in a riparian zone:

- Check for streambank erosion problems;
- Minimize or eliminate herbicide or pesticide applications;
- Maintain an undisturbed ground or leaf layer and understory; and
- Eliminate invasive exotic species.

Steep Slopes

Planting will stabilize steep slopes. However, until roots become established, erosion problems may persist. Monitoring soil stability is important to the survival of the trees and to water quality in adjacent surface waters.

3.4.4 Reinforcement Planting Provisions

If survival requirements are not met, the applicant must establish reinforcement plantings on the planting site prior to the release of the maintenance agreement, but not later than one complete growing season prior to the release of the maintenance agreement.

3.5 Enforcement of Forest Conservation Plans

FCP's approved by the City of Annapolis under the City's Forest Conservation Program are enforced according to regulations adopted by the City of Annapolis and outlined in 21.71.180 of the City Code.

3.5.1 Inspections

The City of Annapolis conducts field inspections of a site that is subject to a FCP. The timing of inspections shall be referenced in the construction sequence and planting plan included in the FCP. Inspections may be conducted to ensure compliance with sediment and erosion control regulations. Violations may result in penalties as outlined in the City Code.

3.5.2 Penalties for Violation

Revocation of an Approved FCP

The City of Annapolis may revoke an approved FCP for cause, including violation of conditions of the plan, obtaining a plan approval by misrepresentation, failing to disclose a relevant or material fact, or change in conditions.

Stop Work Order

The City of Annapolis may issue a stop work order against an applicant who violates any provision of an approved FCP. The stop work order may remain in effect until the violation ceases and corrective action to restore or reforest the area takes place.

Noncompliance Fees

An applicant that is found to be in noncompliance with an approved FCP may be assessed a penalty by the City of Annapolis.

Violation of FCP

An applicant who violates the provisions of an approved FCP is liable for a penalty for each day a violation continues.

3.5.3 Amending a FCP

After the FCP has been reviewed and approved, the applicant may request to amend it by submitting the amended plan to the Department of Planning and Zoning for review and approval. If grading, clearing, or other activities not approved by the approved FCP are conducted before the amended plan is approved, the applicant will be considered in violation.

Chapter 4

Linear Projects

Contents:

- 4.0 Introduction**
- 4.1 Linear Projects**
 - 4.1.1 Forest Stand Delineation Requirements**
 - 4.1.2 Forest Conservation Plan Requirements**
 - 4.1.3 Selective Clearing and Supplemental Planting**

4.0 Introduction

Some types of projects may require alternative procedures from those which have been described in Chapters 2 and 3. Following is a brief discussion of alternatives and conditions under which these may be used.

4.1 Linear Projects

These are projects whose configuration is elongated with nearly parallel sides and used to transport a utility product or public service not otherwise contained in an application for subdivision, such as electricity, gas, water, sewer, communications, trains, and vehicles. Such projects may traverse fee simple properties through defined boundaries or through easement rights.

Examples of linear projects include a public sewer line installation, some overhead electric transmission line installations, or a local transit line for rail service. However, when the proposed development also includes locations for stations, parking lots, or other uses with a relatively polygonal layout, the alternative procedures will apply to the linear portion only. In this case, the project will be divided into the two types and the relevant procedures applied accordingly.

A linear project which disturbs less than 40,000 square feet of forest is exempt with the same conditions for exemption as a single existing lot. Applicants are advised to verify specific program standards for any project.

4.1.1 Forest Stand Delineation Requirements

Simplified Forest Stand Delineations may be submitted for approval on linear projects to determine if sufficient forested area is proposed for disturbance to require submission of a Forest Conservation Plan. In addition, Simplified Forest Stand Delineations may be submitted when:

- The proposed disturbance area is less than 40 feet wide and 120,000 square feet in area and no priority forest or priority retention areas are disturbed, or
- Alternative routes are being considered in studies to support an application for a Certificate for Public Convenience and Necessity.

A Forest Stand Delineation shall be submitted on a minimum project area extending 100 feet from the right-of-way centerline or 50 feet outside the proposed limit of disturbance if the right-of-way is wider than 100 feet.

4.1.2 Forest Conservation Plan Requirements

The net tract area shall be calculated using the area of the right-of-way, new access roads and storage,

the limits of disturbance as shown on an application for sediment and erosion control approval, or as shown in an approved capital improvements program project description.

Linear projects, such as overhead utilities above an agricultural area, which do not result in a change of land use or land disturbing activities do not require afforestation. However, any forest cleared for construction or maintenance shall be cleared in conformance with Best Management Practices and protection measures as approved in a Forest Conservation Plan.

Forest conservation thresholds for linear projects shall conform to the thresholds specified for institutional uses.

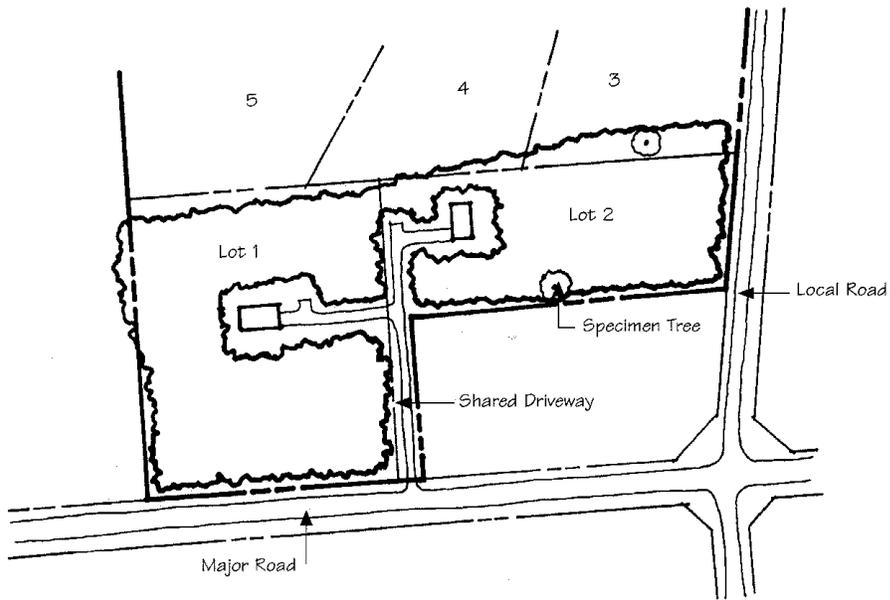
4.1.3 Selective Clearing and Supplemental Planting

This technique for planting may be proposed after all priority areas have been retained or the applicant has satisfactorily demonstrated that these areas cannot be left undisturbed. The following criteria shall apply:

- The Forest Conservation Plan includes a long-term protection agreement which may consist of a long-term management plan approved by the approving authority for all Forest Retention Areas.
- The Planting Plan includes measures for long-term management based on approved Best Management Practices and minimization of further forest disturbances; and,
 - for overhead utilities, the height of existing trees exceeds that allowable for safety during construction or during long-term management; or,
 - for underground utilities, plant surface roots are not disturbed within the Forest Retention Area by using tunneling or other methods.

APPENDIX A

Illustrations



Notes:

1. Site plans can be designed to minimize the total acreage of disturbed forests.
2. Clearing for homes on forested lots should be limited to the area needed for home construction and grading, particularly where priority forests are involved.
3. Shared driveways can be used to limit forest clearing.
4. Forest clearing and/or retention on sewage reserve areas must meet local and state health code regulations. The maximum area need not be cleared immediately.

Source: UMCP

Site Clearing

**Figure
A:1**



North

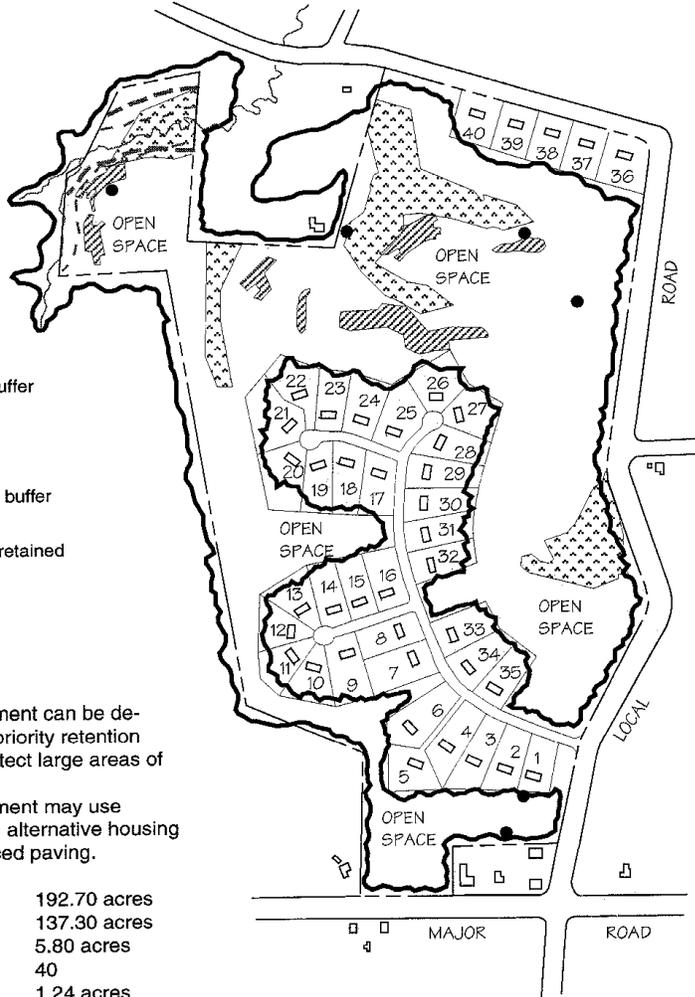
Legend

-  Stream with buffer and floodplain
-  Steep slopes
-  Wetlands with buffer
-  Forests to be retained

Notes

1. Cluster development can be designed to avoid priority retention areas and to protect large areas of forests.
2. Cluster development may use smaller lot sizes, alternative housing types, and reduced paving.

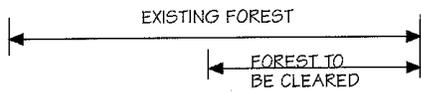
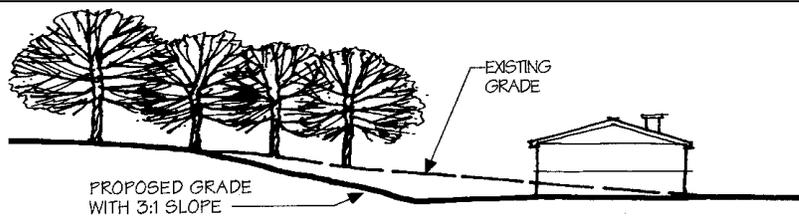
Total Tract Area	192.70 acres
Area in Open Space	137.30 acres
Area in roads	5.80 acres
Number of Lots	40
Average Lot Size	1.24 acres



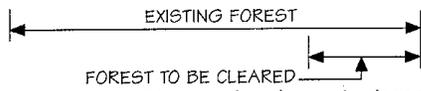
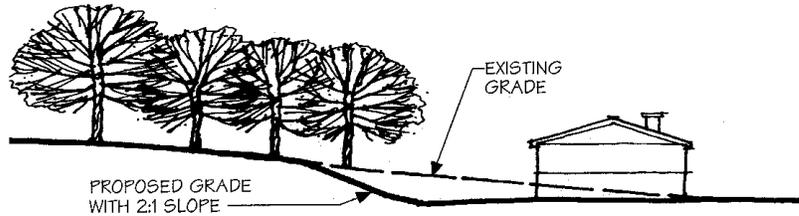
Source: UMCP

Cluster Development Plan

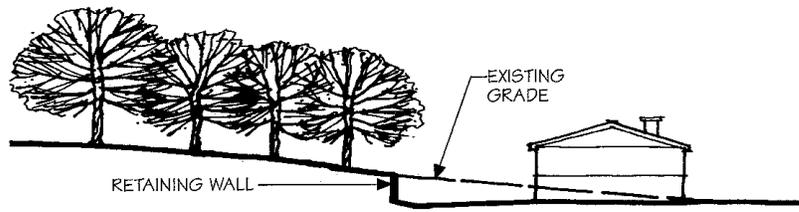
Figure A:2



Site grading may result in unnecessary loss of forests.



It may be possible to seek variances to slope requirements so that forest retention areas can be increased.

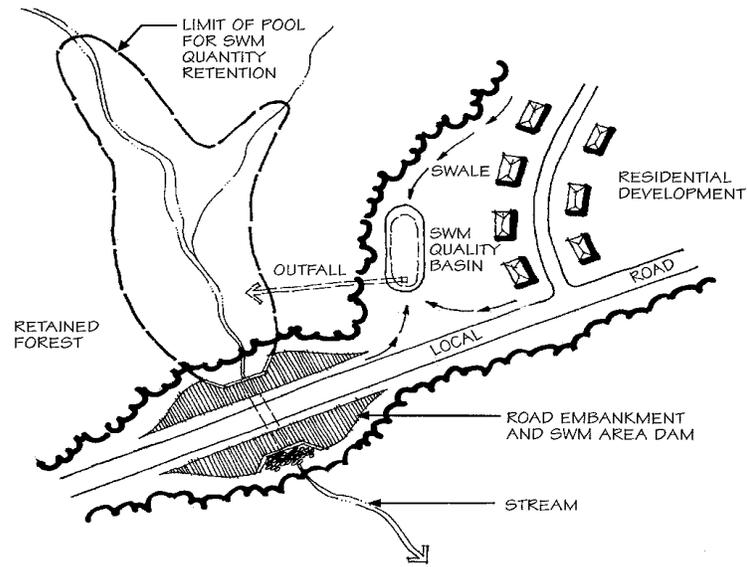


Consider utilizing retaining walls so that forest retention areas can be increased.

Source: UMCP

Grading

**Figure
A:3**



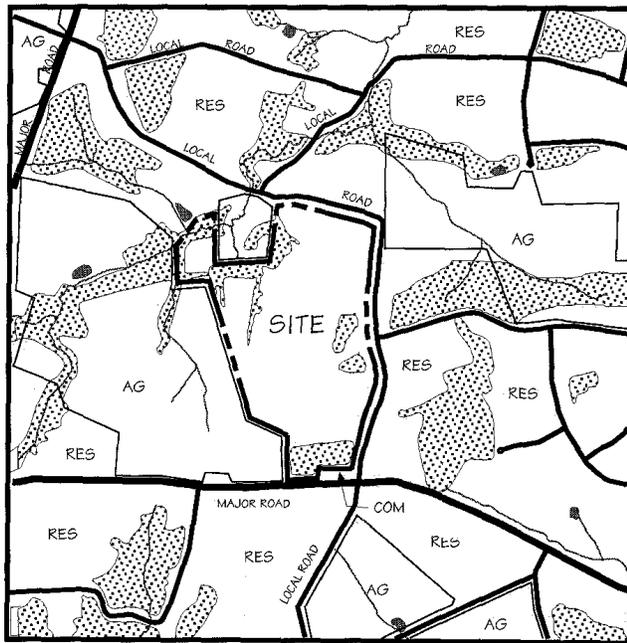
Notes

1. Stormwater management areas can be designed to minimize forest clearing and to incorporate the natural filtering capacities of forests and wetlands into the design.
2. The stormwater quality management basin is designed to remove silt, sediment, and other pollutants prior to discharge of runoff into the forested stormwater quantity management area.
3. Stormwater is detained in the forested area for a brief period of time prior to being released downstream. Floodplains and palustrine forest wetlands may tolerate inundation (extended detention) for up to 24 hours.

Source: UMCP

Stormwater Management

**Figure
A:4**



Legend

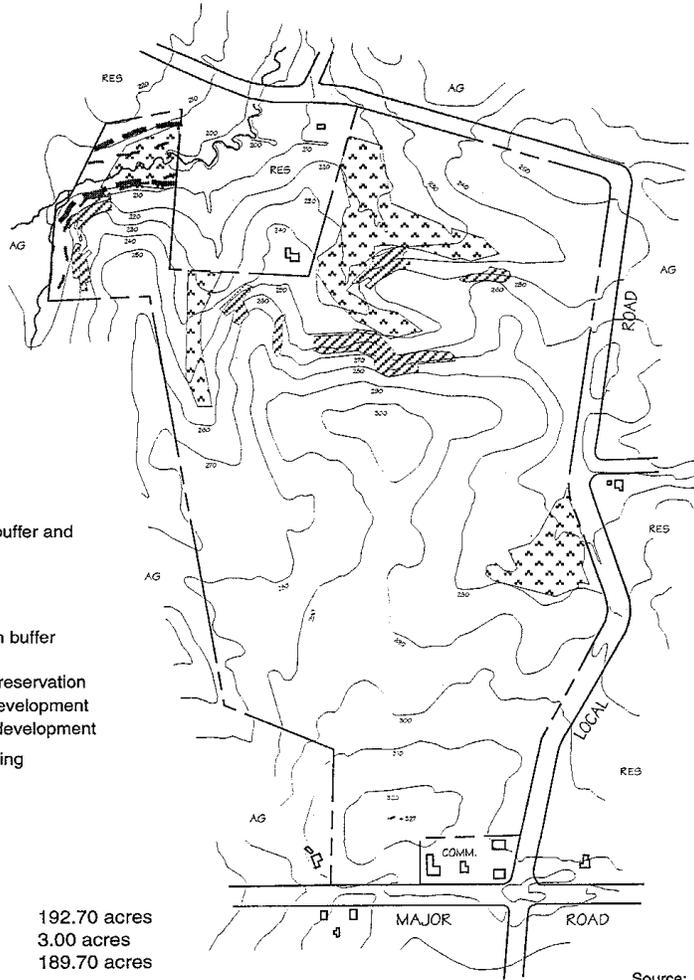
-  Forests
-  Streams and Pond
-  Agricultural Land Use
-  Residential Land Use
-  Commercial Development



Source: UMCP

Site Vicinity Map

**Figure
A:5**



Legend

-  Stream with buffer and floodplain
-  Steep slopes
-  Wetlands with buffer
- AG Agricultural preservation
- RES Residential development
- COMM Commercial development
-  Existing building

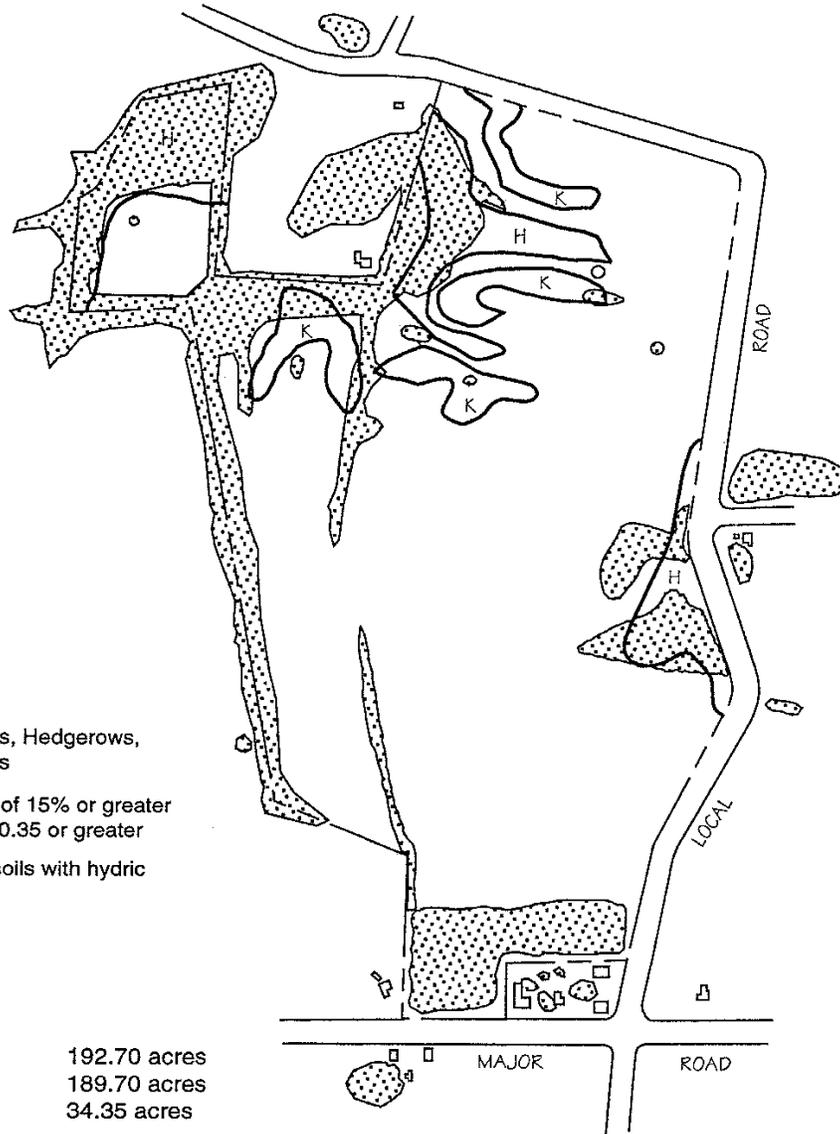
Notes

Total Tract Area	192.70 acres
Flood Plain Area	3.00 acres
Net Tract Area	189.70 acres

Source: UMCP

Preliminary Environmental Features Map

Figure A:6



Legend

-  Existing Forests, Hedgerows, and tree clusters
-  Soils on slopes of 15% or greater with K factor of 0.35 or greater
-  Hydric soils or soils with hydric inclusions

Notes

Total Tract Area	192.70 acres
Net Tract Area	189.70 acres
Existing Forests (in Net Tract Area)	34.35 acres

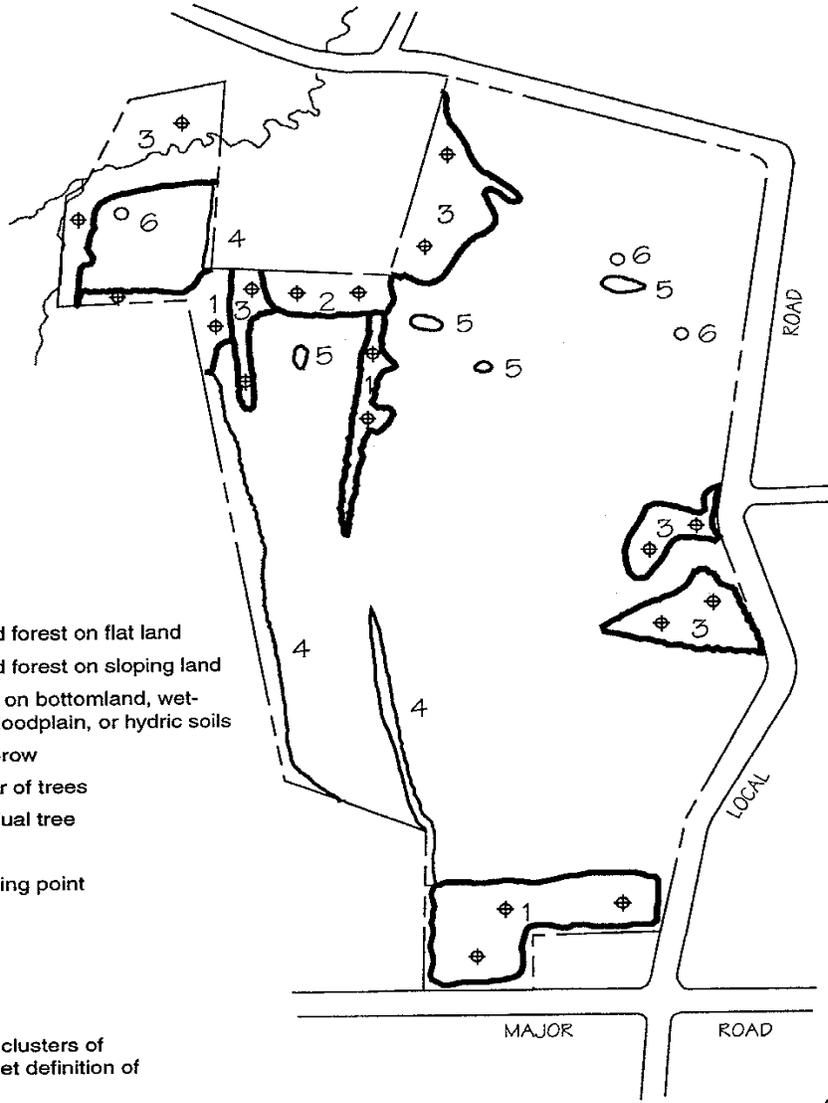
Source: UMCP

Soils and Vegetative Cover Map

**Figure
A:7**



North



Legend

- 1 Upland forest on flat land
- 2 Upland forest on sloping land
- 3 Forest on bottomland, wetland, floodplain, or hydric soils
- 4 Hedgerow
- 5 Cluster of trees
- 6 Individual tree

 Sampling point

Notes

Hedgerows and clusters of trees do not meet definition of forest.

Source: UMCP

Preliminary FSD Map with Sampling Locations

Figure A:8



North

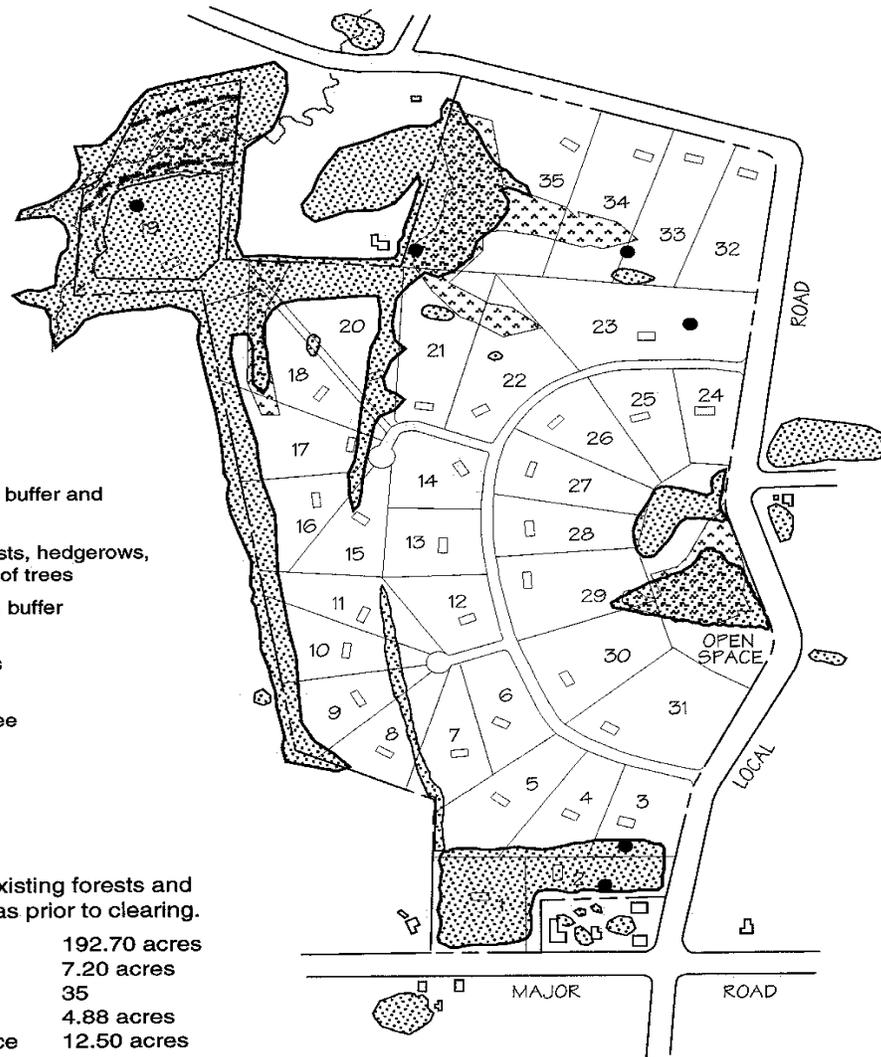
Legend

-  Stream with buffer and floodplain
-  Existing forests, hedgerows, and clusters of trees
-  Wetland with buffer
-  Steep slopes
-  Specimen tree

Notes

Site Plan Shows existing forests and environmental areas prior to clearing.

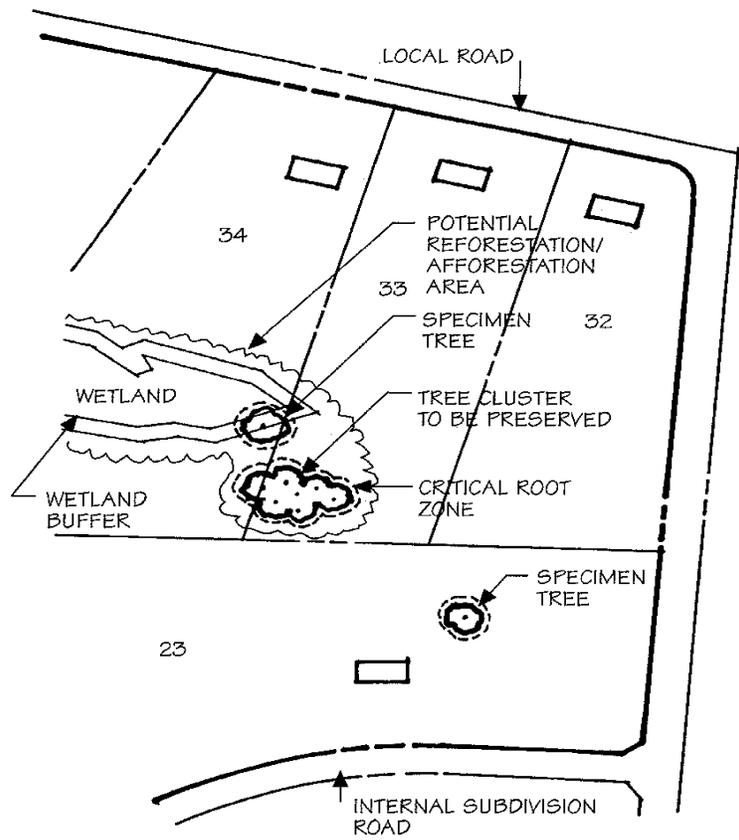
Total Tract Area	192.70 acres
Area in Roads	7.20 acres
Number of Lots	35
Average Lot Size	4.88 acres
Area in Open Space	12.50 acres



Source: UMCP

Site Development Plan before FCP

Figure A:9



Notes:

1. Retained trees, shrubs, or plants may be incorporated into afforestation or reforestation plans.
2. If recommended in an approved FSD, some trees may be designated for retention if : all priority areas have been retained and protected; a minimum 10,000 square foot retention area is specified; and, all Critical Root Zone is included.

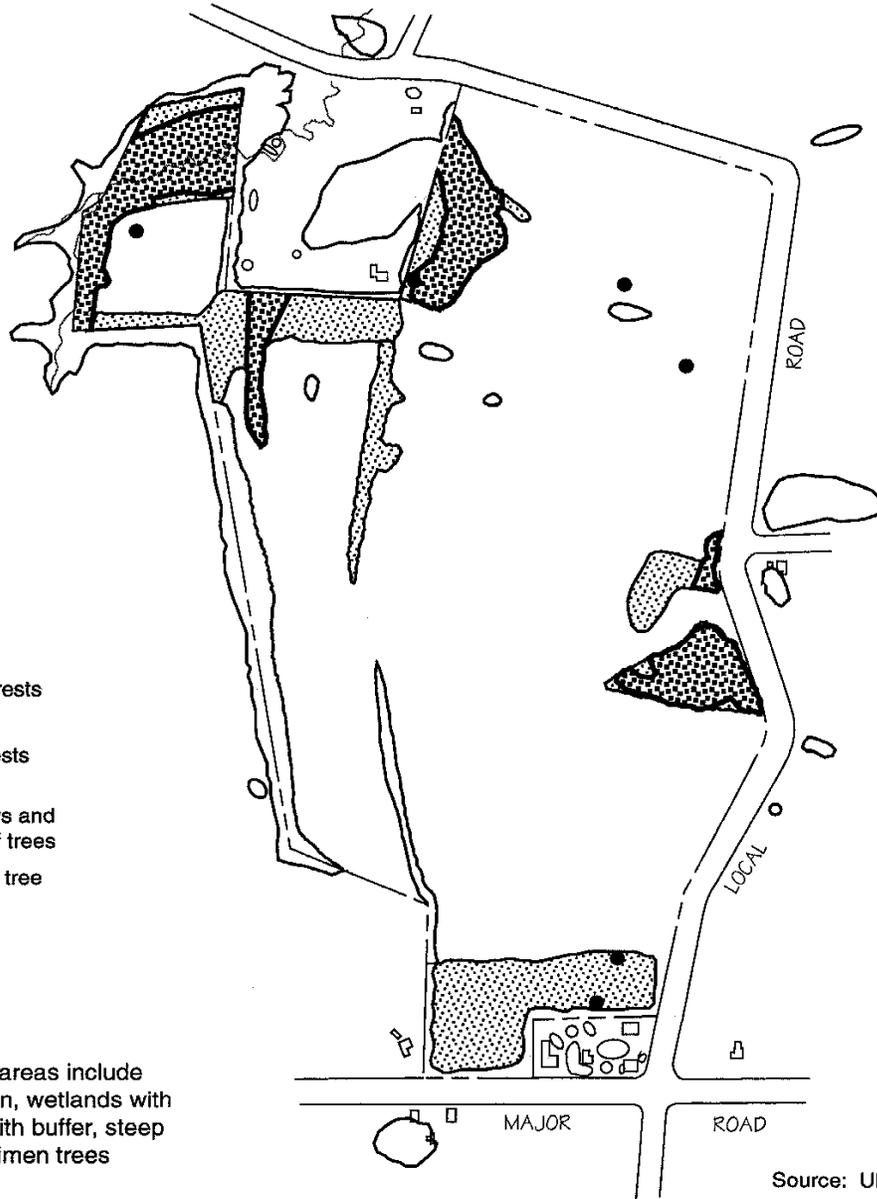
Source: UMCP

Retention Area

**Figure
A:10**



North



Legend

-  Priority forests
-  Other forests
-  Hedgerows and clusters of trees
-  Specimen tree

Notes

Priority retention areas include forested floodplain, wetlands with buffer, streams with buffer, steep slopes, and specimen trees

Source: UMCP

Priority Area Map

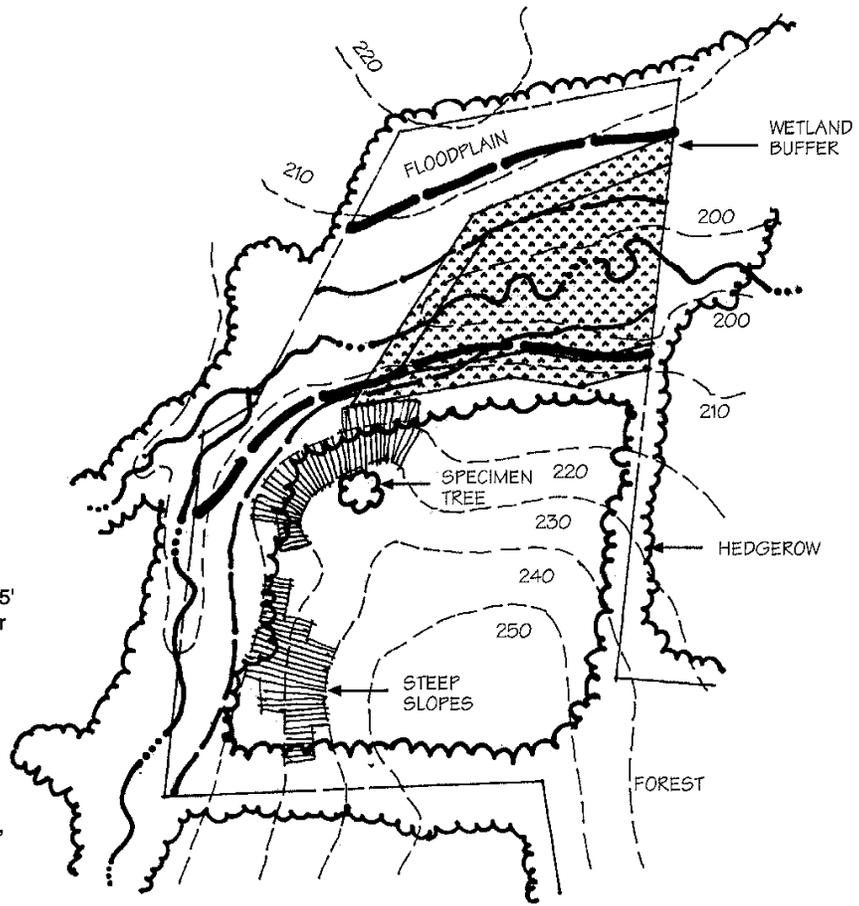
Figure A:11



North

Legend

-  Wetland with 25' minimum buffer
-  Steep Slope
-  Existing forest
-  Stream
-  Minimum 100' stream buffer
-  Floodplain



Notes

Forested steep slopes and nontidal wetlands are priority retention outside the floodplain.

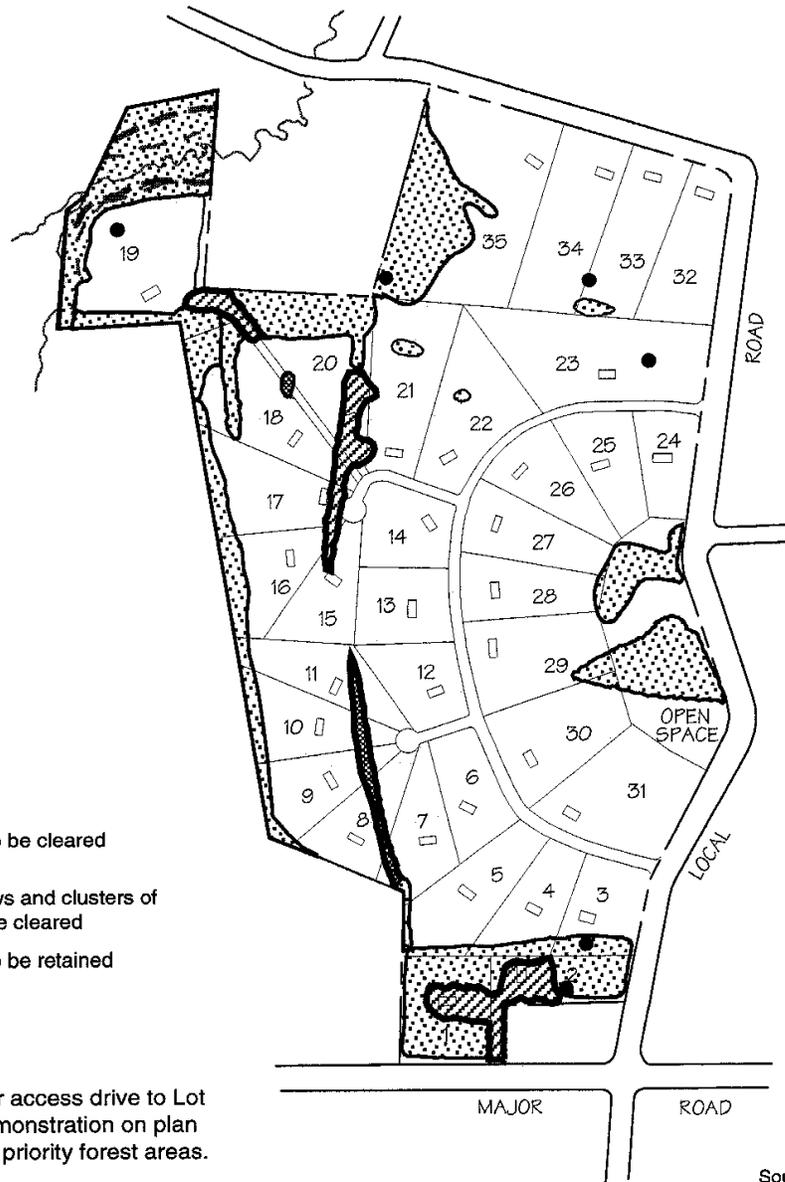
Source: UMCP

Closeup of Priority Areas

Figure A:12

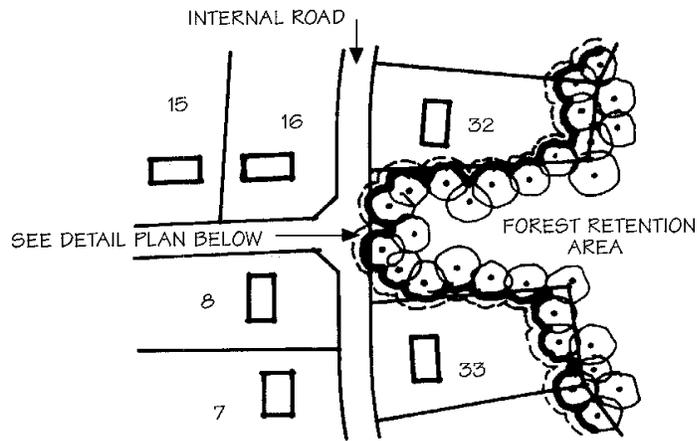


North

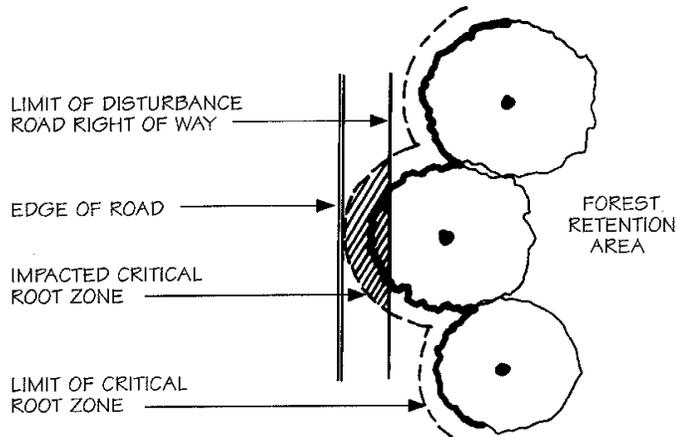


Forest Retention Map

Figure A:13



SITE PLAN



DETAIL PLAN

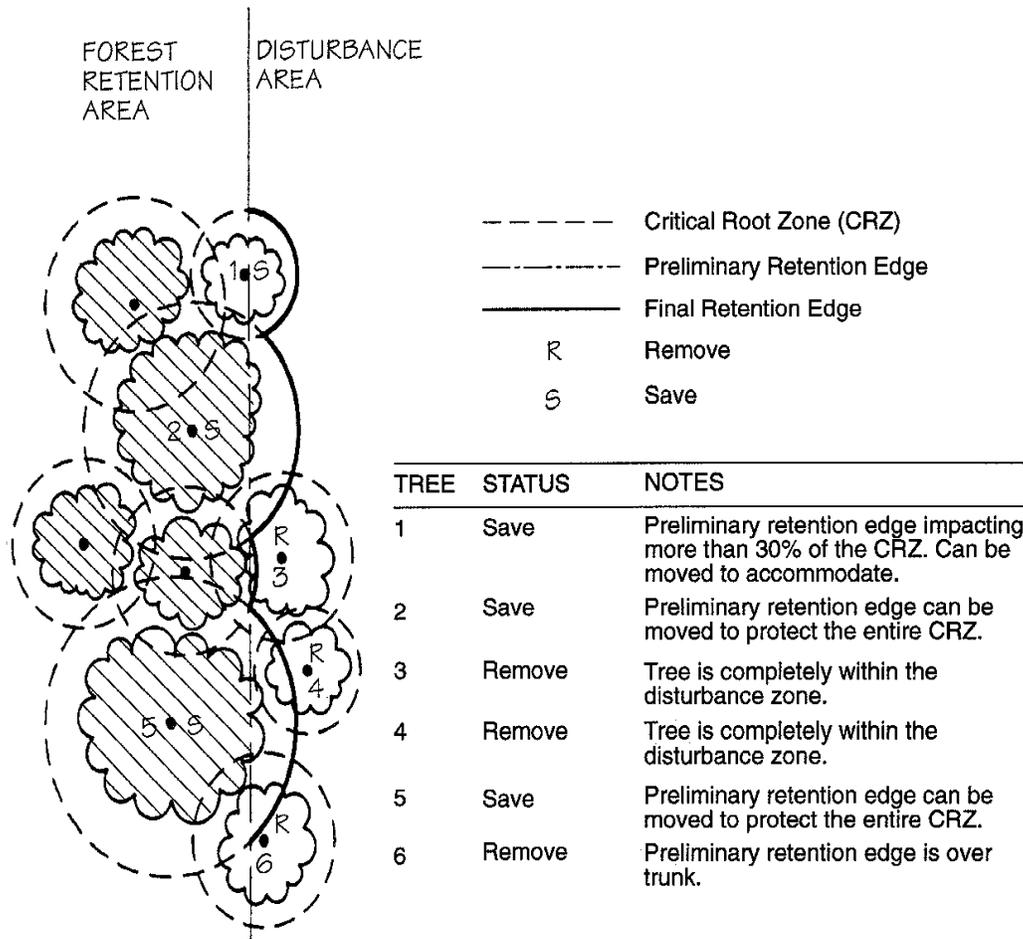
Notes:

1. Critical Root Zones in Retention Areas which are proposed for disturbance must be shown on the Forest Conservation Plan.
2. Pruning, tunneling, aeration systems and other protection mechanisms should be considered to ensure long term survival of retained trees.
3. See Appendix for tree protection devices to be used when retained trees are affected by development or construction activities.

Source: UMCP

Critical Root Zone Disturbance

Figure
A:14

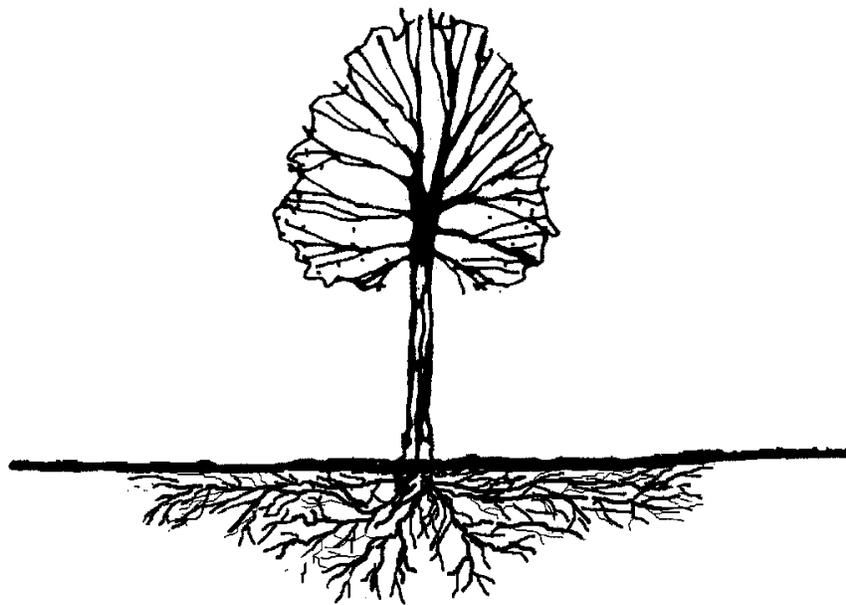


Staking Retention Edges in the field requires tree-by-tree decisions. The above example demonstrates the use of Critical Root Zone, but tree health and tree species must also be considered when laying out a final retention line.

Source: Prince George's County
Woodland Conservation Manual

Field Edge Determination

**Figure
A:15**



PREVENT THE FOLLOWING IMPACTS:

CROWN

- Broken or damaged limbs
- Wounds to bark
- Disease/insect infestation
- Upper crown dieback

TRUNK

- Sun scald
- Wounds to bark
- Disease/insect infestation
- Wind-throw

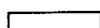
CRITICAL ROOT ZONE

- Tearing/removal/crushing/burial
- Soil compaction
- Flooding
- Dessication
- Toxins
- Changes in soil pH
- Removal of understory

Source: Adapted from Forest Conservation Manual, 1991

Size	Number Required Per Acre	Approximate Spacing feet on center	Survivability Requirement	
			At the end of the second growing season	
Bare Root Seedlings or whips	700	8 x 8	55%	385
Bare Root Whips Container grown seedling tubes (minimum cavity width 1.5")	450	10 x 10	65%	290
Container Grown 1, 2, 3 Gallon	350	12 x 12	75%	260
Container Grown 5, 7 Gallon or 1" Caliper B & B	200	15 x 15	85%	170
Container Grown 15, 25 Gallon or 1.5 - 2" Caliper B & B	100	20 x 20	100%	100
<p>Notes:</p> <ol style="list-style-type: none"> 1. These stocking and survival requirements are the minimum numbers estimated to meet the definition of forest from bare land. 2. In certain circumstances, any combination of the above mentioned stocking options, dry seeding, tree shelters, transplants, and/or natural regeneration may be appropriate strategies to fulfill the requirements of an approved FCD. They will be evaluated on a case-by-case basis by the approving authority. 3. Spacing does not imply that trees or shrubs must be planted in a grid pattern. 				
Site Stocking				Figure A:17

Tasks	Months											
	Jan ⁺	Feb ⁺	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov ⁺	Dec ⁺
Transplant of 2" DBH or Greater	[Recommended with Additional Care]					[Recommended]						
Planting Seedlings, Whips	[Recommended]					[Recommended]						
Minimum Monitoring			*				*				*	
Fertilizer (If Needed) ⁺						[Recommended]				[Recommended]		
Water ⁺⁺						[Recommended]						
Pruning	[Recommended]				[Recommended]					[Recommended]		

-  Recommended, Optimal time
-  Recommended with Additional Care
-  Recommended
- ⁺ Dependent Upon Site Conditions
- ⁺⁺ Dependent Upon Site Conditions: Weekly Watering is Strongly Recommended From May Through October Unless Weekly Rainfall Equals 1"

Notes:

1. Activities during November through February depend on ground conditions.
2. No fall planting of oaks and pines.
3. The planting and care of trees is most successful when coordinated with the local conditions. This calendar summarizes some of the recommended time frames for basic reforestation and stress reduction activities.

Source: Adapted from Forest Conservation Manual, 1991

Tree Planting and Maintenance Calendar

Figure A:18

APPENDIX B

Glossary of Terms

Act - the Forest Conservation Act, Natural Resources Article, 5-1601 et seq., Annotated Code of Maryland.

Afforestation - the establishment of tree cover on an area from which forest cover has been absent for a long period of time or the planting on open areas on which there is no existing forest cover.

Agricultural Activity - farming activities including plowing, tillage, cropping, installation of best management practices, seeding, cultivating, and harvesting for production of food and fiber products (except commercial logging and timber harvesting operations), the grazing and raising of livestock, aquaculture, sod production, orchards, Christmas tree plantations, nursery, and other products cultivated as part of a recognized commercial enterprise.

Agricultural and Resource Areas – undeveloped areas zoned for densities of less than or equal to one dwelling unit per five acres.

Applicant - a person who has lawfully submitted an application for approval of a planned development, special exception, subdivision site design plan, or project plan, or a grading or sediment control permit, or who has submitted a forest stand delineation for review, a preliminary forest conservation plan for review, or a final forest conservation plan for approval for a tract of land that, in its existing or redeveloped state, is forty thousand square feet or greater or who has received approval of a forest stand delineation or forest conservation plan.

Approved forest management plan - a document:

1. Approved by the department of natural resources forester assigned to the city; and
2. Which operates as a protective agreement for forest conservation as described in the Natural Resources Article, §§ 5-1607(e)—(f), Annotated Code of Maryland.

Basal Area - the total cross sectional area of trees per unit area. May be measured using a plotless method such as a basal area factor prism, or may be calculated from the DBH of all trees within a plot.

Caliper - diameter measured at two inches above the root collar.

Champion Tree - the largest tree of its species within the United States, the State, County, or City as applicable.

Codominant Trees - trees with crowns forming the general level of the crown cover and receiving full sunlight from above but little from the sides; trees with medium-sized crowns.

COMAR - the Maryland Code of Regulations.

Commercial and industrial uses - manufacturing operations, office complexes, shopping centers, and other similar uses and their associated storage areas, yarding and parking areas, more specifically described and delineated in City Code Section 21.48.020, Table of Uses.

Commercial Logging or Timber Harvesting - the cutting and removing of tree stems from a site for

commercial purposes, leaving the root mass intact.

Conservation Threshold – the point at which the reforestation requirement changes from a ratio of one acre planted for every one acre removed above the threshold to 2 acres planted for every one acre removed below the threshold, as determined by the land use category-

Contiguous Forest - a forest of twenty acres or more that connects the largest undeveloped or most vegetated tracts of land within, and adjacent to, a site.

Critical Habitat for Endangered Species - a habitat occupied by an endangered species as determined or listed under Section 4-2A-04 or Section 10-2A-04, Natural Resources Article, Annotated Code of Maryland.

Critical Habitat Area - a critical habitat for endangered species and its surrounding protection area. A critical habitat area shall (1) be likely to contribute to the long-term survival of the species, (2) be likely to be occupied by the species for the foreseeable future, and (3) constitute habitat of the species which is considered critical under Natural Resources Article, §§ 4-2a and 10-2a-04, Annotated Code of Maryland.

Critical habitat for endangered species - a habitat occupied by an endangered species as determined or listed under Natural Resources Article, §§ 4-2a-04 and 10-2a-04, Annotated Code of Maryland.

Critical Root Zone - a circular region measured outward from a tree trunk representing the area of the roots that must be maintained or protected for the tree's survival. For the purpose of this manual, critical root zone is one foot of radial distance for every inch of tree diameter (DBH) measured at 4.5 feet above the ground, with a minimum radius of 8 feet. For specimen trees the critical root zone shall be 1.5 feet for every inch of tree diameter.

Cultural Features - human structures, such as roads or buildings, that are within view of the proposed land use change and which affect site planning.

DBH or diameter at breast height - a tree diameter measured at four and one-half feet above the ground.

Declaration of intent:

1. A signed and notarized statement by a landowner or the landowner's agent certifying that the activity on the landowner's property:
 - i. Is for certain activities exempted under the Annapolis City Code or Natural Resources Article, §§ 5-103 and 5-1601—5-1612, Annotated Code of Maryland,
 - ii. Does not circumvent the requirements of the Annapolis City Code or Natural Resources Article, §§ 5-103 and 5-1601—5-1612, Annotated Code of Maryland, and
 - iii. Does not conflict with the purposes of any other declaration of intent; or
2. The document required under COMAR 08.19.01.05 or this chapter.

Department -. the City Department of Planning and Zoning.

Development plan - a drawing or drawings which delineate a planned development, special exception, subdivision, site design plan, or project plan, or a grading or sediment control permit for a tract of land that, in its existing or redeveloped state, is forty thousand square feet or greater.

Development project.

1. "Development project" means the grading or construction activities occurring on a specific tract that is forty thousand square feet or greater.
2. "Development project" includes redevelopment.

Development project completion - for the purposes of afforestation, reforestation:

1. The release of the development bond, if required;
2. Acceptance of the project's streets, utilities, and public services by the Department; or
3. Designation in writing by the Department or State that a:
 - i. Development project has been completed, or
 - ii. Particular stage of a staged development project, including a planned unit development, has been completed.

Dominant Trees - trees with crowns extending above the general level of the crown cover and receiving full sunlight from above and partly from the side; larger than the average trees in the stand.

Environment Article - the Environment Article of the Annotated Code of Maryland, as amended from time to time.

Ephemeral stream - a stream that flows only in direct response to precipitation in the immediate watershed or in response to the melting of a cover of snow or ice, and which has a channel bottom that is always above the local water table.

Erodible Soils - Soils with a K value of .35 or greater on slopes of 15 percent or greater.

Extenuating Circumstances - conditions requiring extension of a set time limit to process an application, render a decision, or conduct a public hearing.

Forest.

1. "Forest" means a biological community dominated by trees and other woody plants covering a land area of ten thousand square feet or greater.
2. "Forest" includes:
 - i. Areas that have at least one hundred live trees per acre with at least fifty percent of those trees having a two-inch or greater diameter at four and one-half feet above the ground and larger; and
 - ii. Areas that have been cut but not cleared.
3. "Forest" does not include orchards

Forest Conservation - the retention of existing forest or the creation of new forest at the levels prescribed by the Department.

Forest conservation and management agreement - an agreement as stated in Tax-Property Article, § 8-211, Annotated Code of Maryland.

Forest Conservation Plan - a plan approved pursuant to sections 21.71.070, 21.71.080, 21.71.090 and 21.71.100 of this chapter.

Forest Conservation Technical Manual - the City technical manual, incorporated by reference herein, used to establish standards of performance required in preparing forest stand delineations and forest conservation plans.

Forest Cover - the area of a site meeting the definition of forest.

Forest management plan - a plan establishing best conservation and management practices for a landowner in assessment of the resource values of forested property.

Forest mitigation bank - an area of land which has been intentionally afforested or reforested for the express purpose of providing credits for reforestation requirements.

Forest mitigation bank agreement - an agreement entered into by an individual owning a forest mitigation bank and the department or local government which commits the banker to certain procedures and requirements when creating and operating the forest mitigation bank.

Forest mitigation bank plan - a plan submitted for approval of a forest mitigation bank to the Department, or to a local government with an approved local program, by an individual proposing to establish a forest mitigation bank.

Forested Slopes - an area meeting the definition of forest and growing on an area with a slope of 25% or more.

Forest Product - any wood fiber product extracted from a forest which can be sold on the commercial market.

Forest Stand - a contiguous group of trees sufficiently uniform in species composition, arrangement of age classes, and condition to be a distinguishable, homogeneous unit.

Forest Stand Delineation - the methodology for evaluating the existing vegetation on a site proposed for development, as provided in the Forest Conservation Technical Manual.

Forest Stewardship Plan - a plan establishing best conservation and management practices for a landowner in assessment of the resource values of forested property.

Forest Structure - a description of vertical and horizontal structural composition or diversity within a stand.

Growing Season - the period of consecutive frost-free days as stated in the Current Soil Survey for this country .published by the National Cooperative Soil Survey Program, 16 U.S.C. § 590(a)—(f).

High Density Residential Areas – areas zoned for densities greater than one dwelling unit per acre, including both existing and planned development and their associated infrastructure, such as roads, utilities, and water and sewer service as all residential zones in the Annapolis City Code, Chapter 21.40.

Historic site or historic structure - any site or structure that is:

1. Individually listed in the National Register of Historic Places (a listing maintained by the U.S. Department of the Interior) or preliminarily determined by the Secretary of the Interior as meeting the requirements for individual listings on the National Register;
2. Certified or preliminarily determined by the Secretary of the Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined by the secretary to qualify as a registered historic district;
3. Individually listed on the Maryland Register of Historic Places; or
4. Individually listed on the inventory of historic places maintained by the City of Annapolis whose historic preservation program has been certified by the Maryland Historic Trust or the Secretary of the Interior.

Hydric Soils - soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper layer of soil.

Institutional Development Area – areas zoned to allow the inclusion of schools, colleges, and universities, military installations, transportation facilities, utility and sewer projects, government offices and facilities, golf courses, recreation areas, parks, and cemeteries as is applied in the Annapolis City Code.

Intermittent Stream - a stream in which surface water is absent during a part of the year as shown on the most recent seven and one-half minute topographic quadrangle published by the United States Geological Survey or as defined in COMAR 26.23.01.01 and confirmed by field verification.

Landscaping Plan –

1. Drawn to scale, showing dimensions and details for reforesting an area at least thirty-five feet wide and covering two thousand five hundred square feet or greater in size;
2. Using native or indigenous plants when appropriate; and
3. Which is made part of an approved forest conservation plan.

Linear Projects – means a project which:

1. Is elongated with nearly parallel sides;
2. Is used to transport a utility product or public service not otherwise contained in an application for subdivision, such as electricity, gas, water, sewer, communications, trains, and vehicles; and
3. May traverse fee simple properties through defined boundaries, or established easement rights.

Local agency - each unit in the executive, legislative, or judicial branch of a county or municipal government, including an office or department.

Lot - a unit of land, the boundaries of which have been established by subdivision of a larger parcel, and which will not be the subject of further subdivision, as defined by Natural Resources Article, § 5-1601, Annotated Code of Maryland and this chapter, and without an approved forest stand delineation and forest conservation plan.

Maintenance Agreement - the short-term management agreement associated with afforestation or reforestation plans required under Natural Resources Article § 5-1605, Annotated Code of Maryland and this chapter.

Medium Density Residential Area – areas zoned for densities greater than one dwelling unit per five acres and less than or equal to one dwelling unit per acre, including both existing and planned development and their associated infrastructure, such as roads, utilities, and water and sewer service.

Minor development project - a project:

1. On less than five acres of land containing not more than four lots per acre; or
2. Substantively similar as defined by the department and approved by the State.

Mixed Use Development – a single, high density development project which includes two or more types of uses, more specifically described and delineated in City Code Section 21.48.030, Table of Uses.

Natural Regeneration – the natural establishment of trees and other vegetation with at least four hundred woody, free to grow seedlings per acre, which are capable of reaching a height of at least 20 feet at maturity.

Natural resources inventory - a compilation of natural site features including forest delineation, geological data, topography, soils series and properties, watershed data including floodplains, water resources including surface water, ground water and wetlands, wildlife habitats and connections, hydric soils, soils with K factors of .35 or greater, and slopes of fifteen percent or greater, and as further defined in the technical manual.

Net Tract Area –

1. Except in agriculture and resource areas, the total area of a site, including both forested and nonforested areas, to the nearest one-tenth-acre, reduced by that area where forest clearing is restricted by another local ordinance or program;
2. In agriculture and resource areas the part of the total tract for which land use will be changed or will no longer be used for primarily agricultural activities, reduced by that area where forest clearing is restricted by another local ordinance or program; and
3. For a linear project:
 - i. The area of a right-of-way width, new access roads, and storage; or
 - ii. The limits of disturbance as shown on an application for sediment and erosion control approval or in a capital improvements program project description.

Nontidal Wetland - an area that is

- i. Inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal conditions does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation; and
- ii. Considered a nontidal wetland in accordance with the publication known as the "Federal Manual for Identifying and Delineating Jurisdictional Wetland," published in 1989 and as may be amended and interpreted by the U.S. Environmental Protection Agency.
- iii. "Nontidal wetlands" does not include tidal wetlands regulated under Environment Article, Title 16, Annotated Code of Maryland.

Nontidal Wetland Buffers - Buffers established for nontidal wetlands as determined under Natural Resources Article 8-1201 et seq., Annotated Code of Maryland.

Offsite – means outside the limits of the area encompassed by the tract area, or the parcel of record on which activity is proposed.

Onsite – means within the limits of the area encompassed by the tract area, or parcel of record on which the activity is proposed, including an area classified as a 100-year floodplain.

100-year flood - a flood which has one percent chance of being equaled or exceeded in any given year.

100-year floodplain - an area along or adjacent to a stream or body of water, except tidal waters, that is capable of storing or conveying floodwaters during a 100-year frequency storm event, or a 100-year flood.

Perennial Stream – a stream containing surface water throughout an average rainfall year, as shown on the most recent seven and one-half minute topographic quadrangle published by the U.S. Geologic Survey, or as defined in COMAR 26.23.01.01 and confirmed by field verification.

Permanent Tree Protection Devices - structural measures, such as retaining walls or aeration devices, that are designed to protect the tree and its root systems throughout its lifetime.

Person - includes the Federal Government, a State, any County, Municipal Corporation, or other political subdivision of a State, or any of their units, or an individual, receiver, trustee, guardian, executor, administrator, fiduciary, or representative of any kind, or any partnership, firm, association, public or private corporation, or any of their affiliates, or any other entity.

Planned Unit Development or planned development - a development comprised of a combination of land uses or varying intensities of the same land use in accordance with an integrated plan that provides flexibility in land use design approved by the City with at least twenty percent of the land permanently dedicated to open space in residential planned developments and at least five percent of the land permanently dedicated to open space in commercial, mixed use and other planned developments.

Planting plan - a labeled diagram that shows the quantities, location, size, shape, color, details and specifications of specific plants to be used in the landscape.

Prime Agricultural Soils - agriculturally fertile soils as defined by the USDA Soil Conservation Service.

Priority Funding Area – an area certified by the local government as a designated growth area and as recognized by the State Department of Planning. A Priority Funding Area can be designated village, industrially zoned land or an area otherwise satisfying the criteria outlined in the “Smart Growth and Neighborhood Conservation Act”.

Priority retention area:

1. Specific areas with trees, shrubs and plants located in sensitive areas including 100-year floodplains, intermittent, perennial and ephemeral streams and their buffers, coastal bays and their buffers, non-tidal wetlands and their buffers, steep slopes and their buffers, hydric soils and critical habitats as further defined in the Forest Conservation Technical Manual;
2. Areas containing trees, shrubs, or plants identified on the list of rare, threatened, and endangered species of the U.S. Fish and Wildlife Service or the Department;
3. Trees that are part of a historic site or associated with a historic structure or designated by the Department as a National, State, or City Champion Tree;
4. Areas containing one or more significant trees;
5. Areas of contiguous forest.

Project plan - a construction, grading, or sediment control activity on an area of forty thousand square feet or greater by a local agency or a "site design plan" as specified in City Code Section 21.22.020.

Public utility:

1. Facility, fixture or means of transmission operated in association with a public service company as defined in Public Utilities Article, Annotated Code of Maryland § 1-101(x);
2. Water and sewer services as specified in Title 16 of the Annapolis City Code; or
3. Cable television systems as defined in Local Government Article, Annotated Code of Maryland § 1-708(a).

Reforestation or Reforested:

1. Creation of a biological community dominated by trees and other woody plants containing at least one hundred live trees per acre with at least fifty percent of those trees having the potential of attaining a two-inch or greater diameter measured at four and one-half feet above the ground, within seven years; or
2. Establishment of a forest according to procedures set forth in the Forest Conservation Technical Manual;
3. Landscaping of areas under an approved landscaping plan;
4. For a linear project involving overhead transmission lines may consist of a biological community dominated by trees and woody shrubs with no minimum height or diameter criteria.

Regulated Activity – means any of the following activities, when that activity occurs on a unit of land which is forty thousand square feet or greater:

1. Subdivision;
2. Grading;
3. An activity that requires a sediment control permit;
4. Project plan; or
5. A planned development or a special exception.

Retention - the deliberate holding and protecting of existing, trees, shrubs or plants on the site according to established standards as provided in the Forest Conservation Technical Manual.

Retention Areas - areas designated onsite for forest protection; to be referred to as long-term Forest Retention Areas.

Sediment control permit - the authorization of an activity regulated under a sediment control plan as provided in Environment Article, Title 4, Annotated Code of Maryland or a grading permit as provided in Chapters 17.08 and 17.10 of the Annapolis City Code.

Seedlings - an unbranched woody plant, less than twenty-four inches in height and having a diameter of less than one-half inch caliper measured at two inches above the root collar.

Selective Clearing - the careful and planned removal of trees, shrubs, and plants using specific standards and protection measures under an approved forest conservation plan.

Significant tree:

1. A champion tree;
2. Or a tree which is at least seventy-five percent of the diameter of the State Champion Tree;
3. Or a tree which is of twenty-four inches DBH or more and which has been determined by the Department Director to be of notable quality and or high value because of its type, size, age, historical significance, canopy benefits, or which otherwise warrants special consideration for preservation.

Slope Aspect - the orientation angle of the site to the sun.

Soil Amendments - the modification of soil properties for improvement of soil structure; not to be confused with fertilizers whose purpose is to correct chemical imbalances in soils for silvicultural purposes.

State Program - the State of Maryland Forest Conservation Program administered by the Department of Natural Resources.

Steep Slopes - a slope of fifteen percent or greater.

Steep slope buffer - a protective setback from the steep slope itself, required by the Anne Arundel County Soil Conservation District that is provided to maintain the integrity of the steep slope.

Stream Buffer - all lands lying up to one hundred feet and no less than fifty feet, measured from the top of each normal bank of a perennial or intermittent stream. The width of the buffer is to be determined by the Director to prevent activity from having a deleterious effect on the stream.

Stream restoration project means an activity that:

1. Is designed to stabilize stream banks or enhance stream function or habitat located within an existing stream, waterway, or floodplain;
2. Avoids and minimizes impacts to forests and provides for replanting onsite an equivalent number of trees to the number removed by the project;
3. Maybe performed under a municipal separate storm sewer system permit, a watershed implementation plan growth offset, or another plan administered by the State or local government to achieve or maintain water quality standards; and
4. Is not performed to satisfy stormwater management, wetlands mitigation, or any other regulatory requirement associated with proposed development activity.

Subdivision - a division of a unit of land into two or more lots or parcels for the purpose, whether immediate or future, of transfer of ownership, sale, lease, or development.

Tax Property Article - the Tax Property Article of the Annotated Code of Maryland as amended from time to time.

Timber harvesting means:

1. A tree-cutting operation affecting one or more acres of forest or developed woodland within a one-year interval that disturbs five thousand square feet or more of forest floor;
2. Does not include grubbing and clearing of root mass.

Temporary Tree Protection Devices - structural measures, such as fencing or berms, installed prior to

construction for the purpose of preventing access to forest retention areas or afforested or reforested areas during construction.

Tract - property or unit of land subject to an application for a grading or sediment control permit, subdivision approval, or project plan approval.

Tree - a large, branched, woody plant having one or several self-supporting stems or trunks that reach a height of at least twenty feet at maturity.

Tree Line - the boundaries of existing forests as determined by the most recent aerial photography and field verification.

Understory Trees - trees with crowns entirely below the general level of the canopy receiving little or no sunlight from above or the sides.

Unwarranted hardship means the applicant has demonstrated that without a variance, the applicant would be denied reasonable and significant use of the entire parcel or lot for which the variance is requested.

Variance –

1. "Variance" means an exemption granted to an applicant from one or more requirements of this chapter.
2. "Variance" does not mean a zoning variance.

Watershed - all lands lying within an area described as a subbasin in the water quality regulations adopted by the Maryland Department of the Environment under COMAR 26.08.02.08

Whip - an unbranched woody plant greater than twenty-four inches in height and having a diameter of less than one-inch caliper measured at two inches above the root collar.

APPENDIX C

Worksheets and Preparation Guidelines

<h1 style="text-align: center;">FOREST CONSERVATION WORKSHEET</h1>	<p>Note: Use 0 for all negative numbers that result from the calculations</p>
<p>Net Tract Area</p> <p>A. <i>Total Tract Area</i> B. <i>Deductions</i> (Critical Area, area restricted by local ordinance or program) C. <i>Net Tract Area</i> Net Tract Area (C) = Total Tract (A) - Deductions (B)</p> <p>Land Use Category:</p> <p>D. <i>Afforestation Threshold</i> (Net Tract Area [C] x _____ %) E. <i>Conservation Threshold</i> (Net Tract Area [C] x _____ %)</p> <p>Existing Forest Cover</p> <p>F. <i>Existing Forest Cover within the Net Tract Area</i> G. <i>Area of Forest Above Conservation Threshold</i></p> <p>If the Existing Forest Cover (F) is greater than the Conservation Threshold (E), then G = F – E; otherwise G = 0.</p> <p>Proposed Forest Clearing</p> <p>H. <i>Total Area of Forest to be Cleared</i> I. <i>Total Area of Forest to be Retained</i> I = Existing Forest Cover (F) – Forest to be Cleared (H)</p> <p>Planting Requirements</p> <p>J. <i>Reforestation for Clearing Above the Conservation Threshold</i> (1) If the Total Area of Forest to be Retained (I) is <u>greater than</u> the Conservation Threshold (E), then J = the Area of Forest to be Cleared (H) x1; (2) If the Forest to be Retained (I) is <u>less than or equal to</u> the Conservation Threshold (E), then J = Area of Forest Above Conservation Threshold (G) x 1</p> <p>K. <i>Reforestation for Clearing Below the Conservation Threshold</i> (1) If Existing Forest Cover (F) is <u>greater than</u> the Conservation Threshold (E) <u>and</u> the Forest to be Retained (I) is <u>less than or equal to</u> the Conservation Threshold (E), then K = 2.0 x (Conservation Threshold (E) – Forest to be Retained (I)) (2) If Existing Forest Cover (F) is <u>less than or equal to</u> the Conservation Threshold (E), then K = 2.0 x Forest to be Cleared (H)</p> <p>L. <i>Total Reforestation Required</i> L = J + K</p> <p>M. <i>Total Afforestation Required</i> If Existing Forest Cover (F) is less than the Afforestation Threshold (D), then M = Afforestation Threshold (D) – Existing Forest Cover (F)</p> <p><i>Total Planting Requirement</i> N = L + M</p>	<p>.</p> <p>A = B = C =</p> <p>D = E =</p> <p>F = G =</p> <p>H = I =</p> <p>J =</p> <p>K =</p> <p>L =</p> <p>M =</p> <p>N =</p>
<p>Forest Conservation Worksheet</p>	<p>C:1</p>

Property: _____ Prepared By _____																
Stand #: _____ Plot #: _____ Plot Size: _____ Date: _____																
Basal Area in sf/acre:		Size class of trees > 20' height within sample plot														
Tree Species	# of Trees 2-5.9" dbh			# of Trees 6-11.9" dbh			# of Trees 12-19.9" dbh			# of Trees 20-29.9 dbh			# of Trees > 30" dbh			Total
	Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	
Chestnut Oak																
Striped Maple																
Scarlet Oak																
Black Oak																
Black Cherry																
Total Number of Trees per Size Class																
Number & Size of Standing Dead Trees																
List of Common Understory Species 3'-20':							% of Canopy Closure					Percent of Invasive Cover per Plot (All Layers):			Plot Successional Stage:	
							C	N	E	S	W					
List of Herbaceous Species 0'-3':							% Understory Cover 3'-20'									
							C	N	E	S	W	Total				
							% of Herbaceous Cover									
							C	N	E	S	W	Total				
Comments																
Sheet ___ of ___																
Forest Sampling Data Worksheet														C:2		

Property Name: _____

Location: _____(Town, County, ADC Map#, and Grid Coordinates)

Prepared By: _____

Date: _____

Stand Variable	Stand # _____	Stand # _____
1. Dominant species/Codominant species		
2. Successional stage		
3. Basal area in s.f. per acre		
4. Size class of dominant species		
5. Percent of canopy closure		
6. Number of tree species per acre		
7. Common understory species per acre		
8. Percent of understory cover 3' to 20' tall		
9. Number of woody plant species 3' to 20' tall		
10. Common herbaceous species 0' to 3' tall		
11. Percent of herbaceous & woody plant cover 0' to 3' tall		
12. List of major invasive plant species & percent of cover		
13. Number of standing dead trees 6" dbh or greater		
14. Comments		

Sheet ___ of ___

Forest Stand Summary Worksheet

C:3

Figure C:4 Preparation Guidelines

Guidelines for Completion of Forest Sampling Data Worksheets and Forest Stand Summary Worksheets

1. **Dominant species/codominant species:** List the dominant and codominant species for each stand. This can be used to determine the Forest Association (Brush et al, 1980). The association can then be used to choose the species recommended for mitigation planting. Dominant species are the species which are largest or tallest.
2. **Successional stage:** Forests are characterized as early, mid or late successional, with characteristic growth rates and species composition. Additional information which may be helpful in assessment is available soil moisture, often described as xeric, mesic, or hydric. Species composition descriptions, such as bottomland or upland, may reflect these soil conditions.
3. **Basal area in square feet per acre:** Data can be taken with a prism, or calculated by knowing the DBH of all trees in the plot. To determine the basal area using a prism, total the number of "in" trees and multiply by the prism factor for each point sampled. To get an average for the stand, add each point for all of the samples for the stand and divide this total by the number of sample points in the stand.
4. **Size class of dominant species:** This is the size class with the highest frequency of dominant trees.
5. **Percent of canopy closure:** This is the average of percent canopy closure of all the sample plots in the stand. Canopy closure may be obtained using a visual estimate for each plot.
6. **Average number of tree species per plot:** For each plot, this is a total of the number of different tree species appearing in the first column of the data sheet.
7. **Common understory species 3' to 20' tall:** List the 3 or 4 most common species that occur in the 3' to 20' layer.
8. **Percent of understory cover 3' to 20' tall:** This is the average of the percent of understory cover for each of the plots in the stand.
9. **Number of understory species 3' to 20' tall:** Count the number of different species in the understory layer.
10. **Understory species 0' to 3' tall:** List the 3 or 4 most common species that occur in the 0' to 3' layer.
11. **Percent of herbaceous & woody plant cover 0' to 3' tall:** Average the percent of herbaceous and woody cover for each of the plots in the stand.
12. **List of major invasive plant species and percent of cover:** For each of overstory (O), understory (U) and herbaceous (H) layers, list the major invasive plant species and the amount of area coverage. For example:

O - Norway Maple	20% (of the overstory layer)
U - Multiflora Rose	60% (of the understory layer)
H - Japanese Honeysuckle	40% (of the herbaceous layer)
13. **Number of standing dead trees 6" dbh or greater per acre:** Divide the average for all plots sampled by plot size. For example, if the average for all plots is 2, and the plot size is 0.1 acre, the number per acre is 20.
14. **Comments:** This may include other noteworthy information such as evidence of past management practices, cultural or historical features, specimen trees, wildlife notes or rare, threatened and endangered plant species.

Figure C:5 Forest Sampling Techniques

Basal Area may be measured as a total for all species, or by each species, using a basal area factor (BAF) prism. This plotless method is relatively fast and easy to use in large, homogenous stands. Basal Area may also be computed from actual diameters (DBH) for each tree measured in a plot. Using size class will give an inaccurate measurement.

Density (trees/unit area) may only be measured by using an area based plot method and counting the total number of trees or number of trees per species in each plot.

Frequency is used as a measure of the distribution patterns of species within a stand. If a species occurs in all plots sampled, it is considered to have 100% frequency. A high frequency for dominant species is an indicator of stand homogeneity.

To measure cover, two methods may be used: First, construct a sampling tube approximately 4-6" long and 2" in diameter from a paper towel or toilet paper roll, or a length of PVC pipe. Attach wires or string on one end of the tube in the shape of a cross with four evenly spaced openings.

Select at least 3 randomly located sample points in each stand. If a random plot sample method is used, these may coincide with plot centers.

1. Locate four points around the plot circumference and a fifth point at the plot center. Walk to each point and look through the tube at the sample layer (canopy, understory or herbaceous).

Record "yes" or "no" for each "hit" with the sample layer when viewed through the tube; i.e., green seen through the tube.

Calculate the percentage of the five samples which were answered by "yes" for each plot. For four "yeses", record 80% cover for that plot.

2. At each plot center or sample point in the stand if a plotless method is used, estimate the percent cover using a density scale chart for comparison. Charts are available from the S. E. Forest Experiment Station, P. O. Box 2680, Asheville, NC 28802. Use cover classes such as 0-10, 10-20, etc. for better precision.

For further information, see:

Avery, T.E. 1964. "To stratify or not to stratify." *Journal of Forestry* 62:106-108.

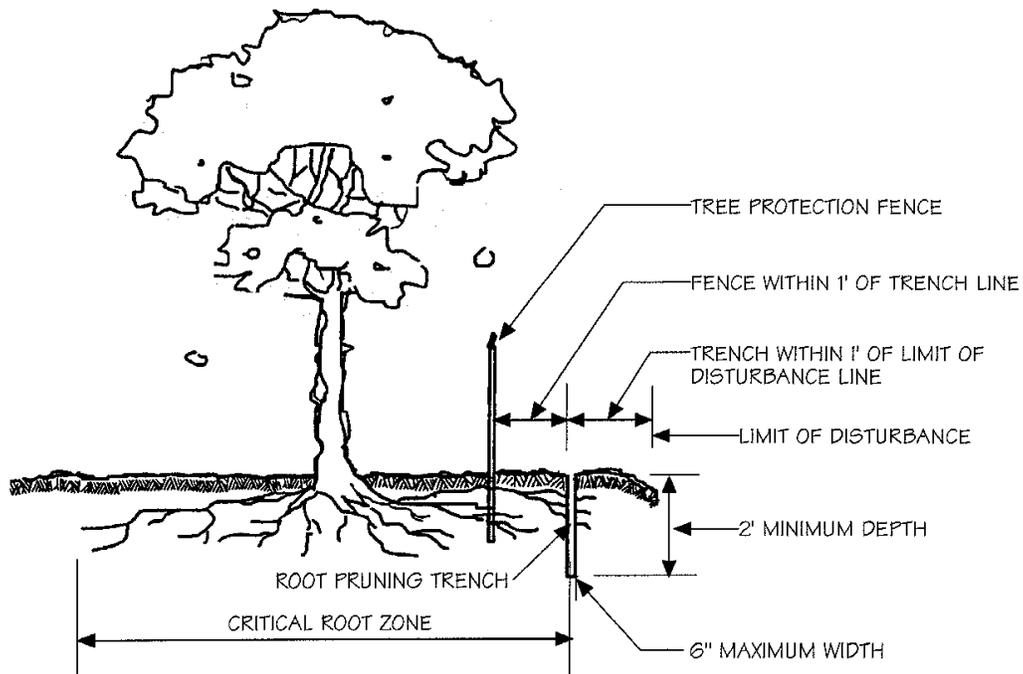
Barbour, Michael G., Jack H. Burk and Wanna D. Pitts. 1987. *Terrestrial Plant Ecology*, 2nd Edition. Benjamin/Cummings Publishing Co., Inc., Menlo Park, CA. Chapter 9.

Ganey, Joseph L. and William M. Block. 1994. "A comparison of two techniques for measuring canopy closure." *Western Journal of Applied Forestry*. 9:21-23.

James, F. C. and Shugart, H. H. 1970. "A quantitative method of habitat description." *Audubon Field Notes* 24:727-736.

APPENDIX D

Sample Details and Specifications



Notes:

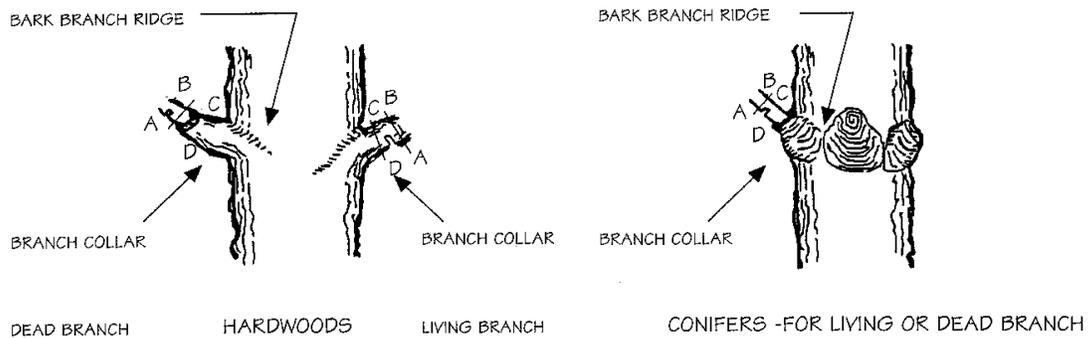
1. Retention Areas to be established as part of the forest conservation plan review process.
2. Boundaries of Retention Areas to be staked, flagged and/or fenced prior to trenching.
3. Exact location of trench should be identified.
4. Trench should be immediately backfilled with soil removed or organic soil.
5. Roots should be cleanly cut using vibratory knife or other acceptable equipment.

Source: Adapted from Steve Clark & Associates/ACRT, Inc. and Forest Conservation Manual, 1991

Root Pruning

**Figure
D:1**

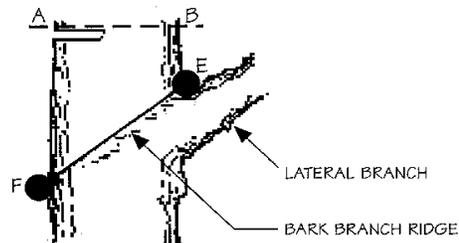
Pruning a Branch



Notes:

1. Remove branch weight by undercutting at A and remove limb by cutting through at AB.
2. Remove stub at CD (line between branch bark ridge and outer edge of branch collar).
3. If D is difficult to find on hardwoods, angle of CD to trunk should be the reflective angle of the bark branch ridge to the trunk.
4. Only prune at specified times.
5. Remove no more than 30% of crown at one time.

Pruning a Leader to Reduce Size

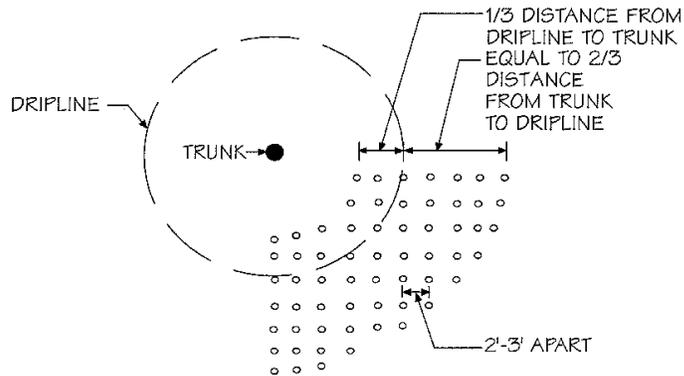


Notes:

1. Remove top weight by undercutting at A and remove limb by cutting through AB.
2. Remove stub at EF parallel to the bark branch ridge.
3. Only prune at specified times.
4. No more than 30% of crown to be removed at one time.
5. Diameter of lateral branch should be no less than 30% of the diameter of the leader.

Source: Fairfax County, Virginia:Vegetation Preservation & Planting, January 1986

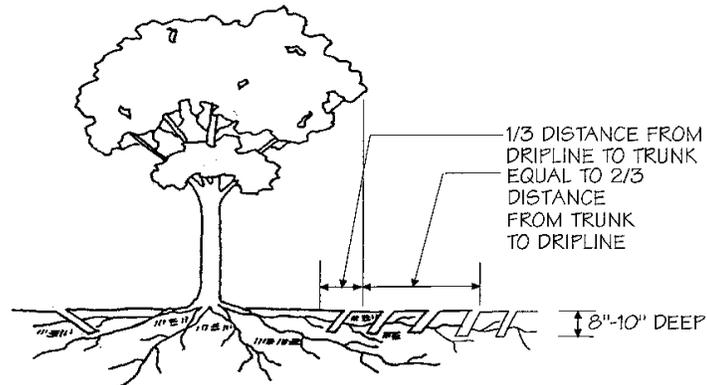
Vertical Mulching or Fertilizing



Notes:

1. Auger holes 8"-10" deep, 2'-3' apart, 1"-3" wide.
2. Leave soil on ground.
3. Apply fertilizer 1/3 distance in from dripline to trunk.
4. Fertilize with 50/50 compost and pine fines.

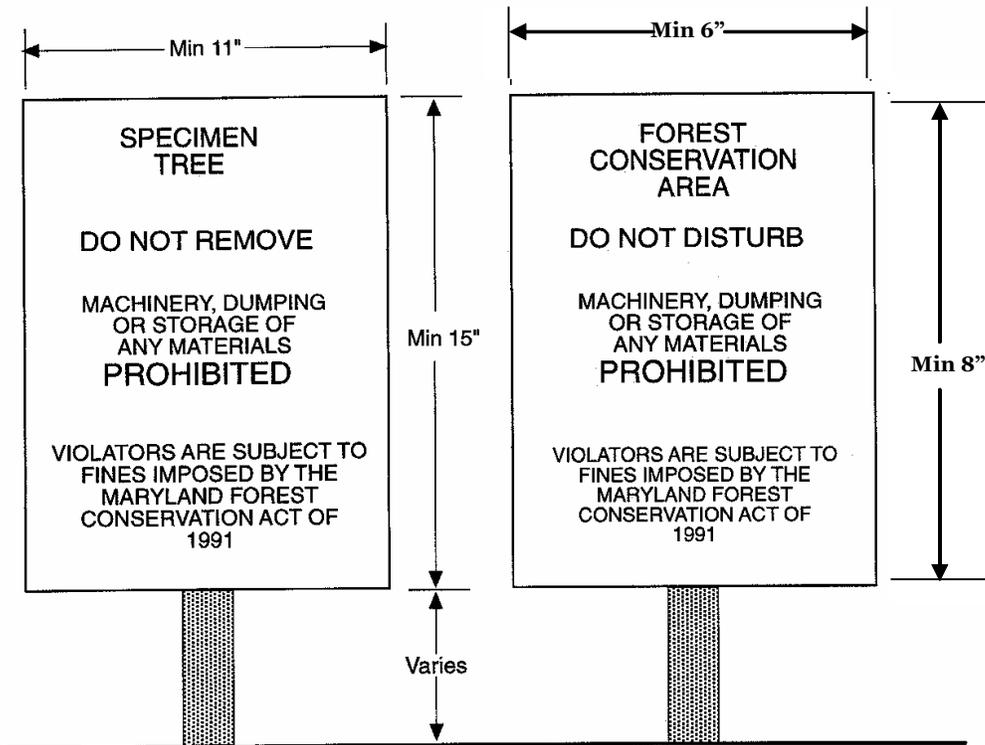
Application of Fertilizer by Injection



Notes:

1. Injection holes to be 8"-10" deep, 2'-3' apart.
2. Auger holes, do not poke. Leave soil on ground.
3. Apply fertilizer 1/3 distance in from dripline to trunk and extend 2/3 out from dripline.

Source: UMCP



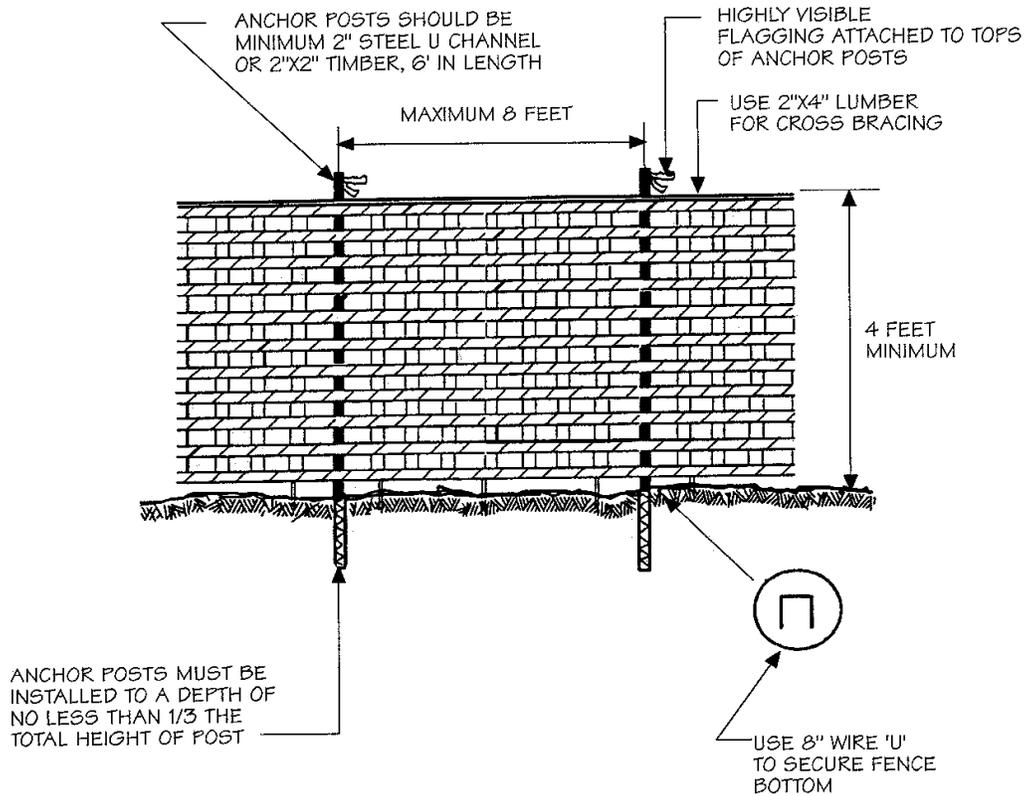
Notes:

1. Bottom of signs to be higher than top of tree protection fence.
2. Signs to be placed approximately 50' feet apart. Conditions on site affecting visibility may warrant placing signs closer or farther apart.
3. Attachment of signs to trees is prohibited.

Source: Adapted from Forest Conservation Manual, 1991

Construction Signs

**Figure
D:4**



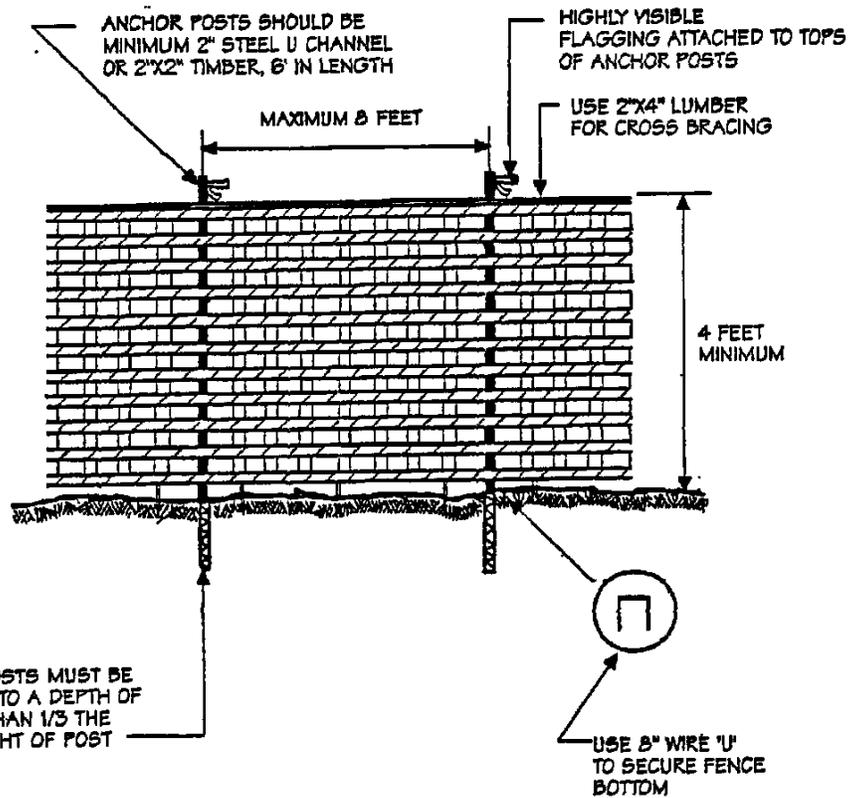
Notes:

1. Blaze orange or blue plastic mesh fence for forest protection device, only.
2. Boundaries of Retention Area will be established as part of the forest conservation plan review process.
3. Boundaries of Retention Area should be staked and flagged prior to installing device.
4. Avoid damage to critical root zone. Do not damage or sever large roots when installing posts.
5. Protection signs are required.
6. Device should be maintained throughout construction.

Source: Adapted from Prince George's County, Maryland: Woodland Conservation Manual and Forest Conservation Manual, 1991

Plastic Mesh Tree Protection Fence

Figure D:5



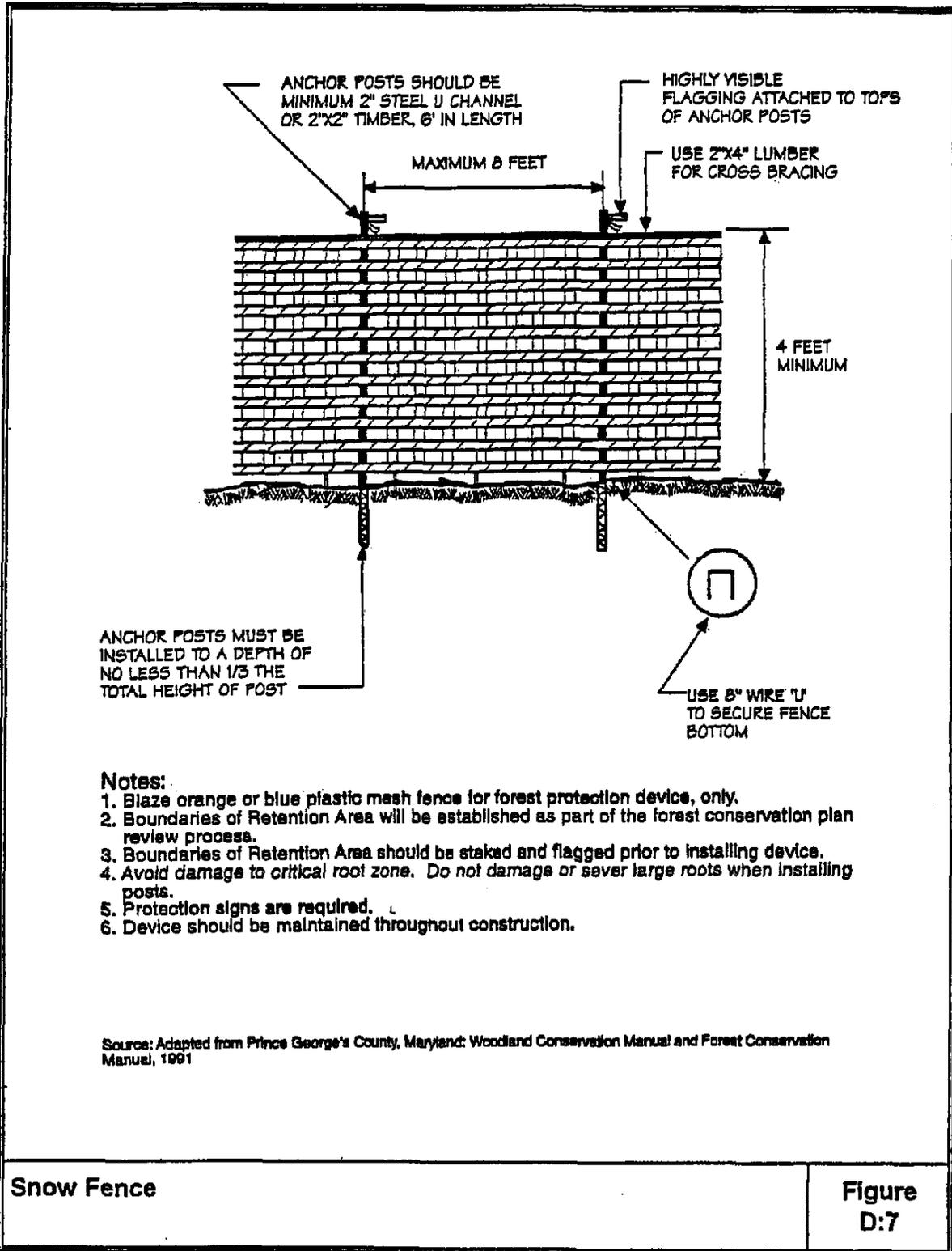
Notes:

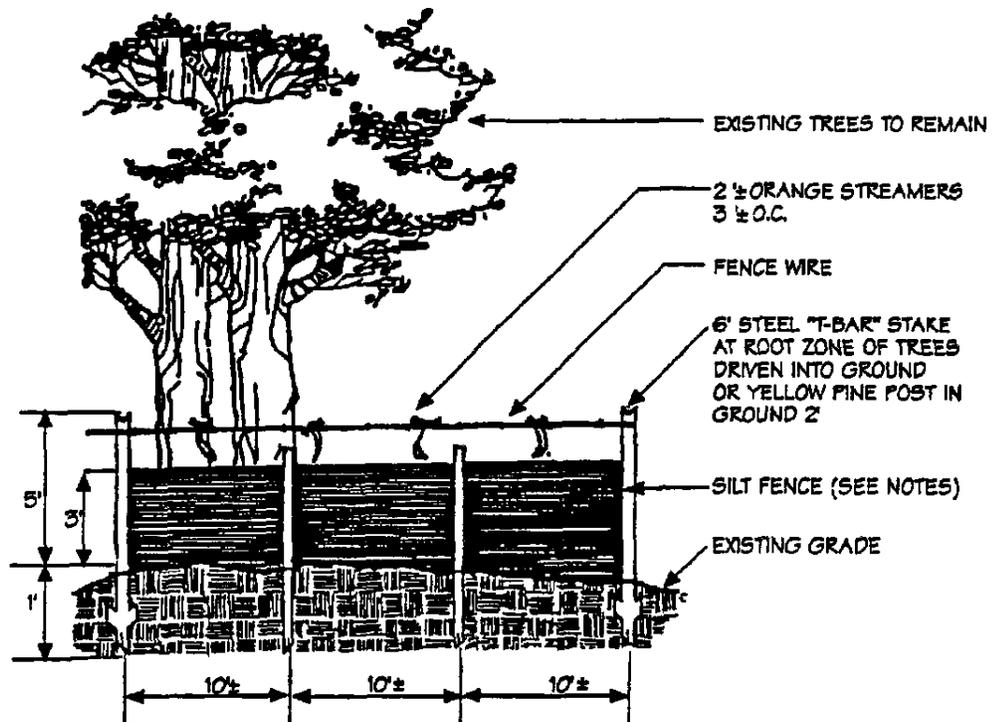
1. Blaze orange or blue plastic mesh fence for forest protection device, only.
2. Boundaries of Retention Area will be established as part of the forest conservation plan review process.
3. Boundaries of Retention Area should be staked and flagged prior to installing device.
4. Avoid damage to critical root zone. Do not damage or sever large roots when installing posts.
5. Protection signs are required.
6. Device should be maintained throughout construction.

Source: Adapted from Prince George's County, Maryland: Woodland Conservation Manual and Forest Conservation Manual, 1991

Wire Tree Protection Fence

Figure D:6





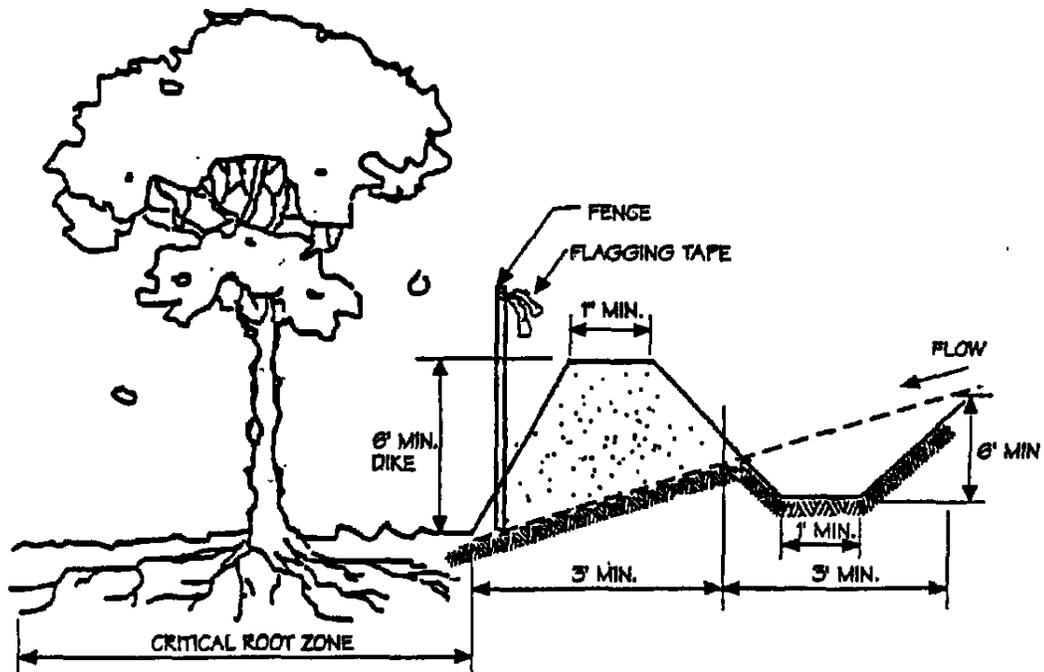
Notes:

1. Silt fence to be heeled into the soil.
2. Wires, snow fence, etc. for tree protection only.
3. Boundaries of Retention Area will be established as part of the forest conservation plan review process.
4. Boundaries of Retention Area should be staked and flagged prior to installing device.
5. Avoid root damage when placing anchor posts.
6. Device should be properly maintained throughout construction.
7. Protection signs are also required.
8. Locate fence outside the Critical Root Zone.

Source: Adapted from Steve Clark & Associates/ACRT, Inc.

Silt Fence and Tree Protection

**Figure
D:8**



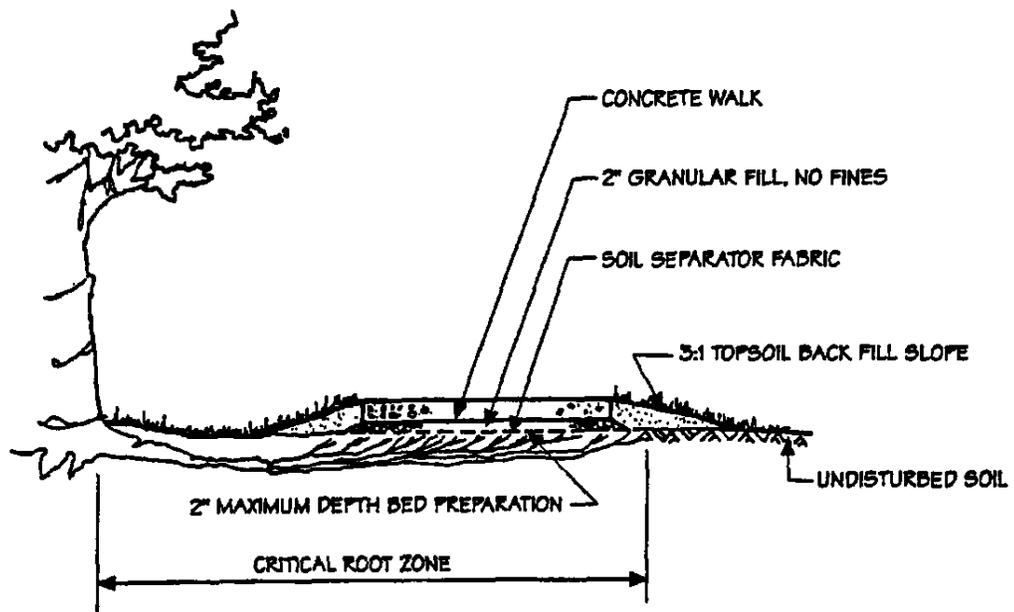
Notes:

1. Combine sediment control and forest protection device.
2. Boundaries of Retention Area will be established as part of the forest conservation plan review process.
3. Boundaries of Retention Area should be staked prior to installing protection device.
4. Root damage should be avoided.
5. Toe of slope should be outside the Critical Root Zone.
6. Equipment is prohibited within Critical Root Zone of Retention Area; place dike accordingly.
7. All standard maintenance for earth dikes and swales apply to these details.
8. All standard reclamation practices for earth dikes and swales shall apply to these details.

Source: Adapted from Prince George's County, Maryland: Woodland Conservation Manual

Earth Dike and Swale Combination Device

**Figure
D:9**



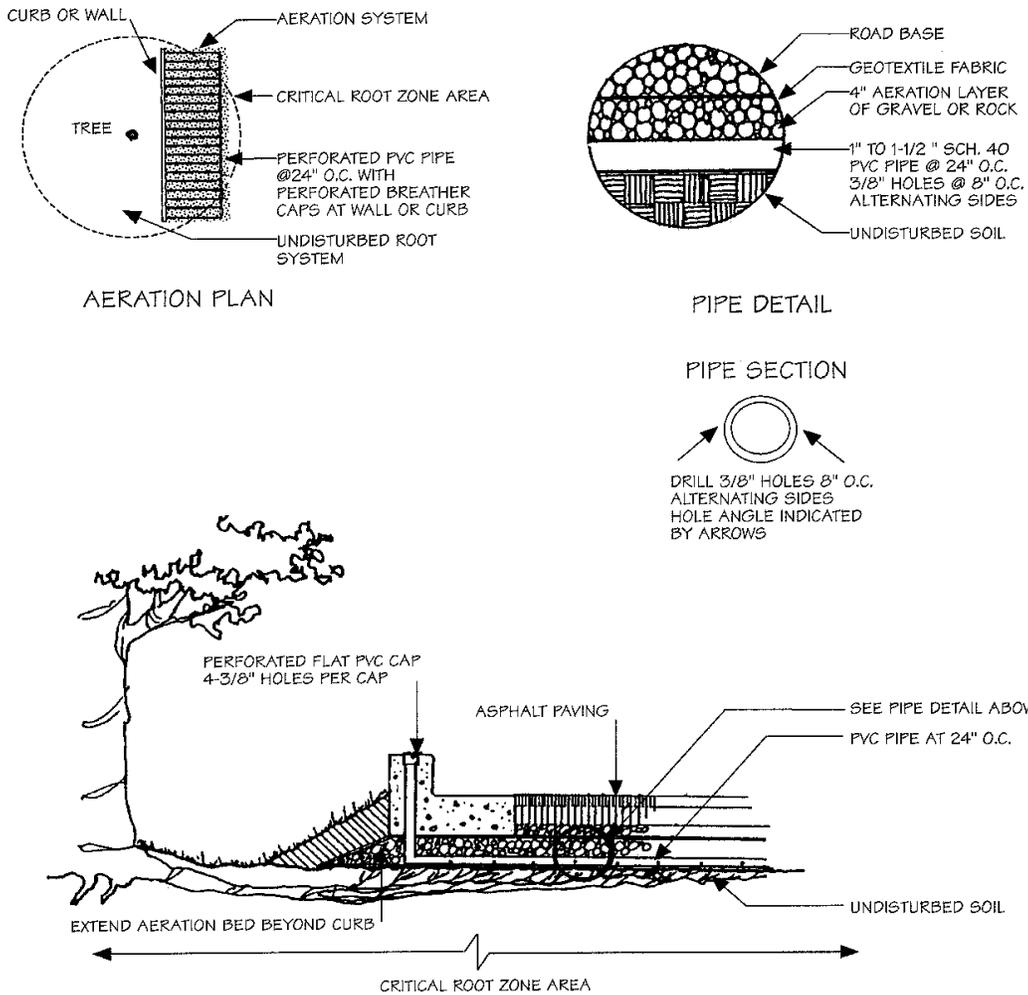
Notes:

1. Bed preparation should not exceed 2 inches
2. Granular fill should contain no fines
3. Minimize width of sidewalk as allowed by code.
4. Take extreme care of existing trees' critical root zone during construction.

Source: Adapted from Steve Clark & Associates/ACRT, Inc.

Sidewalk above Critical Root Zone

**Figure
D:10**



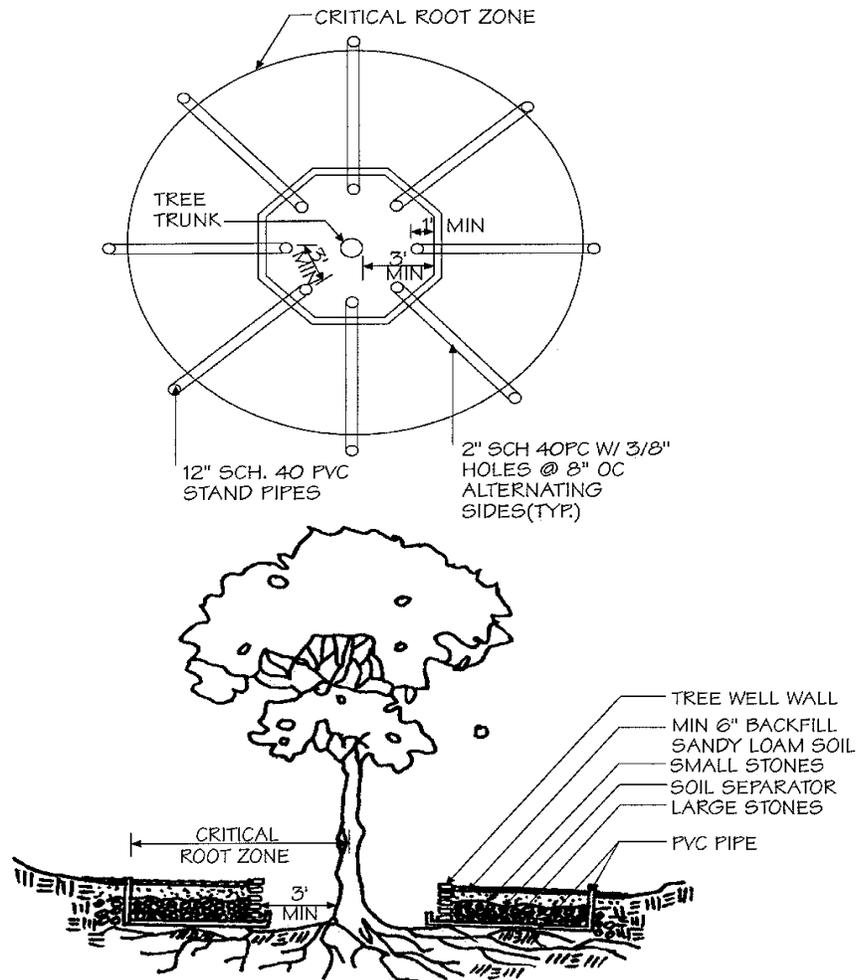
Notes:

1. Bed preparation should not exceed 2 inches.
2. Vertical pipe should be capped with a perforated cap with 4-3/8 inch holes per cap.
3. Gravel or rock should contain no fines.
4. Can also be used when critical root zone is covered by fill instead of asphalt.

Source: Adapted from Steve Clark & Associates/ACRT, Inc.

Aeration for Paving above Critical Root Zone

Figure D:11



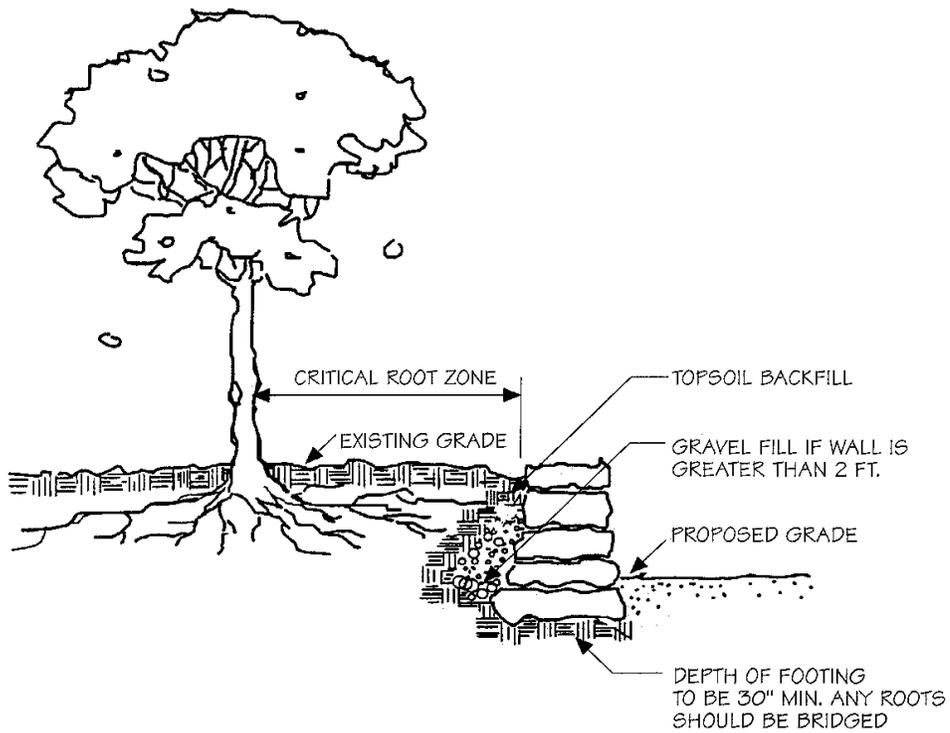
Notes:

1. Well wall should be no closer than 3 feet from tree trunk.
2. Drainage pipe layout should extend beyond the Critical Root Zone.
3. Vertical pipes should be capped with a perforated flat cap with 4-3/8 inch holes per cap.
4. Radiating spokes should be on 3 foot centers at the well wall.

Source: UMCP

Tree Well and Aeration System

Figure D:12



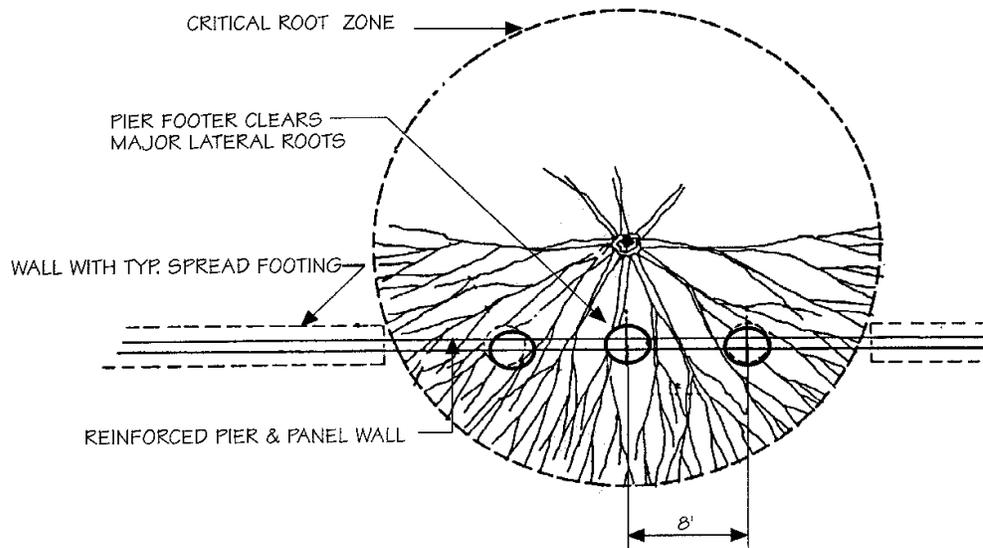
Notes:

1. Wall should be constructed outside the Critical Root Zone.
2. Use extreme care to protect existing roots while constructing retaining wall, including anchoring system, if required.
3. If tree roots must be disturbed, prune roots

Source: Adapted from Fairfax County, Virginia: Vegetation Preservation & Planting, January 1986

Retaining Walls

**Figure
D:13**



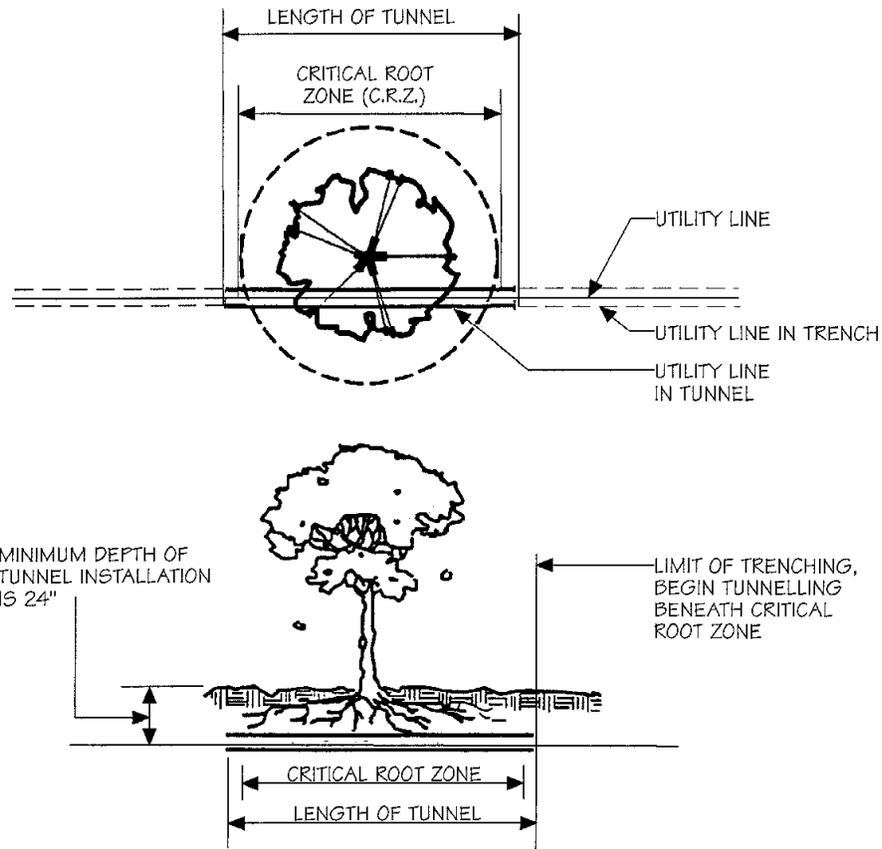
Notes:

1. Area of disturbance should be minimized.
2. Care should be taken to avoid major lateral roots.
3. Roots should be cleanly cut using a vibratory knife or other similar equipment.

Source: Adapted from Steve Clark & Associates/ACRT, Inc.

Reinforced Pier and Panel Wall

**Figure
D:14**



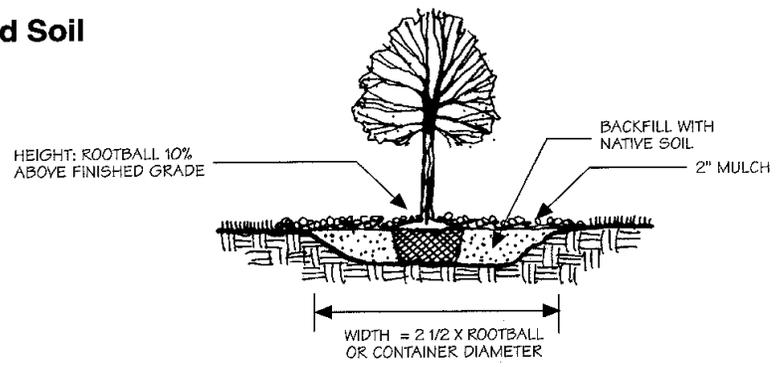
Notes:

Tunnel should be located under Critical Root Zone at a minimum depth of 24 inches.

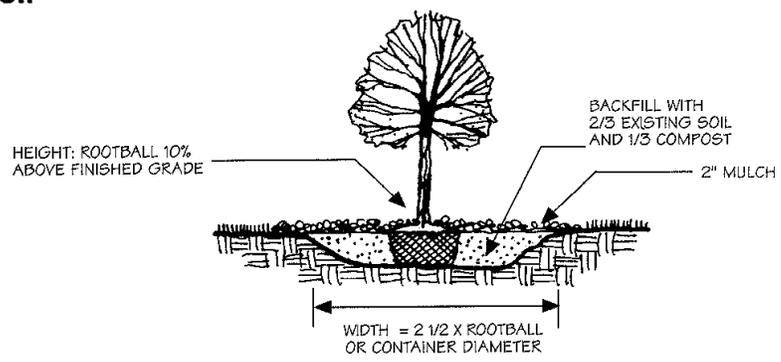
Tunnel through the Critical Root Zone, resume trenching of utilities beyond the Critical Root Zone.

Source: Adapted from Fairfax County, Virginia: Vegetation Preservation and Planting, January, 1986

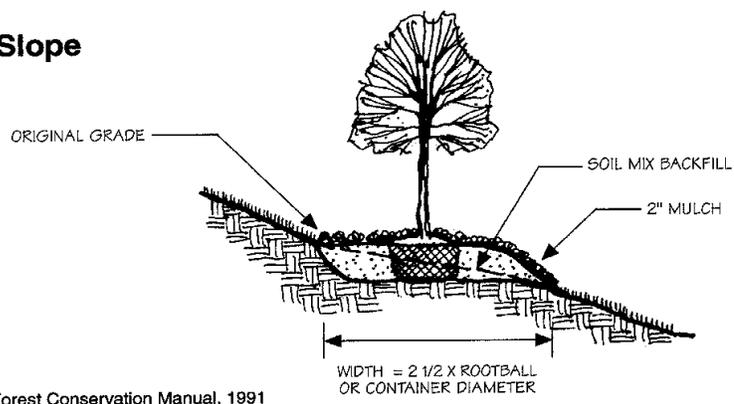
Undisturbed Soil



Disturbed Soil



Planting on Slope

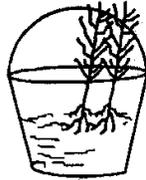


Source: Adapted from Forest Conservation Manual, 1991

Container Grown and B&B Planting Techniques

Figure D:16

Handling Seedlings in the Field



Correct
IN BUCKET WITH SUFFICIENT
WATER TO COVER ROOTS



Incorrect
IN HAND:
ROOTS DRY OUT

Note:

1. Bare root seedlings and whip stock should be heeled-in when left unplanted for more than 24 hours.

Seedlings and Whips



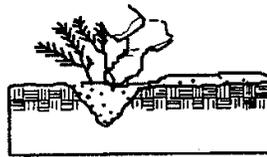
1. DIG V-SHAPED TRENCH
IN MOIST SHADY PLACE



2. BREAK BUNDLES AND
SPREAD OUT EVENLY



3. FILL IN LOOSE SOIL AND
WATER WELL

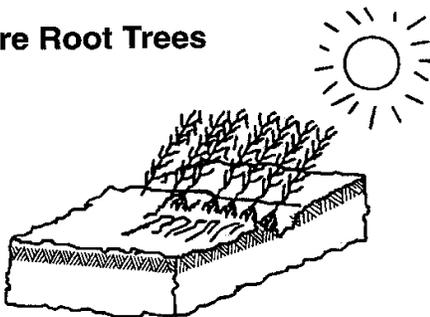


4. COMPLETE FILLING IN SOIL
AND FIRM WITH FEET

Note:

1. Bare root seedlings and whip stock should be heeled-in when left unplanted for more than 24 hours.

Bare Root Trees



Place trees in an east-west trench with the tops of the trees pointing toward the afternoon sun. Moist soil should be worked around the roots to cover them and minimize air pockets. Pointing the tree tops toward the afternoon sun exposes the least surface to the sun so the buds will be less likely to begin growth.

Note:

1. Bare root trees should be banked-in when they must be left unplanted for longer than a few days

Source: Adapted from Forest Conservation Manual, 1991

Handling Bare Root Stock

Figure
D:17

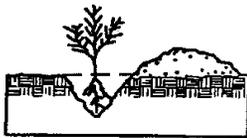
Seedling and Whip Planting



Note:

1. Mulching newly planted seedlings helps the soil retain moisture and protects the seedling from compaction and stem injuries.

Correct and Incorrect Planting Depth

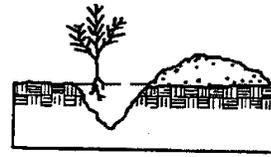


Correct
AT SAME DEPTH

SEEDLING WAS GROWN
IN NURSERY

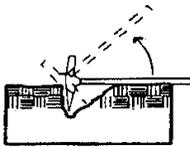


Incorrect
TOO DEEP AND ROOT
BENT



Incorrect
TOO SHALLOW AND ROOTS
EXPOSED

Mattock Planting



1. Insert mattock; lift handle
and pull



2. Place seedling along straight side
at correct depth.



3. Fill in and pack soil to
bottom of roots.



5. Firm around seedling with feet.



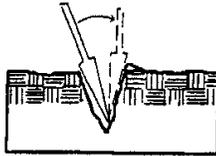
4. Finish filling in soil and firm with heel.

Source: Adapted from Forest Conservation Manual, 1991

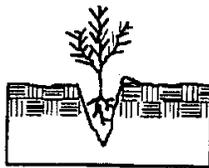
Seedling and Whip Planting Techniques

Figure
D:18

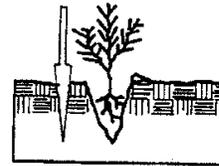
Planting With Dibble Bar



1. INSERT DIBBLE AT ANGLE SHOWN ABOVE AND PUSH FORWARD TO UPRIGHT POSITION



2. REMOVE DIBBLE AND PLACE SEEDLING AT CORRECT DEPTH



3. INSERT DIBBLE 2 INCHES TOWARD PLANTER FROM SEEDLING



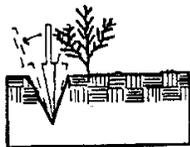
4. PULL HANDLE OF DIBBLE TOWARD PLANTER FIRING SOIL AT BOTTOM OF ROOTS



5. PUSH HANDLE OF DIBBLE FORWARD FROM PLANTER FIRING SOIL AT TOP OF ROOTS



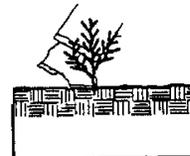
6. INSERT DIBBLE 2 INCHES FROM SEEDLING



7. PULL FORWARD THEN PULL BACKWARD FILLING HOLE



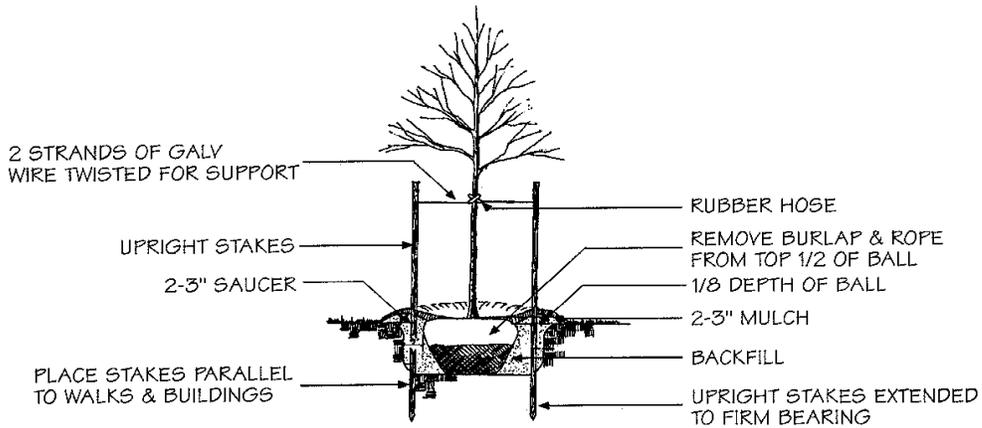
8. FILL LAST HOLE BY STAMPING WITH HEEL



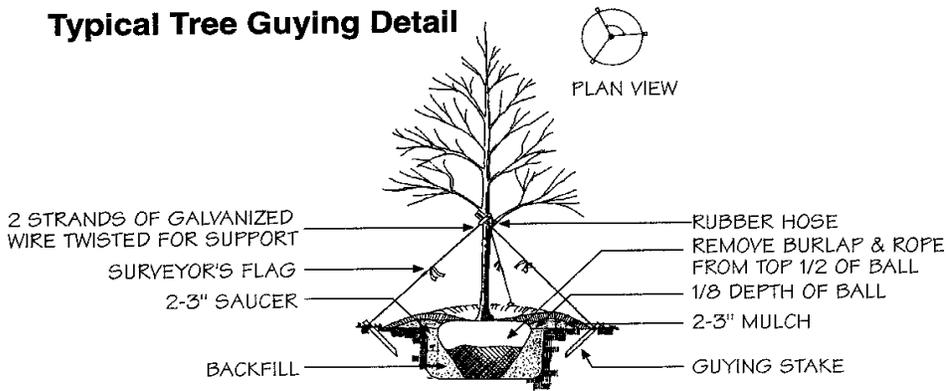
9. FIRM SOIL AROUND SEEDLING WITH FEET

Source: Adapted from Duryea & Dougherty, Forest Regeneration Manual, Kluwer Academic Publishers, Boston, 1991 and Forest Conservation Manual, 1991

Typical Upright Staking Detail



Typical Tree Guying Detail

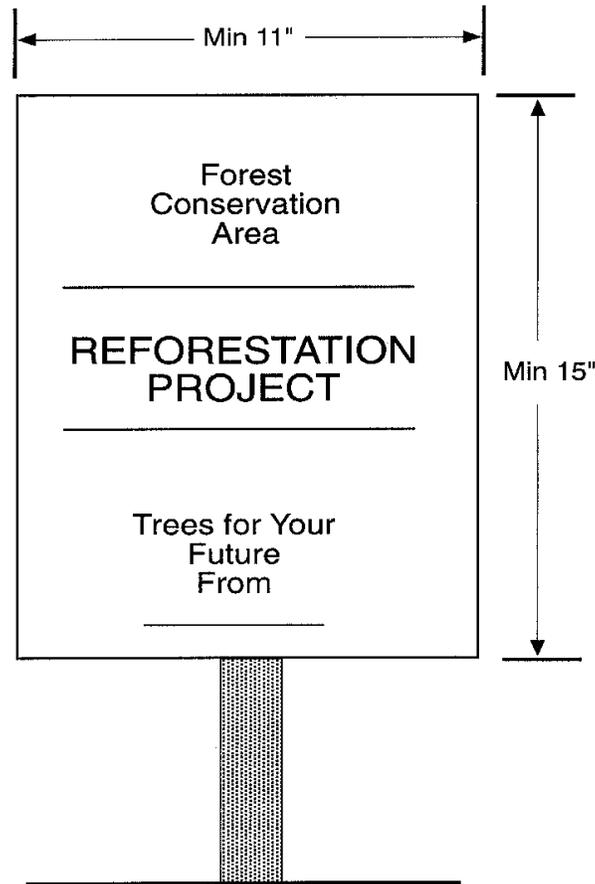


Tree Size Height	Tree Size Caliper	Stake	#	Wire or Cable	Hose
6-10'	1" to 1-1/2"	5-6' upright	2	14 guage wire	1/2"
10-12'	2" to 2-1/2"	7-8' upright	2	14 guage wire	1/2"
12-14'	2-1/2" to 3"	2" guy	3	12 guage wire	1/2"
14-16'	3-4"	2" guy	3	12 guage wire	3/4"

Source: Adapted from Forest Conservation Manual, 1991

Tree Staking and Guying Specifications

Figure D:20



Notes:

1. The signs notify construction workers and future residents of the newly planted material, improving the trees' survival rates.
2. Signs may be adapted by residents for identification of forest retention areas

Source: Adapted from Forest Conservation Manual, 1991

Reforestation and Afforestation Area Signs

**Figure
D:21**

APPENDIX E

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APPENDIX F

List of Invasive Exotic Plants

The following is a list of exotic or invasive plants that threaten or degrade forests in Maryland:

Common Name	Scientific Name
HERBACEOUS	
Garlic Mustard ¹	<i>Alliaria petiolata</i> ¹ (<i>A. officinalis</i>)
a grass	<i>Arthraxon hispidus</i>
Crown-vetch ²	<i>Coronaria varia</i> ²
Tall Fescue, K31 Fescue ²	<i>Festuca elatior</i> (<i>F. arundinacea</i>) ²
Sericea Lespedeza ²	<i>Lespedeza cuneata</i> ²
a grass ¹	<i>Microstegium vimineum</i> ¹ (<i>Eulalia viminea</i>)
Common Reed ¹	<i>Phragmites australis</i> ¹ (<i>P. communis</i>)
Japanese Knotweed ¹	<i>Polygonum cuspidatum</i> ¹
Mile-a-minute Vine, Devil's Tearthumb ¹	<i>Polygonum perfoliatum</i> ¹
Lesser Celandine ¹	<i>Ranunculus ficaria</i> ¹
VINES	
Porcelain Berry ¹	<i>Ampelopsis brevipedunculata</i> ¹
Oriental Bittersweet ¹	<i>Celastrus orbiculatus</i> ¹
Cinnamon Vine ¹	<i>Dioscorea batatas</i> ¹
Climbing Euonymus, Wintercreeper	<i>Euonymus fortunei</i>
English Ivy ²	<i>Hedera helix</i> ²
Japanese Honeysuckle ¹	<i>Lonicera japonica</i> ¹
Kudzu ²	<i>Pueraria lobata</i> ²
Periwinkle	<i>Vinca minor</i>
Wisteria ²	<i>Wisteria floribunda</i> , <i>W. sinensis</i> ²
SHRUBS	
Japanese Barberry	<i>Berberis thunbergii</i>
Russian Olive	<i>Elaeagnus angustifolium</i>
Autumn Olive	<i>Elaeagnus umbellata</i>
Winged Euonymus, Winged Wahoo ¹	<i>Euonymus alatus</i> ¹
Privet	
	<i>Ligustrum</i> spp.
Bush Honeysuckles ¹ , including	<i>Lonicera</i> spp. ¹
Belle Honeysuckle	<i>Lonicera x bella</i>
Amur Honeysuckle	<i>Lonicera maackii</i>
Morrow's Honeysuckle	<i>Lonicera morrowii</i>
Tartarian Honeysuckle	<i>Lonicera tatarica</i>
Bamboo - running varieties ²	<i>Phyllostachys</i> spp., <i>Pseudosasa japonica</i> ²
Common Buckthorn	<i>Rhamnus cathartica</i>
European Buckthorn	<i>Rhamnus frangula</i>
Multiflora Rose ¹	<i>Rosa multiflora</i> ¹
Strawberry-raspberry, Balloonberry	<i>Rubus illecebrosus</i>
Wineberry	<i>Rubus phoenicolasius</i>

Japanese Spiraea¹
Coralberry

*Spiraea japonica*¹
Symphoricarpos orbiculatus

T R E E S

Norway Maple¹
Tree of Heaven
White Mulberry
Empress Tree
Sweet Cherry, Bird Cherry

*Acer platanoides*¹
Ailanthus altissima
Morus alba
Paulownia tomentosa
Prunus avium

1. The most serious threats to natural forests because they are both damaging and strongly invasive.
2. Not as readily established, but once established, very persistent and damaging.

Ranking by Maryland Natural Heritage Program, 21 July 1994.

