State Forest Conservation Technical Manual

Third Edition, 1997

Maryland Department of Natural Resources
Ginger Page Howell, Tod Ericson, Editors.

Acknowledgments

Early in 1993, the DNR-Forest Service convened a task force to review the 1991 edition of the Forest Conservation Manual: Guidance for the Conservation of Maryland's Forests During Land Use Changes and recommend revisions which would clarify and streamline existing procedures and requirements. Our goal was to assist applicants, especially to the State Program, to meet the submission requirements for Forest Stand Delineations and Forest Conservation Plans.

The Technical Manual Task Force met through 1993 and presented its recommendations to the Forest Conservation Advisory Group which had been appointed to review statutory and regulatory requirements of the Forest Conservation Act. Through a cooperative effort, an initial draft of this manual was prepared and reviewed by the two groups. Jeff Horan, Task Force Chair, and Tod Ericson, Task Force Secretary, of the DNR-Forest Service were key to maintaining momentum.

To all the members of the Manual Task Force, especially Bob Syphard, John Blake, Rupert Friday, Martin Tucker, Scott Gove, Mark Burchick, Rich Pais, Elmina Hilsenrath, we thank you for your input, patience, and support. To the Forest Conservation Advisory Group, our thanks for your patient review and comments.

Many individuals and organizations provided valuable time, effort, and skill to produce this revised edition. Special thanks are due to the team which produced the first edition at the Metropolitan Washington Council of Governments. This edition also could not have been produced without the efforts of many who created and drew figures and design details for the second edition. Special thanks are due to the Montgomery County Planning Department and Maryland National Capital Park and Planning Commission who provided redrawn figures by Leiling Tien in its technical manual. Many of these have been adapted for this edition. Figures have also been used or adapted from Environmental Quality Resources, Inc., Silver Spring, MD, and ACRT, Inc., Steve Clark and Associates, Columbia, MD.

The second edition would not have been produced without the contributions of Elmina Hilsenrath, Project Manager, David Jones, Peter Mazzocchi, Tamela Michaels, A. Jay Pecora, and Jingjiu Wang at the University of Maryland, College Park. We thank them for invaluable comments, new and revised figures and assistance with layout and editing.

The case study used in this manual was based on the Gwyndyl Oak Estates property in Howard County, Maryland. Permission to use site plans and inventory data was granted by Wheeler Development, Inc., Owner and Developer, Gaithersburg, MD; Fisher, Collins and Carter, Inc., Civil engineers, Ellicott City, MD; and Exploration Research, Inc., Forest Conservation Consultants, Ellicott City, MD.

To the many DNR-Forest Service staff who reviewed the text drafts and figures and provided information on sampling, a heartfelt thank you for your time and effort. Special mention goes to Maureen Brooks, Barbara Rice, Becky Wilson, Marian Honeczy, Katie Kause, and Jon Chapman.

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Chapter 1

Introduction

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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 forests.

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 and is a means 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.

ISSUE	TREES AND FORESTS CAN...
Carbon Dioxide • Carbon dioxide comprises up to 50% by volume of greenhouse gases • Carbon dioxide is produced primarily through burning of fossil fuels	✔ absorb up to 48 pounds of carbon dioxide per year per tree or up to 10 tons per acre of trees during photosynthesis
Microclimate • Concrete and asphalt increase the temperature of urban areas 3-10° F by absorbing thermal energy • Exposed building walls with northerly orientation lose more heat during colder months	✔ decrease energy consumption by reducing exposure to harsh conditions
Air Pollution • Gaseous pollutants and particulate matter from cars, dust, ash, smoke, and pollen contribute to poor air quality	✔ filter particulates with leaves, stems and twigs ✔ absorb gaseous pollutants through pores on leaves
Water Pollution • Nutrients in water and sediment from agricultural and developed areas contribute to pollution of streams and rivers	✔ absorb as much as a net 6 pound/acre/yr of nitrogen
Soil Erosion • Water and wind erode unvegetated soils removing the most productive layer, depositing sediment in waterways • Erosion is a particular problem along stream banks, drainage ditches and areas prone to surface runoff or high wind	✔ hold soil in place with roots ✔ remove excess water from the soil keeping it cohesive yet not waterlogged
Stormwater Runoff • Uncontrolled runoff from storms increases erosion and flooding	✔ improve soil permeability with roots, decreasing the amount and rate of stormwater
Stream Habitat • Loss of riparian forests decreases the health of streams • Streams with open canopies have fluctuating water temperatures making waterways uninhabitable for many aquatic organisms	✔ filter nutrients, sediments and pollutants ✔ prevent heating of waterways in summer and rapid cooling in winter ✔ provide a major source of food for lower order stream and river communities
Forest Products • Reduced forest cover and poor forest management may result in the loss of resources for forest products	✔ provide timber for building, pulpwood for paper, fuelwood and other products
Recreation • Increasing numbers of urban residents seek local natural areas for a respite from daily life	✔ afford recreational opportunities, psychological and physical health benefits
Economic Values • Removal of existing forest cover during the construction process is costly and may require replacement after final grading	✔ offer economic and aesthetic benefits to the homeowner

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.

1.1 What Are the Basic Planning Requirements?

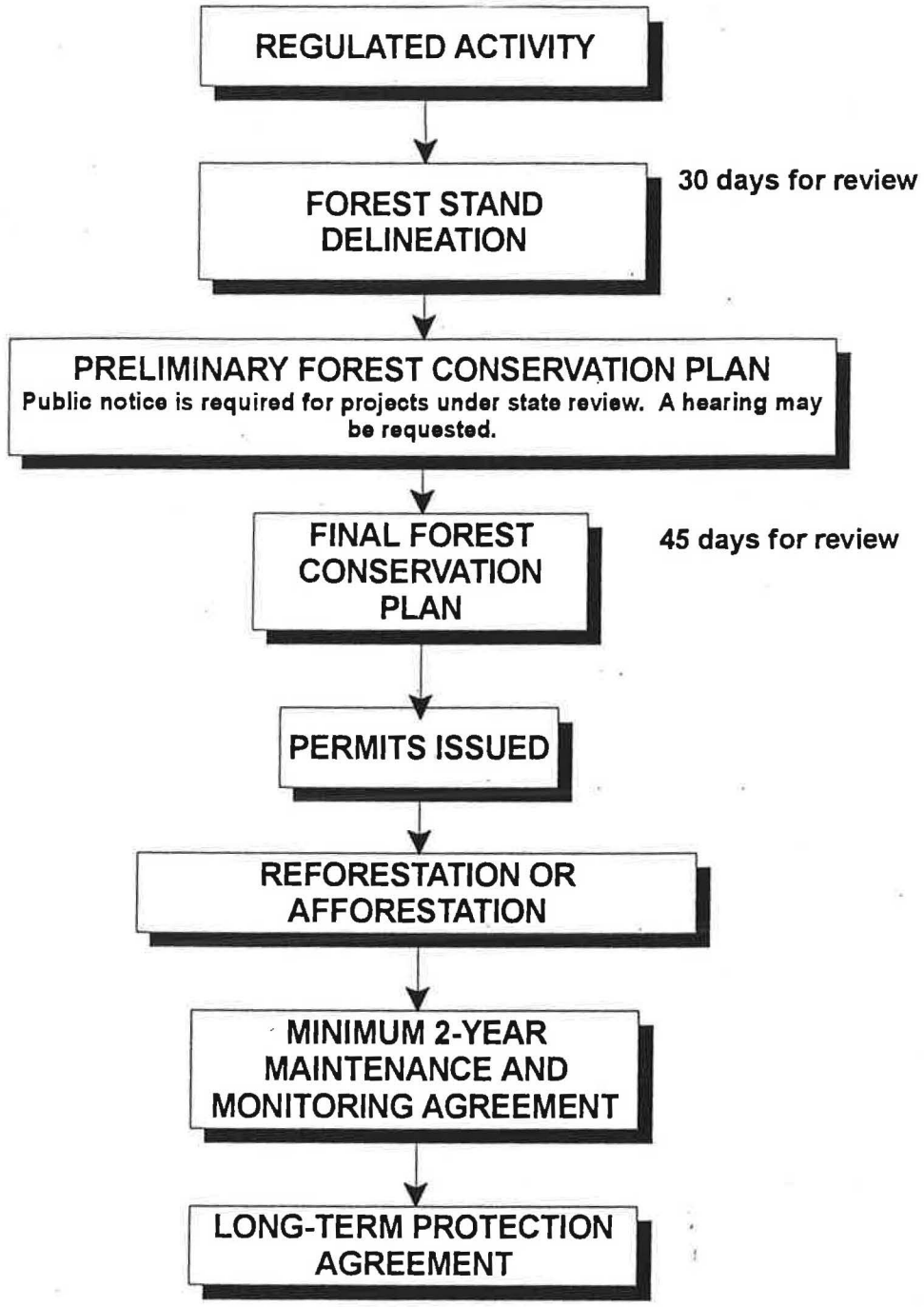
The Maryland Forest Conservation Act of 1991 requires that prior to the approval of any public or private subdivision, project plan, grading permit, or sediment control permit on a unit of land 40,000 square feet or greater, applicants shall submit a **Forest Stand Delineation (FSD)** and a **Forest 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. **Figure 1:2** illustrates a general outline of procedures for a submittal under the Forest Conservation Act.

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. (Natural Resource Article 5-1604).

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 (Natural Resource Article 5-1605).

A **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. (Natural Resource Article 5-1603).



Forest Conservation Procedures | **Figure 1:2**

1.2 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, the Department 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 document is the technical manual for the State Forest Conservation Program and is informational only. It is not incorporated by reference into the Natural Resources Article of the Annotated Code of Maryland or the Code of Maryland Regulations (COMAR). The legal provisions upon which this Manual is based 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). It is recommended that applicants obtain copies of these documents.

Before using this Manual, applicants should always consult with the local authority where the development will occur to determine if specific local program requirements will apply. Local authorities may have adopted these or similar standards for local forest conservation programs. Minimum standards for local programs are found in COMAR, Title 8, Subtitle 19, Chapter 2, "State Review and Approval of a Local Program."

This Technical Manual is cited as the State Forest Conservation Technical Manual, Third Edition, 1997. It replaces the Forest Conservation Manual, Second Edition, 1995, as the standard for the State Program.

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, as noted in Title 5-1602(b) of Natural Resources Article and the Code of Maryland Regulations (COMAR) Title 08.19.01.04(A), 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. Users are also referred to the statutory and regulatory definitions as contained in Natural Resource Article 5-1601 and COMAR 08.19.01.

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.

Comments or questions about this manual may be addressed to:

Forest Conservation Program
Department of Natural Resources - Forest Service
Tawes State Office Building, E-1
Annapolis, MD 21401
410-260-8531
Attn: Forest Conservation Manual, Regulations Coordinator

1.3 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 1:3**.

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 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 and 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.

Sewage reserve areas (SRA's) and septic systems are required in areas without public sewers. Design and installation of these systems is approved by State and local health departments. As with utility easements, these systems require cleared areas at installation or for future replacement systems within the easement areas. Furthermore, State regulations allow no other easements on SRA's, therefore, these areas are not candidates for long-term forest protection. To ensure forest protection when designing utilities:

- Locate septic areas outside of priority forest retention areas whenever possible.
- Minimize disturbance when the location of gravity-driven utility lines and septic areas are dictated by topographic conditions and clearing is necessary.

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

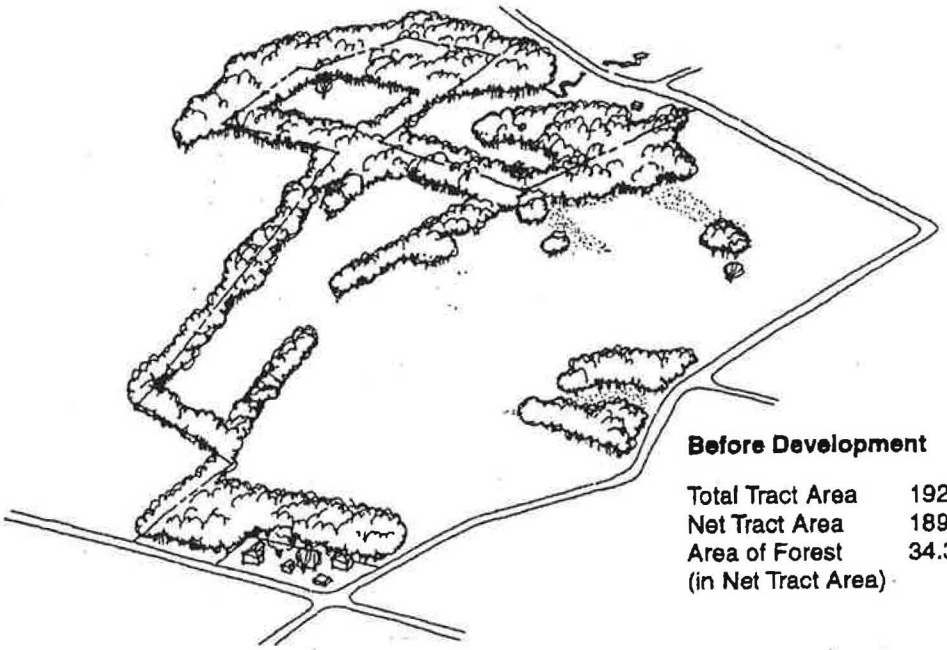
Designing and constructing erosion and sediment control structures should be closely coordinated with forest conservation planning. Protecting retained forests and planted areas requires enforcing defined limits of disturbance and controlling sediment losses from construction sites.

- 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

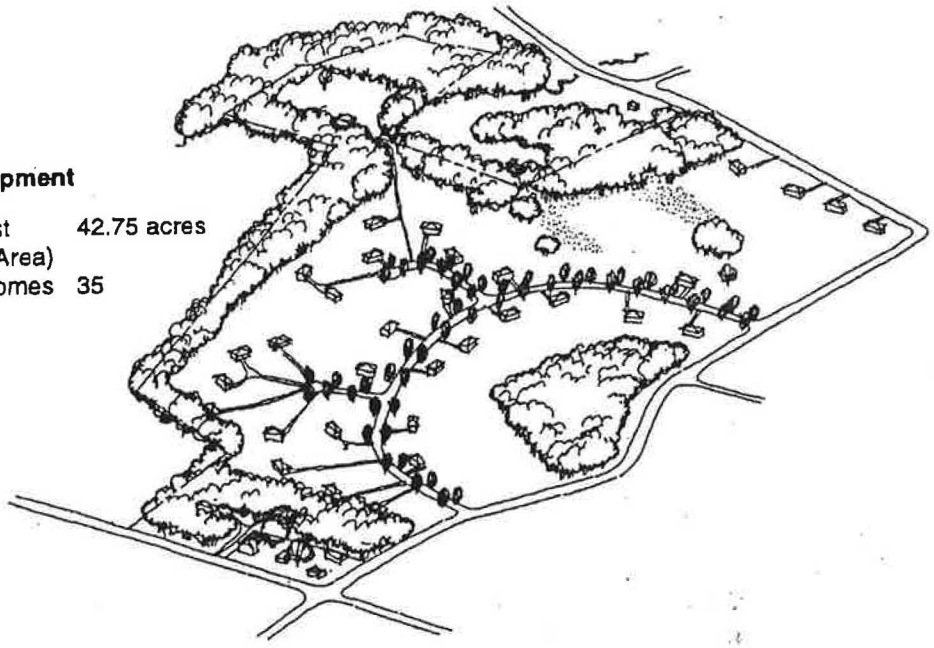
Wetlands protection, as specified by State and federal regulations, should have few conflicts with the Forest Conservation Act. Identifying and delineating wetlands when preparing a Forest Stand Delineation will assist site design and avoid costly or lengthy construction delays.

- Identify forested nontidal wetlands which are priority for retention.
- Report soils, vegetation, and hydrology information collected during a wetland delineation 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 1:3

Chapter 2

Forest Stand Delineations

Contents:

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). The State program requirements are listed for several 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 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?

Three 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 an Intermediate or Full FSD must be submitted. If a Simplified FSP may be used, a Forest Conservation Plan does not have to be prepared.

Intermediate Forest Stand Delineations

Intermediate FSD's may be used when development will occur in forested areas if:

- The amount of forest retained on a development site will be greater or equal to the break-even amount as calculated on the FCP Worksheet (Section 3.1); and
- No priority forests or priority retention areas will be disturbed during or after development (Section 3.1).

Approval of the Intermediate FSD shall be contingent on meeting both of the above two conditions. If the applicant is unable to meet these conditions for any reason, then a Full FSD shall be submitted.

Full Forest Stand Delineations

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

EXISTING FOREST CONDITIONS or PROPOSED LAND USE DEVELOPMENT CHARACTERISTICS	FOREST STAND DELINEATION REQUIREMENTS
Application for subdivision, grading, or sediment control permits on areas less than 40,000 square feet	EXEMPT - No delineation required.
Activities that clear less than 40,000* square feet of forest on a single lot	EXEMPT - No delineation required.
Application for subdivision, grading, or sediment control permits for areas equal to or greater than 40,000 square feet where NO FOREST EXISTS	SIMPLIFIED FOREST STAND DELINEATION Preliminary Forest Conservation Plan may be submitted at the same time as the FSD. • No sampling required • No narrative required
Site has EXISTING FOREST, but • Forest will NOT BE IMPACTED by clearing or grading and • Forests will be fully protected by a long-term protective agreement	SIMPLIFIED FOREST STAND DELINEATION Preliminary Forest Conservation Plan may be submitted at the same time as the FSD. • No sampling but field verification required • No narrative required
Site has EXISTING FOREST and • All high priority areas are retained • The forest retention amount will be EQUAL TO OR GREATER THAN THE BREAK-EVEN POINT and • The retained forest, including all high priority areas, will be placed under a long-term protective agreement	INTERMEDIATE FOREST STAND DELINEATION Preliminary Conservation Plan may be submitted at the same time as the FSD. • Limited field sampling • Narrative may be included as notes on FSD Map
All other development sites where • Priority forests will be cleared • Forest will be cleared below the break-even point • Forests will be cleared below the afforestation threshold	FULL FOREST STAND DELINEATION Separate submittal of Forest Stand Delineation and Forest Conservation Plan required. • Sampling required • Analysis and narrative • Forest Stand Summary required

*State Program requirement, other restrictions may apply in local programs.

Forest Stand Delineation Decision Matrix — **Figure 2:1**

2.2 Required Elements for the Different Types of FSD's

Forest Stand Delineations shall be submitted for the entire site. 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 the Forest Conservation Act (Nat. Res. Art. 5-1601) 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 COMAR 08.19.04.02I for the State program. Application forms are available on request.

- A **Site Vicinity Map**. This map (**Appendix A, 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.

- An **Environmental Features Map** or **Forest Stand Delineation Map**. 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 an Intermediate and Full FSD. Environmental features include:

  -- Sensitive Areas
  - 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 at least 50 feet wide measured from the top of the normal bank.
  - Steep slopes of 25% or more.
  - Critical Habitat Areas designated by the State or local authorities.
  - 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.

  -- Soils
  - Hydric soils, erodible soils on slopes of 15% 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)

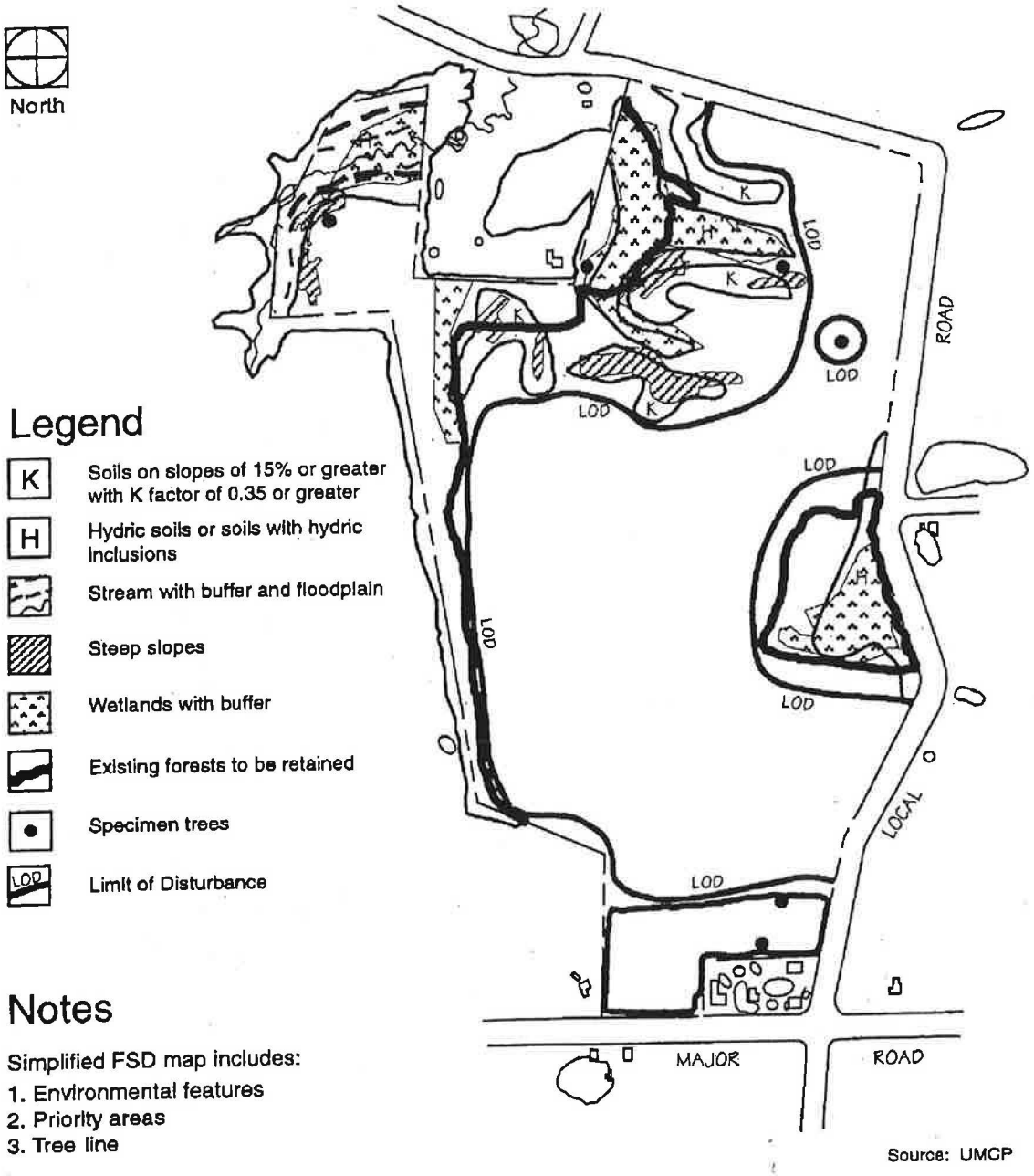
2. Environmental Features Map

- ❑ 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 interval (USGS 7 ½ minute quad or spot elevations)
- ❑ steep slopes greater than 25% (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)
- ❑ Critical Habitat Areas (Maryland Natural Heritage Program)
- ❑ 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 (COMAR 08.19.04.02)

Simplified FSD Checklist	**Figure 2:2**



Simplified FSD Map | **Figure 2:3**

Simplified FSD Plan | **Figure 2:4**

2.2.2 Intermediate FSD Requirements

Requirements for Intermediate FSD's are summarized in the checklist in **Figure 2:5**. A typical proposal using this option is illustrated in **Figures 2:6 and 2:7**.

Intermediate FSD's shall contain the following minimum elements:

- An **Application** signed by the applicant. The applicant shall be an authorized signatory as specified in COMAR 08.19.04.02I for the State program. Application forms are available on request.

- A **Site Vicinity Map**. This map (**Appendix A, 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.

- An **Environmental Features Map** or **Forest Stand Delineation Map**. 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 an Intermediate and Full FSD. Environmental features include:

  -- Sensitive Areas
  - 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 at least 50 feet wide measured from the top of the normal bank.
  - Steep slopes of 25% or more.
  - Critical Habitat Areas designated by the State or local authorities.
  - 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.

  -- Soils
  - Hydric soils, erodible soils on slopes of 15% or more and soils with structural limitations may be classified using USDA Soil Surveys or other local information.

  -- 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. Additional information about forest inside the proposed limits of disturbance shall be summarized on the map. This includes:
  - Composition, using dominant species, forest association, or other description;
  - Area (in acres);
  - Past and present management practices; and,
  - Potential of forested areas adjacent to proposed disturbance limits to

recover or recommendations for management in this new "edge" environment.

-- Proposed areas of long-term protection, if applicable.

- The **calculations** necessary to demonstrate that the development proposal meets the condition of forest retention and protection in the amount greater than or equal to the breakeven amount. This calculation may be shown on the FSD map, and does not require a separate submittal element. Information on calculating the retention amount may be found in Section 3.1.

- **Confirmation** by a walk-through survey that the proposed disturbance areas do not contain any priority forests or priority retention areas (Section 3.1). Such a field survey will require that a qualified professional examine the development areas and locate specific trees, shrubs, or plants which are priority for retention. A description of any such areas may be included in notes on the Intermediate FSD Map.

References to further information about how forests are described and methods for surveying may be found in Appendix E.

Priority Retention Areas

Priority retention areas include forests or other areas which are defined in Natural Resources Article 5-1607(c) or a local forest conservation program. They include trees, shrubs, or plants in sensitive areas such as 100-year nontidal floodplains, intermittent or perennial streams and their buffers, steep slopes, and Critical Habitat Areas. Also included are contiguous forest that connects the largest undeveloped or most vegetated tracts of land within and adjacent to the site, trees, shrubs, or plants identified on the list of rare, threatened, or endangered species of the U.S. Fish and Wildlife Service or the Department of Natural Resources, trees that are part of an historic site or associated with an historic structure or designated as a National, State, or local Champion Tree, and trees which have a diameter at 4.5 feet above the ground (DBH) of 30 inches, or 75% of the DBH of the current State Champion of that species.

SUBMITTAL REQUIREMENTS

1. Site Vicinity Map

- ❑ location of the project site and surrounding area within one square mile
- ❑ major roads
- ❑ political boundaries
- ❑ north arrow
- ❑ 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 interval (USGS 7 ½ minute quad or spot elevations)
- ❑ steep slopes greater than 25% (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, 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)
- ❑ forested areas and unforested areas including tree lines extending offsite
- ❑ adjacent land uses
- ❑ Priority Retention Areas in development areas that are:
  - Critical Habitat Areas (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
  - specimen trees of 30" dbh or greater (local jurisdictions may vary)
  - trees with at least 75% of the diameter of the State champion tree of that species
- ❑ proposed limits of disturbance
- ❑ size and location of forest stands
- ❑ areas proposed for long-term protection
- ❑ size and location of adjacent forested areas

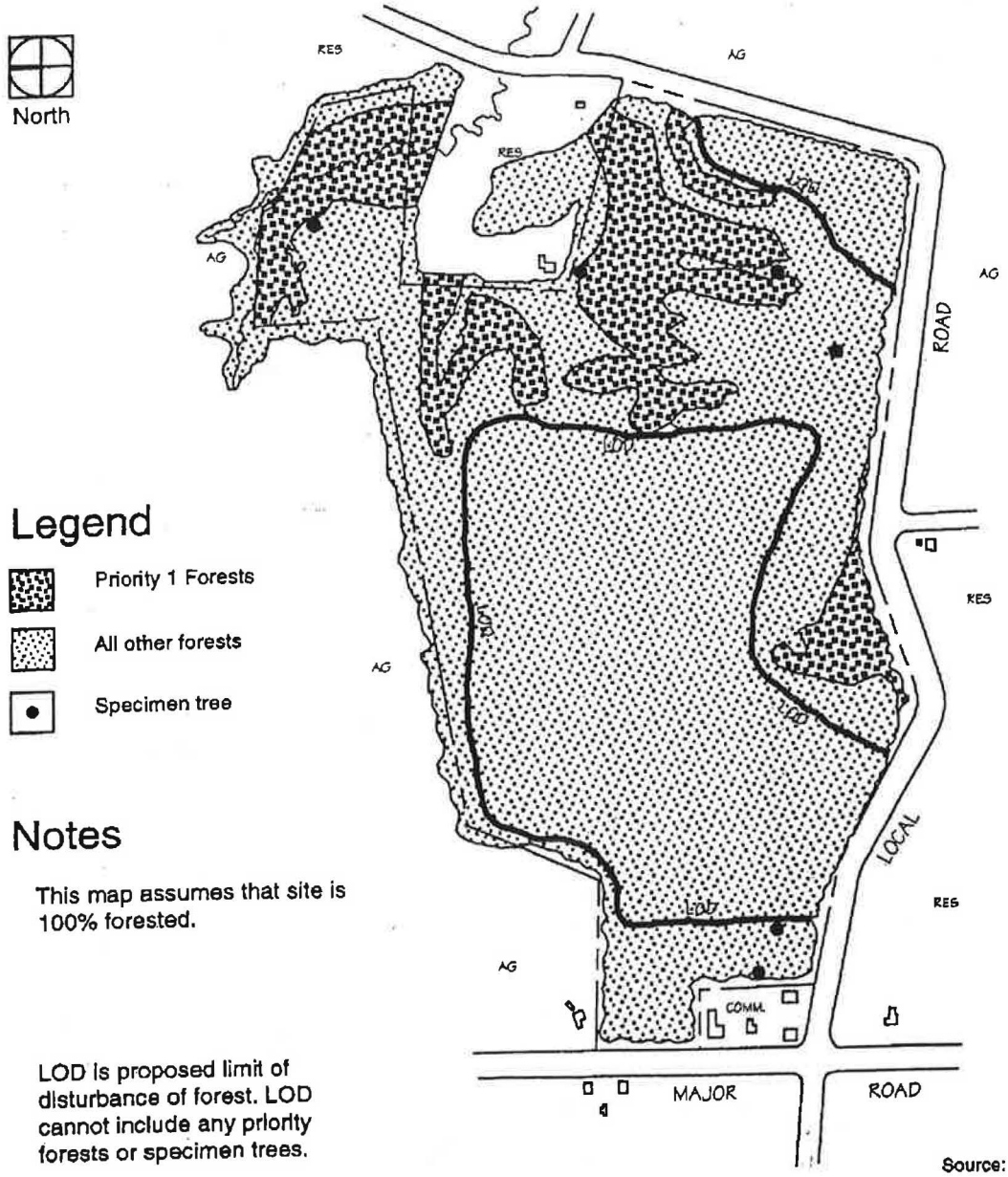
3. Narrative (may be included as notes on the FSD map)

- ❑ preliminary worksheet calculations showing forest conservation thresholds and required retention amounts
- ❑ summary of walk-through forest survey
- ❑ past and present management of forested areas and unforested areas
- ❑ potential of stands adjacent to disturbance to recover or management recommendations

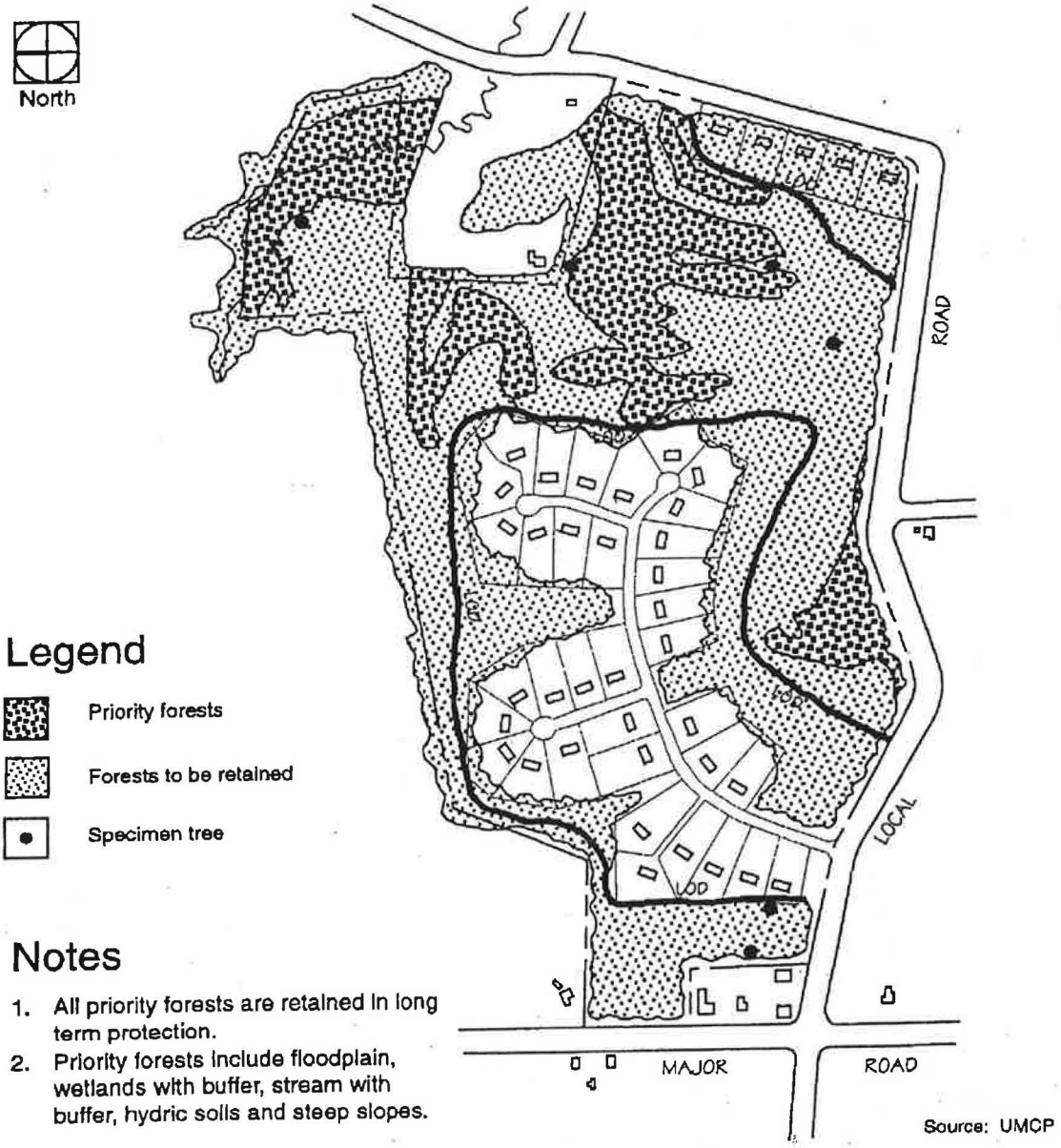
4. Application

- ❑ complete information including signature (COMAR 08.19.04.02)

Intermediate FSD Checklist	**Figure 2:5**



Intermediate FSD Map | **Figure 2:6**



Legend

- Priority forests
- Forests to be retained
- Specimen tree

Notes

1. All priority forests are retained in long term protection.
2. Priority forests include floodplain, wetlands with buffer, stream with buffer, hydric soils and steep slopes.

Intermediate FSD Plan | **Figure 2:7**

2.2.3 Full FSD Requirements

Full FSD requirements are summarized in the checklist in **Figure 2:8**. The following is a suggested step-by-step procedure for preparing a Full FSD. It corresponds with the flow chart in **Figure 2:9** which outlines the process and the maps for the sample site in **Figure 2:13 and A:6 -- A:8**.

Step 1. Prepare Preliminary Map for Field Verification

It is helpful to prepare a preliminary Forest Stand Map or Environmental Features 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
- 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. Applicants to the State Program will be requested to contact the Department about this procedure.

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)

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 interval (USGS 7 ½ minute quad or spot elevations)
- ☐ steep slopes greater than 25% (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, 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 areas
- ☐ 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
  - specimen trees of 30" dbh or greater (local jurisdictions may vary)
  - trees with at least 75% of the diameter of the State champion tree of that species

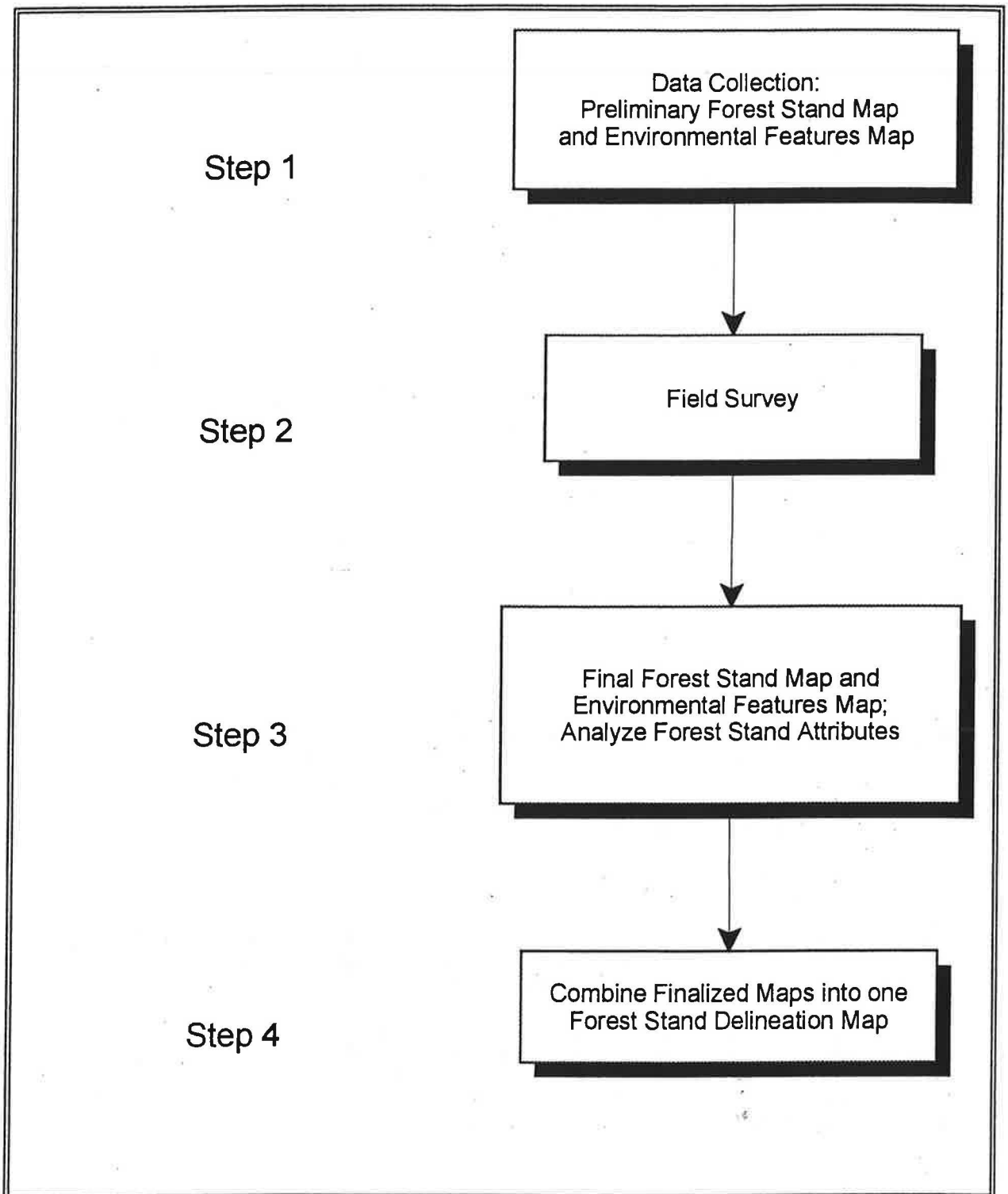
3. Forest Stand Analysis

- ☐ site description
- ☐ methodology
- ☐ summary for each stand describing stand composition, stand structure, stand condition, retention potential relating to proposed development, specific 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 <u>each</u> sample plot
- ☐ forest stand summary sheets including property name, location, name of person preparing summary, date of preparation, and summary for <u>each</u> forest stand

4. Application

- ☐ complete information including signature (COMAR 08.19.04.02)

Full FSD Checklist | **Figure 2:8**



Full FSD Procedures | **Figure 2:9**

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.

The 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 critieria should be used to estimate the number of sample plots required:

- one plot per 4 acres 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 30" 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 2:10**) 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 or 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 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 2:11**). 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, recreation, or others as appropriate to the development proposal.

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 #: F-1 Plot #: 3 Plot Size: 1/10 - acre 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
Chestnut Oak

% of Canopy Closure

C	N	E	S	W	Total
Y	Y	Y	Y	Y	100%

Percent of Invasive Cover per Plot (All Layers): 0

Plot Successional Stage: Mature Upland

List of Herbaceous Species 0'-3':
Lycopdium
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 1 of 14

Forest Sampling Data Worksheet — **Figure 2:10**

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 dominant species	12" - 19": dbh	2" - 5.9" dbh
5. Percent of canopy closure	87%	60%
6. Number of tree species per acre	8	5
7. Common understory species 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	O -None U - Multiflora Rose 15% H - Jap. Honeysuckle 40%	O - 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 2:11**

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 2:12.**)

  #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.

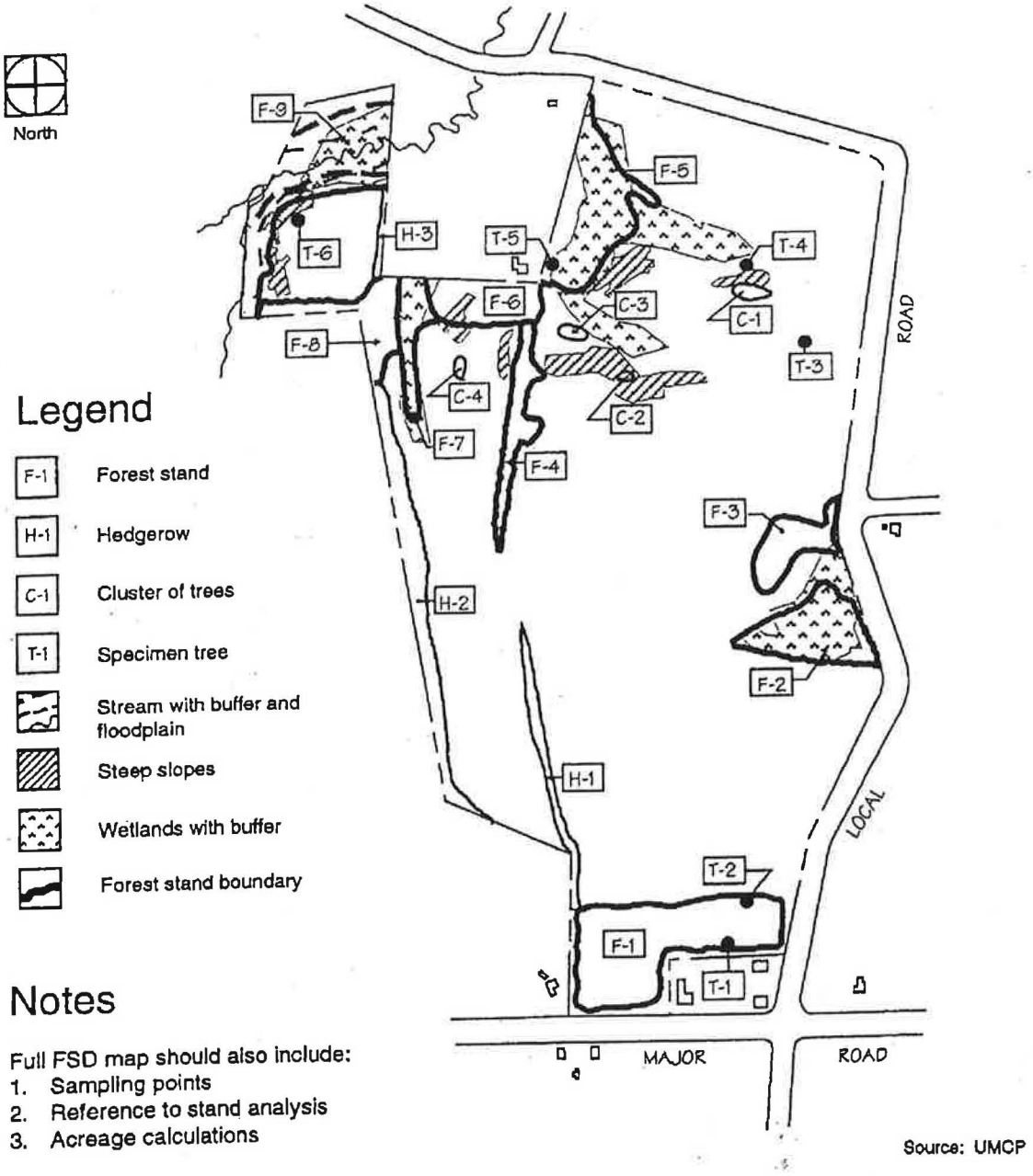
Step 4. Create Final FSD Map

All preliminary field maps are compiled into one final map for submittal (**Figure 2:13**). 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).

Water Quality • 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.	**Measures** ✔ Canopy cover, understory and herbaceous cover type and amount – 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.
• Water absorption potential of soils and vegetation	✔ Canopy, understory and herbaceous cover ✔ Structural diversity (Many layers absorb falling water drops and slow their velocity) ✔ Organic matter accumulation on top of and in first soil layers
• Water retention of vegetation, soils and topography	✔ Presence of wetlands, swales, ravines - Density and structural diversity of vegetation in these areas will enhance water retention ✔ Drainage classification of subsoil - Poorly drained soils have different chemical properties than well–drained soils
• Nutrient removal from surface and subsurface flows	✔ Width and connectivity of forest buffers adjacent to streams and other water bodies
Wildlife Habitat • Available food –often species specific, e.g. gray squirrel consumes hard mast (nuts)	**Measures** ✔ Species composition which provides: forage, browse, mast, fruits, grasses, etc.
• Available cover - provides shelter from predators or environment (shade, warmth, special needs during breeding)	✔ Structure, density, presence or number of snags (standing dead trees), species composition
• Available water - often obtained from surface water.	✔ Presence of streams, riparian buffer zones and wetlands (consider adaptation of constructed retention/detention systems)
• 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.	✔ Contiguous corridors, large patches, landscape scale matrix of forested and related habitat. ✔ Lack of fragmentation, ✔ Presence/absence of linear corridors or barriers
Landscape Uses • Shelter from environmental conditions such as wind or noise	**Measures** ✔ Location, species composition, structure
• Absorption of particulates and pollutants	✔ Location, species composition
• Visual buffer or screen	✔ Location, species composition, deciduous vs. coniferous

Assessing Priority 3 Stands — **Figure 2:12**



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

Full FSD Map — **Figure 2:13**

Chapter 3

Forest Conservation Plans

Contents:

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.

- **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 or, for local applications, approved by a local jurisdiction in accordance with an adopted and approved local forest conservation program, 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	Int	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
Map (continued) Planted areas Offsite planting requires	Simp	Int	Full	Prelim	Final		
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							✓

● As condition of approval

* For details on approvals by State Forest Conservation Program, contact State Forest Conservation Program, DNR-Forest Service

Submission of FCP Elements (continued) — **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 Natural Resources Article 5-1607 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 30" or larger. When such trees are found in a stand that is located in a Retention Area, 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 subject to Natural Resources Article 8-1201 — 8-1211 and COMAR 08.05.04, 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 fron 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 in Natural Resources Article 5-1607 (c). 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. Locate forest stands which contain priority areas identified in a local land use plan or local forest conservation program.

4. If the areas located in (1) through (3) 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.

5. If the requirements of (1) through (4) 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 stated in Natural Resources Article 5-1607 (c), these trees may be designated for protection and retention credit. 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 specimen 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 of the breakeven retention amount or preliminary worksheet calculations for an Intermediate 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.

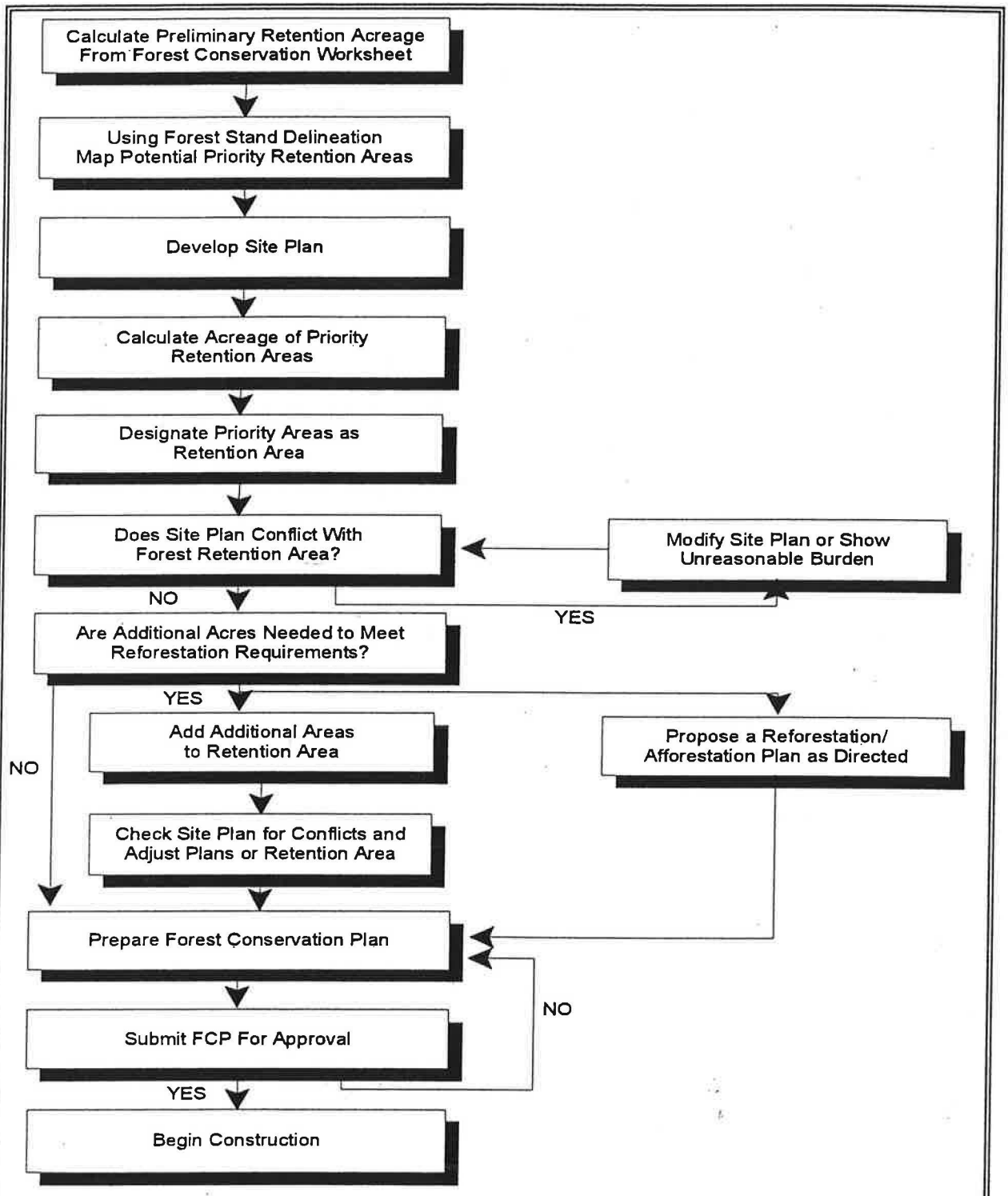
These will appear on the FCP with site improvements; therefore, a current site plan or subdivision plan will be required for this step. If no site plan has been prepared, ensure that site planning objectives include protection of these priority areas.

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 specimen trees on the FCP Map.



Forest Retention Area Decision Matrix | **Figure 3:2**

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 is 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 is 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 eight-fold. Conversely, any forest retained above the threshold is credited at a higher rate. This results in a clearing break-even point (**Figure 3:3**), at which no reforestation will be required for forest clearing resulting from proposed development.

The objective of the FCP in site planning is to maintain forest at the break-even point or above, 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 will 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 in agricultural and resource areas, this is the portion of the total 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 3:4)**.

- **Conservation and Afforestation Threshold Percentage (Figure 3:4)**.

- **Existing Forest Cover**. This is measured to the nearest 1/10 acre and determined from the current approved Forest Stand Delineation (Section 2.2).

Several development scenarios are illustrated in **Figures 3:5 to 3:9** as examples of potential retention, reforestation, and afforestation calculations. 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. **Figures 3:10 through 3:12** illustrate completion of the worksheet using different existing forest areas. Computer software is also available and may be operated from many standard spreadsheet programs.

Size of Retention Areas

Forest Retention Areas shall contain a minimum of 10,000 square feet (0.23 acres) of continuous forest cover. This 10,000 square foot minimum area may include critical root zones as defined in Section 3.2.

Alternatively, where there are trees which are identified as priority for retention according to Natural Resources Article 5-1607 (c) (see Section 3.1), 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

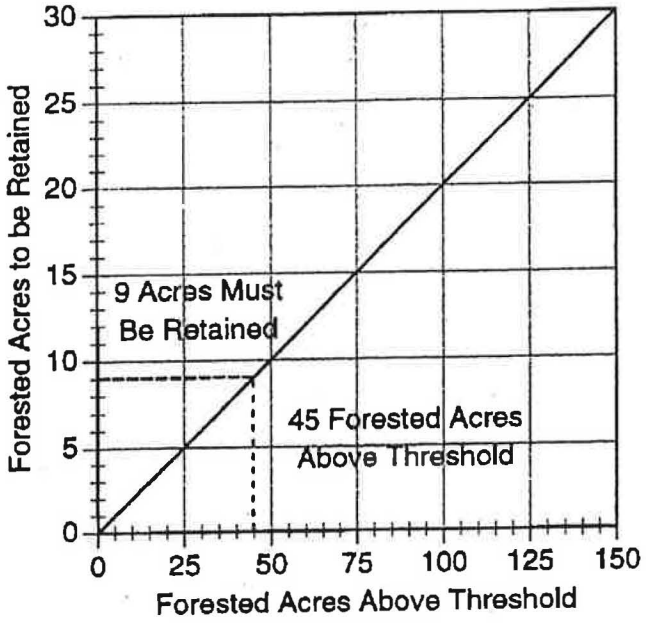
Each FCP map shall contain a table showing the elements and amounts to the nearest 1/10 acre required for the retention, reforestation, or afforestation calculations. These include (although some may not be applicable to the development proposal):

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 wetlands have been identified through delineation or jurisdictional determination subject to Natural Resources Article 8-1201 — 8-1211 and COMAR 08.05.04, 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.

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



A simple relationship exists between the number of forested acres above the Conservation Threshold and the amount of forests required to be retained in order to be exempt from reforestation requirements. One acre of retention is required for every 5 acres of forest above the threshold (1:5 = 20%) The dashed lines above indicate how an applicant would calculate the break even point for the site used as an example

Source: Adapted from Forest Conservation Manual, 1991

Determination of Breakeven Point | **Figure 3:3**

Land Use Type	Conservation Threshold	Afforestation Threshold
Agricultural and Resources Areas	50%	20%
Medium Density Residential Areas	25%	20%
Institutional Development Areas	20%	15%
High Density Residential Areas	20%	15%
Mixed Use and Planned Unit Development Areas	15%	15%
Commercial and Industrial Use Areas	15%	15%

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 unit per acre, including both existing and planned development and their associated infrastructure, such as roads, utilities, and water and sewer service.

Institutional Development Areas – schools, colleges, universities, military installations, transportation facilities, utility and sewer projects, government offices and facilities, golf courses, recreation areas, parks, and cemeteries.

High Density Residential Areas – areas zoned for densitites 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 – single, relatively high density development projects, usually commercial in nature, which include two or more types of uses.

Planned Unit Development Areas – developments comprising 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 local jurisdiction with at least 20% of the land permanently dedicated to open space.

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

Land Use Thresholds	Figure 3:4

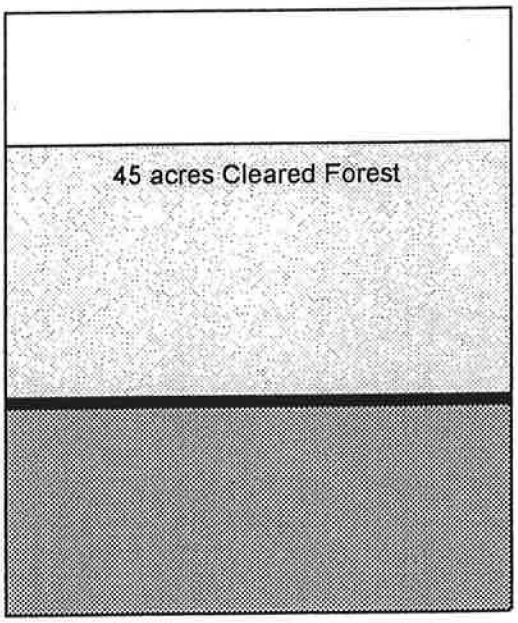
Clearing Down to Conservation Threshold

Site Information

Land Use Category			Medium Density Residential Area
Net Tract Area			100 acres
Current Forest Cover			70 acres
Conservation Threshold (25%)			25 acres
Forest Cover Above Threshold			45 acres
Area of Forest to be Cleared			45 acres

Reforestation Calculations

Above Threshold:	45 acres x 1/4	=	11.25 acres
Below Threshold:	0 acres x 2	=	+ 0.00 acres
Total Planting Requirements		=	11.25 acres Reforestation



Example 1: Reforestation, Clearing to Threshold

Figure 3:5

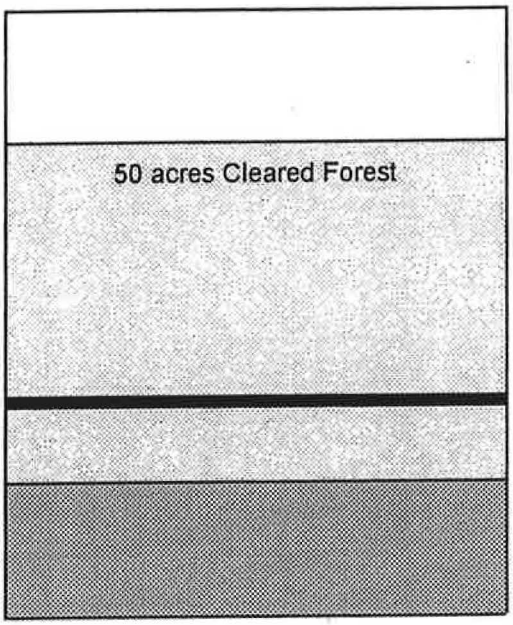
Clearing Below Conservation Threshold

Site Information

Land Use Category	Medium Density Residential Area
Net Tract Area	100 acres
Current Forest Cover	70 acres
Conservation Threshold (25%)	25 acres
Forest Cover Above Threshold	45 acres
Area of Forest to be Cleared	50 acres

Reforestation Calculations

Above Threshold:	45 acres x 1/4	=	11.25 acres
Below Threshold:	5 acres x 2	=	+ 10.00 acres
Total Planting Requirements		=	21.25 acres Reforestation



Example 2: Reforestation, Clearing below Threshold

Figure 3:6

Use of Reforestation Credit

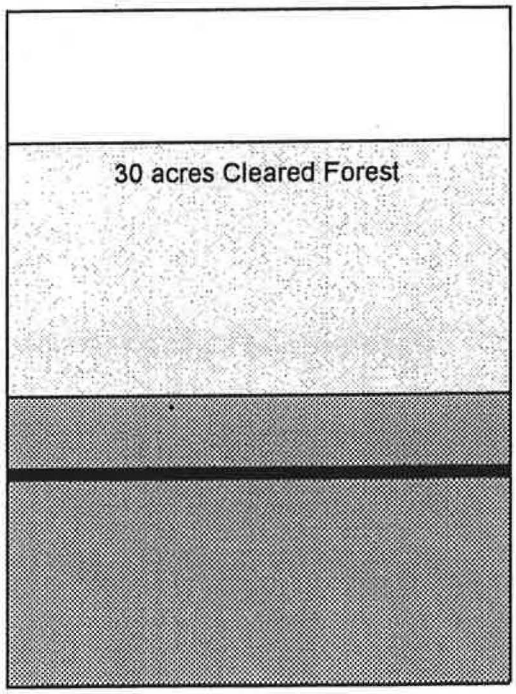
Reforestation Credit Rule: Each acre of forest retained in the Net Tract Area, above the Forest Conservation Threshold, reduces the reforestation requirement by 1 acre such that the retained acreage compensates for the cleared acreage.

Site Information

Land Use Category		Medium Density Residential Area
Net Tract Area		100 acres
Current Forest Cover		70 acres
Conservation Threshold (25%)		25 acres
Forest Cover Above Threshold		45 acres
Area of Forest to be Cleared		30 acres
Area of Forest to Remain Above Threshold		15 acres

Calculations

Reforestation Credit	=	15 acres
15 acres Above Threshold		
Reforestation Required	=	-7.5 acres
30 acres Cleared x 1/4	=	7.5 acres Reforestation Credit
Total Planting Requirements	=	0 acres (Reforestation Credit exceeds Reforestation Requirement)



Example 3: No Reforestation, Use of Credit

Figure 3:7

Forested Acreage Below Afforestation Threshold

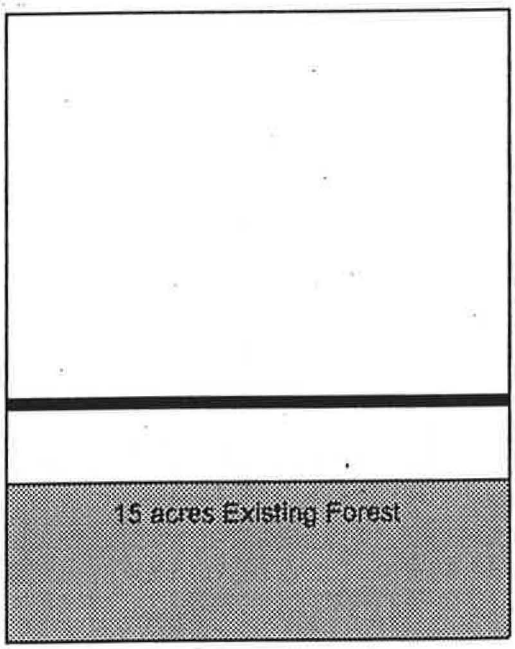
Afforestation Threshold: If the Forest Stand Delineation finds that the site has less than the required percentage of the Net Tract Area in forest cover, it must be afforested to a required Afforestation Threshold (different from the Conservation Threshold).

Site Information

Land Use Category	Medium Density Residential Area
Net Tract Area	100 acres
Current Forest Cover	15 acres
Afforestation Threshold (20%)	20 acres
Forest Cover Above Afforestation Threshold	0 acres
Area of Forest to be Cleared	0 acres

Calculations

100 acres x 20%	=	20 acres must contain forest
20 acres - 15 acres (existing forest)	=	5 acres must be afforested
Total Planting Requirements	=	5 acres Afforestation



Example 4: Afforestation, No Clearing | **Figure 3:8**

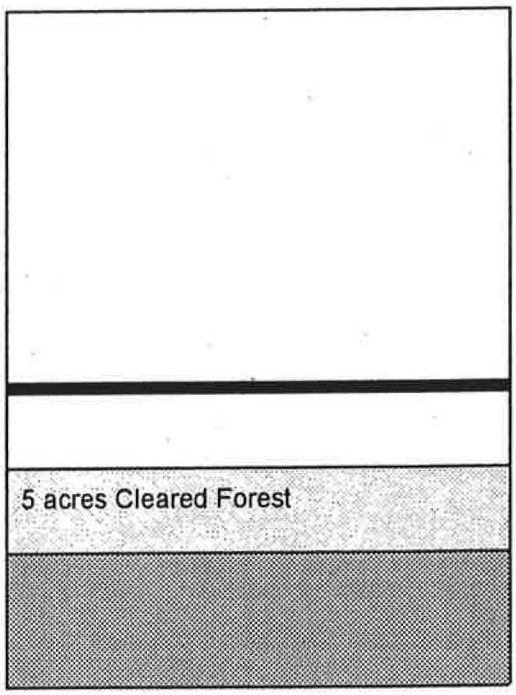
Clearing Below Afforestation Threshold

Site Information

Land Use Category		Medium Density Residential Area
Net Tract Area		100 acres
Current Forest Cover		70 acres
Afforestation Threshold (20%)		20 acres
Forest Cover Above Afforestation Threshold		0 acres
Area of Forest to be Cleared		5 acres

Calculations

Afforestation Requirement:		
100 acres x 20%	=	20 acres must contain forest
20 acres - 15 acres	=	5 acres must be afforested
Reforestation Requirement:		
Area Cleared below Afforestation Threshold 5 acres x 2	=	10 acres must be forested
Total Planting Requirements	=	5 acres afforestation + 10 acres reforestation 15 acres



Example 5: Afforestation and Reforestation | **Figure 3:9**

Note: Use 0 for all negative numbers that result from the calculations.	
Net Tract Area	
A. *Total Tract Area*	A= 189.70
B. *Deductions* (Critical Area, area restricted by local ordinance or program)	B= 0.00
C. *Net Tract Area* Net Tract Area = Total Tract (A) - Deductions (B)	C= 189.70
Land Use Category: Medium Density Residential	
D. *Afforestation Threshold* (Net Tract Area [C] x ____%)	D= 37.94
E. *Conservation Threshold* (Net Tract Area [C] x ____%)	E= 47.43
Existing Forest Cover	
F. *Existing Forest Cover within the Net Tract Area*	F= 34.35
G. *Area of Forest Above Conservation Threshold* If the Existing Forest Cover (F) is greater than the Conservation Threshold (E), then G = F – E; otherwise G = 0.	G= 0.00
Breakeven Point	
H. *Breakeven Point* (Amount of forest that must be retained so that no mitigation is required) (1) If the Area of Forest Above Conservation Threshold (G) is greater than 0, then H = (0.2 x the Area of Forest Above Conservation Threshold (G)) + the Conservation Threshold (E); (2) If the Area of Forest Above Conservation Threshold (G) is equal to 0, then H= Existing Forest Cover (F)	H= 34.35
I. *Forest Clearing Permitted Without Mitigation* I = Existing Forest Cover (F) – Breakeven point (H)	I= 0.00
Proposed Forest Clearing	
J. *Total Area of Forest to be Cleared*	J= 3.45
K. *Total Area of Forest to be Retained* K = Existing Forest Cover (F) – Forest to be Cleared (J)	K= 30.90
Planting Requirements If the Total Area of Forest to be Retained (K) is at or above the Breakeven Point (H), no planting is required, and no further calculations are necessary (L=0, M=0, N=0, P=0, Q=0, R=0). Otherwise, calculate the planting requirement(s) as follows:	
L. *Reforestation for Clearing Above the Conservation Threshold* (1) If the Total Area of Forest to be Retained (K) is greater than the Conservation Threshold (E), then L = the Area of Forest to be Cleared (J) x 0.25; (2) If the Forest to be Retained (K) is less than or equal to the Conservation Threshold (E), then L = Area of Forest Above Conservation Threshold (G) x 0.25	L= 0.00
M. *Reforestation for Clearing Below the Conservation Threshold* (1) If Existing Forest Cover (F) is greater than the Conservation Threshold (E) and the Forest to be Retained (K) is less than or equal to the Conservation Threshold (E), then M = 2.0 x (Conservation Threshold (E) – Forest to be Retained (K)) (2) If Existing Forest Cover (F) is less than or equal to the Conservation Threshold (E), then M = 2.0 x Forest to be Cleared (J)	M= 6.90
N. *Credit for Retention Above the Conservation Threshold* If the area of Forest to be Retained (K) is greater than the Conservation Threshold (E), then N = K – E; Otherwise N=0	N= 0.00
P. *Total Reforestation Required* P = L + M – N	P= 6.90
Q. *Total Afforestation Required* If Existing Forest Cover (F) is less than the Afforestation Threshold (D), then Q = Afforestation Threshold (D) – Existing Forest Cover (F)	Q= 3.59
R. *Total Planting Requirement* R = P + Q	R= 10.49
Forest Conservation Worksheet (Full)	**Figure 3:10**

Note: Use 0 for all negative numbers that result from the calculations.	
Net Tract Area	
A. *Total Tract Area*	A= 189.70
B. *Deductions* (Critical Area, area restricted by local ordinance or program)	B= 0.00
C. *Net Tract Area* Net Tract Area = Total Tract (A) - Deductions (B)	C= 189.70
Land Use Category: Medium Density Residential	
D. *Afforestation Threshold* (Net Tract Area [C] x ____%)	D= 37.94
E. *Conservation Threshold* (Net Tract Area [C] x ____%)	E= 47.43
Existing Forest Cover	
F. *Existing Forest Cover within the Net Tract Area*	F= 189.70
G. *Area of Forest Above Conservation Threshold* If the Existing Forest Cover (F) is greater than the Conservation Threshold (E), then G = F – E; otherwise G = 0.	G= 142.28
Breakeven Point	
H. *Breakeven Point* (Amount of forest that must be retained so that no mitigation is required) (1) If the Area of Forest Above Conservation Threshold (G) is greater than 0, then H = (0.2 x the Area of Forest Above Conservation Threshold (G)) + the Conservation Threshold (E); (2) If the Area of Forest Above Conservation Threshold (G) is equal to 0, then H= Existing Forest Cover (F)	H= 75.88
I. *Forest Clearing Permitted Without Mitigation* I = Existing Forest Cover (F) – Breakeven point (H)	I= 113.82
Proposed Forest Clearing	
J. *Total Area of Forest to be Cleared*	J= 52.50
K. *Total Area of Forest to be Retained* K = Existing Forest Cover (F) – Forest to be Cleared (J)	K= 137.20
Planting Requirements If the Total Area of Forest to be Retained (K) is at or above the Breakeven Point (H), no planting is required, and no further calculations are necessary (L=0, M=0, N=0, P=0, Q=0, R=0). Otherwise, calculate the planting requirement(s) as follows:	
L. *Reforestation for Clearing Above the Conservation Threshold* (1) If the Total Area of Forest to be Retained (K) is greater than the Conservation Threshold (E), then L = the Area of Forest to be Cleared (J) x 0.25; (2) If the Forest to be Retained (K) is less than or equal to the Conservation Threshold (E), then L = Area of Forest Above Conservation Threshold (G) x 0.25	L= 0.00
M. *Reforestation for Clearing Below the Conservation Threshold* (1) If Existing Forest Cover (F) is greater than the Conservation Threshold (E) and the Forest to be Retained (K) is less than or equal to the Conservation Threshold (E), then M = 2.0 x (Conservation Threshold (E) – Forest to be Retained (K)) (2) If Existing Forest Cover (F) is less than or equal to the Conservation Threshold (E), then M = 2.0 x Forest to be Cleared (J)	M= 0.00
N. *Credit for Retention Above the Conservation Threshold* If the area of Forest to be Retained (K) is greater than the Conservation Threshold (E), then N = K – E; Otherwise N=0	N= 0.00
P. *Total Reforestation Required* P = L + M – N	P= 0.00
Q. *Total Afforestation Required* If Existing Forest Cover (F) is less than the Afforestation Threshold (D), then Q = Afforestation Threshold (D) – Existing Forest Cover (F)	Q= 0.00
R. *Total Planting Requirement* R = P + Q	R= 0.00

Forest Conservation Worksheet (Intermediate) — **Figure 3:11**

Note: Use 0 for all negative numbers that result from the calculations.	
Net Tract Area	
A. *Total Tract Area*	A= 189.70
B. *Deductions* (Critical Area, area restricted by local ordinance or program)	B= 0.00
C. *Net Tract Area* Net Tract Area = Total Tract (A) - Deductions (B)	C= 189.70
Land Use Category: Medium Density Residential	
D. *Afforestation Threshold* (Net Tract Area [C] x ____%)	D= 37.94
E. *Conservation Threshold* (Net Tract Area [C] x ____%)	E= 47.43
Existing Forest Cover	
F. *Existing Forest Cover within the Net Tract Area*	F= 45.20
G. *Area of Forest Above Conservation Threshold* If the Existing Forest Cover (F) is greater than the Conservation Threshold (E), then G = F – E; otherwise G = 0.	G= 0.00
Breakeven Point	
H. *Breakeven Point* (Amount of forest that must be retained so that no mitigation is required) (1) If the Area of Forest Above Conservation Threshold (G) is greater than 0, then H = (0.2 x the Area of Forest Above Conservation Threshold (G)) + the Conservation Threshold (E); (2) If the Area of Forest Above Conservation Threshold (G) is equal to 0, then H= Existing Forest Cover (F)	H= 45.20
I. *Forest Clearing Permitted Without Mitigation* I = Existing Forest Cover (F) – Breakeven point (H)	I= 0.00
Proposed Forest Clearing	
J. *Total Area of Forest to be Cleared*	J= 0.00
K. *Total Area of Forest to be Retained* K = Existing Forest Cover (F) – Forest to be Cleared (J)	K= 45.20
Planting Requirements If the Total Area of Forest to be Retained (K) is at or above the Breakeven Point (H), no planting is required, and no further calculations are necessary (L=0, M=0, N=0, P=0, Q=0, R=0). Otherwise, calculate the planting requirement(s) as follows:	
L. *Reforestation for Clearing Above the Conservation Threshold* (1) If the Total Area of Forest to be Retained (K) is greater than the Conservation Threshold (E), then L = the Area of Forest to be Cleared (J) x 0.25; (2) If the Forest to be Retained (K) is less than or equal to the Conservation Threshold (E), then L = Area of Forest Above Conservation Threshold (G) x 0.25	L= 0.00
M. *Reforestation for Clearing Below the Conservation Threshold* (1) If Existing Forest Cover (F) is greater than the Conservation Threshold (E) and the Forest to be Retained (K) is less than or equal to the Conservation Threshold (E), then M = 2.0 x (Conservation Threshold (E) – Forest to be Retained (K)) (2) If Existing Forest Cover (F) is less than or equal to the Conservation Threshold (E), then M = 2.0 x Forest to be Cleared (J)	M= 0.00
N. *Credit for Retention Above the Conservation Threshold* If the area of Forest to be Retained (K) is greater than the Conservation Threshold (E), then N = K – E; Otherwise N=0	N= 0.00
P. *Total Reforestation Required* P = L + M – N	P= 0.00
Q. *Total Afforestation Required* If Existing Forest Cover (F) is less than the Afforestation Threshold (D), then Q = Afforestation Threshold (D) – Existing Forest Cover (F)	Q= 0.00
R. *Total Planting Requirement* R = P + Q	R= 0.00

Forest Conservation Worksheet (Simplified) — **Figure 3:12**

3.2 Forest and Tree Protection

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 credited 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 Forest and Tree Protection: 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 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 will require protection devices, including but not limited to, fencing or adapted sediment and erosion control devices and signs as indicated in the approved FCP. 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 DBH; 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 3:13**.

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

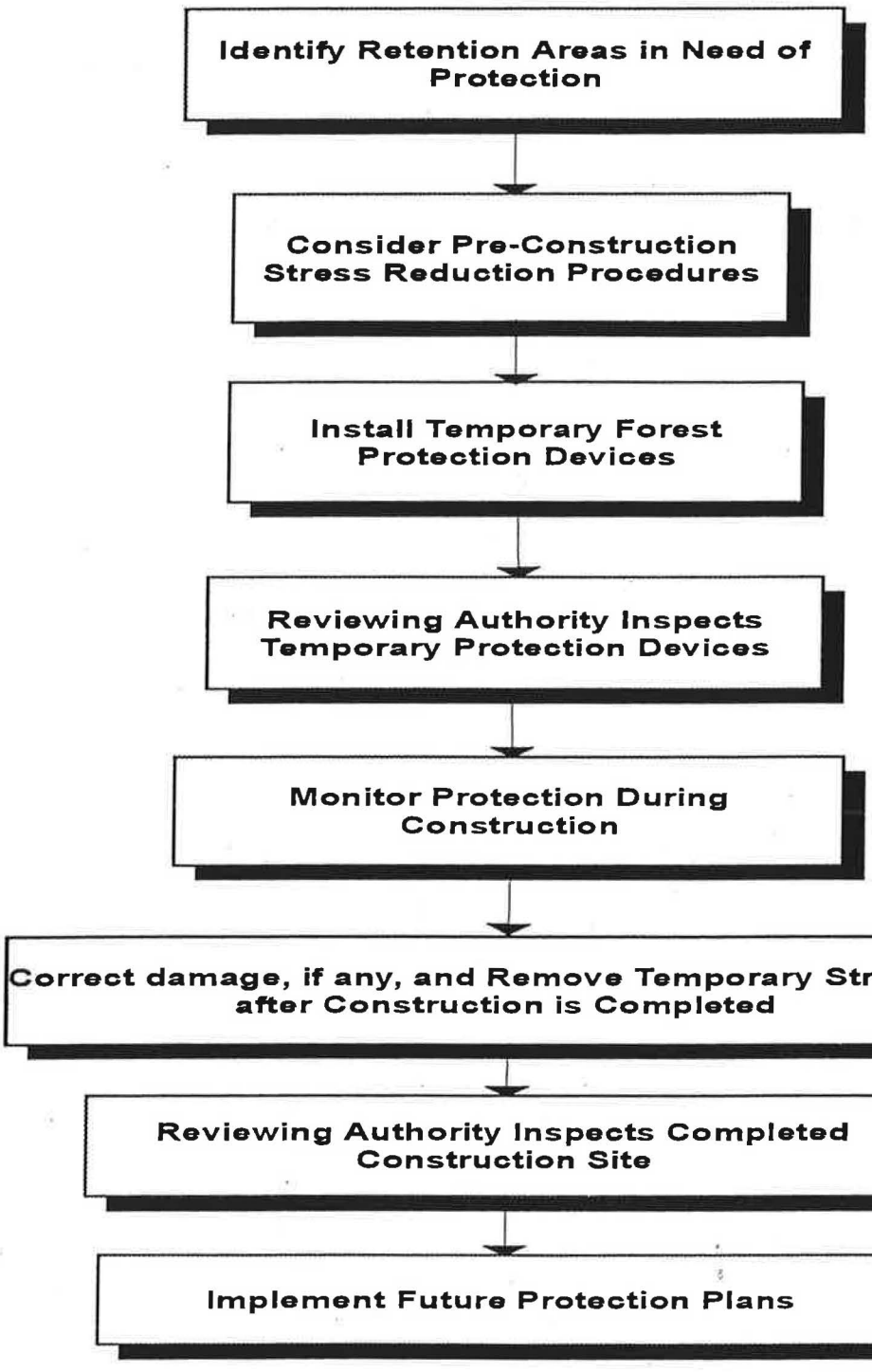
Step 3 Evaluate tree conditions and critical root zones.

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 3:13

3.2.2 Forest and Tree Protection: 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 not enter 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 3:14**.

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 will 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 3:15**.

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 3:16** 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 3:14**

PRACTICE	IMPLEMENTATION GUIDELINES
Root Pruning - Will the critical root zone be affected by construction activities such as grade changes, digging for foundations, roads, or utility construction?	Prune before construction disturbance as shown in Appendix D, Figure D-1. Cut cleanly using well-maintained pruning equipment. Cover exposed roots immediately with topsoil, peat moss, or other suitable material. For trees with DBH greater than 15 inches, conduct root pruning up to one entire growing season before construction disturbance. Monitor for signs of stress and apply water if needed.
Crown Reduction or Pruning - Has the root system been significantly reduced (more than 30%) or are there dead, damaged, or diseased limbs?	Prune at optimal time of the year for the type of plant: *For ornamental flowering trees, after flowering and before bud set* *For non-ornamental flowering trees, in late winter, early spring, or mid-summer.* No more than 1/3 of the crown should be removed at one time (Figure D-2) Monitor for signs of stress.
Watering - Will construction activities alter the hydrology of the site? Has or will root pruning occur?	Water only as necessary. Monitor to ensure that overwatering does not frequently occur. Monitor for signs of stress and re-evaluate method (see Figure 3:16)
Fertilizing - Is or will the tree be stressed? Has or will root pruning occur?	Use low nitrogen and slow release fertilizers and apply in late fall or early spring (Figure A:20) For small trees (less than 3" caliper or DBH), broadcast methods may be appropriate. 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. Monitor for sign of stress and re-evaluate method.
Forest and Tree Protection Practices	**Figure 3:15**

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
__ Repair 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 3:16**

3.2.3 Forest and Tree Protection: 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 county 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, soils, 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 of 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 Maryland Department of Natural Resources. 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 obligation 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 DNR-Forest Service.

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 land use 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, as defined in Natural Resources Article 5-1601. 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. **Figures 3:8** and **3:9** demonstrate the amount of planting which occurs when the existing forest area is less than the afforestation threshold. Note that when any clearing occurs, this cleared area is replaced at the below threshold planting rate of 2 acres for every acre removed.

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, as defined in Natural Resources Article 5-1601. Reforestation 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.

When forest clearing occurs on a tract, reforestation is required unless the area of forest remaining meets the calculated breakeven amount by using the reforestation credit (**Figure 3:7**). This will occur because for every acre retained in forest above the conservation threshold, one acre of reforestation credit is applied, whereas, for every acre cleared above the conservation threshold, only 1/4 acre of reforestation is required. For example, in a medium density residential area containing 45 acres above the conservation threshold, of which 15 will remain after clearing, an onsite reforestation credit of 15 acres is applied to a reforestation requirement of only 7.5 acres.

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 1/4 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, as defined in Natural Resources Article 5–1607 (d). 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 shall 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 1/2 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:14**).

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 forest is removed below the breakeven point.

   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 temporarily disturbed during construction and which will be appropriate for long-term protection.

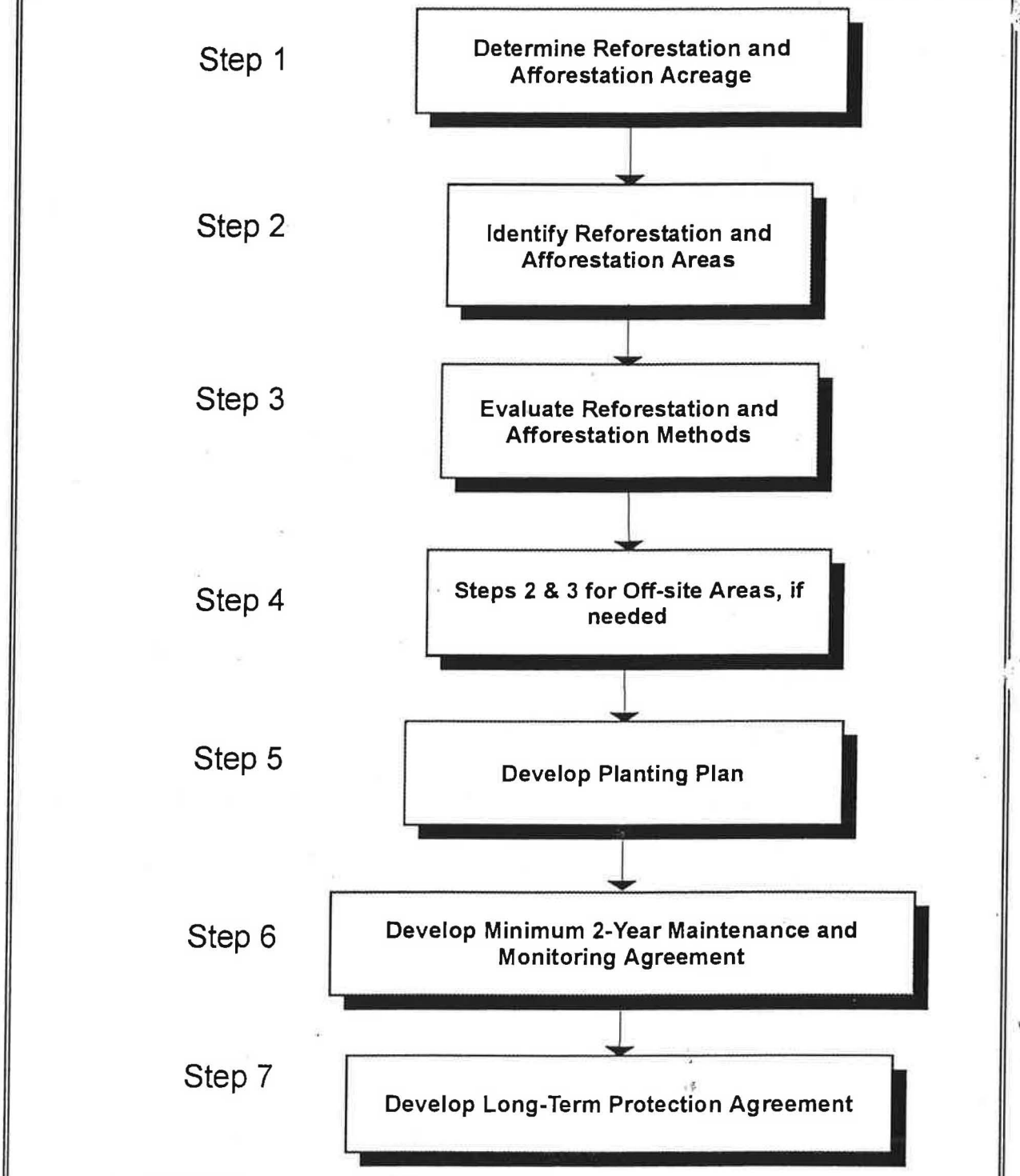
Afforestation

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 disturbed by clearing, it will require reforestation of 2 acres for each acre cleared. 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 3:17.** The comprehensive procedural checklist in **Figure 3:18** 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 3:17**

Step 1: Determine Reforestation and Afforestation

__ 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 municipal corporation or urban area:
    __ 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 3:18**

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 (Natural Resources Article 5-1607 (a)-(b)). The following criteria shall be used to evaluate methods appropriate for a planting site.

Selective Clearing and Supplemental Planting

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 has 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

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, an existing population center as designated in a county master or comprehensive plan adopted to conform with the Economic Growth, Resource Protection and Planning Act of 1992, 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 spec

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 t

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:18.** 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. Some suggested planting distributions are shown in **Figure A:19**. Suggestions for mixing stock and sizes include:

- Plant 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 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:20**. 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-21**.

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

Protection Devices

To prevent damage to planted areas, post all reforestation and afforestation sites with appropriate signs and fences (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 3:19**.

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.

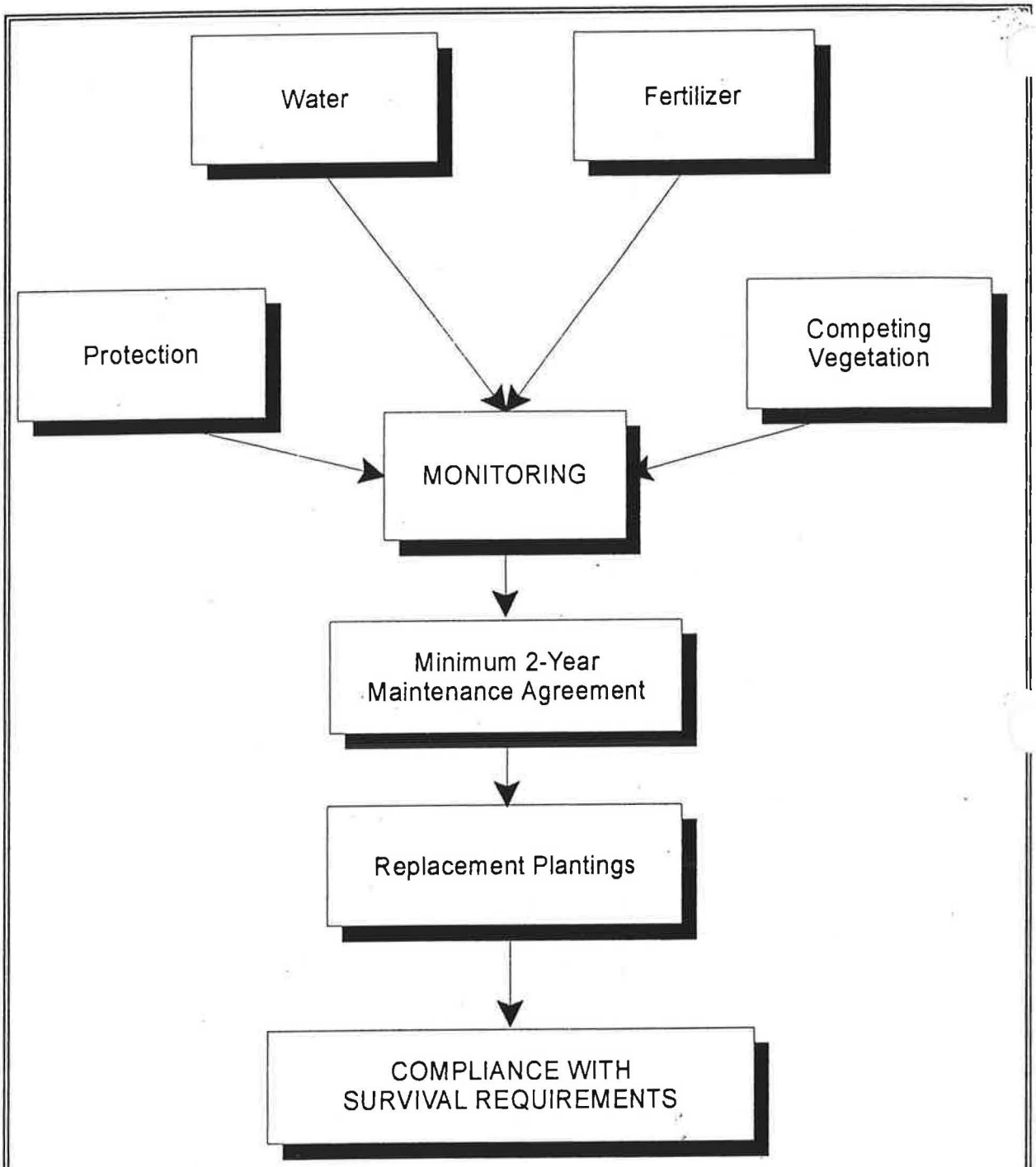
3.4.1 Elements Required in Maintenance Agreements

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 (Section 4.4), and

  –other treatments if required for specific planting techniques (Section 3.3).
- 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.
- 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 3:19**

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. **Figure 3:20** suggests a method for onsite evaluations.

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, phosphorous, 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 be 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 trees avoiding direct contact with the trunk, a prime spot for fu growth. Mulch helps maintain soil moisture levels and provides a buffer from construction and mow 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 guy 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.

You can tell approximately how much water your soil will hold by examining the soil around the tree. The following guidelines can help to decide whether or when to change your watering schedule. Watch leaves for signs of wilting to be sure the time between irrigations is not too long.

Check texture, is it mostly sand or clay? Does it have a lot of fine particles smaller than sand grains (silt)? If, as is normal, it is a mixture of these, which one is more abundant?

Smell the soil. Does it have the odor of fresh, rich garden soil or woods soil? Or does it have a rank, soured smell similar to a faint odor of sewer gas? Use the table below to interpret your examination.

Regardless of soil texture, the following conditions indicate excessively wet soil:

- There is a rank smell.
- Water can be squeezed out of a ball of soil.
- There is water in the bottom of the hole.

Soil Characteristics	Diagnosis	Soil Characteristics	Diagnosis
Half or more **sand**:		Half or more **clay**:	
Won't form into a ball, or else crumbles easily	Too dry	Won't form a ball or crumbles very easily, dusty	Too dry
Forms into a ball, crumbles readily under pressure. Has a smell like fresh soil or freshly wet sand or cement	Okay	Can be readily formed into a ball and crumbles under pressure. Smells like fresh, damp soil from a field, garden, or woods.	Okay
Reacts as above, but when ball is squeezed it leaves a film of moisture on your skin. May have a sour odor.	Too wet	Sticks to shovel or trowel when dug. When formed into a ball, acts like modeling clay, doesn't crumble readily, but breaks into large chunks or extends like a ribbon. Leaves a film of water on your skin when squeezed.	Too wet

How Can I Tell if My Soil Is Wet or Dry? **Figure 3:20**

Steep Slopes

Planting will stabilize steep slopes, however, until roots become established, erosion problems may persi. 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

The following summarizes FCP enforcement by an approving authority. FCP's approved by the Department of Natural Resources under the State Forest Conservation Program are enforced according to regulations adopted in COMAR and the guidelines below.

3.5.1 Inspections

The approving authority 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 conducted by local authorities may be conducted with inspections to ensure compliance with sediment and erosion control regulations. Violations may result in penalties as outlined below.

- Where disturbance occurs within 50 feet of Forest Retention Areas during construction, an inspection occurs before construction begins to ensure that forest protection devices have been instal' properly and retention areas are clearly marked. This inspection shall occur before any for clearing is done. The applicant shall schedule this meeting when all forest protection devices are in place and ready for inspection.

- A second inspection follows completion of all construction activities to ensure compliance with the provisions of the FCP. Again, the applicant shall schedule this inspection with the approving authority.

- Additional inspections may be required to ensure that a Planting Plan is successfully implemented.

- Other inspections or meetings may occur at the request of the approving authority to ensure the FCP is implemented.

3.5.2 Penalties for Violation

Revocation of an Approved FCP

The approving authority 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 approving authority 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 approving authority. This may be at a minimum of 30 cents per square foot of the area found to be in noncompliance. Penalties may vary among jurisdictions.

Violation of FCP

An applicant who violates the provisions of an approved FCP is liable for a penalty not to exceed $1,000 for each day a violation continues.

3.5.3 Appeal of Enforcement Action

Subject to regulations adopted by the approving authority, within ten calendar days of receiving a complaint, order, or notice of violation, a recipient may request a contested case hearing in writing. The recipient may request a stay in conjunction with a request for a hearing. A request for a stay may be heard before or during a hearing on the complaint. At the request of the recipient, a request for stay may be heard within ten business days of receipt of the request.

3.5.4 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 approving authority 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.

An approving authority may request an amended plan when a violation occurs. This amended plan may include post-construction forest and tree protection practices (Section 3.2) or additional planting to mitigate the violation.

Chapter 4

Linear Projects

Contents:

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. Those linear projects which require Public Service Commission approval and highway construction activities subject to Natural Resource Article 5-103 are exempt. Applicants are advised to verify specific program standards for any project.

4.1.2 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.

4.1.3 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.

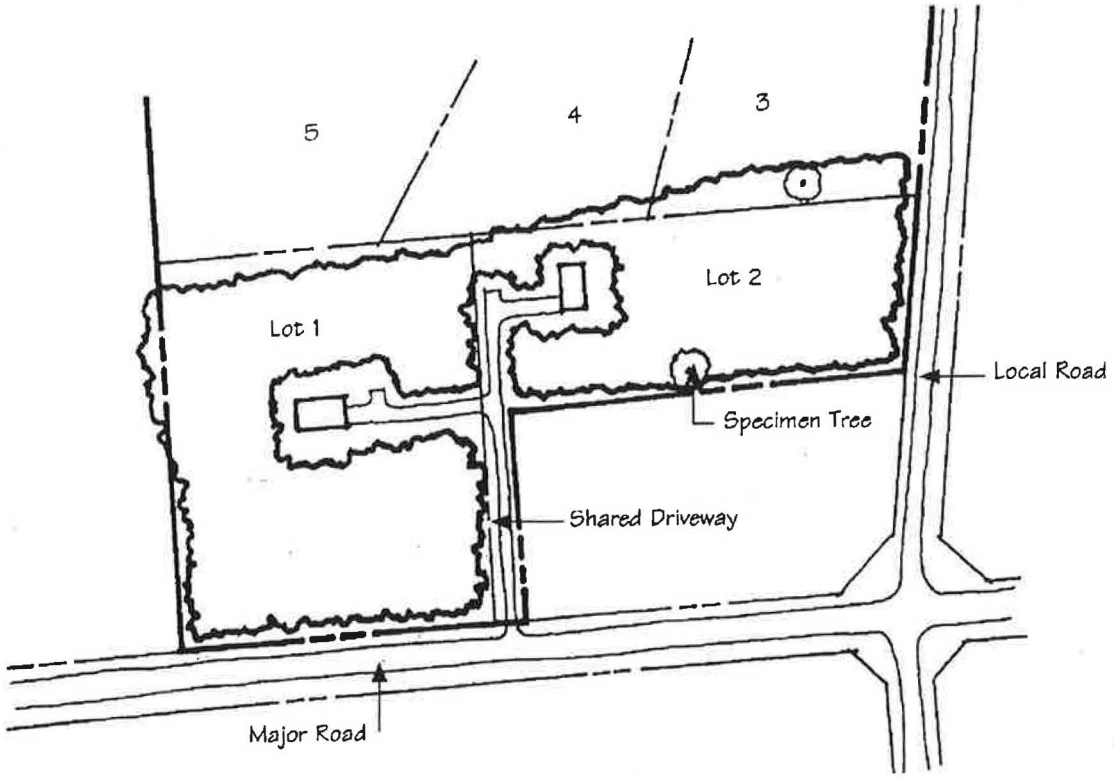
4.1.4 Selective Clearing and Supplemental Planting

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 Area
- 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

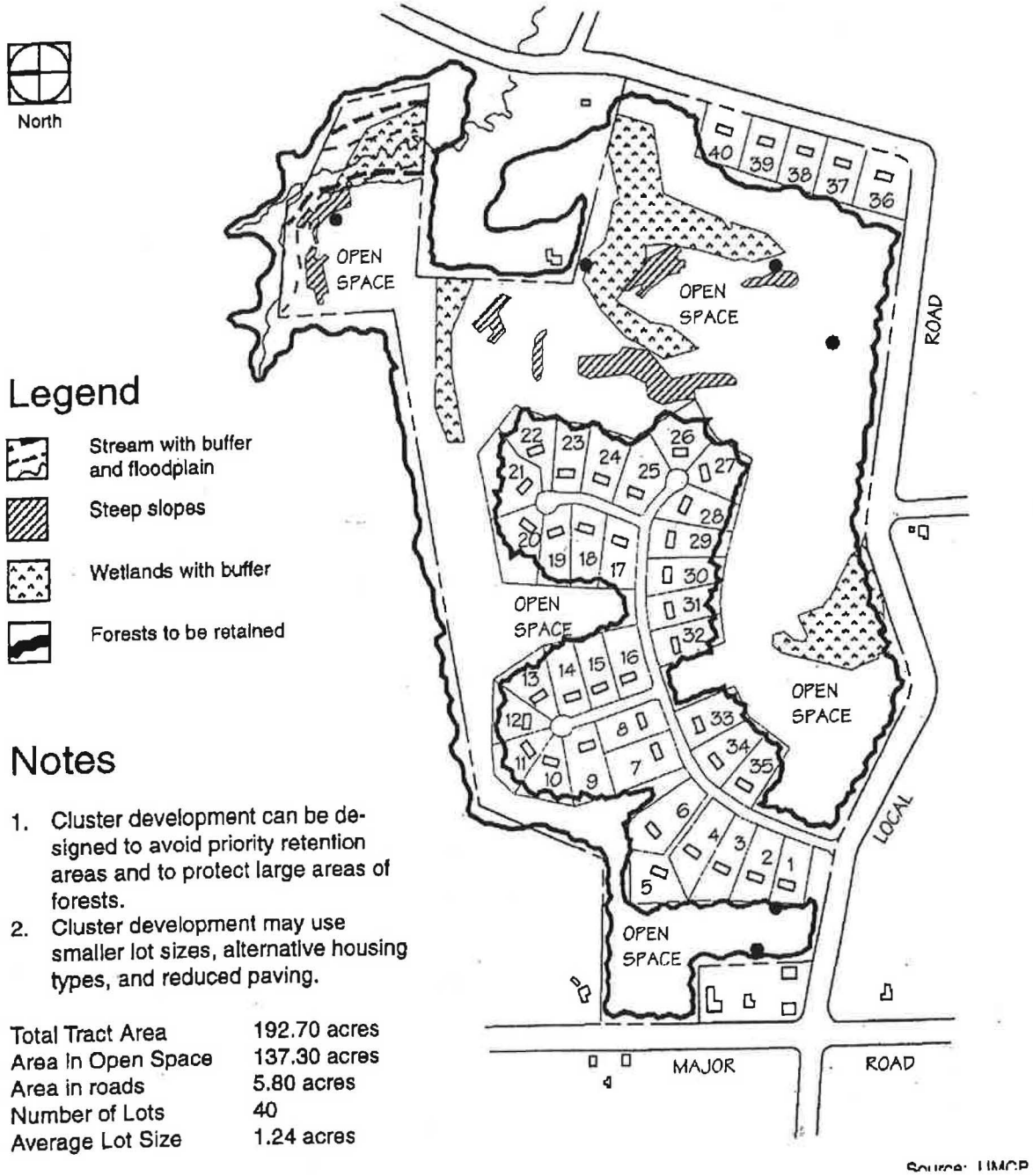
Illustrations



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**



Legend

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

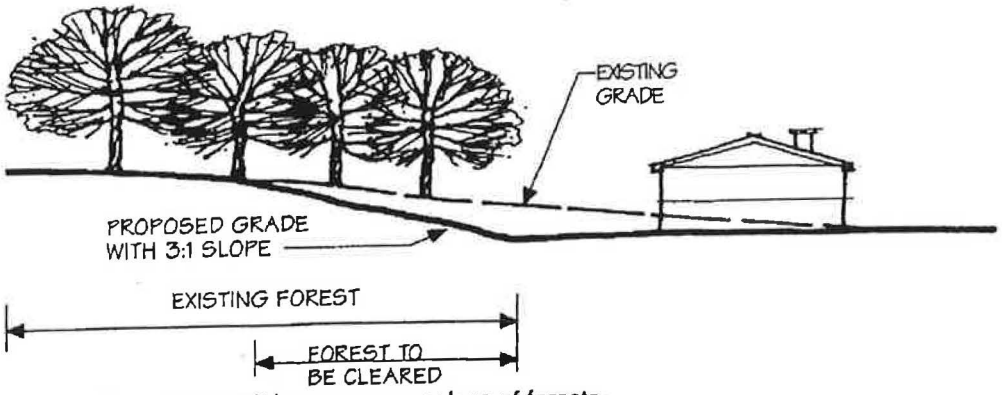
Notes

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.

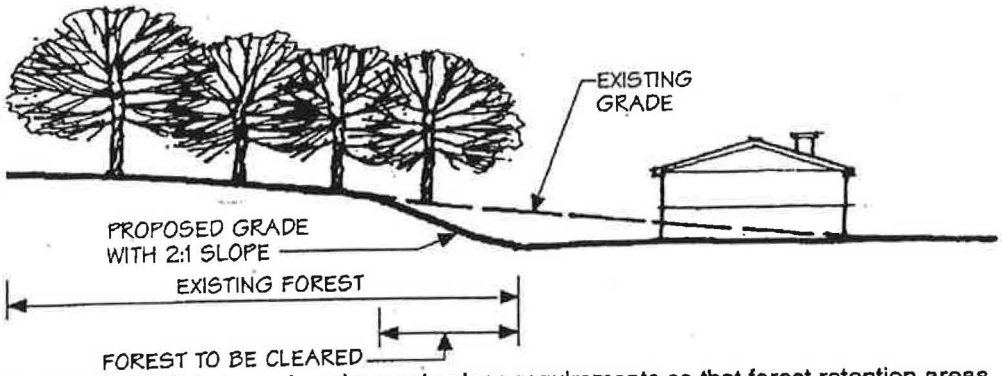
Total Tract Area	192.70 acres
Area In Open Space	137.30 acres
Area in roads	5.80 acres
Number of Lots	40
Average Lot Size	1.24 acres

Source: UMCP

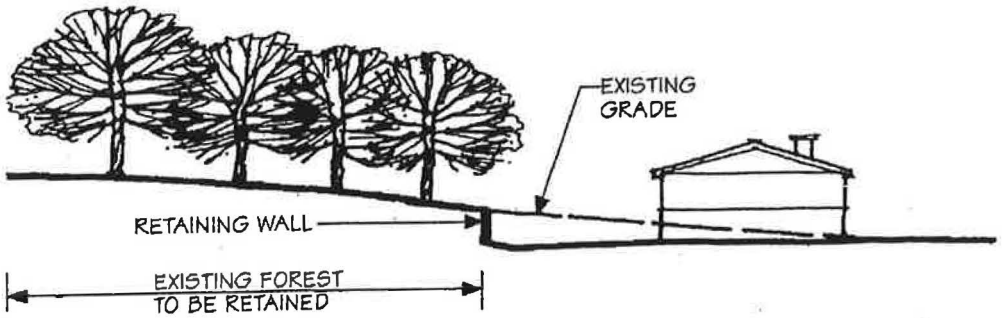
Cluster Development Plan | **Figure A:2**



Site grading may result in unnecessary loss of forests.



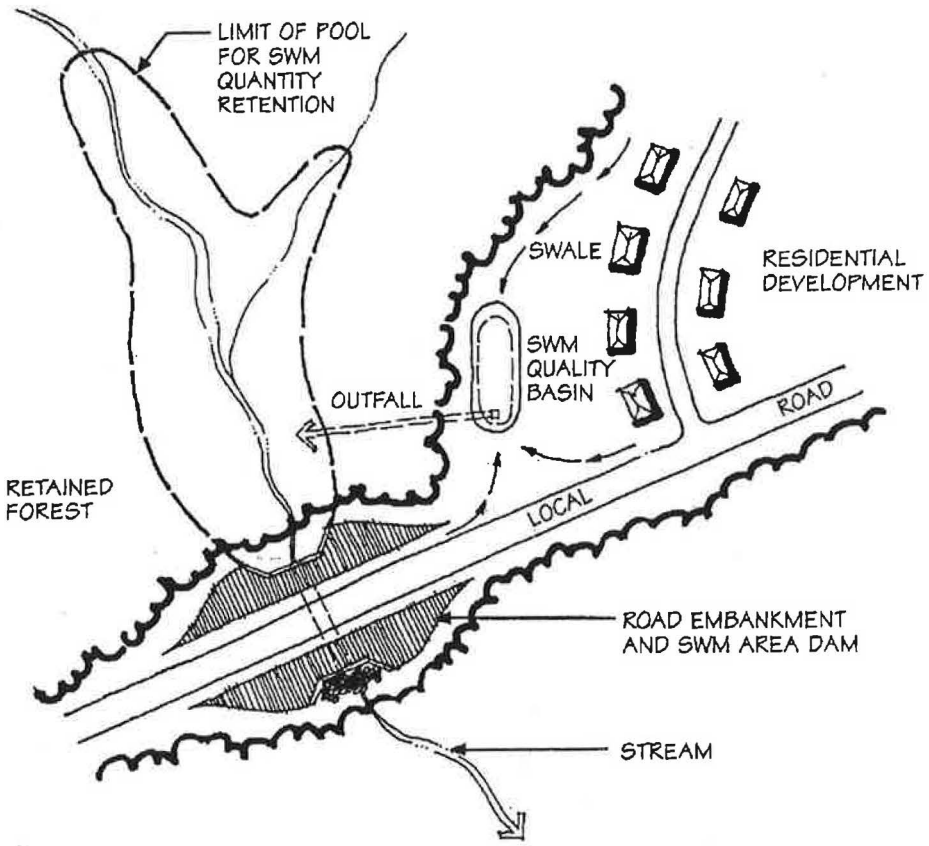
It may be possible to seek variances to slope requirements so that forest retention areas can be increased.



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

Source: UMCP

Grading	Figure A:3

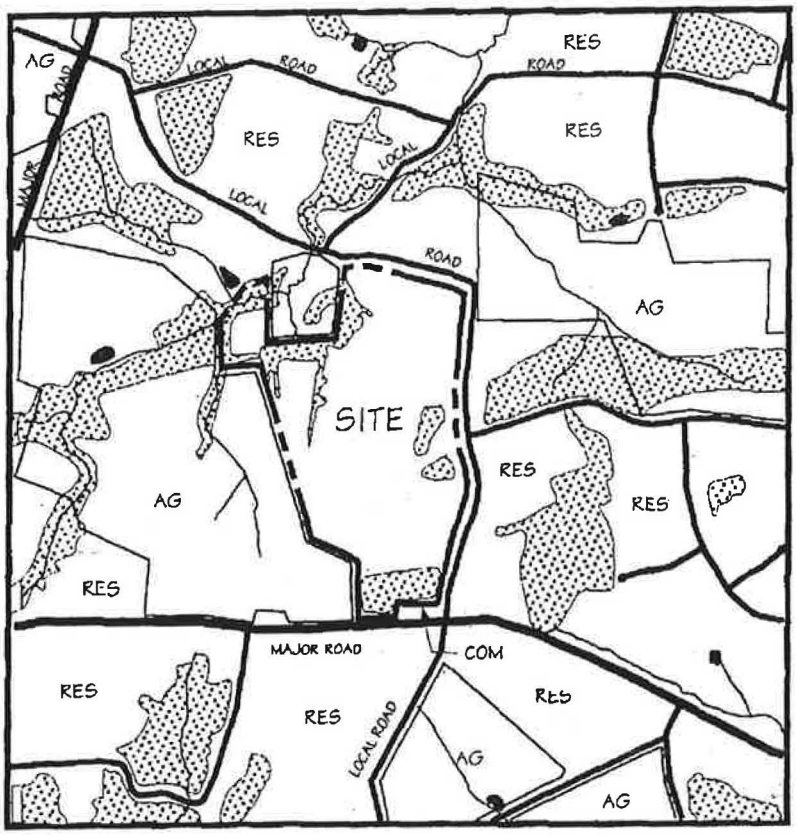


Notes

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 innundation (extended detention) for up to 24 hours.

Source: UMCP

Stormwater Management	Figure A:4



Legend

- Forests
- Streams and Pond
- AG — Agricultural Land Use
- RES — Residential Land Use
- COM — Commercial Development

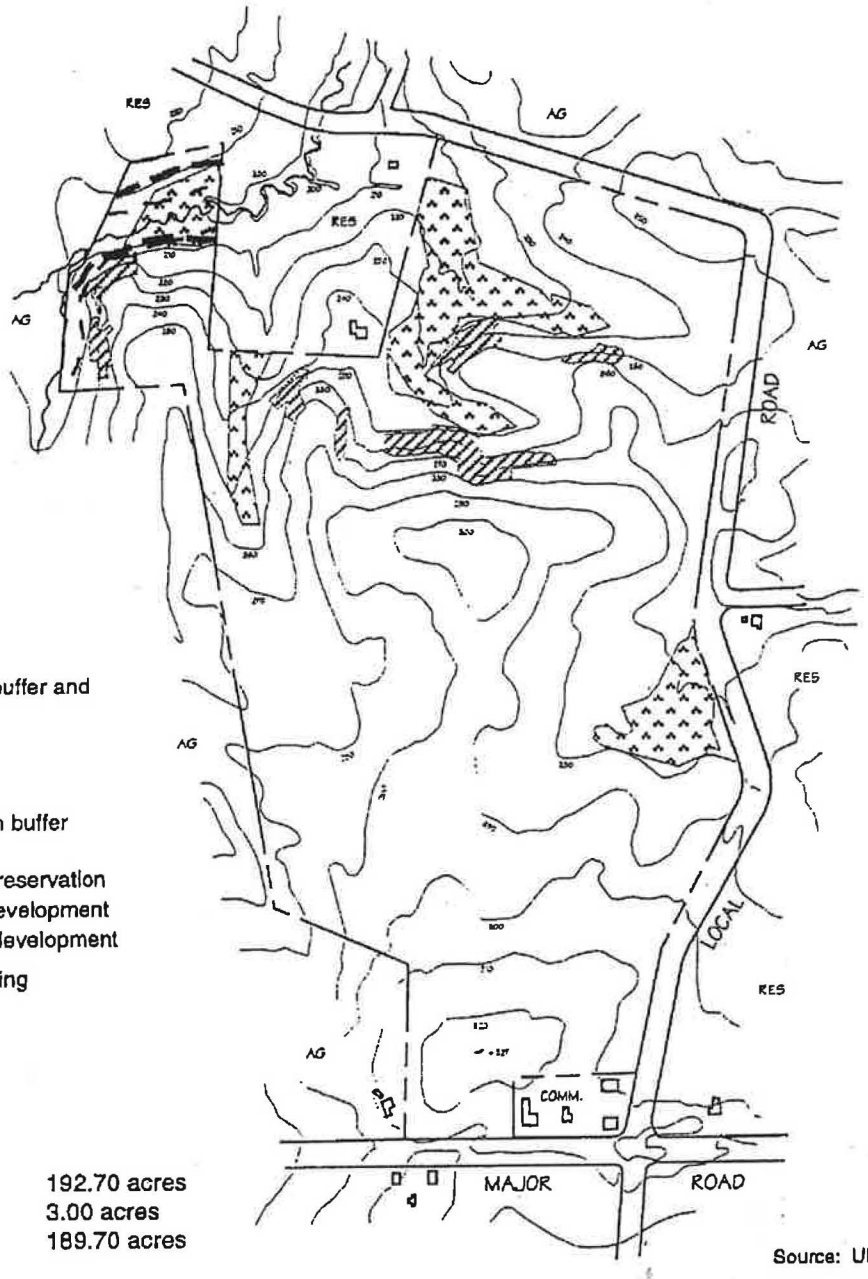
North

Source: UMCP

Site Vicinity Map

Figure A:5

North



Legend

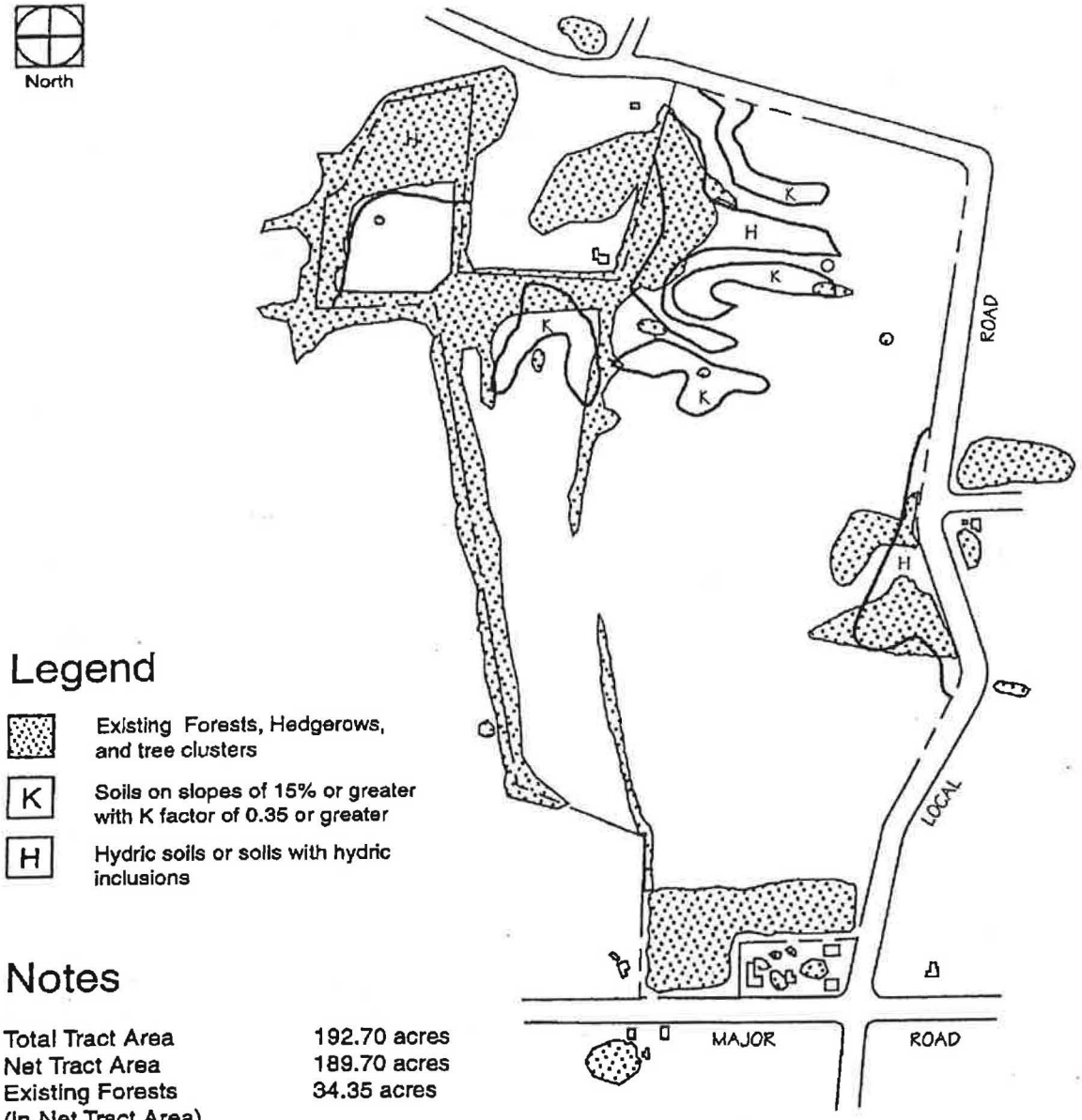
- Stream with buffer and floodplain
- Steep slopes
- Wetlands with buffer
- AG — Agricultural preservation
- RES — Residential development
- COMM — Commercial development
- Existing building

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

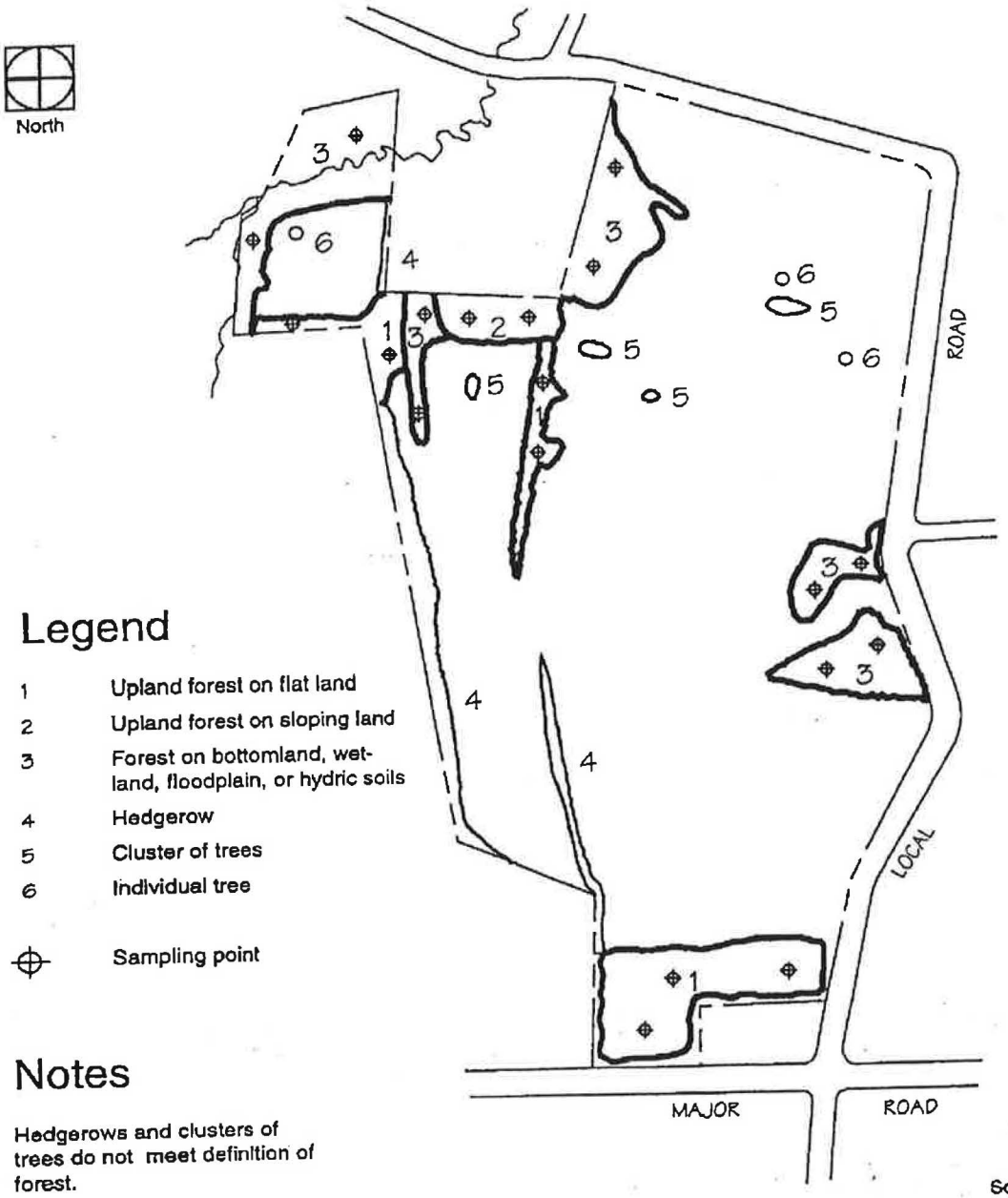
- Existing Forests, Hedgerows, and tree clusters
- K — Soils on slopes of 15% or greater with K factor of 0.35 or greater
- H — Hydric soils or soils with hydric inclusions

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**



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

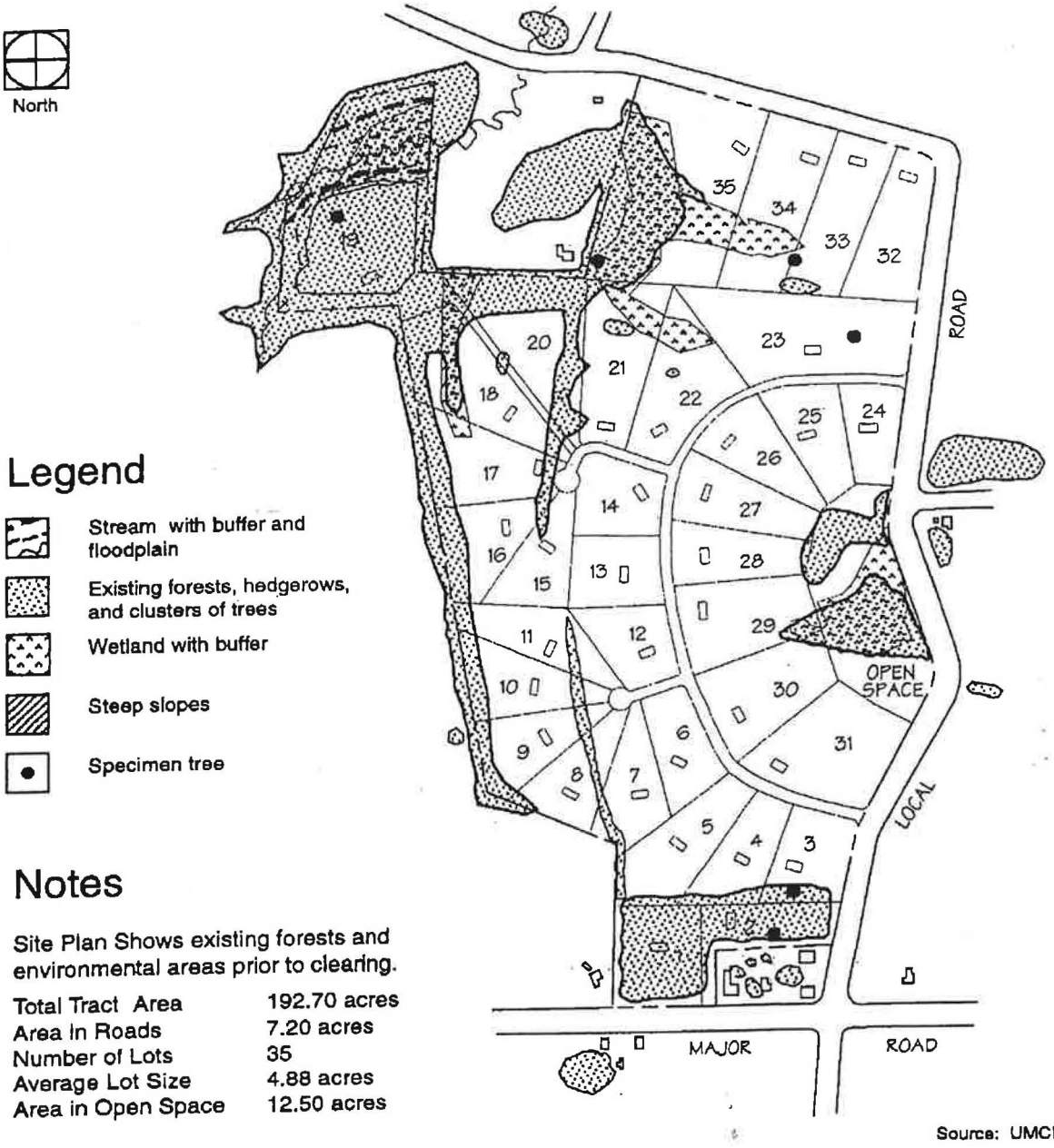
Notes

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

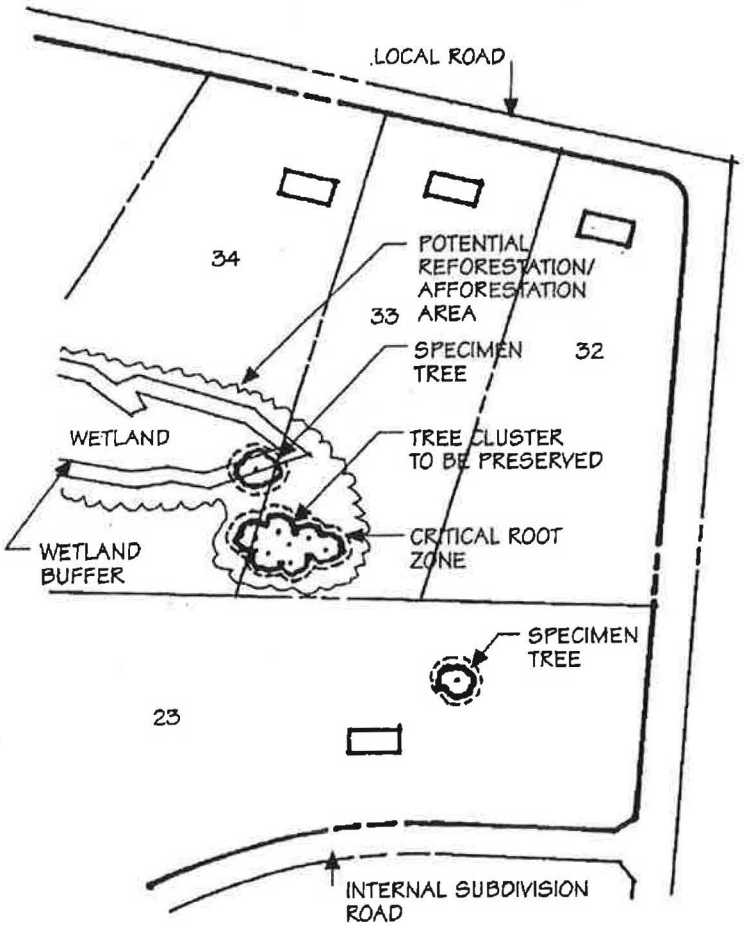
Source: UMCP

Preliminary FSD Map with Sampling Locations

Figure A:8



Site Development Plan before FCP | **Figure A:9**

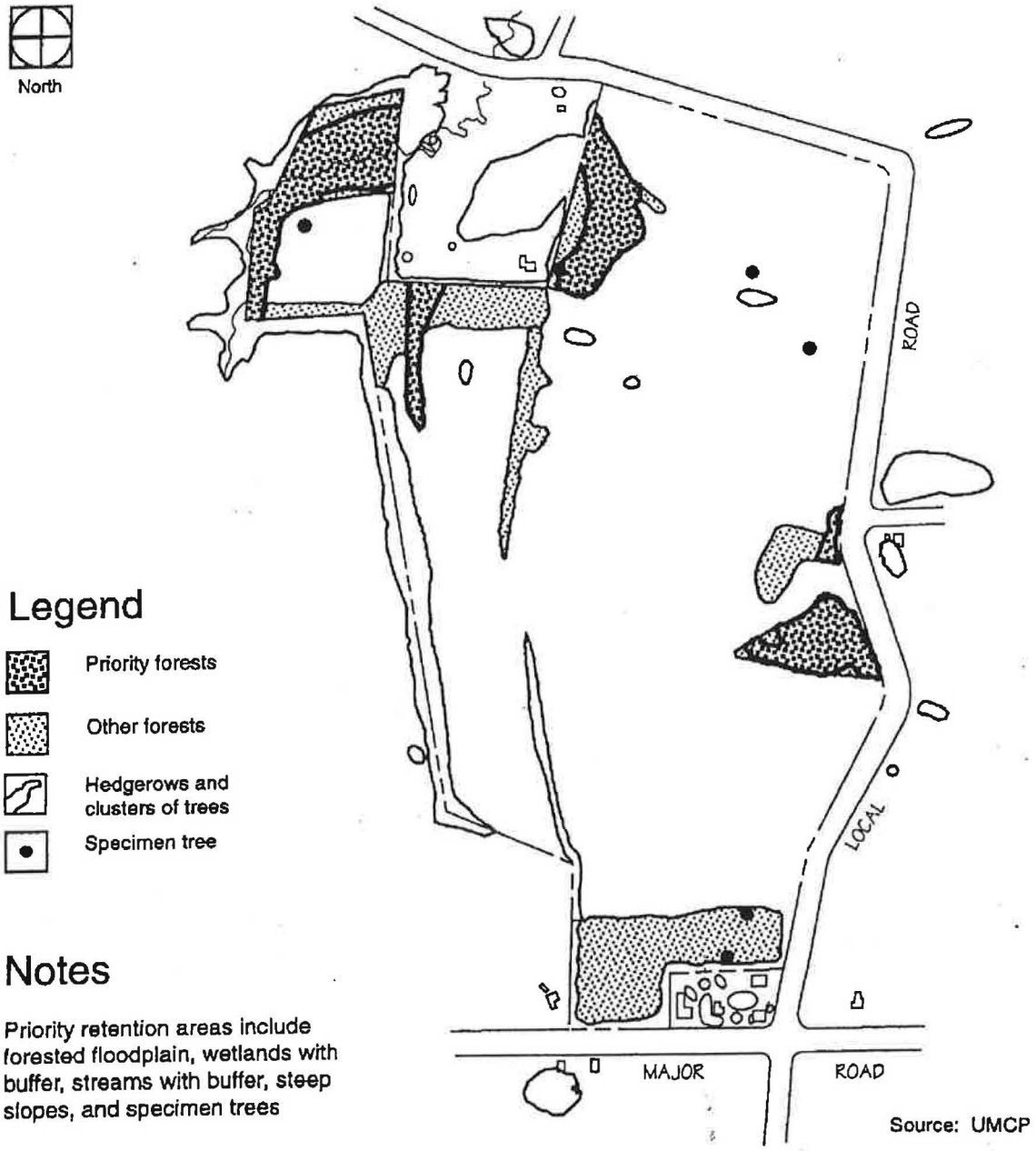


Notes:

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 Credit	Figure A:10



Legend

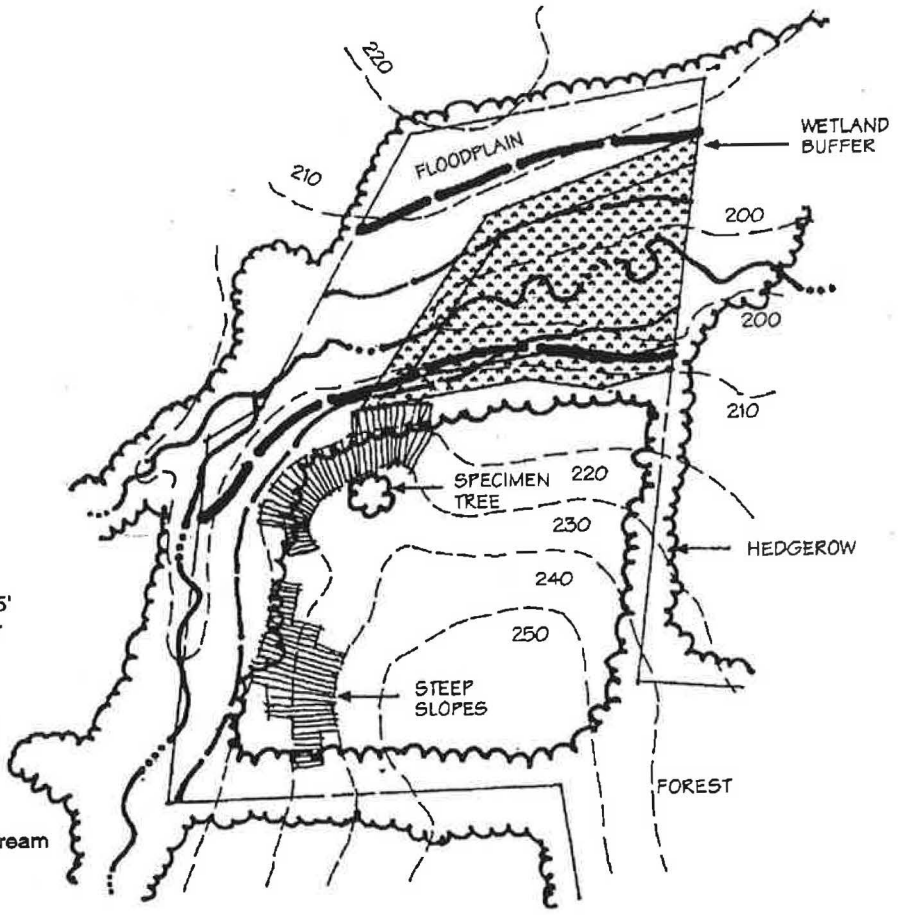
- Priority forests
- Other forests
- Hedgerows and clusters of trees
- Specimen tree

Notes

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

Priority Area Map

Figure A:11



Legend

- Wetland with 25' minimum buffer
- Steep Slope
- Existing forest
- Stream
- Minimum 50' stream buffer
- Floodplain

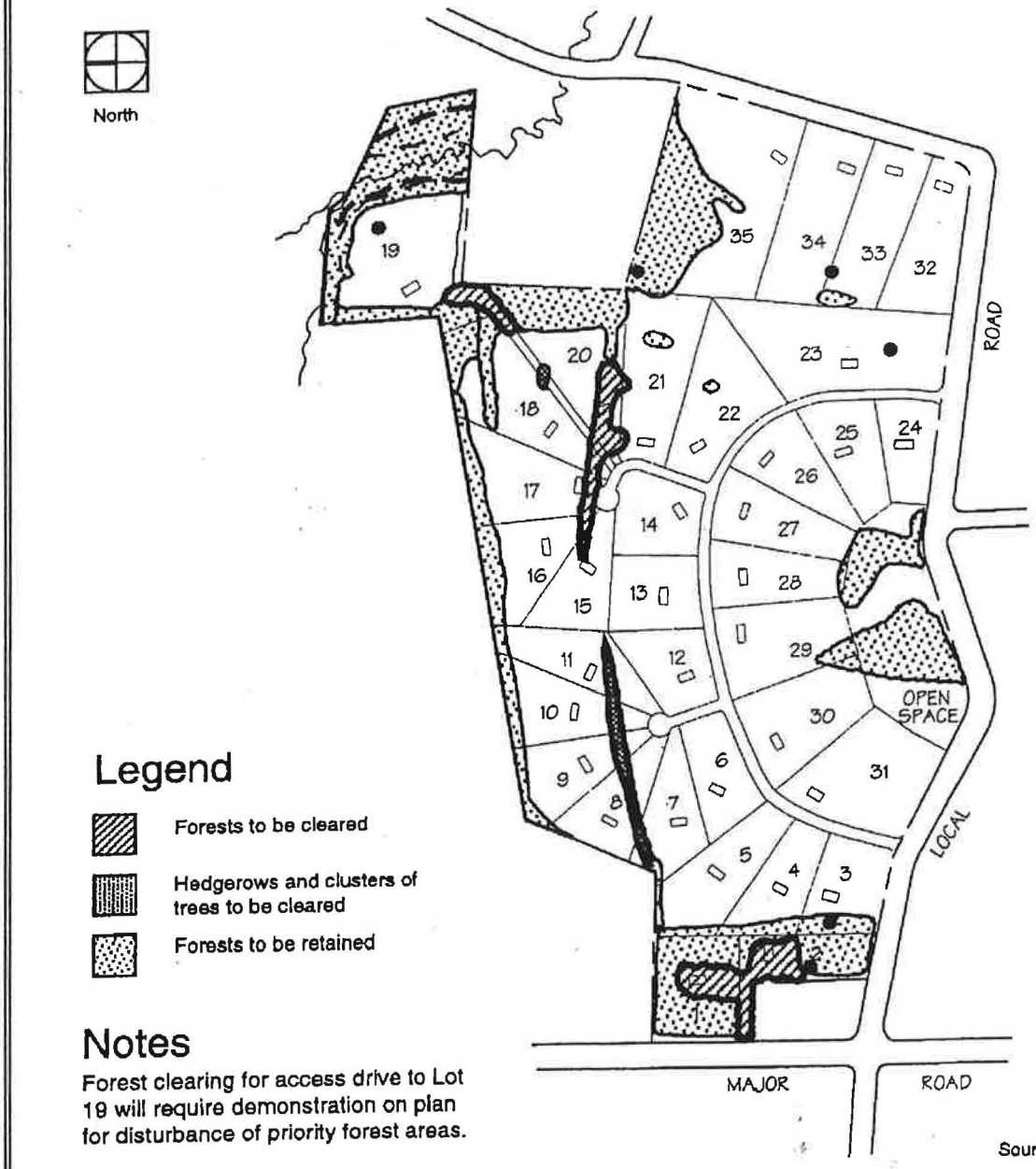
Notes

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

Source: UMCP

Closeup of Priority Areas

Figure A:12



Legend

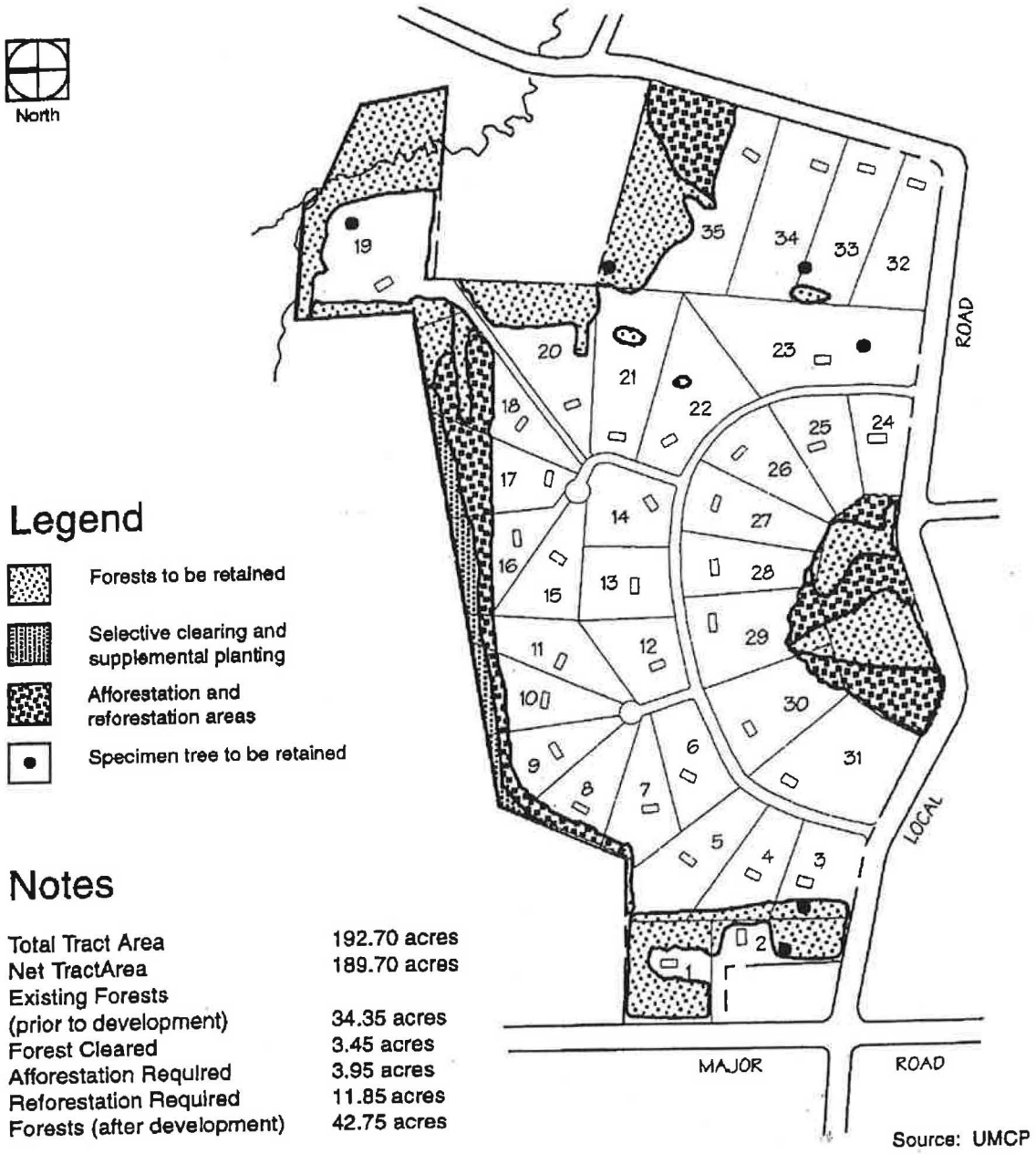
- Forests to be cleared
- Hedgerows and clusters of trees to be cleared
- Forests to be retained

Notes

Forest clearing for access drive to Lot 19 will require demonstration on plan for disturbance of priority forest areas.

Forest Retention Map

Figure A:13



Legend

- Forests to be retained
- Selective clearing and supplemental planting
- Afforestation and reforestation areas
- Specimen tree to be retained

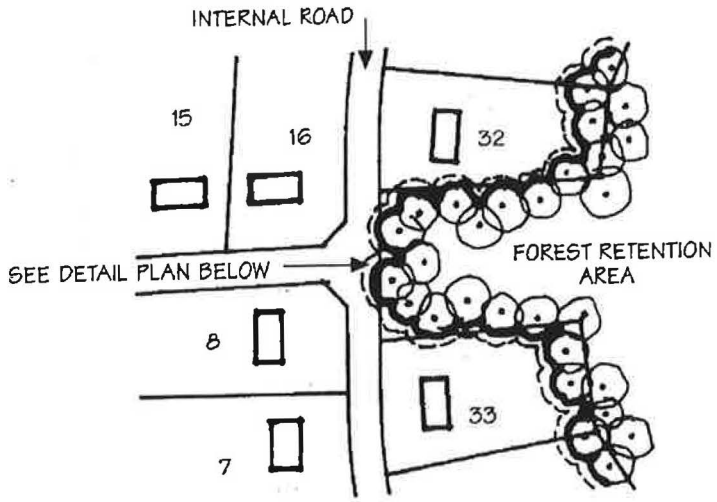
Notes

Total Tract Area	192.70 acres
Net TractArea	189.70 acres
Existing Forests (prior to development)	34.35 acres
Forest Cleared	3.45 acres
Afforestation Required	3.95 acres
Reforestation Required	11.85 acres
Forests (after development)	42.75 acres

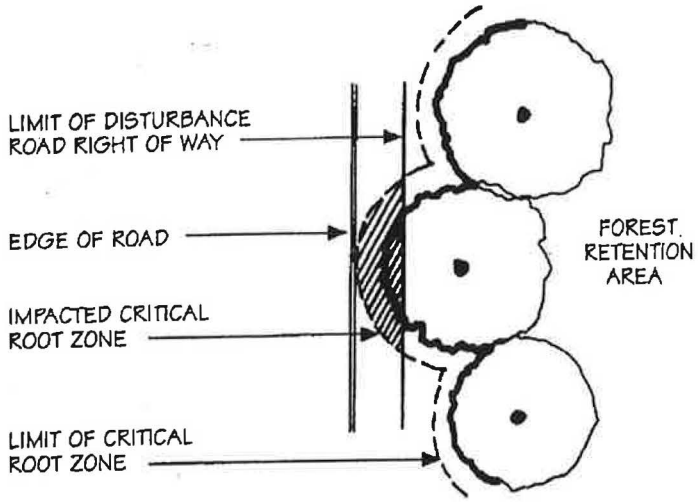
Source: UMCP

FCP Map

Figure A:14



SITE PLAN

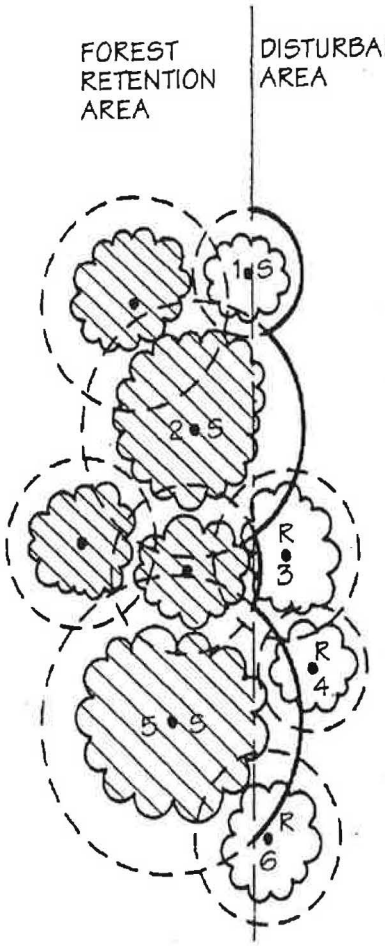


DETAIL PLAN

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:15



Critical Root Zone (CRZ)

Preliminary Retention Edge

Final Retention Edge

R Remove

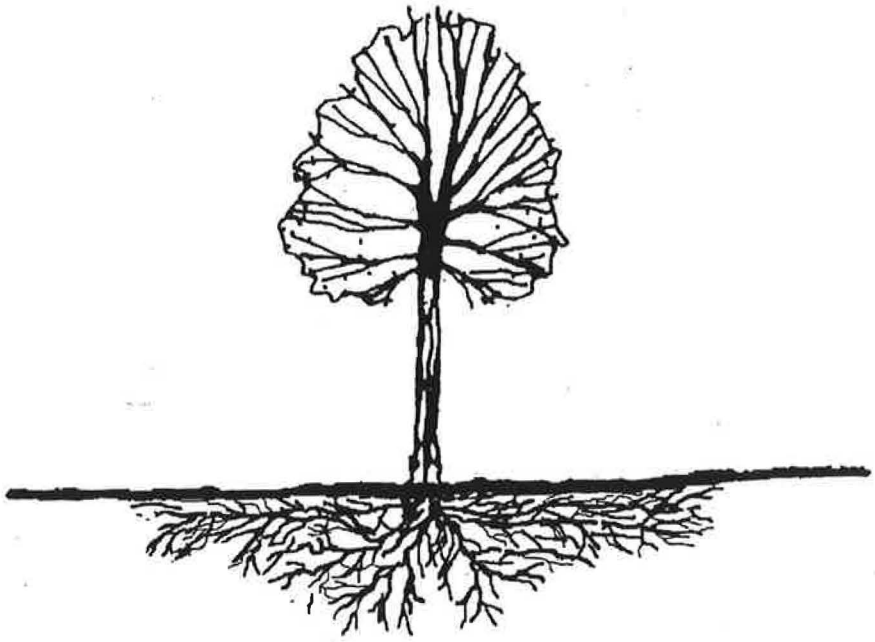
S Save

TREE	STATUS	NOTES
1	Save	Preliminary retention edge impacting more than 30% of the CRZ. Can be moved to accommodate.
2	Save	Preliminary retention edge can be moved to protect the entire CRZ.
3	Remove	Tree is completely within the disturbance zone.
4	Remove	Tree is completely within the disturbance zone.
5	Save	Preliminary retention edge can be moved to protect the entire CRZ.
6	Remove	Preliminary retention edge is over trunk.

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:16**



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

Protecting Trees During Construction | **Figure A:17**

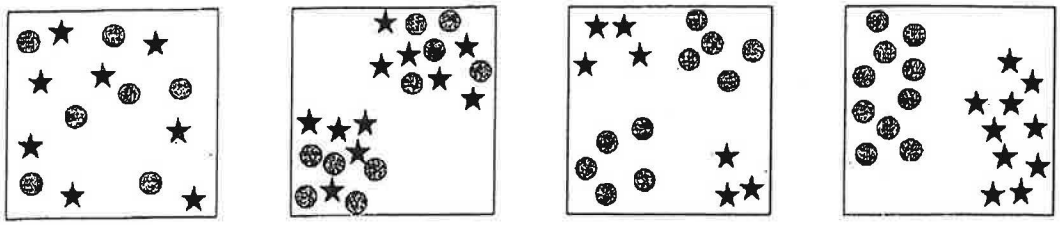
Size	Number Required per Acre	Approximate Spacing feet on center	Survivability Requirement At the end of the second growing season	
Bare Root Seedlings or Whips 1/4" to 1/2" cal.	700	8 x 8	55%	385
Container Grown Seedling Tubes (Minimum Cavity Width 1.5")	450	10 x 10	65%	290
Container Grown 1, 2, 3 Gallon	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

Notes:

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:18**

Typical Forest Tree Distribution Patterns



Random | Nonrandom | Nonrandom | Clumped

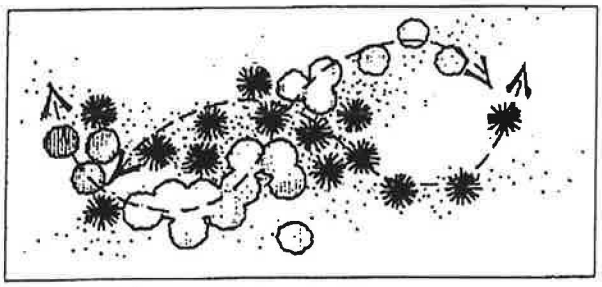
Positive Association | Negative Association

★ SPECIES 1 ● SPECIES 2

Note:
Naturally occurring populations of trees tend to be found in informal groupings. A cluster of trees is really a mosaic of different species groups. The objective of an afforestation/reforestation plan is to select the appropriate species and distribution pattern for a chose site that mimic natural patterns.

Source: Prince Georges County Woodland Conservation Manual.

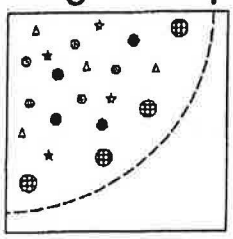
Aggregate Distribution Drift



Note:
When used, plant cluster type groupings that taper or feather out along the edges. Clusters often appear as elongated or tear drop shapes.

Source: EQR, Inc.

Mixing Transplant Stock



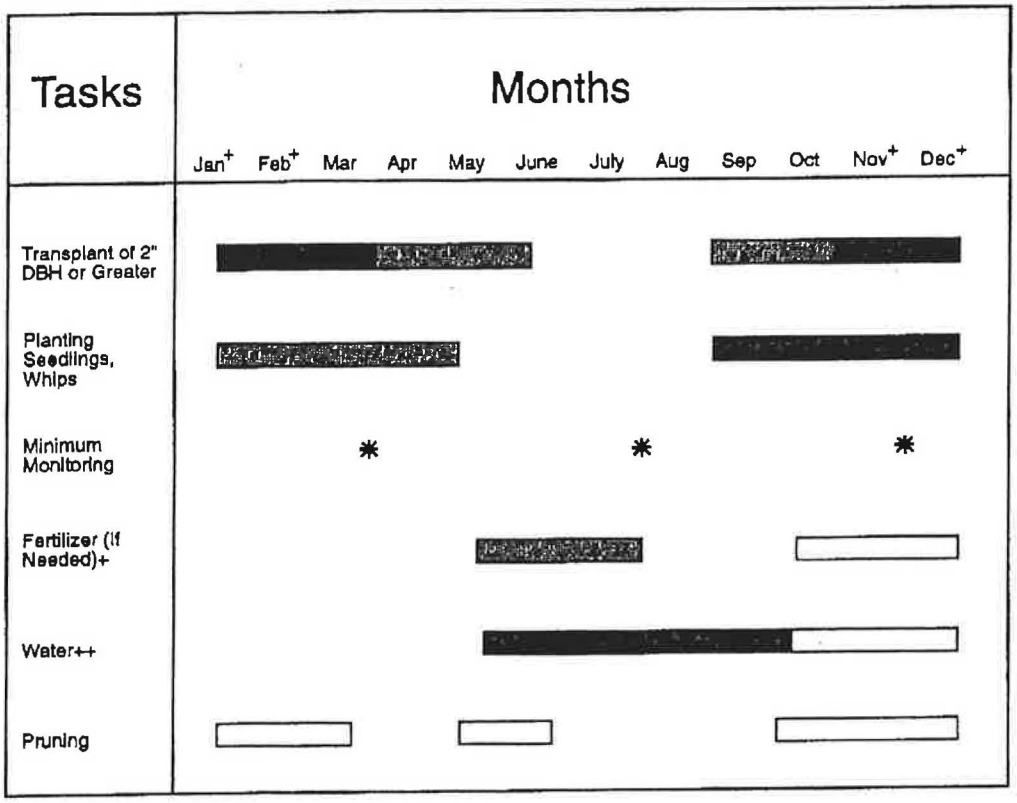
⊕ Locate larger trees (B&B or container grown) or transplant stock at the perimeter of reforestation/afforestation plantings of whips, seedling grown stock.

---- Protective Fencing

★ Smaller Stock

Source: Adapted from Forest Conservation Manual, 1991

Planting Distribution Patterns	Figure A:19



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:20**

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 a forest in an area on which forest cover has been absent for a long period of time or the planting of open areas which are not presently in 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 applying for subdivision approval, grading or sediment control permit, or project plan approval if a state or local agency. A person includes the federal, state, or local government.

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.

Break-even Point - the point at which the forest conservation area requirements can be met solely through forest retention without added reforestation.

Caliper - generally, tree diameters measured at six inches above the root collar for diameters of four inches or less.

Champion Tree - the largest tree of its species within the United States, the state, county, or municipality as determined by the Maryland Department of Natural Resources.

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.

Commercial and Industrial Uses - includes manufacturing operations, office complexes, shopping centers, and other similar uses and their associated storage areas, yarding, and parking areas.

Commercial Logging and 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 1/4 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 which 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 deemed critical under Section 4-2A-06, or Section 10-2A-06, Natural Resources Article, 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.

Department - the Maryland Department of Natural Resources.

Development Project Completion - the release of the development bond or acceptance of the project streets, utilities, and public services.

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.

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 - a biological community dominated by trees and other woody plants covering a land area of 10,000 square feet or greater. Forest includes (1) areas that have at least 100 trees per acre with at least 50% of those having a two-inch or greater diameter at 4.5 feet above the ground and larger, and (2) forest areas that have been cut but not cleared. Forest does not include orchards.

Forest Conservation - the retention of existing forest or the creation of new forest at the levels prescribed by a state or local authority.

Forest Conservation Fund - a fund into which payments for reforestation and for penalties will be made when an applicant is not in compliance with the Forest Conservation Plan.

Forest Conservation Plan - the part of the site development plan which ensures that forest retention, reforestation or afforestation will be accomplished.

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

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 natural features and vegetation on a site proposed for development, taking into account the environmental elements that shape or influence the structure or makeup of a plant community.

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 USDA Soil Survey for the county in which a development project occurs.

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.

Historic Sites - as defined by local, state, or federal Historic Registers.

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 - includes schools, colleges, universities, military installations, transportation facilities, utility and sewer projects, government offices and facilities, golf courses, recreation areas, parks, and cemeteries.

Intermittent Stream - a stream in which surface water is absent during a portion of the year as shown on the most recent 7.5 minute topographic quadrangle published by the United States Geological Survey as confirmed by field verification.

Landscaping Plan - a plan, drawn to scale, showing dimensions and details for revegetating an area 2,500 square feet or greater in size and at least 35 feet wide, including maintenance and protection measures.

Linear Projects - 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.

Maintenance Agreement - a legally binding, minimum two-year agreement to ensure the survivability of all sites afforested, reforested, or landscaped.

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.

Mixed Use Development - a single, relatively high density development project, usually commercial in nature, which includes two or more types of uses.

Natural Regeneration - the natural establishment of trees and other vegetation with at least 400 woody, free-to-grow seedlings per acre, which are capable of reaching a height of at least 20 feet at maturity.

Net Tract Area - 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. For linear projects, the net tract area includes the right-of-way width area, new access roads and storage areas, or the limits of disturbance as shown on an application for sediment and erosion control approval or in a capital improvements program project description. In agricultural and resource areas, net tract area may also be reduced by any portion of the tract remaining in agricultural production.

Nontidal Wetland - an area that is 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. The determination of whether an area is considered a nontidal wetland shall be made in accordance with the publication known as the "Federal Manual for Identifying and Delineating Jurisdictional Wetlands," published in 1989 and as may be amended and interpreted by the U.S. Environmental Protection Agency. Nontidal wetlands do not include tidal wetlands regulated under Natural Resources Article, Title 9, 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 the activity is conducted.

Onsite - means within the limits of the area encompassed by the tract area, or parcel of record on which the activity is conducted.

One-Hundred Year Nontidal 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. A 100-year flood is a flood which has a 1% chance of being equalled or exceeded in any given year. Except for Class III waters (Natural Trout Streams), a body of water with a watershed less than 400 acres is excluded.

Perennial Stream - a stream containing surface water throughout an average rainfall year, as shown on the most recent 7.5 minute topographic quadrangle published by the U.S. Geologic Survey, as 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 - a development comprising 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 local jurisdiction with at least 20% of the land permanently dedicated to open space.

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

Reforestation or Reforested - the creation of a biological community dominated by trees and other woody plants containing at least 100 live trees per acre with at least 50% of those trees having the potential of attaining a two-inch or greater diameter measured at 4.5 feet above the ground, within seven years. Reforestation includes landscaping of areas under an approved landscaping plan that establishes a forest at least 35 feet wide and covering 2,500 square feet of area. Reforestation for a linear project includes establishment of a forest according to approved procedures in the state or local programs.

Regulated Activity - means any of the following activities when they occur on a area of 40,000 square feet or greater: (1) subdivision; (2) grading; (3) sediment control activities; (4) project plan of a State or local agency. Regulated activity does not include any of the activities that are exempted under Natural Resources Article, 5-1602, Annotated Code of Maryland.

Retention - the deliberate holding and protecting of existing or planted forest, trees, shrubs or plants according to established standards as set forth in the Forest Conservation Manual.
Retention Areas - areas designated onsite for forest protection; to be referred to as long-term Forest Retention Areas.

Seedlings - an unbranched woody plant, less than 24 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 certain conditions as established in an approved Forest Conservation Plan.

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.

Specimen Tree - trees having a diameter measured at 4.5 feet above the ground of 30 inches or more, or trees having 75% or more of the diameter of the current State champion of that species. Also includes Champion Trees.

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

Steep Slopes - areas with slopes greater than 25 percent.

Stream Buffer - all lands lying within 50 feet, measured from the top of each normal bank, of any perennial or intermittent stream.

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

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 - any property subject to an application for a grading permit, sediment control plan, or subdivision approval. If a property is included in a planned unit development, "tract" means the entire property subject to the planned unit development.

Tree - a large, branched, woody plant having one or several self-supporting stems or trunks that reach a height of at least 20 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.

Variance - the allowance for deviation from the requirements of the Forest Conservation Act for circumstances where strict adherence to the Act would result in unwarranted hardship. 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.

Whip - an unbranched woody plant greater than 24 inches in height and having a diameter of less than one-inch caliper measured at six inches above the root collar.

Appendix C

Worksheets and Preparation Guidelines

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	Other	
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	Total		

List of Herbaceous Species 0'-3':	% Understory Cover 3'-20'										
	C	N	E	S	W	Total					
	% of Herbaceous Cover 0'-3'										
	C	N	E	S	W	Total					

Comments

Sheet __ of___

Forest Sampling Data Worksheet **C:1**

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:2**

Figure C:3 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 this 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:4 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 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.

Forest Conservation Worksheet 2.1

Note: Use 0 for all negative numbers that result from the calculations.

Net Tract Area

A. *Total Tract Area* — A=

B. *Deductions* (Critical Area, area restricted by local ordinance or program) — B=

C. *Net Tract Area* Net Tract Area = Total Tract (A) - Deductions (B) — C=

Land Use Category:_____

D. *Afforestation Threshold* (Net Tract Area [C] x ____%) — D=

E. *Conservation Threshold* (Net Tract Area [C] x ____%) — E=

Existing Forest Cover

F. *Existing Forest Cover within the Net Tract Area* — F=

G. *Area of Forest Above Conservation Threshold*
If the Existing Forest Cover (F) is greater than the Conservation Threshold (E), then G = F – E; Otherwise G = 0. — G=

Breakeven Point

H. *Breakeven Point* (Amount of forest that must be retained so that no mitigation is required)
(1) If the Area of Forest Above the Conservation Threshold (G) is greater than 0, then H = (0.2 x the Area of Forest Above Conservation Threshold (G) + the Conservation Threshold (E);
(2) If the Area of Forest Above the Conservation Threshold (G) is equal to 0, then H = Existing Forest Cover (F). — H=

I. *Forest Clearing Permitted Without Mitigation*
I = Existing Forest Cover (F) – Breakeven point (H) — I=

Proposed Forest Clearing

J. *Total Area of Forest to be Cleared* — J=

K. *Total Area of Forest to be Retained*
K = Existing Forest Cover (F) – Forest to be Cleared (J) — K=

Planting Requirements

If the Total Area of Forest to be Cleared (K) is at or above the Breakeven Point (H), no planting is required and no further calculations are necessary (L=0, M=0, N=0, P=0); Otherwise, calculate the planting requirement(s) as follows:

L. *Reforestation for Clearing Above the Conservation Threshold*
(1) If the Total Area of Forest to be Retained (K) is greater than the Conservation Threshold (E), then L = the Area of Forest to be Cleared (J) x 0.25;
(2) If the Forest to be Retained (K) is less than or equal to the Conservation Threshold (E), then L = Area of Forest Above Conservation Threshold (G) x 0.25 — L=

M. *Reforestation for Clearing Below the Conservation Threshold*
(1) If Existing Forest Cover (F) is greater than the Conservation Threshold (E) and the Forest to be Retained (K) is less than or equal to the Conservation Threshold (E), then M = 2.0 x (Conservation Threshold (E) – Forest to be Retained [K])
(2) If Existing Forest Cover (F) is less than or equal to the Conservation Threshold (E), then M = 2.0 x Forest to be Cleared (J). — M=

N. *Credit for Retention Above the Conservation Threshold*
If the area of Forest to be Retained (K) is greater than the Conservation Threshold (E), Then N = K – E — N=

P. *Total Reforestation Required* P = L + M – N — P=

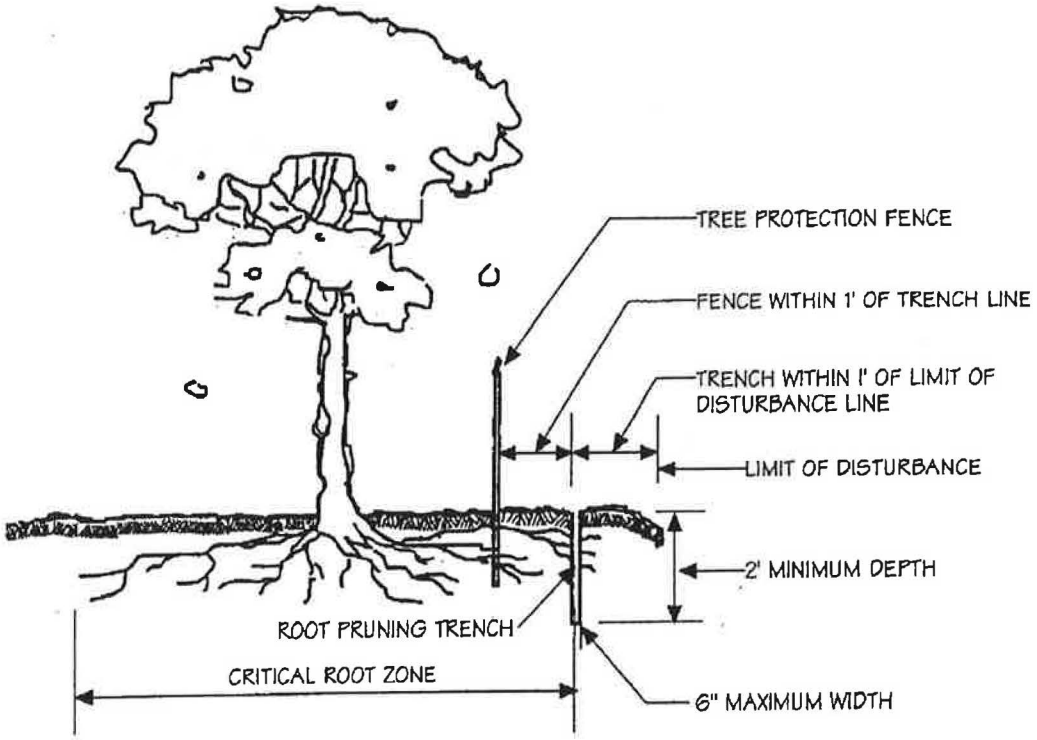
Q. *Total Afforestation Required*
If Existing Forest Cover (F) is less than the Afforestation Threshold (D), then Q = Afforestation Threshold (D) – Existing Forest Cover (F) — Q=

R. *Total Planting Requirement* R = P + Q — R=

Forest Conservation Worksheet — **C:5**

Appendix D

Sample Details and Specifications

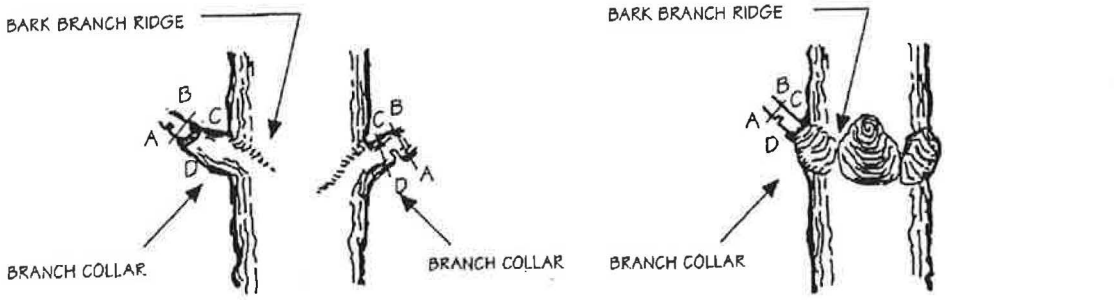


Notes:
1. Retention Areas to be established as part of the forest conservation plan review process.
2. Boundaries of Retention Areas to be staked, flagged and/or fenced prior to trenching.
3. Exact location of trench should be identified.
4. Trench should be immediately backfilled with soil removed or 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

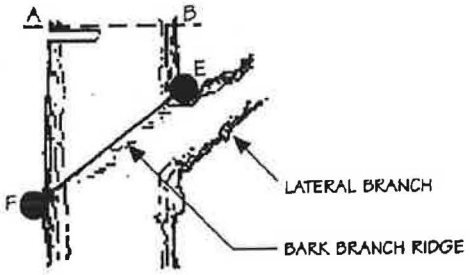
Root Pruning | **Figure D-1**

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

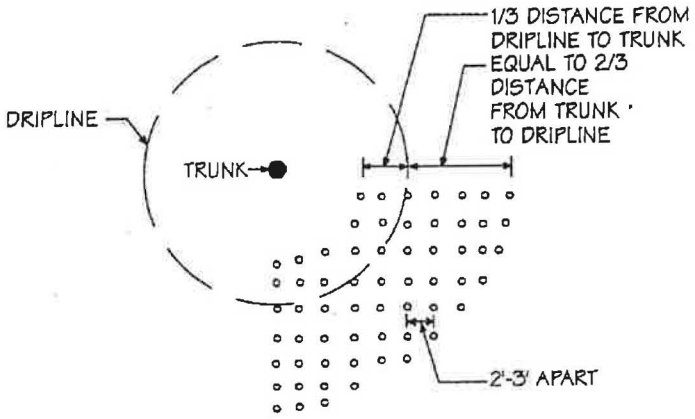


Notes:
1. Remove top weight by undercutting at A and remove limb by cutting through AB.
2. Remove stub at EF parallel to the bark branch ridge.
3. Only prune at specified times.
4. No more than 30% of crown to be removed at one time.
5. Diameter of lateral branch should be no less than 30% of the diameter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

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

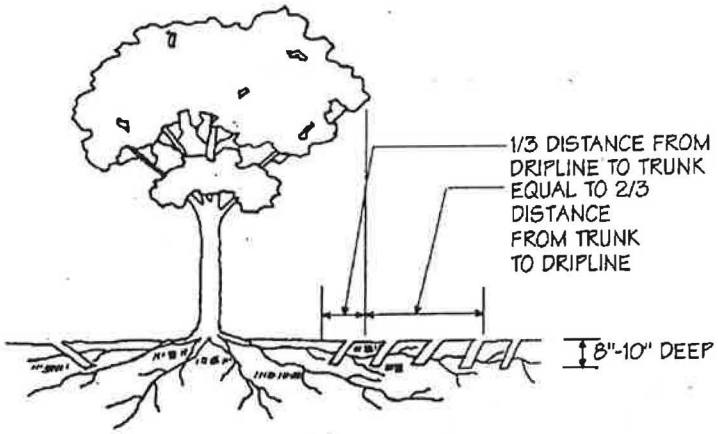
Tree Pruning	Figure D-2

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.

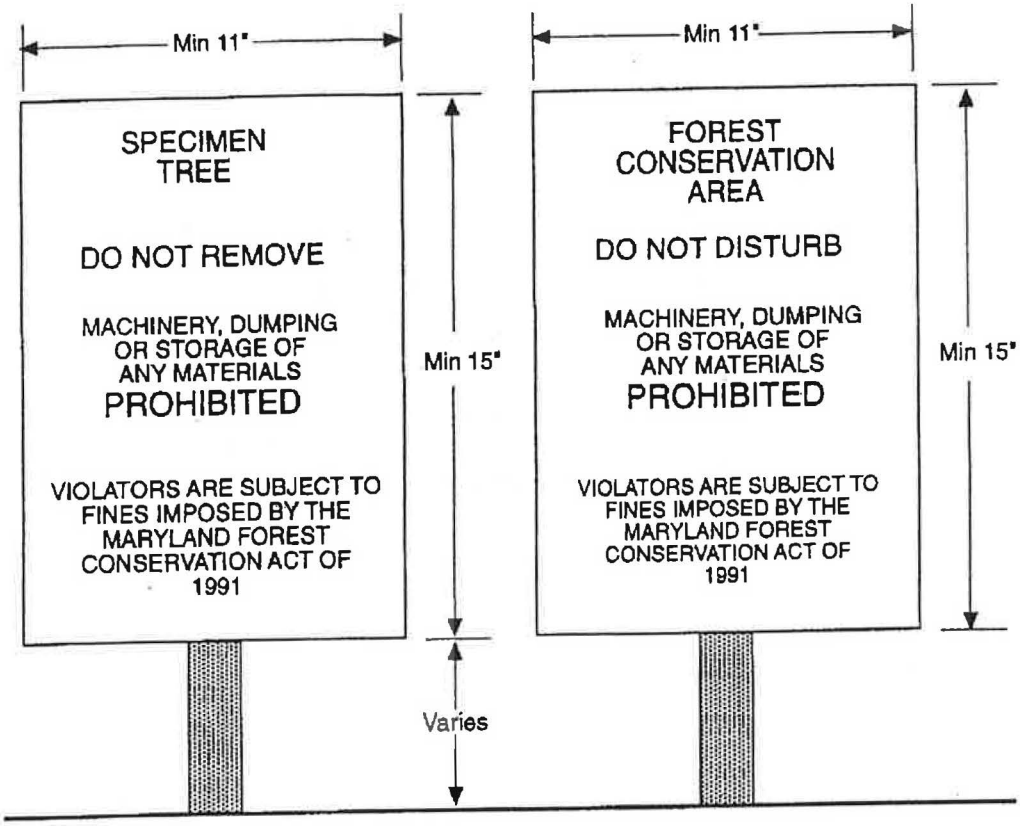
Application of Fertilizer by Injection



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

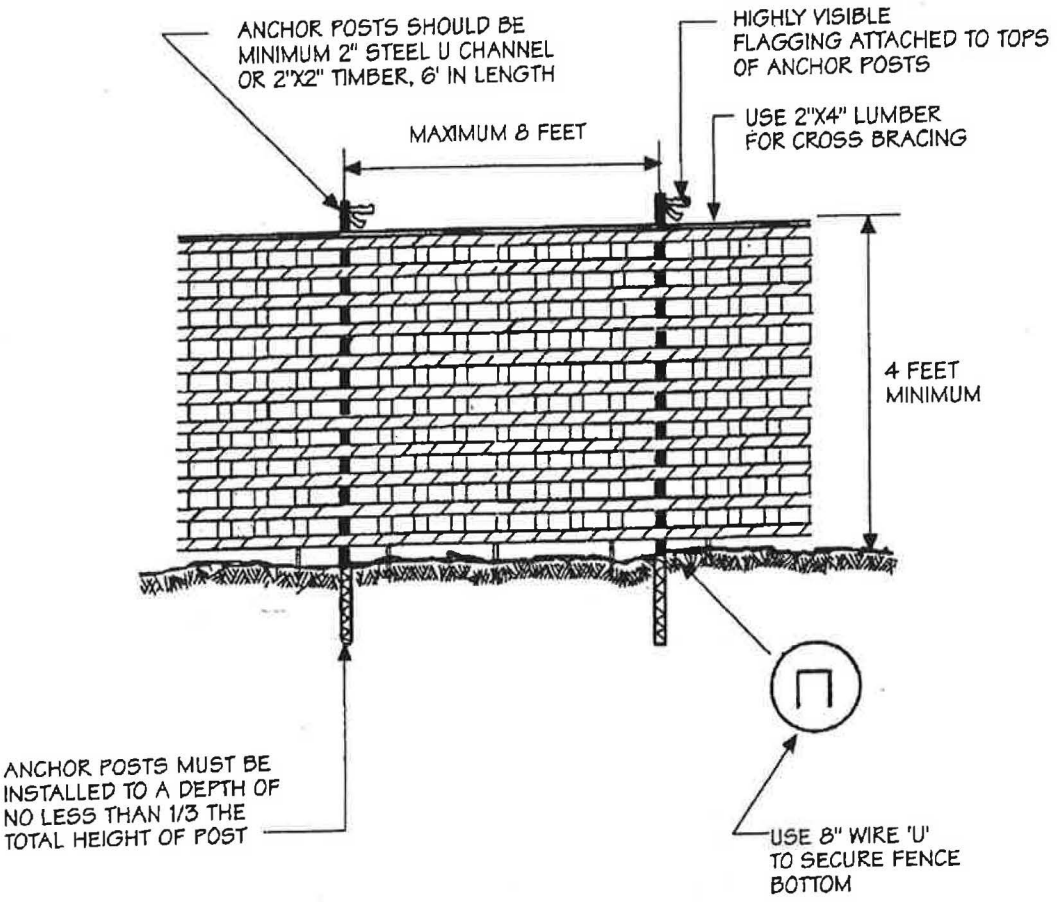
Application of Fertilizers	Figure D-3



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**

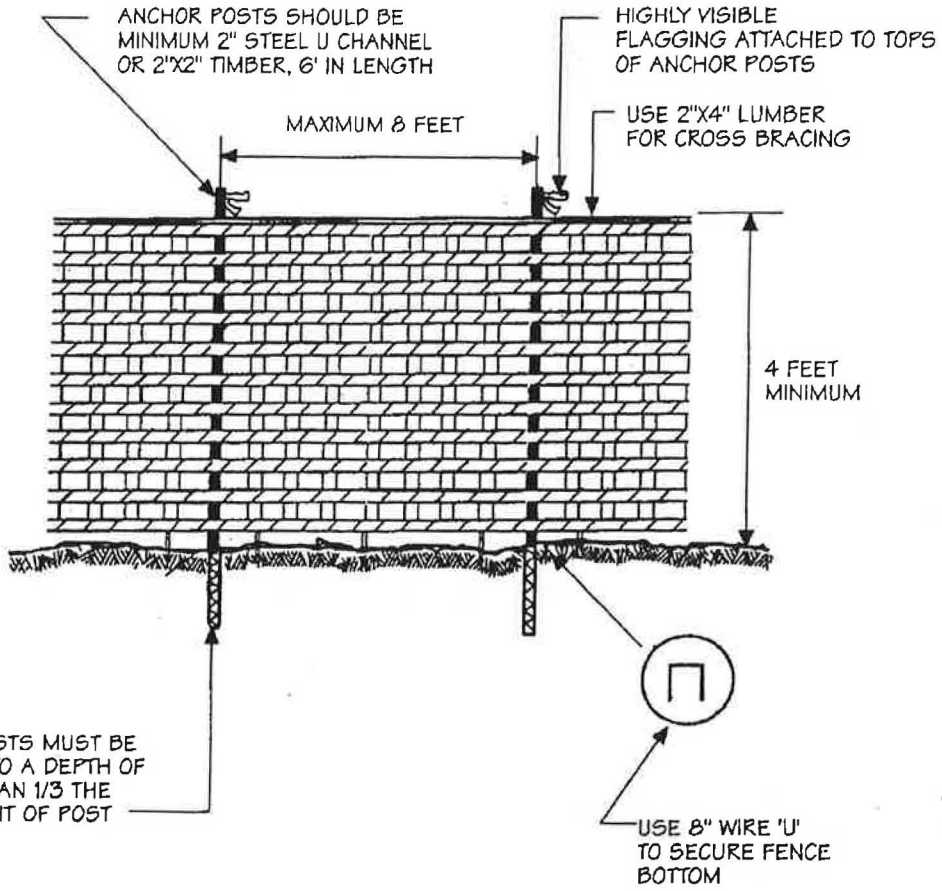


Notes:

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**

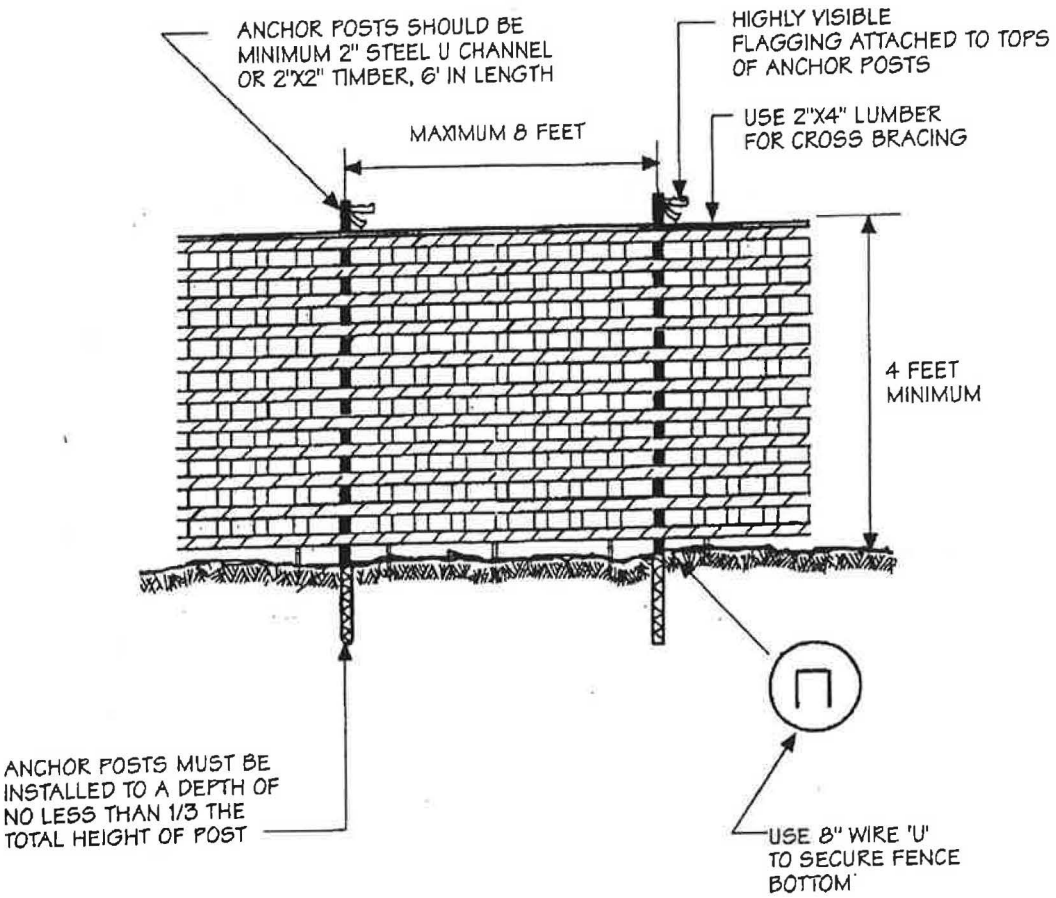


Notes:

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**

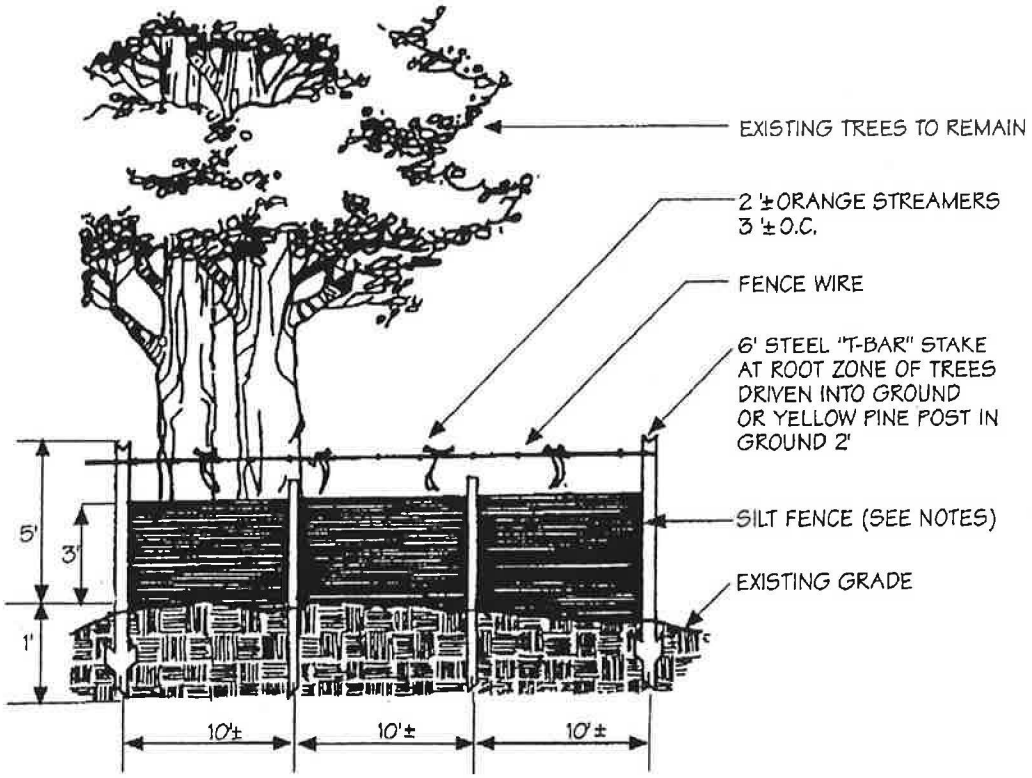


Notes:

1. 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

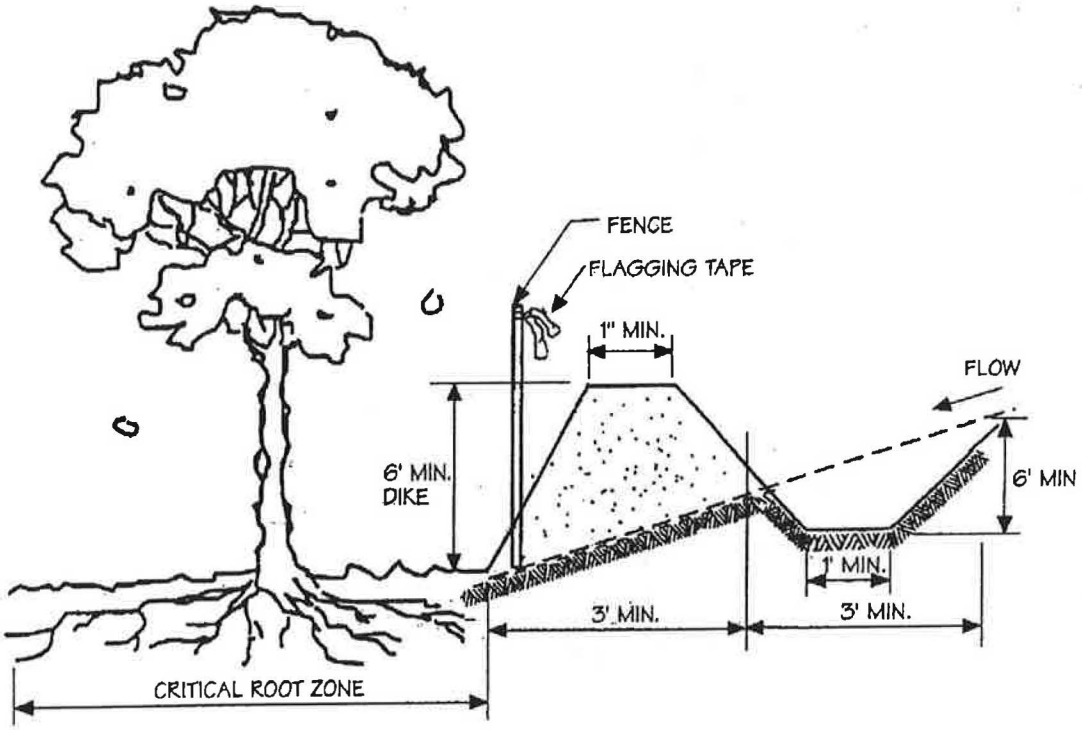
Snow Fence	**Figure D:7**



Notes:
1. Silt fence to be heeled into the soil.
2. Wire, 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.

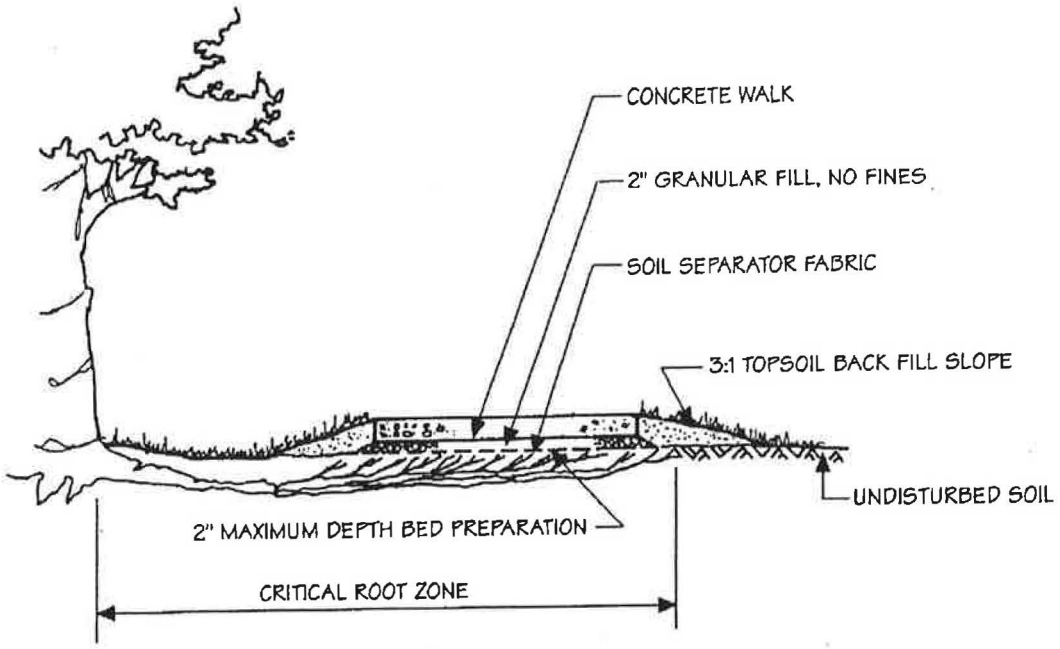
Silt Fence and Tree Protection	Figure D:8



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

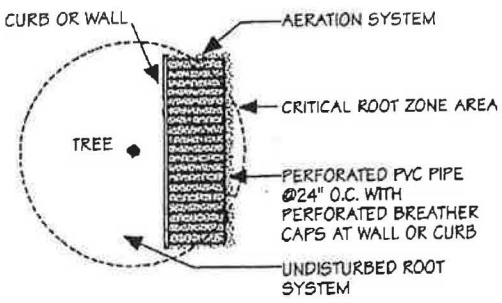
Earth Dike and Swale Combination Device	Figure D:9



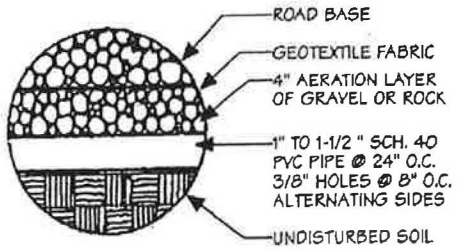
Notes:
1. Bed preparation should not exceed 2 inches
2. Granular fill should contain no fines
3. Minimize width of sidewalk as allowed by code.
4. Take extreme care of existing trees' critical root zone during construction.

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

Sidewalk above Critical Root Zone	Figure D:10

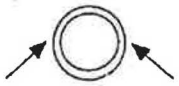


AERATION PLAN

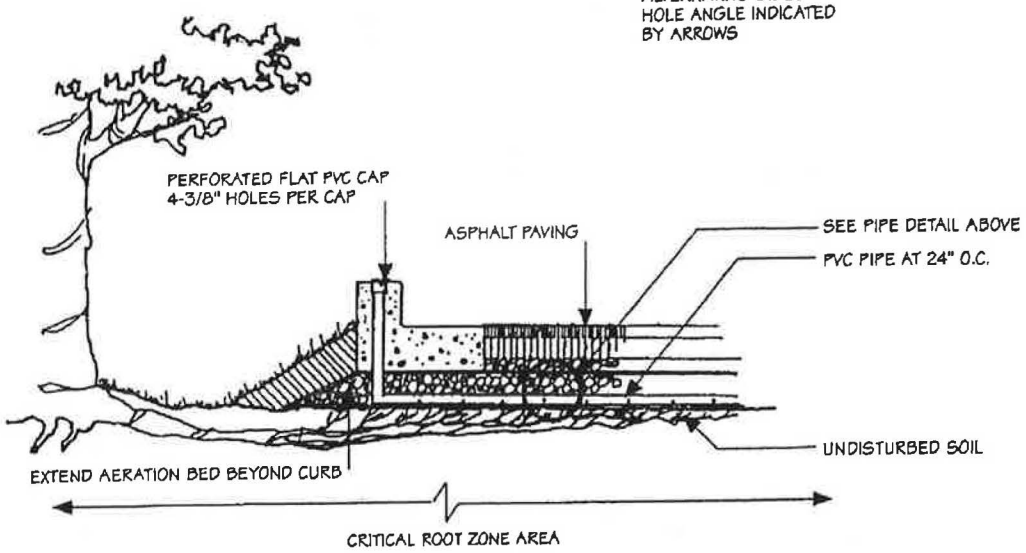


PIPE DETAIL

PIPE SECTION



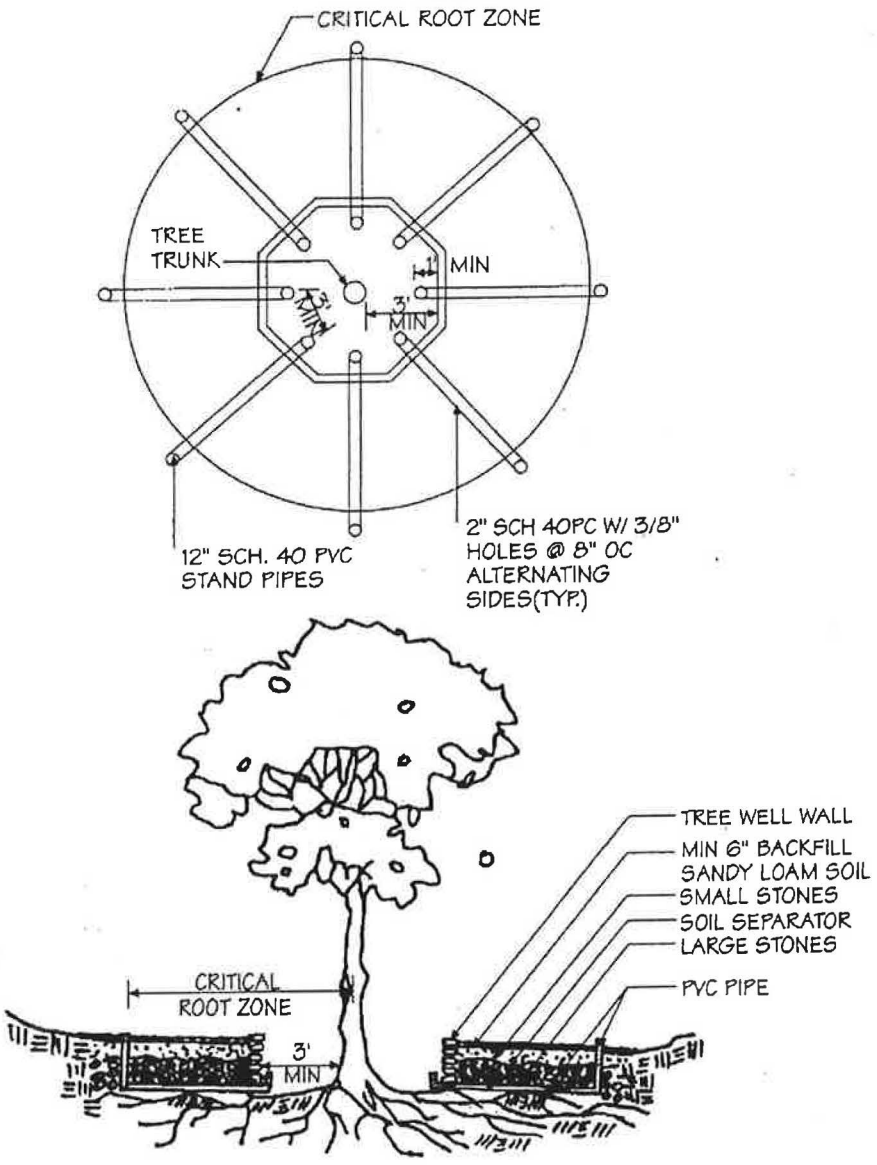
DRILL 3/8" HOLES 8" O.C.
ALTERNATING SIDES
HOLE ANGLE INDICATED
BY ARROWS



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.

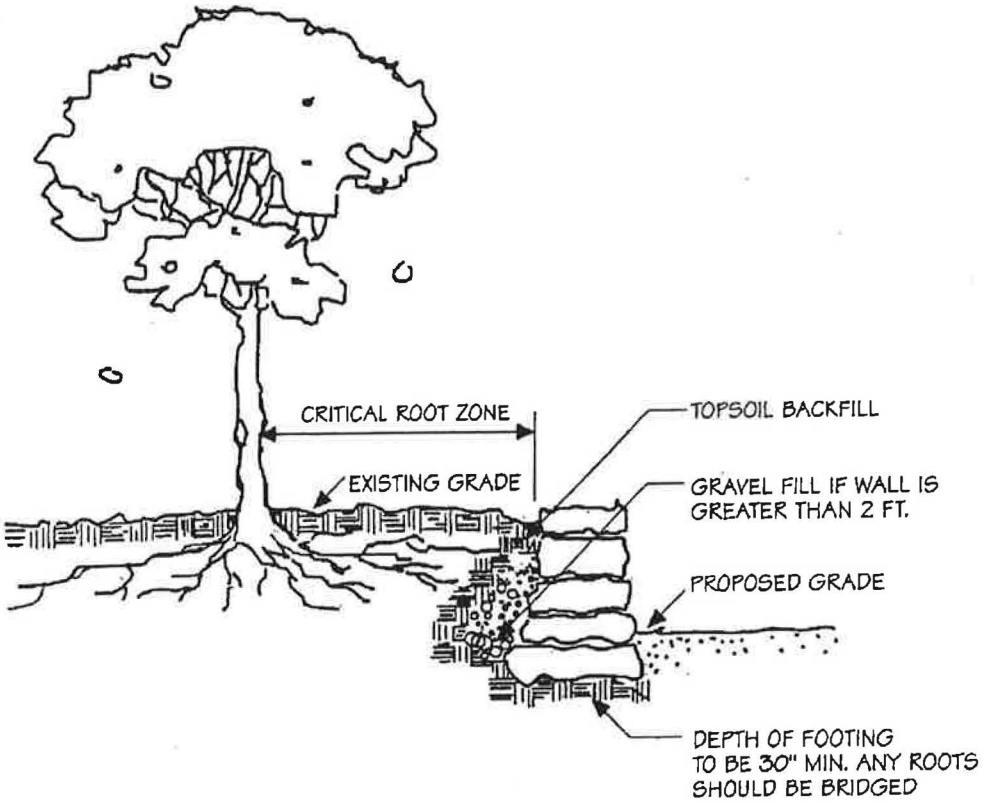
Aeration for Paving above Critical Root Zone | **Figure D:11**



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

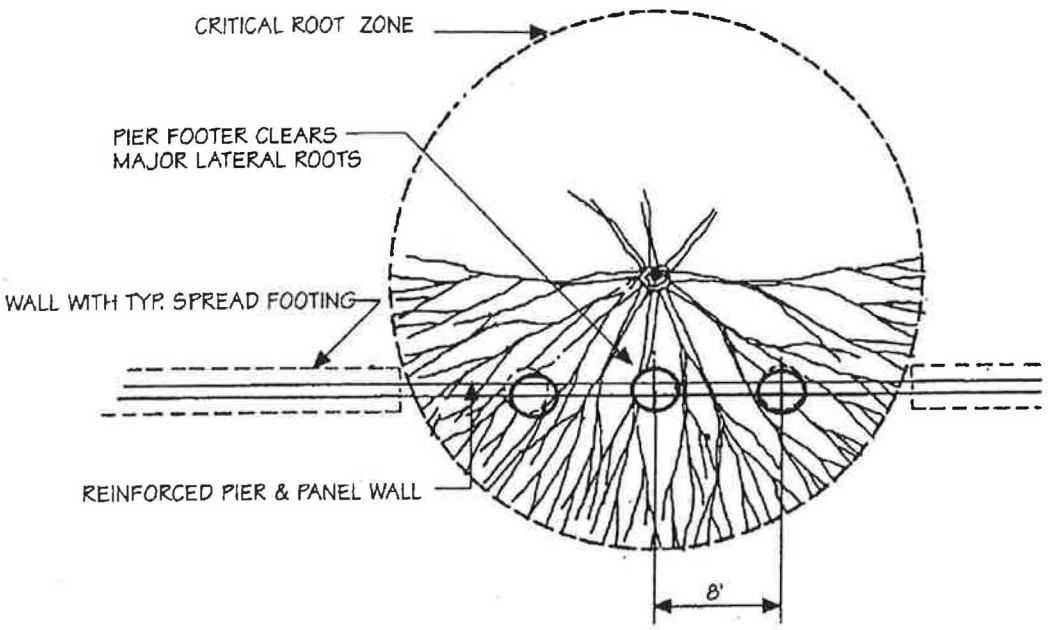
Tree Well and Aeration System	Figure D:12



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

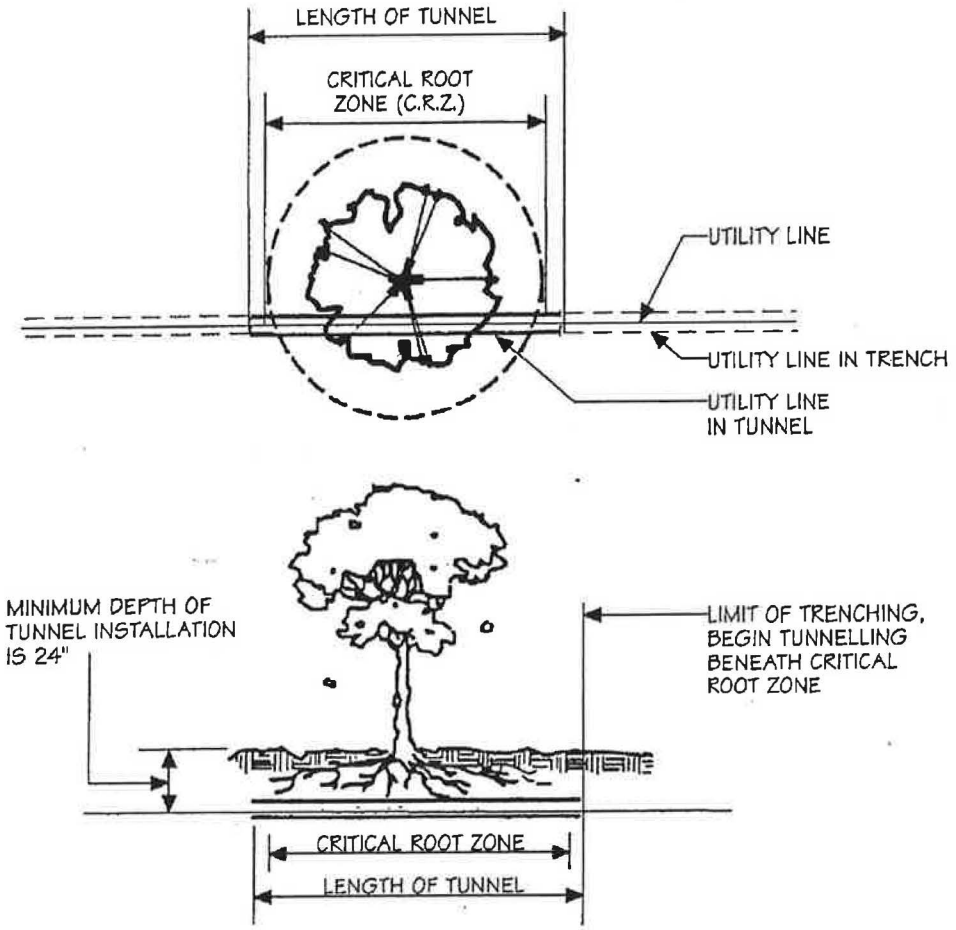
Retaining Walls	Figure D:13



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:

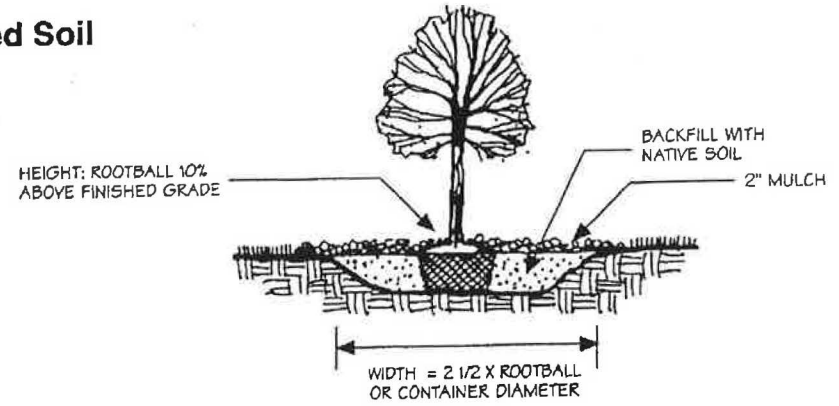
Tunnel should be located under Critical Root Zone at a minimum depth of 24 inches.

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

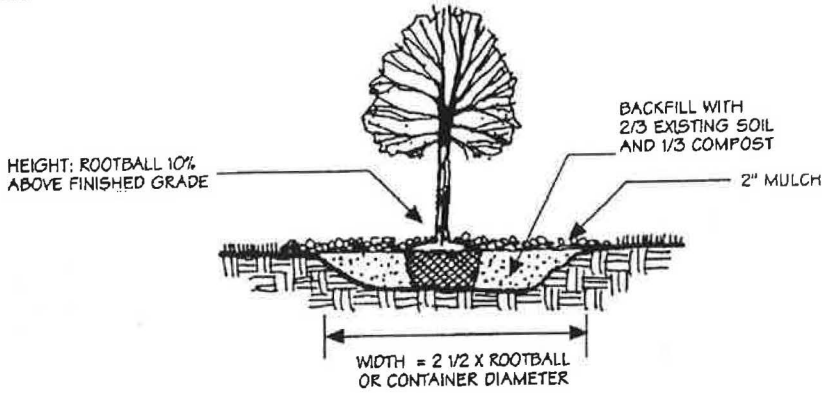
Source: Adapted from Fairfax County, Virginia: Vegetation Preservation and Planting, January 1986

Tunneling	Figure D:15

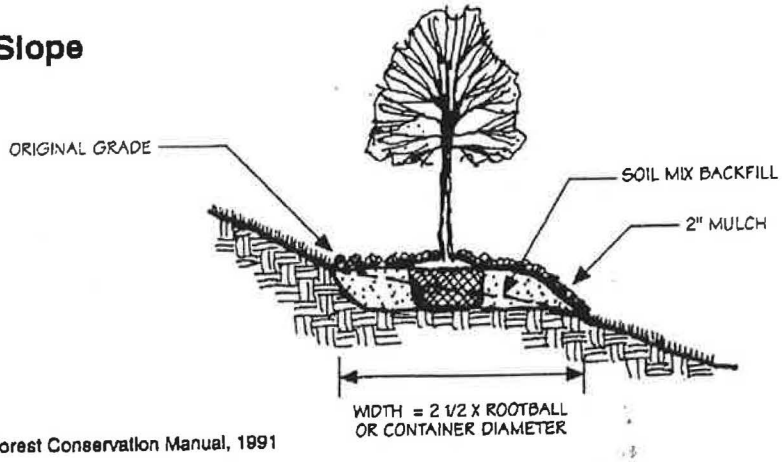
Undisturbed Soil



Disturbed Soil



Planting on Slope

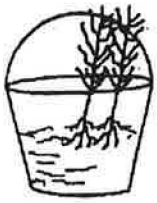


Source:Adapted from Forest Conservation Manual, 1991

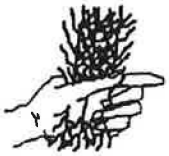
Container Grown and B&B Planting Techniques

Figure D:16

Handling Seedlings in the Field



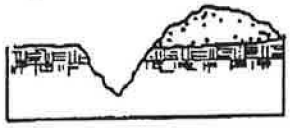
Correct
IN BUCKET WITH SUFFICIENT WATER TO COVER ROOTS



Incorrect
IN HAND:
ROOTS DRY OUT

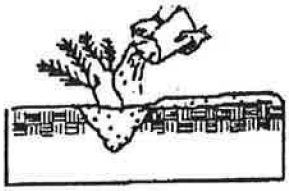
Note:
1. Bare root seedlings and whip stock should be heeled-in when left unplanted for more than 24 hours.

Seedlings and Whips

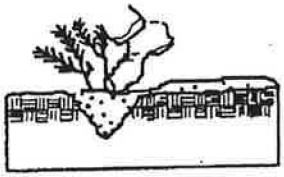


1. DIG V-SHAPED TRENCH IN MOIST SHADY PLACE

2. BREAK BUNDLES AND SPREAD OUT EVENLY



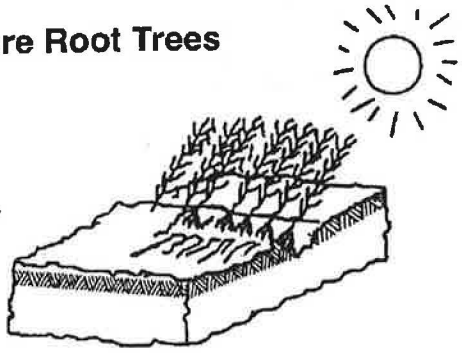
3. FILL IN LOSE SOIL AND WATER WELL



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

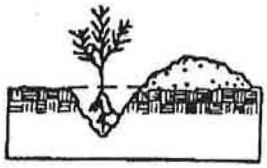
Source: Adapted from Forest Conservation Manual, 1991

Handling Bare Root Stock	Figure D:17

Seedling and Whip Planting

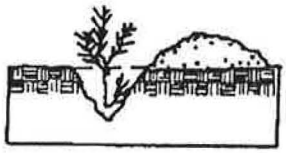
Note:
1. Mulching newly planted seedlings helps the soil retain moisture and protects the seedling from compaction and stem injuries.

Correct and Incorrect Planting Depth

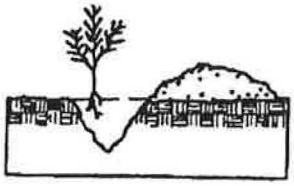


Correct
AT SAME DEPTH

SEEDLING WAS GROWN
IN NURSERY

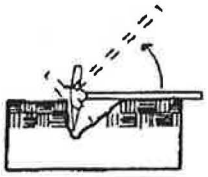


Incorrect
TOO DEEP AND ROOT
BENT



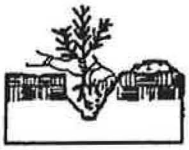
Incorrect
TOO SHALLOW AND ROOTS
EXPOSED

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.

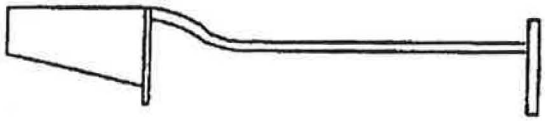
5. Firm around seedling with feet.

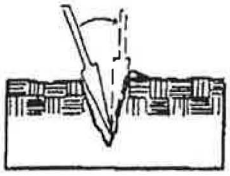
4. Finish filling in soil and firm with heel.

Source: Adapted from Forest Conservation Manual, 1991

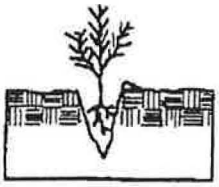
Seedling and Whip Planting Techniques	Figure D:18

Planting With Dibble Bar

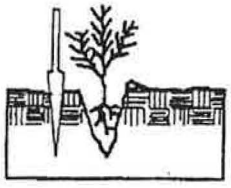




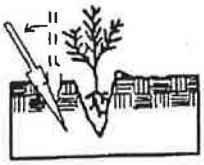
1. INSERT DIBBLE AT ANGLE SHOWN ABOVE AND PUSH FORWARD TO UPRIGHT POSITION



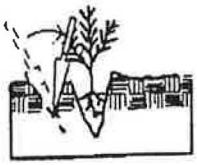
2. REMOVE DIBBLE AND PLACE SEEDLING AT CORRECT DEPTH



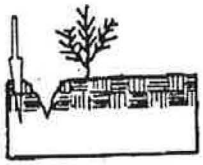
3. INSERT DIBBLE 2 INCHES TOWARD PLANTER FROM SEEDLING



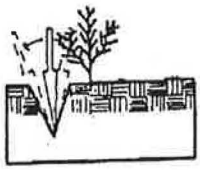
4. PULL HANDLE OF DIBBLE TOWARD PLANTER FIRMING SOIL AT BOTTOM OF ROOTS



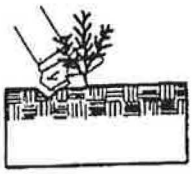
5. PUSH HANDLE OF DIBBLE FORWARD FROM PLANTER FIRMING SOIL AT TOP OF ROOTS



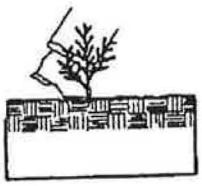
6. INSERT DIBBLE 2 INCHES FROM SEEDLING



7. PULL FORWARD THEN PULL BACKWARD FILLING HOLE



8. FILL LAST HOLE BY STAMPING WITH HEEL



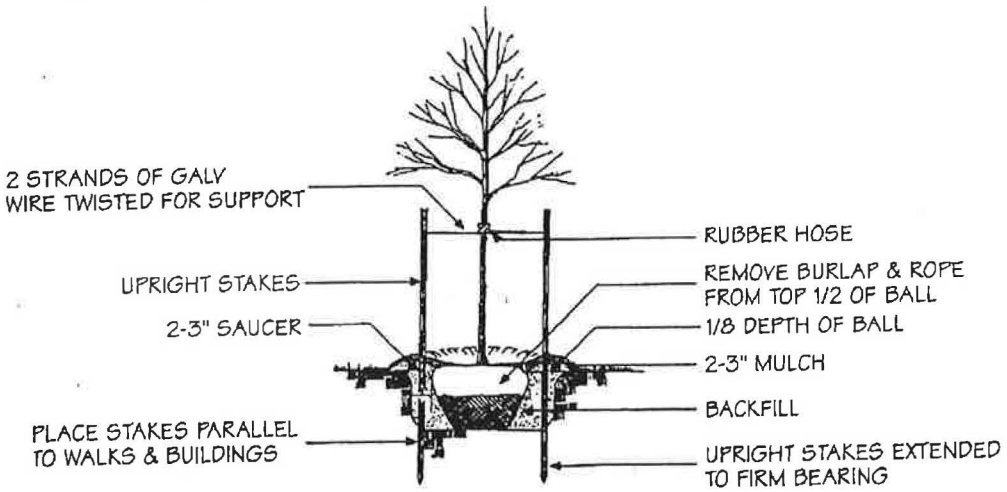
9. FIRM SOIL AROUND SEEDLING WITH FEET

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

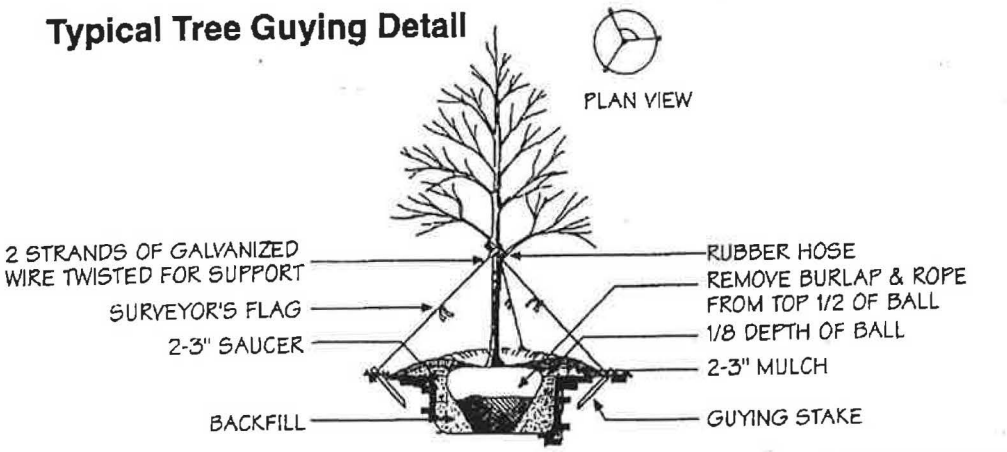
Seedling Planting Techniques

Figure D:19

Typical Upright Staking Detail



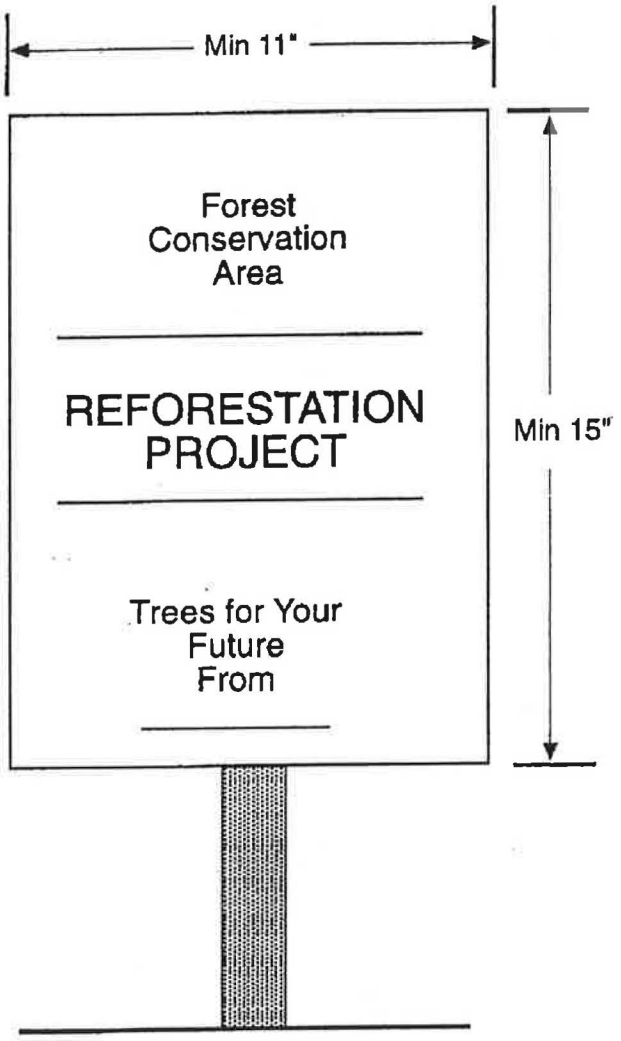
Typical Tree Guying Detail



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

Appendix N

Maryland State Champion Trees 1990

Maryland State Champion Trees

1990

Trees are one of the outstanding features in our landscape. Almost everyone likes trees for one reason or another. Trees vary in size. Some species do not attain a large size such as dogwoods or alder, yet their place in the landscape is just as important as an oak or yellow poplar.

In order to ensure fair comparisons for champion trees, certain measuring procedures are used. To qualify as a tree champion, the tree must have a single stem or trunk for at least 4.5 feet above ground level and have a total height of at least 15 feet. In multiple stemmed trees, only the largest stem should be measured.

The required information necessary to nominate or measure a big tree is:

1. Species - scientific name and common name
2. Location - county, town or road
3. Circumference - the girth, in inches, of the trunk at 4.5 feet above ground
4. Height - total perpendicular height of the tree, in feet
5. Crown Spread - the average of two measurements of the crown spread taken at right angles to each other, in feet
6. Condition - the general condition and health of the tree

The formula is: Total Points = Circumference(inches) + Height(feet) + 25% of the Average Crown Spread(feet).

Our list is constantly changing. The search for the biggest tree of each species continues. This list will be updated as more champion tree candidates are discovered. For the most up to date list, please call the Maryland Department of Natural Resources, Forestry Division at (301)974-3776.

Scientific Name	Common Name	Diameter(inches)
Fagus sylvatica	Copper beech	73.2
Fagus sylvatica atropunicea	Purple beech	49.0
Fagus sylvatica heterophylla	Cutleaf beech	38.2
Fagus sylvatica pendula	Weeping beech	54.1
Fagus sylvatica purpurea	Purple beech	43.3
Fraxinus americana	White ash	65.3
Fraxinus excelsior	European ash	55.1
Fraxinus pennsylvanica	Green ash	36.0
Ginkgo biloba	Ginkgo	65.9
Gleditsia triacanthos	Honey locust	45.9
Gymnocladus dioicus	Kentucky coffeetree	43.3
Hibiscus syriacus	Althea	1.9
Hovenia dulcis	Japanese raisin tree	15.9
Ilex opaca	American holly	38.5
Juglans cinerea	Butternut	34.7
Juglans nigra	Black walnut	79.9
Juglans regia	English walnut	41.7
Juniperus virginiana	Eastern red cedar	49.4
Kalmia latifolia	Mountain laurel	2.9
Lagerstroemia indica	Crepemyrtle	9.2
Larix decidua	European larch	33.1
Larix laricina	Eastern Larch	43.3
Libocedrus decurrens	Incense cedar	52.2
Lindera benzoin	Spicebush	34.4
Liquidambar styraciflua	Sweetgum	67.2
Liriodendron tulipifera	Yellow poplar	95.5
Maclura pomifera	Osage orange	67.8
Magnolia acuminata	Cucumber magnolia	79.6
Magnolia fraseri	Fraser magnolia	22.6
Magnolia grandiflora	Southern magnolia	36.3
Magnolia macrophylla	Big leaved magnolia	29.0
Magnolia soulangeana	Saucer magnolia	29.9
Magnolia virginiana	Sweetbay magnolia	5.1
Malus angustifolia	Crabapple	30.6
Metasequoia glyptostroboides	Dawn redwood	29.9
Morus alba	White mulberry	44.9
Morus nigra	Black mulberry	79.0
Morus rubra	Red mulberry	47.8
Nyssa sylvatica	Black gum	103.2
Paulownia tomentosa	Paulownia	55.7
Picea abies	Norway spruce	53.2
Picea pungens	Blue spruce	24.5
Picea rubens	Red spruce	34.7
Pinus echinata	Shortleaf pine	21.7
Pinus griffithii wallichiana	Himalayan white pine	40.8
Pinus nigra	Austrian pine	41.4
Pinus palustris	Longleaf pine	17.8
Pinus rigida	Pitch pine	27.1
Pinus strobus	White pine	42.7
Pinus taeda	Loblolly pine	51.0
Pinus virginiana	Virginia pine	30.3
Platanus occidentalis	Sycamore	97.1
Populus alba	White poplar	37.3
Populus deltoides	Eastern cottonwood	71.3
Populus grandidentata	Bigtooth aspen	22.6
Prunus avium	Sweet cherry	31.5
Prunus redoensis	Japanese yoshino cherry	45.9
Prunus serotina	Black cherry	86.0
Prunus sub-hirtella	Weeping cherry	19.1

Maryland Big Tree Program
State Champions
2005

March 7, 2005

Latin Name	Common Name	Circum-Ference	Height	Crown Spread	Points	Owner/Location
Abies balsamea	Balsam fir	8' 8"	87'	31'	199	McDermott Residence Prince George's
Abies concolor	White fir	10' 0"	60'	37'	189	Mrs. Gordon Cox Calvert
Abies fraseri	Fraser fir	5' 9"	67'	26'	142	Philip V. W. Dodds Anne Arundel
Abies grandis	Grand fir	9' 4"	115'	52'	240	Phil and Karen Saba Montgomery
Abies nordmanniana	Nordman fir	9' 7"	89'	39'	214	Franz Burda Talbot
Acer campestre	Hedge maple	9' 3"	61'	35'	181	Henry J. Magness Harford
Acer diabolicum	Devil maple	1' 3"	14'	12'	32	City of Baltimore; DPW Forestry Division Baltimore City
Acer griseum	Paperbark maple	4' 0"	46'	33'	102	Brookside Gardens Montgomery
Acer leucoderme	Chalk maple	2' 6"	47'	32'	85	Howard Co Rec & Parks Howard
Acer negundo	Boxelder	19' 2"	120'	84'	371	John Treadway Frederick
Acer nigrum	Black maple	8' 10"	81'	89'	209	Harford Glen Env. Ed. Ctr Harford
Acer opalus	Italian maple	1' 7"	22'	18'	46	City of Baltimore - Cylburn Arboretum Baltimore City
Acer ornatum dentatum	Cutleaf maple	4' 6"	28'	50'	94	Anthony Ladd Talbot
Acer palmatum	Japanese maple	12' 0"	17'	56'	175	Richard Farquhar Montgomery

Acer palmatum atropurpureum	Cutleaf Japanese maple	2' 3"	20'	18'	52	Mr. and Mrs. Millford Marchant, Sr. Anne Arundel
Acer palmatum dissectum atropurpure	Japanese maple	1' 4"	17'	34'	42	Dr. and Mrs. David Hungerford Baltimore
Acer palmatum ornatum dentatum	Japanese cutleaf weeping maple	2' 0"	15'	21'	44	Dr. William Gatewood Harford
Acer palmatum var. dissectum	Japanese maple	4' 3"	34'	68'	102	Ron and Laurie Gates Baltimore
Acer platanoides	Norway maple	16' 1"	71'	88'	286	Mrs. Mary H. Cadwalader Harford
Acer pseudoplatanus	Sycamore maple	9' 11"	47'	58'	180	Theodore and Gretchen Huhn Cecil
Acer rubrum	Red maple	18' 0"	75'	97'	316	St. John the Baptist Catholic Church Montgomery
Acer saccharinum	Silver maple	27' 0"	114'	106'	464	Town of Elkton, Dept of Recreation and Parks Cecil
Acer saccharum	Sugar maple	16' 8"	90'	73'	308	Charles P. Price Harford
Acer truncatum mono	Painted maple	3' 5"	38'	29'	86	City of Baltimore Cylburn Arboretum Baltimore City
Aesculus glabra	Ohio buckeye	14' 9"	88'	67'	282	Mrs. Sophia Powell Allegany
Aesculus hippocastanum	Horsechestnut	17' 4"	110'	58'	332	David and Verna Banner Anne Arundel
Aesculus octandra	Yellow buckeye	12' 3"	101'	50'	260	SLA Enterprises, Inc. Harford
Aesculus pavia	Red buckeye	2' 7"	27'	32'	76	Mrs. Eva Wilcox Calvert
Ailanthus altissima	Tree of Heaven	13' 6"	94'	74'	274	Barry Galef Montgomery
Albizzia julibrissin	Mimosa	11' 10"	60'	92'	225	Mark Habicht Baltimore
Alnus serrulata	Smooth alder	1' 10"	44'	61'	81	Carroll Co. General Hospital c/oJohn Sernulka Carroll
Amelanchier arborea	Serviceberry	10' 1"	39'	28'	167	State of Maryland Garrett
Aralia spinosa	Hercules club	1' 6"	39'	23'	63	Sandy Point State Park Anne Arundel

Asimina triloba	Pawpaw	2' 4"	35'	26'	70	Alice Ferguson Foundation Prince George's
Asimina triloba	Pawpaw	2' 4"	36'	20'	69	City of Hagerstown, Dept. of Public Works Washington
Asimina triloba	Pawpaw	2' 5"	34'	21'	68	Mrs. Cranford Calvert
Asimina triloba	Pawpaw	2' 0"	37'	18'	66	City of Hagerstown, Department of Public Works, Washington
Betula lenta	Black birch	11' 10"	72'	90'	236	Mt. Ararat Farms, c/o Walter Buck Cecil
Betula nigra	River birch	11' 10"	95'	85'	258	Kinder Farm Park, Anne Arundel Co. Dept. of Rec. and Parks Anne Arundel
Betula papyrifera	Paper birch	6' 1"	59'	66'	148	Richard Anderson Montgomery
Betula pendula	European white birch	6' 6"	66'	49'	156	Shirley Fromm Baltimore
Broussonetia papyrifera	Paper mulberry	7' 9"	35'	48'	140	Walton Residence Prince George's
Buxus sempervirens	Boxwood	3' 0"	22'	18'	62	Kevin E. Dayhoff Carroll
Carpinus caroliniana	Musclewood	4' 2"	56'	45'	117	Howard Co Rec & Parks Howard
Carya cordiformis	Bitternut hickory	15' 7"	114'	78'	320	Harford County Government Harford
Carya glabra	Pignut hickory	14' 2"	125'	78'	314	Robert and Barbara Wagoner Talbot
Carya illinoensis	Pecan	15' 9"	99'	104'	314	Hampton National Historic Site Baltimore
Carya ovata	Shagbark hickory	14' 9"	90'	116'	296	James & Kathleen Suite Anne Arundel
Carya pallida	Pale-leaved hickory	11' 6"	104'	68'	259	State of Maryland, Dept. of Housing and Community Dev. Calvert
Carya tomentosa	Mockernut hickory	14' 10"	108'	65'	302	MNCPPC Prince George's
Castanea crenata	Japanese chestnut	11' 6"	56'	50'	206	Henry Covington Queen Anne's

Castanea dentata	American chestnut	7' 3"	75'	36'	171	American Chestnut Land Trust Calvert
Castanea mollissima	Chinese chestnut	17' 2"	52'	59'	273	MD Dept of Nat. Resources Prince George's
Castanea pumila	Chinquapin	' 7"	16'	16'	27	Southern Middle School Calvert
Catalpa bignonioides	Southern catalpa	18' 5"	86'	81'	327	Mr. and Mrs. Charles Curlett Baltimore
Catalpa speciosa	Northern catalpa	19' 5"	77'	92'	333	Darnestown Civic Association Montgomery
Cedrus atlantica	Blue atlas cedar	16' 4"	54'	84'	271	John Scarbrough Baltimore
Cedrus deodara	Deodar cedar	14' 7"	51'	71'	244	Carol Jennette and Kenneth Shook Carroll
Cedrus libani	Lebanon cedar	10' 5"	83'	14'	222	Audubon Naturalist Society, Neal Fitzpatrick Montgomery
Celtis occidentalis	Hackberry	18' 1"	108'	81'	345	Meryl Leonard Washington
Cercidiphyllum japonicum	Katsuratree	11' 10"	71'	68'	230	George Brown Baltimore
Cercis canadensis	Redbud	7' 7"	40'	35'	138	State Highway Administration Montgomery
Chamaecyparis lawsoniana	Port-orford cedar	9' 8"	64'	42'	190	Jack Schumacher Montgomery
Chamaecyparis obtusa	Hinoki cypress	5' 4"	68'	35'	141	Brethern Service Center c/o Edwin Palsgrove Carroll
Chamaecyparis pisifera	Japanese falsecypress	9' 11"	74'	37'	202	Riverfront Conference Center/Univ. of MD Cecil
Chamaecyparis thyoides	Atlantic white cedar	9' 11"	94'	32'	221	Mrs. F.H. Kelly Harford
Chionanthus virginicus	Fringetree	3' 2"	16'	20'	59	Harold Winters Montgomery
Cladrastis lutea	Yellowwood	11' 6"	58'	68'	213	Ted & Jennifer Stanley Talbot
Cladrastis lutea	Yellowwood	9' 11"	75'	75'	213	Mrs. Patricia Hathaway Harford
Cornus florida	Flowering dogwood	8' 5"	28'	42'	140	Walter Harris Kent

Cornus kousa	Kousa dogwood	3' 10"	37'	34'	92	Scientists Cliffs Association Calvert
Corylus americana	American hazelnut	2' 6"	27'	21'	62	Lacouture Residence Calvert
Cotinus obovatus	Smoketree	1' 5"	12'	42'	40	Philip Carroll Howard
Crateagus mollis	Downy hawthorn	2' 6"	28'	30'	66	Christy Rose Calvert
Cryptomeria japonica	Cryptomeria	4' 4"	54'	20'	111	Ted and Mary Nelson Montgomery
Cryptomeria japonica	Cryptomeria	5' 1"	39'	28'	107	James M. Moran, Jr. Cecil
Cryptomeria japonica lobbii	Cryptomeria	6' 0"	77'	36'	158	Mrs. Bernard C. Boykin Baltimore
Cunninghamia lanceolata	Common chinafir	3' 4"	78'	27'	125	Calvert County Government Calvert
Cyrilla racemiflora	Leatherwood	1' 10"	15'	23'	43	Ethel Dutky Calvert
Davidia involucrata	Dove-tree	3' 4"	44'	43'	95	Scientists Cliffs Association Calvert
Diospyros virginiana	Persimmon	8' 10"	95'	54'	214	M-NCPPC Prince George's
Fagus grandifolia	American beech	23' 3"	115'	138'	428	Mrs. Joseph Emmerich Anne Arundel
Fagus sylvatica	Copper beech	14' 5"	104'	67'	294	Robert Kent Baltimore City
Fagus sylvatica	Copper beech	16' 9"	75'	65'	292	John Adams Harford
Fagus sylvatica atropunicea	Purple beech	16' 10"	80'	69'	299	Susan Kidwell Calvert
Fagus sylvatica grandidentata	Cutleaf European beech	12' 9"	59'	65'	228	Linwood Children's Ctr. Howard
Fagus sylvatica heterophylla	Cutleaf beech	10' 4"	79'	65'	219	St. Paul's School Baltimore
Fagus sylvatica pendula	Weeping beech	14' 7"	51'	74'	244	Town of Elkton, c/o Edward McKeown Cecil
Fagus sylvatica purpurea	Purple beech	14' 3"	88'	85'	280	Brethren Service Center Carroll

Firmiana simplex	Chinese parasol tree	1' 9"	21'	15'	46	Bob Steiner Calvert
Franklinia alatamaha	Franklin tree	2' 2"	27'	35'	62	WSSC-Environmental Science Unit Montgomery
Fraxinus americana	White ash	15' 9"	113'	103'	328	David and Linda Hoffmann Harford
Fraxinus americana	White ash	17' 4"	98'	80'	326	Mrs. Poe Burling Talbot
Fraxinus americana	White ash	19' 8"	85'	106'	324	Alvin P. Lehnerd Harford
Fraxinus pennsylvanica	Green ash	17' 2"	96'	91'	325	Noah F. Stephens Cecil
Fraxinus pennsylvanica biltmore	Biltmore ash	12' 4"	94'	76'	261	Hampton National Historic Site Baltimore
Ginkgo biloba	Ginkgo	20' 0"	84'	75'	343	Kimball and Hannah Byron Baltimore
Ginkgo biloba	Ginkgo	19' 3"	88'	88'	341	Jim and Kathleen Cronk Cecil
Gleditsia triacanthos	Honeylocust	19' 8"	114'	93'	373	Gary Schmidt Frederick
Gymnocladus dioicus	Kentucky coffeetree	12' 11"	116'	87'	293	Patrick Dolan Baltimore
Gymnocladus dioicus	Kentucky coffeetree	15' 7"	84'	80'	291	Carl and Leslie Rutherford Washington
Halesia carolina	Carolina silverbell	7' 0"	57'	34'	150	Ladew Topiary Gardens Harford
Hamamelis virginiana	Common witchhazel	0' 9"	15'	15'	28	Howard County Rec & Parks Howard
Hibiscus syriacus	Althea	0' 8"	19'	13'	30	Colby B. Rucker Anne Arundel
Hovenia dulcis	Japanese raisintree	4' 2"	57'	37'	116	National Park Service Prince George's
Hydrangea paniculata	Panicle hydrangea	1' 8"	18'	16'	42	Colby Rucker Anne Arundel
Ilex opaca	American holly	10' 3"	54'	52'	190	Meadowridge Memorial Park Howard
Ilex verticillata	Whorled winterberry	' 6"	19'	9'	27	Colby Rucker Anne Arundel

Juglans cinerea	Butternut	16' 10"	67'	84'	290	William Gallagher Cecil
Juglans nigra	Black walnut	21' 6"	75'	79'	351	Y. Kirkpatrick Howat Anne Arundel
Juglans regia	English walnut	13' 3"	105'	99'	289	Madelle & Dan Tolbert Frederick
Juniperus chinensis	Chinese juniper	5' 3"	68'	28'	138	Scientists Cliffs Association Calvert
Juniperus virginiana	Eastern red cedar	13' 4"	60'	36'	229	Ailene W. Hutchins Calvert
Kalmia latifolia	Mountain laurel	2' 6"	24'	22'	60	Peter & Roslyn Monsees St. Mary's
Kalopanax pictus	Castor-aralia	5' 4"	34'	36'	107	City of Baltimore Baltimore City
Koelreuteria paniculata	Goldenraintree	5' 3"	87'	50'	162	TJ and Julie O'Malley Montgomery
Lagerstroemia indica	Crapemyrtle	4' 6"	32'	40'	96	Bill Jones Somerset
Larix decidua	European larch	9' 1"	101'	52'	223	JoAnne Hitt Baltimore
Larix decidua	European larch	10' 0"	86'	48'	218	West Nottingham Academy, c/o Vince Watchoin Cecil
Larix kaempferi	Japanese larch	5' 1"	74'	40'	145	Cynthia Wood Prince George's
Larix laricina	American larch	9' 2"	93'	53'	216	McDonogh School Baltimore
Libocedrus decurrens	Incensecedar	13' 8"	84'	40'	258	Mr. and Mrs. Duffy Anne Arundel
Libocedrus decurrens	Incensecedar	13' 4"	84'	43'	255	Mr. and Mrs. Duffy Anne Arundel
Ligustum sinense	Chinese privet	2' 6"	17'	22'	52	State of Maryland Calvert
Lindera benzoin	Spicebush	1' 2"	23'	22'	42	Colby Rucker Anne Arundel
Lindera benzoin	Spicebush	0' 9"	24'	22'	38	Sandy Point State Park Anne Arundel
Liquidambar styraciflua	Sweetgum	17' 5"	88'	72'	315	Jackie L. Church Charles

Liriodendron tulipifera	Yellow poplar	23' 6"	126'	80'	428	Robert Jones Montgomery
Liriodendron tulipifera	Yellow poplar	24' 5"	110'	82'	424	Manor Oaks Community,c/o Chuck Sullivan Montgomery
Maackia amurensis	Amur maackia	6' 6"	30'	48'	120	City of Baltimore Baltimore City
Maclura pomifera	Osage orange	20' 9"	109'	94'	382	Robert B. Thompson Queen Anne's
Magnolia acuminata	Cucumber magnolia	22' 7"	77'	73'	366	City of Bowie Prince George's
Magnolia fraseri	Fraser magnolia	6' 6"	68'	46'	158	Douglas Benedict Baltimore City
Magnolia grandiflora	Southern magnolia	14' 4"	64'	46'	248	Mrs. Eileen Dykes Somerset
Magnolia kobus	Kobus magnolia	7' 0"	32'	37'	125	Connie Green Montgomery
Magnolia macrophylla	Bigleaf magnolia	7' 4"	70'	56'	172	Martha Seigel Montgomery
Magnolia stellata	Star magnolia	2' 8"	43'	24'	81	USDA Beltsville Agricultural Research Center Prince George's
Magnolia tripetala	Umbrella magnolia	6' 3"	44'	28'	126	William E. Hubbard III Harford
Magnolia virginiana	Sweetbay magnolia	5' 9"	42'	35'	121	Mrs. Mary H. Cadwalader Harford
Magnolia x soulangeana	Saucer magnolia	9' 0"	47'	48'	167	US Naval Academy, Natural Resources, Env. Div. Anne Arundel
Malus angustifolia	Crabapple	8' 0"	47'	60'	158	James McLaughlin Kent
Metasequoia glyptostroboides	Dawn redwood	12' 1"	98'	46'	254	Ladew Topiary Gardens Harford
Morus alba	White mulberry	19' 1"	68'	79'	317	Susan Pippin Queen Anne's
Morus nigra	Black mulberry	21' 0"	78'	76'	349	Nicholas Samios Carroll
Morus rubra	Red mulberry	13' 2"	67'	90'	248	Dolesh Residence Prince George's
Myrica cerifera	Southern waxmyrtle	1' 10"	17'	24'	45	Calvert County Government Calvert

Nyssa sylvatica	Black gum	14' 11"	86'	88'	287	Katherine Farquhar Montgomery
Ostrya virginiana	Ironwood	2' 10"	57'	38'	100	Randy and Karen Thompson Prince George's
Oxydendrum arboreum	Sourwood	3' 4"	60'	32'	108	Margaret Madert Montgomery
Paulownia tomentosa	Paulownia	19' 1"	43'	58'	286	Ron Standiford Baltimore
Phellodendron amurense	Amur corktree	9' 9"	44'	62'	176	City of Baltimore, DPW Forestry Division Baltimore City
Picea abies	Norway spruce	11' 11"	123'	40'	276	Wendel Fritz Harford
Picea glauca	White spruce	7' 2"	66'	18'	156	MNCPPC Prince George's
Picea orientalis	Oriental spruce	8' 2"	79'	35'	186	Annapolis National Cemetery Anne Arundel
Picea pungens	Blue spruce	6' 5"	70'	43'	158	William Mitchell Anne Arundel
Picea rubens	Red spruce	9' 10"	74'	53'	205	Leah Staling Washington
Pinus echinata	Shortleaf pine	5' 8"	105'	31'	181	William H. Berry Anne Arundel
Pinus mugho	Mugho pine	2' 8"	29'	31'	69	Howard Co. Dept of Recreation and Parks Howard
Pinus nigra	Austrian pine	9' 0"	62'	46'	182	Hampton Nat. Hist. Site Baltimore
Pinus palustris	Longleaf pine	7' 7"	75'	46'	178	Buckingham Presbyterian Church, Rev. Gary Baer Worcester
Pinus ponderosa	Ponderosa pine	3' 2"	37'	25'	81	Lucy Alexander Montgomery
Pinus pungens	Table mountain pine	5' 0"	84'	32'	152	MNCPPC, c/o Eugene Rose Montgomery
Pinus pungens	Table mountain pine	4' 8"	88'	24'	150	Green Ridge State Forest Allegany
Pinus pungens	Table mountain pine	5' 1"	83'	16'	148	MNCPPC, c/o Eugene Rose Montgomery
Pinus resinosa	Red pine	6' 10"	51'	32'	141	J. C. Williams Prince George's

Pinus rigida	Pitch pine	7' 10"	90'	41'	194	US Fish & Wildlife Serv. Prince George's
Pinus strobus	White pine	11' 8"	107'	51'	260	Darnestown Presbyterian Church Montgomery
Pinus strobus	White pine	10' 0"	116'	44'	258	Vernon J. Jones Harford
Pinus strobus fastigiata	Columnar white pine	5' 8"	53'	39'	131	Mrs. William E. Fries Wicomico
Pinus sylvestris	Scotch pine	4' 3"	22'	24'	79	Calvert High School Calvert
Pinus taeda	Loblolly pine	9' 4"	86'	42'	208	Peter R. Stifle Talbot
Pinus virginiana	Virginia pine	7' 11"	77'	50'	184	Rhonda Robins Anne Arundel
Pinus wallichiana	Himalayan pine	10' 9"	102'	49'	243	Thomas Hughes, Jr. Talbot
Platanus occidentalis	Sycamore	26' 3"	110'	87'	447	John E. Smith Carroll
Platanus x acerifolia	London planetree	6' 7"	73'	63'	168	City of Greenbelt Prince George's
Populus alba	White poplar	9' 10"	60'	30'	186	Tuckahoe State Park Caroline
Populus deltoides	Eastern cottonwood	18' 1"	91'	126'	340	Rodger Sutton Baltimore
Populus grandidentata	Bigtooth aspen	3' 8"	99'	23'	149	Randy and Karen Thompson Prince George's
Populus nigra	Lombardy poplar	4' 6"	72'	24'	132	Devin Battley Montgomery
Populus x canadensis	Carolina poplar	4' 0"	62'	30'	118	Wesley S. Koerber Harford
Prunus armeniaca	Apricot	4' 2"	32'	33'	90	Laurence Cumberland Calvert
Prunus avium	Sweet cherry	15' 1"	68'	70'	266	Eugene A. Summers Harford
Prunus avium	Sweet cherry	15' 3"	65'	62'	264	Mt. Ararat Farms, c/o Walter Buck Cecil
Prunus cerasus	Sour cherry	7' 10"	80'	41'	184	Laurence Cumberland Calvert

Prunus serotina	Black cherry	22' 6"	67'	63'	353	Renate E. Sass Kent
Prunus serrulata	Japanese flowering cherry	8' 7"	36'	48'	151	Lelia Carico Harford
Prunus subhirtella pendula	Weeping cherry	11' 0"	56'	52'	201	J. Danial Shulka Harford
Prunus subhirtella pendula	Weeping cherry	10' 5"	59'	57'	198	Rupert and Cynthia Rossetti Cecil
Prunus virginiana	Common chokecherry	14' 0"	74'	88'	264	Frank X. Rurka Baltimore
Prunus x yedoensis f.perpenden	Weeping yoshino cherry	12' 1"	70'	59'	230	Mrs. John Hesson Carroll
Prunus yedoensis	Japanese yoshino cherry	15' 6"	56'	73'	260	Paul and Anne Colburn Montgomery
Pseudotsuga menziesii	Douglas fir	10' 0"	70'	48'	202	St. Rose of Lima Church, att: Don Dibble Montgomery
Pterocarya fraxinifolia	Caucasian wingnut	9' 7"	94'	68'	226	Mann House Harford
Pyrus calleryana 'Bradford'	Bradford pear	7' 1"	56'	56'	155	Van Dyke Residence Prince George's
Pyrus calleryana 'Bradford'	Bradford pear	7' 10"	45'	48'	151	Margo Denney Prince George's
Pyrus communis	Common pear	11' 1"	55'	45'	199	Laurence Cumberland Calvert
Pyrus malus	Common apple	8' 3"	42'	48'	153	MD DNR Calvert
Pyrus malus	Common apple	7' 1"	43'	95'	152	Robert Grant Prince George's
Pyrus pyrifolia	Asian pear	5' 4"	46'	29'	117	Robert Sickle, Sr. Calvert
Quercus acutissima	Sawtooth oak	10' 3"	96'	77'	238	Joseph and Elaine Lantz Baltimore City
Quercus alba	White oak	20' 1"	127'	96'	392	Chief of Natural and Cultural Resources, Anne Arundel County Anne Arundel
Quercus alba	White oak	22' 2"	102'	83'	389	Katherine A. Adams Harford
Quercus alba	White oak	23' 4"	86'	91'	389	George and Carol Kaplan Cecil

Quercus bicolor	Swamp white oak	19' 0"	120'	92'	371	M-NCPPC, Att: Sandy Lyon Prince George's
Quercus cerris	European turkey oak	10' 2"	51'	73'	191	City of Baltimore Baltimore City
Quercus coccinea	Scarlet oak	15' 2"	125'	110'	334	Peter Stifle Talbot
Quercus dentata	Daimio oak	5' 1"	69'	48'	142	Scientists Cliffs Association Calvert
Quercus falcata	Southern red oak	18' 10"	113'	126'	370	Gerard Smith Talbot
Quercus falcata	Southern red oak	21' 6"	81'	104'	365	Myrna Burkhart Queen Anne's
Quercus falcata pagodaefolia	Cherrybark oak	12' 0"	96'	71'	258	Milton Barlow Talbot
Quercus frainetto	Hungarian oak	9' 3"	77'	58'	202	Walters United Methodist Church Calvert
Quercus imbricaria	Shingle oak	13' 1"	111'	76'	287	Henry and Elizabeth Hyde Montgomery
Quercus lyrata	Overcup oak	10' 3"	98'	50'	234	U. S. Government Prince George's
Quercus macrocarpa	Bur oak	18' 2"	100'	82'	338	George Shinham Washington
Quercus marilandica	Blackjack oak	9' 2"	77'	73'	205	Bill Quinn Baltimore City
Quercus michauxii	Swamp chestnut oak	23' 7"	120'	90'	426	St. Paul's Episcopal Ch. Kent
Quercus muehlenbergii	Chinquapin oak	18' 5"	85'	86'	328	Sotterly Mansion Foundation Inc. St. Mary's
Quercus nigra	Water oak	11' 0"	80'	92'	235	Polly Sturm Montgomery
Quercus palustris	Pin oak	16' 6"	145'	75'	362	Marlborough C L, Inc. Prince George's
Quercus petraea	Durmast oak	10' 0"	90'	66'	226	City of Baltimore Baltimore City
Quercus phellos	Willow oak	23' 6"	111'	90'	416	William Myers Talbot
Quercus prinus	Chestnut oak	22' 9"	104'	99'	407	Jeanine Ove Anne Arundel

Quercus robur	English oak	13' 5"	59'	76'	239	City of Baltimore Baltimore City
Quercus robur fastigiata	Columnar English oak	5' 9"	58'	12'	130	City of Baltimore Baltimore City
Quercus rubra	Northern red oak	22' 0"	136'	98'	424	The Iliff Family Anne Arundel
Quercus shumardii	Shumard's red oak	7' 0"	107'	47'	203	C&O Canal National Park Washington
Quercus stellata	Post oak	12' 3"	86'	81'	253	Ailene Hutchins Calvert
Quercus stellata	Post oak	12' 6"	83'	65'	249	St. Thomas Church Prince George's
Quercus variabilis	Oriental cork oak	8' 9"	78'	39'	193	Outdoor Nursery School, Inc. Montgomery
Quercus velutina	Black oak	16' 4"	85'	108'	389	Hazel and Donald Ewing Harford
Quercus virginiana	Live oak	6' 10"	45'	49'	139	Dr. Harry Wachs Calvert
Quercus x schochiana	Pin oak x willow oak	2' 4"	25'	20'	58	City of Baltimore Baltimore City
Rhus vernix	Poison sumac	1' 6"	30'	19'	53	Colby Rucker Anne Arundel
Robinia pseudoacacia	Black locust	18' 7"	60'	37'	292	Clement Gardiner Frederick
Robinia pseudoacacia	Black locust	17' 4"	70'	48'	290	Mr. and Mrs. Davison Dulin Baltimore
Salix babylonica	Weeping willow	26' 9"	97'	17.5'	436	Dora Wilson Allegany
Salix matsudana	Contorted willow	10' 8"	45'	47'	185	Dr. Harry Wachs Calvert
Salix matsudana 'Tortuosa'	Corkscrew willow	7' 1"	47'	53'	145	Ned Surratt Harford
Salix nigra	Black willow	4' 10"	86'	21'	149	Calvert County Government Calvert
Sassafras albidum	Sassafras	13' 2"	56'	51'	227	Patricia Ewing Anne Arundel
Sciadopitys verticillata	Umbrella-pine	5' 6"	50'	24'	122	City of Baltimore, School Board Baltimore City

Sequoia sempervirens	California redwood	6' 4"	79'	32'	163	Ms. Pamela Simson Wicomico
Sophora japonica	Japanese pagodatree	11' 4"	60'	71'	214	Rose Hill Cemetery Washington
Sophora japonica 'pendula'	Weeping japanese scholar tree	6' 2"	17'	24'	97	Hampton National Historic Site Baltimore
Sorbus domestica	Service tree	14' 10"	50'	64'	244	The Arc of Baltimore Baltimore City
Styrax japonicus	Japanese snowbell	3' 0"	29'	39'	75	Kathleen Truelove Baltimore City
Styrax obassia	Fragrant snowbell	1' 1"	22'	18'	40	Scientists Cliffs Association Calvert
Syringa reticulata	Japanese tree lilac	5' 0"	38'	28'	105	Linwood Children's Ctr Howard
Taxodium ascendens v. nutans	Pondcypress	12' 6"	100'	74'	268	MNCPPC, Prince George's
Taxodium distichum	Baldcypress	17' 9"	132'	77'	364	Calvert County Government Calvert
Taxus baccata	English yew	14' 4"	41'	49'	225	Peter Stifel Talbot
Taxus baccata stricta	Irish yew	14' 5"	27'	25'	206	Franz Burda Talbot
Thuja occidentalis	Eastern arborvitae	6' 11"	45'	42'	138	Douglas and Vicki Franz Baltimore
Thuja occidentalis	Eastern arborvitae	7' 6"	34'	46'	136	Douglas and Vicki Franz Baltimore
Thuja occidentalis 'Douglasii Aurea	Eastern arborvitae, var.	3' 1"	34'	22'	76	John Marvel Baltimore
Thuja orientalis	Arborvitae	6' 8"	42'	57'	123	Mr. & Mrs. J. J. Strauch Baltimore
Tilia americana	American basswood	16' 8"	108'	73'	326	Richard Norton Kent
Tilia americana	American basswood	18' 9"	84'	58'	324	James & Joan Snyder Talbot
Tilia cordata	Littleleaf linden	21' 0"	80'	66'	348	Alex Apostolou Montgomery
Tilia heterophylla	White basswood	14' 5"	85'	88'	280	Oden Bowie Prince George's

Tilia petiolaris	Pendent silver linden	14' 4"	85'	77'	276	Melissa Lankler Montgomery
Tilia platyphyllos	Bigleaf linden	18' 11"	94'	70'	338	Jim and Kathleen Cronk Cecil
Tilia x europaea	European linden	22' 2"	91'	71'	375	Woodland Horse Center Montgomery
Tsuga canadensis	Eastern hemlock	15' 9"	78'	52'	280	Howard Co. Rec & Parks Howard
Tsuga canadensis	Eastern hemlock	12' 10"	109'	50'	276	Mrs. Mary H. Cadwalader Harford
Tsuga caroliniana	Carolina hemlock	3' 6"	41'	24'	89	Richard Hubbard Anne Arundel
Ulmus alata	Winged elm	3' 4"	35'	29'	82	University of Maryland Prince George's
Ulmus americana	American elm	20' 0"	80'	100'	345	Mrs. Charles Stapleton Baltimore
Ulmus carpinifolia pendula	Smooth leaved elm	11' 7"	60'	96'	223	Harvey Hastings Somerset
Ulmus glabra	Scotch elm	16' 9"	90'	78'	310	City of Rockville Montgomery
Ulmus glabra 'pendula'	Weeping Scotch elm	7' 5"	20'	40'	119	City of Baltimore, DPW Forestry Division Baltimore City
Ulmus parvifolia	Chinese elm	14' 11"	72'	77'	270	Ann Rowan Anne Arundel
Ulmus procera	English elm	20' 1"	102'	99'	368	Montgomery Co. DPW &T Montgomery
Ulmus pumila	Siberian elm	13' 10"	79'	70'	262	Nancy Clark Baltimore
Ulmus rubra	Slippery elm	19' 4"	103'	93'	358	Frederick High School Frederick
Ulmus x hollandica	Dutch elm	14' 4"	92'	78'	284	Karas & Bradford Law Firm Harford
Vaccinium atrococcum	Black highbush blueberry	0' 9"	17'	7'	29	Sandy Point State Park Anne Arundel
Viburnum prunifolium	Black haw	2' 0"	29'	25'	59	Howard Co Rec & Parks Howard
Zelkova carpinifolia	Caucasian zelkova	5' 3"	31'	54'	108	MNCPPC Prince George's

Zelkova serrata	Japanese zelkova	8' 4"	73'	66'	190	City of Baltimore, DPW Forestry Division Baltimore City

APPENDIX P

WASHINGTON COUNTY FOREST CONSERVATION ORDINANCE

RECOMMENDED NATIVE TREE AND SHRUB LIST

TREES

American chestnut
Basswood
Beech
Big shellbark hickory
Bitternut hickory
Black ash
Black birch
Black cherry
Black gum
Black oak
Black jack oak
Black locust
Black maple
Black walnut
Black willow
Blue beech
Box elder
Chestnut oak
Chiquapin oak
Coffee tree
Cottonwood
Crabapple
Cucumber
Fire cherry
Flowering dogwood
Grape
Hemlock
Holly
Hop hornbeam
Ironwood
Juniper
Mockernut hickory
Mountain ash
Mountain maple
Northern red oak
Persimmon
Pignut hickory
Pin oak
Pitch pine
Post oak
Red Ash
Red cherry

Red maple
River birch
Sassafras
Sawtooth oak
Scarlet oak
Scrub oak
Shagbark hickory
Shingle oak
Short leaf pine
Silver maple
Slippery elm
Smooth alder
Southern red oak
Spice bush
Striped maple
Sugar maple
Swamp white oak
Sweet cherry
Sycamore
Table mountain pine
Tulip poplar
Virginia pine
White ash
White oak
White pine
Willow oak
Yellow birch

SHRUBS

Early low blueberry
Mapleleaf viburnum
Nannyberry
Service berry
Southern arrowwood
Staghorn Sumac
Spicebush
Witchhazel