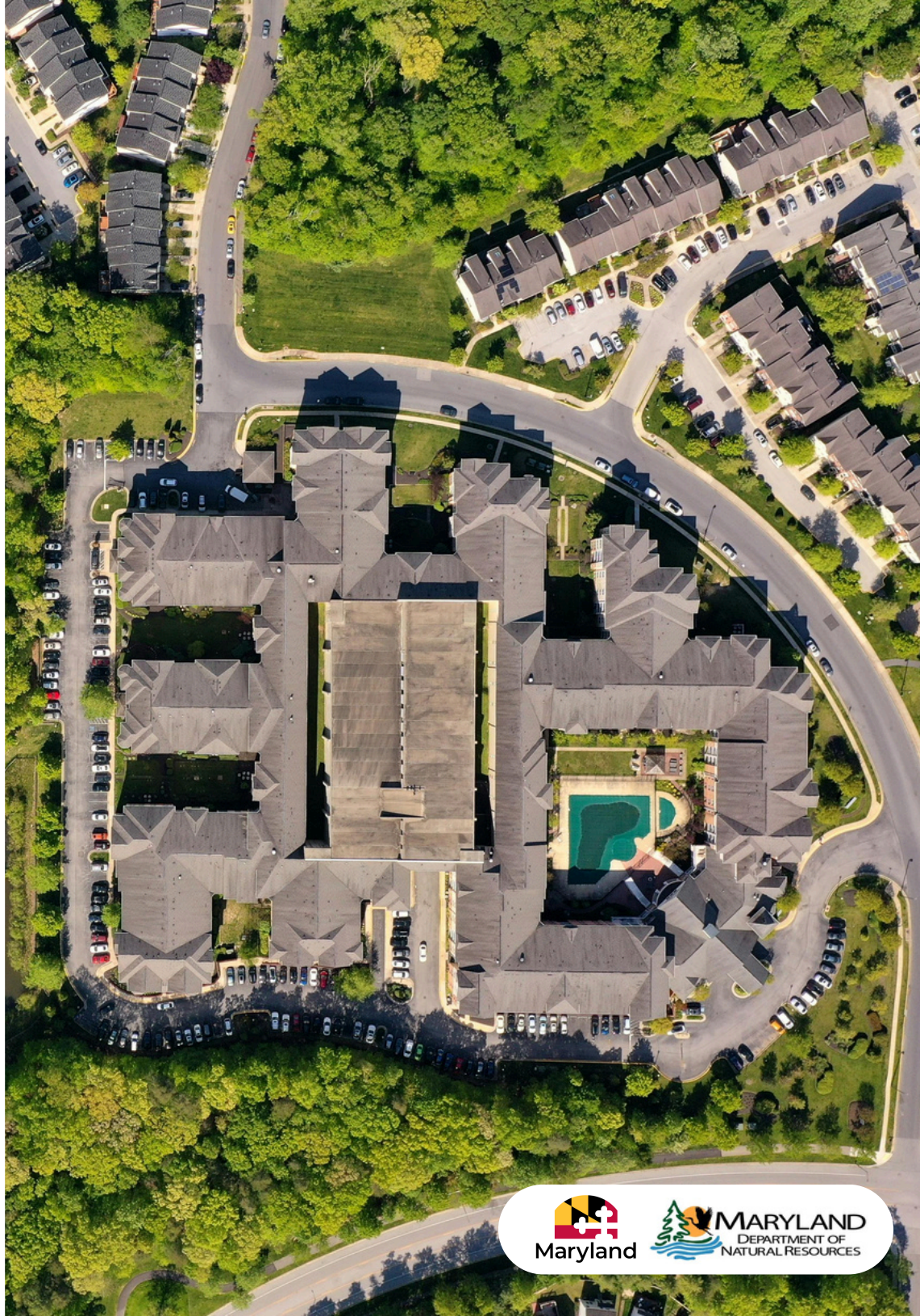
4th Edition

# Forest Conservation Technical Manual

State of Maryland
Department of Natural Resources
Maryland Forest Service

December 2024



# Foreword

By the time the Forest Conservation Act (FCA) was first adopted in 1991, Maryland was no stranger to taking bold, pioneering steps to protect and enhance the state's forest resources. The State of Maryland is proud to boast one of the oldest statewide forestry agencies in the country and statutes like the Roadside Tree, Licensed Tree Expert, and Forest Conservancy District Board laws were some of the most forward-thinking pieces of environmental legislation of their eras.

Managing trees and forests - especially those on the frontlines of urban development - isn't always easy, but the reason for our endeavor is clear: what we are doing is working. Despite seeing a 7% growth in population every decade over the last 30 years, Maryland's tree canopy has held steady near 40%. This translates to cooler communities and healthier watersheds.

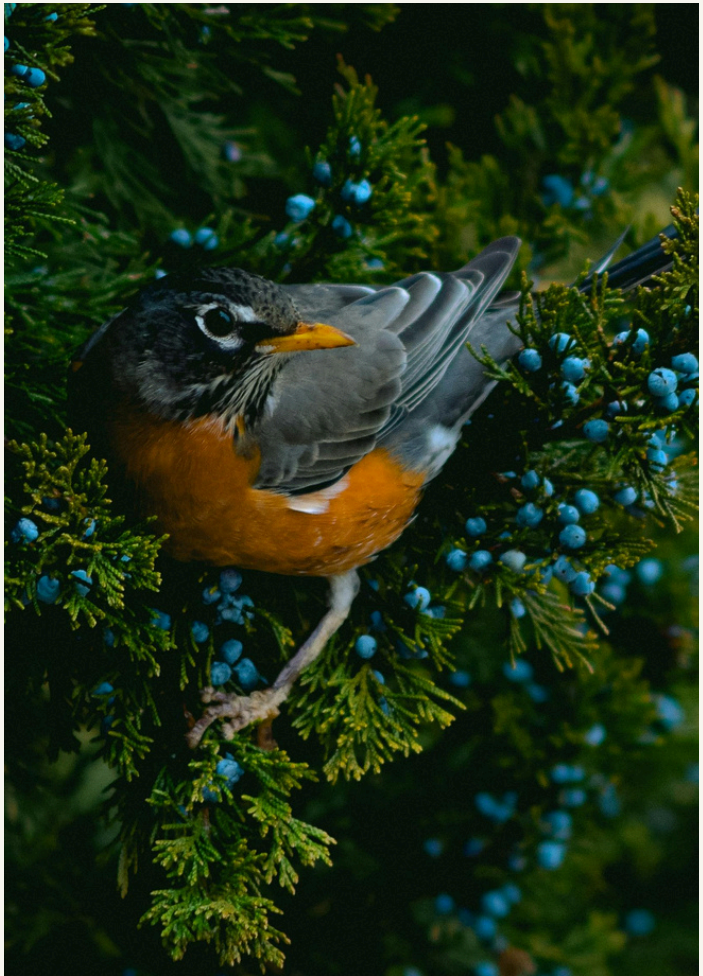
There is ample evidence of the FCA's efficacy when it comes to mitigating the effects of forest disturbance and the associated loss of services that trees, as the keystone of our ecosystem, provide all Marylanders alike. And yet, we know there is still so much work to be done. In recognition of the long-standing and emerging challenges that development poses to the state's trees and forests, in 2022 the Maryland General Assembly passed the most comprehensive update of the law to date.

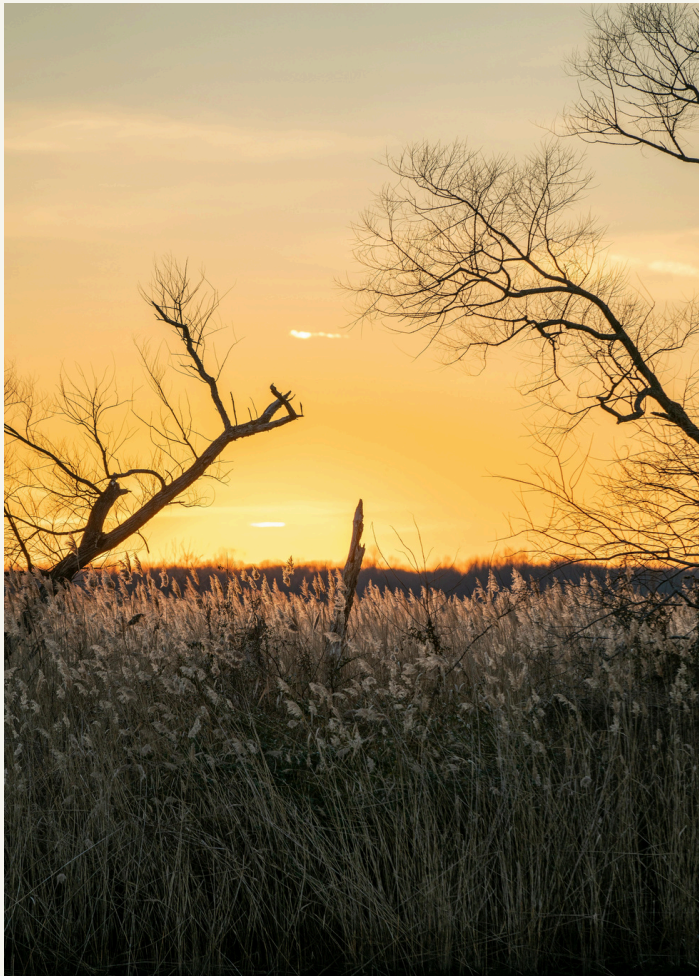
For the first time, the benchmark for Maryland's forests will no longer be "no net loss." We now have our sights set on a net gain. Accomplishing this will be no mean feat, and will require close cooperation between state and local government while we implement new regulations related to "priority urban forests for retention" and balance forest conversation goals with the burgeoning market for solar photovoltaic facilities and transit-oriented development projects.

The FCA has been a difference-maker, helping to keep priority forest areas and prompting more trees close to where people live. With this updated and more accessible technical manual, we are eager to implement the new changes to the law in partnership with all those who are translating the rules into more trees for our citizens. May the State of Maryland be evergreen and ever forward!

Anne Hairston-Strang

**Dr. Anne Hariston-Strang**
State Forester/Director
Maryland Forest Service





# Acknowledgements

In 2022, the Maryland General Assembly passed the most ambitious updates to the Forest Conservation Act (FCA) since its establishment in 1991. Senate Bill 526 tasked the DNR-Forest Service with updating the Forest Conservation Act Technical Manual to reflect these changes by the end of 2024. To complete this task a working group was convened to answer questions of policy and define standards that will guide the FCA program into the future. Furthermore, Maryland Environmental Services was contracted to update the case study and manual content.

This fourth edition would not have been possible without the thoughtful input of many individuals who volunteered their time and expertise to make this document a useful tool for forest conservation practitioners. We would like to offer sincere gratitude to the workgroup's members: Amy Gilder-Busatti, Ben Alexandro, Kim Finch, Katie Lautar, Marisa Olszewski, Amalia Pleake-Tamm, Matthew Rescott, Byan Seipp, Nancy Sonti, and Matt Stegman. We would also like to thank Lauren Wurth and Brandon Parsons from Straughan Environmental. Inc. and contributing staff from Maryland Environmental Services: Ben Buppert, Gwendolyn Gibson, Michael Manen, and Martha Stauss, for their work in putting this manual together.

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 Justin Arseneault, Justin Bowers, Zaire Canino, Daniel Coy, Grant Foehrkolb, Dr. Anne Hairston-Strang, and Sarah Hilderbrand.

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## Chapter 1

# Introduction


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| **1.0** | Protecting Forests and Sensitive Areas Through Site Planning |
| **1.1** | What Are the Basic Planning Requirements? |
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| **1.3** | Site Planning and Design Considerations |


Chapter 1

# Introduction

## 1.0 Protecting 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 last 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.

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. It is policy of the State to not only encourage the retention and sustainable management of forest lands by increasing the acreage of forest land, but also the acreage of land covered by tree canopy, for land located inside and outside of urban areas.

The Maryland Forest Conservation Act (FCA) was passed by the General Assembly in 1991 and subsequently amended to conserve the State's forest resources during development activities. The FCA 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 FCA 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 FCA 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, critical habitats, and water resource areas. Priority urban forests are included in these areas as of 2024.

Identification and mapping of these areas occurs 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, priority 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 approval authorities.

| Issue | | Trees and Forests can: |
|---|---|---|
| **Carbon Dioxide** | • Comprises up to 50% by volume of greenhouse gasses<br>• Produced primarily through burning of fossil fuels | • Absorb up to 48 lbs/tree or up to 10 tons/acre of trees during photosynthesis |
| **Microclimate** | • Concrete and asphalt increase temperatures in urban areas by as much as 16° F by absorbing thermal energy<br>• Exposed building walls with northerly orientations lose more heat during colder months | • Decrease energy consumption by reducing exposure to harsh weather 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<br>• Absorb gaseous pollutants through pores on leaves |
| **Water Pollution** | • Nutrients in water and sediment from agricultural and developed areas contribute to pollution of stream and rivers | • Absorb as much as net 6 lbs/year of nitrogen |
| **Soil Erosion** | • Water and wind erode unvegetated soils removing the most productive layer, depositing sediment in waterways<br>• 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<br>• Remove excess water from the soil, keeping it cohesive yet not waterlogged |
| **Stormwater** | • 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 heath of streams<br>• Streams with open canopies have fluctuating water temperatures making waterways uninhabitable for many aquatic organisms | • Filter nutrients, sediments, and pollutants<br>• Prevent heating of waterways in summer and rapid cooling in winter<br>• 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 buildings, pulpwood for paper, fuelwood and other products |
| **Recreation** | • Increasing number 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 property owner |

**1:1** **Benefits of Conserving Forests**
Source: Maryland Forest Service

MARYLAND DEPARTMENT OF NATURAL RESOURCES

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 FCA requires that prior to the approval of any public or private subdivision, project plan, grading permit, or sediment and erosion control permit on an area of land 40,000 square feet or greater, applicants shall submit a Forest Stand Delineation and a Forest Conservation Plan.

These plans shall be approved by the local authority, under a locally adopted forest conservation program or the Department of Natural Resources (DNR) 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 FCA 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 (FSD) 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 Resources Article §5-1604).

A Forest Conservation Plan (FCP) 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; long term protection measures; and other measures which may be required (Natural Resources Article §5-1605).

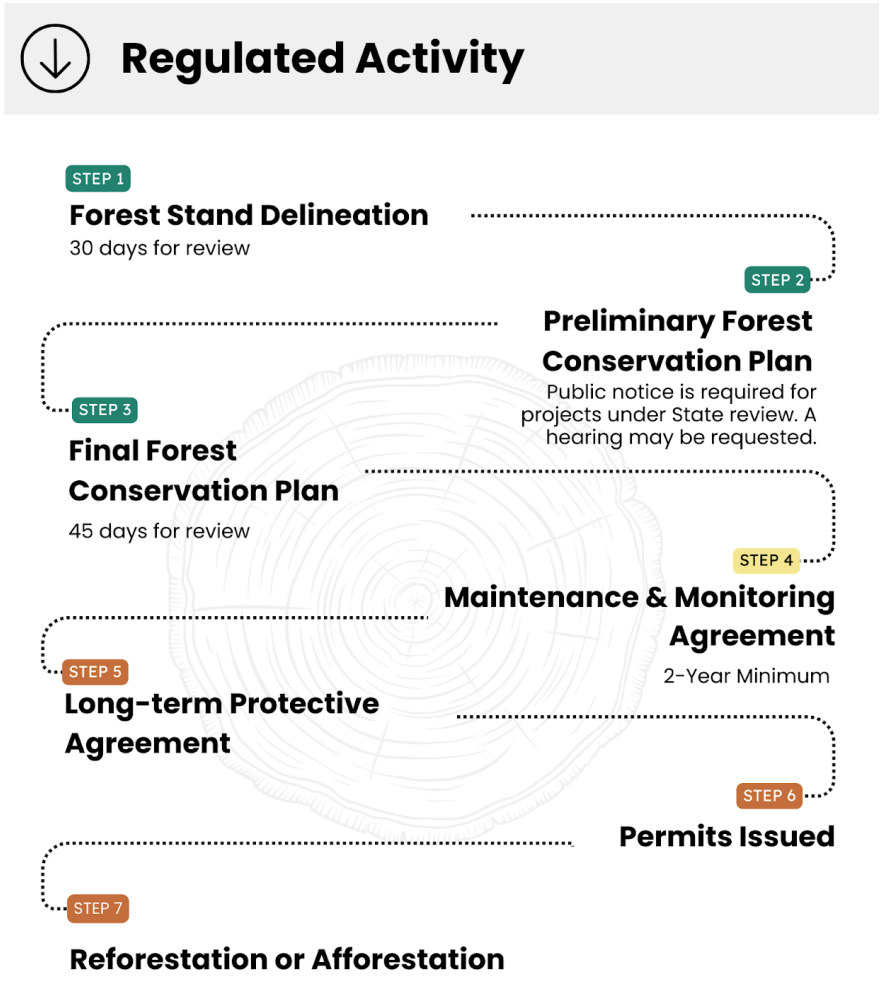
This Forest Conservation Technical Manual outlines submittal requirements for FSDs and includes required information for the approval of FCPs such as specific forest conservation criteria and protection techniques. (Natural Resources Article §5-1603).

# 1.2. Using the Manual

To assist local authorities in development of local forest conservation programs, the Maryland DNR has adopted regulations which set the requirements and standards of performance for submitting FSDs and FCPs. In addition, the Department exercises review authority of all FSDs and FCPs for local projects where no local program is in effect and for State-funded projects under the State Forest Conservation Program (Natural Resources Article §5-1605).

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




**1:2** **Forest Conservation Procedures**
Source: Maryland Forest Service

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, Fourth Edition, 2024. It replaces the State Forest Conservation Manual, Third Edition, 1997, 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 FSD and the FCP.

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 public or private subdivision plan, or application for a grading or SEC permit by any person, including a unit of State or local government on areas 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 sitework associated with the proposed construction activity.

**Chapter 1: Introduction** covers the basic requirements of the FCA and site planning considerations.

**Chapter 2. Forest Stand Delineations** covers the first submittal requirement. FSDs describe the existing forest and environmental features as defined in the FCA and Regulations. There are three types of FSDs 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, critical habitats on and closely adjacent to a development site. If forest is cleared, additional information will be required.

**Chapter 3: Forest Conservation Plans** discusses the second submittal requirement, FCPs, and step-by-step procedures for their preparation. These plans may show the proposed Forest Retention Areas, how much forest is retained or replanted, any required afforestation areas, the plans for planting, and the forest protection measures during and after construction. The specific elements are dependent on the mitigation requirements of the specific project and its area.

**Chapter 4: Linear Projects and Transit-oriented 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 Resources Article §5-1601 and COMAR 08.19.01.

**Appendix C** contains links to the figures and worksheets referenced throughout the manual. 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.

# 1.3. Site Planning and Design Considerations

To illustrate the requirements and procedures of preparing FSDs and FCPs, a sample development site plan has been prepared. The sample site is 157 acres in size and contains approximately 46 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 the wishes of the developer. Subdivision and development also requires coordination of the FCA 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 when the current state of the land and the varying priorities for it are outlined in detail. FSDs aid 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 and/or afforesting priority areas 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 qualified professional 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 areas and FSD information. A FCP 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, enhancing wildlife habitats, and providing recreational opportunities.

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 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. 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 (**Figure A:1**), 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** can afford more lots than an unclustered design and retain more forest land.
- 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 FSD. 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 three feet of horizontal distance) and this specification often results in greater areas of site disturbance than is necessary or desirable (**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. All clearing within priority forest retention areas will require a FCA variance as well as written and approved justification.
- 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, as well as 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 rights-of-way or easement areas may not be credited as a retention, afforestation, or reforestation area.
- Reduce right-of-way width or use trenching when possible. Disturbance within the right-of-way should be the minimum necessary to install and maintain the utility.
- Investigate utilizing underground utilities, which can reduce weather-related power outages resulting in high maintenance costs.

Sewage reserve areas (SRAs) 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 SRAs, 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.
- Planned SRAs that are in existing forest will need to be reforested elsewhere as part of the FCP.
- 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, nontidal 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.
- Where feasible 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.

## Sediment and Erosion Control

Designing and constructing sediment and erosion control (SEC) 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 SEC 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 SEC devices. Adapt silt fencing and other measures used

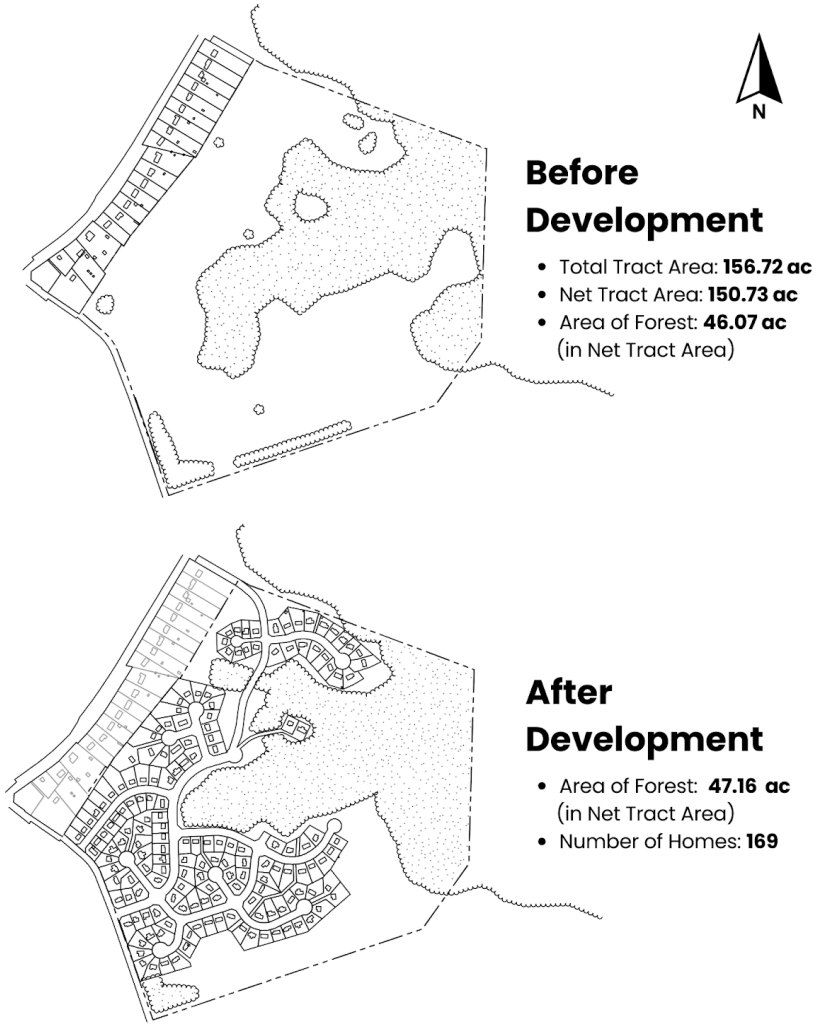
for sediment and erosion control for forest protection when outside of retention or planting areas. Locate perimeter berms outside of Critical Root Zones. Do not direct untreated runoff into forest retention, afforestation, or reforestation areas.

- 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 FSD 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 FSD.
- Reforest disturbed wetlands or their buffers. Verify that local, State, and federal regulatory requirements for replanting will be satisfied first.
- Stream buffers within the project area must be afforested and reforested. Focusing on these areas for preservation will reduce costs and lead to better wetland compliance.




**1:3** **Case Study: Before & After Development**
Source: Maryland Environmental Service

Chapter 2

# Forest Stand Delineations

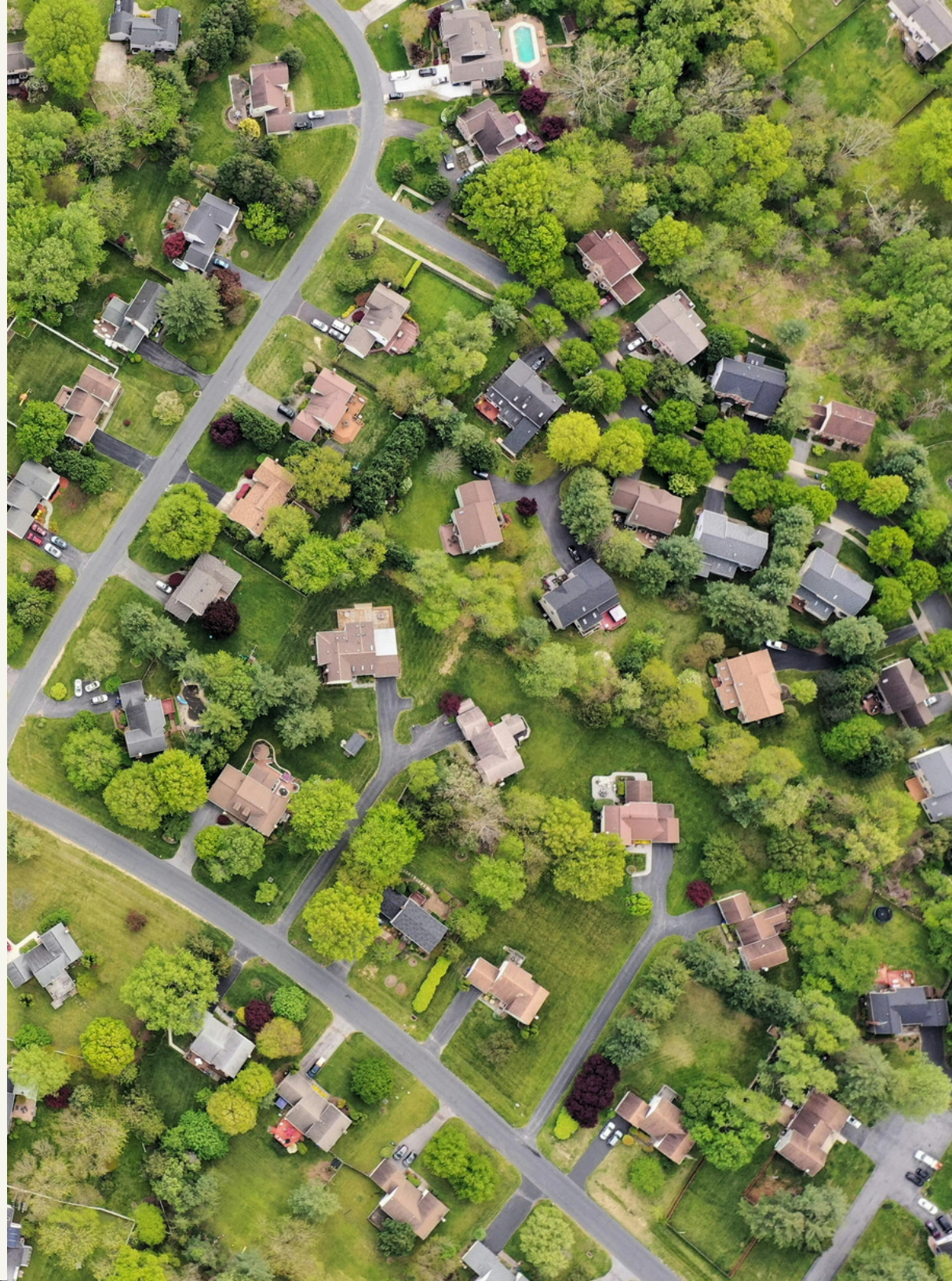

**2.0 Introduction**

- **2.0.1.** Priorities for Retention and Protection
- **2.0.2.** Who May Prepare a FSD?

**2.1 What Type of FSD is Required?**

**2.2 Required Elements for Different Types of FSDs**

- **2.2.1.** Simplified FSD Requirements
- **2.2.2.** Intermediate FSD Requirements
- **2.2.3.** Full FSD Requirements

Chapter 2

# Forest Stand Delineations

## 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 FSDs are required elements of approved Forest Conservation Plans (FCP). 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 FCP encompassing the entire property.

While reforestation or afforestation may occur on a development site after the approval of a FSD and before FCP 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 FSD required (Section 2.1) and the requirements and suggested procedures for preparing FSDs (Section 2.2). The State program requirements are listed for several types of FSDs. 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. Priorities for Retention and Protection

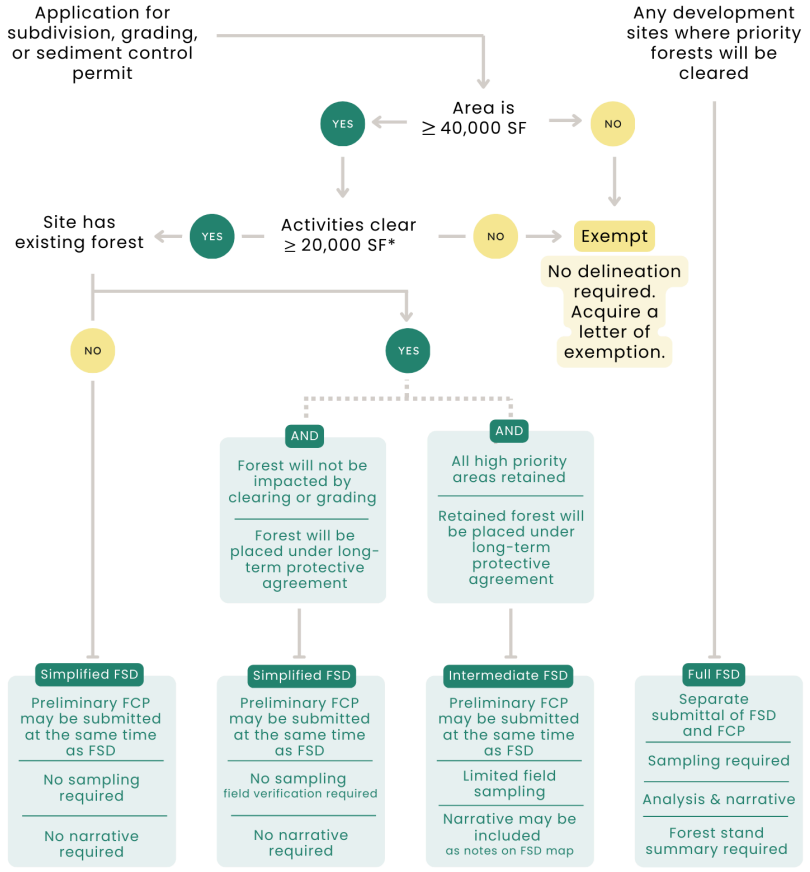
Sensitive areas and plants listed in Natural Resources §5-1607(c) shall be considered priority for retention and protection, and they shall be left in an undisturbed condition unless the applicant has demonstrated, to the satisfaction of the State or local authority, that reasonable efforts have been made to protect them and the plan cannot reasonably be altered. The following is a noncomprehensive list of priority areas.

- Forests suitable for interior dwelling species
- Trees, shrubs, and plants located in sensitive areas, including 100-year floodplains, intermittent and perennial streams and their buffers, coastal bays and their buffers, steep slopes, and critical habitats.
- Rare, threatened, or endangered species habitat, trees that are historically significant, and large trees that are either 30" DBH or have a DBH greater than or equal to 75% of the Maryland state champion for that species.
- Priority urban forests
- Tier II high quality watersheds.
- Forests located in water resource protection zones, reservoir watershed, or a wellhead protection area.

## 2.0.2. Who May Prepare a FSD?

A FSD 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 Maryland 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. A complete list of Qualified Professionals, applications, and criteria are available upon request. Qualified Professionals that wish to be listed can also be found on the Maryland Forest Service's website.




* State Program requirement; other restrictions may apply in local programs

**2:1** **Forest Stand Delineation Decision Matrix**
Source: Maryland Forest Service

# 2.1 What Type of FSD is Required?

There are three different types of FSDs and the type to be used depends on the complexity of the project. The conditions and requirements for these follow and are summarized in **Figure 2:1.**

## Simplified FSDs

Simplified FSDs 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 FSD may be used, and there are no priority areas onsite, and there is no afforestation required, then a FCP does not have to be prepared.

| | | | |
|---|---|---|---|
| 1 | **Site Vicinity Map** | | |
| ○ | Location of the project site<br>and surrounding area within 1 square mile | ○ | Adjacent land uses |
| ○ | Major roads | ○ | Forested areas |
| ○ | Political boundaries | ○ | Minimum scale of 1" = 2,000' (1:24,000) |
| ○ | North arrow | | |
| 2 | **Environmental Features Map** | | |
| ○ | Property boundaries<br>tax maps, plats, or surveyed boundaries | ○ | 100-year nontidal floodplain<br>watersheds of 400 acres or larger or Class III streams |
| ○ | North arrow | ○ | Stream buffers (50-foot) |
| ○ | Title, date, revisions, scale, and legend | ○ | Location and size of adjacent forested areas |
| ○ | Certification from Qualified Professional<br>or stamp of MD registered Landscape Architect or Engineer | ○ | Intermittent and perennial streams<br>USGS 7 ½ minute quads of SCS Soil Surveys |
| ○ | Topographic contours and interval<br>USGS 7 ½ minute quad or spot elevations | ○ | Forested and unforested areas<br>including tree lines extending off-site |
| ○ | Steep slopes greater than 25%<br>on areas greater than or equal to 10,000 square feet | ○ | Forest type<br>Dominant species |
| ○ | Proposed limits of disturbance | ○ | Adjacent land uses |
| ○ | Proposed areas for long-term protection | ○ | Past & present management of un/forested areas |
| ○ | Soil classifications<br>SCS Soil Surveys indicating soils with structural limitations, hydric properties, or K-value greater than 0.35 on slopes grater than or equal to 15% | ○ | Critical Habitat Areas<br>MD-DNR Natural Heritage Program |
| 4 | **Application** | | |
| ○ | Complete information, including signature | | |

**2:2** **Simplified FSD Checklist**
Source: Maryland Forest Service

### Intermediate FSDs

Intermediate FSDs may be used when development will occur in forested areas if no priority forests or priority retention areas will be disturbed during or after development. (see Section 3.1) Approval of the Intermediate FSD shall be contingent on meeting the above condition. If the applicant is unable to meet these conditions for any reason, then a Full FSD shall be submitted.

### Full FSDs

Full FSDs shall be required for all submissions when neither the conditions of a Simplified nor an Intermediate FSD will be met.

## 2.2 Required Elements for the Different Types of FSDs

FSDs 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 a 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.

## 2.2.1. Simplified FSD Requirements

Requirements for Simplified FSDs are summarized in the checklist in **Figure 2:2**. Sample delineation and sample plan maps using this option are shown in **Figure 2:3** and **Figure 2:4**. Simplified FSDs shall contain the following minimum elements:

### Application

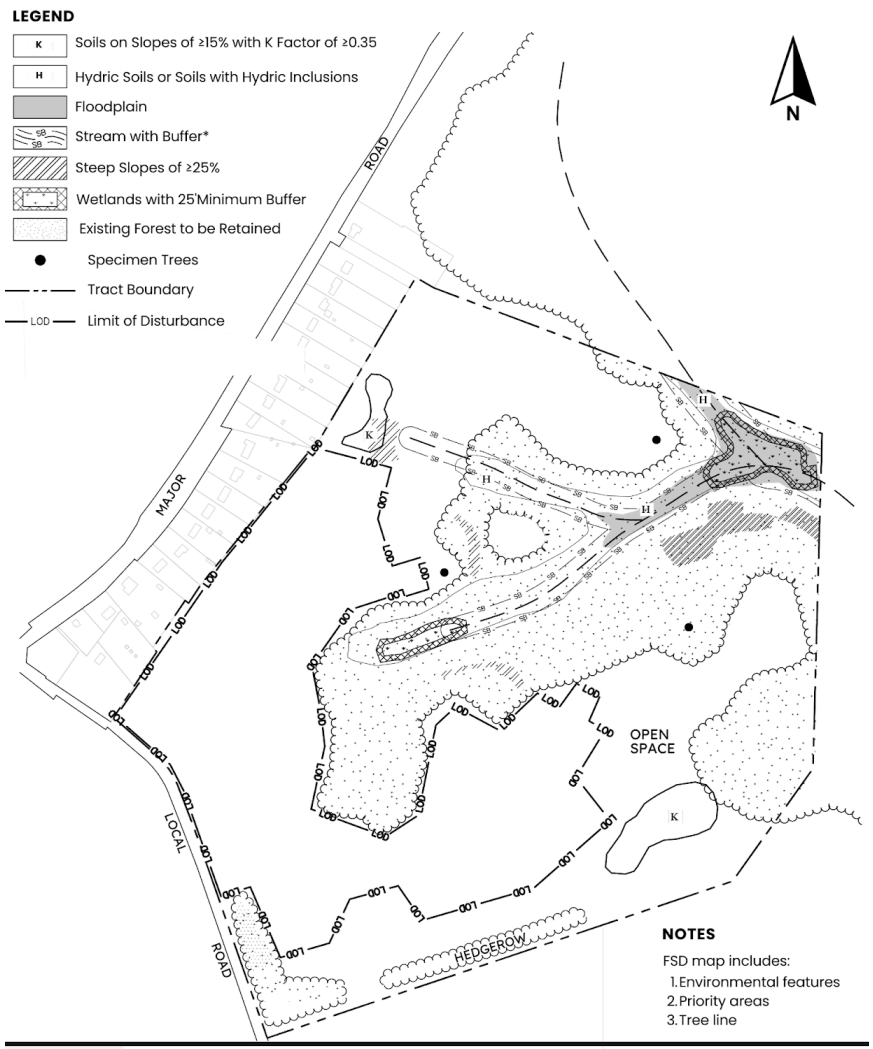
Application forms are available online and must be signed by the applicant prior to submission for the application to be reviewed. In compliance with State law the applicant shall be an authorized signatory as specified in COMAR 08.19.04.021 for the State program..

### Site Vicinity Map

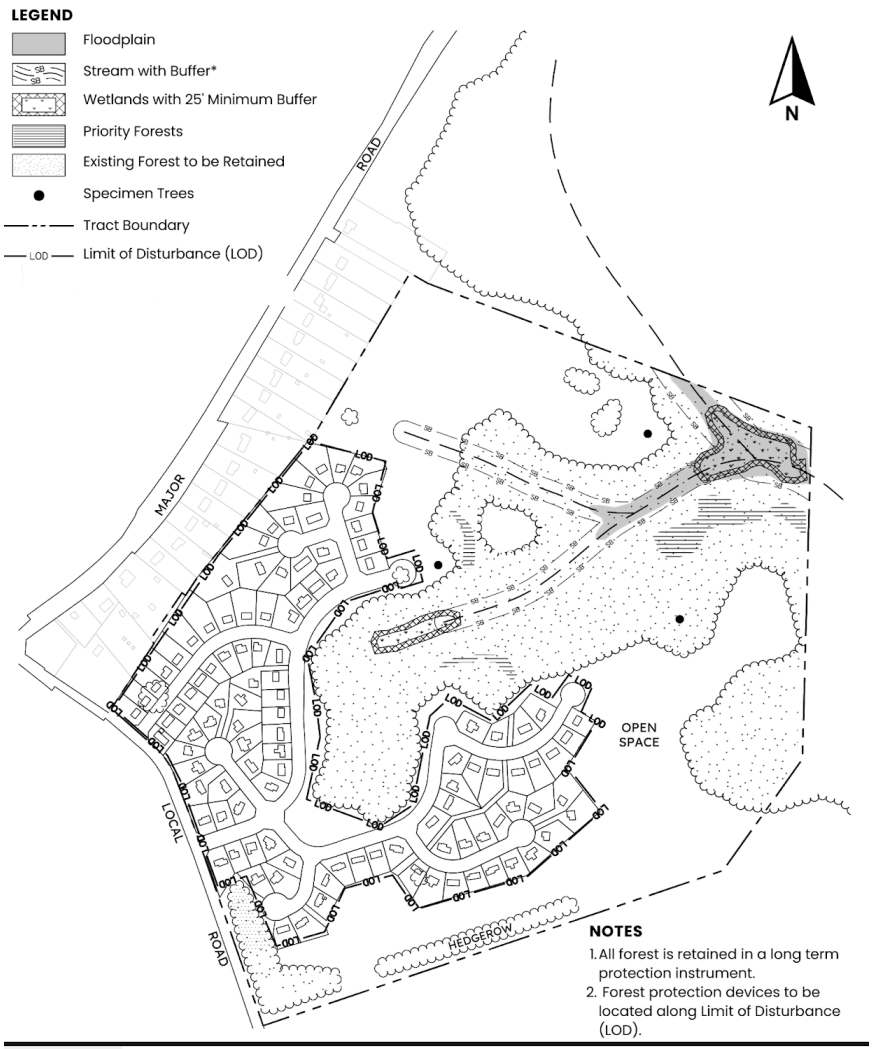
This map (**Figure A:5**) shows the location of the site within approximately one square mile or more, including forested and sensitive areas adjacent to the site. A minimum scale of 1" = 2,000' (1:24,000) is recommended. This map may be an inset on the Environmental Features or FSD Map.

### Environmental Features Map/FSD 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 below and **Figure A:6** and **Figure A:7**).




**2:3** **Simplified FSD Map**
Source: Maryland Environmental Service




**2:4** **Simplified FSD Plan**
Source: Maryland Environmental Service

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 both Intermediate and Full FSDs. Environmental features include:

**Sensitive Areas**

- 100-year nontidal floodplains in watersheds 400 acres or larger, Tier II watersheds, or for Class III streams.
- Intermittent and perennial streams and their buffers. An intermittent stream buffer is at least 50 feet wide and a perennial stream buffer is at least 100 feet wide, as measured from the top of the normal bankstream channel.
- Steep slopes of 25% or more.
- Critical Habitat Areas designated by the State or local authorities.
- Nontidal or tidal wetlands and their buffers.
- Priority urban forests
- Forests located in water resource protection zones, reservoir watershed, or a wellhead protection area.

**Topography**

Topographic contours and intervals. These may be based on USGS 7 ½ minute quadrangles, aerial data, or ground surveys.

**Soils**

Hydric soils or 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.

## 2.2.2 Intermediate FSD Requirements

Requirements for Intermediate FSDs are summarized in the checklist in **Figure 2:5**. A typical proposal using this option is illustrated in **Figure 2:6** and **Figure 2:7**. Intermediate FSDs shall contain the following minimum elements:

### Application

An application signed by the applicant. The applicant shall be an authorized signatory as specified in COMAR 08.19.04.02 for the State program. Application forms are available online.

### Site Vicinity Map

This map (**Figure A:5**) shows the location of the site within approximately one square mile or more, including forested and sensitive areas adjacent to the site. A minimum scale of 1" =

2,000' (1:24,000) is recommended. This map may be an inset on the Environmental Features or FSD Map.

## Environmental Features Map/FSD Map

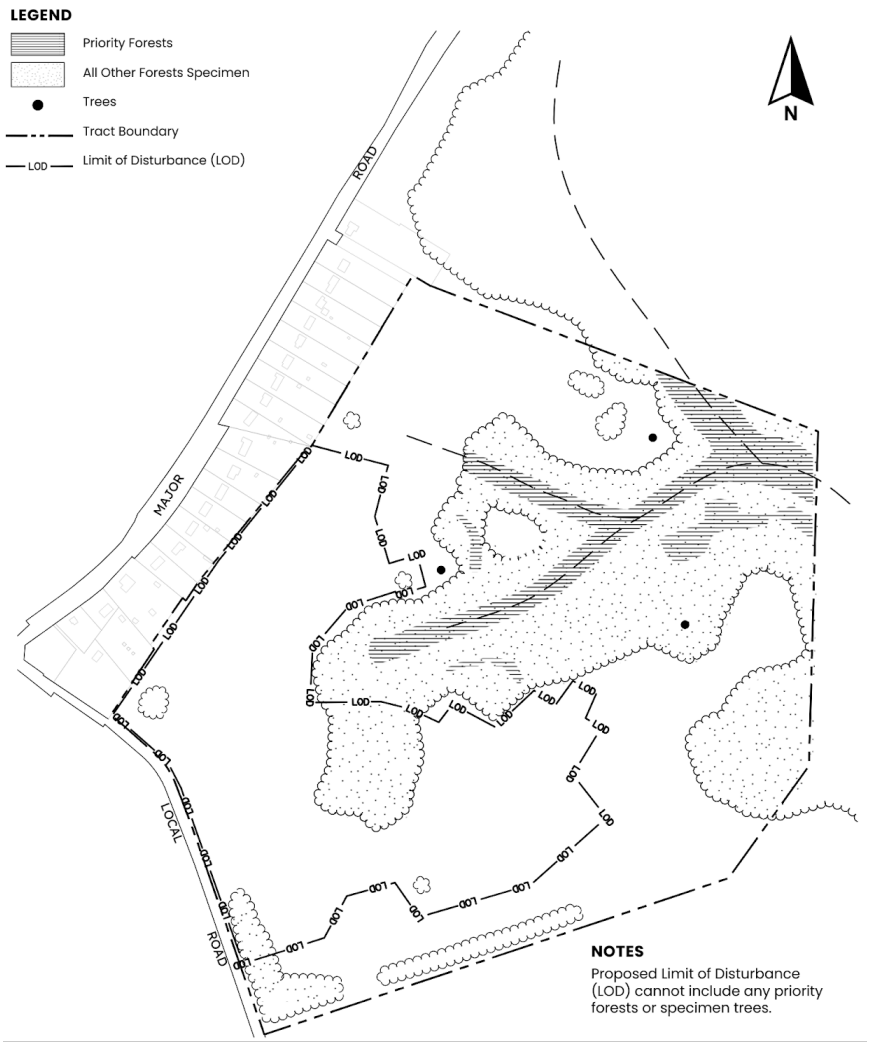
This shall be prepared at approximately the same scale as the proposed development plan and shall sufficiently indicate all of the required features where applicable. (Examples of these maps are in Section 2.2 below and **Figure A:6** and **Figure A:7**) Environmental features may be identified and located 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 FSDs. Environmental features include:

### Sensitive Areas

- 100-year nontidal floodplains in watersheds 400 acres or larger, Tier II watersheds, or for Class III streams.
- Intermittent and perennial streams and their buffers. An intermittent stream buffer is at least 50 feet wide and a perennial stream buffer is at least 100 feet wide, as measured from the top of the normal bankstream channel.
- Steep slopes of 25% or more.
- Critical Habitat Areas designated by the State or local authorities.
- Nontidal or tidal wetlands and their buffers.
- Priority urban forests
- Forests located in water resource protection zones, reservoir watershed, or a wellhead protection area.

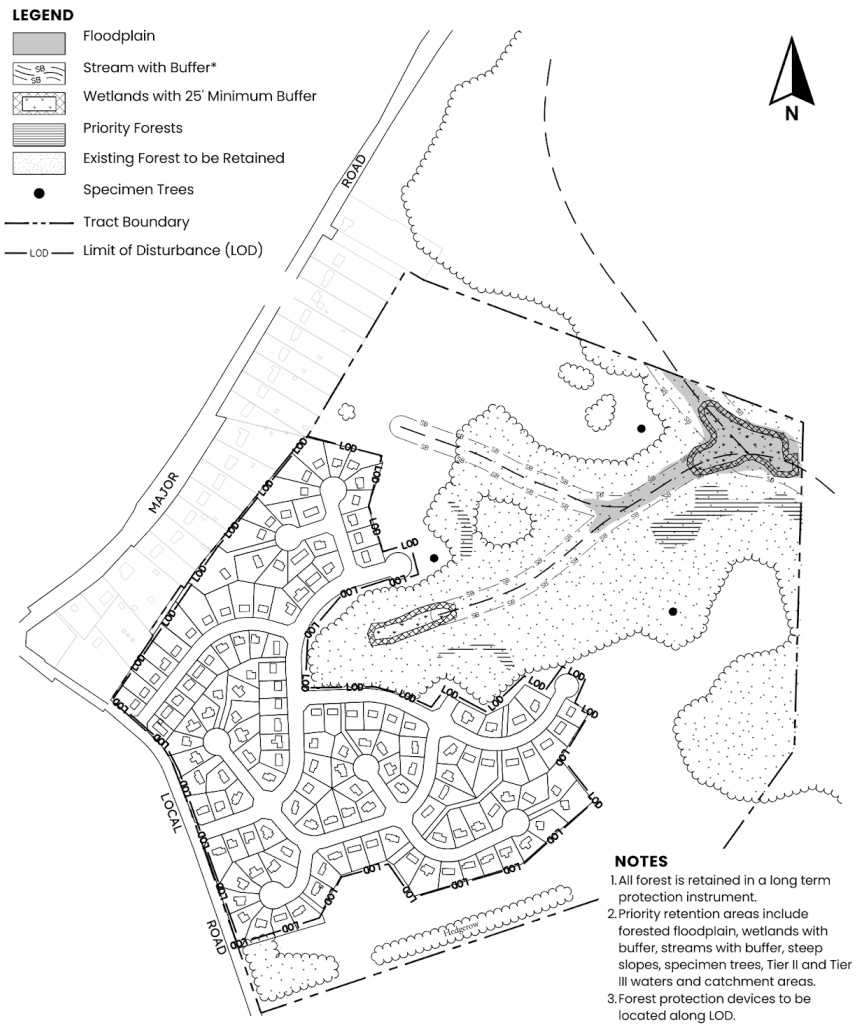
| | | | |
|---|---|---|---|
| **1** | **Site Vicinity Map** | | |
| ○ | Location of the project site<br>and surrounding area within 1 square mile | ○ | Adjacent land uses |
| ○ | Major roads | ○ | Forested areas |
| ○ | Political boundaries | ○ | Minimum scale of 1" = 2,000' (1:24,000) |
| ○ | North arrow | | |
| **2** | **Environmental Features Map** | | |
| ○ | Property boundaries<br>tax maps, plats, or surveyed boundaries | ○ | 100-year nontidal floodplain<br>watersheds of 400 acres or larger or Class III streams |
| ○ | North arrow | ○ | Stream buffers (50-foot) |
| ○ | Title, date, revisions, scale, and legend | ○ | Location and size of adjacent forested areas |
| ○ | Certification from Qualified Professional<br>or stamp of MD registered Landscape Architect or Engineer | ○ | Intermittent and perennial streams<br>USGS 7 ½ minute quads of SCS Soil Surveys |
| ○ | Topographic contours and interval<br>USGS 7 ½ minute quad or spot elevations | ○ | Forested and unforested areas<br>including tree lines extending off-site |
| ○ | Steep slopes greater than 25%<br>on areas greater than or equal to 10,000 square feet | ○ | Nontidal or tidal wetlands and buffers<br>National Wetlands Inventory or Maryland Dept. of Environment |
| ○ | Proposed limits of disturbance | ○ | Adjacent land uses |
| ○ | Proposed areas for long-term protection | ○ | Location and size of forest stands |
| ○ | Soil classifications<br>SCS Soil Surveys indicating soils with structural limitations, hydric properties, or K-value greater than 0.35 on slopes grater than or equal to 15% | ○ | Priority Retention Areas<br>Including specimen trees. See COMAR for full list. |
| | | | |
| ○ | Preliminary worksheet calculations showing 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 | | |

**2:5** **Intermediate FSD Checklist**
Source: Maryland Forest Service




**2:6** **Intermediate FSD Map**

Source: Maryland Environmental Service




**2:7** **Intermediate FSD Plan**

Source: Maryland Environmental Service

**Topography**

Topographic contours and intervals. These may be based on USGS 7 ½ minute 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.

**Tree Lines**

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.

**Proposed Limit of Disturbance**

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
- 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.

### Calculations

The calculations necessary to demonstrate that the development proposal meets the condition of forest retention, protection, reforestation, and afforestation. This calculation may be shown on the FSD map, and does not require a separate submittal element. Information on calculating the retention, reforestation, and afforestation amounts may be found in Section 3.1.

### Confirmation by Walk-through Survey

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 as outlined in Chapter 2.0.1. of this manual and Natural Resources §5-1607. A description of any such areas may be included in notes on the Intermediate FSD Map.

## 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 maps for the sample site in **Figure 2:11** and **Figure A:6** through **Figure A:8**.

## Step 1: Prepare Preliminary Maps for Field Verification

It is helpful to prepare a preliminary FSD 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 FCP, as well as fulfilling the requirements of a FSD. 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 FSD 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 FSD Map may be drawn in, especially if they will require field verification
- any other important information the preparer feels may be helpful to evaluate site or required by COMAR

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 DNR, Natural Heritage Program.

### B. Add Soils

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

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

Another useful source of information is the Natural Soil Groups Technical Report (Maryland Department of Planning, 1973). This

may help to correlate USDA soils map units with soil characteristics.

### 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 form (C) above and the various abiotic factors noted in (A) and (B). Sketch the stand boundaries on the preliminary forest stand map.

## Step 2: Assess Forest Stands and Verify 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 non-plot methods.

| | | | |
|---|---|---|---|
| **1 Site Vicinity Map** | | | |
| ○ | Location of the project site<br>and surrounding area within 1 square mile | ○ | Adjacent land uses |
| ○ | Major roads | ○ | Forested areas |
| ○ | Political boundaries | ○ | Minimum scale of 1" = 2,000' (1:24,000) |
| ○ | North arrow | | |
| **2 Environmental Features Map** | | | |
| ○ | Property boundaries<br>tax maps, plats, or surveyed boundaries | ○ | 100-year nontidal floodplain<br>watersheds of 400 acres or larger or Class III streams |
| ○ | North arrow | ○ | Stream buffers (50-foot) |
| ○ | Title, date, revisions, scale, and legend | ○ | Critical Habitat Areas |
| ○ | Certification from Qualified Professional<br>or stamp of MD registered Landscape Architect or Engineer | ○ | Intermittent and perennial streams<br>USGS 7 ½ minute quads of SCS Soil Surveys |
| ○ | Topographic contours and interval<br>USGS 7 ½ minute quad or spot elevations | ○ | Forested and unforested areas<br>including tree lines extending off-site |
| ○ | Steep slopes greater than 25%<br>on areas greater than or equal to 10,000 square feet | ○ | Nontidal or tidal wetlands and buffers<br>National Wetlands Inventory or Maryland Dept. of Environment |
| ○ | Priority afforestation areas | ○ | Field sampling locations |
| ○ | Priority retention areas | ○ | Location, description, and size of forest stands |
| ○ | Soil classifications<br>SCS Soil Surveys indicating soils with structural limitations, hydric properties, or K-value greater than 0.35 on slopes grater than or equal to 15% | ○ | Location of trees/stands which have trees that are:<br>• rare, threatened or endangered species or plants (MD-DNR)<br>• part of an historic site or associated with an historic structure<br>• designated by MD-DNR or local authority as a champion tree for that species<br>• specimen trees of 30" dbh or greater (local jurisdictions may vary)<br>• trees with at least 75% of the dimater of the State champion tree of that species |
| **3 Forest Stand Analysis** | | | |
| ○ | Site description | ○ | Methodology |
| ○ | Summary of each stand describing:<br>• stand composition<br>• stand structure<br>• stand condition<br>• retention potential relating to proposed development<br>• specific management objectives<br>• stand function, eg. water quality benefits, specific habitat value, etc. | ○ | Recommendations for specific areas<br>such as specimen treess |
| ○ | Field sampling data sheets, if required:<br>• Property name<br>• Name of data collector<br>• Date of data collection<br>• Complete data for each sample plot | ○ | Forest stand summary sheets, including:<br>• Property name and location<br>• Name of summary preparer<br>• Date of preparation<br>• Summary sheets for each sample plot |
| **4 Application** | | | |
| ○ | Complete information, including signature and completed worksheet | | |

**2:8** **Full FSD Checklist**
Source: Maryland Forest Service

MARYLAND DEPARTMENT OF NATURAL RESOURCES

The example (**Figure A:8**) shows a plot sampling method using randomly located 0.1 acre plots. Because statistical precision requires a certain minimum number of plots per stand and forested area, the following sampling criteria should be used to estimate the number of sample plots required:

- one plot per four 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. An example of how plots can be located is in the FSD 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, trees greater than 30" DBH, or other specimen trees 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, as well as field verifying forests that are a priority for retention including priority urban forests.

Our example uses the Forest Sampling Data Worksheet (**Figure 2:9**) 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.

## 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 FCP 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 2:10**). 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.

**Forest Sample Plot Data Sheet**

| | | | | | |
|---|---|---|---|---|---|
| Property: | | Stand #: | | Sheet #: | / |
| Prepared by: | | Plot #: | | Plot Succesional Stage: | |
| Date: | | Plot Size: | | | |

| Basal Area: (sf/acre) | | # of Trees 2-5.9" dbh | | | # of Trees 6-9.9" dbh | | | # of Trees 10-17.9" dbh | | | # of Trees 18-29.9" dbh | | | # of Trees >30" dbh | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tree Species: | Crown Position: | DOM | COD | OTH | DOM | COD | OTH | DOM | COD | OTH | DOM | COD | OTH | DOM | COD | OTH | |
| 1. | | | | | | | | | | | | | | | | | |
| 2. | | | | | | | | | | | | | | | | | |
| 3. | | | | | | | | | | | | | | | | | |
| 4. | | | | | | | | | | | | | | | | | |
| 5. | | | | | | | | | | | | | | | | | |
| 6. | | | | | | | | | | | | | | | | | |
| 7. | | | | | | | | | | | | | | | | | |
| 8. | | | | | | | | | | | | | | | | | |
| Total # Trees per Size Class | | | | | | | | | | | | | | | | | |
| # Standing Dead Trees ≥6" dbh | | | | | | | | | | | | | | | | | |

**1/1,000 Acre Samples**

| List of Common Understory Species, 3'-20' | % Canopy Coverage | | | | | | % Invasive Cover | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | C | N | E | S | W | Total | C | N | E | S | W | Total |
| | | | | | | | | | | | | |
| List of Herbacious Species, 3'-20' | % Understory Cover, 3'-20' | | | | | | % Herb/Woody Cover, 0'-3' | | | | | |
| | C | N | E | S | W | Total | C | N | E | S | W | Total |
| | | | | | | | | | | | | |
| List of Invasive Species | Comments: | | | | | | | | | | | |
| | | | | | | | | | | | | |

**2:9** **Forest Sampling Data Worksheet**
Adapted from: Prince George's County Planning Department

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- **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: (1) Water Quality Protection; (2) Wildlife Habitat; and, (3) 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 (**Figure 2:10**).

- **Priority 1.** Stands which contain priority retention areas are ranked as Priority 1 Stands.
- **Priority 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.
- **Priority 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.

### 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 outlined in the following section.

**Stand Composition.** Are there species and individuals present which will not withstand development stresses? What management methods

**Forest Stand Summary**

| | | | |
|---|---|---|---|
| Property: | | Prepared by: | |
| Location: | | Date: | |
| | | Sheet #: | / |

| Stand Variable | Stand # | Stand # |
|---|---|---|
| 1. Dominant species / Codominant species | | |
| 2. Succesional Stage | | |
| 3. Basal area (sf per acre) | | |
| 4. Size class of dominant species | | |
| 5. Canopy closure (%) | | |
| 6. Tree species per acre (#) | | |
| 7. Common understory species | | |
| 8. Understory cover, 3'-20' (%) | | |
| 9. Woody plant species, 3'-20' (#) | | |
| 10. Common herbacious species, 0'-3' | | |
| 11. Herbacious & woody plant cover, 0'-3' (%) | | |
| 12. List of major invasive plant species & cover (%) | | |
| 13. Standing dead trees, ≥6" dbh | | |
| 14. Comments | | |

**2:10** **Forest Stand Summary Worksheet**
Source: Maryland Forest Service

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.

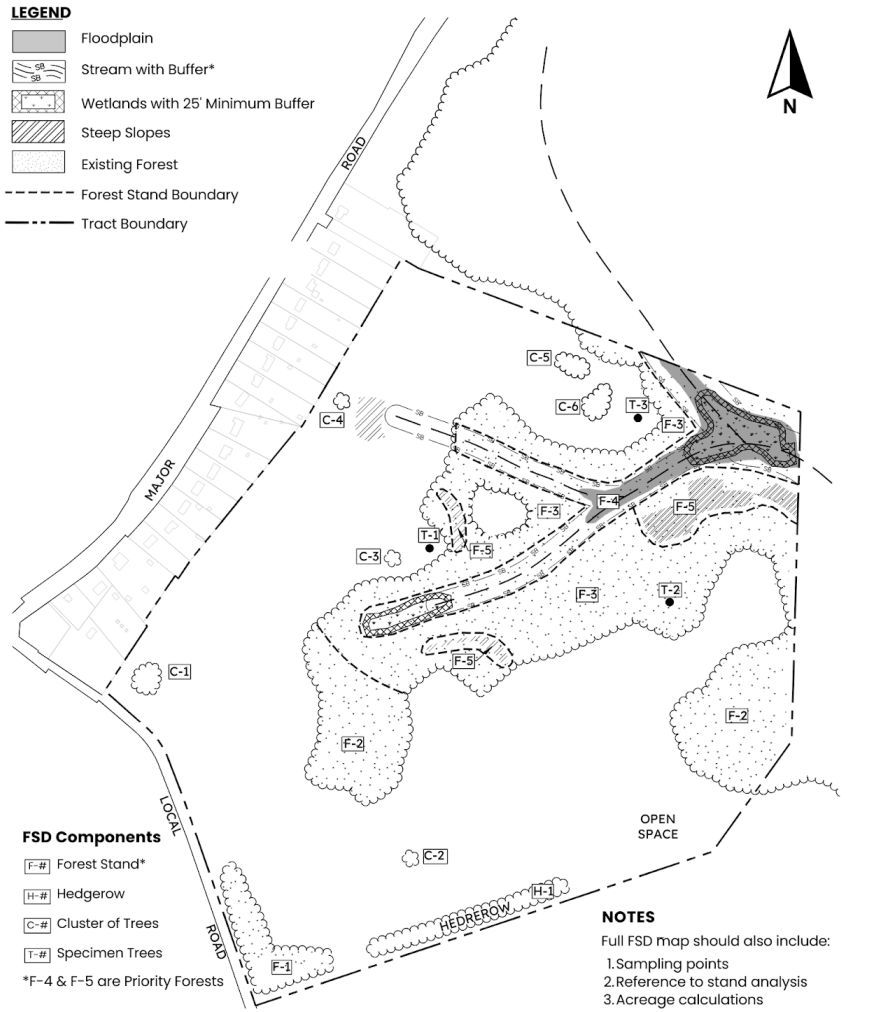
**Stand Function**

- 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?
- 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?
- 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 FSD map for submission (**Figure 2:11**). 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 forests and priority areas for reforestation or afforestation should also be noted (Section. 3.1).




**2:11** **Full FSD Map**

Source: Maryland Environmental Service

Chapter 3

# Forest Conservation Plans


**3.0. Introduction**

- **3.0.1.** Minimum Elements Required in All FCPs
- **3.0.2.** Who May Prepare a FCP?

**3.1. Determining Priority Forests and Priority Areas**

- **3.1.1.** FCP Requirements
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**3.2. Forest and Tree Protection**

- **3.2.1.** Planning and Design
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**3.3 Forest and Tree Planting**

- **3.3.1.** When and Where is Planting Necessary?
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**3.5. Approval, Enforcement, and Amedment of FCPs**

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Chapter 3

# Forest Conservation Plans

## 3.0 Introduction

The 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 re/planting 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 FCA and is divided into five principal topics:

**Section 3.1. Determining Priority Forests and Priority Areas** discusses how to determine where priority areas are located and how much forest to retain.

**Section 3.2. Retained Forest and Tree Protection** covers protection through planning and design, construction techniques, and long-term protection agreements.

**Section 3.3. Forest and Tree Planting** covers afforestation and reforestation plans, information on when and where planting is required, and how planting should occur.

**Section 3.4. Maintenance & Monitoring** discusses maintenance agreements and their implementation.

**Section 3.5. Approval, Enforcement, and Amendment** outlines FCP enforcement.

### 3.0.1. Minimum Elements Required in All FCPs

**Figure 3:1** summarizes requirements for phased submissions of preliminary and final FCPs. All FCPs 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 FCP?

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, COMAR 08.19.04.02.

Qualified Professionals are approved by the Maryland 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. A listing of Qualified Professionals are available on the Maryland Forest Service's website.

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

# 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 FSD 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. FCP 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 FSD or portions of stands. The following describes how to identify priority areas for forest retention:

| Submission of FCP Elements | FSD | | | FCP | | Record Plat | Amended FCP |
|---|---|---|---|---|---|---|---|
| | Simp | Inter | 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 | | | ✓ | ✓ | ✓ | | |
| **Maps:** | | | | | | | |
| Vicinty map | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| Environmental features map | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| Location/description of existing forest area | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Stamp/certification by preparer | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Priority retention areas | | ◆ | ✓ | ✓ | ✓ | | |
| Priority planting areas | | | ✓ | ✓ | ✓ | | ✓ |
| LOD/building restriction lines | ◆ | ◆ | | ✓ | ✓ | | |
| SRA, utility easements, stormwater mgmt. | | | | ✓ | ✓ | | |
| Stockpile areas | | | | ✓ | ✓ | | |
| Forest retention areas | | | | ✓ | ✓ | | |
| Forest protection devices/amended SEC 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 | ◆ | ◆ | | ✓ | ✓ | | |
| Off-site planting areas, if applicable | | | | | | | |
| Site/vicinity map | | | | ✓ | ✓ | | |
| Legal right to plant/maintain | | | | ✓ | ✓ | | |
| Planting plan, incl. specifications, site prep, planting schedule with species, size, condition, plant source | | | | ✓ | ✓ | | ✓ |
| Construction/planting sequences | | | | ✓ | ✓ | | ✓ |

**3:1** **Submission of FCP Elements**
Source: Maryland Forest Service

| Submission of FCP Elements, cont. | FSD | | | FCP | | Record Plat | Amended FCP |
|---|---|---|---|---|---|---|---|
| | Simp | Inter | Full | Prelim | Final | | |
| Management and Monitoring | | | | ✓ | ✓ | | |
| Protection | | | | ✓ | ✓ | | ✓ |
| Reinforcement planting | | | | ✓ | ✓ | | ✓ |
| Binding agreement | | | | | ✓ | | |
| Financial security | | | | | ✓ | | |
| Long-term protection | | | | ✓ | ◆ | ✓ | |
| Agreement between parties | | | | ✓ | ✓ | | |
| Decription 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 | | | | | | | ✓ |

✓ Required element for application to be accepted.

◆ This element is not required for application submission, but will be required for final approval.

**3:1** **Submission of FCP Elements (cont.)**
Source: Maryland Forest Service

## Step 1

Identify forest stands in the priority areas referenced in Natural Resources Article §5-1607, such as sensitive areas.

- Forest within 100-year floodplains which are in a watershed of 400 acres or more, or which include Class III waters.
- Forest within intermittent and perennial streams and their buffers. Stream buffers are typically measured from the top of the normal bank and are at least 50 feet wide on each side for intermittent streams and at least 100 feet wide on each side for perennial streams. Streams include coastal bays and their buffers (not subject to Chesapeake Bay Critical Area Criteria)
- 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
- Forest suitable for Forest Interior Dwelling Species (FIDS)
- Forest located in a Tier II or Tier III high quality watershed, as identified by the Maryland Department of the Environment
- Forest located in a water resource protection area, a reservoir watershed, or a wellhead protection area as identified by a local jurisdiction
- Priority Urban Forests (Appendix C)
- Trees, shrubs, and plants on steep slopes
- Trees, shrubs, and plants located in critical habitats
- Trees, shrubs, and plants listed on the State (Maryland DNR) or Federal (U. S. Fish and Wildlife) lists of rare, threatened or endangered species
- Trees associated with a historic site or structure, Champion Trees, trees with a DBH 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 from the area of disturbance regulated under the Forest Conservation Act before computing the Act's reforestation requirements.

## Step 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). No more than 30% may be disturbed during construction. Stress reduction, extended maintenance, or other measures may be required (Section 3.4).

### Step 3
Locate forest stands which contain priority areas identified in a local land use plan or local forest conservation program.

### Step 4
If the areas located in (1) through (3) above are within the proposed limits of disturbance, the applicant must demonstrate:

- That all techniques for retention of these areas have been exhausted;
- Why these areas cannot be left undisturbed; and
- How afforestation and reforestation, as applicable, will be accomplished, and where on the site in priority areas the required afforestation or reforestation will be located. (see Section 3.1.3 for explanation of afforestation and reforestation 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 road connecting subdivision sections on the example site plan in **Figure A:9** requires such a demonstration.

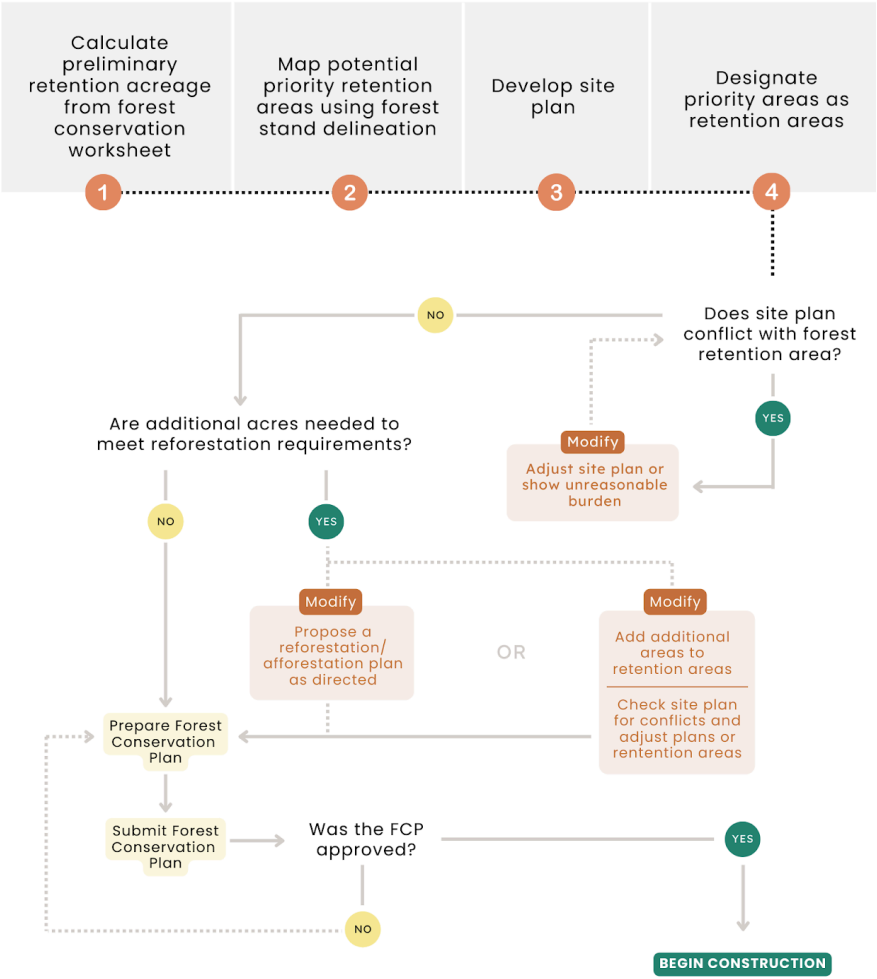
### Step 5
If the requirements of (1) through (4) are satisfied and additional retention area is required (Section 3.3), additional retention areas may be located by the applicant according to an evaluation of forest stands for water quality, wildlife habitat, or other objectives, as determined in the recommendations in the approved FSD. 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. 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 **Figure A:11** through **Figure 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.




**3:2** **Forest Retention Area Decision Matrix**
Source: Maryland Forest Service

## Step 1: Determine Preliminary Retention Requirements

This may be determined by an initial analysis of the preliminary worksheet calculations for an Intermediate FSD. 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, 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 and/or specimen trees on the FCP Map.

## 3.1.3. Calculation of Reforestation and Afforestation

The FCA provides guidelines for the amount of 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.

The objective of the FCP in site planning is to maintain forest while protecting all priority forests and sensitive resource areas on the development site. Information required to calculate the 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. 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 FSD 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 FSD is approved for the entire parcel of record. If this area will be deducted, the final FCP approval shall require a note restricting this area from changes in land use, development or redevelopment, unless a FCP is submitted.
- **Land Use Category** (**Figure 3:3**)
- **Afforestation Threshold Percentage** (**Figure 3:3**)
- **Existing Forest Cover.** This is measured to the nearest 0.1 acre and determined from the current approved FSD (Section 2.2).

The Forest Conservation Worksheet (**Appendix C**) may be completed and appended to the plan. **Figure 3:6** through **Figure 3:8** illustrate completion of the worksheet using different scenarios.

### 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 FCPs

Each FCP map shall contain a table showing the elements and amounts to the nearest 0.1 acre required for the retention, reforestation, or afforestation calculations; including, but not limited to, the following as applicable:

- Total parcel area
- Total Tract Area
- Area in 100-year nontidal floodplain
- Net Tract Area
- Land Use Category, pertinent afforestation percent
- 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 in Section 3.2.1.

| Land Use Categories | Reforestation Ratio | Afforestation Threshold |
|---|---|---|
| Agricultural and Resources Areas<br>Agricultural Activity, e.g. Orchards, Tree Farms, Support Buildings | 1:1<br>Does Not Apply | 20%<br>Does Not Apply |
| Medium Density Residential Areas | 1:1 | 20% |
| Institutional Development Areas | 1:1 | 15% |
| High Density Residential Areas | 1:1 | 15% |
| Mixed Use and Planned Unit Development Areas *<br>Multifamily Housing Units with 25+ dwellings | 1:1<br>1/4 : 1 | 15%<br>0% |
| Commercial and Industrial Use Areas | 1:1 | 15% |
| Development located in Priority Funding Areas | 1/2:1 | 0% |
| Solar Photovoltaic Facilities | -- | 0% |
| Transit-Oriented Development and Linear Projects | 1/4:1 | 0% |

* or mitigated by permanent protection of 1/2 acre for each acre removed

**3:3** **Land Use Thresholds & Reforestation Ratios**
Source: Maryland Forest Service

# 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 retained to meet afforestation threshold and/or fulfill mitigation requirements shall have a long-term protection agreement in place at all times after development project completion. Further information about these long-term protection agreements may be found in Section 3.2.3.

## 3.2.1. Planning and Design

Forests which are retained and protected not only maintain forest functions, but also serve new residential communities or businesses by providing passive recreation, buffering from differing land uses, and aesthetics. 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. Figures 3:4 through 3:8 demonstrate how to calculate and locate required mitigation depending on project complexity.

**Forested Acreage Below Afforestation Threshold**

**Afforestation Threshold:** If the FSD 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.

| Site Information | |
|---|---|
| A. Land use category | Medium Density Residential Area |
| B. Net Tract Area | 100 acres |
| C. Existing Forest Cover | 15 acres |
| D. Afforestation Threshold (20%) | 20 acres |
| E. Forest Cover Above Afforestation Treshold | 0 acres |
| F. Area of Forest Cover 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 Requirement:** | **5 acres afforestation** |


**3:4** **Example: Afforestation, No Clearing**
Source: Maryland Forest Service

| Clearing Below Afforestation Threshold | |
|---|---|
| **Site Information** | |
| A. Land use category | Medium Density Residential Area (Non-Priority Area) |
| B. Net Tract Area | 100 acres |
| C. Existing Forest Cover | 15 acres |
| D. Afforestation Threshold (20%) | 20 acres |
| E. Forest Cover Above Afforestation Treshold | 0 acres |
| F. Area of Forest Cover to be Cleared | 10 acres |
| **Calculations** | |
| 100 acres x 20% | 20 acres must contain forest |
| 20 acres - 15 acres (existing forest) | 5 acres must be afforested |
| 10 acres x 1<br>(area cleared below Afforestation Theshold) | 10 acres must be reforested |
| **TOTAL PLANTING REQUIREMENT** | **15 acres** |


## 3:5 Example: Afforestation & Reforestation

Source: Maryland Forest Service

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

| | | | | |
|---|---|---|---|---|
| **Net Tract Area** | | | | |
| A. | Total Tract Area | A = | 156.72 | ac |
| B. | Deductions (Critical Area, area restricted by local ordinance or program, exising impervious surfaces) | B = | 5.99 | ac |
| C. | Net Tract Area | C = | 150.73 | ac |
| | C = Total Tract (A) - Deductions (B) | | | |
| **Land Use Category: Medium Density Residential** | | | | |
| D. | Afforestation Requirement % (see chart below) | D = | 20 | % |
| E. | Afforestation Requirement | E = | 30.15 | ac |
| | E = Net Tract Area (C) x % (D); If project is a Solar Photovoltaic Facility, enter 0 | | | |
| **Existing Forest Cover** | | | | |
| F. | Unforested Riparian Buffers; If project is a Solar Photovoltaic Facility, enter 0 | F = | 0.74 | ac |
| G. | Existing Forest Cover within the Net Tract Area | G = | 46.07 | ac |
| **Proposed Forest Clearing** | | | | |
| H. | Area of Forest to be Cleared that is in a Priority Funding Area (but not in a Priority Retention Area) | H = | 0.00 | ac |
| I. | None Priority Area of Forest to be Cleared | I = | 0.00 | ac |
| | I = Total Forest to be Cleared - Forests in Priority Funding Area (but not in a Priority Retention Area) H | | | |
| J. | Total Area of Forest to be Retained | J = | 46.07 | ac |
| | J = Existing Forest Cover (G) - None Priority Area of Forest to be Cleared (I) | | | |
| **Planting Requirements** | | | | |
| K. | Afforestation Required | K = | 0.00 | ac |
| | If Existing Forest Cover (G) < Afforestation Requirement (E), then K = Afforestation Requirement (E) - Existing Forest Cover (G); if not K = 0 | | | |
| L. | Reforestation for Clearing Required | L = | 0.00 | ac |
| | L = None Priority Area of Forest to be Cleared (I) + (0.5 x Forest to be Cleared in Priority Funding Area (H)) | | | |
| M. | Semi-Total Afforestation and Reforestation for Clearing M = K + L | M = | 0.00 | ac |
| N. | Unforested Riparian Buffer Planting Required N = F - M | N = | 0.74 | ac |
| P. | Total Planting Required | P = | 0.74 | ac |
| | P = Afforestation Required (K) + Riparian Buffer Afforestation (N) + Reforestation Required (L) | | | |
| Q. | Total Minimum Area to be Placed in Easement J + P | Q= | 46.81 | ac |

| Afforestation Requirments by Land Use Category | |
|---|---|
| Agriculture and Resource Areas | 20% |
| Medium Density Residential | 20% |
| Institutional Development Areas | 15% |
| High Density Residential Areas | 15% |
| Mixed Use and Planned Unit Development Areas | 15% |
| Commercial and Industrial Use Areas | 15% |

This worksheet assumes that the unforested riparian buffers will be afforested and/or reforested as part of the other required mitigation. In the event that a project fullfills their required afforestation and reforestation mitigation without afforesting and/or reforesting their unforested stream buffers, those buffers will have to be afforested and reforested in addition to the required mitigation calculated within this worksheet.

## 3:6 Forest Conservation Worksheet (Simplified)

Source: Maryland Forest Service

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

| | | | | |
|---|---|---|---|---|
| **Net Tract Area** | | | | |
| A. | Total Tract Area | A = | 156.72 | ac |
| B. | Deductions (Critical Area, area restricted by local ordinance or program, exising impervious surfaces) | B = | 5.99 | ac |
| C. | Net Tract Area | C = | 150.73 | ac |
| | C = Total Tract (A) - Deductions (B) | | | |
| **Land Use Category: Medium Density Residential** | | | | |
| D. | Afforestation Requirement % (see chart below) | D = | 20 | % |
| E. | Afforestation Requirement | E = | 30.15 | ac |
| | E = Net Tract Area (C) x % (D); If project is a Solar Photovoltaic Facility, enter 0 | | | |
| **Existing Forest Cover** | | | | |
| F. | Unforested Riparian Buffers; If project is a Solar Photovoltaic Facility, enter 0 | F = | 0.74 | ac |
| G. | Existing Forest Cover within the Net Tract Area | G = | 46.07 | ac |
| **Proposed Forest Clearing** | | | | |
| H. | Area of Forest to be Cleared that is in a Priority Funding Area (but not in a Priority Retention Area) | H = | 0.00 | ac |
| I. | None Priority Area of Forest to be Cleared | I = | 5.01 | ac |
| | I = Total Forest to be Cleared - Forests in Priority Funding Area (but not in a Priority Retention Area) H | | | |
| J. | Total Area of Forest to be Retained | J = | 46.07 | ac |
| | J = Existing Forest Cover (G) - None Priority Area of Forest to be Cleared (I) | | | |
| **Planting Requirements** | | | | |
| K. | Afforestation Required | K = | 0.00 | ac |
| | If Existing Forest Cover (G) < Afforestation Requirement (E), then K = Afforestation Requirement (E) - Existing Forest Cover (G); if not K = 0 | | | |
| L. | Reforestation for Clearing Required | L = | 5.01 | ac |
| | L = None Priority Area of Forest to be Cleared (I) + (0.5 x Forest to be Cleared in Priority Funding Area (H)) | | | |
| M. | Semi-Total Afforestation and Reforestation for Clearing M = K + L | M = | 5.01 | ac |
| N. | Unforested Riparian Buffer Planting Required N = F - M | N = | 0.00 | ac |
| P. | Total Planting Required | P = | 5.01 | ac |
| | P = Afforestation Required (K) + Riparian Buffer Afforestation (N) + Reforestation Required (L) | | | |
| Q. | Total Minimum Area to be Placed in Easement J + P | Q= | 46.07 | ac |

| **Afforestation Requirments by Land Use Category** | |
|---|---|
| Agriculture and Resource Areas | 20% |
| Medium Density Residential | 20% |
| Institutional Development Areas | 15% |
| High Density Residential Areas | 15% |
| Mixed Use and Planned Unit Development Areas | 15% |
| Commercial and Industrial Use Areas | 15% |

This worksheet assumes that the unforested riparian buffers will be afforested and/or reforested as part of the other required mitigation. In the event that a project fullfills their required afforestation and reforestation mitigation without afforesting and/or reforesting their unforested stream buffers, those buffers will have to be afforested and reforested in addition to the required mitigation calculated within this worksheet.

## 3:7 Forest Conservation Worksheet (Full)

Source: Maryland Forest Service

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

| | | | | |
|---|---|---|---|---|
| **Net Tract Area** | | | | |
| A. | Total Tract Area | A = | 156.72 | ac |
| B. | Deductions (Critical Area, area restricted by local ordinance or program, exising impervious surfaces) | B = | 5.99 | ac |
| C. | Net Tract Area | C = | 150.73 | ac |
| | C = Total Tract (A) - Deductions (B) | | | |
| **Land Use Category: Medium Density Residential** | | | | |
| D. | Afforestation Requirement % (see chart below) | D = | 20 | % |
| E. | Afforestation Requirement | E = | 30.15 | ac |
| | E = Net Tract Area (C) x % (D); If project is a Solar Photovoltaic Facility, enter 0 | | | |
| **Existing Forest Cover** | | | | |
| F. | Unforested Riparian Buffers; If project is a Solar Photovoltaic Facility, enter 0 | F = | 0.74 | ac |
| G. | Existing Forest Cover within the Net Tract Area | G = | 46.07 | ac |
| **Proposed Forest Clearing** | | | | |
| H. | Area of Forest to be Cleared that is in a Priority Funding Area (but not in a Priority Retention Area) | H = | 0.00 | ac |
| I. | None Priority Area of Forest to be Cleared | I = | 0.00 | ac |
| | I = Total Forest to be Cleared - Forests in Priority Funding Area (but not in a Priority Retention Area) H | | | |
| J. | Total Area of Forest to be Retained | J = | 46.07 | ac |
| | J = Existing Forest Cover (G) - None Priority Area of Forest to be Cleared (I) | | | |
| **Planting Requirements** | | | | |
| K. | Afforestation Required | K = | 0.00 | ac |
| | If Existing Forest Cover (G) < Afforestation Requirement (E), then K = Afforestation Requirement (E) - Existing Forest Cover (G); if not K = 0 | | | |
| L. | Reforestation for Clearing Required | L = | 0.00 | ac |
| | L = None Priority Area of Forest to be Cleared (I) + (0.5 x Forest to be Cleared in Priority Funding Area (H)) | | | |
| M. | Semi-Total Afforestation and Reforestation for Clearing M = K + L | M = | 0.00 | ac |
| N. | Unforested Riparian Buffer Planting Required N = F - M | N = | 0.74 | ac |
| P. | Total Planting Required | P = | 0.74 | ac |
| | P = Afforestation Required (K) + Riparian Buffer Afforestation (N) + Reforestation Required (L) | | | |
| Q. | Total Minimum Area to be Placed in Easement J + P | Q= | 46.81 | ac |

| **Afforestation Requirments by Land Use Category** | |
|---|---|
| Agriculture and Resource Areas | 20% |
| Medium Density Residential | 20% |
| Institutional Development Areas | 15% |
| High Density Residential Areas | 15% |
| Mixed Use and Planned Unit Development Areas | 15% |
| Commercial and Industrial Use Areas | 15% |

This worksheet assumes that the unforested riparian buffers will be afforested and/or reforested as part of the other required mitigation. In the event that a project fullfills their required afforestation and reforestation mitigation without afforesting and/or reforesting their unforested stream buffers, those buffers will have to be afforested and reforested in addition to the required mitigation calculated within this worksheet.

## 3:8 Forest Conservation Worksheet (Intermediate)

Source: Maryland Forest Service

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 local forest conservation program approved by the Department may allow clustering and other innovative land use techniques that protect and establish forests where open space is preserved, sensitive areas are protected, and development is physically concentrated. A FSD 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 FCP. Therefore, any utility lines, access roads, temporary parking areas, storage areas, and associated grading shall be located outside of Forest Retention Areas.

A 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 restrict 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 species (FIDS) is sought, since threatened FIDS 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 FCP

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

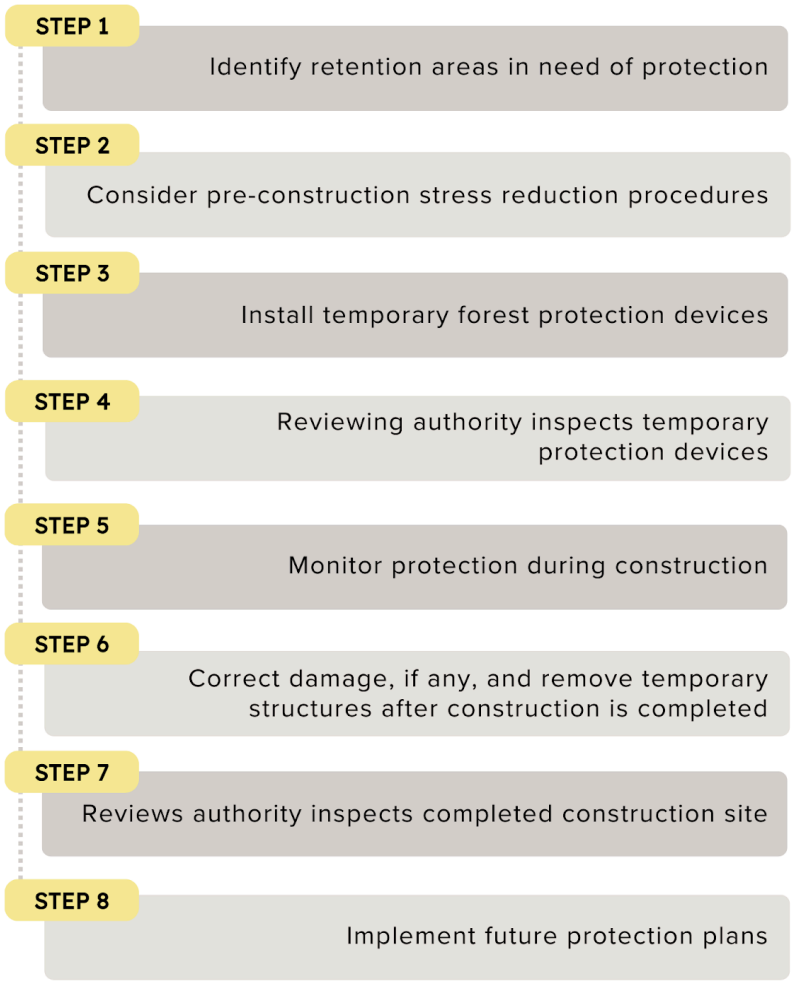
devices and signs as indicated in the approved FCP. All protection devices shall remain in place until construction completion, final inspection, and an occupancy permit, unless waived by the approving authority. More information on protection devices can be found in Section 3.2.2).

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 (**Figure A:15** and **Figure A:16**).

## Critical Root Zones

The Critical Root Zone (CRZ) of a tree is the zone in which most of the roots live. 95% 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 CRZ 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 the trees in question. There are several ways to estimate the size of the CRZ without




**3:9** **Forest Protection Procedures**
Source: Maryland Forest Service

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 CRZ shall be a circle around each edge tree with a radius of one foot for each inch of DBH; the minimum radius should be eight feet.
- For retention areas less than 10,000 square feet and isolated specimen trees, the CRZ should be a circle around each edge tree with a radius of 1.5 feet for each 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 3:9.**

- Field-locate the proposed retention boundary as shown on the preliminary FCP.
- 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.
- Evaluate tree conditions and CRZ.
- Field adjust and stake the retention boundary. In general, if more than 30% of the CRZ 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.
- Obtain final FCP approval, if not obtained earlier. Notify approving authority for inspection approval of installed devices.
- Proceed with construction subject to final approvals.
- Notify approving authority following completion of construction for final inspection.

## 3.2.2. Construction Techniques

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

This section guides the applicant through the construction phase of a project, ensuring that construction activities will not adversely affect the Forest Retention Areas. 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 CRZ 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.
- 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 two days.
- Too little water. Grading will alter the soil moisture regimes in the CRZ, 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.
- 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 by other trees. 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 FCP

### During Construction

Following are requirements for all FCPs which propose forest clearing:

- Locations of 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
    - Remain in place and maintained until construction completion, final inspection, and an occupancy permit is issued, unless waived by the approving authority

**Critical Root Zone Protection**

When 30% or less of a CRZ 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 CRZ 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 3:10**.

Special construction techniques include, but are not limited to:

- tree wells
- retaining walls
- root aeration systems
- raised sidewalks with aeration over roots
- pier wall supports over CRZ
- tunneling to avoid CRZ

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

**Post-Construction**

When warranted by damage to the retention area during construction, the following may be required:

- stress reduction measures as above
- tree or limb removal
- 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% of the CRZ 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 3:11** may be used by contractors to ensure that Forest Retention Areas will be protected.

## 3.2.3. Long-term Instruments

Every FCP must provide for long-term protection of forest retention areas and areas covered by a planting plan using the long-term protection agreements approved by the approving authority. These agreements shall at minimum:

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

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

- Conservation easements
- 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.

## 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 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 Maryland Forest Service staff 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.

## Forest Conservation and Management Agreements

A Forest Conservation and Management Agreement is a binding contract between a landowner and the Department. 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 Department.

| Practice | Implementation Guidelines |
|---|---|
| **Root Pruning**<br><br>Will the Critical Root Zone be affected by construction activities such as grade changes, digging for foundations, roads or utility construction? | • Pune before construction disturbance (Figure D-1).<br>• Cut cleanly using well-maintained pruning equipment.<br>• Cover exposed roots immediately with topsoil, peat moss, or other suitable materials.<br>• For trees with DBH greater than 15", conduct root pruning up to one entire growing season before construction disturbance.<br>• Monitor for signs of stress and apply water if needed. |
| **Crown Reduction or Pruning**<br><br>Has the root system been significantly reduced (more than 30%) or are there dead, damaged, or diseased limbs? | • Prune at the optimal time of the year for the type of plant.<br>  ◦ For ornamental flowering trees, after flowering and before bud.<br>  ◦ For non-ornamental flowering trees, in later winter, early spring, or mid-summer.<br>• No more than 30% of the crown should be removed at one time (Figure D-2).<br>• Monitor for signs of stress. |
| **Watering**<br><br>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.<br>• Monitor for signs of stress and re-evaluate methods. |
| **Fertilizing**<br><br>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)<br>• For small trees (less than 3" caliper or DBH), broadcast methods may be appropriate.<br>• 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 the tree trunk for the pressurized injection method.<br>• Monitor for signs of stress and re-evaluate methods. |

**3:10** **Forest & Tree Protection Practices**
Source: Maryland Forest Service

MARYLAND DEPARTMENT OF NATURAL RESOURCES

| | STEP 1 Pre-Construction Phase | | |
|---|---|---|---|
| | **Stress Reduction, if needed** | | **Include on Site Plan** |
| ○ | Root pruning | ○ | Forest Retention Areas |
| ○ | Crown pruning | ○ | Isolated specimen trees |
| ○ | Watering | ○ | Employee parking areas |
| ○ | Fertilizing | ○ | Equipment staging areas |
| ○ | Mulching | | |
| | **Temporary Forest Protection Devices** | | **Permanent Forest Protection Devices** |
| ○ | Forest protection fences, or | ○ | Tree wells |
| ○ | Combined sediment control and tree protection | ○ | Root aeration system |
| ○ | Forest Retention Area signs | ○ | Retaining walls |
| | **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** | | **Repair of Tree Damage** |
| ○ | Root pruning | ○ | Root repair |
| ○ | Crown pruning | ○ | Repair of dead limbs |
| ○ | Watering | ○ | Soil aeration |
| ○ | Fertilizing | | |
| ○ | Mulching | | |
| | **Other** | | |
| ○ | Removal of dead or dying trees posing an immediate safety concern | ○ | Onsite inspection by approving authority |
| ○ | Removal of temporary tree protection structures | ○ | Amended FCP, if needed |

**3:11** **Forest & Tree Protection Checklist**
Source: Maryland Forest Service

MARYLAND DEPARTMENT OF NATURAL RESOURCES

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.

## 3.3 Forest and Tree Planting

This chapter has reviewed planning and protection of forest retention areas on development sites. The FCA also requires that FCPs 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 to be necessary and with proper justification, off the site. Mitigation banking may also be considered as a means to satisfy afforestation or reforestation requirements on a case-by-case basis.

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.

Applicants should always consult with the local authority where the development will occur to determine if specific local program requirements will apply. A unit of local government with planning and zoning authority may adopt afforestation and reforestation requirements as part of its local forest conservation program that are more stringent than those of the State.

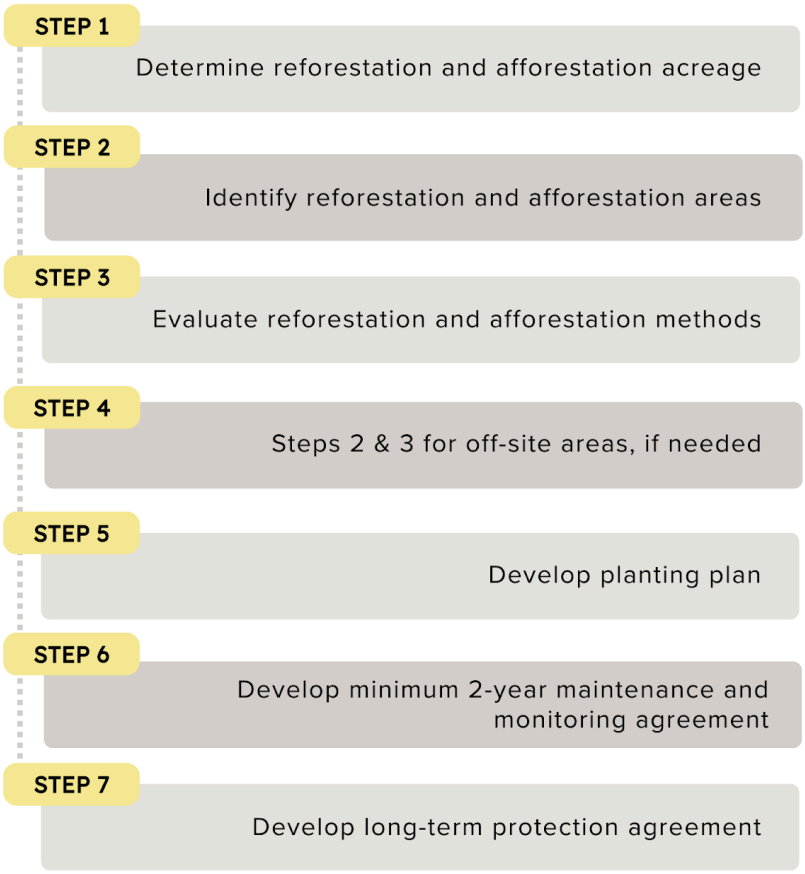
## 3.3.1. When and Where is Planting Necessary?

### Afforestation

For sites with little or no existing forest as verified in a FSD, the FCA sets standards for afforestation depending on the land use category and the size of the tract, with an exemption for solar photovoltaic facilities.

Afforestation is the establishment of tree cover on areas from which it has always, or for a very long time, 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 or street trees, 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% of the net tract area in forest cover shall be




**3:12** **Reforestation and Afforestation Procedures**
Source: Maryland Forest Service

afforested up to 20% of the net tract area. **Figure 3:8 and Figure 3:9** demonstrate the amount of planting which occurs when the existing forest area is less than the afforestation threshold.

For the land use categories of agriculture and resource areas and medium density residential areas, tracts having less than 20% of the net tract area in forest cover shall be afforested up to 20% of the net tract area.

For the land use categories of institutional development areas, high density residential areas, mixed use and planned unit development areas, and commercial and industrial use areas, tracts having less than 15% of the net tract area in forest cover shall be afforested up to 15% of the net tract area:

Upon meeting reforestation and afforestation requirements, all unforested riparian buffers on site shall be afforested and reforested, unless the applicant demonstrates this would be in conflict with allowable uses for the riparian buffer, conflicts with the mission and established stewardship practices of the park property, or is not suitable for the establishment and retention of the required planting materials – in which case substitute environmental protection measures must be implemented.

The Forest Conservation Worksheet (**Appendix C**) assumes that the developer will utilize afforestation of unforested stream buffers to fulfill the afforestation threshold first. However, if the developer does not take this approach then the unforested buffers will need to be afforested in addition to the afforestation threshold requirement.

Afforestation shall be accomplished within one year or two growing seasons after the completion of the development project. If afforestation cannot be reasonably accomplished on-site or off-site, the requirement to contribute money to a Forest Conservation Fund shall be met within 90 days after the completion of the development project.

In the case that both stream buffer afforestation and the afforestation threshold can't be met on- or off-site then the total contribution to the Forest Conservation Fund shall be based on the unbuffered stream area at the end of the project plus the unmet afforestation threshold.

Linear projects that involve no change in land use and solar photovoltaic facilities may not be subject to afforestation requirements.

## 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% of those trees having the potential of attaining a 2-inch or greater DBH within seven years, as defined in Natural Resources Article §5-1601; in order to replace a similarly removed community.

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 because for all existing forest cover (measured to the nearest 0.1 acre cleared on the net tract area), the area of forest removed shall be reforested at a ratio of one acre planted for every one acre removed.

However, for all existing forest cover located in a priority funding area and not within a priority retention area, the area of forest removed shall be reforested at a ratio of 0.5 acre planted for every one acre removed. If the area is in both a priority funding area and a priority retention area, the 1:1 ratio still applies.

If the site disturbance is transit-oriented development as defined under §7-101 of the transportation article or construction of multifamily housing (a single structure containing at least 25 dwelling units), the area of forest removed is reforested at a ratio of at least 0.25 acres replanted for each acre removed.

Reforestation shall be accomplished within one year or two growing seasons after the completion of the development project. If reforestation cannot be reasonably accomplished on-site or off-site, the requirement to contribute money to a Forest Conservation Fund shall be met within 90 days after the completion of the development project.

## Priority Areas for Afforestation and Reforestation

FSDs locate the environmental features which are priority for retention, afforestation, and reforestation, as defined in Natural Resources Article §5—1607(c). Priority retention areas should be preserved. Reforestation or afforestation shall occur in the priority areas described below.

If the applicant demonstrates that this cannot be reasonably accomplished, planting may occur in other areas on the site or in offsite priority areas. If neither on-site or off-site planting is feasible and with written and written justification is submitted and approved, payment of a fee in lieu of planting can be made to the Forest Conservation Fund.

Planting locations shall be approved by the reviewing authority under an approved FCP. Methods for planting are discussed in Section 3.3. Priorities for afforestation or reforestation are to establish and/or enhance:

- Forest buffers adjacent to intermittent and perennial streams and coastal bays to widths of at least 50 feet from the stream channel of intermittent and 100 feet from the stream channel of 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. Streams include any tidal waters not included in the Chesapeake Bay Critical Area.
- Existing forested corridors to connect existing forests within or adjacent to the site and, where practical, forested corridors should be at least 300 feet wide so as to facilitate wildlife movement.

- Forest buffers adjacent to critical habitats where appropriate. These areas may be designated by the Department 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 Maryland Natural Heritage Program.
- Forested areas in 100-year floodplains.
- Plantings to stabilize slopes of 25% or greater and slopes of 15% or greater with erodible soils having a K value of 0.35 or greater in the top layer which require stabilization shall be reforested. Slopes also include ravines and natural depressions.
- Forests in urban areas that are most important for providing wildlife habitat or mitigating flooding, high temperatures, or air pollution; are considered to be a priority for retention and protection as delineated on the State's priority urban forest map.
- Buffers adjacent to areas of differing land uses where appropriate, or adjacent to highways or utility rights of way.
- Forest areas adjacent to existing forests so as to increase the overall area of contiguous forest cover, when appropriate. 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.

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.

## Preferred Sequence for Afforestation and Reforestation

After all techniques for retaining existing forest cover onsite have been exhausted, the preferred sequence for afforestation and reforestation shall be the following:

1. Techniques that enhance existing forest and involve selective clearing or supplemental planting on-site (Section 3.3.2);
2. On-site afforestation or reforestation;
3. Off-site afforestation or reforestation in the same watershed or in accordance with an approved master plan may be utilized where the applicant has demonstrated that no reasonable on-site alternative exists, or where any on-site priority areas for afforestation or reforestation have been planted and the applicant has justified to the satisfaction of the State or local jurisdiction that environmental benefits associated with off-site afforestation or reforestation would exceed those derived from on-site planting;
4. Off-site afforestation or reforestation may include the use of forest mitigation banks which have been so designated in advance by the State or local forest conservation program which is approved by the Department; and

5. The State or local jurisdiction may allow an alternative sequence for a specific project if necessary to achieve the objectives of a local jurisdiction's land use plans or policies or to take advantage of opportunities to consolidate forest conservation efforts.

## When Will Afforestation and Reforestation Be Done?

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

### Reforestation

1. Determine if retention of priority forested 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.

2. Reforestation is required if any forest is cleared. If the site plan cannot be modified to retain forest and reforestation is required, determine if priority areas for reforestation can be utilized.

The FSD 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. Calculate how much additional planting will need to be accomplished to meet the afforestation threshold.
2. Determine if all streams on site are buffered to the required minimum widths.
3. Determine if the necessary planting may be accomplished in priority areas, including stream buffers, as shown in a FSD. 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 3:12**. The comprehensive procedural checklist in **Figure 3:13** may assist the preparer of FCPs in reforestation and afforestation evaluations.

# 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 FCPs. 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
  - environmental features which are priority areas as shown for a Simplified FSD
- Specifications for conducting the afforestation or reforestation activities. A planting schedule table shall be included which lists:
  - species
  - number of plants, spacing or distribution of proposed planting
  - size of plants
  - condition
  - recommended sources of plant materials
  - other requirements for certain planting techniques
- 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

| | | | |
|---|---|---|---|
| STEP 1 | **Determine Reforestation & Afforestation** | | |
| ○ | Forest Conservation Worksheet | | |
| STEP 2 | **Identify Priority Reforestation & Afforestation Areas** | | |
| ○ | Locate reforestation and afforestation areas from priority areas on FSD | | |
| STEP 3 | **Evaluate Various Reforestation Methods** | | |
| | Preferred Sequence for Afforestation and Reforestation | | |
| ○ | On-site afforestation or reforestation | | |
| ○ | Off-site afforestation or reforestation | | |
| ○ | Alternate sequence for certain specific projects | | |
| | Afforestation and Reforestation Methods | | |
| ○ | Selective clearing and supplemental planting to enhance existing forest | | |
| ○ | Forest creation using: | ____ Transplanted or nursery stock<br>____ Whip and seedling stock<br>____ Natural regeneration | |
| ○ | Landscaping | | |
| ○ | In a municipal corporation or urban area: | ____ Street trees<br>____ Off-site protective easement for existing forest | |
| STEP 4 | **Developing a Planting Plan** | | |
| | Site Assessment | | Pre-Planting Considerations |
| ○ | Past and future land uses | ○ | Planting site preparation |
| ○ | Soils evaluation | ○ | Planting period |
| ○ | Species selection | ○ | Plant material storage |
| ○ | Plant material selection | ○ | On-site inspection |
| ○ | Stock Specifications | | |
| | Planting Specifications | | Post-Planting Considerations |
| ○ | Planting pattern | ○ | Soil stabilization |
| ○ | Equipment | ○ | Protection devices |
| ○ | Techniques | | |
| STEP 5 | **Minimum 2-year Maintenance and Monitoring Agreement** | | |
| ○ | Watering | ○ | Reforestation plans for mortality after year one |
| ○ | Fertilizing | ○ | Name of company/individual responsible for tree care |
| ○ | Competing vegetation | ○ | Schedule of site visits |
| ○ | Protection from pests, diseases, and mechanial injury | ○ | Areas with special maintenance concerns |

**3:13** **Resforestation and Afforestation Checklist**
Source: Maryland Forest Service

MARYLAND DEPARTMENT OF NATURAL RESOURCES

authority. This agreement shall be in place for a minimum of two years or three full growing seasons, whichever is longer, after the planting is finished.

## Selecting Planting and/or Mitigation 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) through (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.

This technique may be used only when management of the Forest Retention Area as a result of nearby clearing is recommended in the approved FSD 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 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. Deer fencing or other tree protection measures may be necessary.
- The average cover of invasive exotic plant species in the Forest Retention Area as identified in the FSD exceeds 50%. 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 two-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.

Hundreds of exotic plants occur in the wild in Maryland. Many 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*)

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 mile-a-minute weed (*Polygonum perfoliatum*).

Some species, such as kudzu (*Pueraria lobata*) and bamboos, are extremely persistent and destructive. English ivy (*Hedera helix*), climbing euonymus (*Euonymus fortunei*), burning bush (*Euonymus alatus*), Japanese honeysuckle (*Lonicera japonica*), 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 (*Lonicera japonica*) can readily invade the interior of forested habitats by colonizing light gaps caused by fallen trees. Some species, such as wisteria (*Wisteria spp.*) and Japanese honeysuckle (*Lonicera japonica*), 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 >1.5" DBH

This is a preferred reforestation or afforestation technique when sites are monitored and managed adequately to ensure maximum survival beyond an initial two-year agreement. A landscape contract which includes watering should 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 two–four 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 eight 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, tubing, and caging** 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% of plants must remain from a minimum planting density of 700 plants per acre at the end of a two-year monitoring period. A longer-term management and monitoring agreement may be used to ensure that forest will be established. Management during this period will usually require control of competition and predation.

Standards for hardwoods and conifers vary. Hardwood seedlings shall be ¼–½ inch caliper with roots eight inches or longer. Conifer seedlings must be ⅛ –¼ inch caliper with roots eight inches or longer and top growth six 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 all trees will need shelters 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, 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 expansions. This may be accomplished by adopting and implementing a local tree management policy.

Urban soils are generally poor growth media because of poor fertility, texture, and structure which leads to reduced 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 take in water and nutrients 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 three 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 1,200 cubic foot, or 400 square foot, planting space.

As a landscape technique the purpose of street tree plantings are to achieve screening, noise attenuation, buffering, air cooling, particulate filtering, reduce traffic speeds, decrease crime, and create a more hospitable environment for people. Street trees may be planted in tree lawns or tree pits 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 3 feet wide; medium trees (30–45 feet tall) at least 4 feet wide; and large trees (taller than 45 feet) at least 5 feet wide.
- Tree pits may be used instead of tree lawns where hardscape infrastructure does not allow for tree lawns, in which case the following minimum dimensions apply; alternative configurations are acceptable so long as the minimum square footage is maintained. Small trees require a minimum 3 feet by 5 feet tree pit. Medium trees require a minimum 4 feet by 6 feet tree pit. Large trees require a minimum 5 feet by 8 feet tree pit.
- Spacing intervals of trees should ensure that a continuous canopy will be maintained at or before maturity.
- Credit for planted areas shall be calculated by the size class of the tree species as listed on the Maryland Forest Service's website. Tree canopy coverage at maturity will be credited and assumed to be circular with the radius of the circle being 20 feet for small trees, 40 feet for medium, and 60 for large trees. Where a canopy overlaps with another mature tree canopy, or future or existing structure, the overlapping area(s) will not be credited.
- 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:

- 75% 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% cover of invasive exotic species.

The two-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 seven years. Measures for controlling competition and predation when appropriate must also be included.

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

### Additional Planting Techniques

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

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

### Use of Qualified Conservation

Up to 50% of the required afforestation or reforestation mitigation for a project may be met by use of Qualified Conservation. A written justification for up to 60% of the afforestation or reforestation requirement may be proposed, and after public comment, the Department may approve. For either case, the afforestation or reforestation credit may not exceed 50% of the forest area encumbered in perpetuity.

### Restoration of On- or Offsite Degraded Forest

In a municipal corporation with a tree management plan, in an existing population center designated in a county master plan or in any other designated area approved by the Department as part of a local program, under criteria established by the local program, subject to the approval of the Department, on- or off-site degraded forest may be restored for an afforestation or reforestation credit which may not exceed 50% of the area of forest restored. Restoration may include:

- Soil enhancement
- Removal of invasive species

- Wildlife control
- Improvement of the understory
- New tree plantings

### Planted Green Infrastructure

The establishment of planted green infrastructure or planted environmental site design practices beyond the amount required under §4–203 of the Environment Article may grant full credit as a mitigation technique to be used as Qualified Conservation.

## 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 FSD or through adjacent forest communities.

**Plant Stocking.** Minimum densities at planting and at the release of the two-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 on-site.
- 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 three–five 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. Biochar can be a useful soil amendment to improve soil moisture and plant survivability where site conditions are appropriate. If fill material is used at the planting site, it should be clean fill topped with a minimum of 12 inches of organic topsoil. Stockpiling of native top soils should not compact or damage the remaining seed bank.

**Planting Times.** Recommended times for planting and other practices are summarized in **Figure A: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. **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 **Figure D:16** through **Figure 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 soil 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 two–four inches of mulch.

**Balled-and-Burlapped Trees.** Trees greater than two-inch caliper are usually planted using tree spades. This is particularly useful when transplanting onsite or with local plant materials.

For trees larger than six-inch caliper, specialized equipment is recommended.

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 and all foreign objects shall be removed. Water the planting field to settle soil backfilled around trees, rake soils evenly, and cover with two–four inches of mulch.

**Soil Stabilization.** For areas of large-scale disturbance, stabilize soils with a non-turf-building ground cover, straw, 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.

Each planting plan shall include a binding minimum two-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 3.4.4)

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.

## 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 watered as much as twice a week for the entire growing season. During the next two years, they may require watering only a few times a year, usually more frequently during July and August. After that, trees should only need water during severe drought. Dormant bare root transplants, as opposed to balled and burlapped material, if sufficiently watered during planting, may not need water for several weeks.

### Soil and Watering

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

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

### How to Water

Water deeply and slowly using a garden hose, a soaker hose, or drip irrigation. On larger trees start by watering the root ball thoroughly and then expand the watered area to include the whole root zone after the tree becomes established. A layer of

mulch not thicker than four inches around newly transplanted trees insulates surface roots from drying too quickly while still providing air movement to the roots.

## What Nutrients to Apply?

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

## When to Fertilize

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

## What Type of Fertilizer?

Fertilizers are numbered by the relative amounts of nitrogen, phosphorus, and potassium available for release. A 12-6-4 fertilizer has 12 parts nitrogen (N), six parts phosphorus (P), and four 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 when choosing a reforestation or afforestation area.

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

Mechanical removal or topping of competing plants, such as mowing, may be desirable. The frequency and timing of removal will affect the composition of the plant community. Controlling competing vegetation with herbicides should be carefully assessed so that effects on desirable plants, including those

that self-seed or colonize the site, soils, and surface waters are carefully monitored and minimized.

### Protection: Pests, Diseases, and Mechanical Injury

An Integrated Pest Management (IPM) program is one of the most effective and safe approaches for maintaining a healthy forest. IPMs 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. Mesh tops should be removed once the tree reaches the top of the tube to prevent tree damage.
- 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
- Eliminate invasive exotic species.

### Steep Slopes

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

## 3.4.4. Reinforcement Planting Provisions

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

# 3.5. Approval, Enforcement, and Amendment of FCPs

## 3.5.0. Approval of FCPs

Proposed FCPs follow the procedures outlined in Natural Resources Article §5-1605 for approval and public notice.

At least 20 days before approval of the FCP, the Department or local authority shall provide notice to all property owners abutting and adjacent to the boundary of the subject property of any proposed clearing of a priority retention area. Note that property separated from the subject property by a public right-of-way shall be considered abutting and adjacent.

If the property has a net tract area of at least five acres, and if at least 75% of the priority retention area is proposed to be cleared, the Department or local authority shall provide an opportunity for written and verbal comment before plan approval. For any other project where priority retention area is proposed for clearing, the Department or local authority shall provide an opportunity for public written comment before plan approval.

Within 45 days from receipt of the FCP, the Department or local authority shall notify the applicant whether the FCP is complete. If the Department or local authority fails to notify the applicant about the FCP within 45 days, the plan shall be treated as complete and approved. The Department or local authority may require further information or provide for an extension of this deadline for an additional 15 days for extenuating circumstances. In addition, at the request of the applicant, the State or local authority may extend this deadline for extenuating circumstances.

A person petitioning for judicial review of an approved FCP shall file the petition in accordance with the Maryland Rules not later

than 30 days after approval of the FCP. Any judicial review of a FCP shall be conducted in accordance with the Maryland Rules and limited to the record compiled by the Department or the local authority.

The following summarizes FCP enforcement by an approving authority. FCPs approved by the Department 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 installed properly and retention areas are clearly marked. This inspection shall occur before any forest 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 and Transit-Oriented Projects


**4.0** Introduction

**4.1** Linear and Transit-Oriented Projects

- **4.1.1** FSD Requirements
- **4.1.2** FCP Requirements
- **4.1.3** Selective Clearing and Supplemental Planting


Chapter 4

# Linear and Transit-Oriented Projects

## 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 and Transit-Oriented 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. Linear projects that involve no change in land use may not be subject to afforestation requirements. Applicants are advised to verify specific program standards for any project.

## 4.1.1. FSD Requirements

Simplified FSDs may be submitted for approval on linear projects to determine if sufficient forested area is proposed for disturbance to require submission of a FCP. In addition, Simplified FSDs 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 FSD shall be submitted on a minimum project area extending 100 feet from the right-of-way centerline or 50 feet outside the proposed limit of disturbance if the right-of-way is wider than 100 feet.

## 4.1.2. FCP 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 FCP.

## 4.1.3. Selective Clearing and Supplemental Planting

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

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

# Appendices

A. Illustrations

B. Glossary of Terms

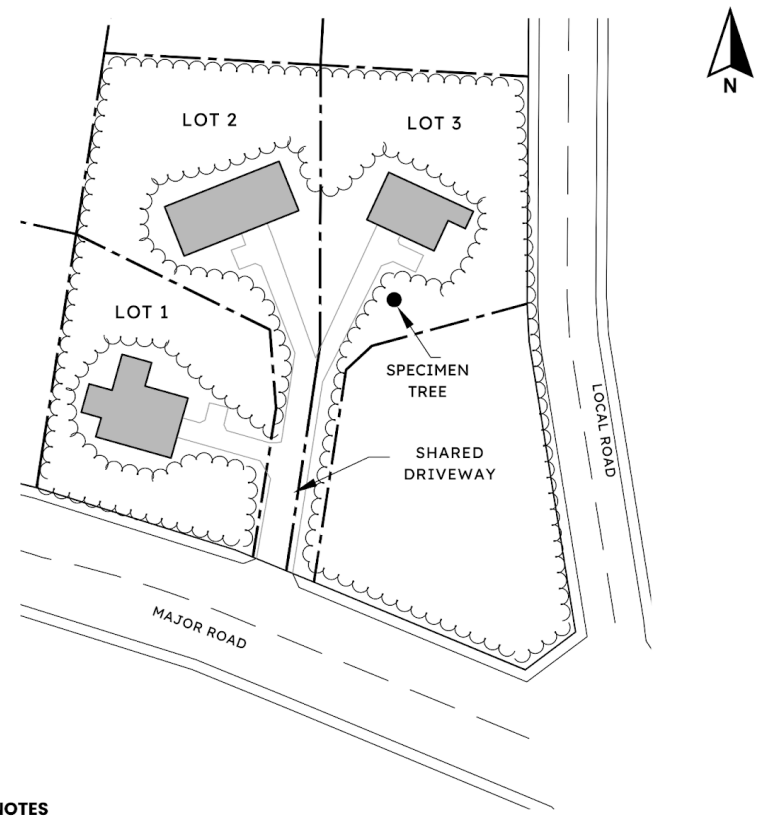
C. Figures & Worksheets

D. Sample Details and Specifications

**Appendix A**

# Illustrations


**A.1.** Site Clearing
**A:2** Cluster Development Plan
**A:3** Grading
**A:4** Stormwater Management
**A:5** Site Vicinity Map
**A:6** Preliminary Environmental Map Features
**A:7** Soil and Vegetation Cover Map
**A:8** Preliminary FSD Map
**A:9** Site Development Plan Before FCP
**A:10** Priority for Retention and Protection
**A:11** Priority Area Map
**A:12** Closeup of Priority Areas
**A:13** Forest Retention Map
**A:14** FCP Map
**A:15** Critical Root Distribution
**A:16** Field Edge Determination
**A:17** Protecting Trees During Construction
**A:18** Site Stocking
**A:19** Planting Distribution Pattern
**A:20** Tree Planting and Maintenance Calendar

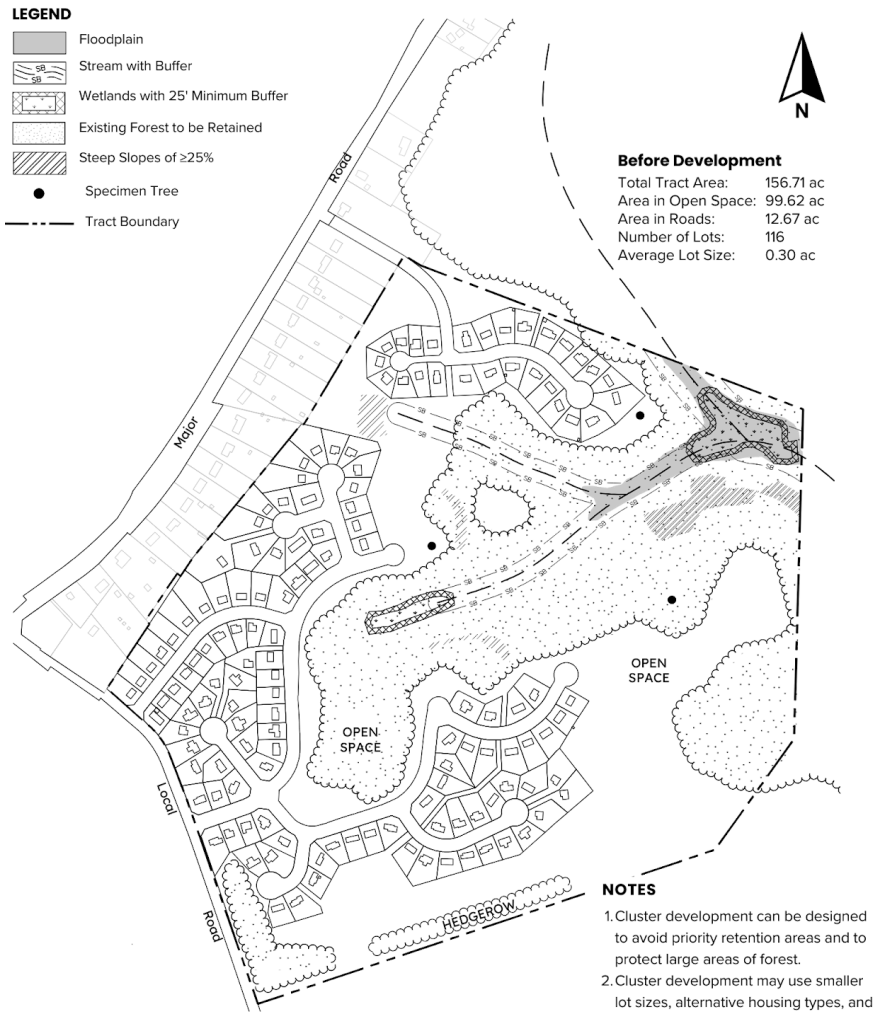




**NOTES**

1. Site plans can be designed to minimize the total acerage 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. Sewage reserve area not to be placed in protective easement.

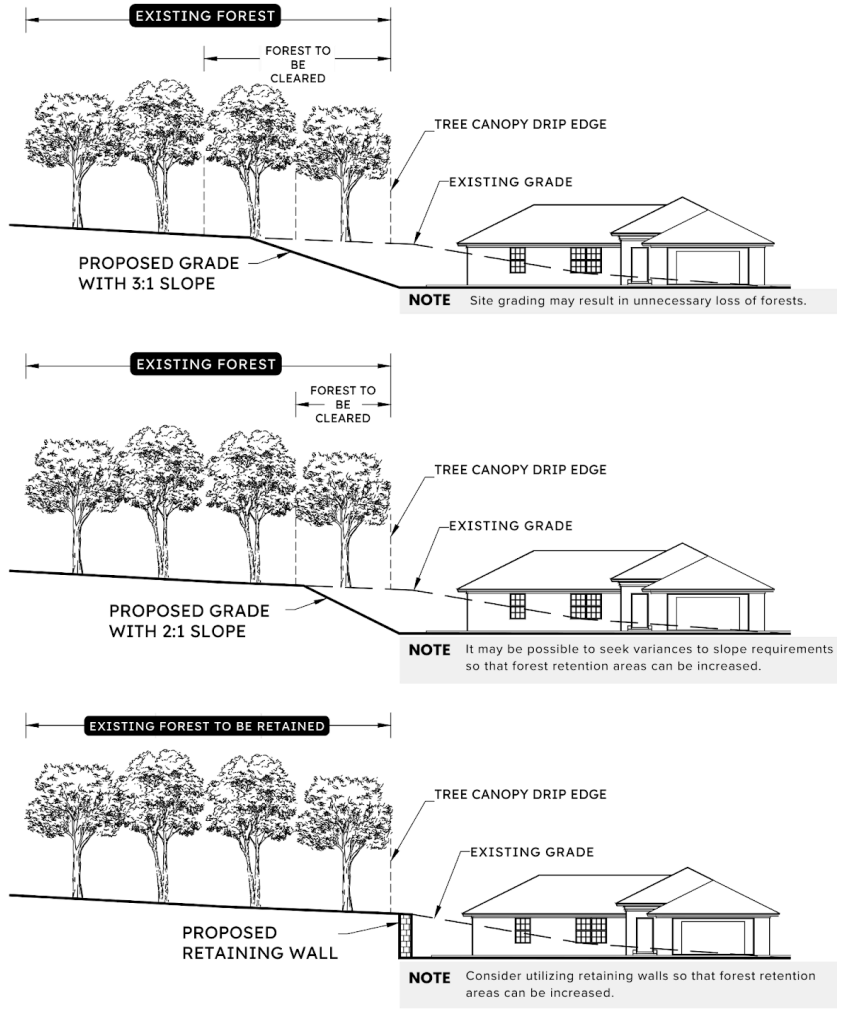
**A:1** **Site Clearing**
Source: Maryland Environmental Service

MARYLAND DEPARTMENT OF NATURAL RESOURCES



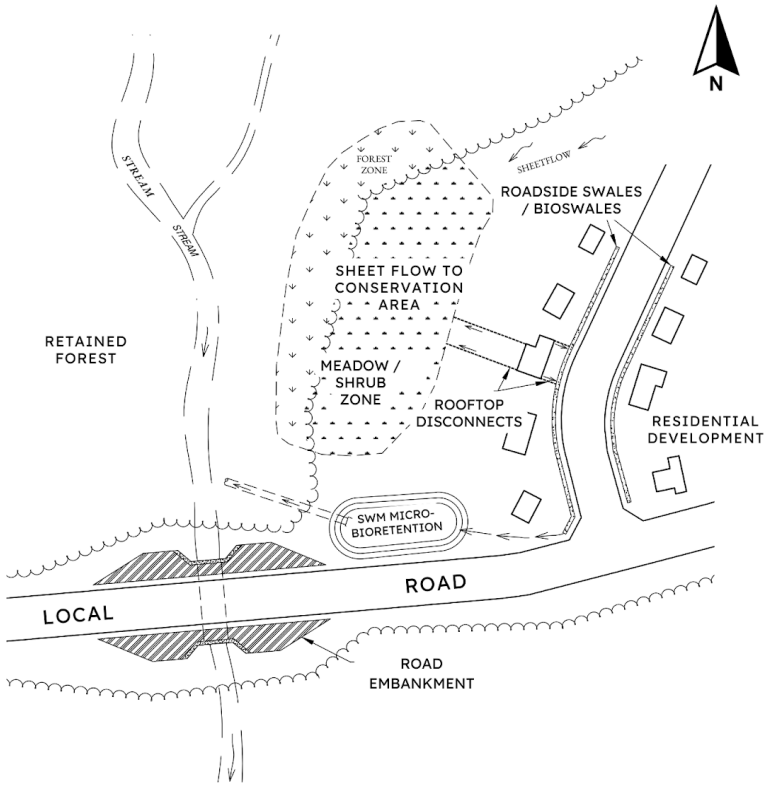

## A:2 Cluster Development Plan

Source: Maryland Environmental Service




## A:3 Grading

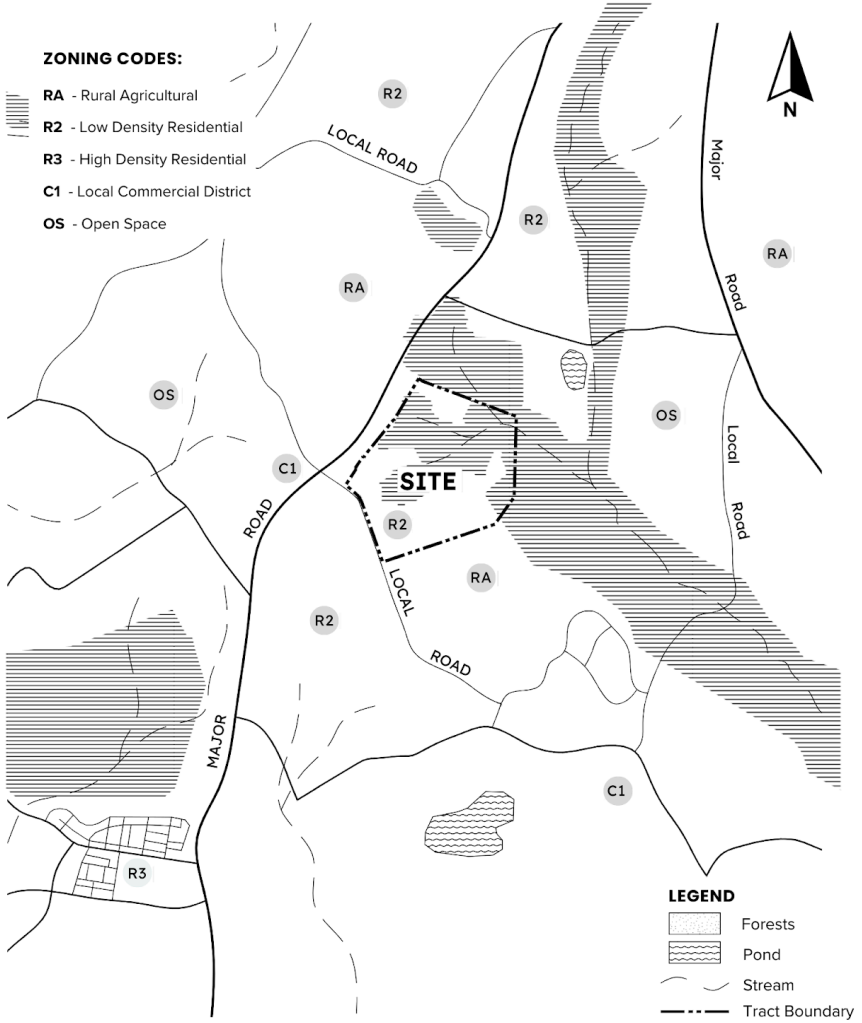
Source: Maryland Environmental Service



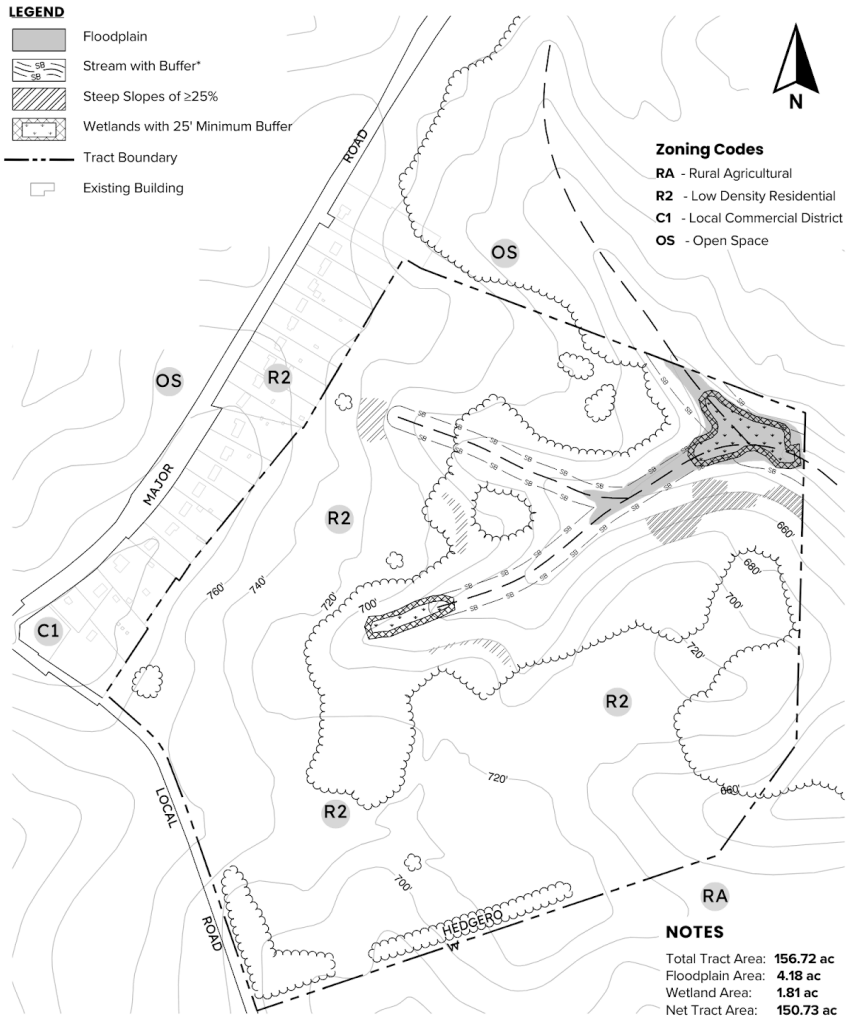

**NOTES**

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. Stormwater devices mimic the natural ability of forests and wetlands to clean and slow stormwater, but can be sized to handle larger quantities of runoff from developed areas.
3. The stormwater management devices, such as bioswales and submerged gravel wetlands, provide filtering to remove silt, sediment, and other pollutants prior to discharge of runoff into receiving streams.

**A:4** **Stormwater Management**
Source: Maryland Environmental Service

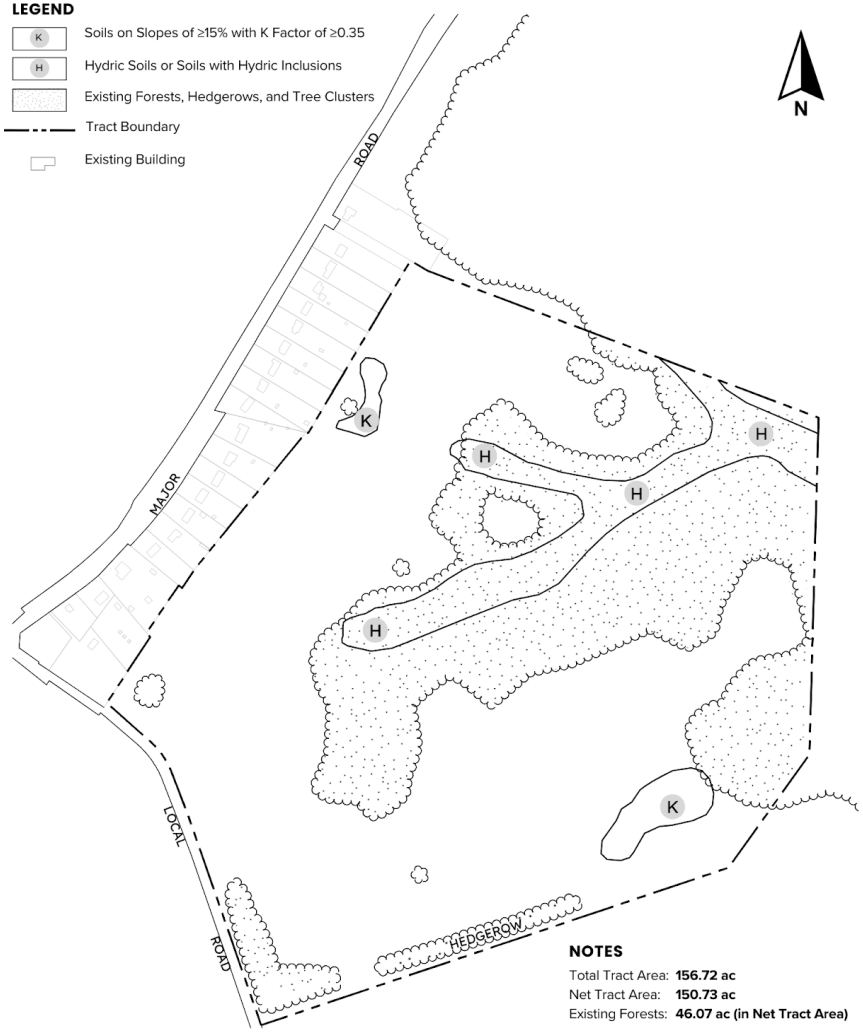



**A:5** **Site Vicinity Map**
Source: Maryland Environmental Service



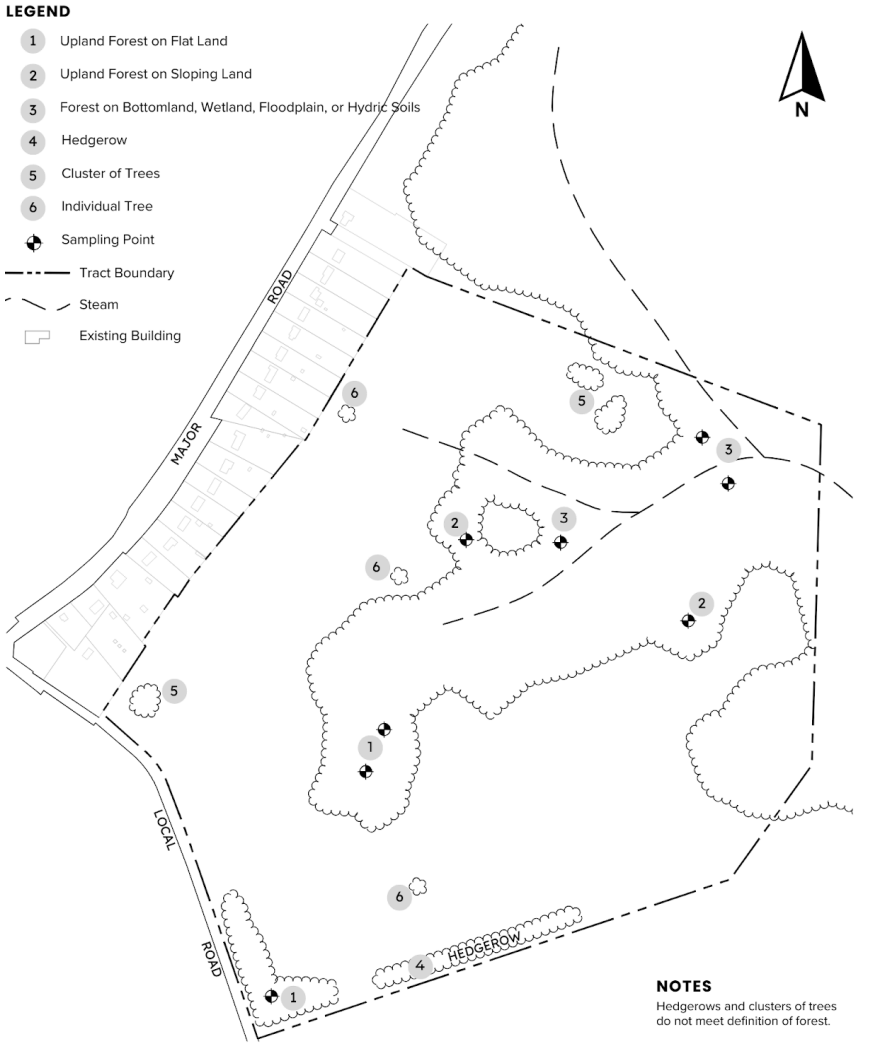

**A:6** **Preliminary Environmental Map Features**

Source: Maryland Environmental Service

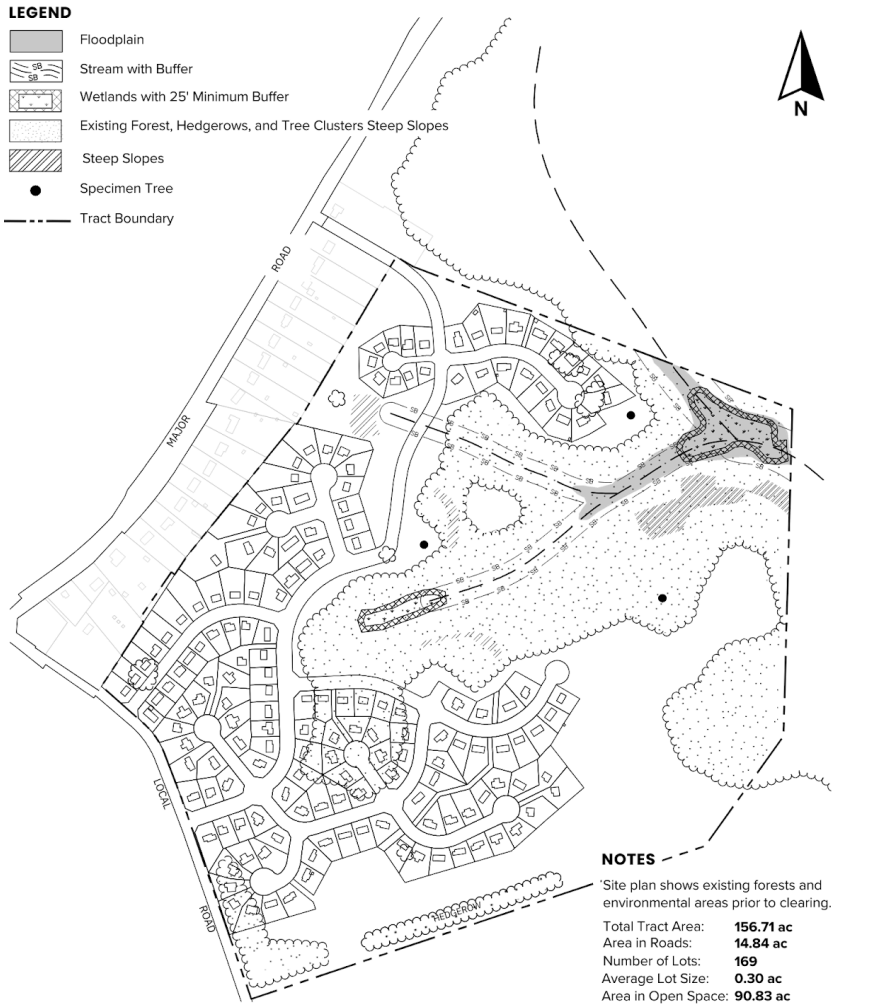



**A:7** **Soil and Vegetation Cover Map**

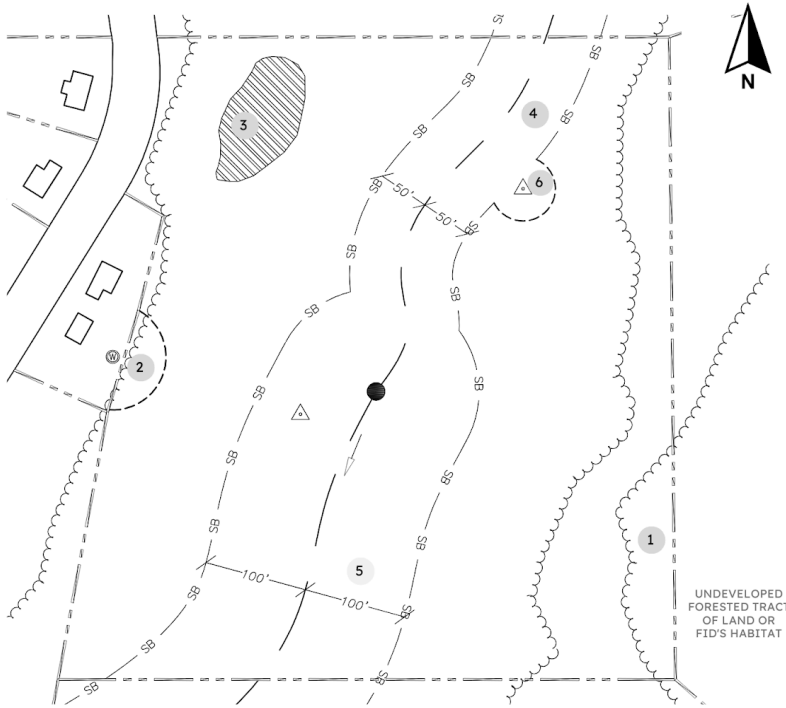
Source: Maryland Environmental Service




**A:8** **Preliminary FSD Map**
Source: Maryland Environmental Service




**A:9** **Site Development Plan Before FCP**
Source: Maryland Environmental Service




**Forests Located in Sensitive Areas Including:**

1. Contigous forest adjacent to undeveloped forested tracts of land or forest suitable for Forest Interior Dwelling Species (FIDS).
2. Well Head Protection area as identified by a local jurisdiction.
3. Steep Slopes
4. Intermittent streams and their buffers of at least 50' on each side of the stream channel.
5. Perennial streams and their buffers of at least 100' on each side of the stream channel.
6. Specimen tree with buffer. Buffer applied when specimen tree is outside of the stream buffer.

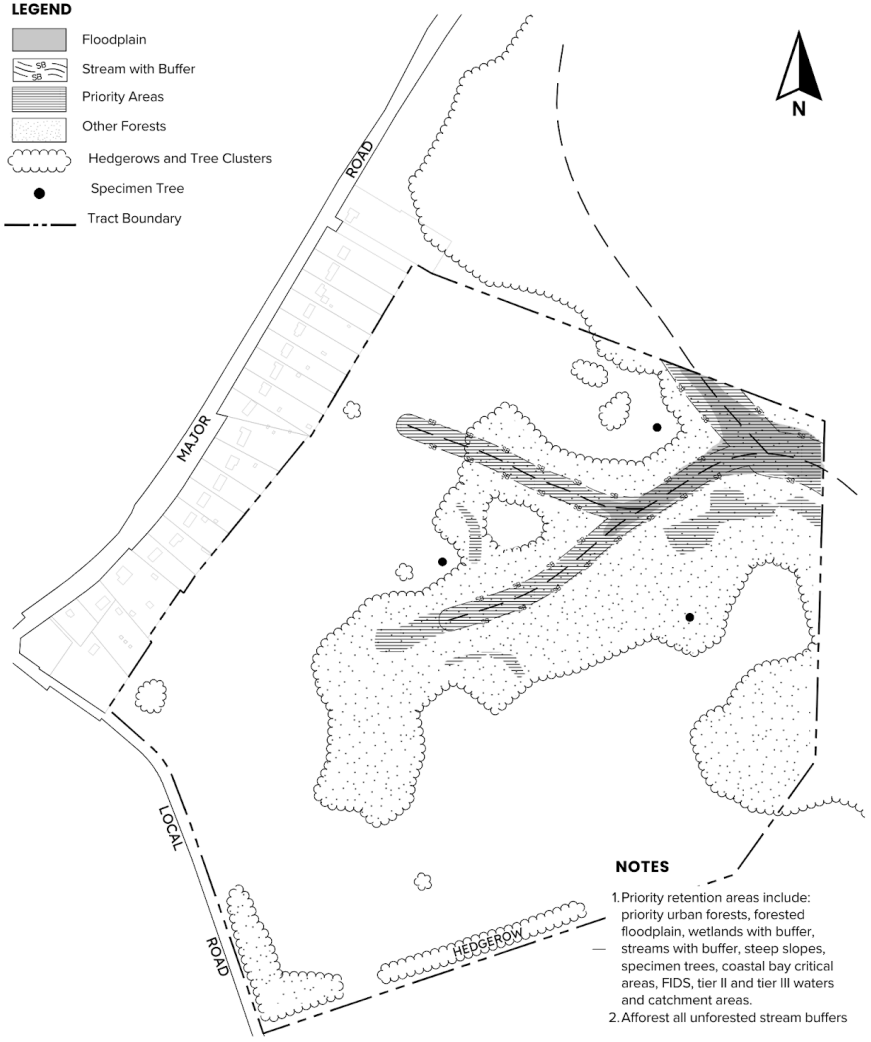
**LEGEND**

- Property Boundary
- Edge of Forest
- Well Head with Protection Buffer
- Stream Buffer
- Steep Slopes of ≥25%
- Specimen Tree
- Head of Perennial Stream

## A:10 Priority for Retention and Protection

Source: Maryland Environmental Service

MARYLAND DEPARTMENT OF NATURAL RESOURCES



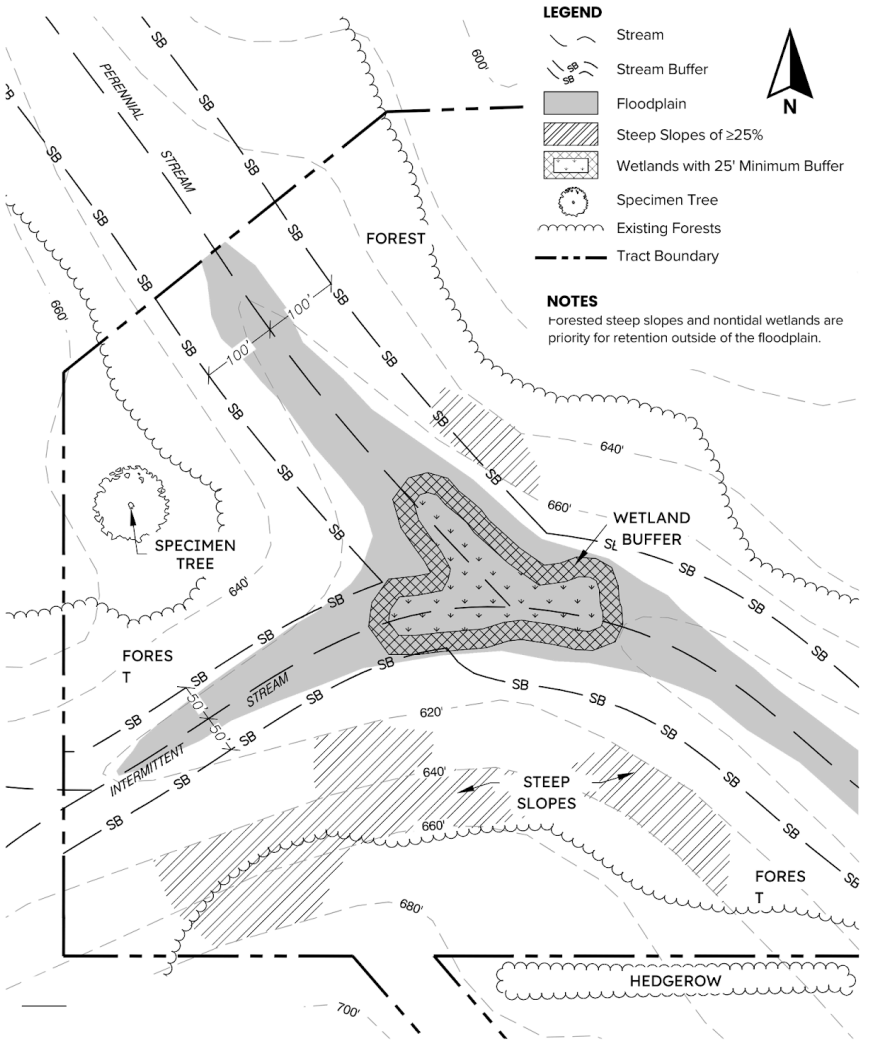

**NOTES**

1. Priority retention areas include: priority urban forests, forested floodplain, wetlands with buffer, streams with buffer, steep slopes, specimen trees, coastal bay critical areas, FIDS, tier II and tier III waters and catchment areas.
2. Afforest all unforested stream buffers

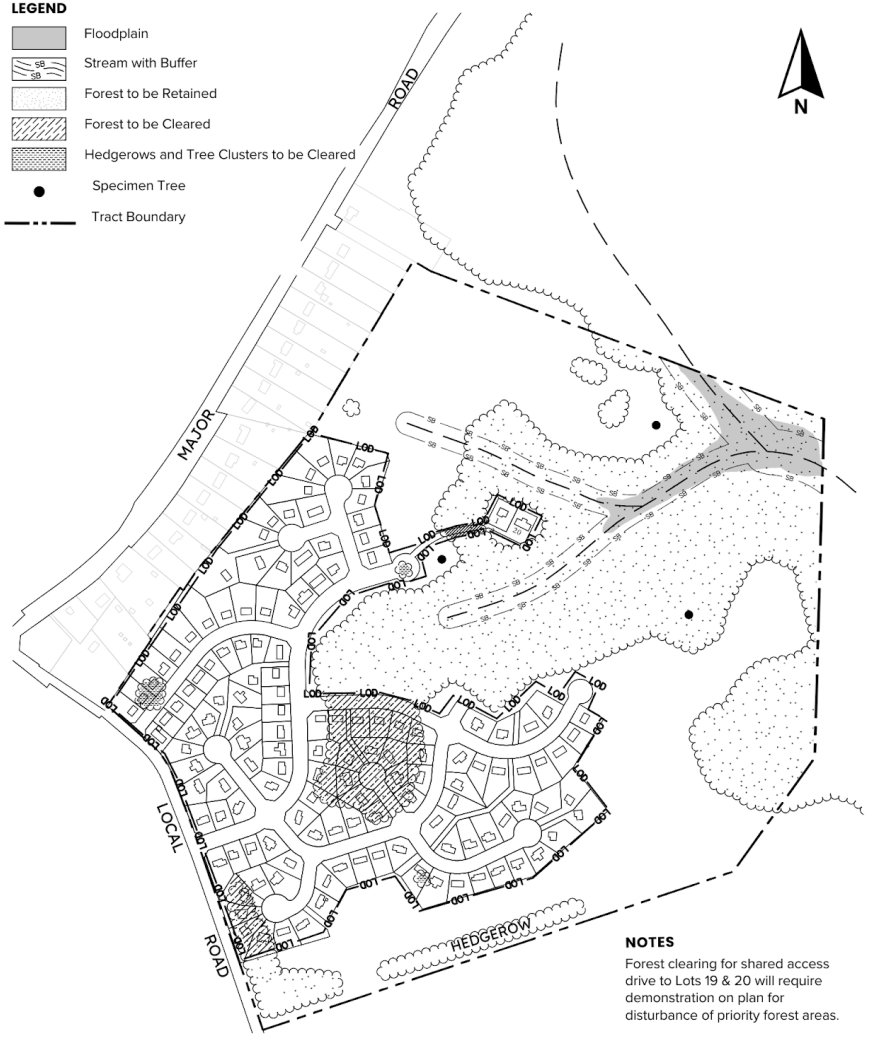
## A:11 Priority Area Map

Source: Maryland Environmental Service

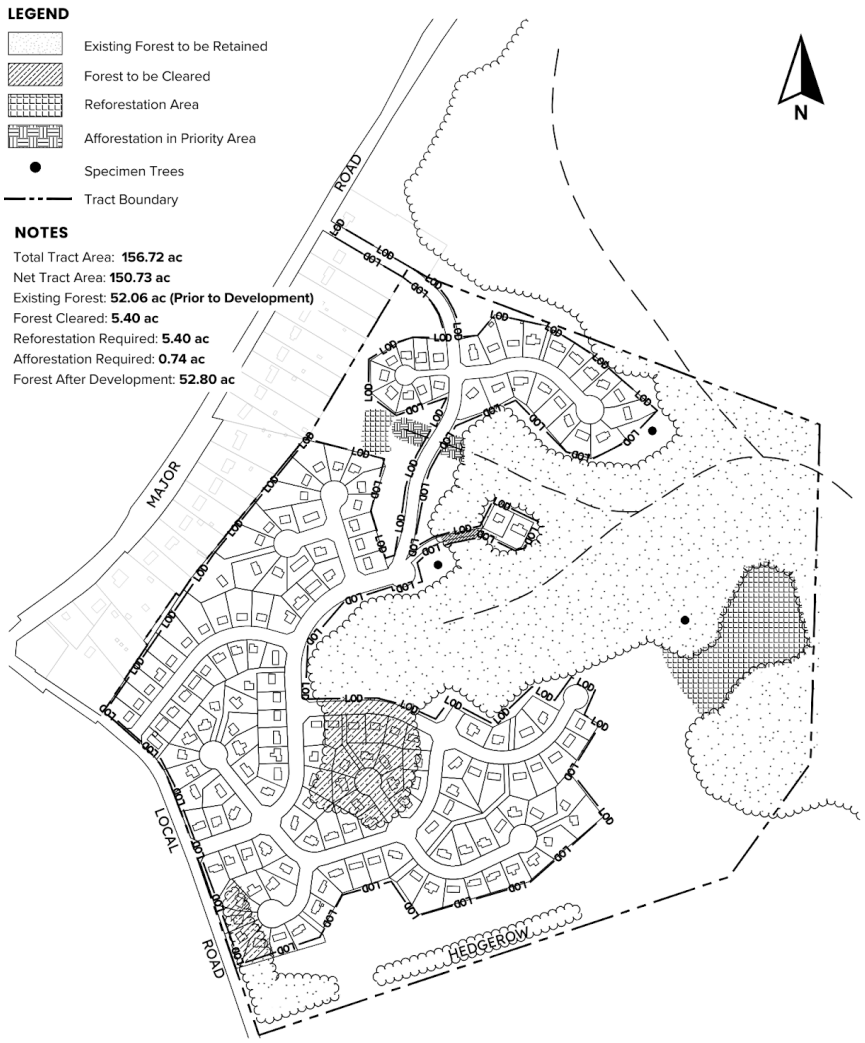
MARYLAND DEPARTMENT OF NATURAL RESOURCES




**A:12** **Closeup of Priority Areas**
Source: Maryland Environmental Service

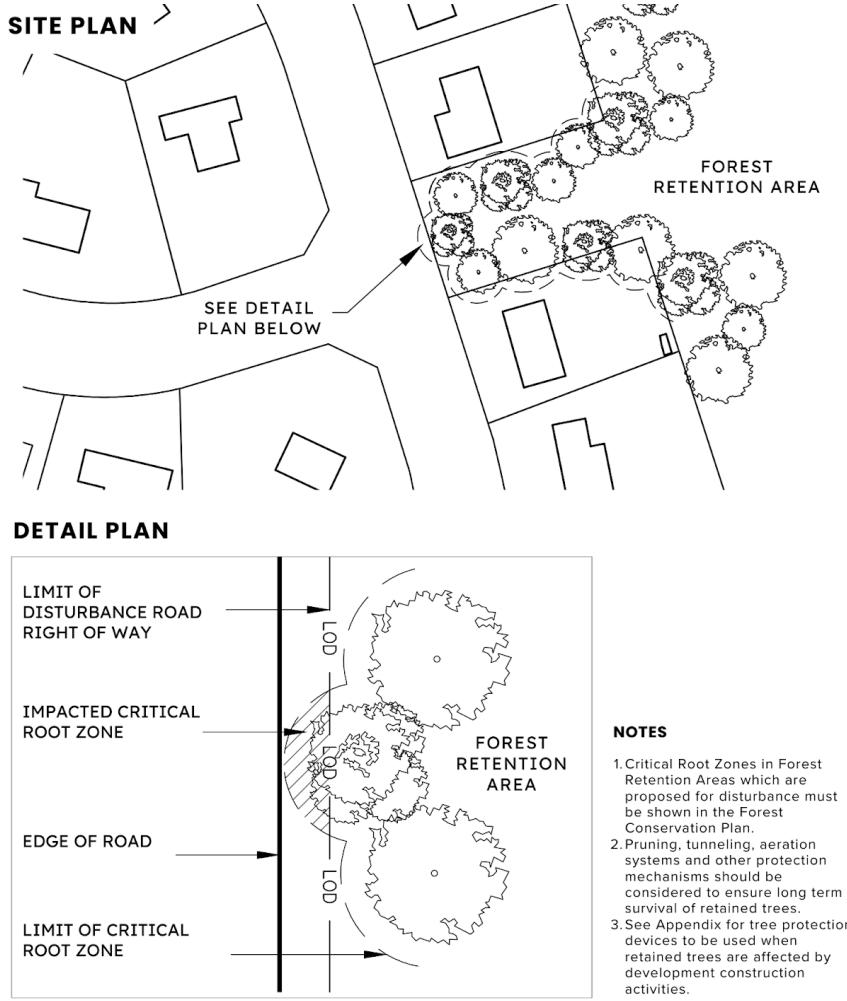



**A:13** **Forest Retention Map**
Source: Maryland Environmental Service




**A:14** **FCP Map**

Source: Maryland Environmental Service




**A:15** **Critical Root Distribution**

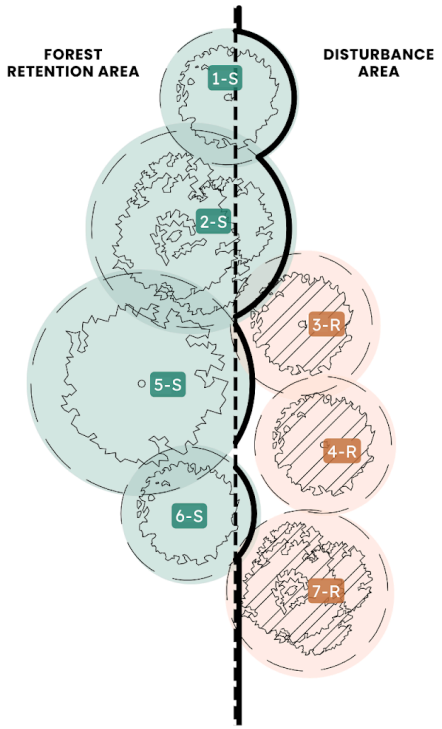
Source: Maryland Environmental Service

**LEGEND**

- Critical Root Zone (CRZ)
- Preliminary Retention
- Edge Final Retention
- Edge
- **R** Tree to be Removed
- **S** Tree to be Saved

**NOTES**

1. 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 restoration line.
2. Preliminary retention edge is offset 1' from the final retention edge for clarity.




| Tree | Status | Notes |
|---|---|---|
| 1 | Save | Preliminary retention edge impacting >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 is not impacting >30% of CRZ. |
| 6 | Save | Preliminary retention edge is not impacting >30% of CRZ. |
| 7 | Remove | Preliminary retention edge is over trunk. |

## A:16 Field Edge Determination

Source: Maryland Environmental Service

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## 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
- Desiccation
- Toxins
- Changes in soil pH
- Removal of understory

## A:17 Protecting Trees During Construction

Source: Maryland Environmental Service

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| | Stems Required per Acre<br>minimum cavity width = 1.5" | Approximate Spacing<br>Feet on center | Survivability requirement<br>At the end of the 2nd growing season | |
|---|---|---|---|---|
| **Bare Root Seedlings or Whips** | 700 | 8 x 8 | 55% | 385 |
| **Seedling Tubes** CONTAINER GROWN | 450 | 10 x 10 | 65% | 290 |
| **1-3 gal** CONTAINER GROWN | 350 | 12 x 12 | 75% | 260 |
| **5,7 gal or 1" Caliper B&B** CONTAINER GROWN | 200 | 15 x 15 | 85% | 170 |
| **15, 25 gal or 1.5" - 2.0" Caliper B&B** CONTAINER GROWN | 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 fulfil 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.

## A:18 Site Stocking

Source: Maryland Environmental Service

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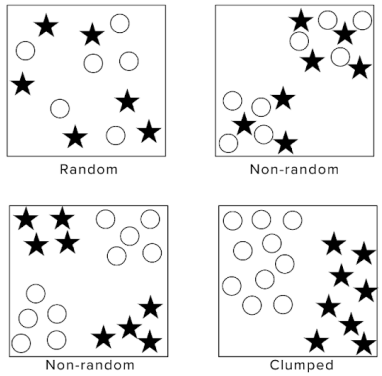
### Positive and Negative Association




★ SPECIES 1

○ SPECIES 2

**NOTE**

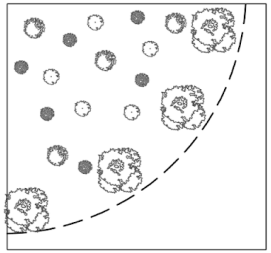
Naturally occurring populations of tree tend to be found in informal groupings. A cluster of trees is really amosaic of different species groups. The objective of an afforestation/reforestation plan is to select the appropriate species and distribution pattern for a chosen site that mimics natural patterns.

### 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.

### 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.

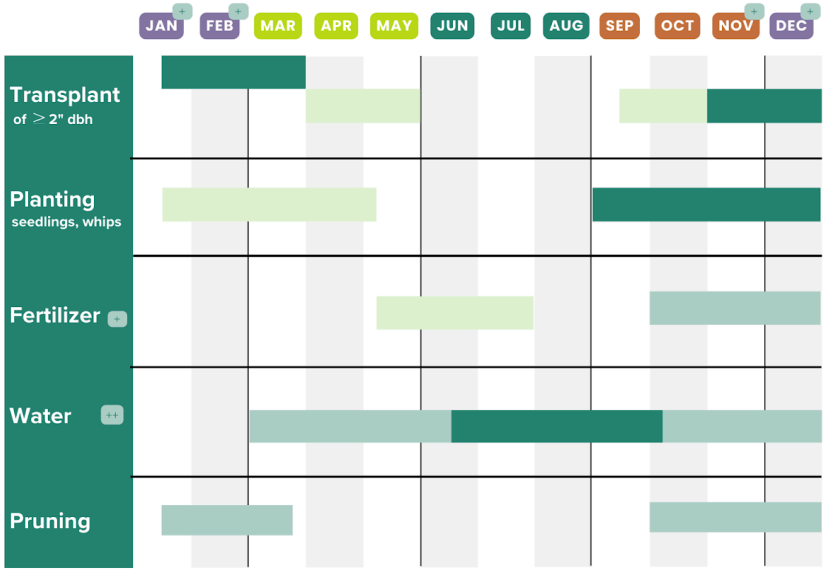
Smaller Stock

Protective Fencing

## A:19 Planting Distribution Pattern

Adapted from Forest Conseration Manual, 1991

MARYLAND DEPARTMENT OF NATURAL RESOURCES




**LEGEND**

- Recommended
- Recommended, Optimal Time
- Recommended, with Additional Care
- \+ Dependent Upon Site Conditions
- ++ Dependent Upon Site Conditions: Weekly Watering is Strongly Recommended from May - October Unless Weekly Rainfall Equals 1".

**NOTES**

1. Activities during Nov - Feb depends on ground conditions. The planting and care of trees is most successful when coordinated with the local conditions.
2. This calendar summarizes some of the recommended time frames for basic reforestation and stress reduction activities.

**A:20** **Tree Planting and Maintenance Calendar**

Source: Maryland Environmental Service

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Appendix B

# Glossary of Terms

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

**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.

**Caliper** - tree stem 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.

**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 MD.

**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 (CRZ)** - 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, the CRZ 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 CRZ 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.

**Degraded Forest** - A forest ecosystem that has lost its natural structure, function, and/or diversity due to human activity or other disturbances, leading to diminished capacity to regenerate and provide ecosystem services.

**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; 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 (FCP)** - 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.

**Forest Management** - Any human intervention in a forest ecosystem, guided by a stewardship plan written by a licensed forester or qualified professional, that is intended to produce specific environmental, economic, and/or social objectives.

**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 (FSD)** - 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.

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

**Planted Green Infrastructure** - An approach using plants, soil, and other organic materials within a landscaped environment to imitate certain ecological functions of a natural system.

**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.

**Multifamily Housing** - a single structure containing at least 25 dwelling units.

**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 non forested 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 MD.

**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.

**Priority Urban Forests** - forests in urban areas that are most important for providing wildlife habitat or mitigating flooding, high temperatures, or air pollution; as delineated by the Departments mapping.

**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 an 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%.

**Stream Buffer** - all lands lying within 50 feet, measured from the stream channel of any intermittent stream or within 100 feet measured from the stream channel of any perennial 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.

**Transit Oriented Development** - as defined under § 7–101 of the Transportation Article.

**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, ‘Iract"

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 Canopy** - The crowns of deciduous and evergreen woody vegetation that is the product of natural growth or human planting and is greater than three (3) meters in height.

**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 warranted 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

# Figures and Worksheets

**Chapter 1: Introduction**

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1:2 - Forest Conservation Procedures
1:3 - Case Study: Before and After Development

**Chapter 2: Forest Stand Delineations**

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2:2 - Simplified FSD Checklist
2:3 - Simplified FSD Map
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2:5 - Intermediate FSD Checklist
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**Chapter 3: Forest Conservation Plans**

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3:2 - Forest Retention Area Decision Matrix
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3:4 - Example 4: Afforestation, No Clearing
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3:10 - Forest and Tree Protection Devices
3:11 - Forest and Tree Protection Checklist
3:12 - Reforestation and Afforestation Procedures
3:13 - Reforestation and Afforestation Checklist

| Data Source | Maintaining Agency | URL (Last Updated: December 2024) |
|---|---|---|
| BioNet | MD Deptartment of Natural Resources | https://geodata.md.gov/imap/rest/services/Biota/MD_BiodiversityConservationNetwork/MapServer/0 |
| Chesapeake Bay Critical Area | MD Deptartment of Natural Resources | https://geodata.md.gov/imap/rest/services/Environment/MD_CriticalAreas/MapServer/1 |
| Coastal Bay Watersheds | MD Deptartment of Natural Resources | https://services.arcgis.com/njFNhDsUCentVYJW/arcgis/rest/services/Coastal_Bays/FeatureServer/0 |
| Forest Interior Dwelling Species | MD Deptartment of Natural Resources | https://geodata.md.gov/imap/rest/services/Biota/MD_LivingResources/FeatureServer/10 |
| Maryland Habitat Connectivity Network - Hubs Corridors and Gaps | MD Deptartment of Natural Resources | https://geodata.md.gov/imap/rest/services/Biota/MD_HabitatConnectivityNetwork/MapServer/0 |
| Maryland Inventory of Historic Properties | MD Historical Trust | https://geodata.md.gov/imap/rest/services/Historic/MD_InventoryHistoricProperties/FeatureServer/0 |
| MD Floodplains | MD Deptartment of Natural Resources | https://geodata.md.gov/imap/rest/services/Hydrology/MD_Floodplain/MapServer |
| MD Protected Lands | MD Deptartment of Natural Resources | https://geodata.md.gov/imap/rest/services/Environment/MD_ProtectedLands/MapServer |
| MD Tier II High Quality Waters | MD Department of Environment | https://mdewin64.mde.state.md.us/arcgis/rest/services/MDE_Water_Quality/MD_TierIIHighQualityWaters_2022/MapServer |
| MDE Final EJ Score (%ile score) | MD Department of Environment | https://mdewin64.mde.state.md.us/arcgis/rest/services/MDE_EJ/MDE_EJ_Score_All/MapServer/0 |
| MDE Rivers, Streams, Lakes, Reservoirs, Tidal Waters | MD Department of Environment | https://mdewin64.mde.state.md.us/arcgis/rest/services/MDE_Water_Quality/MDE_UseClasses/MapServer |
| National Hydrography Dataset - Streams | U.S. Geological Survey | https://www.usgs.gov/national-hydrography/national-hydrography-dataset |
| National Register of Historic Places | MD Historical Trust | https://geodata.md.gov/imap/rest/services/Historic/MD_NationalRegisterHistoricPlaces/FeatureServer/0 |
| **Priority Urban Forest Areas** | MD Department of Natural Resources | https://services.arcgis.com/njFNhDsUCentVYJW/arcgis/rest/services/UrbanPriorityForests/FeatureServer/0 |
| Sensitive Species Project Review Area | MD Department of Natural Resources | https://geodata.md.gov/imap/rest/services/Biota/MD_LivingResources/MapServer/6 |

## Forest Sample Plot Data Sheet

| | | | | | |
|---|---|---|---|---|---|
| Property: | | Stand #: | | Sheet #: | / |
| Prepared by: | | Plot #: | | Plot Succesional Stage: | |
| Date: | | Plot Size: | | | |

| Basal Area: (sf/acre) | | # of Trees 2-5.9" dbh | | | # of Trees 6-9.9" dbh | | | # of Trees 10-17.9" dbh | | | # of Trees 18-29.9" dbh | | | # of Trees >30" dbh | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tree Species: | Crown Position: | DOM | COD | OTH | DOM | COD | OTH | DOM | COD | OTH | DOM | COD | OTH | DOM | COD | OTH | |
| 1. | | | | | | | | | | | | | | | | | |
| 2. | | | | | | | | | | | | | | | | | |
| 3. | | | | | | | | | | | | | | | | | |
| 4. | | | | | | | | | | | | | | | | | |
| 5. | | | | | | | | | | | | | | | | | |
| 6. | | | | | | | | | | | | | | | | | |
| 7. | | | | | | | | | | | | | | | | | |
| 8. | | | | | | | | | | | | | | | | | |
| Total # Trees per Size Class | | | | | | | | | | | | | | | | | |
| # Standing Dead Trees ≥6" dbh | | | | | | | | | | | | | | | | | |

**1/1,000 Acre Samples**

| List of Common Understory Species, 3'-20' | % Canopy Coverage | | | | | | % Invasive Cover | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | C | N | E | S | W | Total | C | N | E | S | W | Total |
| List of Herbacious Species, 3'-20' | % Understory Cover, 3'-20' | | | | | | % Herb/Woody Cover, 0'-3' | | | | | |
| | C | N | E | S | W | Total | C | N | E | S | W | Total |
| List of Invasive Species | Comments: | | | | | | | | | | | |

**C:1** **Forest Sampling Data Worksheet**
Adapted from: Prince George's County Planning Department

## Forest Stand Summary

| | | | |
|---|---|---|---|
| Property: | | Prepared by: | |
| Location: | | Date: | |
| | | Sheet #: | / |

| Stand Variable | Stand # | Stand # |
|---|---|---|
| 1. Dominant species / Codominant species | | |
| 2. Succesional Stage | | |
| 3. Basal area (sf per acre) | | |
| 4. Size class of dominant species | | |
| 5. Canopy closure (%) | | |
| 6. Tree species per acre (#) | | |
| 7. Common understory species | | |
| 8. Understory cover, 3'-20' (%) | | |
| 9. Woody plant species, 3'-20' (#) | | |
| 10. Common herbacious species, 0'-3' | | |
| 11. Herbacious & woody plant cover, 0'-3' (%) | | |
| 12. List of major invasive plant species & cover (%) | | |
| 13. Standing dead trees, ≥6" dbh | | |
| 14. Comments | | |

**C:2** **Forest Stand Summary Worksheet**
Source: Maryland Forest Service

## Forest Stand Summary

| | | | |
|---|---|---|---|
| Property: | | Prepared by: | |
| Location: | | Date: | |
| | | Sheet #: | / |

| Stand Variable | Stand # | Stand # |
|---|---|---|
| 1. Dominant species / Codominant species | | |
| 2. Succesional Stage | | |
| 3. Basal area (sf per acre) | | |
| 4. Size class of dominant species | | |
| 5. Canopy closure (%) | | |
| 6. Tree species per acre (#) | | |
| 7. Common understory species | | |
| 8. Understory cover, 3'-20' (%) | | |
| 9. Woody plant species, 3'-20' (#) | | |
| 10. Common herbacious species, 0'-3' | | |
| 11. Herbacious & woody plant cover, 0'-3' (%) | | |
| 12. List of major invasive plant species & cover (%) | | |
| 13. Standing dead trees, ≥6" dbh | | |
| 14. Comments | | |

**C:3** **Forest Stand Summary Worksheet**
Source: Maryland Forest Service

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

| | | | | |
|---|---|---|---|---|
| **Net Tract Area** | | | | |
| A. | Total Tract Area | A = | | ac |
| B. | Deductions (Critical Area, area restricted by local ordinance or program, exising impervious surfaces) | B = | | ac |
| C. | Net Tract Area | C = | | ac |
| | C = Total Tract (A) - Deductions (B) | | | |
| **Land Use Category:** | | | | |
| D. | Afforestation Requirement % (see chart below) | D = | | % |
| E. | Afforestation Requirement | E = | | ac |
| | E = Net Tract Area (C) x % (D); If project is a Solar Photovoltaic Facility, enter 0 | | | |
| **Existing Forest Cover** | | | | |
| F. | Unforested Riparian Buffers; If project is a Solar Photovoltaic Facility, enter 0 | F = | | ac |
| G. | Existing Forest Cover within the Net Tract Area | G = | | ac |
| **Proposed Forest Clearing** | | | | |
| H. | Area of Forest to be Cleared that is in a Priority Funding Area (but not in a Priority Retention Area) | H = | | ac |
| I. | None Priority Area of Forest to be Cleared | I = | | ac |
| | I = Total Forest to be Cleared - Forests in Priority Funding Area (but not in a Priority Retention Area) H | | | |
| J. | Total Area of Forest to be Retained | J = | | ac |
| | J = Existing Forest Cover (G) - None Priority Area of Forest to be Cleared (I) | | | |
| **Planting Requirements** | | | | |
| K. | Afforestation Required | K = | | ac |
| | If Existing Forest Cover (G) < Afforestation Requirement (E), then K = Afforestation Requirement (E) - Existing Forest Cover (G); if not K = 0 | | | |
| L. | Reforestation for Clearing Required | L = | | ac |
| | L = None Priority Area of Forest to be Cleared (I) + (0.5 x Forest to be Cleared in Priority Funding Area (H)) | | | |
| M. | Semi-Total Afforestation and Reforestation for Clearing M = K + L | M = | | ac |
| N. | Unforested Riparian Buffer Planting Required N = F - M | N = | | ac |
| P. | Total Planting Required | P = | | ac |
| | P = Afforestation Required (K) + Riparian Buffer Afforestation (N) + Reforestation Required (L) | | | |
| Q. | Total Minimum Area to be Placed in Easement J + P | Q= | | ac |

| Afforestation Requirments by Land Use Category | |
|---|---|
| Agriculture and Resource Areas | 20% |
| Medium Density Residential | 20% |
| Institutional Development Areas | 15% |
| High Density Residential Areas | 15% |
| Mixed Use and Planned Unit Development Areas | 15% |
| Commercial and Industrial Use Areas | 15% |

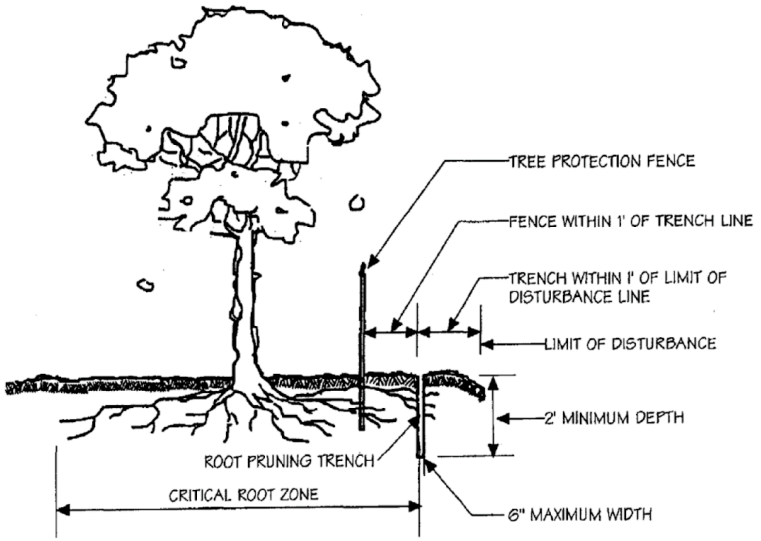
This worksheet assumes that the unforested riparian buffers will be afforested and/or reforested as part of the other required mitigation. In the event that a project fullfills their required afforestation and reforestation mitigation without afforesting and/or reforesting their unforested stream buffers, those buffers will have to be afforested and reforested in addition to the required mitigation calculated within this worksheet.

**C:4** **Forest Conservation Worksheet**
Source: Maryland Forest Service

Appendix D

# Sample Details and Specifications


**D.1.** Root Pruning
**D:2** Tree Pruning
**D:3** Application of Fertilizers
**D:4** Construction Signs
**D:5** Plastic Mesh Tree Protection
**D:6** Wire Tree Protection Fence
**D:7** Snow Fence
**D:8** Silt Fence and Tree Protection
**D:9** Sidewalk above CRZ
**D:10** Aeration for Paving above CRZ
**D:11** Tree Well and Aeration System
**D:12** Closeup of Priority Areas
**D:13** Retaining Walls
**D:14** Reinforced Pier and Panel Wall
**D:15** Tunneling
**D:16** Container Grown and B&B Planting Techniques
**D:17** Handling Bare Root Stock
**D:18** Seedling and Whip Planting Techniques
**D:19** Seedling Planting Techniques
**D:20** Tree Staking and Guying Specifics
**D: 21** Reforestation and Afforestation Area Signs

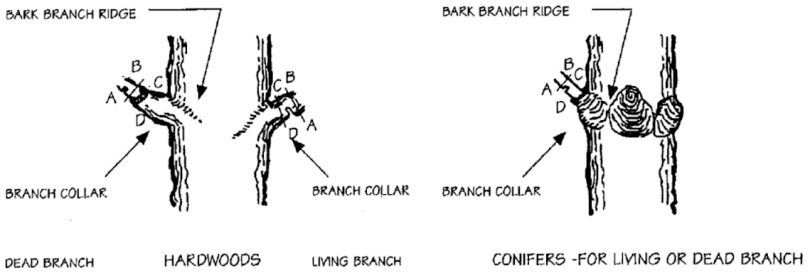




Notes:
1. Retention Areas to be established as part of the forest conservation plan review process.
2. Boundaries of Retention Areas to be staked, flagged and/or fenced prior to trenching.
3. Exact location of trench should be identified.
4. Trench should be immediately backfilled with soil removed or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

**D:1** **Root Pruning**
Source: Adapted from Forest Conservation Manual, 1991

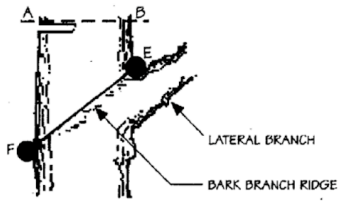
MARYLAND DEPARTMENT OF NATURAL RESOURCES

## 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

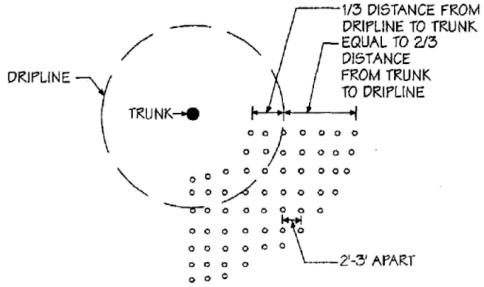



Notes:
1. Remove top weight by undercutting at A and remove limb by cutting through AB.
2. Remove stub at EF parallel to the bark branch ridge.
3. Only prune at specified times.
4. No more than 30% of crown to be removed at one time.
5. Diameter of lateral branch should be no less than 30% of the diameter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

**D:2** **Tree Pruning**

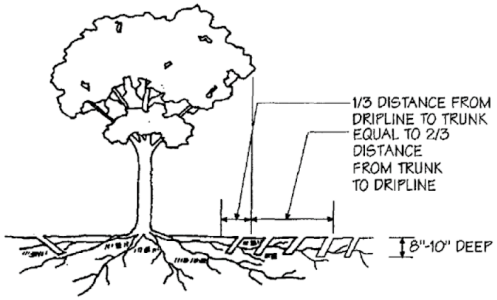
Source: Fairfax County, Virginia: Vegetation Preservation & Planting, January 1986

## Vertical Mulching or Fertilizing




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

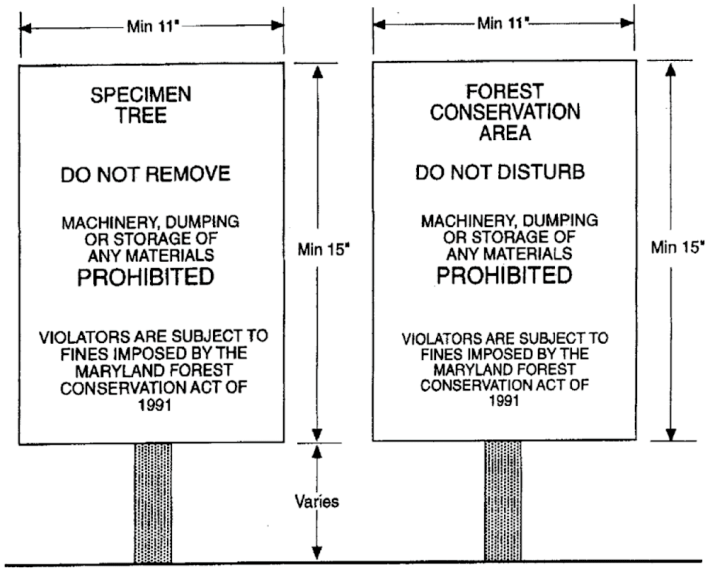
## Application of Fertilizer by Injection




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

**D:3** **Application of Fertilizers**

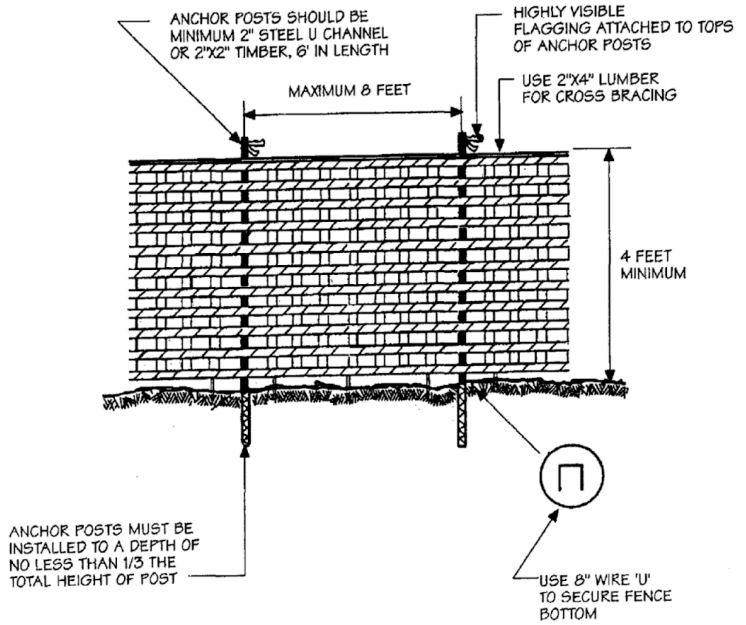
Source: UMCP




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

## D:4 Construction Signs

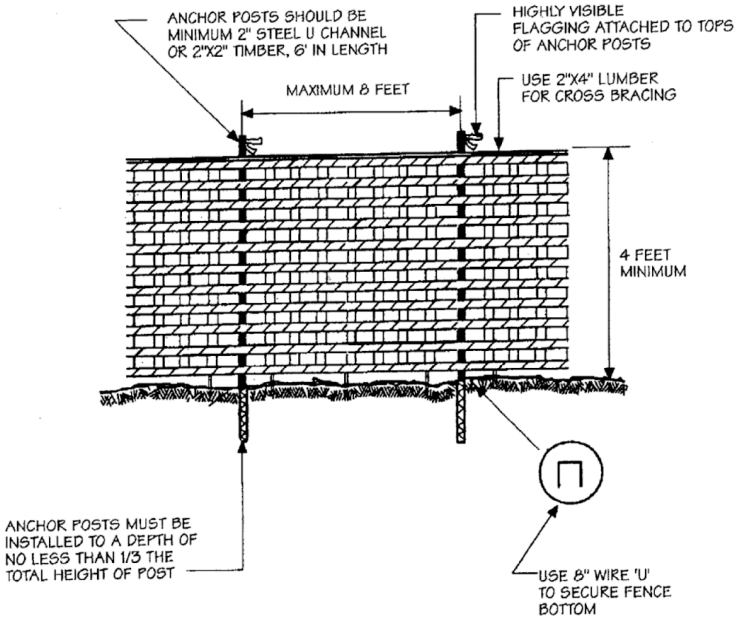
Source: Adapted from Forest Conservation Manual, 1991




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.

## D:5 Plastic Mesh Tree Protection

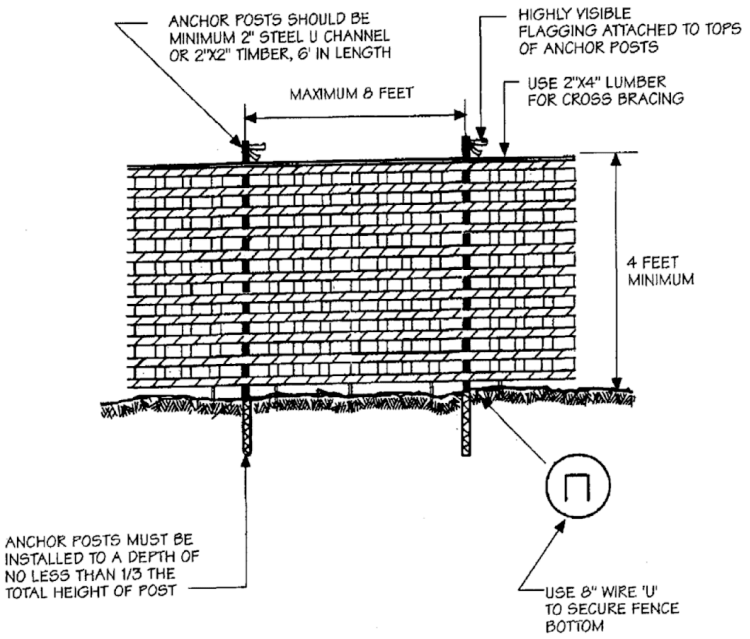
Source: Adapted from Prince George's County, Woodland Conservation Manual, 1991




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.

## D:6 Wire Tree Protection Fence

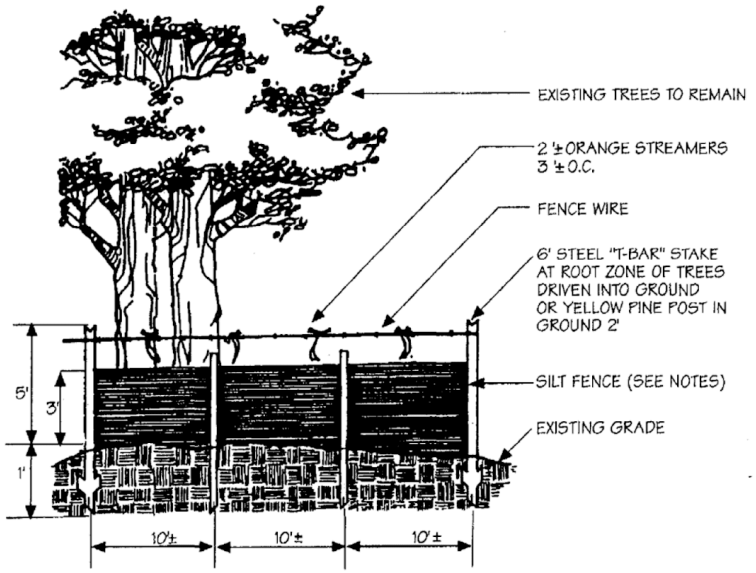
Source: Adapted from Prince George's County, Woodland Conservation Manual, 1991




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.

## D:7 Snow Fence

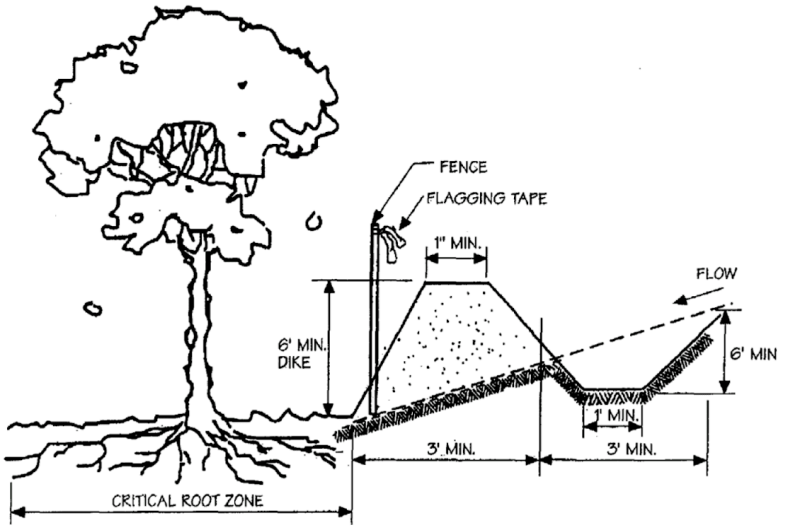
Source: Adapted from Prince George's County, Woodland Conservation Manual, 1991




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.

**D:8** **Silt Fence and Tree Protection**

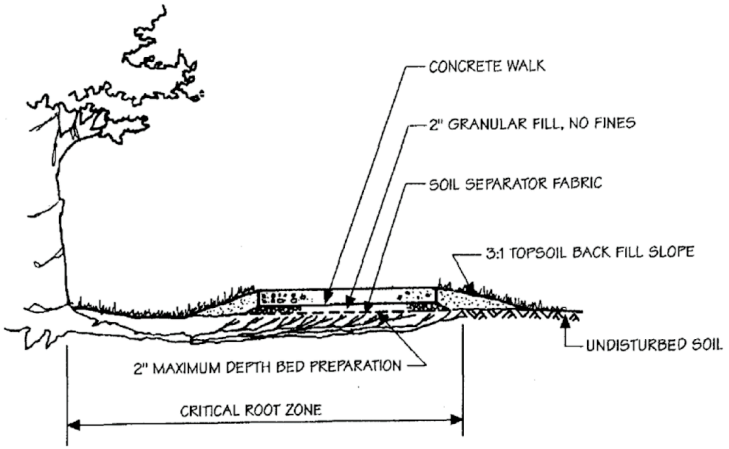
Source: Adapted from Steve Clark & Associates/ACRT, Inc.




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.

**D:9** **Earth Dike & Swale Combination Device**

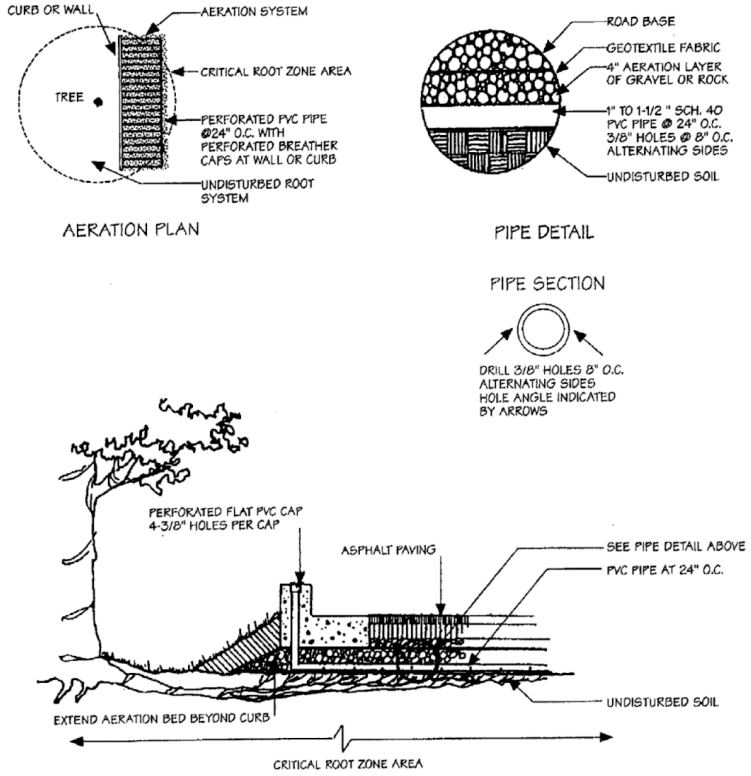
Source: Adapted from Prince George's County, Woodland Conservation Manual, 1991




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.

## D:10 Sidewalk above CRZ

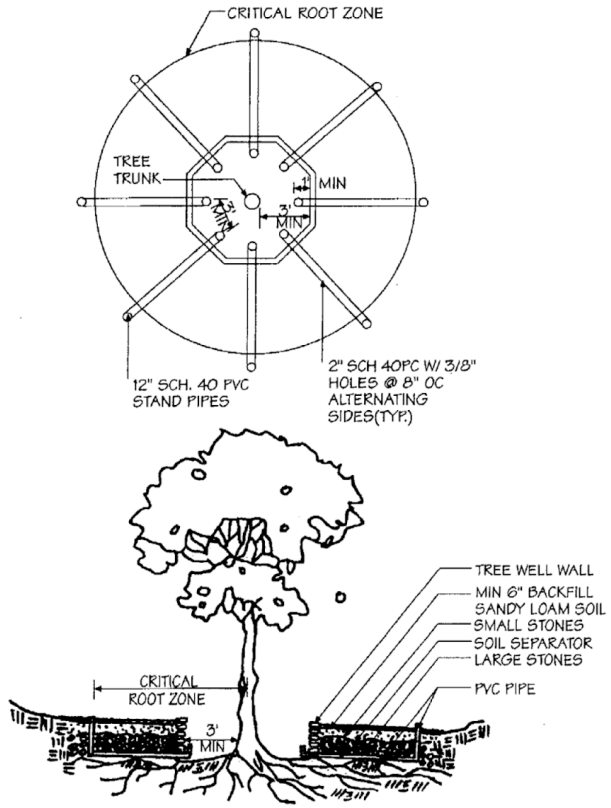
Source: Adapted from Steve Clark & Associates/ACRT, Inc.




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.

## D:11 Aeration for Paving above CRZ

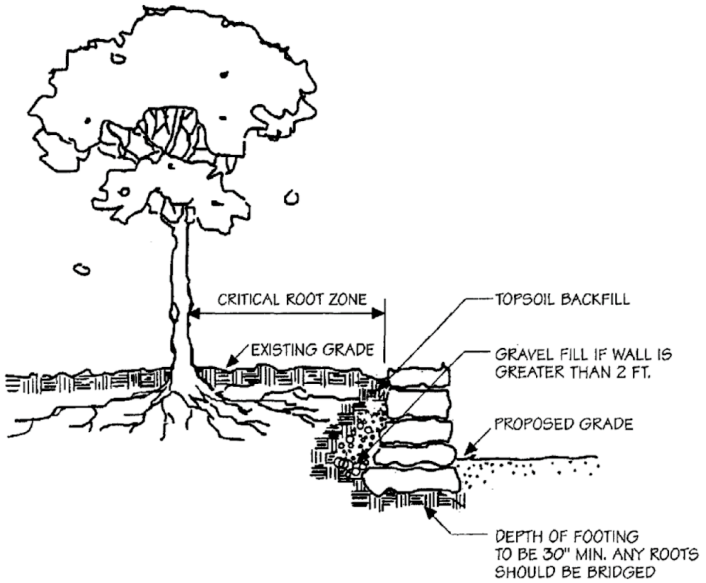
Source: Adapted from Steve Clark & Associates/ACRT, Inc.




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.

## D:12 Tree Well and Aeration System

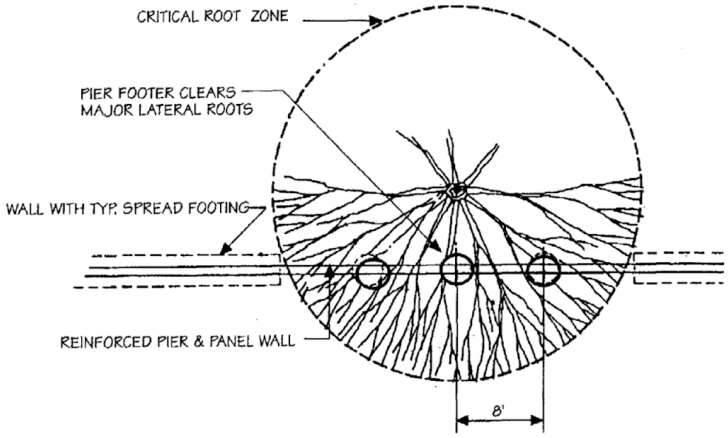
Source: UMCP




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

## D:13 Retaining Walls

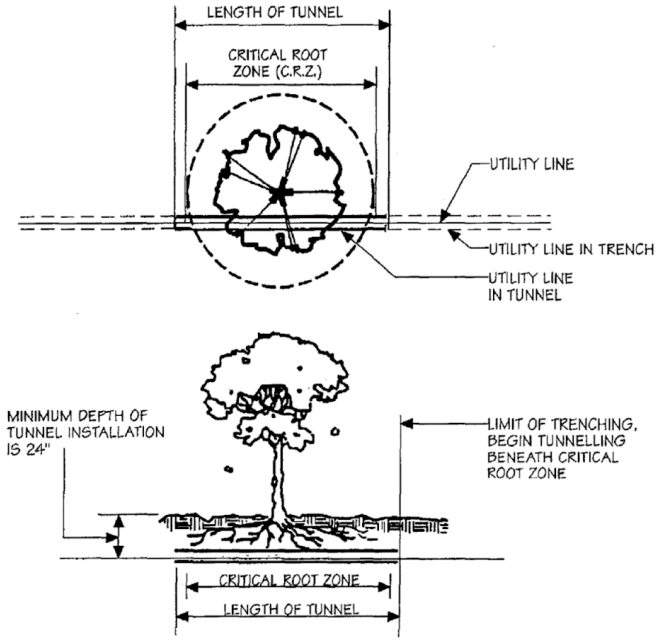
Source: Adapted from Fairfax County, VA: Vegetation Preservation and Planting, 1986




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.

## D:14 Reinforced Pier and Panel Wall

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



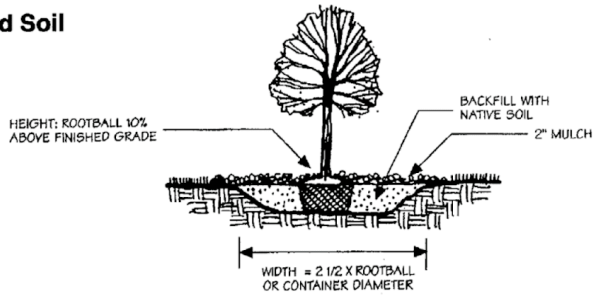

Notes:
Tunnel should be located under Critical Root Zone at a minimum depth of 24 inches.

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

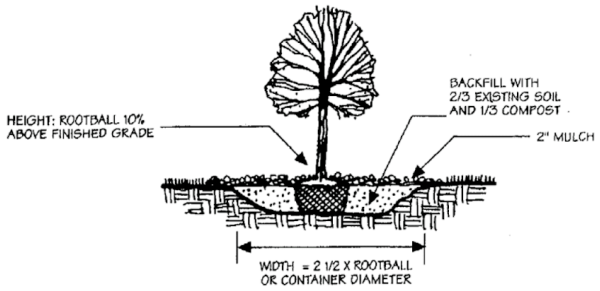
## D:15 Tunneling

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

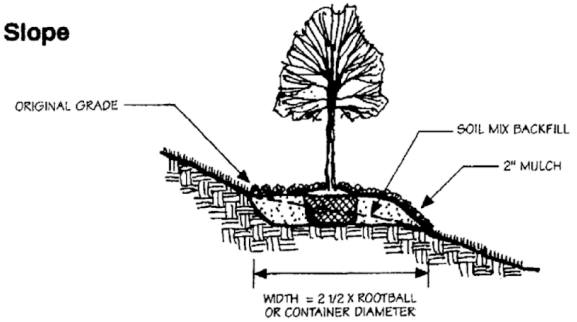
## Undisturbed Soil




## Disturbed Soil




## Planting on Slope




**D:16** **Container Grown and B&B Planting Techniques**

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

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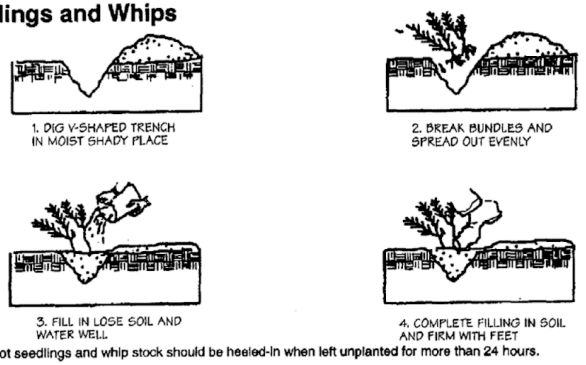
## Handling Seedlings in the Field

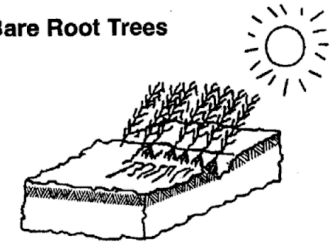

Note:
1. Bare root seedlings and whip stock should be heeled-in when left unplanted for more than 24 hours.

## Seedlings and Whips




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

**D:17** **Handling Bare Root Stock**

Source: Adapted from Forest Conservation Manual, 1991

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## 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

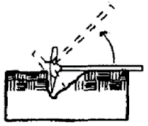
Correct
AT SAME DEPTH

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.

**D:18** **Seedling and Whip Planting Techniques**

Source: Adapted from Forest Conservation Manual, 1991

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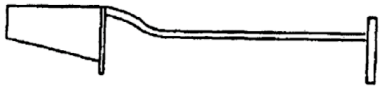
## Planting With Dibble Bar



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

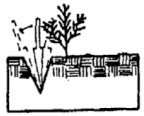
2. REMOVE DIBBLE AND PLACE SEEDLING AT CORRECT DEPTH

3. INSERT DIBBLE 2 INCHES TOWARD PLANTER FROM SEEDLING

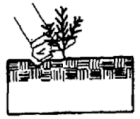
4. PULL HANDLE OF DIBBLE TOWARD PLANTER FIRMING SOIL AT BOTTOM OF ROOTS

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

**D:19** **Seedling Planting Techniques**

Source: Adapted from Forest Conservation Manual, 1991

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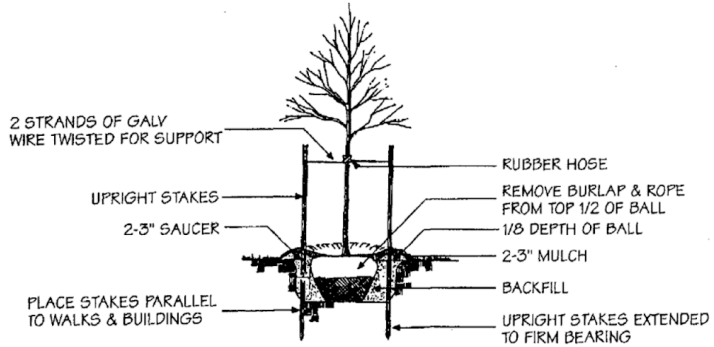
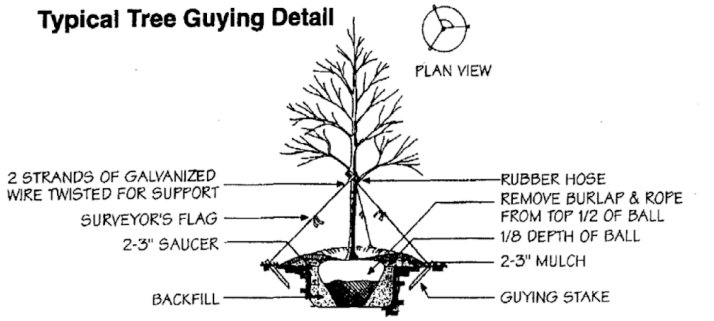
## Typical Upright Staking Detail



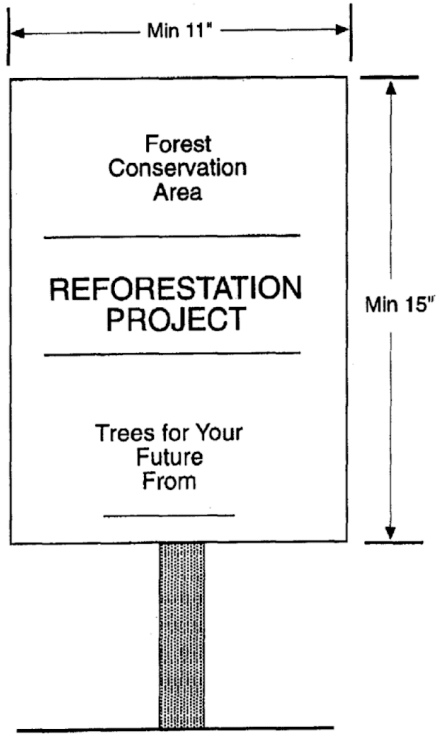

## Typical Tree Guying Detail




| 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" |

**D:20** **Tree Staking and Guying Specifics**

Source: Adapted from Forest Conservation Manual, 1991


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

**D:21** **Reforestation and Afforestation Area Signs**

Source: Adapted from Forest Conservation Manual, 1991