

PART 3

INTEGRATED GUIDELINES

The Purpose of Integrated Guidelines

The purpose of integrated forest management guidelines is to provide consistent, coordinated guidance in sustaining many of the functions and values of our forest resources, including (as outlined in Part 2) cultural resources, forest soil productivity, riparian areas, visual quality, water quality and wetlands, and wildlife habitat.

Forest management includes a broad diversity of activities related to using, maintaining and sustaining Minnesota forests. Major forest management activities, which these integrated guidelines address, include:

- Forest road construction and maintenance
- Timber harvesting
- Site preparation
- Pesticide use
- Reforestation
- Timber stand improvement
- Fire management
- Forest recreation management

These guidelines focus on *how* to protect the functions and values of forest resources during forest management activities. They *do not* provide advice on *whether* to manage or *which* management activities are needed.

How the Guidelines Will Help Sustain Forest Resources

The following outcomes identify the overall benefits of these integrated forest management guidelines. Addressing six forest resources (cultural resources, forest soil productivity, riparian areas, visual quality, water quality and wetlands, and wildlife habitat), the guidelines for forest management activities provide substantial benefits to the sustainability of forest ecosystems by:

- Increasing awareness of cultural resources among forest landowners, resource managers and loggers, and protecting important cultural resources.
- Maintaining the productive capacity of forest soils, to favor the regeneration, survival and long-term growth of desired forest vegetation.
- Maintaining and enhancing vegetation within riparian areas for the benefit of water quality, fish and wildlife, timber products, recreation and aesthetics.
- Maintaining and enhancing scenic quality in forested areas for the enjoyment of tourists, recreational users and local travelers.
- Maintaining water quality and protecting wetlands.
- Encouraging stewardship of wildlife habitat and forest communities, including all organisms that depend on forests for all or part of their needs.

Two Types of Guidelines: General and Activity-Specific

The guidelines that provide these benefits to forest resource sustainability are divided into two groups: general guidelines, which are common to many forest management activities; and activity-specific guidelines, which apply to specific forest management activities.

The guidelines are supplemented from time to time by “Additional Considerations,” which provide additional guidance to further promote the sustainability of forest resources.

GENERAL GUIDELINES

Common to Many Forest Management Activities

These forest management guidelines are designed to help sustain the following forest resources: cultural resources, forest soil productivity, riparian areas, visual quality, water quality and wetlands, and wildlife habitat. These guidelines are applicable to many forest management activities, including forest road construction and maintenance, timber harvesting, mechanical site preparation, pesticide use, reforestation, timber stand improvement, fire management and forest recreation management.

While many guidelines address only one or two particular forest management activities, a number of the guidelines are applicable to many activities. For example, guidelines for managing fuel and lubricants or maintaining coarse woody debris are not specific to any one forest management activity; they apply to all activities, as do guidelines for goal-setting and conducting a preliminary site inventory.

These general guidelines represent a basic framework for sustaining forest ecosystems, providing a common foundation of “how-to’s” that apply to many different management activities.

ACTIVITY-SPECIFIC GUIDELINES

*Applicable to
Particular Forest Management Activities*

Beyond the general guidelines, which share a common application to many—if not all—forest management activities, many guidelines apply to particular forest management activities. These activity-specific guidelines are unique to a particular activity. They are designed to work together with the general guidelines to provide a coordinated framework for helping ensure the sustainability of the functions and values of our forest resources.

Within activity-specific guidelines, frequent references back to the general guidelines will make it easy for landowners, resource managers, loggers and others to consider all of the related guidelines—both general and specific—that apply to a particular management activity.

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Common to Many Forest Management Activities

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GENERAL GUIDELINES

Common to Many Forest Management Activities

General guidelines are divided into two sections: *Planning* and *Operational Activities*. These two sections suggest that a commitment to sustainability of forest resources is both a planning commitment and an operational commitment:

- The *Planning* section recognizes that many planning considerations related to resource protection and forest sustainability are common to most forest management activities, and that the commitment to sustainability begins in the early planning stages—long before the actual management activity begins.
- The *Operational Activities* section focuses on general on-site guidelines that carry out the commitment to sustainability that was begun during the planning phase.

REMEMBER:

Guidelines help with *how* to manage,
not *whether* to manage.

These guidelines focus on *how* to protect the functions and values of forest resources during forest management activities. They do not provide advice on *whether* to manage or which management activities are needed.

Guidelines provide a *menu*, not a *mandate*.

Site-level resource management decisions are based on many different factors, including resource needs, landowner objectives, site capabilities, existing regulations, economics and the best information available at any given time. No one will apply all of the guidelines related to a particular activity. Instead, the landowner, resource manager or logger will consider many different factors in determining which combination of guidelines provides the best “fit” for a particular site at a particular time. The intent of having multiple guidelines is to provide decision-makers with as much flexibility—and as much choice—as possible in taking steps to effectively balance forest management needs and resource sustainability.

Guidelines are supplemented from time to time
by “Additional Considerations.”

The guidelines are supplemented from time to time by “Additional Considerations,” which provide additional guidance to further promote the sustainability of forest resources.

PLANNING

Identifying Goals and Objectives

Getting started requires identifying land ownership goals and objectives. This first step may require the assistance of professionals. A few considerations related to identifying goals and objectives include the following:

- Planning for the long term is critical to managing a forest. Why? Because whatever a landowner does (or doesn't do) will have long-term effects.
- Developing a management plan will assist the landowner in determining objectives, managing efficiently, avoiding costly errors, making knowledgeable decisions and evaluating progress.
- Identifying ownership goals and objectives for the property is the first step in planning how to manage a forest. Begin by identifying the following:
 - What resources are most important: trees? soil? water? recreation? wildlife? fish?
 - What kind of inventory will have to be taken?
 - Are stated goals and objectives for the site in question really possible?

Ask these three questions:

- What does the landowner want from the forest?
 - How much does the landowner want?
 - When does the landowner want it?
- Making objectives specific will make management choices more clear. Professionals may be able to help clarify objectives and make them specific.

8 General Guidelines

- ❑ Establishing priorities is an essential step whenever multiple objectives exist.
- ❑ Once goals and objectives are identified, the next step for a landowner is to determine whether to move forward without professional assistance, or whether the assistance of professionals would be beneficial. For sources of professional assistance, see *Resource Directory*.

Conducting a Site Inventory

Conducting a site survey involves gathering information, surveying the site firsthand, and then considering a number of factors related to resource needs, landowner objectives and site capabilities. The following planning and design considerations are not all inclusive, but they do identify some of the key factors in making informed forest management decisions.

Gathering Information

U Secure aerial photographs, topographic maps, soil surveys, visual sensitivity classification maps and other tools available to provide assistance in evaluating properties and developing plans for forest management activities. Sources of this information include local Soil and Water Conservation District (SWCD) offices, local USDA Natural Resource Conservation Services (NRCS) offices, local Department of Natural Resources (DNR) offices, and county land departments. Many counties have completed soil surveys, and a number of them have also developed visual sensitivity classification maps.

For sources of these information tools, and for a list of counties that have developed visual sensitivity classification maps, see *Resource Directory*.

U Find out whether any special management considerations exist on adjacent properties. For sources of information and assistance, see *Resource Directory*.

U Check existing cultural resource inventories to determine whether any cultural resources are known to be present within the management area. For sources of cultural resource inventories, see *Resource Directory*.

U Consult a Minnesota DNR wildlife manager, forester or nongame specialist, or Minnesota Natural Heritage staff for information about the occurrence of endangered, threatened or special concern species (ETS species), sensitive communities, or sensitive sites on or near the management area prior to beginning management activities. For additional contact information, see *Resource Directory*.

U Determine whether permits are required from the DNR for crossing of intermittent or perennial streams and open water wetlands. See *Appendix H: Work Activities That Do Not Require a DNR Protected Waters Permit*.

Additional Consideration

↳ Consider doing additional research on the history of the project area, especially if existing cultural resource inventories contain no information about the area. Such research efforts may include checking existing maps, air photos and printed historical information, as well as contacting individuals knowledgeable about local history or archaeology. For additional information, see *Part 2: Cultural Resources* and *Resource Directory*.



The preliminary site survey evaluates many resources, features and site conditions, including soil characteristics, such as soil texture, which may be determined by hand. *Photo courtesy of Minnesota DNR*

Surveying the Site Firsthand

U Conduct an on-the-ground evaluation of all land being considered for the forest management activity. It is important to have this firsthand knowledge of the area being considered. Familiarity with soils, terrain and vegetation in the area will assist landowners and resource managers in:

- Making decisions related to operating periods, harvest methods and equipment, tree species suitability, or reforestation strategies
- Choosing appropriate methods of operation
- Affirming (or modifying) forest management objectives

U Evaluate soil conditions to determine tree species, preferred seasons of operation, site preparation and regeneration techniques, and other information related to forest management decisions.

U Identify resources, features and site conditions that may require special attention, such as:

- Perennial and intermittent streams, lakes, wetlands and seasonal ponds
- Steep slopes, rock outcrops, unstable or poorly drained soils, sinkholes, seeps and springs (See Figure GG-1.)
- Snags and nesting sites
- Soil or site conditions that may dictate specific operational timing or methods and equipment to be used, or that may lead to weather-related or seasonal closure of the operations
- Special soil conditions and topographic features that make some areas of the state more sensitive than others to accelerated erosion due to soil disturbance

U Assess cultural resource potential. Identification of cultural resources is fundamental for protection of those resources. See *Part 2, Cultural Resources: Identifying, Assessing and Managing Cultural Resources and Resource Directory*.

Figure GG-1

Seep in a Forested Area



Additional Consideration

⌘ Consider conducting additional field survey work prior to forest management activities to determine whether endangered, threatened or special concern species (ETS species), rare tree species, or sensitive communities or sites are present. See *Part 2, Wildlife Habitat: Endangered, Threatened and Special Concern Species* and *Sensitive Communities and Sites, and Tree Species at the Edge of Their Range*.



Factors To Consider in Site Evaluation

After identifying the physical characteristics of the site during an on-the-ground evaluation (as detailed in the previous section), it is also important to identify how these characteristics may affect the planning and design of a particular forest management activity. Some of these considerations include:

- Soil capabilities and limitations (For information on how to obtain soil interpretations relating to equipment operations, see *Resource Directory*.)
- Location and width of filter strips and riparian management zones (RMZs)
- Stream crossings
- Visual sensitivity areas

□ Evaluating the most efficient use of existing and planned infrastructure (the network of access roads, approaches, trails and landings used to move equipment onto and around a forest management site). Infrastructure considerations include the following:

- Roads, trails, landings and approaches needed to meet objectives
- Adequacy of any roads, trails and landings already in existence
- Assessment of additional roads, trails, landings and approaches needed

Communicating Information

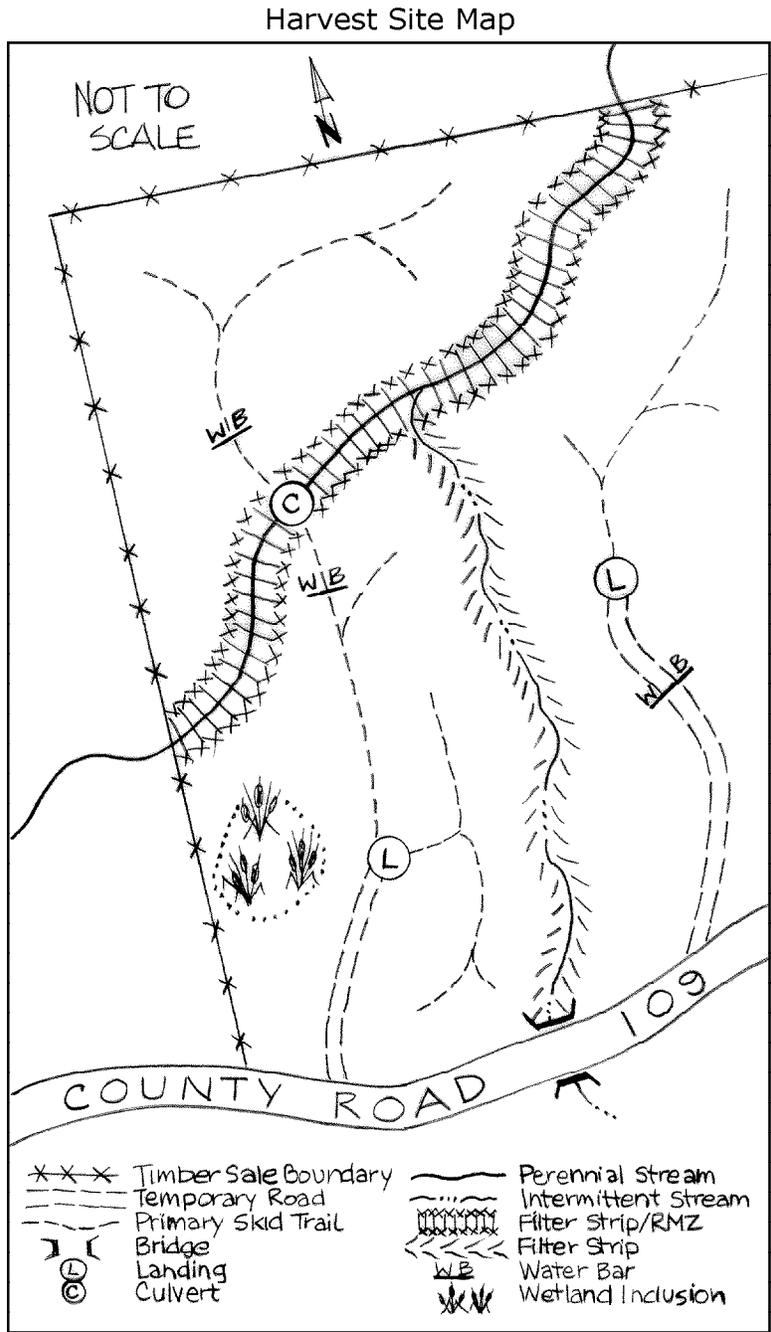
U Create a site map or conduct an on-site review with the operator to indicate the location of any special concern areas identified during the site survey. Be sure that maps are large enough to adequately depict sensitive areas. See Figure GG-2.

U Share any information gained by those conducting the preliminary evaluation among involved landowners, resource managers, loggers and operators. Sharing information helps to assure a common understanding of landowner objectives, existing regulations and site conditions.

Incorporating Sustainability into Forest Management Plans

Forest management activities should follow a well-thought-out plan that defines such factors as the extent and duration of the activity, the most appropriate season and method of operation for the activity, appropriate forest management guidelines to limit site disturbance, and other management objectives related to forest resource sustainability.

Figure GG-2



The timing of forest management activities or recreational activities can be constrained by pre-existing or seasonal conditions, regulations and limitations, such as seasonal road load limits, seasonal forest access limitations, forest fire hazard conditions, and appropriate times for such activities as herbicide treatments, tree planting and road construction.

Timing and Coordination of Activities

U Conduct forest management activities when soil conditions are firm enough to support the type of equipment being used, in order to protect soil productivity and minimize damage to any cultural resources that may be present.

U Plan to conduct forest management activities in wetlands when frozen or when firm enough to support equipment being used. Evaluate the site based on weather conditions to ensure adequate support for equipment to prevent or minimize rutting. Examples of weather conditions that could be cause for concern include heavy rain, flooding, significant snow before frost, and three consecutive nights above freezing after frost has been established.

U Plan for removal of equipment and cut material from wetland areas prior to thawing at the end of the winter season, or leave it until the next winter.

U Plan to conduct activities during the preferred operating periods for site and soil conditions. Preferred operating periods for a site may vary due to local and seasonal climatic conditions, equipment being used and operating techniques.

U Combine and integrate forest management activities where appropriate to reduce or eliminate the need for multiple entries by heavy equipment. For example, full-tree skidding may be used for preparation of jack pine seed beds, eliminating the need for additional site preparation.

U Protect reserve areas and structural habitat components retained in previous stand treatments.

Timing and Coordination of Activities To Reduce Noise and Visual Impacts

*In areas classified as most sensitive:**

- U** Avoid management operations during periods of peak recreational use whenever possible.
- U** Reduce noise in early morning, late evening and other appropriate times whenever possible.
- U** Selectively restrict use of recreational facilities to avoid conflict with management activities.
- U** Temporarily relocate recreation trails away from management activity areas.
- U** Inform and educate recreational users regarding management issues, limitations and timing prior to, during and after management activities.

*In areas classified as moderately sensitive:**

- U** Selectively restrict use of recreational facilities to avoid conflict with management activities.
- U** Time management activity with consideration for public use patterns.
- U** Minimize direct conflict with forest recreational users during peak use and special event periods.
- U** Temporarily relocate recreation trails away from management activity areas.
- U** Inform and educate recreational users regarding management issues, limitations and timing prior to, during and after management activities.

*In areas classified as less sensitive:**

- U** Limit time constraints to special events or site-specific concerns.

*See *Part 2, Visual Quality: Visual Sensitivity Classifications* for information related to how classifications are determined and which Minnesota counties have developed visual sensitivity classification maps.

Winter harvesting is one example of timing forest management activities to protect soil and cultural resources, as well as to avoid periods of peak summer recreational use.
Photo courtesy of Minnesota Timber Producers Association



Designing Operations To Fit Site Conditions

U Determine the preferred operating season for a specific site to help avoid unwanted impacts to the site, as well as the costly process of moving equipment from a site or shutting down operations if negative impacts are occurring.

U Take into account that the preferred operating season may vary for any one site depending on soil characteristics, local climatic conditions, equipment being used, and operating techniques. The use of low ground pressure (LGP) equipment and such operating techniques as using slash mats to drive on can extend operating seasons on low-strength soils.

U Use caution when operating heavy equipment on sites whenever adverse soil impacts are likely. Soil susceptibility to compaction and rutting is primarily dependent on soil texture and moisture content. Soils are most susceptible to compaction, rutting and puddling at the following times:

- During spring and early summer months
- Immediately following heavy rains
- During the period between when transpiration ceases in the fall and before freeze-up occurs

Managing and Minimizing Infrastructure

In the context of forest management activities, infrastructure is defined as the network of access roads, approaches, trails and landings used to move equipment onto and around a forest management site.

Any reduction in the total amount of area occupied by such infrastructure reduces the impact on soil productivity, as well as potential impacts to cultural resources, riparian areas and wildlife habitat. For more information on how to obtain soil interpretations relating to equipment operation, see *Resource Directory*.

U Consider future management activities that may use common infrastructure for management of adjacent stands or ownerships. Develop or plan infrastructure accordingly.

U Examine existing access routes to determine whether they are the best routes to improve. Consider whether relocation would provide a better long-term access route.

U Where appropriate, limit direct trafficking of a site to the smallest area necessary when planning such management activities as harvesting and site preparation.

Equipment, Fuel and Lubricants

Forest management activities often require the use of a variety of equipment during field operations, as well as the associated use of fuels and lubricants. These operations typically occur at remote locations, with maintenance activities taking place on-site.

Precautions are needed to prevent soil, water and wetland contamination when using fuels, lubricants and other materials associated with heavy equipment operations. Proper planning will help prevent or minimize spills of fuels, lubricants or other materials.



Contamination of soil, water and wetlands can be prevented with proper planning, such as this remote storage tank for waste oil. *Photo courtesy of Minnesota DNR*

U Eliminate or reduce potential contamination arising from spills. Routine maintenance of equipment, including regular checks of hoses and fittings for leaks or wear, is essential to protecting streams, lakes, wetlands, seasonal ponds, ground water and soils from the impacts of fuel and lubricant spills and leaks.

U Place fueling and maintenance areas, wherever practical, outside of filter strips or the riparian management zone, which-ever is wider.

Water Quality and Wetlands

U Plan forest management activities to avoid operations in wetlands, including building landings, skid trails and roads. Where avoidance is not practical, minimize impacts by limiting the extent of wetland activities.

20 General Guidelines

U State and federal wetland regulations provide an exemption for roads constructed for the primary purpose of providing access for conducting forest management activities.

Under the Minnesota Wetland Conservation Act (Minnesota Rules Chapter 8420.0122 Subp. 7), a replacement plan for wetlands is not required for 1) temporary or permanent crossings, or for 2) entering a wetland to perform silvicultural activities, including timber harvesting as part of a forest management activity, so long as the activity:

- Limits the impact on the hydrologic and biologic characteristics of the wetland.
- Does not result in the construction of dikes, drainage ditches, tile lines or buildings.
- Does not result in the drainage of the wetland or public waters.
- Avoids filling whenever possible.

To qualify for an exemption under the Minnesota Wetland Conservation Act (Minnesota Rules Chapter 8420.0115), an individual or organization:

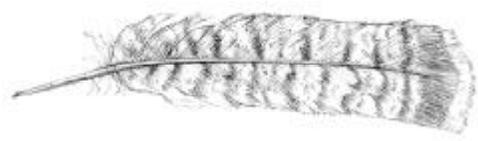
- Must use appropriate erosion control measures to prevent sedimentation of water.
- Must not block fish activity in a watercourse.
- Must comply with all other applicable federal, state and local requirements, including water resource protection requirements and water quality Best Management Practices (BMPs), as presented in *Protecting Water Quality and Wetlands in Forest Management: Best Management Practices in Minnesota* (1995).

When planning to conduct an exempt activity, contact the appropriate local governmental unit for advice on minimizing wetland impacts.

Rare or Sensitive Species

U Modify management activities to maintain, promote or enhance ETS species (endangered, threatened or of special concern) on the site.

U Avoid forest management activities that isolate or eliminate populations of tree species at the edge of their range. Favor these species via regeneration, as leave trees, or through other suitable methods to perpetuate them on site. See *Part 2, Wildlife Habitat: Sensitive Communities and Sites, and Tree Species at the Edge of Their Range*.



Additional Consideration

K Consider consulting with the DNR or other forest management experts on ways to maintain or enhance sensitive communities and sites while conducting forest management activities on or near them. For a specific listing of sensitive communities, see *Part 2, Wildlife Habitat: Sensitive Communities and Sites, and Tree Species at the Edge of Their Range*.

Maintaining Filter Strips

Managing land to control nonpoint source pollution near surface water and wetlands is important. Timber harvesting activities, mechanical site preparation, prescribed burning and road construction increase the potential for sedimentation due to mineral soil exposure.

Planning Considerations

☐ Maintaining a filter strip between the water body and the forest disturbance can protect surface water. Filter strips are areas adjacent to perennial and intermittent streams, lakes, open water wetlands, wetland inclusions, seasonal ponds, seeps and springs that help minimize the runoff of sediment, debris, nutrients and pesticides into these water bodies.

Filter strips provide a zone of infiltration that protects surface water by 1) allowing remaining vegetation to remain essentially undisturbed, and 2) allowing the forest floor to trap sediment from adjacent land areas.

☐ Forest management activities may be conducted in filter strips as long as the integrity of the filter strip is maintained. These activities should produce minimal exposure of mineral soil.

Defining Filter Strips

U Apply the following filter strip guidelines to all perennial and intermittent streams, lakes, open water wetlands, wetland inclusions, seasonal ponds, seeps and springs. Filter strips should border and parallel the edge of all water bodies.

Apply them independently of the width of the riparian management zone, and adhere to them except when the recommended 5% maximum level of mineral soil exposure is unacceptable for the regeneration of certain desired species:

- Limit mineral soil exposure to less than 5%, well distributed throughout the filter strip.

- Avoid concentrating disturbance in the filter strip, to prevent concentration of flows across the filter strip.
- Establish filter strip widths based on percent and length of slope. See Table GG-1, Figure GG-3 and Figure GG-4.

Filter Strip Width Guide	
Slope of land between activity and water body	Recommended width of filter strip (slope distance)*
0-10%	50 feet
11-20%	51-70 feet
21-40%	71-110 feet
41-70%	111-150 feet

**For roads, distance is measured from the edge of soil disturbance. For fills, distance is measured from the bottom of the fill slope.*

Table GG-1

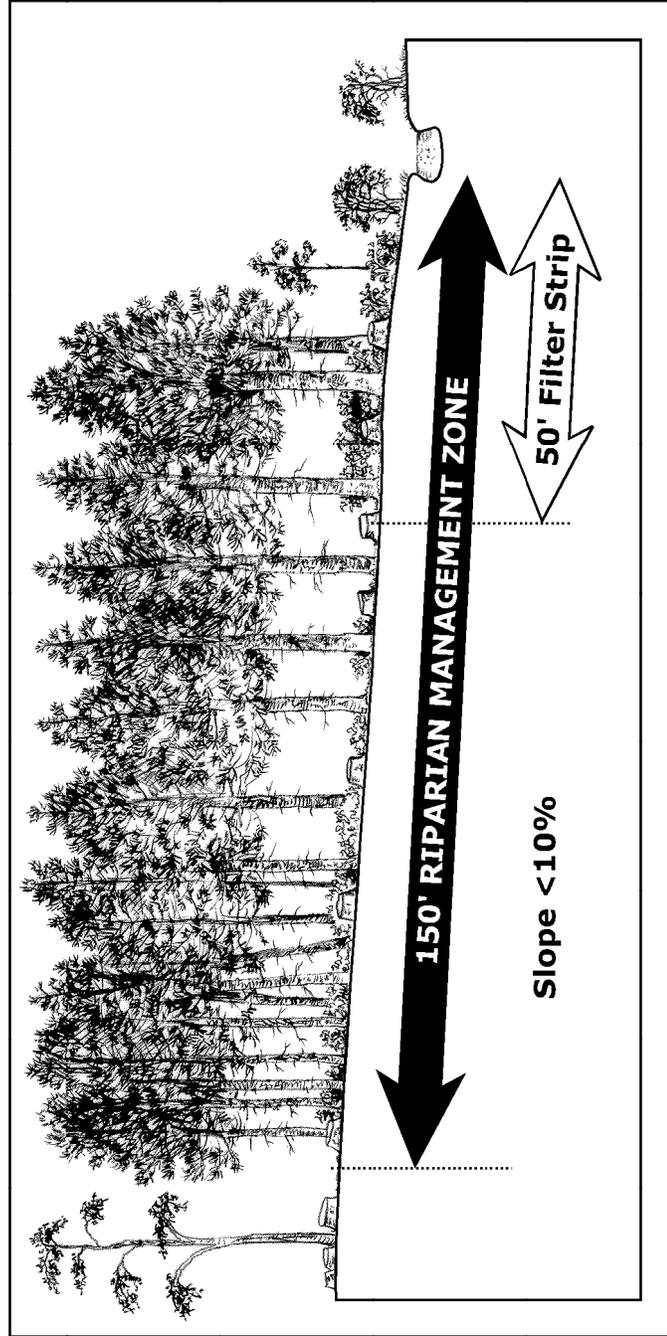
U Consider additional stabilization measures when necessary, such as the use of slash, straw bale barriers, mulch and silt fences, including instances when:

- An area of soil is exposed within the filter strip and sedimentation is likely to result.
- Management objectives preclude the use of a filter strip and sedimentation is likely to occur.



Figure GG-4

Filter Strips and RMZ for Designated Trout Streams Where Slope Is < 10%:
Even-Age Management



Managing Riparian Areas

Riparian management zone (RMZ) guidelines should be determined during the on-the-ground evaluation of the site. They are based on the topography, hydrology and vegetation within the riparian area.

Width, residual basal area and other recommendations are provided based on different types of water bodies, site conditions within the riparian area, and management objectives (even-age or uneven-age management).

The recommended width and basal area guidelines and the flexibility considerations apply within the RMZ. Outside of the RMZ, normal operations apply, unless other guidelines further modify those operations.

Forest management activities may be conducted within the riparian management zone.

Components of RMZ Guidelines

Riparian management zone guidelines include width and residual basal area recommendations:

- Recommended widths are measured along the slope distance from the edge of the water body. Where the edge of the water body is not a straight line, the RMZ width may either parallel that edge or be a straight line (see Figure GG-5). In either case, the width that is applied on the ground represents the average distance from the water's edge.
- Basal area is the cross-sectional area of a live tree 4.5 feet above ground (based on its diameter at breast height, or DBH). Basal area describes the extent to which an area is occupied by trees (a relative index of the density of trees in an area). It is expressed in square feet per tree (ft²/tree) or per acre (ft²/acre). See *Appendix F: Determining Basal Area*.

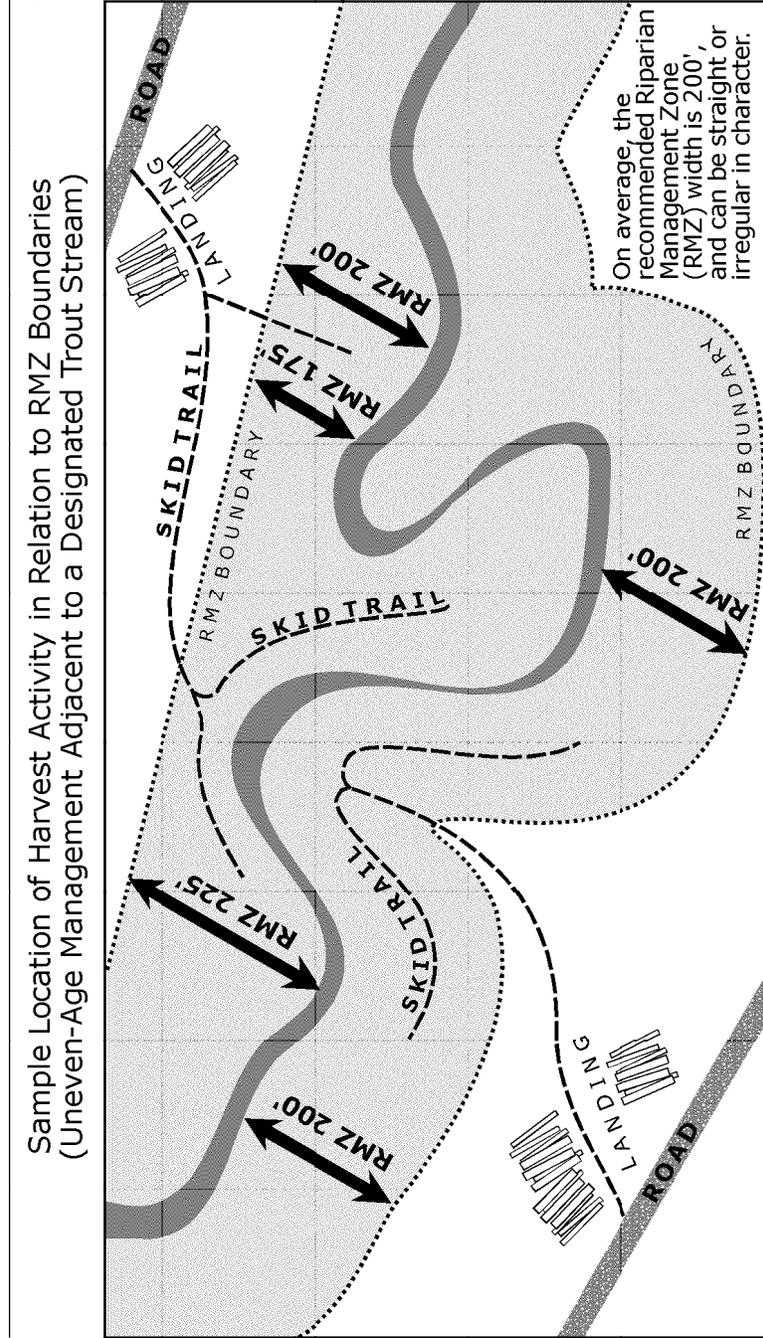
Basal area is the cross-sectional area of a live tree 4.5 feet above ground (based on its diameter at breast height, or DBH). *Photo courtesy of Potlatch Corporation*



Crown closure (the degree to which the forest floor is shaded by tree crowns when the sun is immediately overhead) can also provide an approximation of the extent to which an area is occupied by trees. See *Appendix F: Determining Basal Area*.

In addition to width and basal area recommendations, there are other riparian guidelines which address other issues within the RMZ. See *Incorporating Riparian Guidelines into Plan Design* (page 35).

Figure GG-5



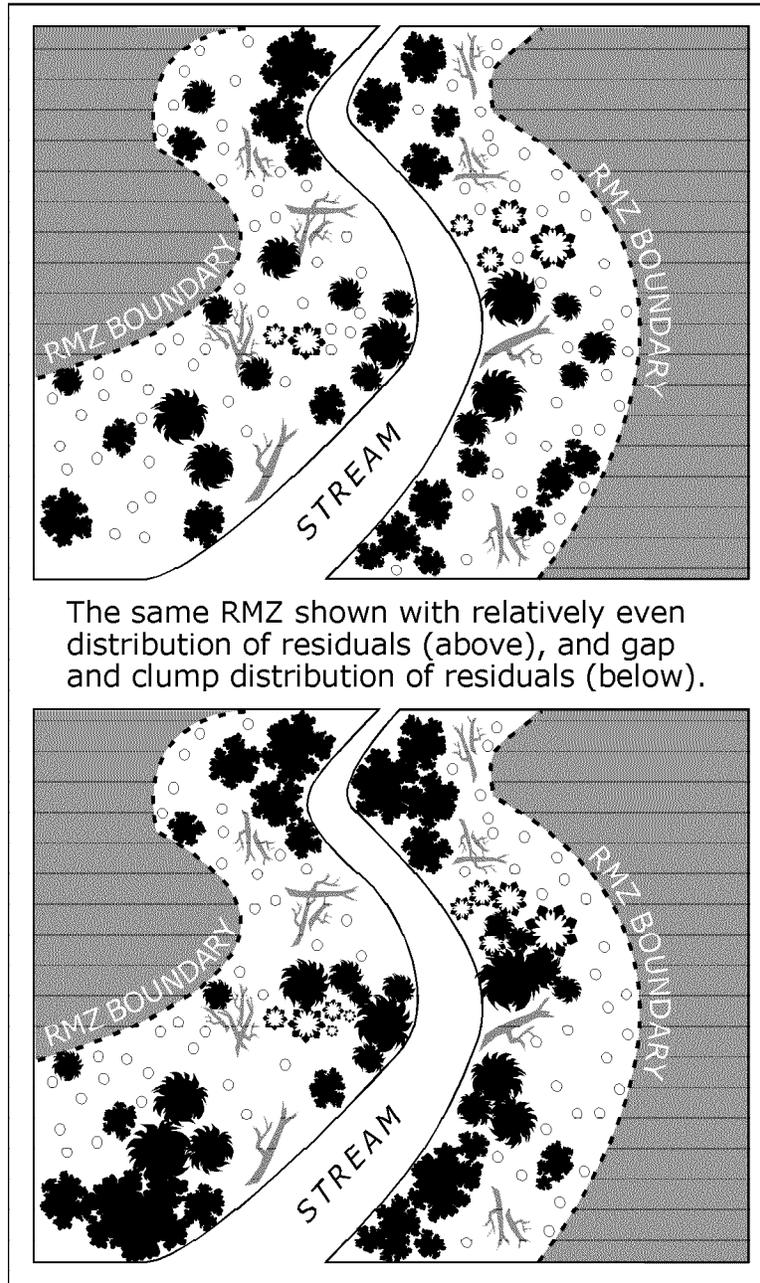
Flexibility Considerations

The variability of site conditions and landowner objectives points to the need for flexibility and professional judgment in making forest management decisions within RMZs. The following flexibility considerations, which are applicable to streams, lakes and open water wetlands, can help landowners, resource managers and loggers make appropriate forest management decisions.

- ❑ The width and residual basal area guidelines represent recommendations designed to protect and maintain riparian functions and values. Landowners, resource managers, loggers and contractors should consider the silvicultural needs of the species to be managed, as well as the protection and maintenance of riparian functions and values. Forest management plans within RMZs should consider stream characteristics, as well as goals related to forest regeneration, fisheries and recreation.
- ❑ It is acceptable to vary above or below recommended width and residual basal area guidelines, including those situations in which the management objective is to mimic natural processes. Landowner management objectives and management recommendations for the RMZ should be documented during the planning process.
- ❑ The slope aspect (direction that the slope faces) should not determine whether the RMZ guidelines should be altered around a water body, since shade is not the sole function of an RMZ.
- ❑ The residual basal area within the RMZ should be relatively evenly distributed throughout the RMZ. Gap and clump regeneration patterns may be used. See Figure GG-6.
- ❑ Cleared areas within the RMZ should be kept to the minimum size required to meet forest management objectives, while also considering the protection and maintenance of riparian functions and values.
- ❑ Consider that many riparian functions and values are best maintained at higher residual basal areas, which will not provide the best regeneration of species managed using even-age management approaches. See *Recognizing Tradeoffs*, page 32.

Figure GG-6

Residual Distribution Options Within the RMZ



☐ Best professional judgment should be used to determine the species and distribution of residual trees within the RMZ. Consider:

- Site conditions (such as steep slopes or highly erodible soils)
- Species
- Wildlife habitat needs, especially for cavity-nesting riparian species
- Bunching or clumping of residuals, which helps to reduce windthrow
- Favoring tree retention near the bank edge
- Other management objectives



☐ Decisions regarding residual species, as well as individual trees to be retained, should be based on the following considerations:

- Distribution within the RMZ
- Regeneration requirements (such as shade tolerance and amount of scarification needed)
- Crown size (for example, maples generally have a larger crown than aspens)
- Windfirmness (including rooting pattern and pre-harvest exposure to wind). See *General Guidelines: Retaining Leave Trees*.

☐ Application of some wildlife-related guidelines may differ within and outside of the RMZ. For more detail, see *Part 2, Wildlife Habitat: Riparian Wildlife Habitat*.

Recognizing Tradeoffs

As with many forest management activities and decisions, riparian guidelines may present tradeoffs that need to be considered.

One example of such tradeoffs is the density of residual trees, as measured by residual basal area, when considering even-age management guidelines.

According to management guidelines for aspen (a species commonly managed using even-age management approaches):*

“For best aspen sucker regeneration...the parent stand must have a minimum aspen density of 50 trees or 20 square feet basal area per acre. To stimulate suckering, allow heat and light to reach the forest floor by removing as much of the overstory as possible, preferably all trees 2 inches or more DBH (diameter at breast height). As little as 10 to 15 square feet basal area of residual overstory will slow sucker growth by 35 to 40 percent.” (Perala 1979).

In contrast, however:

The protection and maintenance of riparian functions and values (such as inputs of coarse woody debris and fine litter, bank and shoreline stability, shading of the water body, and aesthetics) is enhanced by leaving more residual overstory than is normally recommended to promote the best regeneration of shade-intolerant species such as aspen.

A tradeoff exists. In this case, riparian functions and values are best maintained at residual basal areas that will NOT provide the best regeneration of shade-intolerant species such as aspen.

, Another example of these tradeoffs is the issue of the width of the riparian management zone. Not all riparian functions and values are equally important at all distances from the water's edge.

While the area closest to the water body is most important for protecting riparian functions and values, that importance decreases and can become very low at a location some distance from the water's edge.

, Tradeoffs can also interact with each other. As an example, regeneration of shade-intolerant species may be sufficient when more residual overstory is retained if the slope, aspect or width of the RMZ allows heat and light from the side to reach the forest floor.

In recognition of these and other tradeoffs, the RMZ guidelines include several recommendations that are intended to provide flexibility for accommodating a range of landowner objectives and site conditions, including forest diversity. Exercise professional judgment when making riparian recommendations. Landowner management objectives and management recommendations for the riparian management zone should be documented during the planning process.

*To obtain management recommendations for other species, contact a forestry professional for assistance. See *Resource Directory*.

Defining the Riparian Management Zone

The riparian management zone (RMZ) is the area where site conditions and landowner objectives are used to determine management activities that address riparian resource needs. It is the area where riparian guidelines apply. Outside of the RMZ, normal operations apply, unless other guidelines further modify those operations.

Forest management activities may be conducted within the RMZ.

Management of riparian areas focuses on differentiating between various types of water bodies and associated site conditions within the riparian area. Riparian area site conditions include topography, hydrology and vegetation.

Width and basal area recommendations are based on the following:

- Type of water body
- Riparian area site condition
- Management objective (even-age or uneven-age management).

The recommendations are divided into two primary groups:

- Designated trout streams (and their designated tributaries) and designated trout lakes
- All other water bodies, including non-trout streams, non-trout lakes, and open water wetlands

Recommended guidelines for the second group (“all other water bodies”) vary depending upon the forest type adjacent to the water body.

Incorporating Riparian Guidelines into Plan Design

In addition to width and basal area recommendations for riparian zone management, the following guidelines address additional issues within the RMZ:

U Review Flexibility Considerations (pages 29-31) and incorporate into forest management activities as appropriate.

U Manage lands adjacent to water bodies according to forest type and site conditions, including the option of varying from riparian guidelines where the management objective is to mimic natural processes.

U Maintain a forested condition of varying ages adjacent to water bodies, generally to the top of the adjacent terrace slope when a terrace slope exists.

U Manage for longer-lived, uneven-age, mixed-species stands within the RMZ to provide:

- Shade and moderated microclimate
- Coarse woody debris
- Microhabitat diversity
- Resiliency to natural catastrophes
- Bank stability
- Nutrient cycling and carbon and nutrient input

U Manage for long-lived conifers in northern Minnesota as an option where beaver are to be discouraged near water bodies.

U Consider extended rotation forestry within the RMZ around all streams, lakes and open water wetlands.

U Leave some super-canopy trees and other long-lived species in the riparian management zone. If possible, choose trees from the “Excellent” category list. This decision will provide habitat for riparian species that require large super-canopy trees (trees above the existing mature canopy) for hunting perches and nesting sites. See Table GG-7: Leave Tree Preferences for Longevity, Windfirmness and Cavity Potential, page 73.

U When a timber stand is in a deteriorating or declining condition, apply appropriate forest management activities to rejuvenate it.

U Use flagging or paint to clearly delineate the edge of the RMZ so that operators can identify its location on the ground.

U Distribute the residual basal area within the RMZ relatively evenly throughout the RMZ, but allow for gap and clump regeneration patterns. Avoid creating large cleared areas within the RMZ.

U Create or retain at least four leave logs per acre within the RMZ. Use sound forest management where insect and disease concerns exist. See *General Guidelines: Providing Coarse Woody Debris*.

U Adhere to filter strip guidelines except when the recommended 5% maximum level of mineral soil exposure is unacceptable for the regeneration of certain desired species. See *General Guidelines: Maintaining Filter Strips*.

U Minimize disturbance to other vegetation (such as brush or grass) within the RMZ where such vegetation provides primary shading, bank stability and energy input.

U Wherever practical, place fueling and maintenance areas, landings and roads (except those roads that are needed to cross a stream, lake or open water wetland) outside of filter strips or the RMZ, whichever is wider. See *General Guidelines: Maintaining Filter Strips* and *General Guidelines: Managing Riparian Areas*.

U Use diversion structures on approaches to water crossings or on roads and trails found within the RMZ to divert water off of the right-of-way before it reaches the water body.



Overview of RMZ Width and Residual Basal Area Recommendations

Designated Trout Streams (and Their Designated Tributaries) and Designated Trout Lakes

(even-age and uneven-age management)

Table GG-2 only

Fig. GG-7 (even-age)

Fig. GG-8 (uneven-age)

All Other Water Bodies (Non-Trout Streams, Non-Trout Lakes, Open Water Wetlands)

Sedge, Grass, Shrubs and Swamp Forests

(even-age and uneven-age management)

Table GG-3 only

(no figure)

High Bank and Upland Forests

(even-age management)

Table GG-3

(general recommendations)

Fig. GG-13 (streams)

Fig. GG-14 (lakes, open water
wetlands)

Table GG-4

(specific recommendations)

Table GG-5 and Fig. GG-15

(management considerations)

High Bank and Upland Forests

(uneven-age management)

Table GG-3

(general recommendations)

Fig. GG-16 (streams)

Fig. GG-17 (lakes, open water
wetlands)

Table GG-6

(specific recommendations)

(see next page for locator listing)

Locator Listing for RMZ Tables and Figures

<i>Recommendations</i>	<i>Table or figure</i>	<i>Page number</i>
DESIGNATED TROUT	Table GG-2	41
STREAMS (and their	Fig. GG-7	42
designated tributaries)	Fig. GG-8	43
and designated trout lakes		
ALL OTHER WATER BODIES		
Sedge, grass, shrubs and swamp forests*	Table GG-3	46-47
High bank and upland forests* (<i>even-age management</i>)	Table GG-3	46-47
	Table GG-4	54-55
	Fig. GG-13	56
	Fig. GG-14	57
	Table GG-5	58-59
	Fig. GG-15	60
High bank and upland forests* (<i>uneven-age management</i>)	Table GG-3	46-47
	Table GG-6	62-63
	Fig. GG-16	64
	Fig. GG-17	65
*Description of general forest types and illustrations	Fig. G-9	48-52
	Fig. G-10	
	Fig. G-11	
	Fig. G-12	

Designated Trout Streams (and Their Designated Tributaries) and Designated Trout Lakes

RMZ WIDTH AND RESIDUAL BASAL AREA RECOMMENDATIONS

Certain water bodies are designated through rule-making as trout streams (and their designated tributaries) or trout lakes. If forest management activities occur adjacent to these designated water bodies, refer to the following table and figures for RMZ width and residual basal area recommendations that apply:

- Table GG-2 (even-age and uneven-age management)
- Fig. GG-7 (even-age management)
- Fig. GG-8 (uneven-age management)

Important Considerations

Four important considerations relate to these guidelines:

- Stream width is estimated at the bankfull elevation at the narrowest portion of a straight channel segment within the management area.
- RMZ width is measured as slope distance (the linear distance along the ground), not horizontal distance, except when the ground is level, in which case slope distance and horizontal distance are the same.
- Residual basal area recommendations represent the density of residual trees, measured in ft²/acre, immediately following any forest management activities that remove trees.
- No minimum tree diameter is established when measuring for basal area reserves.



Table GG-2

Designated Trout Streams
(and Their Designated Tributaries) and Designated Trout Lakes:
RMZ Width and Residual Basal Area Recommendations^{1,2,3}

Management Objective	Recommended Minimum RMZ Width (slope distance) (in feet)	Recommended Minimum Residual Basal Area (ft ² /acre)
Even-Age Management (see Fig. GG-7)	150	60
Uneven-Age Management (see Fig. GG-8)	200	80

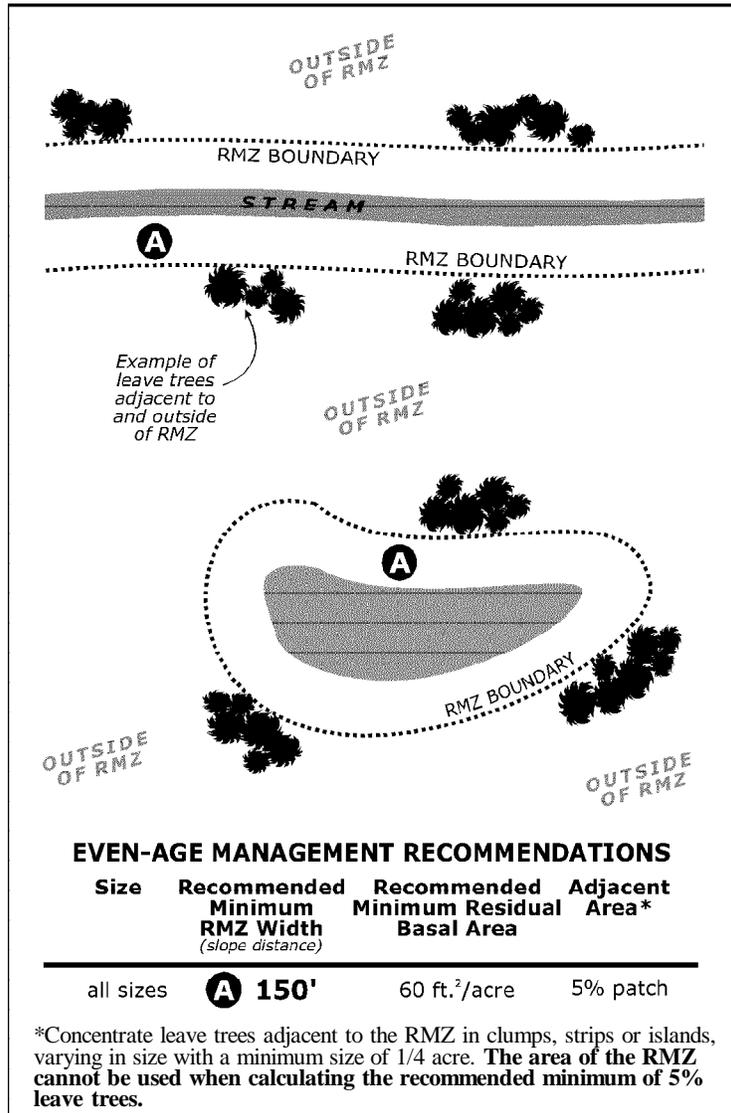
¹Forest management may be conducted within the RMZ. Review *Flexibility Considerations* and *Incorporating Riparian Guidelines into Plan Design*.

²Filter strip guidelines apply adjacent to all water bodies. See *General Guidelines: Maintaining Filter Strips*.

³For a listing of current designated trout streams (and their designated tributaries) and designated trout lakes, contact regional DNR fisheries offices (see *Resource Directory*), local zoning offices or the legislative web site at: www.revisor.leg.state.mn.us/arule/6264

Figure GG-7

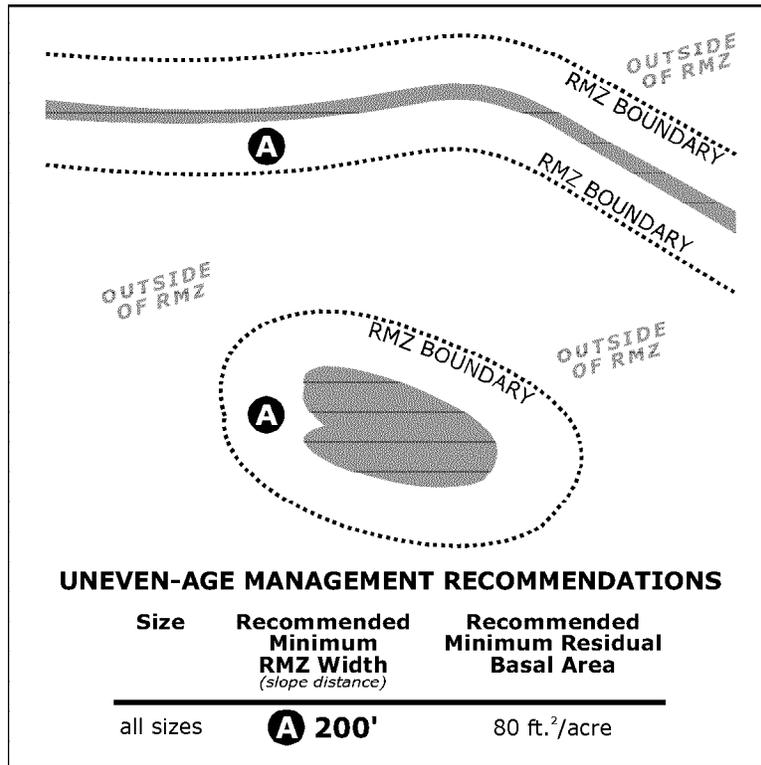
Designated Trout Streams (and Their Designated
Even-Age Management
**RMZ Width and Residual Basal Area
Recommendations**



Forest management may be conducted within the RMZ. Review *Flexibility Considerations* and *Incorporating Riparian Guidelines into Plan Design*.

Figure GG-8

Designated Trout Streams (and Their Designated
 Uneven-Age Management
**RMZ Width and Residual Basal Area
 Recommendations**



Forest management may be conducted within the RMZ. Review *Flexibility Considerations* and *Incorporating Riparian Guidelines into Plan Design*.



All Other Water Bodies (Non-Trout Streams, Non-Trout Lakes and Open Water Wetlands)

RMZ WIDTH AND RESIDUAL BASAL AREA RECOMMENDATIONS

If forest management activities occur adjacent to a non-trout stream, non-trout lake or open water wetland, begin by referring to the following table, text and figures:

- Table GG-3 (general recommendations; will make reference to specific tables as appropriate)
- Description of General Forest Types (including Figs. GG-9 through GG-12)

Important Considerations

Four important considerations relate to these guidelines:

- Stream width is estimated at the bankfull elevation at the narrowest portion of a straight channel segment within the management area.
- RMZ width is measured as slope distance (the linear distance along the ground), not horizontal distance, except when the ground is level, in which case slope distance and horizontal distance are the same.
- Residual basal area recommendations represent the density of residual trees, measured in ft²/acre, immediately following any forest management activities that remove trees.
- No minimum tree diameter is established when measuring for basal area reserves.

Table GG-3

All Other Water Bodies (Non-Trout Streams, Non-Trout Lakes and Open Water Wetlands):
RMZ Width and Residual Basal Area Recommendations

Forest Type	Sedge, Grass, Shrubs	Swamp Forests	Swamp Forests	High Bank Forests	High Bank Forests	Upland Forests	Upland Forests
Depth to Water Table ³	< 6"	6" - 18"	6" - 18"	> 10 feet	> 10 feet	> 1.5 feet	> 1.5 feet
Soil Moisture Condition	Wet	Wet	Wet	Dry-Moist	Moist	Dry-Moist	Moist
Silvicultural System	Not Applicable	Even-Age	Uneven-Age	Even-Age	Uneven-Age	Even-Age	Uneven-Age
Representative Species and Forest Cover Types	Alders, willows, sedges, grasses, mosses	Black spruce, tamarack	Northern white cedar, black ash	Aspen, birch, jack pine, red pine, balsam fir, red oak, bur oak, white oak	Maple/basswood, red oak, white pine, white oak, bur oak, balsam fir, ash/elm/cottonwood, red maple, white spruce	Aspen, birch, jack pine, red pine, balsam fir, red oak, bur oak, white oak	Maple/basswood, red oak, white pine, white oak, bur oak, balsam fir, ash/elm/cottonwood, red maple, white spruce

table continues on page 47

Table GG-3 (cont'd)

table begins on page 46

Forest Type	Sedge, Grass, Shrubs	Swamp Forests	Swamp Forests	High Bank Forests	High Bank Forests	Upland Forests	Upland Forests
RMZ recommendations and references to specific tables.	Leave undisturbed or manage with prescribed fire to mimic natural disturbance.	Use clearcut harvest to the water's edge to prevent high-risk wind-throw.	Reserve unless effective regeneration can be assured.	Use clearcut, fire, or site preparation to the edge of the high bank forest. For management on bank slope, use filter strip guidelines and see Table GG-4 for width and residual basal area recommendations.	See Table GG-6 for width and residual basal area recommendations.	See Table GG-6 for width and residual basal area recommendations.	See Table GG-4 for width and residual basal area recommendations.

¹Forest management may be conducted within the RMZ. Review *Flexibility Considerations and Incorporating Riparian Guidelines into Plan Design*.

²Filter strip guidelines apply adjacent to all water bodies. See *General Guidelines: Maintaining Filter Strips*.

³Average depth to the water table during the growing season.

Description of General Forest Types

Sedge/grass/shrub forest: An area adjacent to a stream, lake or open water wetland that is covered by grasslike sedges or shrubs and where the soils are wet. The depth to the water table in these areas averages less than 6 inches.

Depending on the site and ecological history, dominant plant species are alders, willows, sedges, grasses or mosses. See Figure GG-9.

Swamp forest: An area adjacent to a stream, lake or open water wetland where the depth to the water table is between 6 and 18 inches, and the soils are wet.

Depending on the site and ecological history, dominant tree species are black spruce, tamarack, northern white cedar or black ash. See Figure GG-10.

High bank forest: An area immediately adjacent to a stream or lake where the depth to the water table is more than 10 feet, soil moisture ranges from moist to dry, the hillside bank rises steeply above the water, and the water body cuts into the hillside bank, which results in its eroding. Roots from trees growing on the terrace above the water do not reach the water table and therefore do not provide much bank stability.

Depending on the site and ecological history, dominant tree species are aspen, birch, jack pine, red pine, balm o'Gilead, red oak, bur oak, white oak, maple/basswood, balsam fir, ash/elm/cottonwood, red maple or white spruce. See Figure GG-11.

Upland forest: An area adjacent to a stream, lake or open water wetland where the depth to the water table is at least 1.5 feet, and soil moisture ranges from moist to dry.

Depending on the site and ecological history, dominant tree species are aspen, birch, jack pine, red pine, balm o'Gilead, red oak, bur oak, white oak, maple/basswood, balsam fir, ash/elm/cottonwood, red maple or white spruce. See Figure GG-12.

Figure GG-9

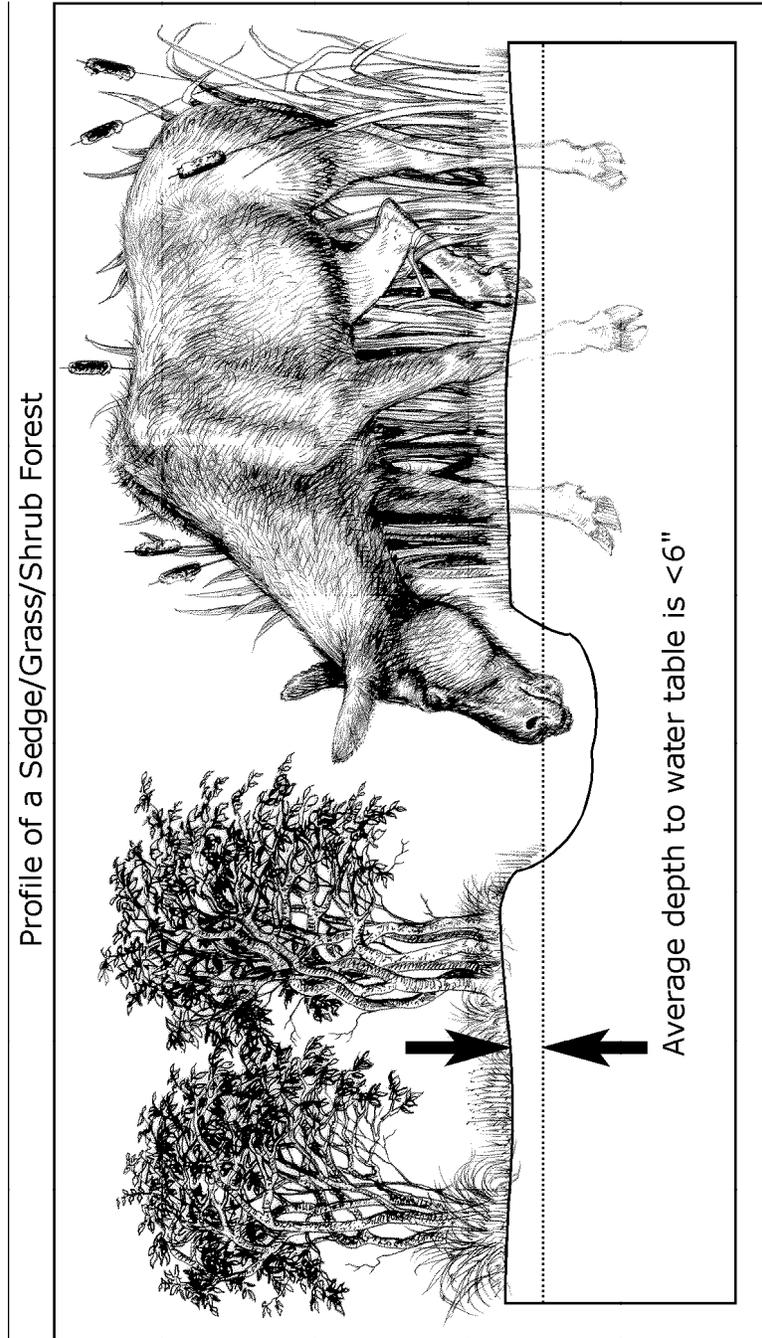


Figure GG-10

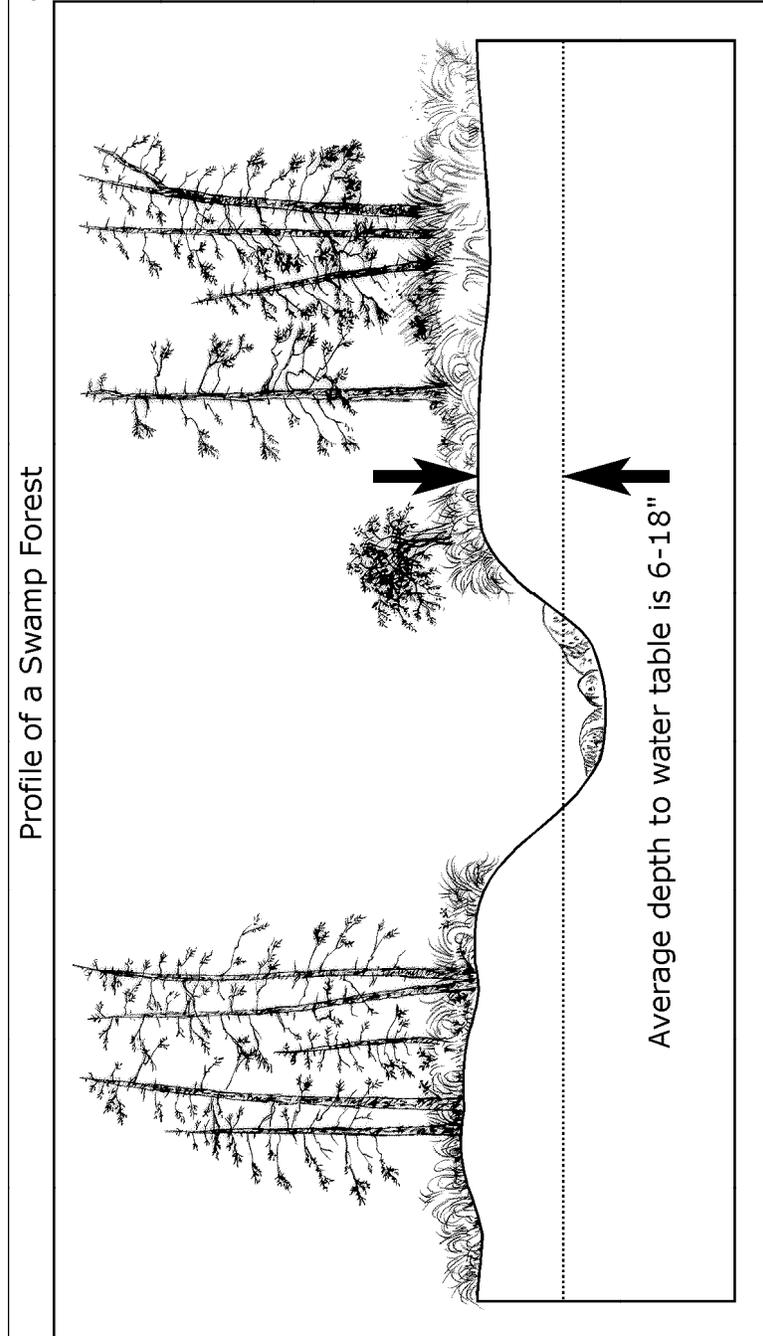


Figure GG-11

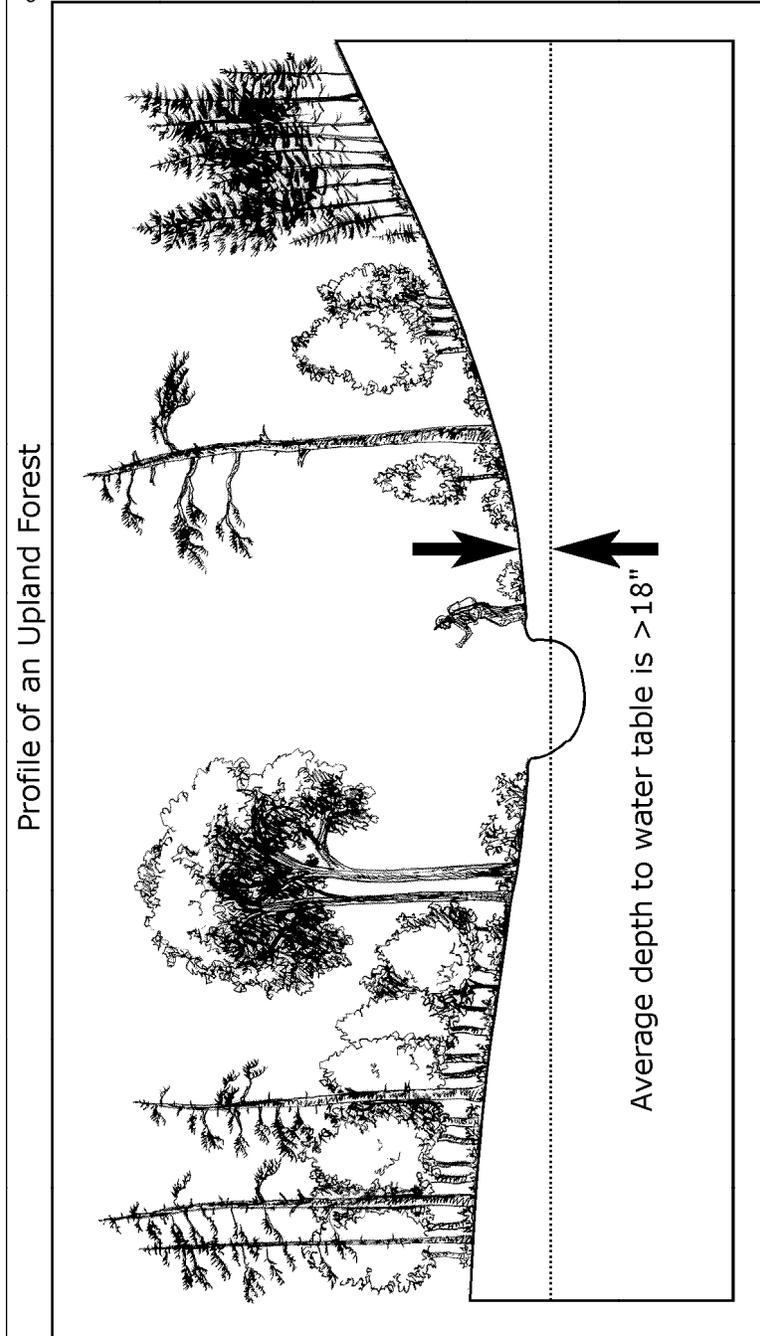
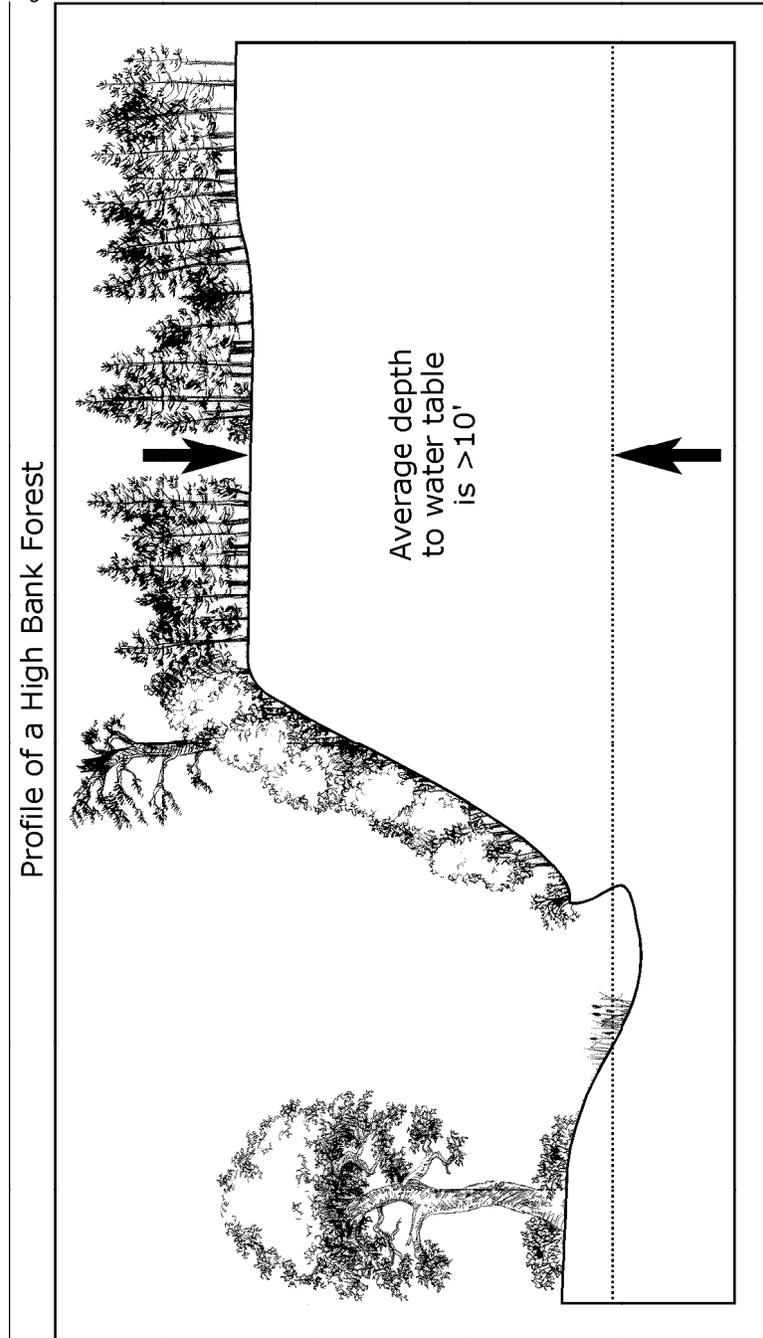


Figure GG-12



EVEN-AGE MANAGEMENT

All Other Water Bodies

(Non-Trout Streams, Non-Trout Lakes

and Open Water Wetlands)

RMZ WIDTH AND RESIDUAL BASAL AREA RECOMMENDATIONS

After consulting Table GG-3 (paged 46-47) and the Description of General Forest Types (pages 48-52), refer to the following tables and figures for specific RMZ width and residual basal area recommendations for even-age management, as well as management considerations that can aid in decision-making:

- Table GG-4 (specific recommendations)
- Table GG-5 (management considerations)
- Fig. GG-15 (management considerations)

- Fig. GG-13 (streams)
- Fig. GG-14 (lakes and open water wetlands)

Important Considerations

Four important considerations relate to these guidelines:

- Stream width is estimated at the bankfull elevation at the narrowest portion of a straight channel segment within the management area.
- RMZ width is measured as slope distance (the linear distance along the ground), not horizontal distance, except when the ground is level, in which case slope distance and horizontal distance are the same.
- Residual basal area recommendations represent the density of residual trees, measured in ft²/acre, immediately following any forest management activities that remove trees.
- No minimum tree diameter is established when measuring for basal area reserves.

Table GG-4

All Other Water Bodies (Non-Trout Streams, Non-Trout Lakes and Open Water Wetlands): Age Management RMZ Width and Residual Basal Area Recommendations

Water Body	Size	Recommended Minimum		Adjacent Area ^{3,4}
		RMZ Width (slope distance) (in feet)	Residual Basal Area (ft ² /acre)	
Non-Trout Streams (see Fig. GG-13)	> 10 feet wide	100	25-80 (see Table GG-5)	5% patch
Non-Trout Streams (see Fig. GG-13)	3-10 feet wide	50	25-80 (see Table GG-5)	5% patch
Non-Trout Streams (Perennial) (see Fig. GG-13)	< 3 feet wide	50	25-80 (see Table GG-5)	not applicable

table continues on page 55

Figure GG-4 (cont'd)

table begins on page 54

Non-Trout Streams (Intermittent) (see Fig. GG-13)	< 3 feet wide	not applicable	not applicable	not applicable
Non-Trout Lakes/ Open Water Wetlands (see Fig. GG-14)	≥ 10 acres	100	25-80 (see Table GG-5)	5% patch
Non-Trout Lakes/ Open Water Wetlands (see Fig. GG-14)	< 10 acres	50	25-80 (see Table GG-5)	5% patch

¹Forest management may be conducted within the RMZ. Review *Flexibility Considerations* and *Incorporating Riparian Guidelines into Plan Design*.

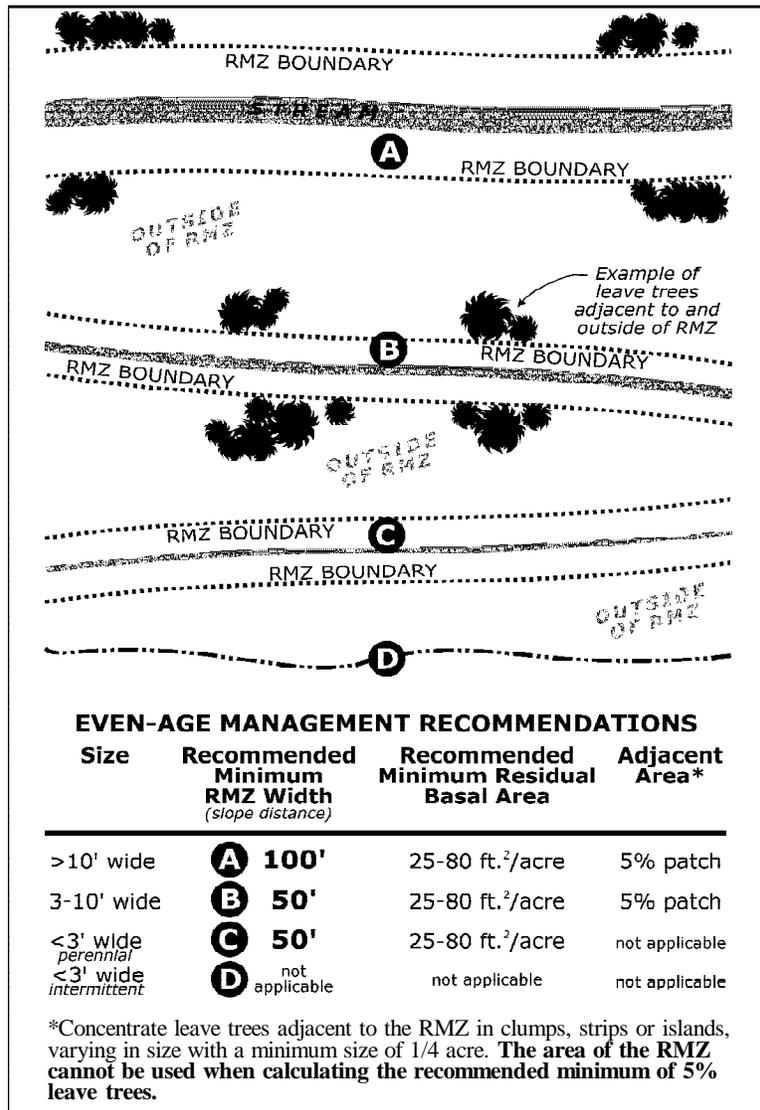
²Filter strip guidelines apply adjacent to all water bodies. See *General Guidelines: Maintaining Filter Strips*.

³Following harvest, concentrate leave trees adjacent to the RMZ in clumps, strips or islands, varying in size with a minimum size of 1/4 acre per clump and occupying a minimum of 5% of the area adjacent to the RMZ. These leave trees add windfirmness to the RMZ, improve water conservation, increase energy inputs to the aquatic system, and enhance the microclimate affecting the aquatic system. The area of the RMZ cannot be used when calculating the recommended minimum of 5% of leave trees retained in clumps, strips or islands. Also refer to *Flexibility Considerations* and *Guidelines: Provide a Menu, Not a Mandate* (page 6).

⁴Refer to county and local zoning ordinances and visual quality guidelines. See *Timber Harvesting: Reducing Visual Impacts of Apparent Harvest Size*.

Figure GG-13

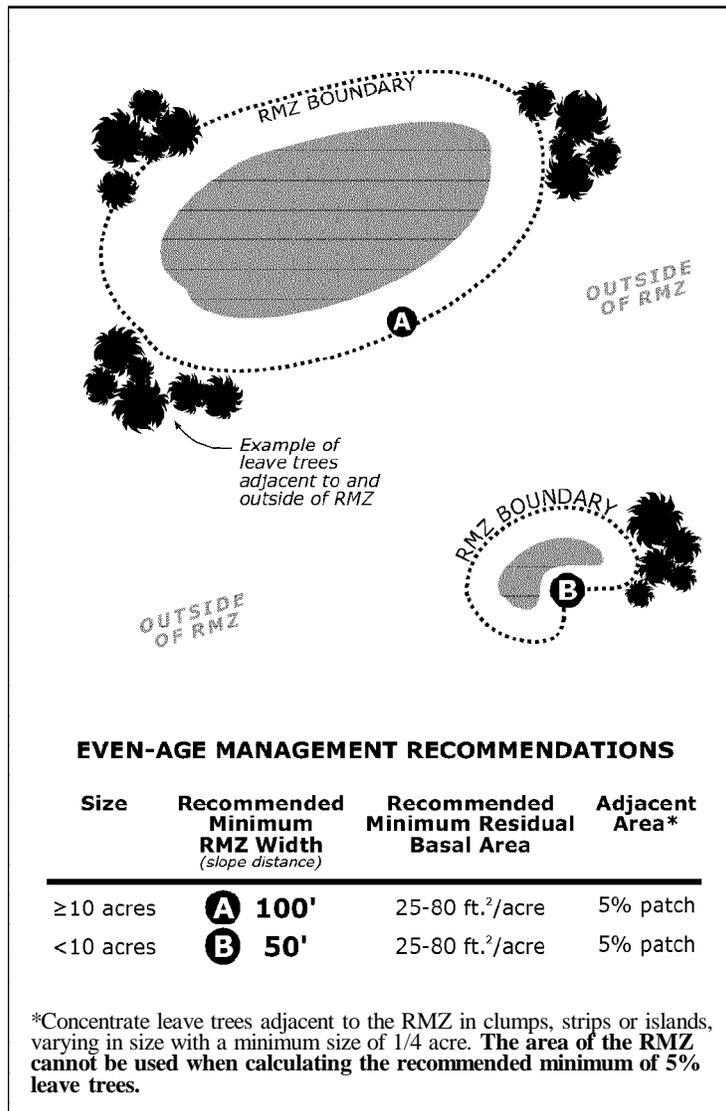
Perennial and Intermittent Non-Trout Streams
 in High Bank and Upland Forests:
Even-Age Management
**RMZ Width and Residual Basal Area
 Recommendations**



Forest management may be conducted within the RMZ. Review *Flexibility Considerations* and *Incorporating Riparian Guidelines into Plan Design*.

Figure GG-14

Non-Trout Lakes and Open Water Wetlands
in High Bank and Upland Forests:
Even-Age Management
**RMZ Width and Residual Basal Area
Recommendations**



Forest management may be conducted within the RMZ. Review *Flexibility Considerations* and *Incorporating Riparian Guidelines into Plan Design*.

Table GG-5

Relative Impact of Residual Basal Area
on Accomplishing Landowner Management Objectives...

MANAGEMENT CONSIDERATIONS FOR ALL RMZs	
Landowner Management Objectives	Residual Basal Area ¹ (ft ² /acre)
<p><i>(low residual basal area)</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> Maximum volume removed from timber harvest <input type="checkbox"/> Best overall natural regeneration (aspen, birch, jack pine, spruce) <input type="checkbox"/> Facilitates red pine, spruce, jack pine planting 	25
<ul style="list-style-type: none"> <input type="checkbox"/> Wildlife habitat: early successional vegetation <input type="checkbox"/> White pine underplanting <input type="checkbox"/> Partial (< 50%) shading of water bodies <input type="checkbox"/> Release conifer understory <input type="checkbox"/> 50% shading of water bodies 	40
<ul style="list-style-type: none"> <input type="checkbox"/> Wildlife habitat: mixed species and age diversity <input type="checkbox"/> Cover for wildlife travel corridor <input type="checkbox"/> Selective timber harvest <input type="checkbox"/> Full shading of water bodies 	60
<ul style="list-style-type: none"> <input type="checkbox"/> Nutrient and food input into aquatic system <input type="checkbox"/> Wildlife habitat: contiguous closed canopy <input type="checkbox"/> Aesthetics <p><i>(high residual basal area)</i></p>	80



table continues on page 59

¹Consider seeking professional assistance when determining appropriate residual basal area silvicultural guidelines for desired even-age species. See *Resource Directory*.

Table GG-5 (cont'd)

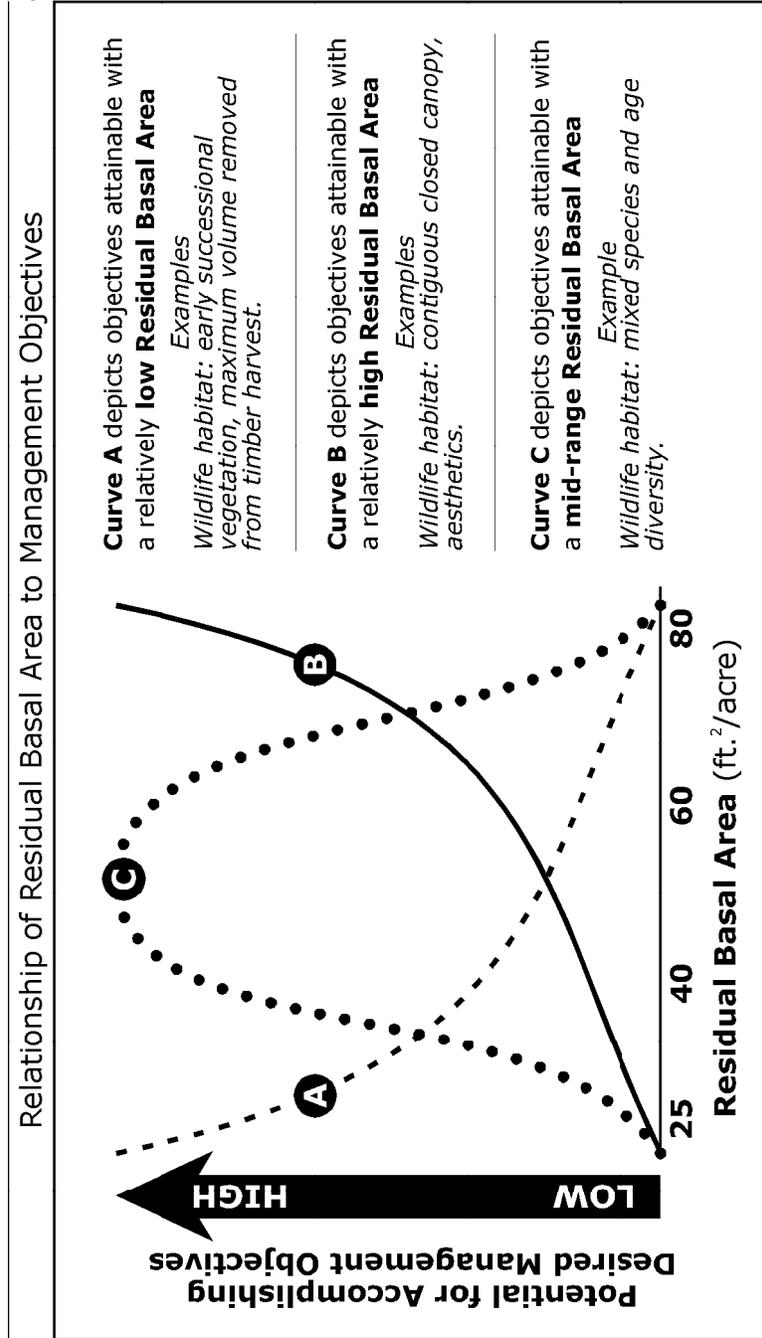
...in High Bank and Upland Forests: *Even-Age Management*
(Non-Trout Streams, Non-Trout Lakes and Open Water Wetlands)

RIPARIAN FUNCTION	
Temperature Moderation (Shading), Coarse Woody Debris and Fine Litter Inputs, and Shoreline/Bank/Channel Stabilization	Retention of Sediment or Nutrients Associated with Surface or Subsurface Runoff
The protection and maintenance of these riparian functions may be reduced at this basal area for a period of time. To increase the protection and maintenance of these functions, landowners may want to consider retaining higher basal areas near (especially within one mature tree length of) the water body. See <i>Recognizing Tradeoffs</i> , page 32.	Retaining ground vegetation and retention of a relatively undisturbed forest floor is important to control sediment and chemical release into aquatic systems. See <i>Maintaining Filter Strips</i> , page 22.
There should be a reasonable to high level of protection and maintenance of these riparian functions in this basal area range. Leaving this amount of residual basal area, however, may impact natural or artificial regeneration of shade-intolerant species such as aspen or red pine on the site. Consider tradeoffs between the protection and maintenance of riparian functions and other landowner objectives for the site. See <i>Recognizing Tradeoffs</i> , page 32.	

table begins on page 58

See also Figure GG-15, page 60.

Figure GG-15



UNEVEN-AGE MANAGEMENT

All Other Water Bodies

(Non-Trout Streams, Non-Trout Lakes and Open Water Wetlands)

RMZ WIDTH AND RESIDUAL BASAL AREA RECOMMENDATIONS

After consulting Table GG-3 (page 46-47) and the Description of General Forest Types (pages 48-52), refer to the following table and figures for specific RMZ width and residual basal area recommendations for uneven-age management:

- Table GG-6 (specific recommendations)
- Fig. GG-16 (streams)
- Fig. GG-17 (lakes and open water wetlands)

Important Considerations

Four important considerations relate to these guidelines:

- Stream width is estimated at the bankfull elevation at the narrowest portion of a straight channel segment within the management area.
- RMZ width is measured as slope distance (the linear distance along the ground), not horizontal distance, except when the ground is level, in which case slope distance and horizontal distance are the same.
- Residual basal area recommendations represent the density, measured in ft²/acre, immediately following any forest management activities that remove trees.
- No minimum tree diameter is established when measuring for basal area reserves.

All Other Water Bodies (Non-Trout Streams, Non-Trout Lakes and Open Water Wetlands) Ten-Age Management
 RMZ Width and Residual Basal Area Recommendations

Table GG-6

Water Body	Size	Recommended Minimum	
		RMZ Width (slope distance) (in feet)	Residual Basal Area ³ (ft ² /acre)
Non-Trout Streams (see Fig. GG-16)	> 10 feet wide	200	80
Non-Trout Streams (see Fig. GG-16)	3-10 feet wide	100	80
Non-Trout Streams (Perennial) (see Fig. GG-16)	< 3 feet wide	50	80

table continues on page 63

Table GG-6 (cont'd)

table begins on page 62

Non-Trout Streams (Intermittent) (see Fig. GG-16)	< 3 feet wide	not applicable	not applicable
Non-Trout Lakes/ Open Water Wetlands (see Fig. GG-17)	all sizes	200	80

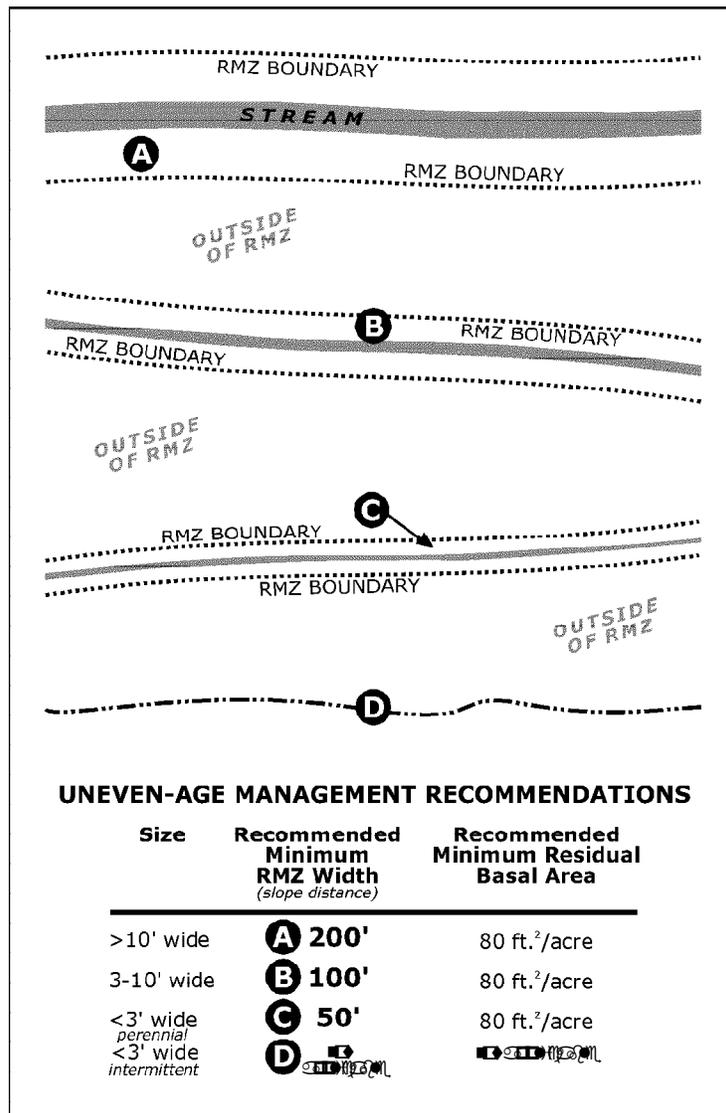
¹Forest management may be conducted within the RMZ. Review *Flexibility Considerations and Incorporating Riparian Guidelines into Plan Design*.

²Filter strip guidelines apply adjacent to all water bodies. See *General Guidelines: Maintaining Filter Strips*.

³Consider seeking professional assistance when determining appropriate residual basal area silvicultural guidelines for desired uneven-age species. See *Resource Directory*.

Figure GG-16

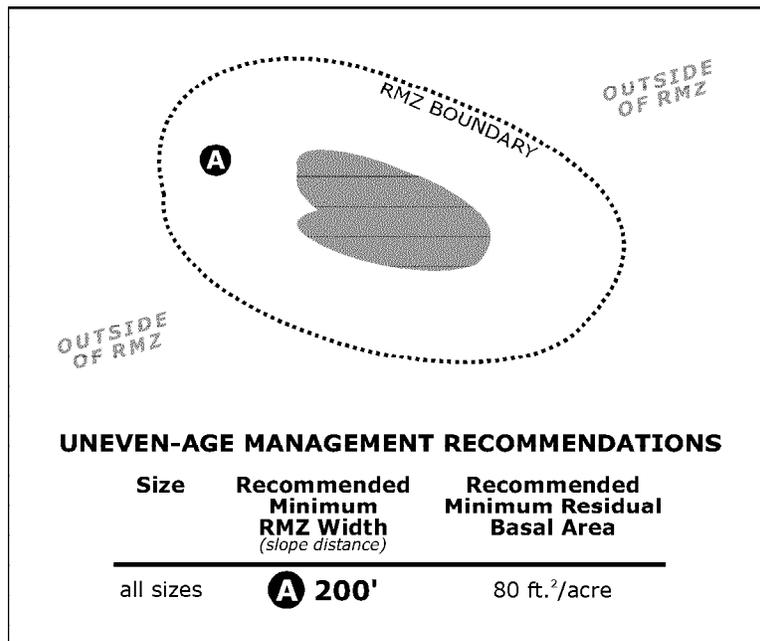
Perennial and Intermittent Non-Trout Streams
in High Bank and Upland Forests:
Uneven-Age Management
**RMZ Width and Residual Basal Area
Recommendations**



Forest management may be conducted within the RMZ. Review *Flexibility Considerations* and *Incorporating Riparian Guidelines into Plan Design*.

Figure GG-17

Non-Trout Lakes and Open Water Wetlands
in High Bank and Upland Forests:
Uneven-Age Management
**RMZ Width and Residual Basal Area
Recommendations**



Forest management may be conducted within the RMZ. Review *Flexibility Considerations* and *Incorporating Riparian Guidelines into Plan Design*.





OPERATIONAL ACTIVITIES

Protecting Cultural Resources

Some types of cultural resources are protected by federal or state law. See *Part 2, Cultural Resources: Cultural Resource Management and the Law*. For sources of information and assistance, see *Resource Directory*.

U When practical or feasible, avoid management activities within cultural resource areas.

U Delineate cultural resource areas using flagging, signs or other appropriate methods. Communicate with loggers and equipment operators to assure clear understanding that there is to be no work in the marked area.

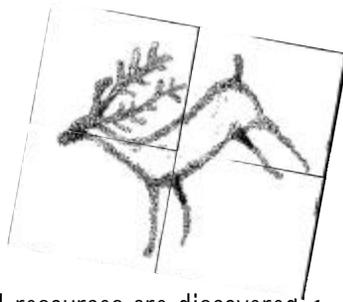
U When it is not practical or feasible to avoid cultural resource areas during forest management activities, protect resources by applying one or more of the following procedures:

- Use temporary fencing, barricades or other measures to restrict the movement of heavy equipment and machinery in the cultural resource area.
- Temporarily brace walls and board up windows and doors of historic buildings.
- Prevent potential structural damage or deterioration of historic buildings and structures that might result from heavy equipment operation.
- Avoid felling trees directly onto historic buildings, structures, or surface features of archaeological sites.
- Use temporary protection such as slash, corduroy, tire mats or fill over geotextile.
- Place fill over archaeological sites to prevent soil compaction and erosion.
- Revegetate archaeological sites to prevent erosion.

U For cultural resources that cannot be protected from damage, consider data recovery (professional excavation of archaeological sites or documentation of above-ground cultural resources). For sources of information and assistance, see *Resource Directory*.

U If a human burial site is accidentally discovered during operations, cease operations immediately in the vicinity of the discovery. Contact the Office of the State Archaeologist and your local law enforcement agency. For sources of information and assistance, see *Resource Directory*.

U For accidental discovery of other types of cultural resources (such as archaeological artifacts), temporary suspension is not required, but it is recommended. Suspending operations in the immediate vicinity of the cultural resource will allow time to contact a cultural resource professional or develop plans to initiate procedures to avoid or reduce damage to the cultural resource.



U When cultural resources are discovered during forest management activities:

- Safeguard the condition of the cultural resource by preventing further damage, loss or deterioration.
- Investigate and document the cultural resource in order to determine its significance and conservation potential. For information on documenting a cultural resource, see *Resource Directory*.
- Adjust work schedules to allow time for data recovery or other mitigation measures.

U Monitor the effectiveness of cultural resource management practices during forest management operations.

Managing Equipment, Fuel and Lubricants

U Designate a specified area for draining lubricants from equipment during routine maintenance. The area should allow all waste lubricants to be collected and stored until transported off-site for recycling, reuse or disposal at an approved site.

U Provide maintenance vehicles with necessary equipment to collect and store lubricants drained during repair activities. Breakdowns could require that lubricants be drained from equipment at locations away from the designated collection area. *It is illegal To burn the residues or drain these materials directly onto the ground (Minn. Rule 7045.0845).*

U Provide waste containers in maintenance areas or vehicles for collecting solid wastes, such as oil containers, grease tubes, oil filters and other trash.

U Recycle or properly dispose of collected solid waste materials at an approved solid waste site. *It is illegal to burn these wastes (Minn. Statute 88.171).*

U Locate fuel and maintenance areas away from open water, on upland sites whenever practical, and at locations where a potential spill can be contained and properly treated with minimal risk of surface water or ground-water contamination. Whenever practical, place them outside the filter strip or riparian management zone (whichever is wider). When operating on wetland areas, an upland site may also be the preferred location for fueling and maintenance.

U Report all petroleum spills of five or more gallons. Direct all reports to the Minnesota Duty Officer. The two 24-hour phone numbers are (651) 649-5451 (Metro Area) and (800) 422-0798 (Greater Minnesota). The Minnesota Duty Officer will contact appropriate state agencies.

U Thin-spread any soil contaminated by spills of petroleum products of less than 5 gallons.

Protecting the Normal Flow of Streams and Wetlands

U Mark the presence of seeps and springs and avoid damaging their normal flow during management operations. Establish filter strips and employ other wetland protection measures as applicable. See *General Guidelines: Maintaining Filter Strips*.

U Avoid disturbances such as ruts, soil compaction and addition of fill, which can interrupt or redirect the flow of water through a wetland. Such disturbances can also impact the depth of the water table or the extent of flooding or draining that occurs in a wetland, significantly altering the plant and animal community in that wetland.

U Approach water crossings at or near right angles to the stream direction, and use measures to minimize streambank disturbances.

Wetland Inclusions and Seasonal Ponds

- Wetland inclusions are wetland basins within an upland site.
- Seasonal ponds: Sometimes called *vernal pools*, seasonal ponds are depressions in the soil surface where water pools during wet periods of the year, typically in spring and fall.
 - A seasonal pond will have an identifiable edge caused by annual flooding and local topography.
 - The edge is best identified during the spring or fall, but it may be identified during dry periods by the lack of forest litter in the depression. Such depressions typically are fishless and retain water for longer periods than puddles.
 - Note: The leaf litter is replenished annually but is consumed during inundated periods and noticeably depleted thereafter. Deciduous litter will likely be consumed faster and more thoroughly than conifer litter.



A wetland inclusion is a wetland basin within an upland site. *Photo courtesy of Minnesota DNR*

Protecting Wetland Inclusions and Seasonal Ponds

Considerations

- Vegetation is important in protecting the functionality of wetland inclusions and seasonal ponds. The desired amount of leave trees and other vegetation left on a site following forest management activity will depend on site characteristics and landowner objectives.
- Residual vegetation should provide significant shading to prevent excessive warming of soil and water, while also preventing sedimentation due to mineral soil exposure. Residual vegetation should also provide key habitat features, such as coarse woody debris and leaf litter.

□ Targeting application of leave tree guidelines around these water bodies (such as retaining on even-age harvest units a minimum of 5% of the harvest area in clumps and/or 6-12 scattered leave trees per acre) will maintain the shading and structure needed while simultaneously providing habitat for cavity-nesting birds and other wildlife.

The following guidelines are designed to help protect the functionality of wetland inclusions and seasonal ponds:

U Limit forest management activities to minimize mineral soil exposure. See *General Guidelines: Maintaining Filter Strips*.

U Avoid disturbances such as ruts, soil compaction, excessive disturbance to litter layer, and addition of fill, which can interrupt or redirect the flow of water through a wetland inclusion or seasonal pond. Such disturbances can also impact the depth of the water table or the extent of flooding or draining that occurs in a wetland inclusion or seasonal pond, as well as the integrity of the ground layer, significantly altering its plant and animal community.

Retaining Leave Trees (live trees)

U Retain leave trees according to the following characteristics related to species, size and condition. Specific recommendations for numbers and distribution of leave trees (such as retaining on clearcuts a minimum of 5% of the harvest area in clumps and/or 6-12 scattered leave trees per acre) can be found in *Timber Harvesting: Leave Trees* and *Timber Stand Improvement: Operational Activities*.

Note: Retaining leave trees to benefit one resource may simultaneously fulfill guidelines focused on another resource. For example, leave trees retained to benefit cavity-nesting wildlife may also provide benefits for visual quality, mast, water quality, cultural resources or wetland habitat.

□ **Species:** A mix of species is desirable, but preference should be given to particular species for their longevity, windfirmness or cavity potential. TSI (timber stand improvement) operations often favor retention of one or more preferred tree species, but retention of a mix of naturally occurring species is desired. Recognize that all tree species have some value to particular wildlife, and that it is necessary to work with what is available on a particular site.

Table GG-7 characterizes leave trees as excellent, good or fair in terms of longevity, windfirmness and cavity potential. Windfirmness may vary based on site characteristics.

Table GG-7

Leave Tree Preferences for Longevity, Windfirmness and Cavity Potential		
Excellent	Good	Fair
white pine	aspens	white birch
oaks	red pine*	balsam fir*
elms	tamarack	jack pine*
ashes	cedar	black spruce*
sugar maple	red maple	balsam poplar
yellow birch	white spruce*	
basswood	black cherry	
	hickories	
	box elder	
	cottonwood	
	walnut	
	hackberry	

**Leaving these species in the overstory imposes a risk of insect and disease infestation to understory regeneration of that same species.*

☐ **Size:** Larger-diameter leave trees are generally more valuable to wildlife, but smaller trees have the potential to grow over time and provide habitat as a harvested stand regenerates. Therefore, leave a range of sizes on each managed site as follows:

- Leave trees should be at least 6 inches DBH (diameter at breast height), if possible.
- About 50% of leave trees should be greater than 12 inches DBH.
- At least 1-2 trees per clump or per acre should be greater than 18 inches DBH (or the largest size class available).

☐ **Condition:** While trees with some degree of decay or existing cavities have immediate benefits to wildlife, retaining some sound, windfirm trees will provide future snag and cavity needs as a harvested stand regenerates. Therefore, plan to leave trees with a range of conditions on managed sites:

- Include some trees showing signs of decay or trees with cavities.
- Leave some larger, healthy dominants or codominants.
- Leave some smaller, healthy, non-suppressed trees.



Retaining cavity trees enhances the quality of wildlife habitat in forested areas. *Photo courtesy of Minnesota DNR*

U Avoid felling or damaging any canopy individuals of rare or declining tree species in the state, specifically eastern hemlock, butternut, chinkapin (yellow) oak, honey locust, and Kentucky coffee-tree. Minimize damage to advance regeneration of these species.

U Allow some individuals of longer-lived species to reach ages of 200–300 years old in managed stands. Such longer-lived species include sugar maple, yellow birch, white pine, red pine, bur oak or red oak. Leave large cull trees standing.



U Exceptions to leave tree guidelines may be made for a number of reasons, including:

- Operator safety (of loggers, aerial spray applicators and others)
- Public safety (including hazard trees near rights-of-way, recreation sites or airport vicinities)
- Specific silvicultural applications (such as genetic considerations for seed reproduction systems)
- Visual quality
- Surrounding landscape concerns (such as sites adjacent to sharp-tailed grouse management units)
- Forest insects and diseases (such as dwarf mistletoe on black spruce, gypsy moth and pine bark beetles)

Providing Coarse Woody Debris

U Avoid having equipment disturb pre-existing large down logs, stumps and uprooted stumps.

U If a snag must be dropped, leave it where it falls whenever possible.

U Create at least 2 to 5 bark-on down logs greater than 12 inches in diameter per acre, if fewer than this number already exist. In choosing candidates for leave logs, consider the following:

- Hollow butt sections or other defective lengths of at least 6 feet are preferred.
- Sound logs and 6-inch to 12-inch diameter logs may be used if they represent the best available candidates.



Both aquatic and terrestrial coarse woody debris enhance aquatic and wildlife habitat in forested areas. *Photo courtesy of Minnesota DNR*

- Hardwood logs have more hollows or cavities and are favored by certain amphibians.
- Conifer logs decay more slowly and thus remain present as structure on a site longer than hardwoods.
- Using pines as down logs, especially in summer, increases the risk of bark beetle damage to adjacent healthy pines.

U Scatter leave logs across the site, including a few near wetlands.

U If a site includes riparian areas, create 4 leave logs per acre in the riparian management zone, if fewer than this number already exist. The overall average number for the site, however, can remain at a minimum of 2 per acre.

U Exceptions to guidelines for providing coarse woody debris may be made for a number of reasons, including:

- Alignment of skid trails
- Specific silvicultural applications (such as insect pests)
- Visual quality issues

Post-Operational Activities and Followup Visits

U If a road will provide access to a cultural resource, consider closing the road after the operation is completed.

U Remove flagging, signs or other markings that identify a cultural resource when a forest management activity is completed.

U If slash, corduroy or fill over geotextile was used for temporary protection of cultural resources, it is preferable in most cases to leave it in place. If tire mats were used, remove them.

U Restore watercourses to approximate their natural condition by removing temporary drainage structures and stabilizing the soil along the banks.

U Stabilize bare soil areas and install water diversion devices and erosion control barriers where appropriate to prevent or minimize erosion and sedimentation from roads, skid trails and landings into surface water and cultural resource areas.

- Seed and fertilize as appropriate.
- Fill in ruts as necessary, weighing the benefits of filling in ruts on skid trails against the potential for additional impact to soil productivity as a result of equipment used to eliminate ruts.
- Inspect erosion control measures periodically and maintain or remove as needed.

U Place traffic barriers where appropriate to prevent vehicles from disturbing recently stabilized areas. Barriers should be visible and well marked, and they should not present a safety hazard.

U Conduct followup visits to areas where structures (such as culverts or water bars) or other protection measures (such as seeding of bare areas) are used to minimize impacts on water quality and wetlands. Such followup visits can help assure that the protection measures remain functional.