CHAPTER 3: MANAGEMENT MEASURES

Scope of This Chapter

For the purposes of this guidance, EPA has addressed the activities associated with forestry activities that could affect water quality through nine management measures. A separate management measure is applicable specifically to forested wetlands. The management measures are stated as steps to be taken, guidelines for operations, or goals to be achieved for protecting water quality during the related phases or activities. The following are EPA's forestry management measures:

- Preharvest planning
- Streamside management areas
- Road construction/reconstruction
- Road management
- Timber harvesting
- Site preparation and forest regeneration
- Fire management
- Revegetation of disturbed areas
- Forest chemical management
- Wetland forest management

Numerous BMPs are associated with each management measure. BMPs are specific actions, processes, or technologies that can be used to achieve a management measure. These BMPs are very similar to those recommended by most states. Because of the national scope of this guidance, however, some of the particulars of implementation (such as prescriptions for sizes of pipes, lengths of road at particular slopes, and other such site- or region-specific details) are not included as part of the descriptions of BMPs. Implementation of one or more BMPs is usually necessary to achieve the level of pollution control intended by a single management measure.

Each management measure is addressed in a separate section of this chapter. Each section contains the wording of the management measure, which has not been changed from that in the 1993 CZARA guidance; a description of the management measure's purpose or how it can be used effectively to protect water quality; and information on BMPs that are suitable, either alone or in combination with other BMPs, to achieve the management measure. Where new or improved versions of BMPs have been developed, they are discussed in this guidance. Many of the BMPs were in the 1993 CZARA guidance, and most can be found in state forest practices manuals. For recommendations on widths of streamside management areas, slopes and lengths of culverts, and other criteria for your specific area, consult a state forest practices manual or contact your local forester.

Since the forestry management measures developed for CZARA are for the most part a system of BMPs commonly used and recommended by states and the U.S. Forest Service, many BMPs are already being implemented at many harvest sites and on many forest roads. Where the BMPs in place are inadequate to protect water quality, augmenting them with additional or complementary BMPs might be all that is necessary. Where measures are lacking and water quality is or might become impaired, this guidance can assist in the choice of BMPs suitable to the source of water quality impairment.

Management Measure Effectiveness

States have used a number of approaches for assessing the effectiveness of management measures and BMPs. Florida and South Carolina have assessed their effectiveness using bioassessment techniques and stream habitat assessment. Florida has compared sites adjacent to harvests with non-logged reference sites, and South Carolina has also compared sites upstream from harvests to those downstream from harvests and conditions at the same site before harvests to those after harvests. Maine and Virginia have placed in-stream water quality samplers in streams near forest harvest operations. South Carolina and Washington have used a weight-of-evidence approach, in which a variety of different assessment approaches are used and the conclusion about effectiveness arrived at most by the different approaches is accepted as the overall conclusion. South Carolina has concluded from its weight-of-evidence assessments that on sites with perennial streams, BMP compliance checks, stream habitat assessment, and benthic macroinvertebrate assessments can be used effectively to assess BMP effectiveness.

All of the approaches have produced valuable information about BMP effectiveness. The conclusions from these studies are many:

- BMP assessment monitoring is important for determining that the standards for design and implementation of BMPs are appropriate for the soils and topography where they are to be used.
- One or more BMP assessment approaches, including BMP compliance and an in-stream habitat or macroinvertebrate approach, can help determine whether BMP implementation standards are adequate.
- Once adequate implementation standards have been developed, rigorous BMP compliance checks generally suffice as an indicator of BMP effectiveness. The compliance checks are used to verify that BMPs are being installed properly and in a timely manner, and that they are maintained adequately.
- It is important to assess the effectiveness of BMPs under a variety of site conditions and to tailor implementation standards to different types of soils, slopes, and regional site characteristics if the BMPs are to be effectively applied.
- Application of BMPs per implementation standards during forest harvesting protects water quality in adjacent streams. BMPs protect stream ecology and stream temperature, and they prevent sedimentation.
- When BMPs are not properly applied, they do not adequately protect water quality. Improperly applied BMPs can result in stream sedimentation, changes in stream morphology, increased average water temperatures, wider water temperature fluctuations, and changes to stream ecology.

- Many water quality problems that arise from forest harvesting are associated with improperly applied BMPs or not having used BMPs. The most frequently misapplied or missing BMPs are those for road surface drainage control, erosion control prior to the harvest, stream crossings, and SMAs.
- Some states do not adequately address some water quality problems associated with forest harvesting. BMPs for ephemeral drainages need to be developed and the circumstances under which ephemeral drainages require BMPs needs to be determined. Ephemeral drainages can produce or deliver large quantities of sediment to other streams if left unprotected after a harvest.
- The most important BMPs for protecting stream water quality are properly sized SMAs, properly designed BMPs for erosion control implemented prior to the commencement of road construction and harvesting, properly designed stream crossings, and comprehensive preharvest plans.

Examples of Management Measure Effectiveness

Examples of how BMPs can operate as a system to control nonpoint source pollution are given in a paper that summarizes a national effort by USDA's Forest Service to develop analysis procedures for estimating the economic benefits of soil and water resource management (Dissmeyer and Foster, 1990). The paper focuses on benefits in five areas—timber, forage, fish, enhanced water quality, and road construction and maintenance. The benefits noted from the use of resource management systems are expressed as increased timber production, increased forage on the harvest site, and benefits to other resources from improved soil and water resource management. The following are the examples of the proper implementation of resource management systems provided in Dissmeyer and Foster (1990) and Dissmeyer and Frandsen (1988). Each example begins with a hypothetical situation and then describes how BMPs apply to the situation.

Example 1 focuses on soil and water resource management in road construction and maintenance. In this example, a main haul road is built across problem soils, cutbanks yield excessive surface runoff and erode easily, the runoff volume from the site is sufficient to erode through the road surface and road subgrade, road maintenance (without BMPs installed) is needed every 3 years, and the road is assumed to be used for 20 years. Applying a resource management system to this situation, the following solution was devised: construct the road with midslope terraces in the cutbanks; install water diversions above the cutbanks; and seed, fertilize, and mulch the cutbanks. The total estimated repair costs over 20 years were calculated at $2,137 for materials, labor, and cost of technical assistance. The one-time installation of BMPs, which would eliminate the need for maintenance every 3 years, would cost $1,200. The resulting net present value, or economic benefit to the property owner, of installing the BMPs in this example was calculated as $937 (all cost figures in 1990 dollars).

Example 2 relates to recouping timber growth and yield losses through skid trail rehabilitation. Skid trails and skid roads in harvest areas are areas where sediment is lost, and as a result the timber yield in primary skid trails and on skid roads is in general severely reduced. Soils in skid trails can become severely compacted, limiting water infiltration and thus soil moisture availability and tree root development. Finally, soil nutrients are removed during skidding and during road construction. A resource management system solution to this problem involves using the following BMPs: ripping and tilling the soil, waterbarring, seeding, fertilizing, and mulching. Using these practices as a system, the net present value of timber volume recovered (based on estimations provided in published studies) would be $210 per acre based on a harvest of shortleaf pine stands and $237 per acre in hardwood stands. Note that the economic returns are positive in high-value shortleaf pine stands and negative in low-value hardwood stands. The study notes, however, that the herbaceous growth from applying a system of resource BMPs in hardwood stands would have positive value for hunting and environmental protection.

Example 3 relates to the effect of site preparation, which can affect sediment production, soil productivity, and timber growth and yields. Poor site preparation practices that compact the soil, remove litter, and remove nutrients adversely affect soil productivity and sediment retention. The study, based on modeling data from independent studies of BMPs used for site preparation, found that site preparation results in economic benefits. Specifically, investing $50 *more* per acre in preparing a site with shearing and windrowing *reduced* future maintenance costs by $129 per acre, compared to chopping and burning.

These examples highlight the economic and ecological advantages of using management measures and BMPs as a system to reduce effects on surface waters and to ensure more rapid site regeneration and healthier timber stands.