



WOODLAND OWNERS TRAINING MANUAL
for Developing a
**Forestry Agriculture
Water Quality Plan**



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Woodland Owners Training Manual for Developing a Forestry Agriculture Water Quality Plan

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All parties involved in forestry operations, including landowners, loggers, and silvicultural operators, are responsible for water quality protection. Forestry operations include both silvicultural and timber harvesting activities. Silvicultural activities are those used to grow and care for forests and trees. Activities such as tree planting, thinning, timber stand improvement, and any work done to encourage artificial or natural tree regeneration after a timber harvest are considered silvicultural operations.

One of the most effective methods of protecting water quality during forestry operations is to use Best Management Practices (BMPs). BMPs are guidelines and techniques that, when used properly, can eliminate or help reduce water pollution. Specifically, silviculture and timber harvesting BMPs are designed to reduce nonpoint source pollutants.

Forestry Nonpoint Source Pollutants

Muddy water runoff from logging roads, skid trails, and log decks. Muddy water caused by suspended sediments can directly harm aquatic life. Sediments can also settle to the bottom of the stream or pond, choking out plant and animal life.

Tree tops and logging and site preparation debris. When these are pushed into streams, they can cause diversion of the streams, resulting in bank erosion and muddy water.

Loose fill from roads and log decks. When pushed over stream banks and into sinkholes, these will be washed into streams or possibly underground waters below sinkholes.

Excessive sunlight on streams, ponds, and sloughs. This can cause an increase in temperature and a reduction in oxygen, both of which can harm sensitive stream life.

Fertilizers. Excess nutrients cause nutrient imbalances and suffocating algae blooms.

Pesticides. Applied improperly, these can have negative impacts on aquatic plants and animals.

Vehicle fluids such as hydraulic fluid, oil, and gas. Leaking fluids from operating or resting equipment can make their way into ground or surface water.

Landowner Responsibilities for Protecting Water Quality

Proper stewardship of Kentucky's forests and the law require that forest owners protect water quality. The Kentucky Agriculture Water Quality Act specifies that landowners must have a written Water Quality Plan that states which BMPs are to be used in forestry and agriculture operations on their property. BMPs involve a wide range of practices used to help protect water quality. The Kentucky Water Quality Act specifies a minimum set of BMP requirements that must be used in forestry operations. These minimum requirements should be viewed as the least that can be done to help reduce water pollution, and landowners are encouraged to use BMPs that go beyond the minimums. Landowners are responsible for developing a water quality plan that includes the Agriculture Water Quality Act BMPs. Landowners are also responsible for ensuring that the plan is adhered to during operations. The development of the Water Quality Plan should be one of the first steps during the planning of a forestry operation.

The selection of BMPs is based on the type of operation, topography (the shape of the land), and the type of water bodies or drainage channels present. Forestry BMPs are normally implemented during or directly after the operation. Many times landowners may be directly involved in the silvicultural activities and can implement the BMPs. However, in the case of timber harvesting and large and intensive silvicultural operations, most BMPs are implemented by the logger or silvicultural operator.

Regardless of whether the landowner has a direct role in BMP implementation or a timber harvesting operator installs the BMPs, the landowner is responsible for writing a plan that specifies the use of the appropriate BMPs. In some instances, especially for timber harvesting operations, landowners may find it helpful to consult with a forestry professional or logger before writing the plan. Loggers, as specified in the Forest Conservation Act, are required to use the same appropriate BMPs. The two laws, the Agriculture Water Quality Act and the Forest Conservation Act, make it imperative that both landowners and loggers become familiar with appropriate BMP use.

This training manual will help landowners become familiar with "writing" Water Quality Plans for forestry operations and provide an opportunity to become familiar with the BMPs specified by the Agriculture Water Quality Authority (AWQA) for silvicultural and timber harvesting operations in Kentucky. The BMPs are contained in the technical manual

FOR-67, *Kentucky Forest Practices for Water Quality Management* (1997). This manual is the reference document for silviculture BMPs contained in the State Agriculture Water Quality Plan and serves as the reference document for all field guides for forestry and timber harvesting BMPs in Kentucky. See Appendix A for a general description of the BMPs.

When Is a Landowner Required to Have a Water Quality Plan?

No one is exempt from protecting the waters of Kentucky. However, not all landowners are required to have a plan. You can use the following questions to determine if you are required to have an Agriculture Water Quality Plan. It is important to remember that the term silviculture, used a number of times in agriculture water quality information, includes most forestry and timber harvesting operations. It does not include Christmas tree production (see “Note to Farmers, Christmas Tree Growers, and Fruit and Nut Producers”).

1. Do you have 10 or more contiguous acres of land in Kentucky?

Helpful hint: Contiguous means all in one place. Notice that the question does not ask for the size of the operation. The size of the operation is not important; it is the size of the ownership that matters.

No—No plan needed. Yes—Go to 2.

2. Is the property being used for agricultural and/or silvicultural operations?

Helpful hint: For the purpose of the Agriculture Water Quality Plan, timber harvesting and most forestry operations are included as a silvicultural operation.

No—No plan needed. Yes—Go to 3.

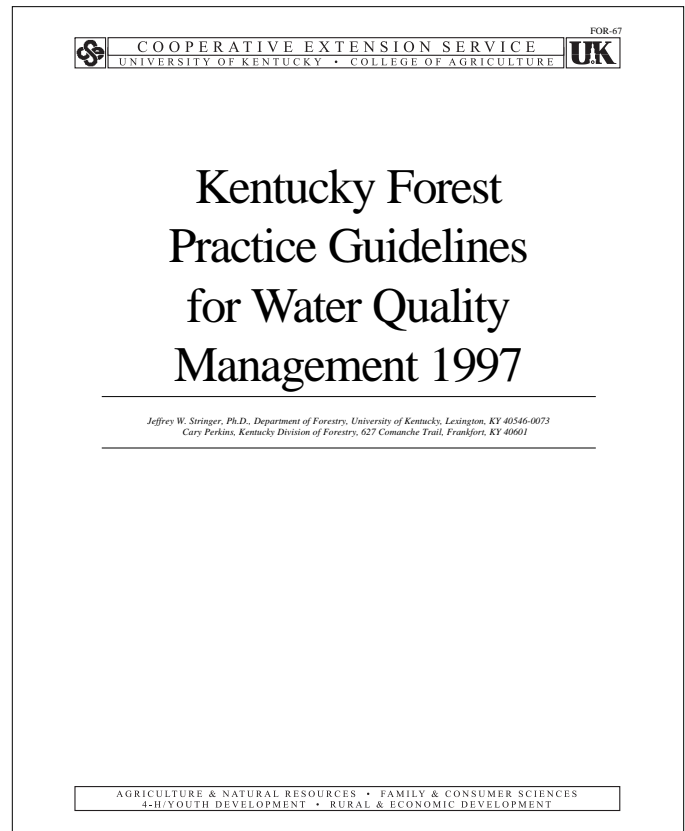
3. Do you have a conservation, compliance, or forest stewardship plan for your operation?

Helpful hint: Conservation and compliance plans are written for farming operations in Kentucky, and Forest Stewardship Plans are written for the landowner by the Kentucky Division of Forestry or a forestry professional approved by the Kentucky Division of Forestry.

No—You will need an AWQA plan.
 Yes—Develop an AWQA plan or update other plans to include surface water protection.

Note to Farmers, Christmas Tree Growers, and Fruit and Nut Producers

The Agriculture Water Quality Act specifies that most landowners involved in agriculture and forestry operations have a written water quality plan for their operations. The *Agriculture Water Quality Authority Producer Workbook* outlines the BMPs needed for all types of agriculture and forestry operations and is available from most agriculture agencies and conservation districts. The workbook contains several different sections, including silviculture, pesticides and fertilizers, farmstead, cropland, livestock, and streams and other waters. The producer workbook helps those engaged in multiple activities to determine which BMPs are needed for each type of operation. Many farmers will produce an Agriculture Water Quality Plan for operations that are ongoing, such as livestock and crop production. In the future, a forestry operation, such as timber harvest, may be done. When this occurs, the Agriculture Water Quality Plan will have to be amended to include the new operation. Christmas tree producers and those having orchards are required to use the crop BMPs and should refer to the Crops Section in the producer workbook.



How to Use This Training Manual

This training manual is designed to help forest owners learn how to properly develop an Agriculture Water Quality Plan and to help farmers amend existing plans to include forestry operations.

This manual contains seven **Forestry Exercises**. Each exercise contains a written example of a forestry operation used in Kentucky. The exercises are completed by reading the example and answering a set of **Silvicultural BMP Questions**. Based on a “yes” or “no” answer to each question, the manual will indicate the appropriate BMPs to be used in that operation. Each example also includes a small **BMP Table** used to keep track of the BMPs that you have determined are necessary for the specific operation outlined in the example.

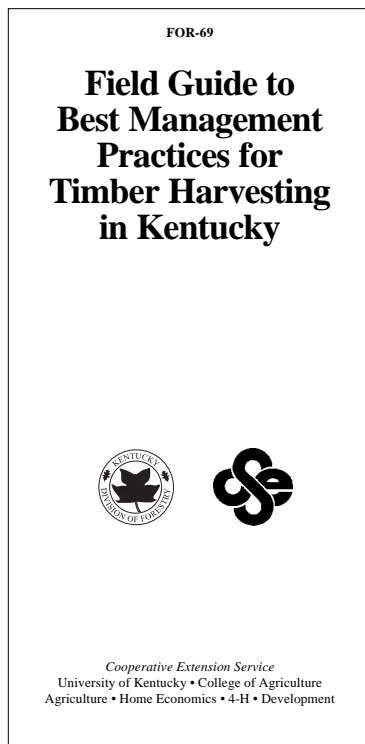
The silvicultural questions in this manual are the same questions that are found in the silviculture section of the *Agriculture Water Quality Producer Workbook*. Some helpful hints have been provided to help you answer the questions. Each exercise also contains a set of **Discussion Questions**. These are not part of the Agriculture Water Quality Plan. They are included to give you an opportunity to examine the details of the BMPs and consider some of the issues that might arise during their implementation.

This manual also contains summaries of Kentucky’s Silvicultural BMPs, Streams and Other Waters BMPs, and BMPs for Pesticide and Fertilizer use specified by the Agriculture Water Quality Authority.

Working through several Forestry Exercises will help you understand how to write water quality plans and will highlight some of the decisions that landowners must make when they undertake forestry operations.

Follow These Steps to Complete the Exercises:

- 1. Select one of the Forestry Exercises.**
Although it would be a good idea to go through all the exercises, start with the one most similar to operations on your property. A list of the exercises is on page 7.
- 2. Read the description thoroughly.**
You will use this description to answer the Silviculture BMP Questions.
- 3. Turn to the Silviculture BMP Questions (page 6) and answer the first question.**
If the question is answered “no,” move to the next question. If the question is answered “yes,” you must use the BMPs that are specified.
- 4. Use the BMP Table to keep track of the BMPs needed.**
Example: You have read a timber harvesting description and answered “yes” to the first Silviculture BMP Question that asks, “As a part of any timber harvesting and/or silvicultural operation, will you or the logger need to construct, use, and/or maintain roads, skid trails, and/or log landings on your property?” A “yes” answer indicates that BMPs No. 1 and No. 5 are needed. Go to the BMP Table in the example you are working on and place a check in the box below numbers 1 and 5.
- 5. Answer all the Silviculture BMP Questions.**
Proceed until you have answered all of the Silviculture BMP Questions and have marked the appropriate BMPs in the BMP Table.
After completing all the questions, the BMPs marked in the BMP Table are those required for that operation. A similar type of table completed for your operations and a simple statement indicating that those Silvicultural BMPs will be used in your operations would meet the requirements for a written water quality plan. Maps and other related information can also be added to the plan. Consult the *Agriculture Water Quality Authority Producer Workbook* for a detailed description of how to write water quality plans. The workbook also contains information on regulatory requirements that you might encounter during forestry operations.
- 6. Discussion questions.** After completing the BMP Table, read and consider the discussion questions. These are not a part of the Agriculture Water Quality Plan. However, answering the questions allows you to get a glimpse of the BMPs and may bring to light some concerns and issues that you might have to face when implementing forestry operations on your property.



Silviculture BMP Questions

Question 1.

As part of any timber harvesting and/or silvicultural operation, will you or the logger need to construct, use, and/or maintain roads, skid trails, and/or log landings on your property?

Helpful hint: Logging roads, skid trails, and landings are generally always used in timber harvesting operations in Kentucky, and this question is generally answered "yes."

Yes No

If yes: BMPs No. 1 and No. 5

Question 2.

Does the area where the silvicultural operation is to occur contain perennial or intermittent streams or other bodies of water?

Helpful hint: Perennial streams flow all year round. Intermittent streams have defined banks and flow only during the wet portions of the year and directly after rainfall in dry summer months. Drainage channels that contain water only during or after rain events, even in the winter, are not streams.

Yes No

If yes: BMPs No. 3 and No. 5

Question 3.

Does the boundary or tract where the silvicultural operation is to occur contain sinkholes?

Yes No

If yes: BMPs No. 4 and No. 5

Question 4.

In conjunction with your silvicultural operation, are there disturbed or otherwise bare areas (including roads, trails, and landings) that need to be revegetated to prevent and/or control soil erosion?

Helpful hint: This question pertains to areas where the protective duff layer has been removed and bare mineral soil is exposed and susceptible to erosion. Generally, landings, roads, and highly used skid trails need revegetation. Exceptions are roads that are to be graveled or limited-use skid trails where the duff layer is disturbed but not removed. In some instances, these areas of bare ground are far away from drainage channels or are on flat ground. Although these situations are less likely to cause water quality problems, it is best to consider all areas potentially erodible and capable of delivering sediments to streams. Generally, this question does not pertain to areas where groundcover is being killed to aid in tree planting or to encourage natural reforestation.

Yes No

If yes: BMP No. 2

Question 5.

Will you conduct any silvicultural activities in areas classified as wetlands by the Natural Resources Conservation Service (NRCS) or the U.S. Army Corps of Engineers?

Helpful hint: It is sometimes difficult for an untrained individual to determine if an area is a wetland. A wetland does not have to be an area full of cattails and bald cypress trees. Many bottomland hardwood forests on floodplains are considered wetlands. Generally, soils that stay wet near the surface indicate a wetland. Good indicators of wetland forests include soil of a bluish gray color below the surface, dug soil that has the odor of rotten eggs, sandy soil that has a thick layer of organic matter on top or dark streaks in it, or seeping water that quickly fills the bottoms of shovel holes. If you have an area that you suspect is a wetland, you can contact the Corps of Engineers, or contact your local district conservationist with the Natural Resource Conservation Service, county Cooperative Extension Service agent, or personnel from the Kentucky Division of Forestry for help.

Yes No

If yes: BMP No. 10

Question 6.

Will you, an operator, or a vendor working for you engage in site preparation activities prior to, or as part of, reforestation practices on your property?

Helpful hint: Site preparation activities are forestry practices used to help establish a new crop of trees, whether it be in a forested area or in a field. These activities include shearing, raking, and drum chopping tree tops and stumps and similar practices completed with heavy machinery, as well as prescribed burning and the use of herbicides to control competing vegetation. These practices are not normally a part of timber harvesting operations, and during a timber harvest this question is normally answered "no."

Yes No

If yes: BMPs No. 6 and No. 9

Question 7.

Will you, an operator, or a vendor working for you be applying pesticides, including herbicides or fertilizers, in connection with your silvicultural activities?

Helpful hint: This question usually pertains to silvicultural operations for culturing tree plantings or timber stand improvement work. Timber harvesting operations might include the use of fertilizers to help ensure successful revegetation of roads, trails, or landings. If this is the case, use only BMP No. 7, which is the fertilizer BMP. BMP No. 8 is for pesticides, which include herbicides.

Yes No

If yes: BMPs No. 7 and No. 8, and consult the "Pesticides and Fertilizer Section" of the *Agriculture Water Quality Authority Producer Workbook* (Appendix D). This section deals with storage, mixing, and disposal and generally reflects label specifications.

Question 8.

Do you allow livestock to have access to your forested areas or to forested areas in streamside corridors or around lakes or ponds?

Helpful hint: Also note that there is a Livestock Management BMP found in the *Kentucky Forest Practices for Water Quality Management* guidelines. From the standpoint of the Agriculture Water Quality Act, you should refer to the "Livestock Section" of the producer workbook. However, the Livestock Management BMP in the *Kentucky Forest Practices for Water Quality Management* guidelines provides guidance on grazing woodlands to those individuals whose primary concern is for timber production and woodland health. If you are concerned with these issues, also use the Livestock Management BMP (No.11).

Yes No

If yes, refer to the appropriate BMP in the "Livestock Section" of the *Agriculture Water Quality Authority Producer Workbook*.

Question 9.

Will low water stream crossings be constructed, or will gravel, sediments, or logjams be removed from a stream?

Yes No

If yes, refer to the "Streams and Other Waters Section" of the *Agriculture Water Quality Authority Producer Workbook* (Appendix C).

List of Forestry Exercises

Timber Harvesting in Eastern Kentucky—Exercise 1 8

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Timber Harvesting in Western Kentucky—Exercise 3 10

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Tree Planting in a Harvested Area—Exercise 6 13

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Timber Harvesting in Eastern Kentucky—Exercise 1

A timber harvesting operation is being planned along an **intermittent stream** in Perry County. Intermittent streams are those that flow only during the winter and after rains in the summer. A dozer will be used to develop **landings and primary skid trails** used to move logs out of the woods and load them onto trucks. There is **no indication of sinkholes or wetlands**. The land along the **intermittent stream is relatively steep, having a 35 percent slope**. The property has two access points, one next to a state highway where the intermittent stream has to be crossed, and a second on the ridge where a surface mine road is open and leads to the property.

The landowner would like to ensure that the landing and primary skid trails are well covered with grass and legume cover. The owner would like to see that everything is done to ensure good groundcover **including practices such as fertilization**. However, the harvesting operation will be completed outside the recommended seeding dates for the recommended species. Answer the Silviculture BMP Questions on pages 6-7, and fill in the table below.

Silvicultural BMPs									
1	2	3	4	5	6	7	8	9	10

Discussion Questions

1. The access point for a timber harvesting operation often determines how difficult protecting water quality will be. Generally the rule is to select the access point that is highest and thus the farthest away from the water. Based on this general rule, what is the best access point in the example above?

2. Would you be willing to allow access through a field or talk to adjacent landowners about access through their property to help avoid water quality problems?

3. Using information in BMP No. 3, how far away should roads, trails, and landings be from the intermittent stream? _____feet.

4. The intermittent stream does not contain water during the summer. The minimum criteria found in BMP No. 3 allow all the overstory trees next to this type of stream to be cut. As a landowner who is concerned about water quality, would you suggest to the logger that some trees be left standing around the intermittent stream?

Would you be willing to accept slightly less timber revenue for this? _____

5. The completion of the harvesting operation will occur during a time that is outside the recommended seeding dates. While successful revegetation can be obtained outside of the recommended seeding dates, it often requires several cultural treatments such as mulches and increases of the amount of seed used (normally by 50 percent). If you wanted to ensure good revegetation, would you be willing to assume the responsibility of seeding these areas? _____

Would you forgo some timber income to allow the logger to use mulch and increase the amount of seed in order to get adequate germination of the grass and legume cover? _____

6. The majority of the skid trails are sloped at 20 percent. How far apart on average should water bars be placed along the skid trails when they are retired (BMP No. 1)? _____ feet.

Timber Harvesting in South Central Kentucky—Exercise 2

A timber harvesting operation using a wheeled skidder to move the logs along a **primary skid trail in the woods to the log deck** is being planned along the **Barren River** in Warren County near Bowling Green. The land along the river is gently rolling with a slope of less than 10 percent, and **no wetlands are present**. **Sinkholes are present in upland areas of the timber boundary**. The landowner has asked that the logger use a large opening in the woods to load the logs onto the truck (this area is commonly called a log deck). One edge of this opening slopes toward the bottom of one of the sinkholes. The other place that the logs can be safely loaded on the truck is at the end of one of the pasture fields near the woodlot. Regardless of the location of the log deck, a relatively flat haul road will have to go from the log deck to a paved highway. The soils are productive, and the harvest will be completed during the recommended seeding dates. It has been decided that **no fertilizer or mulch will be used** to revegetate roads, trails, and landings. Answer the Silviculture BMP Questions on pages 6-7 and fill in the table below.

Silvicultural BMPs									
1	2	3	4	5	6	7	8	9	10

Discussion Questions

1. This section of the Barren River is a warm-water aquatic habitat. What percentage of the overstory trees should be left standing around the river (BMP No. 3)? _____ percent.

2. What is the minimum distance to leave overstory trees standing? _____ feet.

3. Would it be a good idea, from a water quality standpoint, to consider leaving a wider strip of trees? Why?

4. The property contains sinkholes. Muddy surface water that is allowed to drain into the bottom of a sinkhole can flow into underground streams and pollute them. BMP No. 4 provides information on how to help avoid this problem and states that runoff be diverted away from and logging debris be kept out of sinkholes. Based on this, which location, the woods opening or the pasture, would be best for the log deck? _____

5. Although not a water quality concern, mud deposited onto highways is against the law and can cause problems in the community. Practices such as graveling a logging road might be necessary to avoid this problem. In this case, the landowner wants to use the haul road for access to the property after the logging and has asked the logger to build water control structures and gravel the road so that a pickup truck can easily use it. Who should pay for these operations?

6. What BMP contains information for revegetating the roads, trails, and landings? _____

Timber Harvesting in Western Kentucky—Exercise 3

A timber harvesting operation is being planned for a 120-acre boundary adjacent to the **Ohio River** in Henderson County. The tract is relatively flat, and approximately 35 acres of this boundary contain **soils that are wet and are designated as wetlands**. A small warm-water perennial stream flows through the area of wet soils. The rest of the boundary has soils that are dry throughout the summer and fall. **No sinkholes** are present. It is now the first of December, and the landowner wants the operation completed by April. **No fertilizers** will be used to revegetate the roads, trails, or landings. Answer the Silviculture BMP Questions on pages 6-7 and fill in the table below.

Silvicultural BMPs									
1	2	3	4	5	6	7	8	9	10

Discussion Questions

- If you were unsure about whether you had wetlands on your property or not, where could you go to get assistance?

- If you fill or drain wetlands during an operation (even if it is unintentional), there could be legal implications. Allowing logging during wet portions of the year will increase rutting and possibly change water drainage of the area. Is the time frame that the landowner has allowed for the harvest reasonable? _____
- Using information in BMP No. 10, what is the minimum percentage of overstory trees that should be left to shade the stream? _____ percent.
- What is the minimum distance that overstory trees should be left standing next to the small streams? _____ feet.
- Log decks are normally flat, or nearly so, and are an excellent place to revegetate with groundcover species that are beneficial for wildlife. The minimum requirement for the Agriculture Water Quality Plan says that sediment-producing, erodible, or severely eroded areas, such as access roads, skid trails, and landings, must be revegetated. BMP No. 2 gives recommended seed mixes for this purpose. List the species in one of the mixes that would be appropriate to use on the log deck and the haul road (both have a slope of less than 5 percent and are on dry soils):

- List species from a mix that is recommended for wet soils:

- Would it be a good idea to keep the number of stream crossings to a minimum (BMP No. 3)? _____

Timber Harvesting in Northeast Kentucky—Exercise 4

A timber harvesting operation is being planned for a 17-acre farm woodlot. A wheeled skidder will be used during the selective harvest. The majority of the **skidding will be done along two old woods roads** having a maximum grade of 5 percent. The woodlot, which is being grazed, is on a **hillside with a 20 percent slope**. At the bottom of the hill is the **Licking River**, which has just come through the dam of Cave Run Lake. The water is cool and can hold trout. **The property does not contain sinkholes or wetlands**. The timber boundary has two access points. At the top of the hill is a pasture road leading from a county road to the woodlot. A second access point is an old woods road that runs along the river bank. Either road could physically carry skidders or log trucks; however, the owner is concerned about the use of the pasture as a haul road and is considering the woods road for access to the woodlot. **No fertilizers will be used**. Answer the Silviculture BMP Questions on pages 6-7 and fill in the table below.

Silvicultural BMPs									
1	2	3	4	5	6	7	8	9	10

Discussion Questions

1. From a water quality perspective, which access road would you recommend that the landowner use, the pasture road or the woods road on the river bank?

2. Would you be willing to allow access through a field or talk to adjacent landowners about access through their property to help avoid water quality problems? _____

3. The cool-running river can potentially hold trout and is designated a Coldwater Aquatic Habitat. BMP No. 3 states that a minimum of 75 percent of the overstory trees must be left in the Streamside Management Zone (SMZ) along its bank. Kentucky's BMPs recommend that 50 percent of the overstory trees be kept along other types of streams. Why would a larger number of trees need to be kept along the bank of a Coldwater Aquatic Habitat?

4. Using the information in BMP No. 3, what is the minimum distance that roads, trails, and landings can be from this part of the Licking River? _____feet.

5. What BMP contains information for revegetating roads, trails, and landings? _____

Tree Planting in an Abandoned Agriculture Field—Exercise 5

An abandoned 35-acre field is being planted to black walnut and other valuable hardwood species. It is gently rolling and the soils are rich and well drained. One edge of the field is bounded by a warm-water **perennial stream** (a stream where water flows throughout the year). The field is currently covered with fescue, and there are several grass-covered drainage channels running through the field. These are generally dry and carry water to the stream only when it is raining. The landowner is planning on **preparing the site for tree planting** by eliminating the fescue groundcover with **herbicides** and establishing a less aggressive cover of orchard grass and a legume. Lime and **fertilizer will be also be applied** to the entire area prior to planting trees. A mechanical tree planter will be used to plant the walnut trees. Pre-emergent herbicides will be used in strips for one to two years after planting to control aggressive weeds. Answer the Silviculture BMP Questions on pages 6-7 and fill in the table below.

Silvicultural BMPs									
1	2	3	4	5	6	7	8	9	10

Discussion Questions

1. Furrows or planting slits are produced by mechanical tree planters. These slits have the potential to easily erode in some types of soils. Based on BMP No. 6, what direction should the landowner run the machine planter?

2. Besides the appropriate BMP, what is the best source of information on the use of herbicides?

3. The drainage channels in the field represent areas that could easily carry pollutants, such as sediments, pesticides, and fertilizers, to the stream. Although this is not specifically addressed in the BMP information on mechanical tree planting, site preparation, or streamside management zones, would you recommend to the owner that these drainage channels be left in grass cover during the initial establishment of the plantation?

Tree Planting in a Harvested Area—Exercise 6

A 100-acre, gently rolling hardwood forest has recently been harvested, and the owner is going to convert part of the acreage to pine trees. A small **perennial stream flows** through a section of the area to be converted. The ground has an average slope of 10 percent around the stream. **No sinkholes or wetlands are located on the property.** The landowner is going to use some type of **site preparation technique** to facilitate the planting. This will include killing and/or removing hardwood trees remaining on the site. The pine trees will be planted by hand. **Herbicides will be used** to help control weeds and sprouting of the hardwoods after the planting. Answer the Silviculture BMP Questions on pages 6-7 and fill in the table below.

Silvicultural BMPs									
1	2	3	4	5	6	7	8	9	10

Discussion Questions

1. The landowner is considering whether to use a bulldozer to shear the remaining trees and stumps and windrow the logging slash or whether to inject the remaining trees with herbicide and plant underneath. Based on the information in BMP No. 9, which method would potentially be less hazardous from a water-quality standpoint?

2. If a mechanical method was used to prepare the site, what is the minimum distance that disturbed ground should be kept from the stream (BMP No. 3)? _____feet.
3. During the application of herbicides and fertilizers, care must be taken to ensure that they are kept out of Streamside Management Zones (SMZs). If the landowner is going to use a commercial applicator to apply herbicides and fertilizers, would you recommend that the landowner clearly mark the Streamside Management Zones (SMZs) prior to application?

Timber Stand Improvement—Exercise 7

A woodland owner is planning a timber stand improvement (TSI) operation for a 50-acre tract. One of the boundaries of this tract is a **perennial stream** that has been designated as a **coldwater aquatic habitat**. The goal of the landowner is to maximize high-value timber production with a secondary goal of wildlife habitat development. The Kentucky Division of Forestry has recommended using **herbicides** applied with a tree injector to deaden undesirable trees in the area. The trees to be removed will allow more desirable trees to increase in growth and value. In certain portions of the stand, a large number of poor-quality “wolf” trees are suppressing the development of younger, potentially high-value trees, requiring a large portion of overstory cover to be deadened in these areas. The forestry and wildlife specialists have determined that they will keep two of these big trees per acre to provide habitat for certain species of wildlife. Also, a few areas have been marked nearby to produce wildlife openings and increase the diversity of habitats. Answer the Silviculture BMP Questions on pages 6-7 and fill in the table below.

Silvicultural BMPs									
1	2	3	4	5	6	7	8	9	10

Discussion Questions

1. Besides the appropriate BMPs, what is the best source of information on herbicide use?

2. The landowner has walked through the area that has been marked for treatment and has noticed that a high number of large, undesirable trees have **not** been marked for deadening near the perennial stream. Why?

3. What other BMPs or section in the *Agriculture Water Quality Authority Producer Workbook* might need to be consulted (see question 7)? _____

4. Are there BMPs that specify how to dispose of empty herbicide containers and left-over herbicide solutions? _____

Appendix A. Outline of Kentucky's Silvicultural Agriculture Water Quality Act BMPs

Silvicultural Best Management Practices were developed by the Agriculture Water Quality Authority and can be found in the *Kentucky Forest Practice Guidelines for Water Quality Management*. They were developed to guide silvicultural and timber harvesting operations in a manner that protects water quality. However, implementation of the *Guidelines* will also help maintain soil productivity and ecological components of riparian habitats. Each BMP section contains specific practice recommendations, as well as information on the regulatory requirements that might be mandated during the operation and the minimum requirements of the *Kentucky Agriculture Statewide Water Quality Plan*. The following is a brief description of each Silvicultural Best Management Practice.

BMP No. 1—Access Roads, Skid Trails, and Landings

General recommendations for the placement, grade, drainage, maintenance, and retirement of access roads, skid trails, and landings as part of silvicultural and timber harvesting operations are given. These recommendations were devised to minimize soil erosion and to protect nearby bodies of water from sediments. Specific information on placement relative to bodies of water and sinkholes is presented in BMPs No. 3 and No. 4, respectively. Details of the revegetation component of retirement are presented in BMP No. 2.

BMP No. 2—Vegetative Establishment on Silviculturally Disturbed Areas

This BMP contains species and species-mix recommendations for various soil and site conditions for the revegetation of sediment-producing, erodible, or severely eroded areas, such as access roads, skid trails, and landings. These areas have the potential to produce sediment in runoff, which can affect downstream areas. Recommended seeding dates, seeding rates, cultural practices, and general fertilizer and mulching rates are also provided. These guidelines normally apply to roads, trails, and landings. Disturbed areas resulting from site-preparation activities, such as shearing, raking, chopping, and prescribed burning, will be allowed to revegetate naturally or be converted directly to a forest crop. Revegetation of these areas, based on this BMP, is often not appropriate or consistent with state-of-the-art silviculture. Guidelines for site preparation, prescribed burning, and tree planting are provided in other BMPs.

BMP No. 3—Streamside Management Zones (SMZs)

Streamside Management Zones (SMZs) are areas adjacent to intermittent and perennial streams and other waters where only limited disturbance is desirable. To help minimize or eliminate sediment delivery to bodies of water, this BMP specifies the minimum distance, based on slope percent and water body type, between roads, trails, and landings and bodies of water. This BMP also provides information on the width of residual trees that should be maintained near bodies of water and the percentage of trees that can be removed within these zones during timber harvesting operations. These latter specifications are used to maintain natural stream temperature in perennial streams through shading, to maintain the integrity of the stream bank, and to reduce the amount of sediment entering the water by minimizing soil disturbance and filtering overland flow. As a general rule, these guidelines do not apply to watercourses that flow only in direct response to precipitation (ephemeral channels). BMP No. 5, "Logging Debris," also contains information concerning streams and ephemeral channels.

BMP No. 4—Sinkholes

The purpose of this BMP is to minimize the flow of nonpoint source pollutants into sinkholes. For purposes of this BMP, sinkholes include depressional areas with or without swallets, sinking streams, caves, karst windows, and pits or vertical shafts. Silvicultural pollutants can cause degradation to groundwater, underground drainage systems, and downstream surface waters into which the underground streams flow. Sinkholes containing open swallets are of particular concern. This BMP specifies the distance between sediment-generating structures, such as roads, skid trails, and landings, and the bottom or open swallet of a sinkhole. Information concerning felled tree density and other logging debris is also given.

BMP No. 5—Logging Debris

Logging debris consists of the noncommercial portions of trees and brush, including tops and cutoffs, or other logging operation waste products that can clog or in some other way degrade water courses and water quality. This BMP specifies removal of debris, fill, and trash from intermittent and perennial streams and provides information for operations around ephemeral channels. It also provides guidance for equipment concerning fluid leakage.

BMP No. 6—Proper Planting of Tree Seedlings by Machine

This BMP provides recommendations for the proper planting of tree seedling stock with mechanical tree planters in order to minimize potential degradation of water quality resulting from planting slits.

BMP No. 7—Fertilization

This BMP concerns minimizing water quality degradation while artificially applying specific chemicals to the soil to favor increased growth of vegetation. General guidelines concerning application in Streamside Management Zones (SMZs) and in and around sinkholes are also given.

BMP No. 8—Application of Pesticides

Pesticides include insecticides, herbicides, fungicides, rodenticides, and nematocides. These chemicals are used to destroy, prevent, or control woody or herbaceous vegetation and forest pests on forested lands or areas being reforested. All forest chemicals are labeled with detailed use information that must be strictly followed. This BMP has general information on cleanup, storage, and use of pesticides around Streamside Management Zones (SMZs) and in and around sinkholes.

BMP No. 9—Site Preparation for Reforestation

The purpose of this BMP is to minimize potential water quality degradation while eliminating or suppressing undesirable vegetation that would otherwise prevent the successful establishment and growth of tree seedlings through competition for sunlight, moisture, and nutrients, and to facilitate hand- or machine-planting operations. Specifications for windrowing and other site-preparation methods using heavy equipment are given.

BMP No. 10—Silviculture in Wetland Areas

Wetlands are defined as areas characterized as having hydric soils and supporting a dominance of hydrophytes (plants adapted to primarily wet conditions). Such areas are transition zones between predominantly dry upland sites and permanent water in streams and lakes. The U.S. Army Corps of Engineers officially determines whether a forested area is a wetland unless there is adjacent cropland, in which case the Natural Resources Conservation Service may make the determination. The requirements in this BMP are supplemental to other silvicultural BMPs and contain information and specifications for trafficking and timber harvesting around streams, sloughs, and other waters in a wetland.

BMP No. 11—Livestock Management

Livestock management in forested areas is often necessary to maintain enough cover to protect the soil and prevent sedimentation of nearby bodies of water; to protect, maintain, or improve the quantity and quality of the plant resources; and to maintain soil productivity and to prevent soil compaction. This BMP can be applied where desired forest reproduction, soil hydrologic values, and/or existing vegetation can be seriously damaged by livestock.

BMP No. 12—Fire Lines for Wildfire Control

A fire line is a path of varying width constructed through the litter on the forest floor down to mineral soil to restrict and control wildfire. Both hand tools and mechanized equipment can be used to construct fire lines, and this BMP contains information to minimize the sedimentation of water bodies resulting from erosion of the line after fire suppression.

BMP No. 13—Prescribed Burning

Prescribed burning involves the use of fire under conditions that will assure confinement yet produce the intensity of heat and behavior required to accomplish one or more management objectives. The purpose of this BMP is to conduct those burning practices used to modify a forest stand or to reduce forest residue to some desired level that minimizes soil erosion and protects nearby bodies of water from sedimentation. Guidelines concerning fire lane placement, drainage, and retirement are also included in this BMP.

Appendix B. Answers to BMP Tables and Discussion Points

Example No. 1

Silvicultural BMPs: No. 1, No. 2, No. 3, No. 5, and No. 7
Discussion Questions: **1.** The surface mine road on the ridge is the greatest distance from the water and may provide the best access. If the lower access point is to be used, a low-water crossing or other type of crossing may be desired. If this is the case, consult the “Streams and Other Waters” BMPs. **2.** In many cases, good access points might necessitate hauling across another property. Large timber companies and the federal and state governments realize this and will generally help private landowners with access across their boundaries. **3.** Roads, trails, and landings should be kept at least 60 feet up the slope. **4.** It is important to realize that the minimum criteria listed in the BMPs are just that. In some instances, it may be prudent to go beyond these minimum criteria. The use of BMPs and, in this case, measures that go beyond the minimum criteria, cost money. In this example, pushing the logger to maximize revenues may make it difficult for the logger to adequately address all the landowner's concerns. **5.** If seeding occurs outside the recommended seeding dates, it may be difficult to establish good groundcover. In some cases, the landowner may want to take on this responsibility. This is also true when a landowner wants to establish a mix that takes time and care to establish, such as those containing native species. **6.** 47 feet.

Example No. 2

Silvicultural BMPs: No. 1, No. 2, No. 3, No. 4, and No. 5
Discussion Questions: **1.** For most streams **not** designated a coldwater aquatic habitat, a minimum of 50 percent of the overstory trees must be retained. **2.** 25 feet. **3.** Yes. It is a good rule-of-thumb to leave as many standing overstory trees around streams as possible. **4.** It is best to keep disturbed ground as far away from the bottoms or openings of sinkholes as practical. The end of the pasture field would be more acceptable from a water-quality standpoint. Forcing the logger to use a site that is close to water or sinkholes so as to avoid disrupting a field may put the operation at risk. **5.** Issues such as mud on the highway should be discussed prior to the harvest. Extra harvesting costs may be associated with developing permanent roads compared to retiring them, as would normally be the case if they were used only for logging. **6.** BMP No. 2. Vegetative Establishment of Silviculturally Disturbed Areas.

Example No. 3

Silvicultural BMPs: No. 1, No. 2, No. 3, No. 5, and No. 10
Discussion Questions: **1.** Several agencies can assist with this determination. Regional offices of the Corps of Engineers can be contacted. Professionals such as the district conservationist with the Natural Resources Conservation Service, the county Extension agent, and personnel with the Kentucky Division of Forestry can also be contacted and are locally available. **2.** The December-through-April time frame means that the logger will have to remove the timber during a portion of the year when the chance for rutting is high. If the landowner would extend the ending time, there would be a better chance of avoiding problems. **3.** The minimum amount of trees that should be retained around the stream is 50 percent. **4.** 50 feet. **5a.** One of the temporary species (normally wheat, rye, or oats) should be used, combined with one of the permanent mixes listed in the table titled “Mixtures for Slopes Less Than 10 Percent.” **5b.** A temporary species along with the one of the mixes from the table titled “Mixtures for Wet or Poorly Drained Areas” should be used. **6.** Yes. It is always wise to minimize stream crossings.

Example No. 4

Silvicultural BMPs: No. 1, No. 2, No. 3, and No. 5
Discussion Questions: **1.** The pasture road would probably cause the least number of problems. The best access points from a water-quality perspective are normally those farthest from the water. Remember, always keep operations as far from streams and other sensitive areas as possible. **2.** In many cases, good access points might necessitate hauling across another property. Large timber companies and the federal and state governments realize this and will generally help private landowners with access across their boundaries. **3.** Retaining a minimum of 75 percent of the overstory trees means that more shade will be on the stream than if 50 percent of the overstory trees were left. More shade means cooler water and potentially more oxygen. Some species, such as trout, need these conditions. **4.** Roads, trails, and landings should be kept at least a minimum of 55 feet up the slope from the river bank. The greater the distance disturbed ground is kept from streams, the less likely it is that muddy water runoff will reach them. **5.** BMP No. 2. Vegetative Establishment of Silviculturally Disturbed Areas.

Example No. 5

Silvicultural BMPs: No. 3, No. 5, No. 7, No. 8, and No. 9

Discussion Questions: **1.** Machine planting, along with most operations, should occur along the contour, not straight up and down the hill. **2.** The herbicide label is the best source of information on how to properly apply chemicals and avoid both safety and environmental problems. **3.** If tree planting and fertilizer and pesticides were used in these drainage channels, there could be a possibility that pollutants might enter the stream during rain storms. It might well be prudent to leave the existing grass cover in these channels.

Example No. 6

Silvicultural BMPs: No. 3, No. 5, No. 8, and No. 9

Discussion Questions: **1.** Killing unwanted trees by injection and planting the pines under them would disturb almost no soil, compared with significant soil disturbances associated with shearing and raking with a bulldozer. **2.** Mechanical site preparation activities should be kept at least 45 feet from the stream bank. **3.** Streamside Management Zones (SMZs) and any other areas around sensitive spots, such as sinkholes, should be clearly marked before any forestry operation.

Example No. 7

Silvicultural BMPs: No. 3, No. 5, and No. 8

Discussion Questions: **1.** The herbicide label is the best source of information on how to properly apply chemicals and avoid both safety and environmental problems. **2.** To make sure that the water in the coldwater aquatic habitat stream was protected from temperature change, the forester did not mark for deadening any trees in the Streamside Management Zone (SMZ). **3.** Pesticide and Fertilizer section. **4.** Yes. BMP No. 9 and No. 10 in the Pesticide and Fertilizer section.

Appendix C. Streams and Other Waters Agriculture Water Quality Act BMPs

Details of these BMPs can be obtained from the *Kentucky Agriculture Water Quality Authority Producer Workbook*. Refer to the workbook for regulatory requirements that may be encountered using these BMPs. The minimum requirements for each of the four Streams and Other Waters BMPs are as follows:

BMP No. 1 — Stream Crossing Protection

- Construct low-water crossings in a manner that does not obstruct the normal flow of the stream.
- Minimize soil erosion and removal of streamside vegetation.

BMP No. 2 — Sand and Gravel Removal

- Minimize disturbance to streams by excavation equipment and access gravel from shore as much as possible.

BMP No. 3 — Stream Bank and Shoreline Protection

This includes requirements for stream bank stabilization for banks that are eroding at an accelerated rate and stream crossings that might be damaged by vehicular traffic.

BMP No. 4 — Proper Stream Drainage Maintenance

This specifies requirements for clearing logjams or sediment blockage as follows:

For projects in streams where the watershed above the work is less than one square mile (640 acres):

- Focus work only in areas where problems occur, and avoid unnecessary disturbance to adjacent stream habitat.
- Minimize the removal of streamside vegetation. Remove only the necessary vegetation, and operate equipment from only one side of the stream.
- Minimize straightening of stream meanders.
- When working in streams that have been channelized, consult the NRCS and the Kentucky Division of Water.
- Care should be taken to avoid impacts to wetlands adjacent to streams (see special note on Corps of Engineers notification in the producer workbook).

For projects in streams where the watershed above the work is more than one square mile (640 acres), assistance must be obtained from sources such as the U.S. Army Corps of Engineers, USDA Natural Resource Conservation Service, private consultants, etc., and the Kentucky Division of Water. The Kentucky Division of Forestry and county Extension offices can help identify the appropriate sources in your area.

Appendix D. Pesticides and Fertilizers Agriculture Water Quality Act BMPs

BMP No. 1 — Storage of Dry Bulk Fertilizer

Deals with storage of more than 25 tons of fertilizer for more than one year.

BMP No. 2 — Storage of Liquid Bulk Fertilizer

Deals with storage of more than 5,000 gallons for more than one year.

BMP No. 3 — Storage of Liquid and Dry Fertilizers (small quantities)

To prevent water quality problems from spills and leaks of less than 25 tons or 5,000 gallons of fertilizer:

- Store fertilizers in compatible containers that are properly labeled.
- Construct, install, and maintain storage containers and appurtenances so as to prevent the discharge of liquid fertilizers.
- Clean up spills immediately.
- Store fertilizers and pesticides separately from one another and away from foodstuffs and feed.
- Read and follow label directions for storage.

BMP No. 4 — Storage of Dry Bulk Pesticides

Deals with storage of more than 300 pounds for more than one year.

BMP No. 5 — Storage of Liquid Bulk Pesticides

Deals with storage of more than 300 gallons for more than one year.

BMP No. 6 — Storage of Liquid and Dry Pesticides (small quantities)

To prevent water quality problems from spills and leaks of less than 300 pounds or gallons of pesticides (including herbicides):

- Keep pesticides in original containers (do not place them in food or drink containers).
- Store each type of pesticide separately from other types.
- Construct, install, and maintain storage containers and appurtenances so as to prevent the discharge of liquid pesticides.
- Do not allow pesticides to contaminate feed or foodstuffs.
- Do not store or transport pesticides near feed or foodstuffs.
- Read and follow label directions.
- Clean up spills immediately.

BMP No. 7 — Transport of Pesticides and Fertilizers

When transporting on public highways:

- Follow all Division of Transportation requirements.
- All packages and containers should be transported in a safe and stable manner.

BMP No. 8 — Mixing, Loading, and Handling

- Follow all pesticide and fertilizer label requirements.
- Follow all regulations concerning the licensure of pesticide applicators and commercial operator training.
- Use backflow prevention techniques for all measuring, mixing, and loading.

BMP No. 9 — Excess Pesticide Disposal

When disposing of pesticides and adjuvants:

- Use only a label-approved site.
- Store excess pesticides in secure, dry locations until used, recycled, or disposed of properly.

BMP No. 10 — Pesticide and Fertilizer Container Disposal

When disposing of all containers for pesticides and fertilizers:

- Dispose of nonreturnable containers according to label directions.
- Containers that have been rinsed until clean should be stored in a ventilated area until properly disposed of or recycled.

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