

New York State Forestry

A photograph of a red pickup truck with a flatbed trailer. The trailer is loaded with several logs. The truck is driving on a dirt road, kicking up dust. The background is a dense forest.

Best Management Practices

for Water Quality

BMP Field Guide

This BMP Field Guide is property of:

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Management
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BMP Field Guide
January 2000

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Many other local, state and federal agencies provided insight, inspiration and illustrations from their BMPs, which helped tremendously in developing this guide. A special thanks goes to the Hudson Mohawk RC&D Council, the Massachusetts Department of Environmental Protection, Minnesota Department of Natural Resources, the U. S. D. A. Forest Service, the NYC Dept. of Environmental Protection, the Wisconsin Department of Natural Resources, and the Northern Logger and Timber Processor.

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Introduction

Protecting water quality and the forest and soil resources on the land, are among the most important aspects of a successful and environmentally-sustainable timber harvest. Studies have shown that while timber harvesting is not a major cause of water quality problems, skid trails, haul roads and landings have the potential to be sources of sedimentation, erosion and siltation of streams and other water bodies. The key to success is proper planning and the use of appropriate, or "best" management practices (BMPs). These are simple, often low-cost practices and techniques you can incorporate in your timber harvest. They will pay big dividends in keeping our water clean, maintaining the productivity of the forest, improving public confidence in timber harvesters and maintaining public support for forest management and timber harvesting, which are essential for sustainable forest management.

This field guide is intended to be a practical tool for timber harvesters, forest managers and landowners. It presents suggestions, guidelines and technical references on a range of timber harvesting BMPs. The guide is meant to be used as a menu of options,

allowing flexibility for professional discretion and decision-making in the field. It does not present a single prescription that can or should be applied in all cases. The ultimate objective is to have an economically-viable timber harvest which protects the soil, water and remaining timber resources from loss or degradation.

The timber harvesting BMPs outlined in this guide are consistent with the EPA-approved State Non-point Source Management Plan. That plan outlines our voluntary, education and promotion-based approach to implementing timber harvesting BMPs which is supported by the New York State Department of Environmental Conservation (NYS DEC), Division of Lands and Forests, the Empire State Forest Products Association, the New York Logger Training and the Watershed Agricultural Council Forestry Program. This guide provides additional technical and practical information to help operators and managers identify potential problem areas, select the best preventative measure(s) and install and maintain it (them) properly.

Erosion and sediment are the primary potential non-point source pollution problems associated with forest management activities, especially at stream crossings for forest roads and skid trails. Erosion moves soil and can damage or destroy forest roads or skid trails,

Introduction

making it more expensive or impossible to use them during or after timber harvests. Sedimentation and turbidity (cloudiness) — caused when the eroded soil finds its way into a stream, wetland pond or lake — can damage fish habitats and spawning areas, and make the water unsuitable for other uses downstream. These sorts of problems, if they occur, are most likely to trigger a negative reaction from neighbors or the general public, and may violate state or local water protection laws. They've also led to local timber harvesting ordinances. Avoiding them is the best way to avoid controversies and the possibility of new timber harvesting ordinances or restrictions.

It is almost always more economical and effective to plan your harvests in advance and take preventative measures, than it is to have to try to fix problems after they occur. If the suggestions outlined in this field guide are followed, and appropriate practices are applied as needed, timber harvesting will have minimal impact on water quality and forest management will continue to be a "preferred land use" in New York.



Planning

Timber harvesting activities should follow a well-thought-out plan that protects soil and water resources. Landowners considering a timber harvest should always contact a forestry professional for assistance and an on-the-ground evaluation.

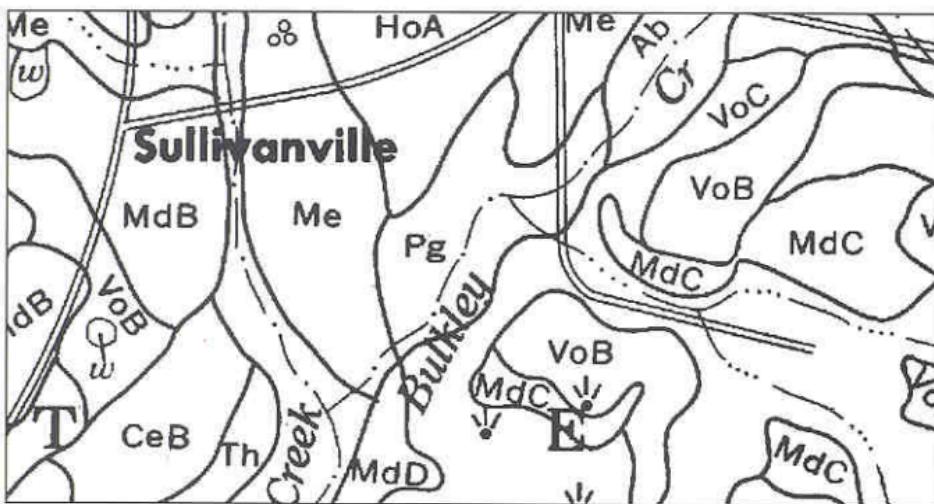
A variety of tools can help in evaluating the property and developing a plan for logging and other land management activities. These tools include aerial photographs, soil surveys, soil survey maps, topographic maps, and property survey or tax maps.

Walk the property to identify areas of special concern such as streams, ponds, lakes, wetlands, snags and nesting sites. Establish objectives for timber harvesting and forest regeneration.

Planning not only means how you will access the timber, but also when the timber will be cut. Timing is one of the most important Best Management Practices. Operating when the ground is dry, frozen or snow-covered, or when water levels are low, is an excellent way to reduce or eliminate erosion and sedimentation.

Plan to take additional precautions or even to suspend harvesting during mud season in the spring or fall.

Figure 1
County soil survey map



Planning

Once a site evaluation has been conducted, follow these recommendations to plan forest management activities:

- Make a tentative list of site-specific BMPs needed to protect water quality in all forest management plans, timber harvest plans, and timber sale contracts.
- Review forest management plan and landowner's objectives for site.

Planning

- ❑ Identify on a map the following:
 - Property boundaries and stand boundaries
 - Public highways
 - Existing and planned forest access system (roads, skid trails and landings)
 - Areas to avoid (streams, wetlands, water bodies, steep slopes [30% or greater], unstable soils, and flood plains)
 - Equipment maintenance and fueling areas
 - Stream crossings
 - Stream side management zones — areas next to streams, ponds, lakes, wetlands and other water bodies where activities are modified to protect water quality, fish and other aquatic resources
 - Other sensitive areas such as habitat areas of endangered and threatened species, deer wintering yards, etc.
- ❑ Mark roads, trails and landings on the ground and any stream crossings and specific control devices

to be used. Take advantage of natural features that will make construction easier and drainage most effective.

- ❑ Consider weather and ground conditions when scheduling road building and harvesting operations.
 - Avoid wet seasons and plan water crossings (including the installation of culverts and bridges) for summer months when water is low and fish eggs aren't incubating (May–Sept.).
 - On wet sites and when working in or around wetlands, time operations to coincide with frozen ground.
- ❑ The following resources can be used to identify site conditions:
 - Aerial photographs
 - County soil survey maps



Always check to see if a permit is required before beginning any activities. See **Regulations and Permits** for information about permits.

Planning

- United States Geological Survey (USGS) topographic maps
- Wetland inventory maps
- Classified stream maps
- Natural Heritage database maps (for threatened and endangered species)

These can be found at most regional DEC offices across the state.



Log Decks and Landings

Landings are one of the most visible parts of any timber harvest. If possible, locate the landing out of sight of the public. Curve the access road to break the line-of-sight view from the public highway. Leave a strip of vegetation between the landing and public highways. Muddy roads, piles of slash and debris, and trash spread about the landing will give a poor impression of logging, regardless of the condition of the rest of the harvest.

Log Decks and Landings

The following recommendations should be considered when planning, locating and constructing landings and the roads in and out:

- Use existing landings if possible. Close existing landings next to streams and water bodies unless construction of new landings would cause greater harm to water quality than using existing landings.
- If possible, construct new landings at least 200 feet from water bodies and wetlands.

- If the landing must be closer than 200 feet to a water body or wetland, use straw bales, silt fencing, or both, to minimize or prevent erosion.
- Locate landings on frozen ground or firm, well-drained soils with a slight slope, or on ground shaped to promote efficient drainage. Landings may need a crown shape to allow for drainage.
- Size all landings to the minimum necessary for the acreage to be harvested, yet with enough room for efficient equipment operation and product sorting and removal.
- Locate residue piles such as slash, sawdust or chips away from drainages where runoff may wash residue into streams, lakes or wetlands.
- Locate diversions such as water bars on the skid trail leading into the landing. Construct skid trails to prevent water from flowing into the landing and ponding, where compaction from the machinery has occurred.
- Locate diversions such as water bars and broad-based dips on the truck road leading out of the landing to prevent water and sediment from flowing out onto the public highway.

Log Decks and Landings

- Place coarse rock or stone to shake mud off vehicles before entering public highways.
- Remove all mud tracked onto public roads immediately.
- During muddy conditions, use coarse gravel over geotextiles or rubber mats.

Landing maintenance

- Check hoses and fittings regularly to prevent leaks of lubricants and hydraulic oil. Repair all leaks immediately.
- Have oil absorbent mats or material (kitty litter) on the landing in case fuel, lubricant, or hydraulic fluid spills or leaks.
- If the machinery is parked for an extended period, place an oil absorbent mat under the equipment to catch any slow leaks.
- Remove all unnatural debris such as cans, papers, discarded tires, cables, chains and other junk on a daily basis.

- Scatter all woody debris about to improve the appearance of the site.
- If necessary, soil should be stabilized by seeding and mulching at the end of the operation. See [PostHarvest Wrap-up](#) (starting on page 48) for recommendations on seedmixes and planting.
- For additional guidelines, see the [Hazardous Materials](#) section (starting on page 52).

Please consult [Erosion Control Tools & Techniques](#) section (starting on page 54) for details on installing waterbars, broad-based dips, straw bales, and other erosion control devices.

Forest Roads

Proper road construction will minimize disturbance to waterflow over the landscape and ensure the longevity and the stability of the road. Forest roads provide a simple road structure of adequate strength to support heavy vehicle traffic while providing drainage structures to allow water to pass through the road corridor.

Choices regarding road construction standards and maintenance activities will be influenced by site characteristics and the value of the resources served. Culverts and ditches will be necessary in many situations.

To reduce costs and minimize road mileage, coordinate with adjacent landowners. It may be more efficient to use an existing road on a neighbor's property than to construct a new road.

Forest Road Planning

The following recommendations should be considered when planning the design of the road:

- Consult a professional for guidance in designing and constructing forest roads.

- Examine existing access routes to determine whether they are the best routes to use. Consider whether relocation would provide better long-term routes.
- Minimize total road mileage and ground disturbance required to facilitate an economical harvest.
- Minimize the number of water crossings.
- Identify appropriate stabilization, drainage and erosion control measures.

Alignment and location

The proper alignment and location of roads will reduce the potential for non-point source pollution. The following recommendations should be incorporated in the road design:

- Locate roads to minimize the amount of cut and fill
- Locate roads away from streams, ponds, lakes, and wetlands whenever possible, and provide adequate filter strips.

Forest Roads



Contact utility companies when operating under power lines or crossing buried pipelines or other underground utilities.

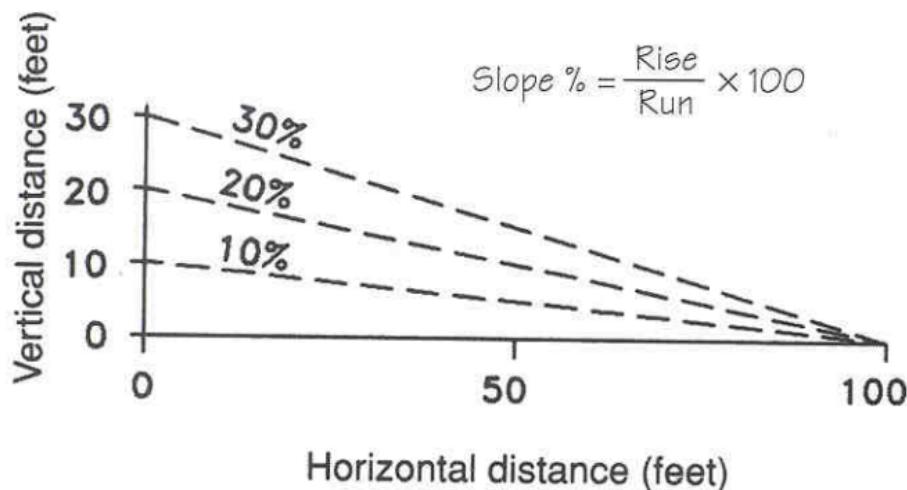
- Avoid locating roads on unstable slopes subject to slumping or creep. County soil surveys maps will identify these soils.
- Avoid locating roads with grades in excess of 10%. Plan routes to avoid these areas. On highly erodible soils, also identified on soil surveys maps, maximum grades of 5% are recommended.
- Use Table 1 and the grade meter inside the back cover to calculate slope grade.

Drainage

Water flowing along or onto the road should be diverted before gaining sufficient volume or velocity



Table 1
Calculating slope grade

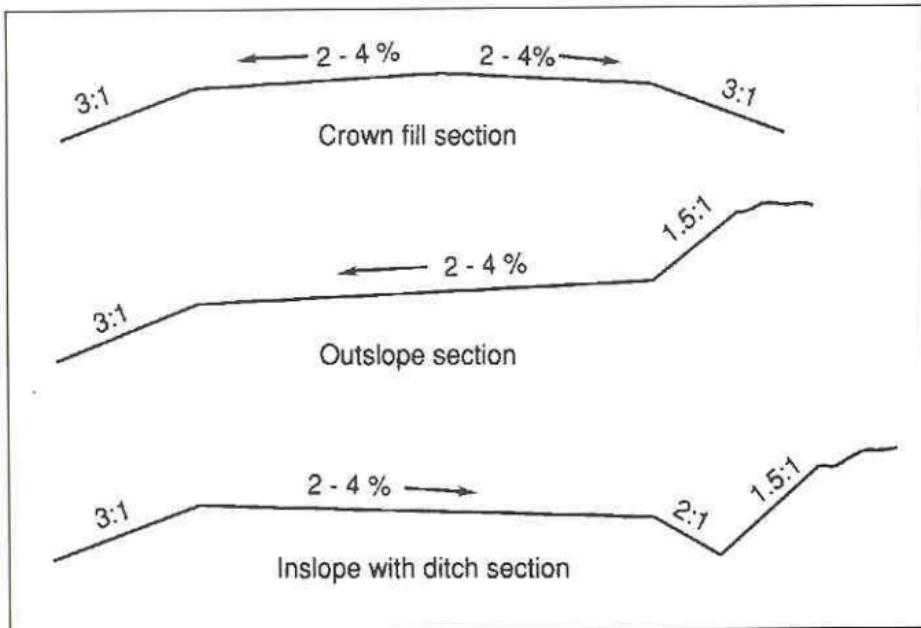


to cause significant erosion of the road and ditch. The following recommendations should be used to minimize erosion:

- Control the flow of surface water on roads by using a combination of the appropriate road cross-section (Figures 2 and 3) and water diversion structures within the roadbed itself.
- Install cross drains and diversion ditches to avoid carrying water long distance in roadside ditches.

Forest Roads

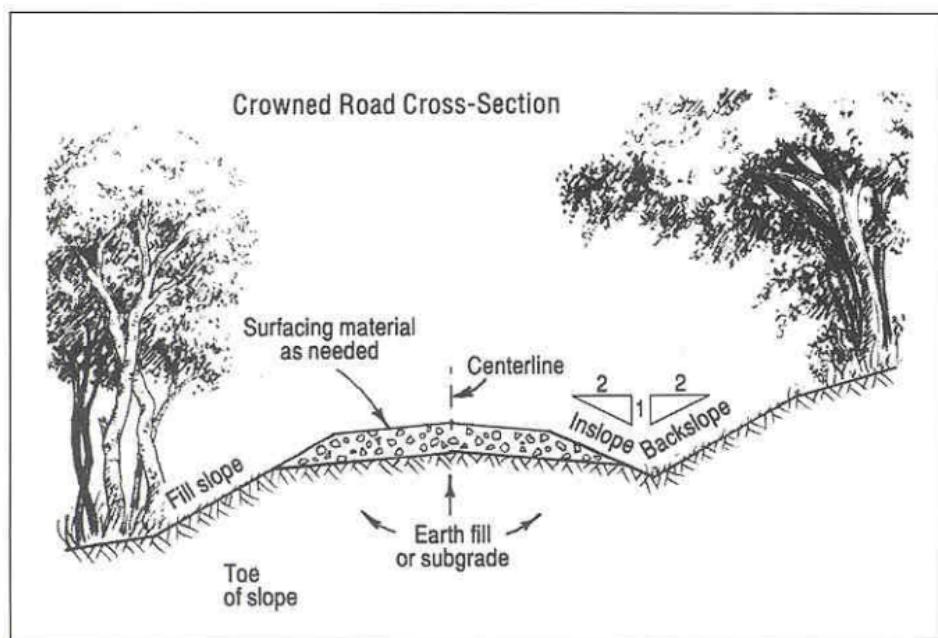
Figure 2
Road cross-sections



- ❑ A 15" pipe culvert is the minimum recommended size for cross drainage. Smaller culverts can clog with debris and require frequent maintenance.
- ❑ Spacing of cross drainage is critical as slope increases. (See Table 5 on page 61.)

- Road cross drains may include pipe culverts, open-top culverts and water deflectors. (See pages 60 through 64 for details.)
- Install culverts at grades 2% more than the ditch grade and angled at least 30 degrees from perpendicular to the flow of water.

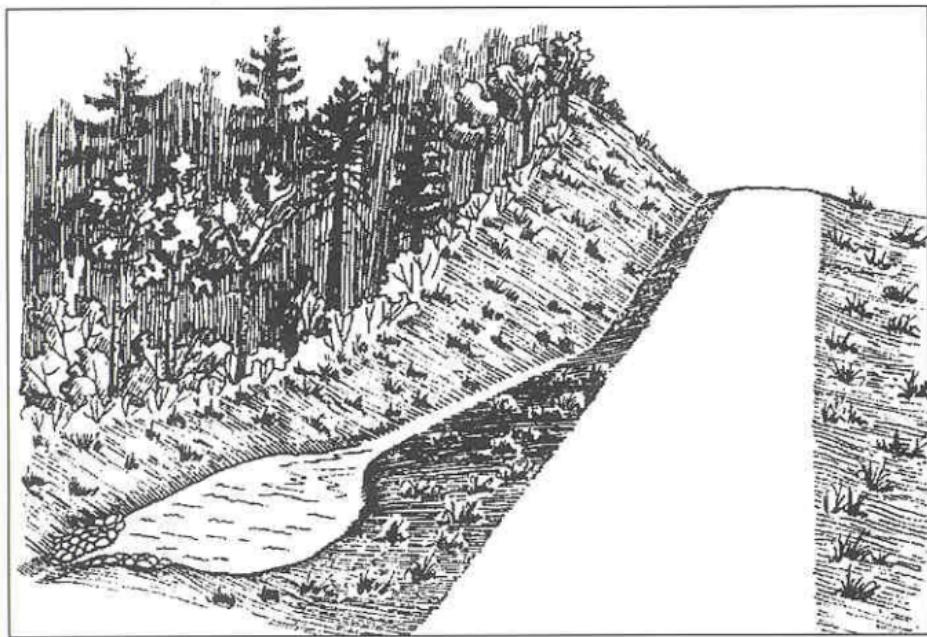
Figure 3
Road cross-section



Forest Roads

- ☐ Size culverts and other drainage structures large enough to minimize impact on water flow and quality. For more detail see [Stream Crossing](#) section (starting on page 36).
- ☐ Avoid draining surface water from roads directly into streams, ponds, lakes or wetlands.

Figure 4
Sediment trap



Instead, drain the water into the filter strip or vegetated area.

- Build a sediment trap (Figure 4) into the ditch to catch debris as it travels down the ditch.

Constructing Forest Roads

Proper construction of roads is a vital step in preventing erosion. The following are some practices that may lessen the potential for problems.

Clearing widths will vary depending on the needs of both the owner and user of the road. Consideration should be given to the necessity for roadway drying, as well as to the safety, cost and aesthetics of narrow right-of-ways.

Excavation

During work on new projects, recently exposed soil is the most critical factor affecting siltation of waters.

Recommended methods for placement of materials associated with road construction include the following:

- Place excavated material in a manner that will not impede water flow or potentially increase the sedimentation of waters.

Forest Roads

- Deposit excess material in stable locations away from streams, ponds, lakes and wetlands.
- Avoid placing excavated material in filter strips.
- Shape inslopes and backslopes to promote revegetation and soil stabilization. Slopes of 1:1 or flatter are preferred if the terrain permits.
- Compact fill material to reduce entry of water, increase load-carrying capacity and minimize settling.
- Limit the area excavated to that which can be properly shaped and compacted within a day, with provisions for storm drainage and sedimentation control.

Construction

Site drainage and cross-drainage are important for controlling sedimentation. Proper handling of water during construction will minimize potential impacts on water quality. These recommendations should be followed to reduce possible impacts:

- Provide adequate drainage for road grades during construction to minimize erosion of unconsolidated materials.
- Install drainage structures as construction proceeds.
- Avoid locating roads with grades in excess of 10%. On highly erodible soils, also identified on soil survey maps, maximum grades of 5% are recommended. (See Table 1 for calculating grade on page 19.)
- Minimize down-road flow and ponding by constructing roads with a slight grade (1% or 2%). Install broad-based dips or other diversions if grades are greater.
- Crown the road surface and excavate ditches where necessary.
- Compact fill firmly around culverts, paying special attention to the sides and lower portion. Cover the top of culverts with fill to a depth of one-half the pipe diameter or 12 inches, whichever is greater.
- Use riprap or large boulders to stabilize culvert inlets and outlets to reduce bank and channel erosion and sedimentation.

Forest Roads

- ❑ Provide temporary cross-drainage structures such as water bars, during construction, where needed to drain water off road surfaces.
- ❑ Install siltation barriers, such as silt fences and straw bales, during construction in sites where roads and water have close contact for long periods.

Soil protection

Disturbed areas should be shaped, stabilized, and if necessary, seeded ([Post Harvest Wrap-Up](#)) as soon as possible to minimize the potential for erosion. The greatest potential for soil erosion occurs immediately after construction.

The following measures are recommended:

- ❑ Vegetative cover is recommended along all roadsides.
- ❑ To prevent erosion before vegetation takes hold, mulch with hay, straw, bark or native vegetation. Hay mulch should be applied at the approximate rate of 60 bales per acre.

- Inspect and repair erosion control measures on a regular basis to ensure they remain functional.

Designing Wetland Forest Roads

Landowners are strongly advised to utilize the services of a professional forester to design wetland forest roads. This professional assistance is particularly important when constructing permanent all-season roads.

The following general recommendations apply when planning the design of all roads across wetlands:

- Avoid crossing wetlands if possible.



Contact a DEC office to determine whether the proposed road will cross a classified stream or wetland, or if the local government requires any permits or authorization. If so, secure the required permit.

Forest Roads

- ❑ Minimize total wetland road mileage when wetlands must be crossed, while still meeting landowner objectives.
- ❑ Determine the type and depth of wetland sub-soils to ensure proper design and construction.
- ❑ Minimize width of roads consistent with maintaining safety and road design considerations.
- ❑ Design approaches to wetlands so that surface runoff carrying potential sediment is diverted before entering the wetland.
- ❑ Plan to remove temporary fills and structures to the extent practical when use is complete.
- ❑ Provide adequate cross-drainage by employing one or both of the following techniques:
 - Use construction methods that allow free water flow throughout the entire roadbed; or
 - place culverts or other cross-drain structures at each end of each wetland crossing and at intermediate lowpoints.

- ❑ Space culverts or other cross-drain structures at maximum 300-foot intervals to ensure adequate cross-drainage throughout the roadbed.

Constructing Wetland Forest Roads

Choosing the appropriate road construction technique will depend on a knowledge of water table position, zone of water flow, type of wetland soils, and the strength of wetland soils.

With any road construction technique, culverts or ditches (or both) may be necessary.

Follow these recommendations when constructing ditches on wetland roads:

- ❑ Construct all road embankments with clean fill and other suitable materials.
- ❑ Construct ditches in wetland crossings, where necessary, to intercept and carry surface and subsurface water (the top 12 inches) to, through, and away from the culverts.
- ❑ Avoid having ditches create outlets that will result in drainage of the wetland.

Forest Roads

- ❑ Employ sediment control techniques such as straw bales and silt fencing to prevent movement to open water when placing fill during construction.
- ❑ Anchor temporary structures at one end to allow the structure to move aside during high-waterflows.

Winter Roads

Winter roads provide access under frozen ground conditions for timber harvesting and other timber management activities. Like all other roads, winter roads need to have provisions for adequate drainage to prevent or minimize erosion and sedimentation into wetlands and open water. With much of the timber harvesting occurring during January, February and March, properly constructed winter roads are an important component of timber management.

To minimize the impact to water quality during spring breakup, the following recommendations should be followed:

- Construct temporary stream crossings for winter roads where practical. Examples of temporary crossings include ice bridges, timber bridges, log materials, and rubber mats.
- Soil fill should not be used on these structures.
- Construct crossings to prevent water from backing up.
- Install all temporary structures that could block water flow in such a manner that they can be easily removed prior to breakup.



Skid Trails

Many of the practices recommended for forest roads are also applicable to skid trails. The main difference is that skid trails are temporary and are built to handle less traffic. Since skid trails often involve stream crossings, BMPs are vital to prevent or reduce sedimentation and erosion.

Skid Trails

- Use existing trails if they provide the best long-term access. Consider relocating existing trails if both access and environmental impact can be improved.
- Consider the topography in the location of skidroads and avoid steep slopes whenever possible.
- Where possible, keep skid trail grades less than 15%. Where steep grades are unavoidable, break the grade, install drainage structures, and use soil-stabilization practices where needed to minimize runoff and erosion.
- Grades greater than 15% should not exceed 300 feet in length.

- Layout skid trails to use low-value trees as "bumper-trees" at turns to reduce residual stand damage.
- Every reasonable effort should be made to preserve advanced regeneration.
- Minimize debarking and other damage to residual trees.
- Watch the weather forecast and plan ahead for severe storms. Most sediment enters a stream following severe storms. Water bars and other diversion methods are the best way to keep sediment-laden water from entering streams at crossings. Construct water turnouts or water bars as necessary.
- All woods roads and skid trails should be repaired, smoothed and seeded after logging, and left in a stable condition to resist erosion. (See [Post Harvest Wrap-up](#), for recommendations.)

Stream Crossings

Stream crossing structures are installed across intermittent or perennial streams to provide temporary access for logging equipment. When properly located and constructed, stream crossing structures can prevent damage to the bed and banks of streams, and can control the movement of sediment into the water.

Stream crossing structures that are poorly located or constructed can result in disturbance of the banks and bottoms of streams, increasing the chance for erosion and sedimentation to occur.

A forestry professional can assist you in planning the stream crossing structure best suited to the site.

Locating Stream Crossings

- Use stream crossings only when absolutely necessary.
- Keep the number of stream crossings to a minimum.
- Cross streams by the most direct route.



A permit is required to construct a ford or install a culvert or bridge across any classified stream. See **Regulations & Permits**. If you have a question about classification, contact the nearest DEC office.

- Find crossing sites that have low, stable banks, a firm stream bottom, minimal surface runoff and gentle slopes along the approaches whenever possible.
- Stabilize the soil around all culverts and bridges immediately after installation.

Stream Crossing Design

Operating equipment in or near perennial or intermittent stream channels may add sediment directly to streams.

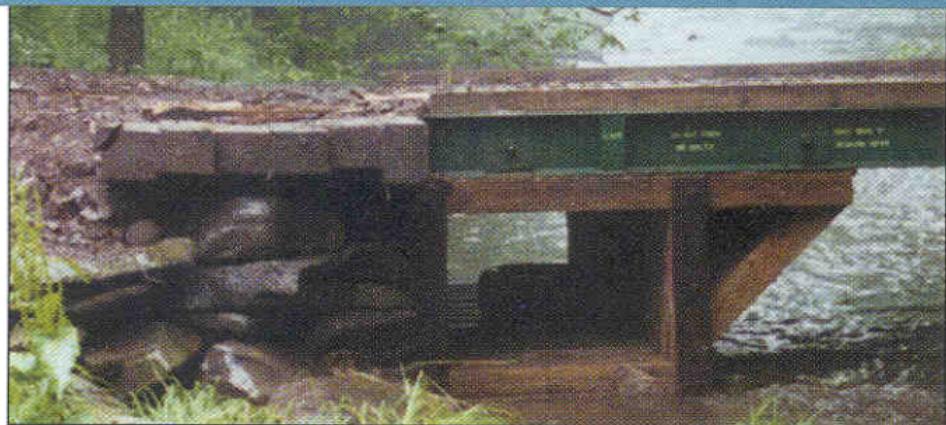
As roads approach a stream crossing, proper road drainage is critical to avoid sedimentation in streams. Three common stream crossing structures are culverts, bridges and fords.

Stream Crossings

Stream crossings should be designed, constructed, and maintained to safely handle expected vehicle loads and to minimize disturbance of stream banks, channels and, ultimately, aquatic organisms.

Consider stream materials, stream size, storm frequency, flow rates, intensity of use (permanent or temporary), and the passage of fish when planning crossings.

- Design, construct and maintain stream crossings to avoid disrupting the migration or movement of fish and other aquatic life. Bridges or culverts that retain the natural stream bottom and slope are preferred for this reason.
- Install stream crossings using materials that are clean, non-erodible and non-toxic to aquatic life.
- Install stream crossing structures at right angles to the stream channel.
- Minimize channel changes and the amount of excavation or fill needed at the crossing by selecting locations where the water channel is straight and unobstructed.



- Culverts and bridges that are too small can plug up with debris and result in the road washing out or in flooding upstream. **Crossings requiring a permit may be subject to different standards. Check with your local DEC office.** For non-permitted situations, size openings for anticipated water flow by using the following five-step procedure.

Step 1: Measure stream width from high water mark to high water mark.

Step 2: Measure the depth of the stream from the high water mark to the stream bed. (Measure in several places to determine average depth.)

Stream Crossings

Step 3: Multiply the width by the average depth to determine the square foot cross section of the waterway.

Step 4: For roads that will be used and maintained after the harvest, multiply the total by 2.5 (10 year storm interval). For roads that will be infrequently maintained, multiply the total by 3.5 (25 year storm interval).

Step 5: The total square feet determine the opening size of your bridge. For pipe culverts see Table 6 (page 62). This table provides appropriate pipe culverts based on the 2.5 or 3.5 times guideline. It has already converted square foot measurements into circular area.

In some cases of intermittent streams you cannot see a definitive stream channel to take cross section measurements. In that situation, estimate how many uphill acres drain to that point. Then use the following table (Figure 5).

Figure 5

Recommended Pipe Culvert Sizes
for undefined stream channels and cross drainage

| Area in acres | Pipe size |
|---------------|-----------|
| 10 | 18" |
| 20 | 20" |
| 30 | 24" |
| 40 | 26" |
| 50 | 28" |
| 75 | 30" |
| 100 | 34" |
| 150 | 38" |
| 200 | 42" |

Source: U.S.D.A. Forest Service, 1998

- Divert road drainage into undisturbed vegetation, preferably outside the stream management zone so that drainage does not directly enter the stream.
- Select pipe culverts long enough (at least a foot beyond fill) so that road fill does not extend beyond the ends of a culvert.

Stream Crossings

Stream Crossing Construction and Maintenance

- Limit construction activity in the water to periods of low or normal flow.
- Keep use of equipment in the stream to a minimum.
- Construct a bridge or place fill directly over a culvert higher than the road approach to prevent surface road runoff from draining onto the crossing structure and into the stream.
- Install culverts so there is no change in the stream bottom elevation. Culverts should not cause damming or pooling.
- Firmly compact fill material around culverts, particularly around the bottom half. Cover the top of culverts with fill to a depth of one-half of the pipe diameter or at least 12 inches, whichever is greater, to prevent crushing.
- Use rip rap around the inlet of culverts to prevent water from eroding and undercutting the culvert. For permanent installations, use filter fabric under the riprap. In addition, consider using flared-end culvert sections for outfall. (See pages 63 and 64.)

- ❑ Use soil stabilization practices on exposed soil at stream crossings. Use seed and mulch and install temporary sediment control structures such as straw bales or silt fences immediately following construction to minimize erosion into streams. Maintain these practices until the soil is permanently stabilized.
- ❑ Stabilize approaches to bridge, culvert, and ford crossings with aggregate or other suitable material to reduce sediment entering the stream.
- ❑ Anchor temporary structures on one end with a cable or other device so they do not float away during high water. Install them so they can be easily removed when no longer used, regardless of the season.
- ❑ Keep culverts and bridges clear and free of debris so that water can pass unimpeded at all times. This is especially important in areas where beaver are present.
- ❑ On un-maintained roads, it is recommended that first consideration be given to using temporary crossing devices that can be removed.

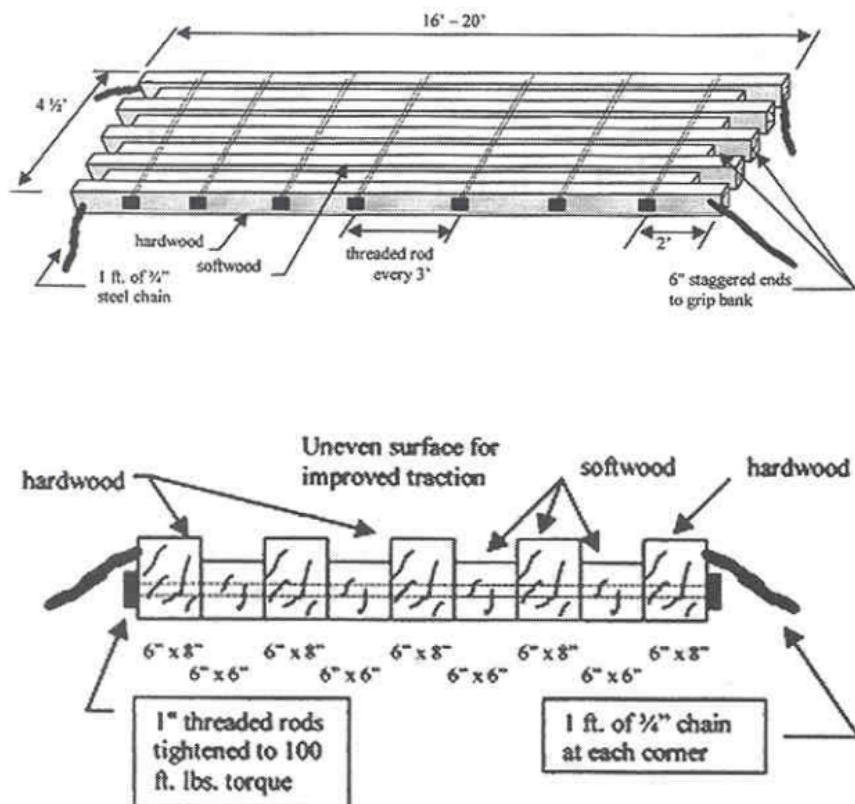
Stream Crossings



Temporary Bridges

Portable bridges are recommended for un-maintained roads or skid trails. They are easily installed and are a cost effective alternative to pipe culverts and other permanent structures. The following photos and diagrams illustrate some design options.

Figure 6
Temporary timber bridge



Stream Crossings

Figure 7
Temporary timber bridge

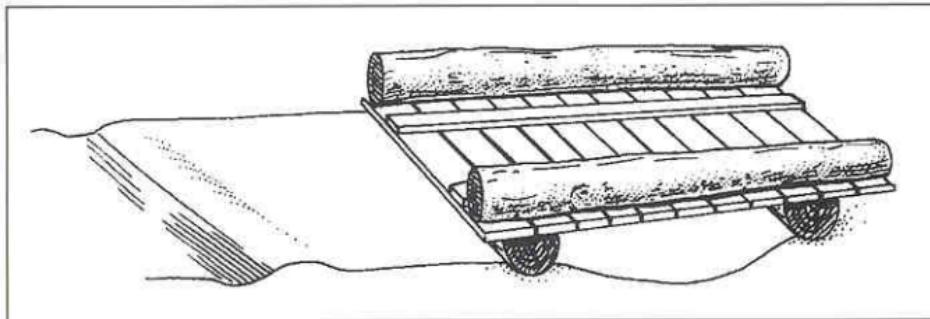
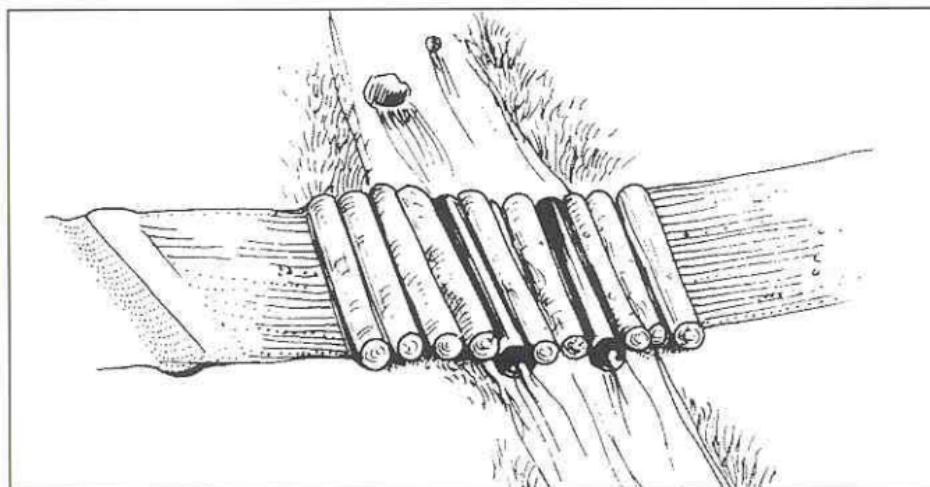


Figure 8
Pole ford using pipe for water flow



Fords

- Fords may be an option for crossing dry stream beds or where fording would cause minimal water quality impacts. **Check with your local DEC office for their recommendations.**
- Locate fords where stream banks are low.
- Stream should have a firm rock or gravel base. Otherwise, install stabilizing material such as reinforced concrete planks, crushed rock, riprap or rubber mats on streambeds.

Figure 9
Ford using geotextile



Post Harvest Wrap-up

Post Harvest Wrap-up

- All unnatural debris such as cans, paper, discarded tires, metal parts, and other junk must be removed immediately.
- Exposed soils prone to erosion, should be stabilized and if necessary, seeded and mulched at the end of the operation. Consult your local soil and water Conservation District for recommendations and seed mixtures specific to your area.
- Many erosive areas can be stabilized with seedlings of appropriate grasses and legumes. Species selection varies with soil type, drainage class, and degree of shading. Most seedlings should be immediately mulched with hay or straw at 2 tons per acre (approximately 2½ – 40 pound bales per 1000 square feet), or with wood cellulose at 2000 lbs. per acre. In forest land erosion control, straw or hay are the preferred mulches. These may require the use of mulch netting to be held in place on steep slopes (over 30 percent).
- Landings should be left free of excess woody debris.

Table 2

A Guide to Conservation Plantings on Critical Areas for New York 1991

| Seed Mixture | Variety | Rate in lbs/ac (lbs/1000 sq. ft.) | |
|---|----------|---|-------|
| #4 — Used for general seeding. | | | |
| Creeping red fescue or | Ensylva | 20 | (.5) |
| Tall fescue | KY-31 | | |
| Redtop or | Common | 2 | (.1) |
| Perennial ryegrass | Pennfine | 5 | (.1) |
| & Birdfoot trefoil | Empire | 8 | (.2) |
| #18 — Used to inhibit woody vegetation from reclaiming road surfaces. | | | |
| Tall fescue | KY-31 | 10 | (.25) |
| Red Top | Common | 2 | (.1) |
| Perennial ryegrass | Pennfine | 5 | (.1) |
| Flatpea | Lathco | 30 | (.7) |
| #23 — Used to provide a food source for deer. | | | |
| White clover | — | 10 | (.25) |
| Perennial ryegrass | — | 2 | (.2) |
| (1 Acre = 43,560 sq. ft.) | | | |

Chemung County Soil and Water Conservation District BMP

Post Harvest Wrap-up

- ❑ Traffic barriers should be placed where appropriate to prevent off-road vehicles from disturbing recently stabilized areas. Barriers should be visible and well marked, and they should not present a safety hazard.
- ❑ Fill in ruts, and install water bars and erosion barriers to prevent or minimize erosion and sedimentation from roads, skid trails, and landings.
- ❑ Restore watercourses to approximate their natural condition by removing temporary drainage structures and stabilizing the soil along the banks.
- ❑ Inspect erosion control measures periodically and maintain or remove as needed.



Hazardous Materials

The proper storage, handling and use of hazardous materials is critical to the protection of water quality before, during and after timber harvesting operations.

Hazardous Materials

The following recommendations should be followed when using any hazardous material on the timber harvest operation:

- Products should be used only when necessary to meet objectives **and only according to the product's label.**
- Less hazardous products or procedures should be considered whenever possible.
- Equipment should be maintained and stored away from any water bodies.
- Applications should not be made when wind or expected runoff conditions could cause drift or contamination.
- Plans for handling spills should be developed during the planning of the harvest.

- Pesticides and fertilizers should be applied at the proper times and according to their labels.
- Restricted pesticides should only be applied by certified applicators.**
- Buffer strips around water bodies should be identified for applicators.
- Waste oil, hydraulic fluid, and other hazardous materials should be collected and transported off-site for proper disposal.
- Maintain a spill containment and cleanup kit appropriate for the equipment being used. At a minimum, kits should contain: plugs and clamps to control hydraulic line breaks, a container to catch leaking fluids, a shovel, and absorbent material such as sawdust or clay granules to clean leaked fluids.
- All federal, state and local rules and regulations should be followed regarding the use, transport, storage, spillage and disposal of these materials, their containers, and their wash water.

Erosion Control Tools & Techniques

Water bars and broad-based dips

Figure 10

Water bar

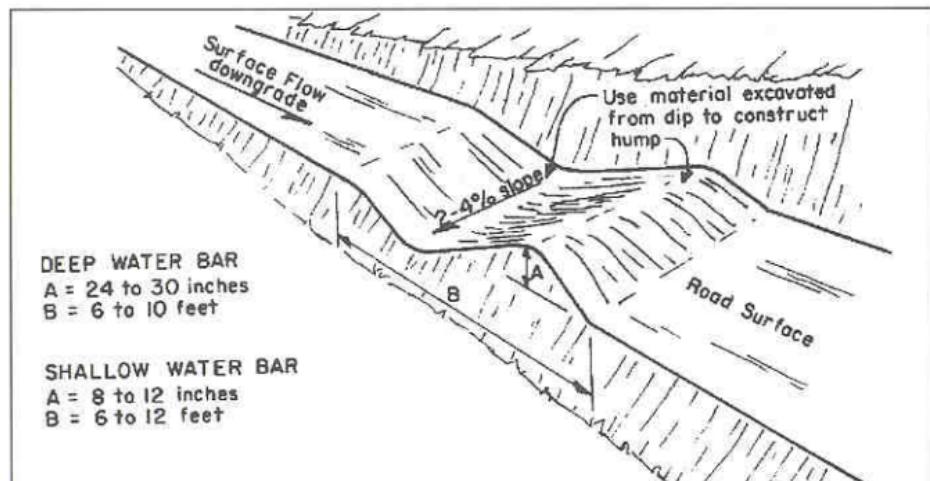


Table 3
Suggested spacing for waterbars

| Road Grade (percent) | Distance (feet) | Road Grade (percent) | Distance (feet) |
|-------------------------|--------------------|-------------------------|--------------------|
| 2 | 250 | 20 | 45 |
| 5 | 135 | 25 | 40 |
| 10 | 80 | 30 | 35 |
| 15 | 60 | | |

Source: U.S.D.A. Forest Service, 1998

Figure 11
Broad-based dip

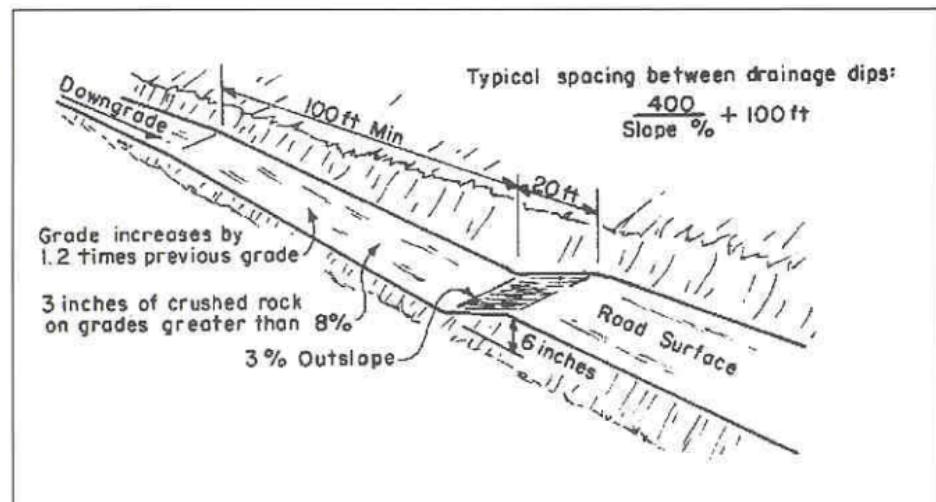


Table 4
Suggested spacing for broad-based dips

| Road Grade (percent) | Distance (feet) |
|----------------------|-----------------|
| 2 – 4 | 300 – 200 |
| 5 – 7 | 180 – 160 |
| 8 – 10 | 150 – 140 |

Source: U.S.D.A. Forest Service, 1998

Erosion Control Tools & Techniques

Water deflection

Figure 12
Water deflector, typical plan

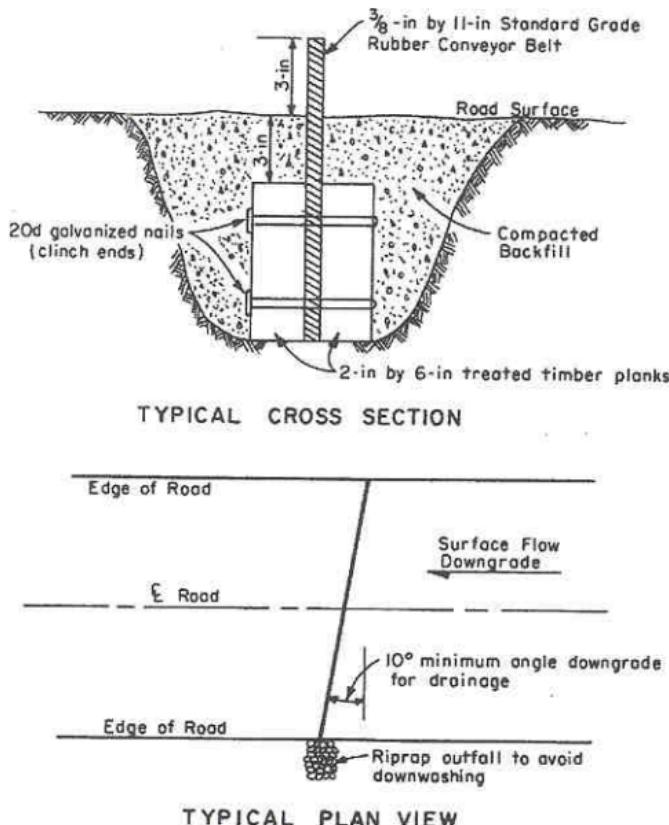
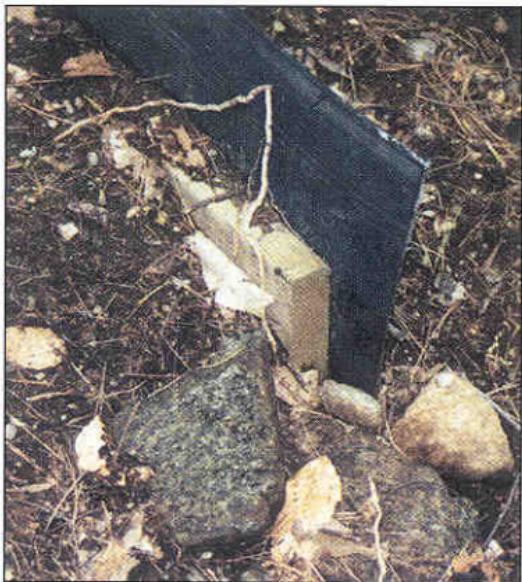


Figure 13
Water deflector installation

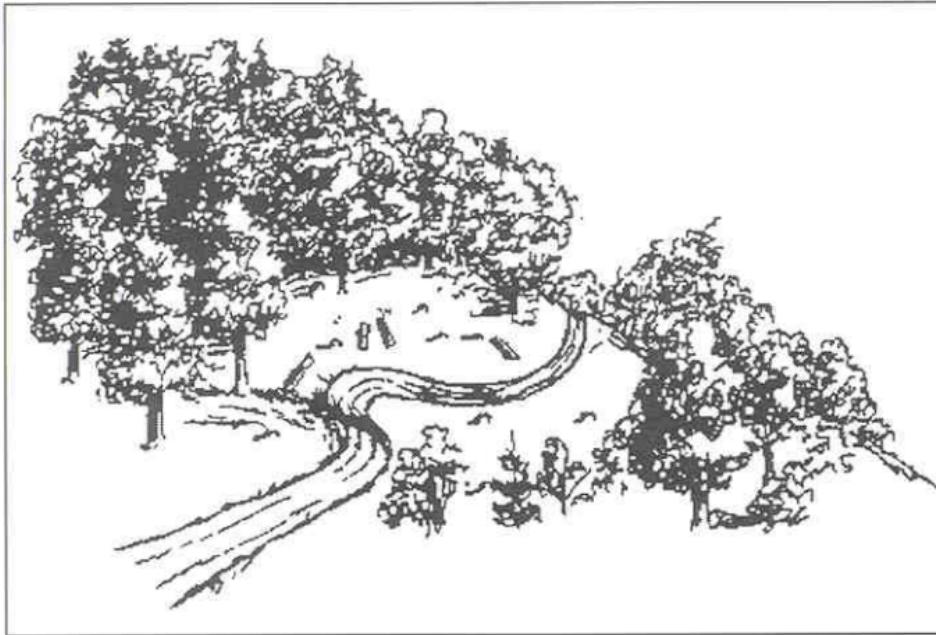


Figure 14
Detail of water deflector



Erosion Control Tools & Techniques

Figure 15
Turn-up



A turn-up in the skid trail can reduce water velocity. It is a good technique in steep terrain when it is used in conjunction with water bars or diversion ditches.

Figure 16
Diversion ditch



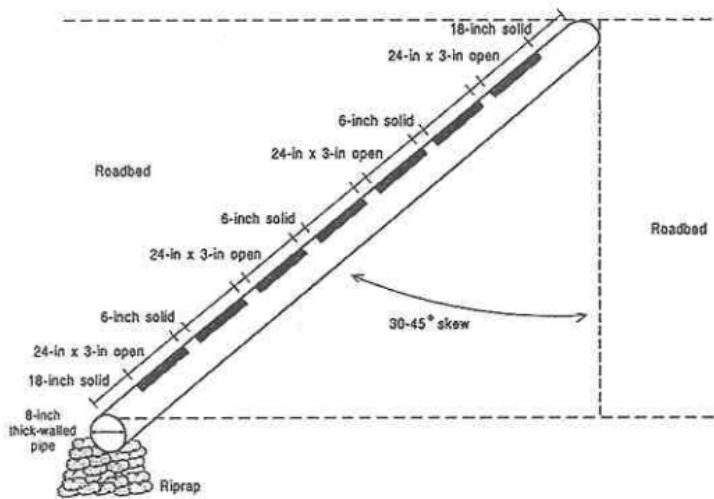
A diversion ditch into a filter area is a good alternative to a water bar or cross drainage culvert where slope allows.

Erosion Control Tools & Techniques

Cross Drainage and Culverts

The main function of an open-top pipe culvert is to remove road surface run-off. The culvert should be laid 30 degrees down slope with the top or slotted side either flush or 3 inches below road grade. Open top pipe culverts are usually self-cleaning as long as they are used with slopes greater than 10% and with adequate down slope angle. The culverts can be used

Figure 17
Open-top pipe culvert



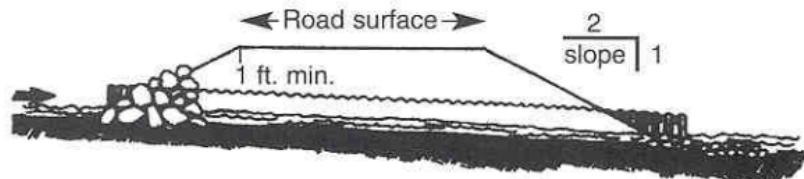
in place of broad based dips on road grades greater than 10% at spacings determined by the following calculation: $400/\text{percent slope} + 100$ feet. It is also recommended to fill roughly half the diameter around the culvert with a coarse aggregate, such as #3 stone.

Table 5
Suggested spacing for cross drainage culverts

| Road Grade (percent) | Distance (feet) | Road Grade (percent) | Distance (feet) |
|-------------------------|--------------------|-------------------------|--------------------|
| 0 – 2 | 500 – 300 | 11 – 15 | 136 – 140 |
| 3 – 4 | 250 – 180 | 16 – 20 | 126 – 120 |
| 6 – 10 | 167 – 140 | 21+ | 100 |

Source: Maine Forest Service, 1998

Figure 18
Pipe culvert



Erosion Control Tools & Techniques

Table 6

Recommended Pipe Culvert Sizes
for well-defined stream channels

| Stream Width | Depth | Culvert diameter (inches) Maintained road | Culvert diameter (inches) Unmaintained road |
|--------------|-------|--|--|
| 18" | 6" | 16" | 22" |
| 18" | 9" | 23" | 27" |
| 18" | 12" | 26" | 31" |
| 24" | 6" | 21" | 25" |
| 24" | 12" | 30" | 36" |
| 30" | 6" | 24" | 28" |
| 30" | 12" | 34" | 40" |
| 36" | 6" | 26" | 31" |
| 36" | 12" | 37" | 44" |
| 48" | 6" | 30" | 36" |
| 48" | 12" | 43" | 51" |
| 60" | 12" | 48" | 57" |
| 60" | 18" | 60" | 70" |
| 60" | 24" | 68" | 80" |

Proper design of intake and outfall is important for culvert use in cross drainage and stream bed situations.

Figure 19
Culvert intake



Erosion Control Tools & Techniques

Figure 20
Culvert outfall



Filter and buffer strips

Figure 21
Filter strip

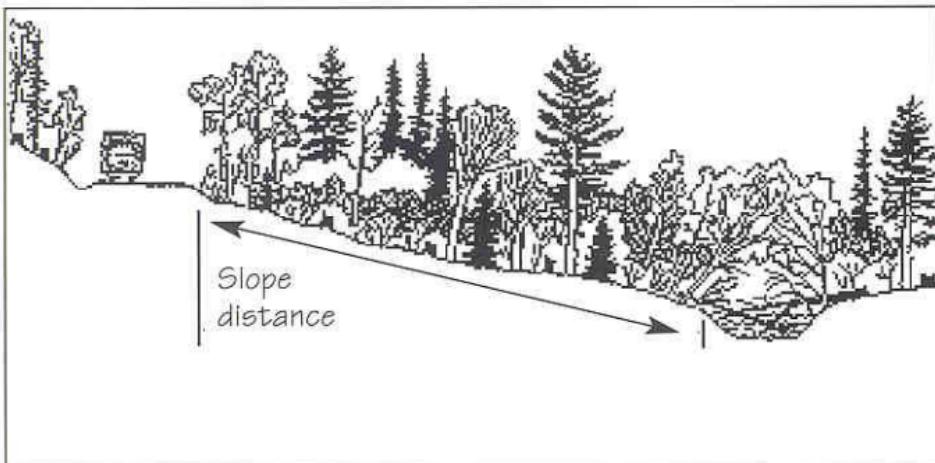


Table 7
Suggested spacing for filter strips

| Slope of the land between road and stream (percent) | Recommended buffer width in feet (slope distance*) |
|---|--|
| 0 – 10 | 50 |
| 11 – 20 | 51 – 70 |
| 21 – 40 | 71 – 110 |
| 41 – 70 | 111 – 150 |

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

Erosion Control Tools & Techniques

Straw bales and silt fences

Straw bales need regular maintenance. They should be inspected weekly and after storms to maintain effectiveness.

Figure 22
Straw bales

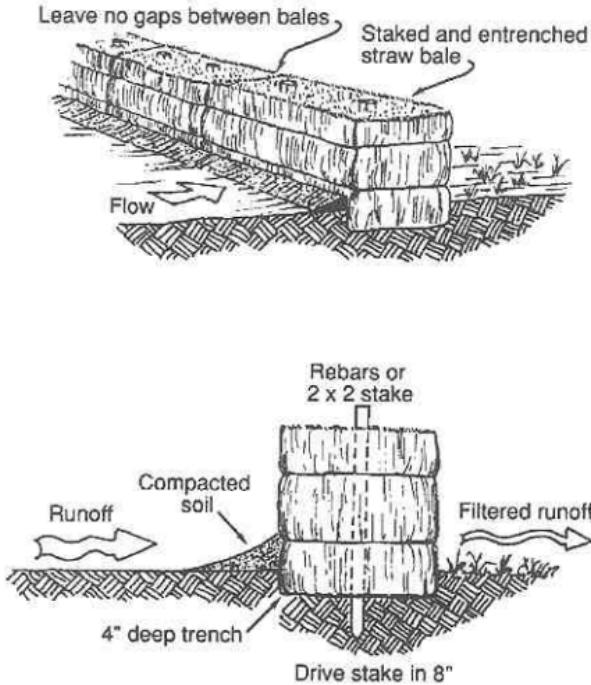
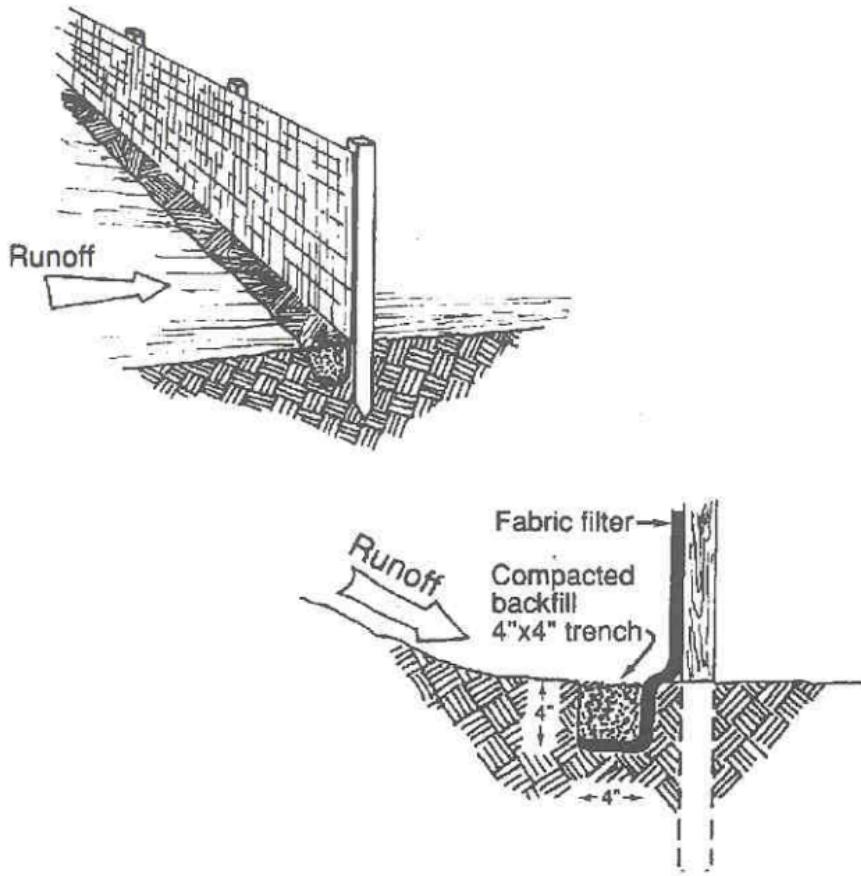


Figure 23
Silt fencing



Erosion Control Tools & Techniques

Rubber mats and geotextile fabrics

Geotextiles are fabrics used for the stabilization of soil and other material. They keep these materials in place for heavier and longer use. They can also be used in road and bank stabilization. The manufacturer's directions should be followed in their use. Contact a logging or forestry equipment supplier for sources of these materials.

Figure 24
Geotextile

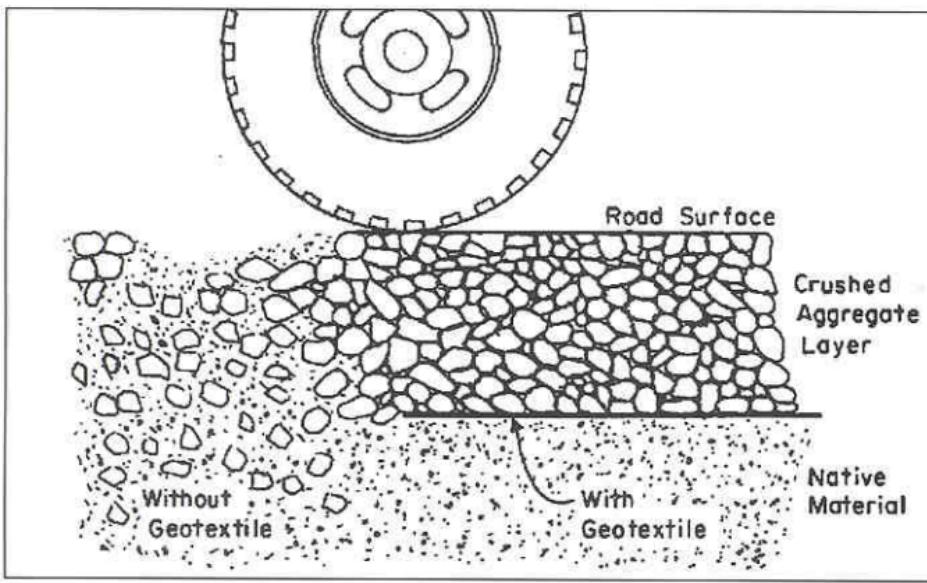
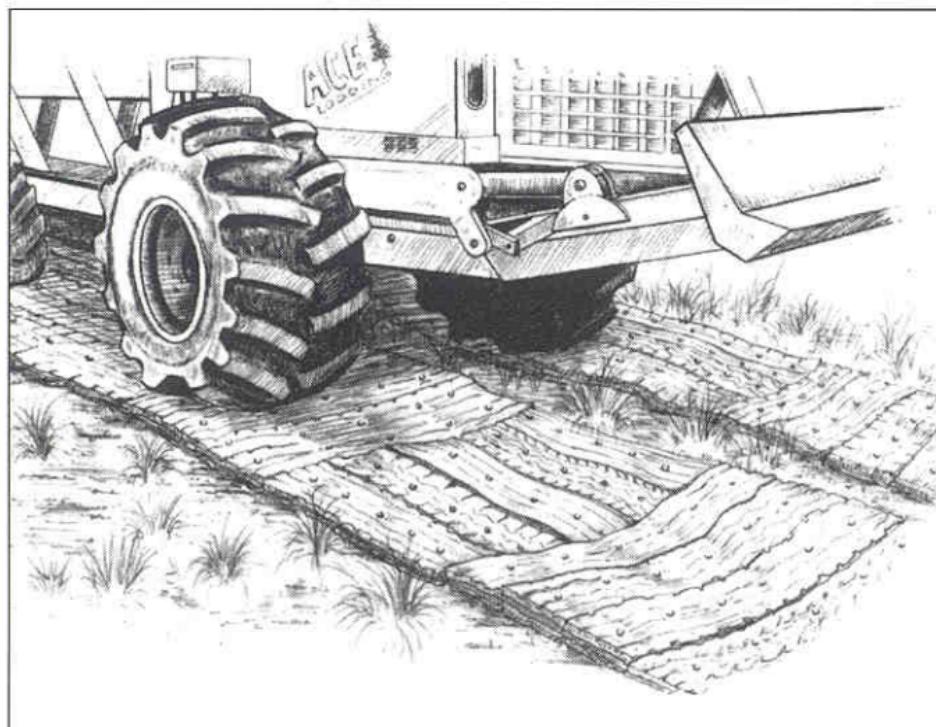


Figure 25
Rubber Mats



Rubber mats can be purchased or made from recycled tires. They can be used in many situations (access roads, skid trails, landings) to prevent or reduce erosion.

Regulations & Permits

Several state and federal regulations pertain to possible impacts of timber harvesting on water quality. Certain streams within the state are regulated by the NYS DEC based on the existing or best usage of these waters. A permit is required for stream crossings across classified streams. For more detailed information about regulations concerning classified streams and the permit application process, obtain a copy of the Protection of Waters Program Applicants' Guide from the regional NYS DEC office.

DEC Regional Offices

Region 1

Suffolk and Nassau counties
(516) 444-0354

Region 2

Manhattan, Bronx, Queens, Brooklyn and Staten Island
(718) 482-4900

Region 3

Sullivan, Ulster, Orange, Dutchess, Putnam, Rockland and Westchester counties
(914) 256-3000

Region 4

Montgomery, Otsego, Delaware, Schoharie, Schenectady, Albany, Greene, Rensselaer and Columbia counties
(518) 357-2234

Region 5

Franklin, Clinton, Essex, Hamilton, Warren, Fulton, Saratoga and Washington counties
(518) 897-1200

Region 6

Jefferson, St. Lawrence, Lewis, Oneida and Herkimer counties
(315) 785-2239

Region 7

Oswego, Cayuga, Onondaga, Madison, Tompkins, Cortland, Chenango, Tioga and Broome counties
(315) 426-7400

Region 8

Orleans, Monroe, Wayne, Genesee, Livingston, Ontario, Yates, Seneca, Steuben, Schuyler and Chemung counties
(716) 226-2466

Region 9

Niagara, Erie, Wyoming, Chautauqua, Cattaraugus and Allegany counties
(716) 851-7000

Regulations & Permits

The U.S. Army Corps of Engineers (USACE) may also require a permit for stream crossings. Under Section 404 of the Clean Water Act, the USACE has jurisdiction over the discharge of dredged or fill material into waters of the United States. However, exemptions are available for certain crossings provided BMPs are applied.

These BMPs are described in Title 33 of the Code of Federal Regulation (CFR) Parts: 323.4(a) (6), subsections (I) through (xv). To receive a copy of these BMPs, or to find out if you require a permit from the Army Corps, contact the nearest USACE office.

Regulations for hazardous materials include, but are not limited to, Department of Transportation, Code of Federal Regulations, Title 49 and New York State Codes, Rules and Regulations, Title 6 Parts 325,326 – Pesticides and Parts 371, 373, 374 – Hazardous Waste Management.



Sources for Information

Professional forestry assistance should always be obtained before undertaking any timber harvest. Information and assistance in using Best Management Practices for forest management activities can be found at many federal, state and local organizations. Some of these organizations include:

Adirondack Park Agency
(518) 891-4050

Catskill Forest Association
(914) 586-3054

Cornell County Cooperative Extension
(607) 255-4696

County Soil and Water Conservation Districts
(See telephone book for local number)

Empire State Forest Products Association
(518) 463-1297

**New York City Department of
Environmental Protection**
(718) 337-4357

New York Forest Owners Association
(800) 836-3566

**New York State Department of
Environmental Conservation**
(518) 457-7370

New York Tree Farm
(800) 836-3566

Society of American Foresters
(301) 897-8720

**State University of New York College of
Environmental Science and Forestry**
(315) 470-6500

USDA Forest Service
(603) 868-7616

USDA Natural Resource Conservation Service
(315) 423-5076

Watershed Agricultural Council - Forestry Program
(607) 865-7790

Sources for Information

Select publications available from
USDA Forest Service:

- USDA Forest Service. 1998. A Landowner's Guide to Building Forest Access Roads.
- USDA Forest Service. 1978. Permanent Logging Roads for Better Woodlot Management.
- USDA Forest Service. 1996. Portable Timber Bridges: An Eco-friendly Solution for Stream Crossings.
- USDA Forest Service. 1995. Using Open-top Pipe Culverts to Control Surface Water on Steep Road Grades.
- USDA Forest Service. 1977. Woodlands of the Northeast, Erosion & Sediment Control Guides.
- USDA Soil Conservation Service (Natural Resources Conservation Service). 1991. A Guide To: Conservation Plantings on Critical Areas for New York.

Other related materials

Chemung County Soil and Water Conservation District. 1997. Best Management Practices During Timber Harvesting Operations.

Massachusetts Department of Environmental Protection and U. S. Environmental Protection Agency. 1996. Massachusetts Forestry Best Management Practices Manual.

Minnesota Department of Natural Resources, Division of Forestry. 1995. Protecting Water Quality and Wetlands in Forest Management: Best Management Practices in Minnesota.

New York Society of American Foresters. 1975. Applying Timber Harvesting Guidelines for New York.

Northeast Regional Agricultural Engineering Service. 1993. A Guide To Logging Aesthetics, Practical Tips for Loggers, Foresters, and Landowners.

Watershed Forestry Program. BMP Fact Sheets.

Wisconsin Department of Natural Resources, Bureau of Forestry. 1995. Wisconsin's Forestry Best Management Practices for Water Quality.

Notes

Instructions for using grade meter on inside back cover:

1. Punch a small hole in back cover.
2. Put a short (6 inch) piece of string through hole.
3. Tie a knot large enough to hold string.
4. At other end of string, tie a small weight (nut, bolt, pen).
5. Use spiral binding as a sight.
6. Read slope using string.



Put tack or nail here
and attach string with
nut or bolt on end

