NEW YORK STATE FORESTRY BEST MANAGMENT PRACTICES FOR WATER QUALITY

2011
EDITION

BMP FIELD GUIDE

This BMP Field Guide is the property of

For more information about forestry and water quality, contact:

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Many other local, state and federal agencies provided information as well: Massachusetts Department of Environmental Protection, Minnesota Department of Natural Resources, the US Forest Service, the NYC Department of Environmental Protection, the Wisconsin Department of Natural Resources, and the Northern Logger and Timber Processor.

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Protecting water quality, forest and soil resources 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 erosion that can result in the sedimentation 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 into your timber harvest. BMPs 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. All are essential for sustainable forest management.

This field guide is 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 provides a menu of options, allowing flexibility for professional discretion and decision-making in the field. This manual has not been designed to provide a required standard for use in enforcement. 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 Nonpoint Source Pollution Management Plan. That plan outlines a 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, New York Logger Training and the Watershed Agricultural Council's Forestry Program. This guide provides additional technical and practical information to help operators and managers identify potential problem areas, select the best preventative measures, and provide instruction for proper installation and maintainence of BMPs.

Erosion and sedimentation are the primary potential nonpoint 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, 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. The best way to avoid controversies and the possibility of new timber harvesting ordinances or restrictions is by avoiding erosion and sedimentation issues.

It is almost always more economical and effective to plan your harvests in advance and take preventative measures than it is to fix erosion and sedimentation issues after they occur. If you follow the suggestions outlined in this field guide, and apply appropriate practices 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.

Introduction

PLANNING - INTRODUCTION

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 developing a plan for logging and other land management activities. These tools include aerial photographs, soil survey maps, forest inventory, topographic maps, and property survey or tax maps.

Use available maps to identify important features in the harvest site, such as streams, ponds, lakes, wetlands, existing access, steep slopes, and highly erodible or wet soils. Walk the property to verify these features and identify other areas of special interest such as seeps, springs, nesting sites, and important habitat. Knowing what features need to be accessed or protected in advance of operations helps ensure the best methods are utilized during the harvest.

Most sediment is introduced to water bodies as a result of the road and trail system on the property. The thoughtful layout of the road and trail system will provide complete site access, maximize forest productivity and minimize opportunities for erosion and sedimentation. Proper layout also reduces the number of Best Managment Practices

(BMPs) required to stabilize the site following operations, saving time and money while preventing erosion. The timing of a harvest 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 suspend harvesting during wet periods.

PLANNING - RECOMMENDATIONS

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

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

- Review forest management plan and landowner's objectives for site.
- Make a tentative list of site-specific BMPs needed to protect water quality. This information can often be found in forest management plans, timber harvest plans, and timber sale contracts.
- On a map, identify the following:
  - Mark roads, trails and landings on the ground as well as any stream crossings and specific BMPs 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 are not incubating (May–September).
    - 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
    - United States Geological Survey (USGS) topographic maps
    - Wetland inventory maps
    - Classified stream maps
    - Natural Heritage database maps (for threatened and endangered species)

This information can be found at most regional DEC offices across the state as well as online. The following websites are just a few useful ones for locating this data.

- www.fws.gov/wetlands/Data/index.html
- www.dec.ny.gov/animals/38801.html
- http://websoilsurvey.nrcs.usda.gov/app/
- http://soils.usda.gov/survey/printed_surveys
- www.nysgis.state.ny.us/

LOG DECKS & LANDINGS - INTRODUCTION

Landings are one of the most visible parts of any timber harvest. When appropriate, 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 all give a poor impression of logging, regardless of the rest of the harvest conditions.

LOG DECKS & LANDINGS - RECOMMENDATIONS

STOP Please consult the Skid Trails & Roads section for details on installing water bars, broad-based dips, straw bales, and other erosion control devices.

The following recommendations should be considered when planning, locating and constructing log decks and landings:

- 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 pooling 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.
- Place coarse rock or stone to shake mud off vehicle tires before entering public highways.
- Remove all mud tracked onto public roads immediately.
- During muddy conditions, use coarse gravel over geotextiles or rubber mats.
- Check hoses and fittings regularly to prevent leaks of lubricants and hydraulic oil. Repair all leaks immediately.
- If the machinery is parked for an extended period, place an oil absorbent mat under the equipment to catch any slow leaks.

LOG DECKS & LANDINGS - LANDING MAINTENANCE

- Remove all unnatural debris such as cans, papers, discarded tires, cables, chains and other junk on a daily basis.
- If necessary, soil should be stabilized by seeding and mulching at the end of the operation. See Post Harvest Wrap-up (page 72) for recommendations on seed mixes and planting.
- For additional guidelines, see the Hazardous Materials section (page 74).

RIPARIAN ZONES - INTRODUCTION

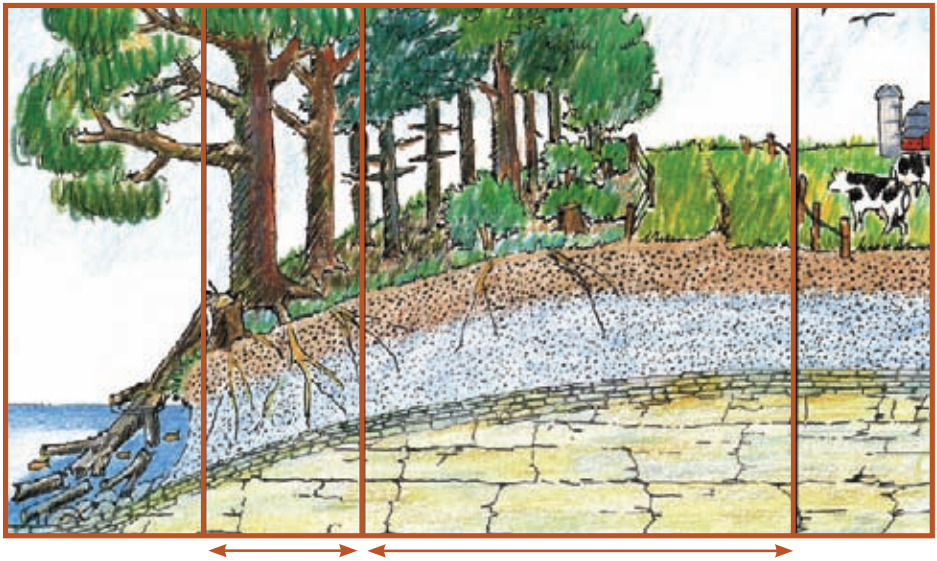
Riparian Zones (also referred to as Streamside Management Zones or SMZs) are lands connected with or immediately adjacent to the banks of a stream, wetland, or other water body. Riparian Zones are transitional areas adjacent to streams and water bodies which buffer areas sensitive to disturbance. Riparian Zones are defined by the functions they perform, such as

- Regulate nutrient and sediment movement
- Regulate water temperature and light
- Enhance bank stability
- Sustain hydrologic integrity
- Regulate particulate and dissolved organic input
- Enhance aquatic habitat and aquatic food web
- Enhance amphibian and terrestrial wildlife habitat and corridors

TABLE 1: SUGGESTED SPACING FOR RIPARIAN ZONE 2

Slope of land perpendicular to stream (percent)	Recommended width of Zone 2 (feet)
0-10	50
11-20	51-70
21-40	71-110
41-70	111-150

Figure 1: Riparian Zone



RIPARIAN ZONES - RECOMMENDATIONS

A **Riparian Zone** is a three-dimensional area of interaction that extends:

- *Down into the groundwater and up above the canopy*
- *Outward across the floodplain and up the slopes that drain to the water*
- *Laterally into the terrestrial ecosystem along the watercourse at a variable width*

The size of the Riparian Zone varies along the water body, may vary from one bank to another, and is unrelated to the size of the water body.

The Riparian Zone is:

- *NOT a no-cut zone*
- *NOT a no-equipment zone*
- *NOT a zone of minimum stocking requirements*

It *IS* a zone to be managed for water resource objectives; special consideration should be given due to its sensitivity to disturbance.

Riparian Zone 1: 15 ft +/-

- Tree removal limited, but not excluded.

- Avoid soil disturbance by excluding equipment except for water body crossings.
- Remove timber by:
    - Directionally felling trees into Zone 2
    - Using cable to winch trees out
    - Reaching into the zone with a mechanical felling arm
- Stabilize stream banks by minimizing tree cutting on the bank.
- Provide large woody debris.

Riparian Zone 2: The width of this zone is determined by the slope of the land perpendicular to the water body (table 1, page 18).

- Periodic harvesting of timber and specialty products allowed.
- Different age classes and habitat structure should be encourged.
- Habitat for macro invertebrates should be encouraged by retaining a diversity of tree species.
- Equipment operation is permissible but should be minimized.

The number of functions a riparian ecosystem performs decreases the farther it extends from the water surface.

WETLANDS, SEEPS & VERNAL POOLS - INTRODUCTION

Wetlands are important for their ability to filter sediments and improve water quality. They also provide unique habitat for plants and animals. Logging is often exempt from permitting requirements normally required for other activities in wetlands. However, it is important that logging activities do not impair the wetlands' functions. Operators are still at risk of fines if the wetlands' flow or functions are seriously changed by logging operations.

Seeps are natural springs or areas where the water table is close to the surface.

Running equipment through seeps can alter water flows and create significant rutting. Avoid seeps where possible.

Vernal pools can be important habitat and breeding areas for amphibians and

reptiles. A vernal pool is frequently dry except during heavy rainfall and seasonally wet periods of the year. Avoid running equipment through vernal pools at any time.

Consider the following to avoid problems:

- Avoid working in wetlands where possible. Consider alternative routes when planning harvest operations.
- Do NOT locate haul roads in wetlands without a permit.

WETLANDS, SEEPS & VERNAL POOLS - RECOMMENDATIONS

- Plan wetland harvests for winter or frozen periods.
- Minimize impacts by crossing at the narrowest point or moving across islands (high spots).
- Minimize rutting as much as practicable. Do NOT allow rutting to impede or change the flow of a wetland.
- Use brush mats and corduroy to stabilize skid trails. Remove all material six inches and larger from corduroy trails upon completion. This material may be considered fill if left in place.

SKID TRAILS - INTRODUCTION

Skidding access systems are composed of primary and secondary skid trails. The difference between primary and secondary skid trails lies in the degree of preparation prior to use. Primary skid trails are flagged, cleared, and graded in preparation for the high degree of equipment traffic they will carry over the course of the logging operation. Secondary skid trails are used to bring logs from the stump to the primary skid trail. Secondary skid trails are usually not graded, need only a minimum amount of clearing and are characterized by a low degree of equipment traffic over the course of the logging operation. Some thought must be given to planning for repeated operations on the same area, and provisions must be made for the protection and re-use of the skidding access systems in the future. Maintenance of skid trails during periods of use is usually confined to keeping the surface water adequately drained. However, immediately upon seasonal shut-down, or at completion of the operation, water bars should be installed to protect the skid trails from erosion.

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

SKID TRAILS - RECOMMENDATIONS

- Refer to Temporary Stream Crossing section – page 58 when skid trails cross a stream.
- 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 soil types when laying out and stabilizing skid trails. Avoid poorly drained soils whenever possible.
- Consider the topography in the location of skid trails. Avoid steep slopes whenever possible.
- Keep skid trail grades less than 15 percent where possible. Where steep grades are unavoidable, break the

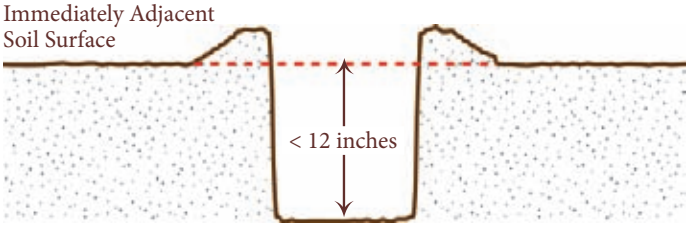
grade, install drainage structures, and use soil-stabilization practices where needed to minimize runoff and erosion. Use Table 2 on page 29 and the grade meter provided inside this Guide's back cover.

- Grades greater than 15 percent should not exceed 300 feet in length.
- Avoid saturated soils wherever possible.
- Lay out skid trails to use low-value trees as "bumper-trees" at turns to reduce residual stand damage.
- Make every reasonable effort to preserve advanced regeneration.
- Minimize debarking and other damage to residual trees.
- Minimize wheel rutting to less than 12 inches.
- Ruts may be acceptable provided it is shown that they are not causing significant erosion, channelized mud or water flow, and will be repaired prior to final operational close-out. Smooth out ruts with the installation of BMPs if work will be suspended for 14 or more consecutive days or if a significant storm event is likely during off-hours.
- Prevent erosion before vegetation takes hold; mulch with hay, straw, bark or native vegetation.
- 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 skid roads should be repaired, smoothed and seeded after logging, and left in a stable condition to resist erosion. (See Post Harvest Wrap-up, page 72, for recommendations.)
- If skid trails have significant rutting, they should also be repaired after the harvest and left in a stable condition.

Figure 2: Rut Cross-Section



Water Bars

Water bars are mounds of soil excavated across the width of a skid trail at a 30 degree downward angle. Effective water bars extend the entire width of the skid trail and possess a clear outlet which facilitates the drainage of water from the compacted surface of a skid trail into undisturbed forest soil. The number of water bars installed on a skid trail is contingent upon the trail slope. The steeper the slope, the greater the number of water bars necessary to control runoff on the skid trail. Water bars control the volume and velocity of water that flows down skid trails, intercepting runoff and returning it to its natural place within the landscape where it can be absorbed by undisturbed forest soils. Water bars can accommodate ATV traffic, although annual maintenance is necessary to insure continued functionality. Water bars are a necessary tool for controlling the forces of erosion associated with storm water runoff on skid trails.

Figure 3: Water bar

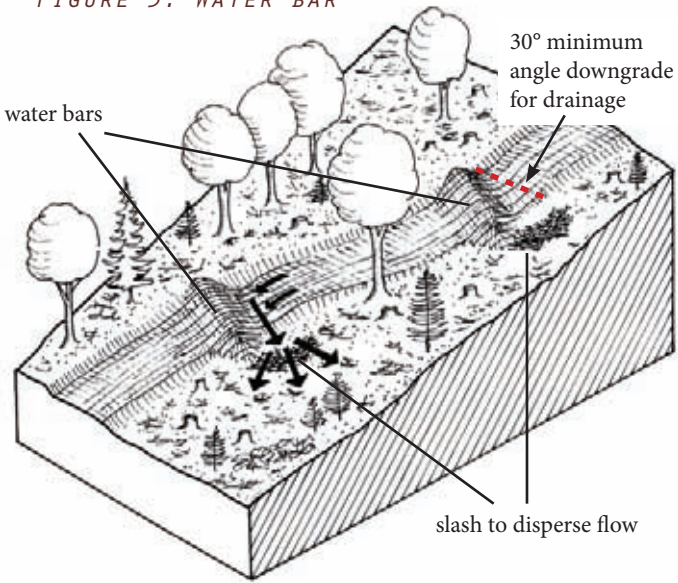


Table 2: Water bar Spacing Guidelines

Slope (percent)	Spacing (feet)
2	250
5	135
10	80
15	60
20	45
25	30
30	35

Photo 1: Water bar

Turn-up

A turn-up in a skid trail takes advantage of natural topography to interupt the flow of water. Loggers can locate a turn-up by turning the trail briefly uphill prior to resuming the trails downward course. 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 4: Turn-up

Rolling Dip

Rolling dips are a cross between a water bar and a broad based dip (see Forest Roads section, page 36). Like broad based dips, they have a reverse grade (although shorter) and direct water off the road. Like water bars, they may rely on a mound of soil at the downhill side. Rolling dips should be used on truck haul roads and heavily-used skid trails having a gradient of 15 percent or less. Rolling dips should not be used for crossing streams, springs and seeps.

Purpose

- To gather water and direct it safely off the road to prevent build-up of surface runoff and subsequent erosion, while allowing the passage of traffic.

Specifications

- Installation follows basic clearing and grading for road bed consruction or on skid trails after logging is complete.
- A 10-15 foot long, 3 to 8 percent reverse grade is constructed into the road bed by cutting upgrade to the dip location and then using cut material to build the mound for the reverse grade.

Figure 5: Rolling Dip

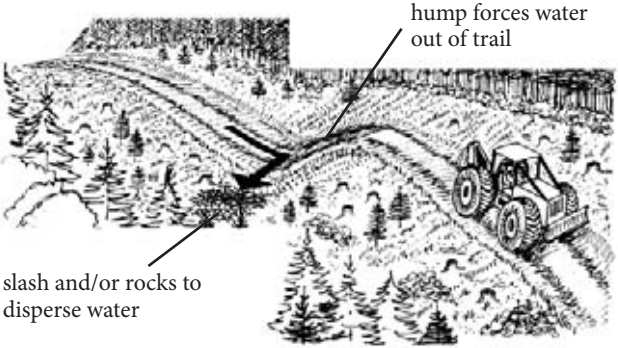


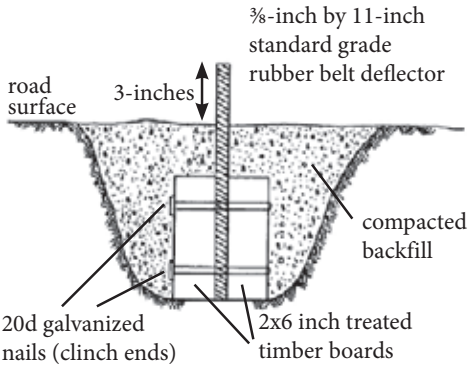
Table 3: Rolling Dip Spacing Guidelines

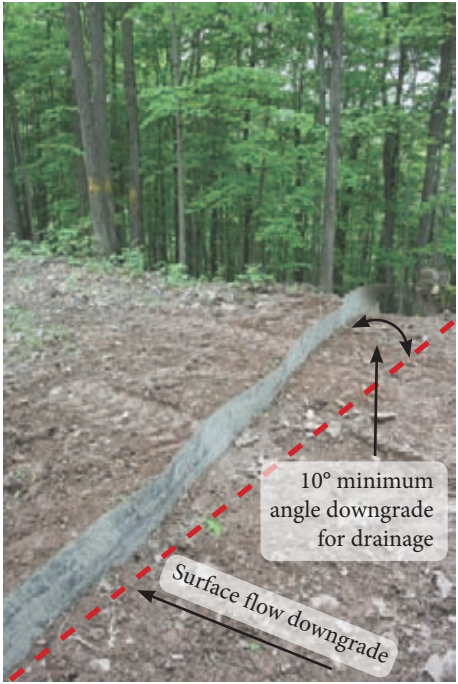
Slope (percent)	Spacing (feet)
2	250
5	135
10	80
15	60
20	45
25	30
30	35

Rubber Belt Deflectors

Rubber belt deflectors are an excellent BMP for skid roads and trails that will support regular vehicle traffic after a harvest is completed. A rubber belt deflector is a piece of conveyor belt rubber sandwiched between two 2x6 boards. The deflector is then buried in the road surface so that the rubber strip is the only piece visible. The rubber is easily compressed by passing vehicles to facilitate access, while still providing a mechanism for diverting water flow from the skid road. Rubber belt deflectors should be installed at a 30-degree downward angle, extend the entire width of the skid road or trail and possess a clear outlet to facilitate the drainage of water into undisturbed forest soil. The number of rubber belt deflectors installed on a skid road or trail is contingent upon the trails slope. The steeper the slope, the greater the number of rubber belt deflectors necessary to control runoff on the skid road or trail. Like water bars, rubber belt deflectors control the volume and velocity of water that flows down skid roads and trails, intercepting runoff and returning water to its natural place within the landscape where it can be absorbed by undisturbed forest soils.

Figure 6: Rubber Belt Deflector





FOREST ROADS - INTRODUCTION

Forest roads comprise the access system that facilitates log truck access to landing areas for the purpose of transporting logs to mills. 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. Due to a strong public road infrastructure in the majority of New York State, loggers will find a minimal need to construct forest roads. Forest road construction is often limited to the development of a short section of stable road that connects a public road to a landing area. Forest roads should be planned to minimize their total length, as well as the number of stream crossings. Soil exposed in disturbed areas should be shaped, stabilized, and if necessary, seeded as soon as possible to minimize the potential for erosion. The greatest potential for soil erosion occurs immediately after construction.

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

FOREST ROADS - RECOMMENDATIONS

- Refer to temprary stream crossing section, - page 58 when a forest road crosses a stream.

- Identify appropriate stabilization, drainage and erosion control measures.
- 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.
- Avoid locating roads on unstable slopes subject to slumping or creep. County soil survey maps will identify these soils.
- Avoid locating roads with grades in excess of 10 percent. Plan routes to avoid these areas. On highly erodible soils (also identified on soil survey maps), maximum grades of 5 percent are recommended. Use Table 2, page 29 and the grade meter inside the back cover to calculate slope grade.
- Drain water flowing along or onto the road. Divert water before it gains sufficient volume and/or velocity to cause significant erosion of the road.
- Avoid draining surface water from roads directly into streams, ponds, lakes or wetlands. Instead, drain the water into undisturbed forest soil or other vegetated areas.
- Prevent erosion before vegetation takes hold; mulch with hay, straw, bark or native vegetation.
- Inspect and repair erosion control measures on a regular basis to ensure they remain functional.

FOREST ROADS - EROSION CONTROL TECHNIQUES
WATER DEFLECTION

Figure 7: Water bar

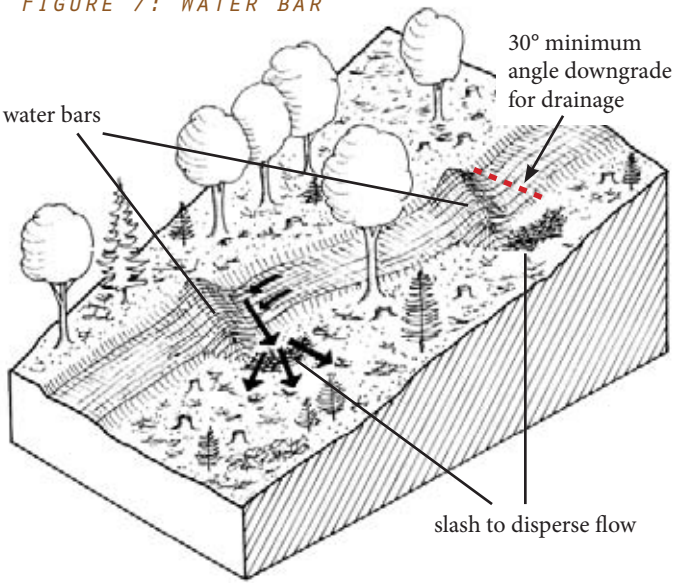


Table 4: Water bar Spacing Guidelines

Slope (percent)	Spacing (feet)
2	250
5	135
10	80
15	60
20	45
25	30
30	35

Broad Based Dips

Broad based dips are structures that change the grade of a forest road in order to facilitate the drainage of water. Broad based dips are not intended for use on grades in excess of 10 percent and are not suitable for skid trails. Broad based dips can facilitate vehicle traffic by providing a gentle grade that can be navigated by four-wheel drive vehicles and log trucks. Broad based dips are a useful tool to control the erosion associated with stormwater runoff on forest roads which require regular vehicular access.

Figure 8: Broad Based Dip

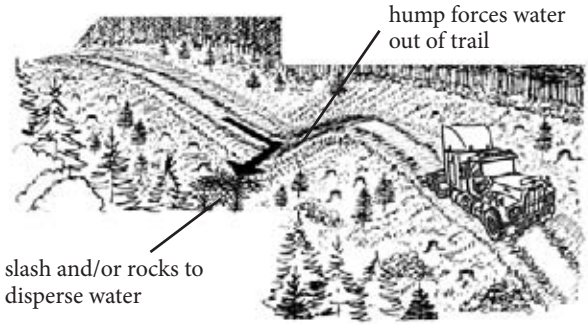


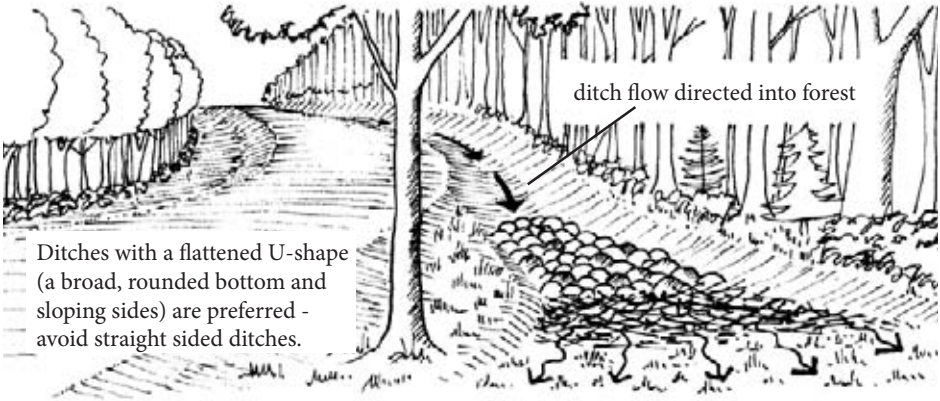
Table 5: Broad Based Dip Spacing Guidelines

Slope (percent)	Spacing (feet)
2-4	300-200
5-7	180-160
8-10	150-140

Diversion Ditch

Figure 9: Diversion Ditch

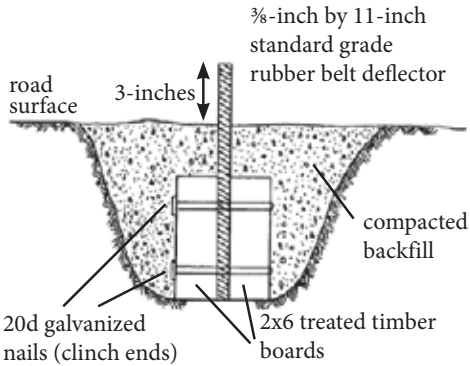
Where slope allows, a diversion ditch into undisturbed forest soil or other vegetative area is a good alternative to a water bar or cross-drainage culvert.

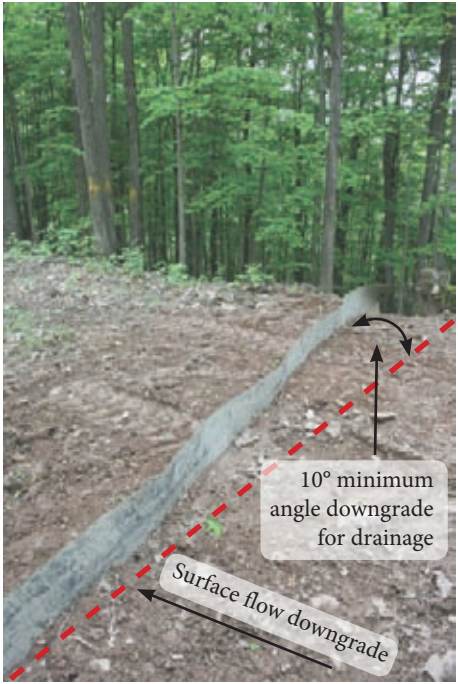


Rubber Belt Deflectors

Rubber belt deflectors are an excellent BMP for forest roads that will support regular vehicle traffic after a harvest is completed. A rubber belt deflector is a piece of conveyor belt rubber sandwiched between two 2x6 boards. The deflector is then buried in the road surface so that the rubber strip is the only piece visible. The rubber is easily compressed by passing vehicles to facilitate access, while still providing a mechanism for diverting water flow from the forest road surface. Rubber belt deflectors should be installed at a 30-degree downward angle, extend the entire width of the forest road and possess a clear outlet to facilitate the drainage of water into undisturbed forest soil. The number of rubber belt deflectors installed on a forest road or trail is contingent upon the slope of the trail. The steeper the slope, the greater the number of rubber belt deflectors necessary to control runoff on the forest road. Like water bars, rubber belt deflectors control the volume and velocity of water that flows down forest roads, intercepting runoff and returning water to its natural place within the landscape where it can be absorbed by undisturbed forest soils.

Figure 10: Rubber Belt Deflector

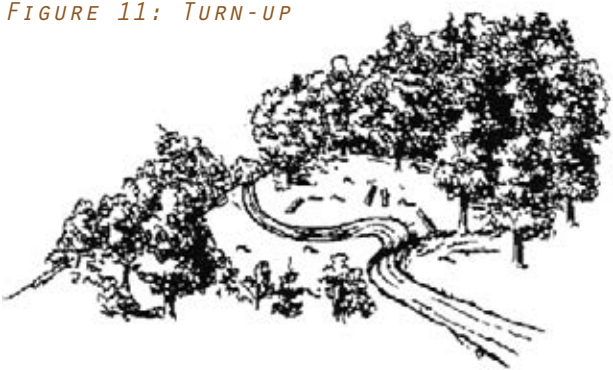




Turn-up

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

Figure 11: Turn-up



Forest Roads - Erosion Control Techniques

Open Top Culverts

Open top culverts are also an excellent BMP for forest roads that will support regular vehicle traffic after a harvest is completed. Open top culverts come in a variety of forms. Metal pipes, pressure-treated lumber and even small diameter trees can be used to create an open top culvert that effectively diverts the flow of water from the compacted forest road surface into undisturbed forest soil. Open top culverts should be installed at a 30-degree downward angle, extend the entire width of the forest road and possess a clear outlet

to facilitate water drainage into undisturbed forest soil. The top, or slotted side, of the culvert should be 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 percent and with adequate downslope angle. The number of open top culverts installed on a forest road is contingent upon the trail slope. The steeper the slope, the greater the number of open top culverts necessary to control runoff on the forest road. The culverts can be used in place of broad based dips on road grades greater than 10 percent at spacings determined by the following calculation: 400/ percent slope + 100 feet. Like water bars, open top culverts control the volume and velocity of water that flows down forest roads, intercepting runoff and returning water to its natural place within the landscape where it can be absorbed by undisturbed forest soils.

Table 6: Open Top Culvert Spacing Guidelines

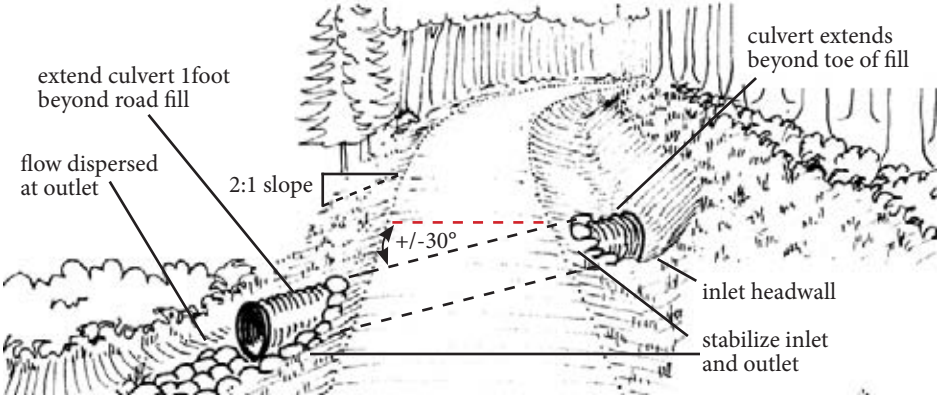
Slope (percent)	Spacing (feet)
2-4	300-200
5-7	180-160
8-10	150-140

Photo 2:
Open top
Pipe Culvert

Ditch Relief Culverts

Ditch relief culverts are used to manage the flow of water in roadside ditches. Ditch relief culverts transport runoff under the road surface before it can build in sufficient volume and velocity to damage the ditch and road. The number of ditch relief culverts installed on a forest road is contingent upon the ditch slope. The steeper the slope, the greater the number of ditch relief culverts necessary to control runoff in the ditch. Ditch relief culverts should be installed at a 30-degree downward angle with a 2-4 percent slope, extend the entire width of the forest road and possess a clear outlet to facilitate the drainage of water into undisturbed forest soil. Ditch relief culverts are costly and are commonly reserved for use in roads that will carry significant vehicle traffic on a regular basis. Ditch relief culverts rely upon fully functional ditches and road crowns in order to successfully manage runoff, so annual maintenance is a must for all of these structures.

Figure 12: Pipe Culvert



It is also recommended to fill roughly half the diameter around the culvert with a coarse aggregate, such as #3 stone.

Figure 12a: Pipe Culvert (cross-section)

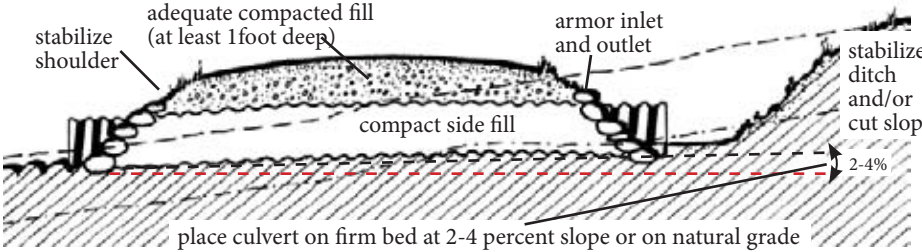
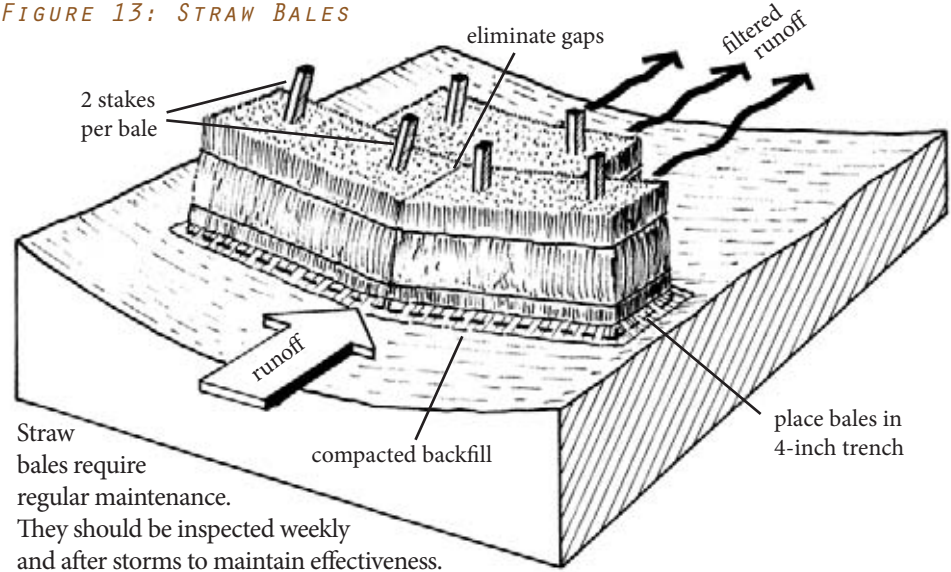


Table 7: Suggested Spacing for Cross-Drainage Culverts

Slope (percent)	Spacing (feet)
0-2	500-300
3-4	250-180
6-10	167-140
11-15	136-140
16-20	126-120
21+	100

FIGURE 13: STRAW BALES



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

Photo 3: Erosion Control Blankets

Figure 14: Silt Fencing

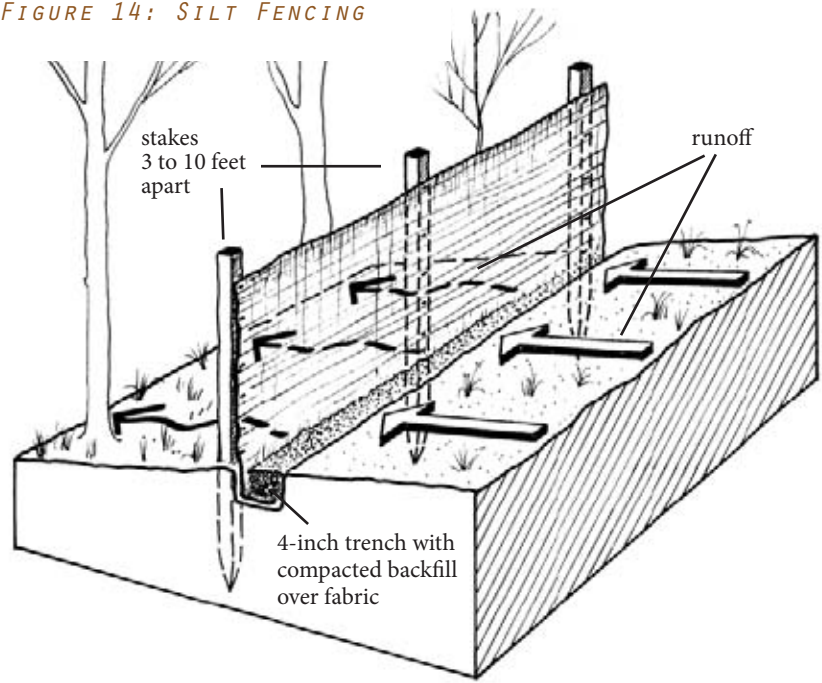
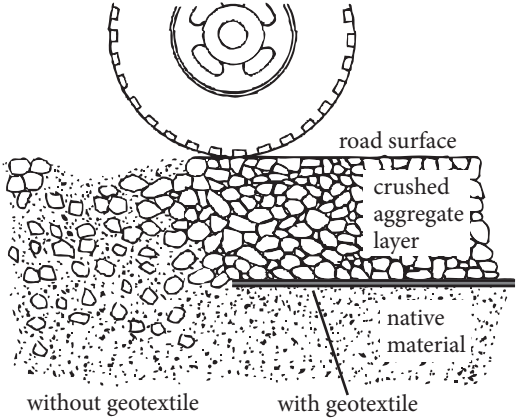


Figure 15: Geotextile Fabric



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 16: 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.

WINTER ROADS - INTRODUCTION

Winter roads provide access under frozen ground conditions for timber harvesting and other timber management activities. Like all other roads, winter roads need 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.

WINTER ROADS - RECOMMENDATIONS

To minimize the impact to water quality during mud season, 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 mud season.

TEMPORARY STREAM CROSSINGS - INTRODUCTION

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 minimize the movement of sediment into the water. Stream crossing structures that are poorly located or constructed can result in disturbance of the banks and stream bottoms, increasing the chance for erosion and sedimentation to occur. 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. Bridges or culverts that retain the natural stream bottom and slope should allow the natural migration and movement patterns of fish and aquatic life. Stream crossings should be used only when absolutely necessary and the number of crossings kept to a minimum.

A permit is required for any disturbance to the bed or bank of a protected stream. See Regulations and Permits, page 76. If you have a question contact, the nearest NYS DEC office.

Temporary Stream Crossings

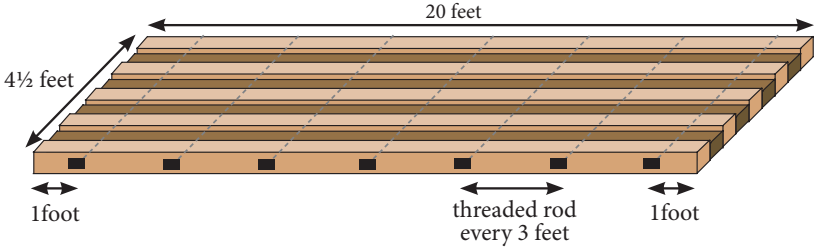
TEMPORARY STREAM CROSSINGS - RECOMMENDATIONS

- Find crossing sites along the approaches that have stable banks, a firm stream bottom, minimal surface runoff and gentle slopes, whenever possible.
- Stabilize the soil around all culverts and bridges immediately after installation.
- Install stream crossings using materials that are clean, non-erodible and non-toxic to aquatic life.
- Consider stream materials, stream size, storm frequency, flow rates, and intensity of use when planning crossings.
- Install stream crossing structures at right angles to the stream channel.
- Divert road drainage into undisturbed forest soils, preferably outside the stream management zone so that runoff does not directly enter the stream.
- 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.
- Keep use of equipment in the stream to a minimum.
- Limit construction activity in the water to periods of low or normal flow.

- Use soil stabilization practices on exposed soil at stream crossings. Use seed and mulch. 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.
- Use BMPs to stabilize the approaches to the stream crossing during and after the harvest in order to prevent sedimentation. BMPs suitable for this purpose are water bars, gravel, and geotextile fabric, rubber belt deflectors, open top culverts and hay and grass seed.
- Anchor temporary structures on one end with a cable or other device so they do not float away during high water. Install structures so they can be easily removed when no longer in use, 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.
- Remove any accumulated debris from the bridge surface prior to installation and removal, making sure not to push debris into the stream.

TEMPORARY STREAM CROSSINGS - METHODS

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.



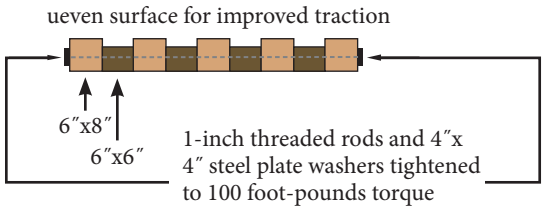


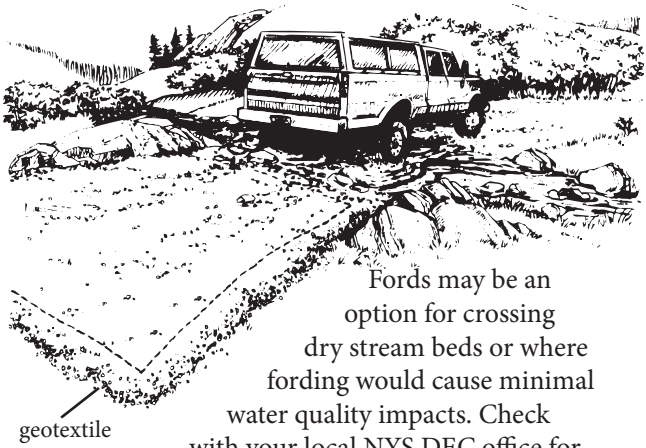
Figure 17: 20 foot Skidder Bridge Panel Construction

Photo 4: 20ft Portable Skidder Bridge

Photo 5: 30ft Portable Skidder Bridge

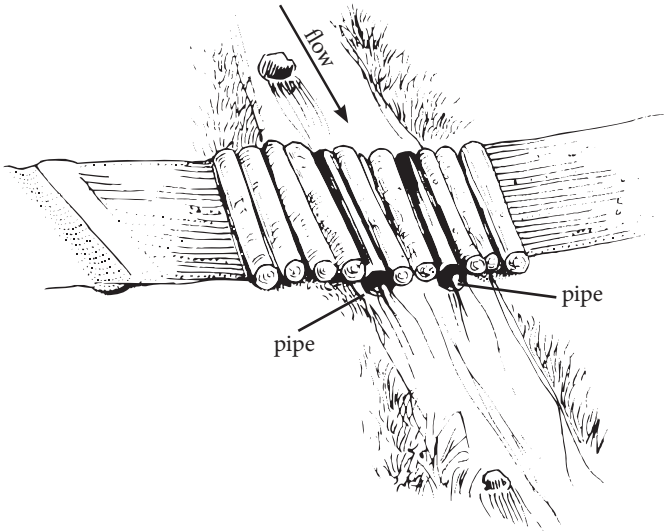
Photo 6: Arch Culvert

Figure 18: Ford Crossing Using Geotextile



Fords may be an option for crossing dry stream beds or where fording would cause minimal water quality impacts. Check with your local NYS DEC office for recommendations. Fords should be located where stream banks are low. The stream should have a firm rock or gravel base. Otherwise, install stabilizing material such as reinforced concrete planks, crushed rock, rip rap or rubber mats on stream beds.

Figure 19: Pole Ford Crossing Using Pipe for Water Flow



Culverts and bridges that are too small can plug up with debris and result in the road washing out or flooding upstream. Crossings requiring a permit may be subject to different standards. Check with your local NYS DEC office. For non-permitted situations, size openings for anticipated seasonal high water flow. In some cases of intermittent streams, you cannot see a definitive stream channel to take cross-section measurements. In these situations, estimate how many uphill acres drain to that point. Then use the following tables:

Table 8: Recommended Pipe Culvert Sizes for Well-defined Stream Channels

Stream Width (inches)	Stream Depth (inches)	Culvert Diameter for Maintained Road (inches)	Culvert Diameter for Unmaintained Road (inches)
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

Table 9: Recommended Pipe Culvert Sizes for Undefined Streams, Channels and Cross Drains

Area (acres)	Pipe Size (inches)
10	18
20	20
30	24
40	26
50	28
75	30
100	34
150	38
200	42

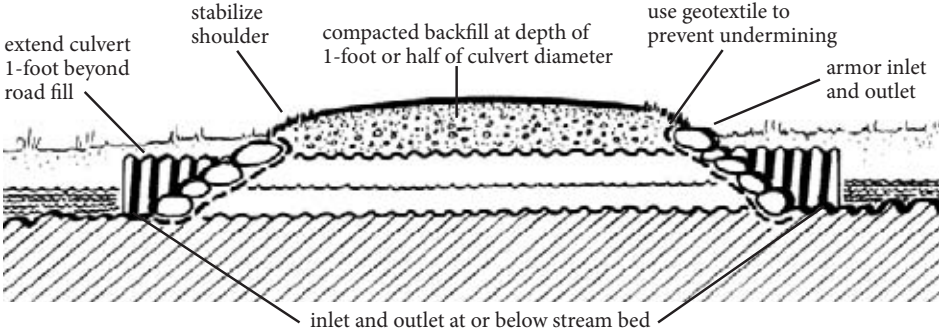
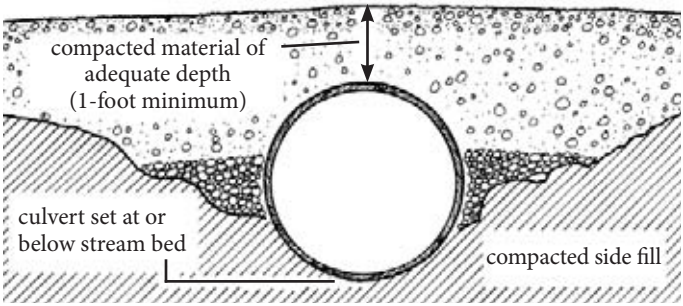


Figure 20: Stream Crossing Using Pipe Culvert



POST HARVEST WRAP-UP - INTRODUCTION

Post harvest actions are your last opportunity to maintain or improve water quality and positively impact the environment. By cleaning up after yourself, the harvest impact will be lessened for the waterways, the landowner, and others taking notice of the activities.

POST HARVEST WRAP-UP - RECOMMENDATIONS

- 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 areas prone to erosion can be stabilized by seedings of appropriate grasses and legumes. Species selection varies with soil type, drainage class, and degree of shading. Most seeds should be immediately mulched with hay or straw at 2 tons per acre (approximately two and a half 40-pound bales per 1000 square feet), or with wood cellulose at 2000 pounds per acre. In forest land erosion control, straw or hay are the preferred mulches. These may require the use of mulch netting on steep slopes (over 30 percent).
- Landings should be left free of excess woody debris.

- 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 their approximate 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 are critical to the protection of water quality before, during and after timber harvesting operations. Even small amounts of hydrocarbons (i.e. fuel, oil, and grease) can have serious effects on the environment.

Application of pesticides, herbicides, insecticides, or any other chemical control agents can only be applied by a NYS DEC Licensed Pesticide Applicator.

An accidental petroleum spill is not a crime, the failure to report it is!

Spills must be reported unless **ALL** of the following apply:

- It is less than five gallons *and*
- It has not and will not reach soil or water *and*
- It is contained and controlled *and*
- It is cleaned up within two hours of discovery

NYS DEC Spills Hotline: (800) 457-7362

The penalty for not reporting a spill may include a fine for every day since the spill occurred, as well as the cost of clean-up and remediation.

Proper planning can reduce the number and severity of hazardous material leaks:

- Maintain equipment and store away from any water bodies (at least 200 feet where possible).
- Containers and waste oil, hydraulic fluid, and other hazardous materials should be collected and transported off-site for proper disposal. Soiled cleaning rags are considered hazardous materials.
- Use secondary containment containers for products stored on-site.
- Active log landings should have a spill response kit containing:
    - Approved absorbent material – loose powder, pads or socks. Kitty litter is not acceptable as its absorbency is not suited to leaching oil from soil.
    - Safety goggles
    - Non-latex gloves, such as disposable 4-mil nitrile gloves.
    - Heavy plastic or vinyl sealable bag suitable for transporting the contaminated contents of the kit after it has been utilized.

STOP

A pesticide applicator's licence is required for any commercial use of pesticide or herbicide.

REGULATIONS AND 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.

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 need 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.

DEC Regional Offices

Region 1 - (631) 444-0350
Suffolk and Nassau counties

Region 2 - (718) 482-4900
Manhattan, Bronx, Queens, Brooklyn and Staten Island

Region 3 - (845) 256-3018
Sullivan, Ulster, Orange, Dutchess, Putnam, Rockland and Westchester counties

Region 4 - (518) 357-2068
Montgomery, Otsego, Delaware, Schoharie, Schenectady, Albany, Greene, Rensselaer and Columbia counties

Region 5 - (518) 897-1200
Franklin, Clinton, Essex, Hamilton, Warren, Fulton, Saratoga and Washington counties

Region 6 - (315) 785-2239
Jefferson, St. Lawrence, Lewis, Oneida and Herkimer counties

Region 7 - (315) 426-7403
Oswego, Cayuga, Onondaga, Madison, Tompkins, Cortland, Chenango, Tioga and Broome counties

Region 8 - (585) 226-2466
Orleans, Monroe, Wayne, Genesee, Livingston, Ontario, Yates, Seneca, Steuben, Schuyler and Chemung counties

Region 9 - (716) 851-7000
Niagara, Erie, Wyoming, Chautauqua, Cattaraugus and Allegany counties

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
www.apa.state.ny.us

Catskill Forest Association (CFA)
(845) 586-3054
www.catskillforest.org

Cornell Cooperative Extension (CCE)
(See telephone book for local number)
www.cce.cornell.edu

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

Empire State Forest Products Association (ESFPA)
(518) 463-1297
www.esfpa.org

New York City Department of Environmental Protection (NYC DEP)
(718) 337-4357
www.nyc.gov/dep

New York Forest Owners Association (NYFOA)
(800) 836-3566
www.nyfoa.org

New York State Department of Environmental Conservation (NYS DEC)
(518) 402-9424
www.dec.ny.gov

New York Tree Farm
(800) 836-3566
www.nytreefarm.org

Society of American Foresters (SAF)
(301) 897-8720
www.safnet.org

State University of New York College of Environmental Science and Forestry (SUNY-ESF)
(315) 470-6500
www.esf.edu

USDA Forest Service
(603) 868-7616
www.fs.fed.us

USDA Natural Resource Conservation Service
(315) 423-5076
www.nrcs.usda.gov

Watershed Agricultural Council (WAC) Forestry Program
(607) 865-7790
www.nycwatershed.org

SELECT PUBLICATIONS AVAILABLE FROM THE US 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

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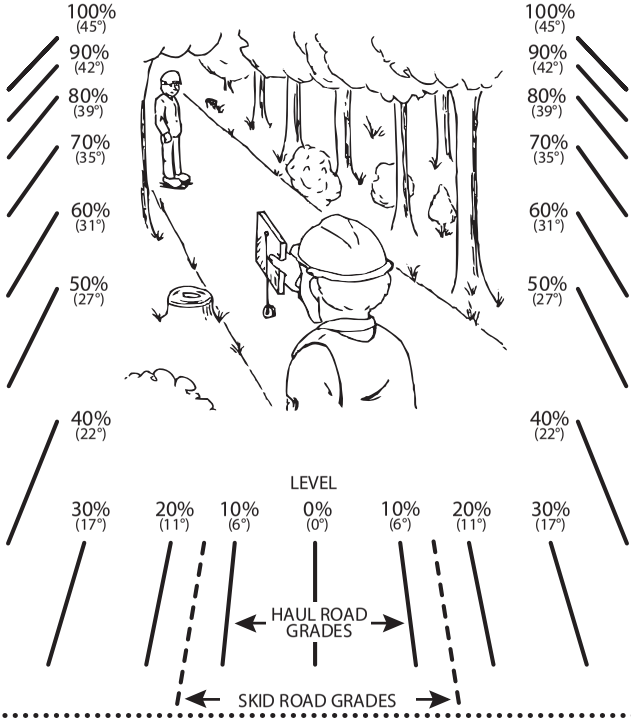
GRADE METER INSTRUCTIONS (LOCATED ON BACK COVER)

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

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



GRADE METER

WWW.NYSBMPGUIDELINES.COM