Proposed Changes to the AMPs
December 2012 Draft Version

TRUCK ROADS
Practices to Be Applied During Logging

Proposed AMP #1 – <u>Grades on permanent truck roads should not exceed 15 percent. Short, steep sections over 15 percent grade shall not exceed 300 feet in length.</u>

Supportive Information and Technical Guidance: A permanent truck road is defined as one that will remain open to vehicular access all or most of the year. It's difficult to control soil erosion on steep roads. As road grade increases, so does velocity of runoff, making the potential for soil erosion greater. Steeper road grades will require more erosion control measures and maintenance. Road grades on truck roads should be kept under 15 percent or to the minimum grade practical to effectively manage runoff and minimize the potential for erosion. On those portions of roads with steep grades, apply a surface coat of gravel or crushed stone to avoid erosion and rutting.

Proposed AMP #2 –<u>Drainage structures on truck roads shall be correctly installed to intercept and re-direct surface runoff into road ditches or vegetated areas. Drainage structures shall be spaced at intervals according to Table 1 where ground conditions allow.</u>

Supportive Information and Technical Guidance: Truck road surfaces need to be adequately drained to prevent soil erosion and sedimentation. Provide for road surface drainage by crowning or in-sloping into a ditch or by out-sloping into a vegetated area. Broad based dips can also be used on grades of 10 percent or less. Water deflectors, open top and pole culverts are other methods to consider. Install drainage structures at a 30 degree angle downgrade to the road and at a 2-4 percent downhill pitch to ensure self-cleaning and reduce maintenance. Depending on the method used for draining the road surface, install drainage structures either during or immediately after road construction is completed. High shoulders should be graded or broken at strategic locations to allow runoff to drain into ditches or vegetated areas

Proposed AMP #3 – <u>Water entering a roadway shall be moved under or away from the roadway before gaining sufficient flow and velocity to erode ditches. Culverts used for ditch drainage on truck roads shall be at least 15 inches in diameter, correctly installed and spaced according to Table #1 where ground conditions allow.</u>

Supportive Information and Technical Guidance: Culverts shall be used where it is necessary to prevent an excessive accumulation of ditch water volume by moving water under and away from the road before it gains sufficient flow to cause erosion. Culverts should be at least 15 inches in diameter, installed at a 30 degree angle downhill to the road and with a 2-4 percent downhill pitch to ensure self-cleaning and reduce maintenance. Culverts less than 15 inches in diameter have a higher tendency to plug from forest debris (limbs, twigs and leaves) that are washed down the ditch. Install culverts larger than 15 inches diameter where ephemeral flows and wet seeps are being intercepted by road ditches. Culverts should be long enough so that they extend beyond the 'shoulders' of the road. Construct a stone header at the inlet and

install stone rip-rap or place brush at the outlet to prevent soil erosion. All drainage structures should be periodically inspected, cleaned and functioning properly at all times.

Proposed AMP #4 – Drainage ditches shall not terminate directly into streams or other bodies of water.

Supportive Information and Technical Guidance: On approaches to stream crossings, divert road ditches by turning them out into a vegetated stream buffer. A vegetated stream buffer will trap sediment before it reaches the stream. The width of the buffer should be at least 50 feet as measured along the surface of the ground from the top of the streambank. This distance should be increased as slope of the land to the stream increases. Refer to Table 4 for determining width of the buffer based upon percent slope. Road ditches should be properly stabilized (seeding and mulching, rock lining, stone check dams, etc.) to minimize erosion. Stone or brush can be used at the end of the diversion ditch to disperse water flow. In cases where it may be difficult or unfeasible to turn out or divert road ditches into a vegetated buffer due to terrain, install small 'settling basins' to trap sediment. Reinforce settling basins with hay bales and/or silt fence and maintain them during logging.

TRUCK ROADS

Practices to Be Applied Upon Closeout

Proposed AMP #5 – Deep waterbars on temporary truck roads shall be correctly installed and spaced at intervals shown in Table 1 where ground conditions allow.

Supportive Information and Technical Guidance: A temporary truck road is defined as a road that will not be open to vehicular traffic after logging. Because of the long duration between harvest entries, it is important to close out temporary truck roads properly to reduce the potential for soil erosion and sedimentation. Install deep waterbars 24-30 inches deep at a 30 degree angle downhill to the road and with a 2-4 percent downhill pitch to ensure self-cleaning and reduce maintenance. Construct waterbars across the entire width of the road and provide for a clear outlet to facilitate the drainage of water into a vegetated area.

SKID TRAILS

Practices to Be Applied During Logging

Proposed AMP #6 - Grades on skid trails should not exceed 25 percent. Short, steep sections over 25 percent grade shall not exceed 300 feet in length.

Supportive Information and Technical Guidance: Avoid or minimize skidding on steep slopes for long distances. Runoff will accelerate quickly under these situations thus increasing the chance for soil erosion and sedimentation. Waterbars on steep slopes and unfrozen ground are difficult to maintain because skidder tires are more likely to spin-out when travelling over them,

damaging the waterbars and loosening the soil. The loose soil will then be carried further down slope when hitches of wood are dragged over them. In time, an inverted trail profile or "dug-way" may develop making it difficult to divert runoff from the skid trail. Consider installing reinforced log waterbars on steep slopes. Install them at a 10 degree downhill angle to the skid trail to divert runoff and for ease of getting over them with equipment.

Proposed AMP #7 – <u>Dips, turn-ups and other effective measures shall be properly installed on skid trails and spaced at intervals according to Table 1 where ground conditions allow.</u>

Supportive Information and Technical Guidance: Skid trails need to be adequately drained to prevent rutting and to minimize the potential for soil erosion and to keep sediment from entering streams and other bodies of water. When laying out skid trails incorporate turn-ups and construct dips. Turn-ups are constructed by turning the skid trail uphill a short distance, then turning downhill again. By reversing the grade in this way, water will run off the downhill side of the skid trail. Construct dips by cutting and filling sections of a skid trail to create a grade break or dip. Dips are usually broad and shallow structures 20 feet long and 16 to 20 inches deep from the top of the filled area to the bottom of the cut area thus allowing a skidder to travel over them without creating ruts. Critical locations to construct dips are on approaches to steep pitches. Out-sloping sections of skid trails is another method to consider on side slopes to divert runoff from skid trails into vegetated areas. Use log-reinforced waterbars on long, straight sections of skid trail and on approaches to stream crossings.

SKID TRAILS

Practices to Be Applied Upon Closeout

Proposed AMP #8 - <u>Ruts on skid trails shall be smoothed out where they offer any potential for gully erosion and to keep sediment from entering streams and other bodies of water of water.</u>

Supportive Information and Technical Guidance: To prevent rutting, avoid skidding when soil conditions are wet. Install log corduroy or brush-in wet sections of skid trails with tops and logging slash. Both methods are most effective if implemented before rutting occurs. Ruts will collect and carry water which can result in soil erosion and sediment reaching streams or other bodies of water. During active logging and when done using a skid trail, smooth ruts wherever there is the potential for gullies to form.

Proposed AMP #9 - <u>Waterbars on skid trails shall be correctly installed and spaced at intervals according to Table 1 where ground conditions allow.</u>

Supportive Information and Technical Guidance: Select the best locations available to effectively manage surface runoff. Install waterbars at least 24 to 30 inches deep where conditions allow. When outlets are difficult, such as on dug-way sections of skid trails, install berms perpendicular to the direction of the skid trail to stop runoff and capture sediment. Clean them out periodically since they will fill up with sediment over time. Whenever possible, close out sections of the skid trail network as portions of the harvest are completed.

STREAMS AND ALL BODIES OF WATER

Practices to Be Applied During Logging

Proposed AMP #10 - Streams and all bodies of water shall be kept free of logging slash and other logging debris.

Supportive Information and Technical Guidance: It is illegal to discharge any waste into the waters of the state, therefore, the deposition of slash or logging debris in a stream constitutes a "discharge." Logging slash left in streams may cause a blockage and alter the natural course of streams which can result in soil erosion and flood damage. If trees are felled into or across streams or other bodies of water when logging, they should be immediately removed from the stream or body of water to a point beyond the normal high water mark before being lopped and limbed.

Proposed AMP #11 - Stream crossings should be located where the stream channel is well defined, streambanks are stable, approaches are level or gently sloping and at right angle to the stream channel.

Supportive Information and Technical Guidance: It should be recognized that stream crossings will receive repeated use. Choosing the best site available for stream crossings is important. Cross streams at their narrowest point and where the stream is constricted to one well-defined channel. Avoid locating stream crossings where there are multiple or "braided" stream channels that are not well-defined. Choose sites where streambanks are well defined. Avoid wet areas adjacent to streams where soil drainage is poor. These areas will be prone to rutting and the potential for discharging sediment into the stream is great.

Proposed AMP #12 – Truck road crossings on streams shall be over a bridge, culvert or by constructing a stone ford. Structure size opening shall be determined according to Table 2. Constructed stone fords are to be used only where streams have low banks, stable beds (cobble or ledge) and stable, gradual approaches.

Supportive Information and Technical Guidance:

Bridges: Bridges are preferable for stream crossing structures because they cause less disturbance to the stream channel, and minimize the potential for soil erosion and sediment from entering a stream. Install bridges so that all portions of the bridge are above the stream's normal high water mark. Extend bridges well beyond the edges of the stream-banks or a minimum of 2-3 feet. Install the bridge on sill logs to protect the stream-banks from damage and erosion during use. When using portable bridges that are re-usable, sill logs will prevent the bridge from settling or freezing into the soil and minimize the chances that the bridge will be damaged when removed. Sill logs should be removed following bridge removal and the streambanks restored to their condition prior to logging.

Culverts: Install culverts so there is no change to the streambed elevation which will cause the outlet to be "perched." Perched culverts cause scouring of the stream channel. Culverts should be adequately sized to avoid being washed out during periods of high-flow events. Culvert size is determined by the size of the watershed upstream from where the culvert is installed – the area that drains towards the stream. For temporary culvert installations, consider backfilling and covering the culvert with logs and poles rather than soil. This will minimize the chance for soil erosion and from sediment entering a stream. Culverts will also be easier to remove during frozen winter conditions.

Constructed Stone Ford Crossings: Constructed stone fords are an acceptable method for crossing streams under low-flow conditions during logging or when occasional vehicular traffic is expected. Streams must have stable beds (cobble or ledge) and stable, gradual approaches. Minimize the amount of streambank disturbance by locating fords where the streambanks are low. Fording a stream with a truck compared to using skidders or forwarders will minimize the number of trips and reduce the amount of disturbance to the streambed.

Proposed AMP #13 - Skid trail crossings on streams shall be over a bridge, culvert or ford. Structure size opening shall be determined according to Table 2. Open ford crossings are allowed on skid trails, but only where streams have low banks, stable beds (cobble or ledge) and stable, gradual approaches. Streams may also be crossed by brushing-in, but only during frozen winter conditions.

Supportive Information and Technical Guidance:
Pole Fords: Pole fords should only be installed on shallow, low velocity streams that have firm streambeds. Avoid installing pole fords on soft-bottom streams. Poles will become embedded into the streambed when travelling across them with equipment, making them difficult to remove. Pole fords can significantly reduce the stream channel's capacity to carry water so it's important to use larger-sized poles, 10 inches diameter or larger, to allow for water flow. Metal or plastic pipes can be used in conjunction with poles to provide for water flow.

Brushed-in Crossings: Brushed-in crossings should be restricted to small stream channels and frozen in place for winter use only. Small stream channels can also be frozen-in with snow during the winter creating an ice ford crossing.

Open Ford Crossings: Open ford crossings should be located where streams are shallow with low banks; stable, gradual approaches and stable streambeds made up of cobble or ledge. Open ford crossings are acceptable as temporary stream crossings on skid trails when there is no other feasible alternative.

Proposed AMP #14 - Logging equipment shall be kept out of stream channels, except for the construction of stream crossing structures or the use of ford crossings.

Supportive Information and Technical Guidance: All streams should be left in their natural courses. Placement of bridges or culverts that require work in the stream should be done when the water level is low and within the shortest time period possible. Keep streambank and streambed disturbance to a minimum. Excavators, forwarders and mechanized timber harvesters are ideal for installing stream crossing structures in a way that minimizes disturbance to the stream channel.

Proposed AMP #15 – Drainage structures such as waterbars, diversion ditches, broad-based dips or other effective measures shall be correctly installed on approaches to stream crossings on truck roads and skid trails.

Supportive Information and Technical Guidance: Install drainage structures, such as waterbars, or broad-based dips on the approaches to stream crossings to prevent surface runoff on truck roads or skid trails from entering a stream. Turn out drainage ditches into a vegetated buffer on approaches to streams or other bodies of water so that surface runoff is diverted. The width of the buffer should be at least 50 feet wide as measured along the surface of the ground from the top of the streambank. This distance should be increased as slope to the stream increases.

Refer to Table 4 for determining width of buffer based upon percent slope. Reinforced log waterbars are an effective method for use on skid trail approaches to stream crossings. Install them at a 10 degree angle downhill to the skid trail to divert runoff and for ease of getting over them with equipment. Make sure to anchor the ends well to keep the log in place and the waterbar functioning properly. On skid trails, stabilize approaches to stream crossings using brush, poles or a combination of both. Armoring the approaches to stream crossings in this way, will prevent rutting and reduce the potential for sedimentation. Maintain the brush mat during the course of the logging operation by adding to it as needed. If left in place after logging, it will provide for continued soil and streambank stability. Do not place brush in the stream channel. Portable and re-usable rubber or wood mats can also be used to armor approaches to stream crossings. Install silt fence, hay bale erosion checks or other effective measures to prevent sediment from reaching streams or other bodies of water. Place silt fence and hay bale check dams to intercept runoff and trap sediment before it reaches streams or other waterbodies. Do not install silt fence or hay bales in streams! Hay bales and silt fence should be embedded into the ground using stakes. Overlap hay bales to increase effectiveness. Periodically clean these devices during the course of the timber harvesting operation before they fill up with sediment. Silt fence and hay bale check dams are temporary devices and should be removed when the site is stabilized.

Proposed AMP #16 - <u>Except for the travelled portions of truck roads and skid trails, areas of exposed soil within 25 feet of streams shall be seeded and mulched immediately after installing stream crossing structures.</u>

Supportive Information and Technical Guidance:
It is inevitable that soil will be disturbed and exposed when installing stream crossing structures such as culverts and bridges. To prevent soil erosion and the potential for sediment reaching streams, make sure to seed and mulch areas of exposed soil within 25 feet of streams as soon as possible, except for the travelled surface portion of truck roads and skid trails.

STREAM CROSSINGS

Practices to Be Applied Upon Closeout

Proposed AMP #17 - <u>All temporary structures shall be removed from streams and the channel restored to a stable condition. Brushed-in crossings shall be removed when skid trail use has been completed or as soon as ground conditions allow. Permanent structures left in streams shall be sized according to Table 2.</u>

Supportive Information and Technical Guidance:
Stream crossing structures installed for the purpose of timber harvesting are generally temporary. While they may be in place for up to several months, they need to be removed after harvesting. Remove any slash and logging debris from streams that may have accumulated during logging. Remove the crossing structure and re-shape the streambanks to a stable condition. When using brushed-in crossings during winter conditions, remove all brush that is not frozen-in and immediately after skid trail use has been completed. Remove the remaining brush, if there is any, during close-out when ground conditions permit. Seed and mulch all exposed soil a minimum of 25 feet on either side of the stream crossing. Permanent stream crossing structures are intended to be in place for many years. Stream crossing structures on truck roads, for example, are often permanent and require careful design, installation, and long-term periodic maintenance. Permanent stream crossing structures are occasionally installed on skid trails if the landowner has long-term access needs. Make sure that stream crossing

structures are functioning correctly, are free of debris and sediment and are adequately sized for storm events.

Proposed AMP #18 - <u>All areas of exposed soil within 25 feet of a stream or other waterbody shall be seeded and mulched at application rates according to Table 3 immediately after logging or as soon as ground conditions allow. Seed and mulch approaches to stream crossings to the first water diversion or a minimum of 25 feet on each side of the stream as measured from the top of the streambank.</u>

Supportive Information and Technical Guidance: Seed and mulch all areas of exposed soil within 25 feet of streams and other waterbodies immediately after logging or as soon as ground conditions allow to minimize the potential for soil erosion and to prevent sedimentation. Apply only mulch to stabilize areas of exposed soil if logging is going to be interrupted for prolonged periods of time. Seed and mulch as portions of the harvest area are completed.

BUFFER STRIPS

Proposed AMP #19 - <u>Except for the necessary construction of stream crossings, a forested buffer strip shall be left along streams and other bodies of water in which only partial cutting can occur so that breaks made in the canopy are minimal and continuous cover is maintained. Log transport machinery must remain outside a 25 foot margin along the stream or waterbody. Including this 25 foot margin, the width of the buffer strip shall be according to Table 4.</u>

Supportive Information and Technical Guidance: A forested buffer strip prevents sediment from reaching streams and maintains shade and streambank stability. Maintain 60 to 70 percent crown closure or B-level stocking as recommended in U.S. Forest Service silvicultural guides. (See Leak and Tubbs 1983, to convert crown closure percentages to basal area). Activities conducted within the buffer strip must minimize ground disturbance resulting in exposed soil. Conduct operations on dry or frozen ground when possible and brush-in wet areas that cannot be avoided. Logging equipment is excluded within the 25-foot zone immediately adjacent to streams and other bodies of water. Remove timber within this zone by directionally felling trees into the forested buffer; use cable to winch trees out or reach into this zone with a mechanical felling arm. Take extra precautions by installing silt fence and hay bale check dams if any portion of a log landing, truck road or skid trail encroaches upon a buffer strip. Recommended minimum buffer strip widths are based on the ability of an undisturbed forest floor to absorb water and filter sediment. The minimum width of a buffer strip is 50 feet adjacent to open water (i.e., lakes and ponds) or on each side of streams. Refer to Table 4 for minimum buffer widths. The width of a buffer strip is the slope distance as measured along the surface of the ground from the top of the streambank or shoreline. Minimum recommended buffer strip width increases as the slope of the land to the stream or waterbody becomes steeper.

Proposed AMP #20 - <u>Petroleum products and other hazardous materials shall be stored in leak-proof containers placed outside of buffer strips and shall be removed when logging is completed.</u>

Supportive Information and Technical Guidance: Proper storage, handling and use of petroleum products and other hazardous materials are critical to protect water quality during logging operations. Logging equipment uses fuels, lubricants, coolants and solvents, all of which are considered hazardous materials and are toxic at very low concentrations. Maintain and repair equipment outside of buffer strips. Have spill kits or other absorbent materials readily available for mopping up spills. If a spill does occur, keep it from flowing into streams or other bodies of water.

LOG LANDINGS

Practices to Be Applied During Logging

Proposed AMP # 21 – <u>Log landings shall not be located in buffer strips. The width of the buffer strip shall be in accordance with Table 4.</u>

Supportive Information and Technical Guidance: Log landings are to be located outside of buffer strips. Take extra precautions by installing silt fence and hay bale check dams if any portion of a log landing encroaches upon a buffer strip. Log landings will become compacted due to the heavy traffic they receive during a logging operation making them more prone to runoff.

Proposed AMP #22 – <u>Drainage structures shall be correctly installed on log landings. Silt fence, haybale erosion checks or other effective measures shall be used to prevent sediment from entering streams and other bodies of water.</u>

Supportive Information and Technical Guidance: Log landings should be located on level or gently sloping, stable ground. Incorporate drainage features to direct surface runoff from log landings into vegetated areas. Divert upslope drainage from skid trails around the log landing. Locate silt fence and hay bale check dams to intercept runoff and trap sediment before it reaches streams or other bodies of water. Do not install silt fence or hay bales in streams! Hay bales and silt fence should be embedded into the ground using stakes. Overlap hay bales to increase effectiveness. Periodically clean these devices during the course of the timber harvesting operation before they fill up with sediment. Silt fence and hay bale check dams are temporary devices and should be removed when the site is stabilized.

LOG LANDINGS

Practices to Be Applied Upon Closeout

Proposed AMP #23 - <u>Log landings shall be stabilized and drainage structures installed to prevent sediment from entering streams and other bodies of water.</u>

Supportive Information and Technical Guidance: Smooth ruts on landings to keep gullies from forming and to direct runoff into vegetated areas. Ruts will collect and carry water which can result in sedimentation and soil erosion. Install 24 to 30 inch deep waterbars to divert runoff into vegetated areas. Clean sediment from temporary devices such as hay bales and silt fence. Prevent further collection of sediment into these temporary devices by stabilizing areas of exposed soil. Collect used oil, oil filters, hydraulic fluids, and all other hazardous materials and transport them off-site for proper disposal.

Table 1: Distance between Drainage Structures on Skid Trails and Truck Roads

Road Grade (Percent)	Distance Between Waterbars After Logging (Feet)	Distance Between Culverts During and After Logging (Feet)	Distance Between Turn-ups and Dips During Logging (Feet)
1	400	450	500
2	250	300	300
5	135	200	180
10	80	140	140
15	60	130	130
20	45	120	120
25	40	65	---
30	35	60	---
40	30	50	---

Trimble and Weitzman (1953)
Kochenderfer (1970)

Table 2: Minimum Culvert Sizing

Drainage Area (Acres)	**Minimum Culvert Diameter (Inches)**	
	Temporary Installation (2-year flood event)	**Permanent Installation (25-year flood event)**
8	15	18
15	18	24
20	18	30
40	24	36
50	30	42
80	36	48
100	36	48
150	42	60
200	48	66
250	48	72
300	54	72
350	54	78
450	60	90
550	66	96
640	72	96

Table 3: Methods of Seeding and Mulching Truck Roads, Log Landings, Skid Trails and Stream Crossings

Temporary Cover: Use any of the three options for establishing temporary cover to control soil erosion. Use only hay or straw mulch to encourage re-establishment of native vegetation. Applying straw mulch instead of hay will reduce introduction of weed species. Annual Ryegrass and Winter Rye germinates quickly and becomes readily established and may also aid in establishment of native vegetation while limiting erosion.		
Material	Rate of Application	Timing of Application
Option 1. Hay or Straw Mulch Only	60 bales/acre OR 2 ½ bales/1,000 square feet	Anytime
Option 2. Annual Ryegrass	40 lbs./acre OR 1 lb./1,000 square feet	Anytime
Option 3. Winter Rye	112 lbs./acre OR 2 ½ lbs./1,000 square feet	Anytime
Permanent Cover: Use option listed below for establishing permanent cover to control soil erosion and apply mulch at the rate of 60 bales/acre or 2 ½ bales/1,000 square feet. Mulch at this rate to maintain soil moisture and provide erosion protection while allowing adequate light penetration for seedling germination and emergence.		
Soil Conservation Mix	42 lbs./acre OR 1 lb./1,000 square feet	Anytime. Best when applied between April 15 – June 15 OR August 1 – September 15

Table 4: Minimum Forested Buffer Strip Widths

Percent Slope of Land Between Skid Trails, Truck Roads or Log Landings and Streams or Other Bodies of Water	Width from Top of the Streambank* (Feet Along Surface of Ground)
0-10	50
11-20	70
21-30	90
31-40**	110

*As determined by the normal high water mark

**Add 20 feet for each additional 10 percent slope

Trimble and Sartz (1957)