Proposed Biomass Harvesting Guidelines and Rationale

for Physical Properties of Soil

Photo: Joe Kovach, DNR

Goals

- Preserve and maintain soil quality by limiting the effects of biomass harvesting on a soil's:
  - Texture
  - Structure
  - Porosity
  - Density
  - Drainage
  - Hydrology

Photo: Jeff Martin, DNR

Primary Threats to Soil Quality

- Soil compaction
- Rutting
- Soil erosion

Photo: Jeff Martin, DNR

Compacted Soil

- Is more difficult for plant roots to penetrate
- Provides less air for plant roots to “breathe”
- Allows less water to soak into the soil and be available for plants to use
- Slows the warming of soil in the spring

Photo: Carmen Wagner, DNR

Rutting

- Severs tree roots and trunks which can result in:
  - Decreased nutrient uptake and declines in tree growth
  - Entry points for disease and insects
  - Trees more vulnerable to windthrow
  - Tree mortality if damage is severe enough

Photo: Kristin Shy, DNR

Soil Erosion

- Nutrient-rich top soil and organic matter are lost and can result in:
  - Reduced plant growth
  - Decreased levels of soil moisture
  - Poor growing conditions for plants

Photo: Carmen Wagner, DNR

Guideline Rationale

- Avoid and minimize potential for soil disturbances
- Address concerns raised by biomass harvests that are above and beyond what one would expect in traditional timber harvest

Photo: Joe Kovach, DNR

General Guidelines

- Guideline 2.A - Retain and limit disturbance to down coarse woody debris already present
- Rationale - Retain CWD to cushion soil and prevent soil compaction

Photo: Carmen Wagner, DNR

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General Guidelines

- Guideline 3.A - Retain 1/3 of harvested FWD on site. If possible, leave the material well-distributed throughout the site.
- Rationale - Critical habitat for insects, nematodes, fungi and other organisms that create large soil pores, improve soil texture and assist trees with nutrient uptake

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General Guidelines

- Guideline 4.A - Do not remove the forest litter layer, stumps, and/or root systems for utilization as biomass.
- Rationale - Litter acts as a “mulch” protecting soil and removal of stumps and roots will alter soil structure

Photo: Carmen Wagner, DNR

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General Guidelines

- Guideline 5.A - Minimize stand entries to the extent possible.
- Rationale - Each entry increases the potential for soil disturbances

Photo: Joe Kovach, DNR

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General Guidelines

- Guideline 6.A - Roads and landings should not occupy more than 3% of the harvest area. Roads, landings and skid trails should not occupy more than 15% of the harvest area.
- Rationale - Limit the area disturbed by transportation infrastructure

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Results from 2006 Soil Disturbance Monitoring on State Lands

- On average, 4.2% of sale harvested was devoted to roads, landings and primary skid trails
  - Min = 0.4%
  - Max = 18.6%

- On average, 50% of infrastructure removed from harvestable area

Site Specific Guidelines

Site Specific Guidelines

- Guideline 6.B - Do not harvest woody biomass (over and above bolewood utilization) on shallow soils where bedrock is within 20 inches of the surface.
- Rationale - Shallow soils are susceptible to displacement and erosion

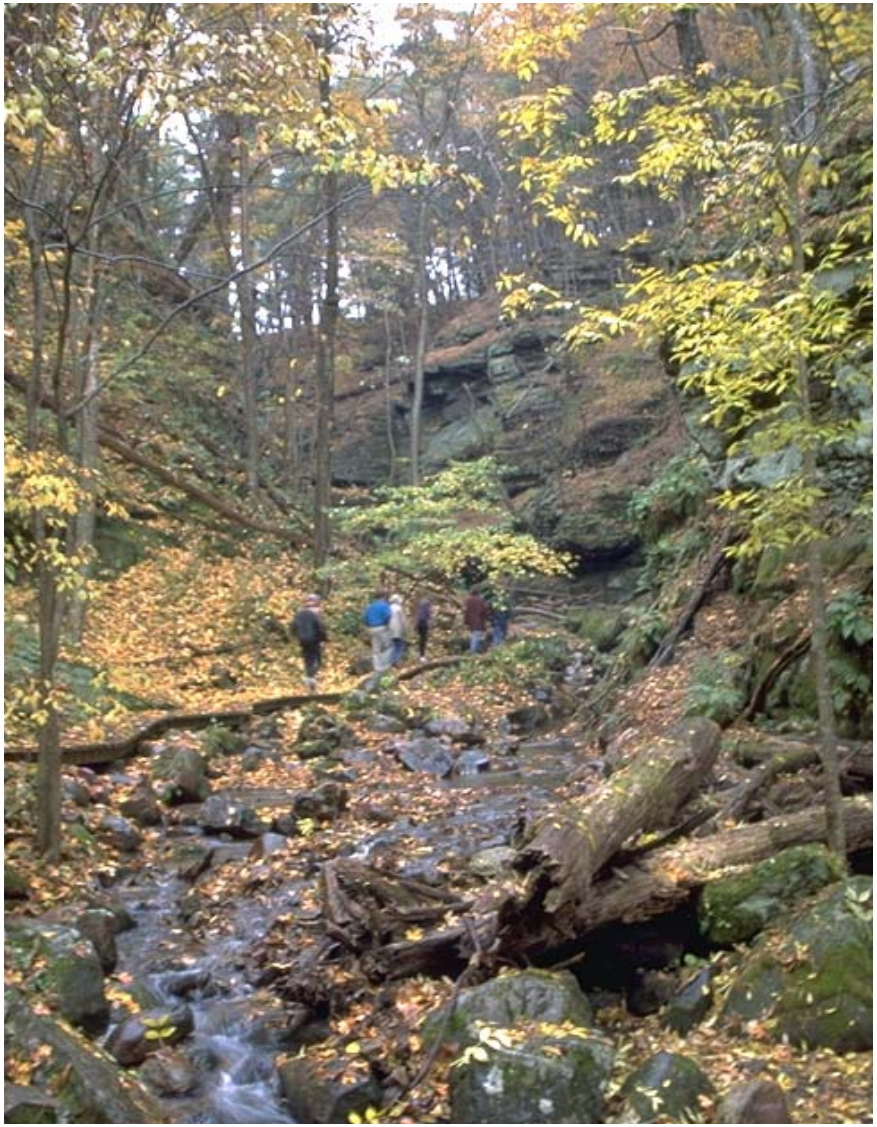

Photo: Jim Bach

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Site Specific Guidelines

- Guideline 8.B - Do not harvest woody biomass (over and above bolewood utilization) on organic soils deeper than 24 inches.
- Rationale - Deep organic soils are susceptible to rutting and displacement

Photo: Carmen Wagner, DNR

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Proposed Biomass Harvesting Guidelines and Rationale

for Water Quality

Photo: Joe Kovach, DNR

Goals

- Preserve and maintain water quality by limiting the effects of biomass harvesting on:
  - Drainage patterns
  - Water flows
  - Erosion and sedimentation

Photo: Kristin Shy, DNR

Drainage Patterns

- Can be altered by rutting
  - If ruts follow the flow of water, areas can be drained more quickly
  - If ruts cut across the flow of water, they can act as “dams” and hold water – drowning plants uphill and starving plants downhill

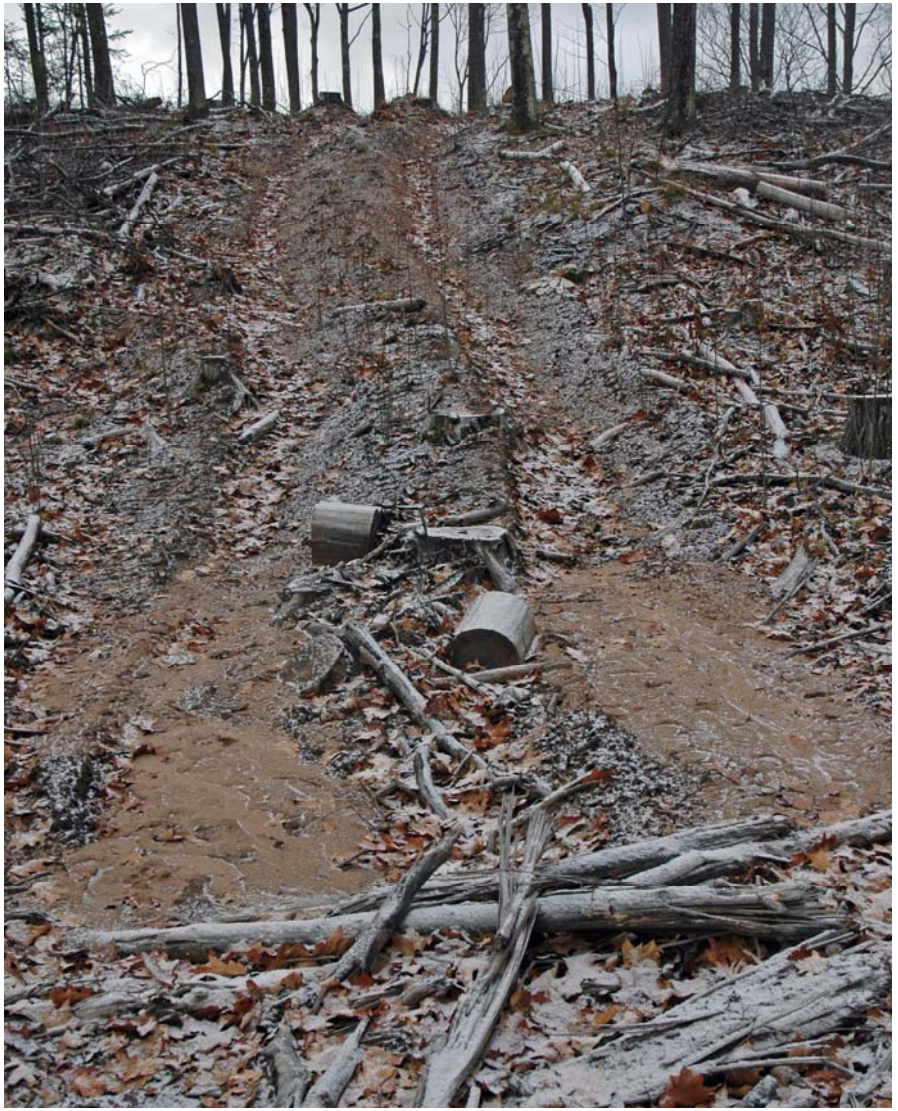


Photo: Carmen Wagner, DNR

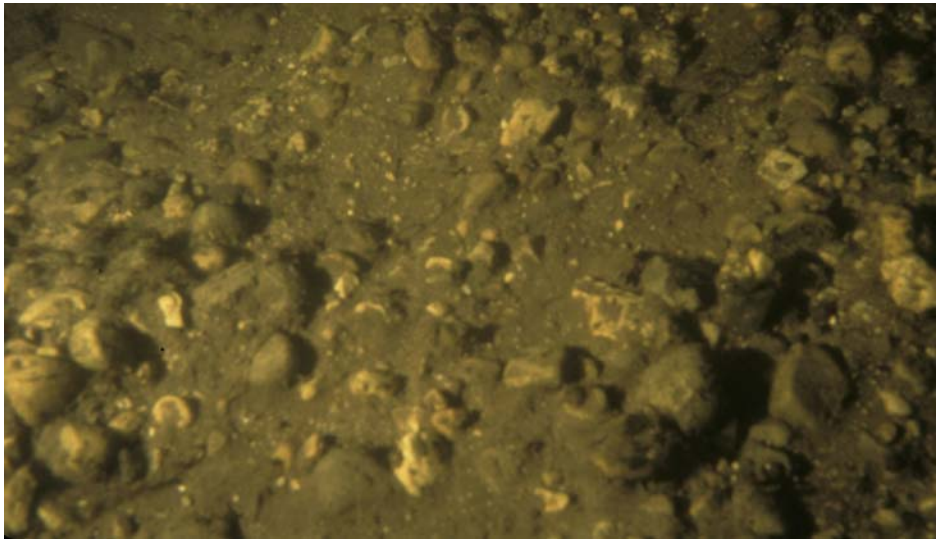
Water Flows

- “Swamping” can occur if transpiration is reduced
- Wetlands can dry up if water is diverted away from them or become wetter if water is directed to them by ruts

Photo: Carmen Wagner, DNR

Erosion and Sedimentation

- Decreases water quality
- Degrades fish and wildlife habitat
- Injures fish and other organisms
- Reduces oxygen levels



Photos: Mike Miller, DNR

Types of Erosion

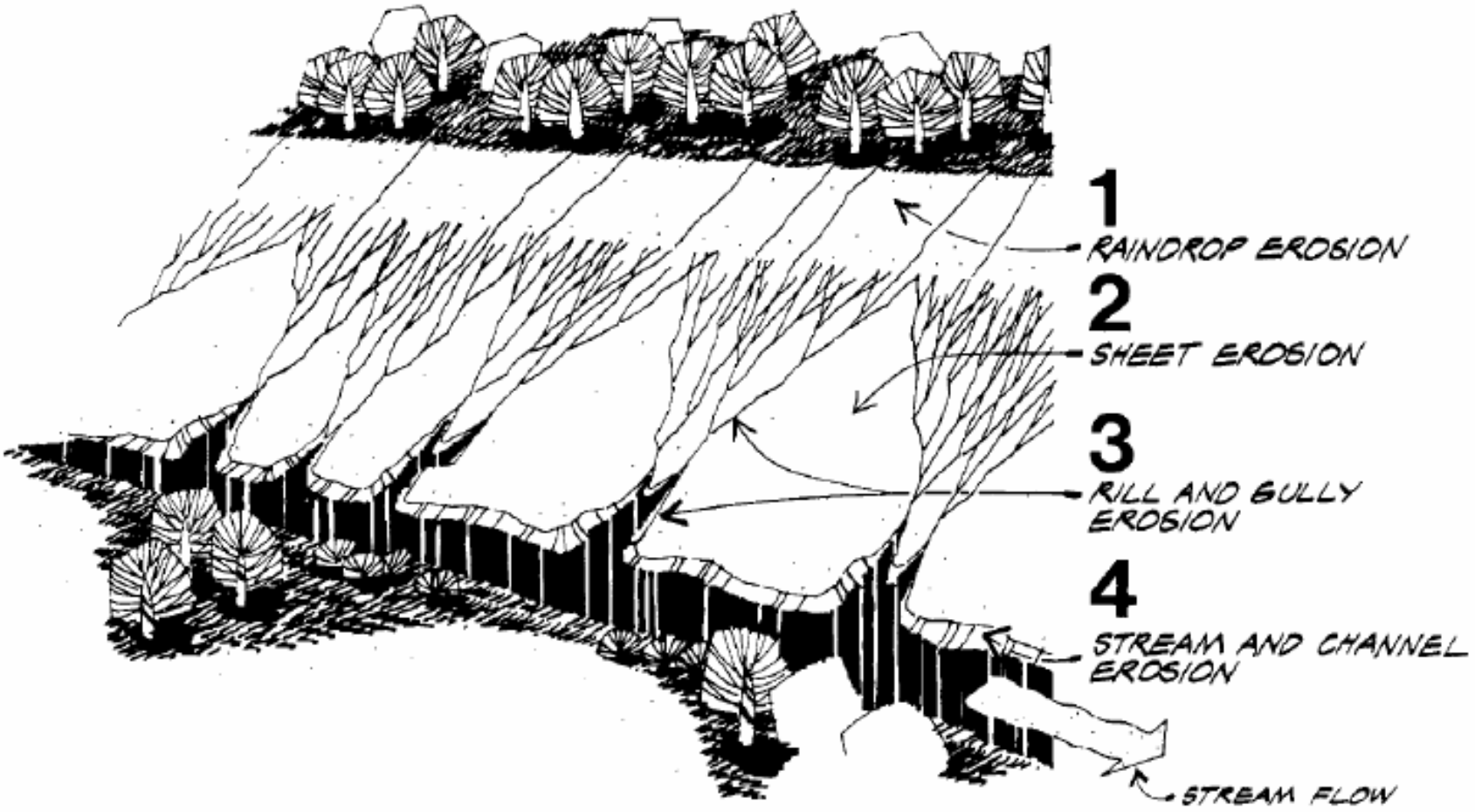


Image Credit: USDA NRCS 2002

Raindrop (Splash) Erosion

- When vegetation is removed, the soil is exposed to the impact of raindrops
- Soil particles are separated as raindrops strike the bare soil and the soil structure is destroyed
- Raindrop erosion is related to rain intensity and raindrop size
- Splashed soil particles may rise as high as 30 inches and move as much as 60 inches horizontally

Photo Credit: USDA NRCS

Sheet Erosion

- Caused by water flowing over the soil surface
- The shallow, moving sheets of water are not usually detaching agents, but the flow of water transports soil particles that have become detached by raindrop impact
- Usually moves as a uniform sheet for only a few feet before concentrating in low spots

Photo Credit: Carmen Wagner, DNR

Rill Erosion

- Begins when the shallow sheet flow begins to concentrate in the low areas
- As the turbulence and velocity of the water increases, the runoff has the energy both to detach and transport soil
- The small channels are called rills and usually are only a few inches deep, but are well-defined channels

Photo Credit: Carmen Wager, DNR

Gully Erosion

- Formed when runoff cuts rills deeper than 6 inches
- Can become enlarged both up and down the slope
- In some soils, a heavy rain can change a rill into a major gully in a very short time

Photo Credit: Kristin Shy, DNR

Channel Erosion

- Occurs when the velocity of the flow in a stream is increased or when riparian vegetation is damaged or destroyed
- Most common at bends in the stream or where the flow is restricted

Photo: Carmen Wagner, DNR

Soil Erosion by Water

- Depends on:
  - potential of rain to cause erosion
  - Susceptibility of soil to erosion

Photo: Carol Nielsen, DNR

USLE and RUSLE

- A = R x K x LS x C x P

- A = Soil loss in tons/acre/year
- R = Climate
- K = Soil
- LS = Topography
- C = Cover
- P = Erosion-control practice

- The lower the number, the better

R Factor - Climate

- Measure of erosivity of climate at specific locations
  - Ashland County = 100
  - Manitowoc County = 110
  - Dodge County = 130
  - Richland County = 140
  - Rock County = 150

K Factor - Soil

- Based on a soil's inherent potential to erode factoring in texture, organic matter, structure and permeability
- Recognizes seasonal differences in structure and permeability due to freeze-thaw cycles, soil moisture content and soil compaction
- Values typically range from 0.17 to 0.60

LS Factor – Topography

- Values are based on the length and steepness of slope

Slope Length

Slope %	25 feet	100 feet	400 feet
2% slope	0.13	0.20	0.31
8% slope	0.50	0.99	1.98
20% slope	2.04	4.08	8.16

C Factor - Cover

- Considers prior land use, canopy, surface roughness, surface cover

Soil Surface Cover

Canopy Cover	20%	60%	95+%
25%	0.42	0.041 – 0.089	0.003 – 0.011
50%	0.39	0.040 – 0.087	0.003 – 0.011
75%	0.36	0.039 – 0.084	0.003 – 0.011

P Factor – Erosion Control Practices

- Computes effects of erosion control practiced based on transport of sediment to practice and through practice
- Primarily agricultural practices like contour strips

Examples

- In Richland County with Keene silty loam on a 4% slope for 200 feet
- A = R x K x LS x C x P

- With 50% canopy cover & 20% soil cover
- A = 140 x .48 x .53 x .42 x 1 = 15 t/a/yr

- With 50% canopy cover & 60% soil cover
- A = 140 x .48 x .53 x .04 x 1 = 1.5 t/a/yr

Guideline Rationale

- Avoid and minimize potential for water quality impacts
- Address concerns raised by biomass harvests that are above and beyond what one would expect in traditional timber harvest

Photo: Joe Kovach, DNR

General Guidelines

- Guideline 2.A - Retain and limit disturbance to down coarse woody debris already present.
- Rationale - CWD intercepts runoff, slowing its flow, allowing more time for runoff to soak into the ground

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Photo: MN DNR Forestry

General Guidelines

Guideline 3.A - Retain 1/3 of harvested FWD on site. If possible, leave the material well-distributed throughout the site.

Rationale

- FWD intercepts runoff, slowing its flow, allowing more time for runoff to soak into the ground

Photo: Carmen Wagner, DNR

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General Guidelines

- Guideline 4.A - Do not remove the forest litter layer, stumps, and/or root systems for utilization as biomass.
- Rationale - Litter acts as a “mulch” protecting soil and stumps and roots help to hold the soil in place

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Photo: Carmen Wagner, DNR

Site Specific Guidelines

Site Specific Guidelines

- Guideline 6.B - Do not harvest woody biomass (over and above bolewood utilization) on shallow soils where bedrock is within 20 inches of the surface.
- Rationale - Shallow soils are susceptible to displacement and erosion

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Photo: Donald S. Abrams

Site Specific Guidelines

Guideline

- 9.B Do not harvest woody biomass (over and above bolewood utilization) on:
  - Erosion prone sites
  - 35 feet of the bank of a dry wash
  - 35 feet of the ordinary high-water mark (OHWM) of non-navigable streams
  - 35 feet of the OHWM of navigable intermittent streams
  - 100 feet of the OHWM of navigable perennial streams
  - 100 feet of the OHWM of navigable lakes
  - 100 feet of wetland borders

Site Specific Guidelines

- Guideline 9.B - Do not harvest woody biomass (over and above bolewood utilization) on erosion prone sites
- Rationale - Based on slope and soil, these sites are rated as severe or very severe erosion hazards (off-road, off-trail) by the USDA NRCS where 50 to 75 percent of the surface has been exposed by logging, grazing, mining, or other kinds of disturbance

Photo: Eunice Padley, DNR

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Site Specific Guidelines

- Guideline 9.B - Do not harvest woody biomass (over and above bolewood utilization) within:
  - 35 feet of the bank of a dry wash
  - 35 feet of the ordinary high-water mark (OHWM) of non-navigable streams
  - 35 feet of the OHWM of navigable intermittent streams
- Rationale - Provide a buffer around areas likely to deposit sediment into a waterway

Photo: Carmen Wagner, DNR

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Site Specific Guidelines

- Guideline 9.B - Do not harvest woody biomass (over and above bolewood utilization) within:
  - 100 feet of the OHWM of navigable perennial streams
  - 100 feet of the OHWM of navigable lakes
  - 100 feet of wetland borders
- Rationale - Provide a buffer around areas likely to deposit sediment into a waterway

Photo: Carmen Wagner, DNR

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	WI RMZ	MN Filter Strip	MN RMZ
Dry washes			25’
Non-navigable streams	35’		
Navigable intermittent streams	35’	50’-150’	50’-200’
Navigable perennial streams	100’	50’-150’	50’-200’
Lakes	100’	50’-150’	50’-200’
Wetlands		50’-150’	50’-200’


Questions?
Photo: Carmen Wagner, DNR