

Plastics (synthetic fibers) in Erosion Prevention & Sediment Control Practices

Have we reached a point of the bandage being worse than the wound?

Sediment, when originating from construction activities is considered a pollutant. However not all sediment is bad, as sediment is also an important component of natural geomorphic processes of our streams and rivers. A goal of designers and regulators is to prevent erosion within a construction site and control sediment from being added to our waters by implementing Best Management Practices (BMP). Many of these BMP devices include synthetic elements such as synthetic fibers (plastics), polymers, plasticizers, and dyes. These products are not a natural component of any streams ecology. Are there unintended consequences of these products? At what point do they themselves become a pollutant? What is the eventual fate of these components as they degrade and are carried off site? What initially may be 'good' for erosion prevention and sediment control may later become 'bad' for animals and other ecological concerns. The solution to this conundrum is to utilize alternatives that do not contain these components to begin with. Some alternatives are shown below.

Plastic components intentionally or unintentionally remain long after their intended purpose. Is this adding to the buildup of plastic pollutants in the local and global environment?

Plastics¹

in Rolled Cover

- Erosion control blanket netting weighs 0.24oz/yd² (5.7g/m²)
- Polyethylene sheeting 6 mil weighs 4.13oz/yd² (98g/m²)
- Geogrid minimum of 7.0 oz/ yd² (165g/ m²)
- Turf Reinforcement Mats contain 8.9 to 14.7oz/yd² (210 to 348 g/m²)

in Perimeter Control

- Control Log (bio roll) 6-8" Tubing contain up to 1oz/ft (93g/m)
- Silt fence (3ft tall) weighs 1.28oz/ft (119g/m)
- Silt Curtain fabric weighs 12oz or 15oz/ft (1100 – 1400g/m)

in Hydraulic applications

- Synthetic Fiber content up to 0.07oz/yd² (2.4 g/m²)

Plastic Equivalent²

per 100 square yards

- 70 bottles or 150 shopping bags
- 1,200 bottles or 2,500 shopping bags
- 2,000 bottles or 4,300 shopping bags
- 2,300 - 6,000 bottles or 5,000 - 13,300 shopping bags

per 100 feet

- 290 bottles or 630 shopping bags
- 370 bottles or 800 shopping bags
- 3,400 - 4,200 bottles or 7,500 - 9,200 shopping bags

per 100 square yards

- 19 bottles or 41 shopping bags

Alternatives. Reduce temporary stabilization needs by going to final grade and stabilization within permitted timelines. IE Reduce amounts of temporary stabilization with appropriate staging.

- Products woven with natural fiber³, disc anchor natural mulch, watering
- Stage work to reduce need, use mulch alternatives, reuse instead of single use applications
- Reduce need by reducing slopes, or use of rock, or combination rock/vegetation
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Reduce overall use by only using where actually needed for downslope protection

- Woven with natural fiber³, wood chip berms, vegetated berms
- Wood chip berms (from clearing/grubbing operations), vegetated berms, burlap
- Limit use to only those times of actual in-water disturbance. Remove when not needed. Thus reducing its degradation and increasing reusability.

-- Choose products with only natural fiber³

These products are all permanently placed on site or if removed, enter the garbage stream (zero percent recycling is expected) MnDOT is estimated to apply up to 31 tons of these plastics (synthetic fiber) per year (three year average 2016-2018)

Other Biotoxicity Issues?

- Malachite Green⁴ (Colorant): Mayfly LC50 0.079 mg/L, Smallmouth Bass LC50 0.04 mg/L, Rainbow Trout LC50 0.267mg/L, Toad (larvae) LC50 0.068mg/L)⁵
- Methyl Acrylate (Acrylate polymer degradate): Green Algae EC50 15mg/L, Water Flea LC50 1.2-9.6mg/L, Bony Fish LC50 5-7.5mg/L⁵
- Ethyl Acrylate (Acrylate polymer degradate): Scud LC50 1.86mg/L, Fathead Minnow LC50 2.5mg/L)⁵
- Diethylhexyl phthalate (Plasticizer): Green Algae EC50 0.96mg/L, Water Flea EC50 0.133mg/L, Fathead Minnow LC50 71.5mg/L, Redear Sunfish LC50 6.18mg/L, Leopard Frog LC50 4.44mg/L⁵
- Dibutyl phthalate (Plasticizer): Green Algae LC50 0.21mg/L, Water Flea LC50 4.3mg/L, Opossum Shrimp LC50 0.5mg/L, Bluegill LC50 1.23mg/L, Channel Catfish LC50 3.72mg/L, Rainbow Trout LC50 1.6mg/L)⁵

We must do better to balance erosion prevention & sediment control products from doing more ecological harm than the pollutant they are designed to prevent.

(1) Average plastic (synthetic fiber) weight equivalents per survey of manufacturer's product specifications and application recommendations
 (2) Rounding based on: 0.5 liter water bottle = 0.35oz, Typical shopping bag being 12 microns thick & 11.5" x 6.5" x 21" = 0.16oz
 (3) Natural fiber = "Biodegradable", as meaning the product will decompose under ambient soil conditions into carbon dioxide, water, and other naturally occurring materials within one year
 (4) Malachite Green is a dye commonly used in hydromulch/hydroseeding applications. MnDOT has removed Malachite Green from its approved products list due to Biotoxicity concerns.
 (5) EPA ECOTOX Database. <https://cfpub.epa.gov/ecotox/> LC50: Concentration of toxicant for 50% test population mortality. EC50: Concentration of toxicant at which 50% of test population shows an impaired biological function.

Plastic in blanket products remains long after the need



Discarded Poly sheets, buried or hauled to garbage?



Hydraulic applications and Malachite Green



One plastic bottle and decaying bioroll



Silt fence products remains long after the need



Plastic remnants from shoreline restoration project



Silt curtain in garbage stream



Fibers in hydraulic applications



One plastic shopping bag



Plastic in bioroll products remains long after the need



Turf Reinforcement Mats permanently placed

