MUDDY WATERS

Quinnipiac River Watershed Association, River Resources Education Series

HOW DOES ORDINARY DIRT DEGRADE STREAMS?

Wherever the land is bare, erosion occurs. Without protective vegetation, leaf litter, and a stabilizing root network, pelting raindrops and flowing stormwater erode exposed soil particles. Muddy water reaches streams, ponds, and rivers, carrying a load of sediment.

Deposited sediment *buries aquatic habitat. It covers and clogs gravel spawning beds, increasing fish egg mortality, and it smothers stream bottom invertebrates, an important food supply for fish.* Stream invertebrates like stoneflies and mayflies live among rocks and cobbles, hiding in crevices. Water penny beetles and various kinds of caddisflies are attached to hard surfaces of stones and sticks. Sediment buries them along with the microscopic plants (diatoms) which also grow on these hard surfaces, and are eaten by aquatic "scraper insects". Sediment also covers the dead leaves eaten by "shredder insects." With less invertebrate food, there are also fewer fish, turtles, kingfishers, and herons in a sediment-choked stream or river.

Sediment deposits also make streams *shallower* so that they *heat up more quickly* and are able to *hold less oxygen;* they become less suitable for creatures like brook trout and stoneflies, which need cool, oxygen-rich water. (Some forms of aquatic life, like suckers and carp, midge larvae and aquatic sowbugs can tolerate low oxygen conditions.) With less space in the stream channel, over-bank flooding also happens more often, and bank erosion may increase, generating still more sediment.

Suspended sediment (muddy water) *impairs gill function* of fish and invertebrates. *Suspended sediment also blocks light and interferes with photosynthesis by underwater plants*, both macrophytes (larger plants) and microscopic plants like diatoms. *Muddy water reduces the hunting efficiency of fish* that locate prey by sight. However, some kinds of fish tolerate fairly high levels of turbidity. Suckers can seek food by smell and carp by using whisker-like feelers, more than by sight.

WHY WORRY? MUD ISN'T TOXIC AFTER ALL.

Although not toxic in itself, *eroding soil is rich in nutrients, such as nitrogen and phosphorus,* which in excessive amounts, have serious negative impacts on watercourses, ponds, and Long Island Sound. Nutrient rich water stimulates excessive growth of algae and aquatic vegetation. When the plants die and decompose, oxygen is consumed, sometimes leading to levels of oxygen too low to support most forms of aquatic life, a condition known as *hypoxia*. Excessive algal growth in streams - like actual sediment deposits - also smothers spawning areas and rocky habitat for stream invertebrates.

Many types of toxic pollutants adsorb readily onto soil particles. Air-pollution fall-out, dust from road and tire-wear, engine fluids, and chemicals in lawn run-off are sources of pollutants which attach to sediment particles. Very small quantities of metals occur naturally in soil, and in fact plants need them as trace nutrients. However, these metals and other compounds are harmful to aquatic life when present at too high concentrations. Deep sumps in roadside catch basins trap road sand. Unfortunately, sumps are often not regularly cleaned out, and sumps are not efficient traps for small-sized particles. Most toxic pollutants are attached to tiny particles, which settle out much more slowly than sand. Shallow, vegetated roadside drainageways (swales) and properly sized and designed wet-bottom detention basins are more effective at intercepting this form of pollution.

HOW DOES INCREASED RUNOFF AFFECT TURBIDITY?

All stream beds and banks naturally experience some erosion, and some sediment deposition. The outside of stream bends erode most, and deposition is greatest on the insides of curves, where water velocity is lower. This is related to centrifugal force, which draws water to the outside of a curve. But *accelerated bank and streambed erosion* result from higher volumes of runoff from impervious (non-absorbent) surfaces. This is a signficant source of excessive turbidity and sediment deposition, as well as shifting, unstable stream channels, in an urbanizing watershed. Stream erosion and downstream flooding are reduced if runoff is held in detention basins and slowly released.

DOES SEDIMENT ALWAYS HARM WETLANDS AND WATERWAYS?

A marsh or shallow pond with enough circulation, may be able to tolerate some sediment deposition and intermittent high turbidity better than a flowing stream. Marsh plants can take up many excess nutrients. Emergent wetlands are often "created" (excavated and planted) to help remove pollutants from urban storm water. They need an easy-to-clean forebay to trap sand, since too much sediment harms any wetland system.

HOW DO WE MEASURE SEDIMENT IN WATER?

It is easy to see when water is muddy and brown, but one can determine the severity of turbidity with a turbidimeter, which measures the amount of refraction by a light beam, giving results in "nephelometric turbidity units"or NTU's. Dirt in water is also often referred to as TSS, which stands for Total Suspended Solids, measured in milligrams per liter (mg/l).

QRWA volunteer monitors collect water samples during and after heavy rains, and turbidities are measured to document and identify erosion sources in the watershed. Samples are collected during a narrow window of time so that data from different stream sections is comparable, and the sampling station location, time and date are recorded. Any clean container may be used. It is important not to disturb the stream bottom while collecting, and to keep samples cool. Volunteers bring samples to a central location in each town for pick-up, and they are processed within 48 hours.

If elevated turbidity or sediment deposits are documented in a stream section, upstream watershed scouting can identify sediment sources.

QRWA volunteers on illegally placed fill by the Muddy River, a Quinnipiac River tributary.

HOW CAN WE MINIMIZE MUDDY RUNOFF?

Best Management Practices (BMP's) help protect aquatic habitat from muddy water. Look for them along streets, on farms, and at construction sites? * Regular *catch-basin cleaning* and *street sweeping* help keep winter road sand out of streams. * *Contour plowing, not plowing steep fields,* and leaving a vegetated *buffer strip next to streams and ponds* reduces farm erosion. * *Exposed soils* should be *stabilized promptly* with hay or fast-germinating grass. *Erosion-control matting* helps if slopes are steep. * Truck tires and construction equipment track mud onto roads. This is reduced by *"anti-tracking pads"*, beds of crushed stone at construction site entrances. * *Protecting catch-basins next to construction sites*, preferably with filter fabric silt sacks, reduces the amount of sediment reaching streams via storm sewers. * *Silt fences and hay bale rows should be properly installed and maintained* - no gaps, securely staked, trenched in at the bottom, and curved uphill at the ends so muddy water won't just flow around them; these barriers, alone, *can't handle runoff from large areas* of exposed soil. * For large construction projects, additional BMP's are needed. It helps to excavate one section at a time - an approach known as "*phased construction*". *Check dams* (hay bale or stone barriers in drainage swales) reduce the velocity of runoff. *Detention ponds, catch basin sumps, and specially designed swirl separators* are also used to settle out sediment, to reduce the amount reaching waterways. But all too often, they are not well-maintained, are too small, or have other design problems. Small sediment particles - which are the most harmful - settle out very slowly, taking as long as 36 hours. Runoff may in fact stir up previously settled mud in a detention basin and release it into streams.

Finally, wise *land use planning* helps prevent sedimentation, erosion, and turbidity from happening in the first place: 1) Protection of steep slopes and highly erodible soils as open space, 2) Development plans that include wide enough naturally vegetated buffers next to watercourses, and 3) Permits that stipulate state-of-the-art Best Management Practices. Citizen participation at public hearings helps encourage conscientious use of measures to reduce sediment discharges into waterways and keep our aquatic ecosystems healthy .

Report erosion & turbidity concerns to wetlands enforcement officers, who work in town Planning Departments. These officers report to Inland Wetlands and Watercourses Commissions. It is helpful to document observations with photographs and accurate notes. For help with follow-up, contact the QRWA.

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