

## ***Human Impacts Upon Watersheds***

A stream is impacted by land uses in the watershed. Loudoun watersheds have a mix of different land uses that result in a variety of different potential sources of pollution that affect it. Major land uses include forest, agricultural and pasture, residential, commercial, and industrial.

Some sources of pollution affect the water quality on a continuous basis such as cattle that use a stream for drinking water. Other sources of pollution may be intermittent such as marginally operating septic tanks that overflow after heavy rainfalls when the ground is saturated with water. Some sources of pollution may flow from a single point source such as a pipe discharging gray or laundry water from a residence. Other sources may be more diffused in their impact upon a stream such as runoff from lands pasturing cattle and urban areas. **Table 1** provides a list of major pollution stressors in urban and agricultural areas, and their effects on stream quality.

<b>Stressor</b>	<b>Source</b>	<b>Environmental Effect</b>
<b>Nutrients (Nitrogen and Phosphorus)</b>	Improper use of lawn or crop fertilizers and manure	Stimulate algae blooms. May reduce sunlight reaching stream bottom, limiting plant growth. Rapid accumulation of dead algae decomposes aerobically, robbing other stream animals of oxygen.
<b>Toxic Chemicals</b>	Various. Underground storage tank leakage, surface spills, illegal discharges, chlorine from swimming pool drainage	Can have an immediate (acute) affect on stream biota at high enough levels. May be chronic, eliminating the more sensitive species and disrupting ecosystem balance over time.
<b>Sediment</b>	Poorly managed construction sites, winter road sand, instream erosion, bare soils, improper agricultural practices, over-grazing	Clogs gills of fish and insects, embeds substrate, reducing available habitat and potential fish spawning areas.
	Sewage leaks, domestic and livestock	Human health hazard (pathogens), similar oxygen depletion

<b>Organic Loading</b>	wastes, yard wastes dumped into streams	situation as Nutrients. Causes Benthic community shift to favor filter feeders as well as organisms with low oxygen requirements.
<b>Thermal Loading</b>	Water impoundments (lakes or ponds). Industrial discharges and power plants. Removal of riparian tree cover along streams. Runoff from hot paved surfaces.	Biological community structure altered, shift to species tolerant of higher temperatures, sensitive species lost. Dissolved oxygen depleted.
<b>Stream Channel Alteration</b>	In very urban areas, concrete, metal, and riprap stabilization of stream banks. Stream channelization, flood erosion control.	Major habitat reduction/elimination, changes flow regime dramatically. Dramatic alteration of biological communities can cause thermal loading and sediment problems. Transfer erosion potential downstream.
<b>Altered Hydrology</b>	Conversion of forested/ natural areas to impervious surfaces. Increases amount and rate of surface runoff and erosion.	Overall channel instability, habitat degradation or loss.
<b>Riparian Loss</b>	Development. Clearing or mowing of vegetation all the way up to stream banks.	Increase water temperature, greater pollution input, less groundwater recharge, greater erosion potential from stream banks. Alters community composition.

**Urban Storm Water** -- When forests and farmlands are cleared to make way for residential, commercial, or other uses, vegetation is removed and bare soil is exposed. The removal of the vegetation destabilizes the soil, and infiltration rates are reduced and less rainwater is absorbed. There is a great potential for water and sediment to runoff directly into waterways. This sediment runoff, and the nutrients and pollutants it carries, is one of the greatest threats to healthy stream habitats in Loudoun.

**Impervious Surfaces** -- Over 18 acres of Loudoun County's natural landscape is being converted to buildings, roads, and manicured lawns **each day**. These rooftops, driveways, roads, and parking lots are a major cause of the change in many of Loudoun's streams. A typical residential subdivision in eastern Loudoun has 25% to 28% impervious surface. Studies have demonstrated that as little as 10% impervious surfaces in a watershed can have negative effects on water quality. Impervious surfaces of 25% produce possibly irreversible degradation in the local stream as well as the entire downstream watershed. Degradation is caused by substantially higher peak water flows during storm events. The increased flows generate extra energy that the stream accommodates by down-cutting the stream bottom and widening the channel. If the stream channel is at bedrock, the extra energy is accommodated by creating meanders that widen the stream channel. Both the down cutting and meanders cause stream banks to erode

which puts sediments into the water. These instable conditions will last long after development is completed. Attaining a stable stream channel and establishing equilibrium typically can takes decades.

Stormwater runoff from urban/suburban areas, industrial parks, and roadways also contain a variety of pollutants including oil, grease, heavy metal, and pesticides. Without forested floodplains and vegetative buffer zones along streams, these pollutants are not absorbed into the ground and converted by bacteria. Instead they flow directly into the waterways where they are toxic to aquatic organisms and other organisms in the stream food chain.

Land-use patterns in the Goose Creek watershed were identified using results from the 1997 version of the Multi-Resolution Land Characteristics (MRLC) Consortium study (EPA, 2002).<sup>1</sup>

Segment	Pervious Land (Acres)				Impervious Land (Acres)		% Imperviousness
	Forest	Cropland	Pasture	Developed	Developed	Barren	
Lower Sycolin Cr.	521	178	542	23	47	209	<b>17%</b>
Middle Sycolin Cr.	1718	149	2315	25	20	25	<b>1%</b>
Upper Sycolin Cr.	266	63	638	1	1	0	<b>0%</b>
South Fork Sycolin Cr.	443	0	921	0	0	0	<b>0%</b>
North Fork, Sycolin Cr.	983	18	1776	14	8	0	<b>0%</b>

<sup>1</sup> Interstate Commission on the Potomac River Basin. *Bacteria TMDLs for the Goose Creek Watershed*. November 12, 2002, page 11.

<b>Stream Segment</b>	<b>% Imperviousness</b>
Lower Sycolin Cr.	<b>17%</b>
Middle Sycolin Cr.	<b>1%</b>
Upper Sycolin Cr.	<b>0%</b>
South Fork Sycolin Cr.	<b>0%</b>
North Fork, Sycolin Cr.	<b>0%</b>