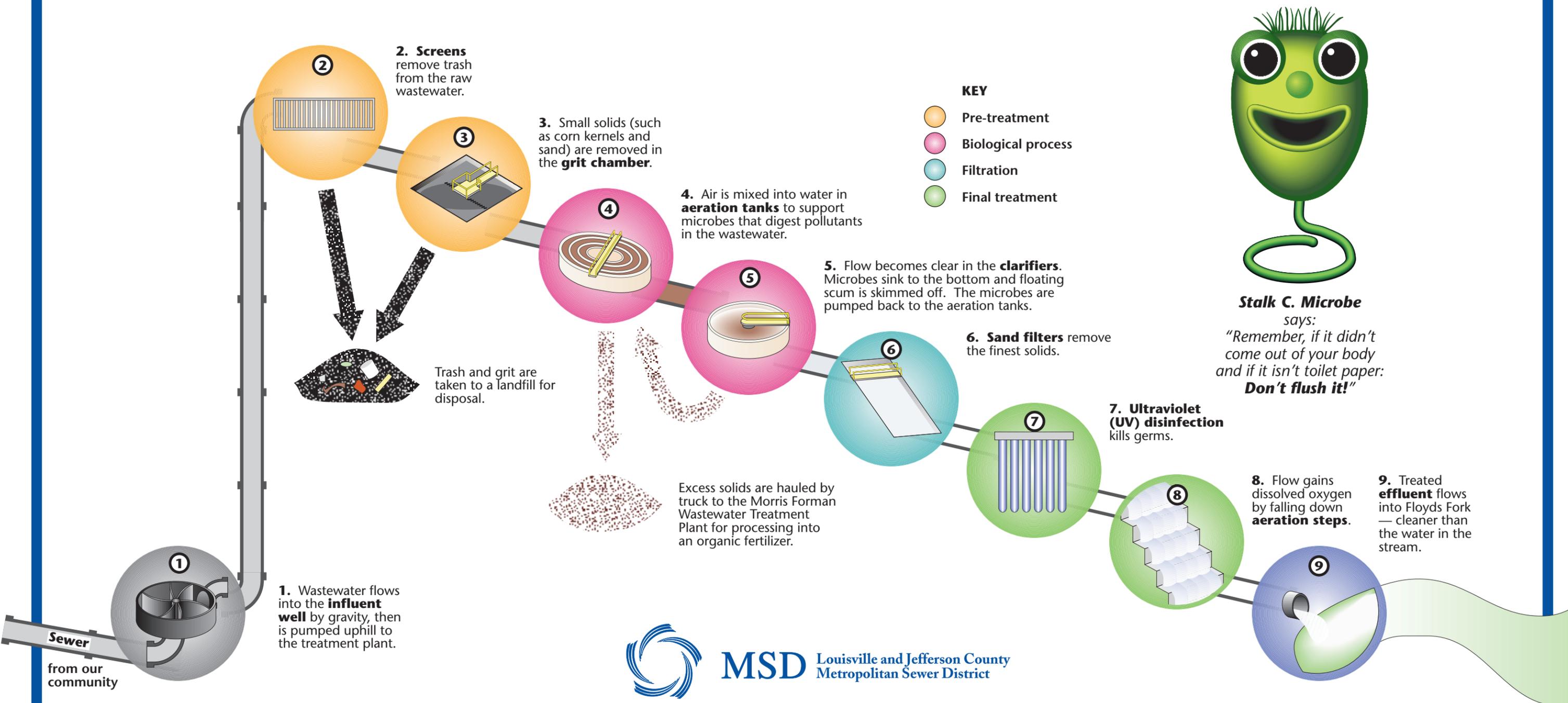


# ~ From Sewer to Stream ~



- KEY**
- Pre-treatment
  - Biological process
  - Filtration
  - Final treatment



**Stalk C. Microbe**  
says:  
"Remember, if it didn't  
come out of your body  
and if it isn't toilet paper:  
**Don't flush it!**"



## Glossary

**aerate:** to expose microbes to air by bubblers, falling action or stirring.

**aerobic bacteria:** bacteria that need oxygen to live. (Anaerobic bacteria live without oxygen.)

**aquatic life:** plants, animals and micro-organisms that live in water.

**biodegradable:** capable of being decomposed or broken down by biological processes.

**biological treatment:** wastewater process that uses microbes to digest pollutants.

**biosolids:** solids left over after wastewater treatment, processed to meet safety rules; some biosolids are used to fertilize soil.

**catch basin:** a small pit below (sometimes grated) openings in curbs, to which runoff water drains on its way to a stream, detention pond or sewer.

**Clean Water Act:** federal law, first adopted by the U.S. Congress in 1972, to restore and maintain the nation's waters.

**coliforms:** bacteria in the intestines of warm-blooded animals; a sign of sewage pollution in water.

**combined sewer overflow (CSO):** an opening in a combined sewer that discharges excess stormwater and wastewater into streams and rivers during heavy rains.

**communities:** groups of people, plants and/or animals living together.

**conservation:** practices that reduce the use of resources, such as water, energy or money.

**discharge:** to release into a body of water.

**disinfect:** to kill germs (that cause diseases).

**dissolved oxygen:** oxygen (O<sub>2</sub>) dissolved in water and used by aquatic life.

**ecosystem:** a community of living things and their environment.

**effluent:** the flow discharged by a wastewater treatment plant into a body of water.

**environment:** the sum of all external conditions and influences, including other organisms, that affect an organism.

**environmental history:** change over time, what caused change and the impacts of the change; includes natural history, technological history and environmental views.

**filtration:** passing water through sand to capture the finest solids.



Painting by Jennifer Hagerman  
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## Ellen Swallow Richards (1842-1911)

**M**SD's Ellen Swallow Richards Ecology Learning Center is named for a pioneer in ecology, public health, education and nutrition.

In the mid-1800s, rural children often had no schools to attend. Ellen's parents taught her at home. At 16, her family traded their farm for a general store in town, so she could go to high school. She read every book and magazine she could find, and made good grades.

Few colleges were open to women in the 1860s, but Ms. Swallow was admitted to Vassar College. Her professors were impressed with their bright student. She studied astronomy, chemistry, German, Latin and math. To pay expenses, she tutored classmates and worked summers in the general store.

Later, Ms. Swallow was the first woman to enroll in the Massachusetts Institute of Technology. After

she graduated, she was the first woman to teach there.

Professor Swallow read science journals in English and German. She stumbled onto an article by German biologist Ernst Haeckel. It described terms he had coined for new branches of science he thought were needed, including "oekologie."

Haeckel's term sparked Professor Swallow's interest. Historians credit her with using the new word to describe the new science she was developing. In English, it became "ecology."

Always connecting people with their environment, she used the term to teach the value of pure water, clean air and wholesome food.

(At MIT, she married fellow Professor Robert Richards and changed her name to Ellen Swallow Richards.)

Besides teaching, she did research and wrote

articles for scientists and the public. She gave speeches and organized people. She also promoted higher education for women.

Ellen Swallow Richards is credited with the following other pioneering firsts:

- Mapping water quality trends
- Teaching sanitary engineering
- Ecology education for children
- Proposing quality standards for drinking water, wastewater and school lunches

To learn more, read:

*Adventurous Spirit:*

*A Story about Ellen Swallow Richards*

by Ethlie Ann Vare

(Minneapolis: Carolrhoda Books, 1992).

## Glossary (continued)

**gravity:** natural force that causes matter to fall downhill, toward the center of the earth.

**influent well:** in-ground tank where wastewater collects as it arrives at a treatment plant. When the well begins to be full, pumps lift the wastewater to the treatment plant.

**microbe:** see micro-organisms.

**microbial digestion:** break down and use of a substance by micro-organisms, such as when microbes digest pollutants in wastewater.

**micro-organisms:** organisms too small to be seen without a microscope, including bacteria, protists, yeasts, viruses and algae; microbes.

**monitor:** to routinely test water to ensure that a treatment plant is working well.

**organism:** any living being, plant or animal.

**pollution:** contaminants in air, water or soil that harm organisms or the environment.

**run-off:** rain or snow melt flowing across the land to a body of water, often carrying pollutants with it.

**septic system:** a backyard tank in which microbes digest wastewater before it drains into the soil.

**sewer access hole:** vertical pipes between sewers and the surface for maintenance worker access; covered by heavy iron lids.

**sewer, combined:** older sewer designed to carry both wastewater and stormwater.

**sewer, sanitary:** newer sewer designed to carry only wastewater.

**sewer, storm:** newer sewer designed to carry only stormwater.

**sewer system:** underground network of pipes that carries stormwater runoff and/or wastewater.

**treatment plant:** facility for cleaning wastewater before discharging into a body of water.

**ultraviolet (UV) light:** a part of sunlight, not visible to humans; used to disinfect wastewater.

**wastewater:** water that has been used by homes, businesses, schools or factories.

**wastewater treatment:** physical, chemical and biological processes for removing pollutants from wastewater before discharging into a body of water.

**watershed:** land area from which water drains to a body of water; such as the Ohio River Valley.