Outline

I. Overview

a. *Water cycle* – All the water on Earth is found in the atmosphere, the ocean, surface waters such as rivers, ice and snow, and groundwater. It is always cycling among these places through processes such as precipitation, evaporation, runoff, groundwater flow, and condensation.

b. *Watershed* - A watershed is the area of land where all the water on it drains to the same place.

II. Groundwater –
Water under the land's surface, existing in pores or cracks in soils and rocks. The *water table* is the top of the zone where the pores or crevices in the rock are fully saturated with water. Groundwater is naturally discharged through springs and into lakes, streams, and rivers, and recharged when there is enough precipitation to infiltrate back down through the soil. *Aquifers* are the permeable rocks in which groundwater is stored and moves through.

III. Lakes (example of *lentic*, or standing, waters)

a. Only two natural lakes in Virginia; most are human-made impoundments

b. Lakes are impacted by physical factors (e.g., shape, size, depth, transparency, turbidity, temperature), chemical factors (e.g., pH, dissolved oxygen), and biological factors (e.g., aquatic plants and phytoplankton, fish populations, decomposer populations)

c. Deeper lakes may exhibit *thermal stratification* in summer and winter, when layers of water at different temperatures form, and *turnover* in spring and fall, when the layers mix again.

IV. Streams (example of lotic, or running, waters. Always transporting water, sediments, nutrients.)

a. Physical characteristics include depth, width, velocity. *Base flow* is the stream flow in dry weather resulting from groundwater seepage. *Bankfull* is the stream flow that fills the channel up to the floodplain.

b. Chemical characteristics include temperature, pH, and dissolved oxygen (DO). Healthier streams tend to be cooler, more neutral in pH, and higher in DO, but these characteristics vary with location and season.

c. In-stream habitats include *riffles* (shallower, faster moving), *pools* (deeper, slower), and *runs* (moderate in depth and velocity)

d. The *riparian zone* is the interface between the stream and the land. Vegetation there provides important habitat, shading, and nutrients to the stream.

e. Biological characteristics are frequently measured by *benthic macroinvertebrates* – invertebrates living at the bottom of aquatic habitats.

   i. Pollution intolerant groups: stoneflies, mayflies, most caddisflies, gilled snails

   ii. Moderately intolerant groups: crayfish, amphipods, dragonflies, damselflies, hellgrammites, netspinning caddisflies, beetles, clams, true flies

   iii. Tolerant groups: worms, leeches, lunged snails, midges

V. Aquatic Resource Threats

a. **Pollution** – *Point source pollution* results from pollution released directly into a body of water from a single source. *Non-point source pollution* is the result of runoff throughout a watershed. Four main pollutant types are sediment, nutrients, pathogens, and toxins.

b. **Aquatic invasives** – Aquatic weeds such as hydrilla and benthic invertebrates such as zebra mussels.

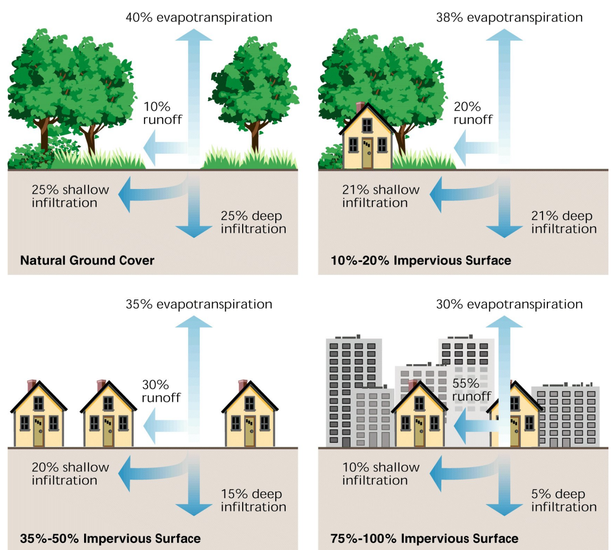

Fig. 3.21 -- Relationship between impervious cover and surface runoff. Impervious cover in a watershed results in increased surface runoff. As little as 10 percent impervious cover in a watershed can result in stream degradation.
In Stream Corridor Restoration: Principles, Processes, and Practices (10/98).
By the Federal Interagency Stream Restoration Working Group (FISRWG) (15 Federal agencies of the US)

Figure 1: As impervious surfaces increase on the landscape, a greater percentage of precipitation runs off into surface waters and a lesser percentage infiltrates the groundwater. Image: Stream Corridor Restoration: Principles, Processes, and Practices, 10/98, by the Federal Interagency Stream Restoration Working Group (FISRWG).

c. **Urbanization** – Replacement of natural areas with a built environment that has impermeable surfaces. Results include increases in runoff, pollutants, water temperatures, erosion; plus decreases in DO, habitat, water table levels, stream flow in drought periods.

VI. Aquatic Resource Management

a. *Soil and Water Conservation Districts* work with many landowners to carry out conservation projects and provide educational programs. Find which of the SWCDs serves your community at http://vaswcd.org.

b. The *Dept. of Environmental Quality* makes sure VA meets the requirements of the Clean Water Act and administers state laws and regulations to improve and protect our waterways, including groundwater. DEQ coordinates extensive monitoring of Virginia's waters, through their own employees and in collaboration with citizen monitoring groups. The 305(b)/303(d) water quality assessment report maps impaired waters, identifies pollution sources, and describes programs to improve water quality.

c. *TMDL* – Stands for Total Maximum Daily Load and is a "pollution diet plan" that lists amounts of allowed pollution, proportioned out to different sources for a given water body.

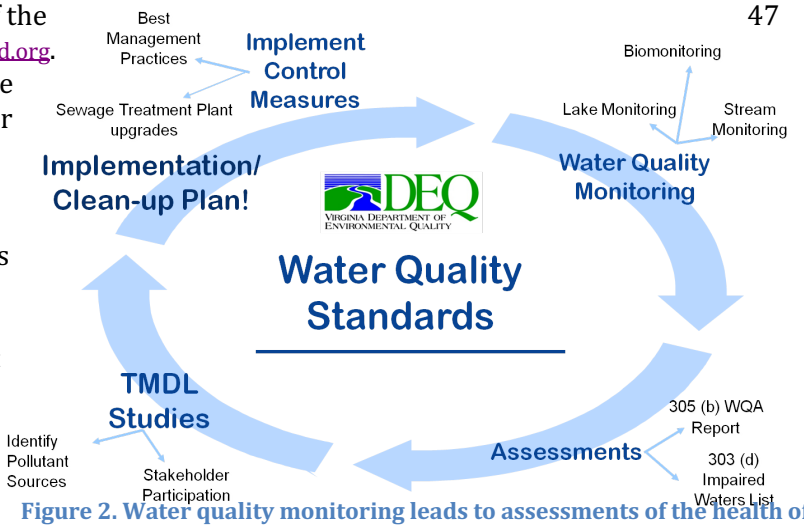

Figure 2. Water quality monitoring leads to assessments of the health of the state's waters. When waters are impaired, a TMDL study is ordered. Once the study identifies pollution sources and creates a "pollution diet" plan, control measures are implemented. Continued monitoring shows whether the control measures are effective. Image: VA DEQ.

d. Role of citizens – Every citizen can help by taking actions such as keeping debris and pollutants out of storm drains, limiting use of lawn and garden chemicals, controlling soil erosion, conserving water by reducing use, and reducing runoff by replacing turf with native plants.

VII. Related volunteer projects for Virginia Master Naturalists

a. Education

i. Lead educational programs for any age group about the importance of our ponds, lakes, and streams and what individuals can do to help them.
ii. Hold aquatic resource themed booths at community events and festivals
iii. Organize workshops to educate property owners about watershed-friendly landscaping and greener ways to protect their properties from erosion.
iv. Assist schools with Meaningful Watershed Educational Experiences, https://vaswcd.org/mwee/
v. Conduct environmental education for youth or K-12 teachers as a Project Wet educator or facilitator, https://www.projectwet.org

b. Citizen Science

i. Water quality monitoring with VDEQ or local partners, https://www.deq.virginia.gov/our-programs/water/water-quality/monitoring/citizen-monitoring

c. Stewardship

i. Organize and lead clean-up events that get the public involved. See Clean the Bay Day (http://www.cbf.org/events/clean-the-bay-day) and Clean Virginia Waterways (http://www.longwood.edu/cleanva/VolunteerForCleanup.html)
ii. Plant riparian buffers on public lands

Virginia Environmental Endowment