

## **National Special Topic: Water Resource Management: Local Control and Local Solutions**

Nebraska is fortunate to sit atop the Ogallala aquifer, one of the largest unconfined aquifers in the world. This natural resource provides drinking water for most of the state and has enabled Nebraska to lead the country as the #1 irrigated state, helping to sustain agriculture as the states leading industry. Managing and protecting this resource is the responsibility of Nebraska's unique local Natural Resources Districts (NRDs). While NRDs have maintained groundwater levels near pre-development levels, competing uses and variable supplies have placed additional management requirements on locally elected policy makers.

Students will learn the concepts of how water is managed in Nebraska, and how the local Natural Resources District system works to address integrated water management challenges.

Key topics will include:

- Understand the ability of Natural Resources Districts to implement local policy and local management to protect water users;
- Understand administrative structures and processes for managing water uses and supplies;
- Understand ground and surface water hydrology and connectivity;
- Understand the economic, social and environmental impacts of projects and policy decisions.

### **Key Topics & Learning Objectives**

Key Topics:

1. Understanding how groundwater and surface water systems function.
2. Understanding the importance of water quality and quantity as a foundation in a healthy ecosystem
3. Understanding a variety of water quality indicators in different landscapes.
4. Understanding a variety of water quantity indicators in different landscapes
5. Understanding how sustainable and best management practices enhance and protect water quality and quantity for humans and wildlife.
6. Understanding the differences of local, regional, and national systems that manage natural resources and the importance of each in water resources.
7. Understanding the social, economic, political impacts of natural resources management and decision making.

**RESOURCES:**

USGS Groundwater and Surface Water: A Single Resource: <https://pubs.usgs.gov/circ/circ1139/>

A Guide to Protecting Virginia's Valuable Resource: Groundwater:  
<https://vtechworks.lib.vt.edu/handle/10919/55267>

Septic Smart, EPA: <https://www.epa.gov/septic/septicsmart-homeowners>

<sup>2</sup>EPA Watersense Program: <https://www.epa.gov/watersense>

Groundwater Watch Monitoring: <https://groundwaterwatch.usgs.gov/default.asp>

Surface Water Gages: [https://waterwatch.usgs.gov/?id=ww\\_current](https://waterwatch.usgs.gov/?id=ww_current)

EPA Drinking Water Mapper: <https://geopub.epa.gov/DWWidgetApp/>

EPA Safe Drinking Water Act (SDWA) fact sheet: <https://www.epa.gov/sites/production/files/2015-04/documents/epa816f04030.pdf>

EPA Emergency Drinking Supply: [https://www.epa.gov/sites/production/files/2015-03/documents/planning\\_for\\_an\\_emergency\\_drinking\\_water\\_supply.pdf](https://www.epa.gov/sites/production/files/2015-03/documents/planning_for_an_emergency_drinking_water_supply.pdf)

Drinking Water Standards: <https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations>

EPA Wells: <https://www.epa.gov/privatewells/learn-about-private-water-wells>

<sup>4</sup>VCE Home Water Quality: <https://ext.vt.edu/food-health/home-water-quality.html>

Virginia Household Water Quality Program: <https://www.wellwater.bse.vt.edu/>

VDH Source Water Programs: <http://www.vdh.virginia.gov/drinking-water/source-water-programs/>

<sup>5</sup>Virginia Source Water Assessment Program. 1999. VDH.  
[http://www.vdh.virginia.gov/content/uploads/sites/14/2016/04/1999VDH\\_SWAP.pdf](http://www.vdh.virginia.gov/content/uploads/sites/14/2016/04/1999VDH_SWAP.pdf)

Virginia Harmful Algae Bloom (HAB): <http://www.vdh.virginia.gov/environmental-epidemiology/harmful-algal-blooms-habs/>

Waterborne Hazards Control (VDH): <http://www.vdh.virginia.gov/environmental-epidemiology/waterborne-hazards-control/>

DEQ Water Supply Planning Program Website:

<https://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/WaterSupplyPlanning.aspx>

<sup>1</sup>Virginia State Water Supply Plan:

<https://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/WaterSupplyPlanning/StateWaterResourcesPlan.aspx>

Water Quality Information and TMDLs:

<https://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs.aspx>

Illicit Discharge Elimination Fact Sheet: <https://www3.epa.gov/npdes/pubs/fact2-5.pdf>

Overview DEQ Presentation (2014):

<http://www.rrregion.org/pdf/workshops/2014/3.%20Stephenson%20-%20VA%20Water%20Supply.pdf>

Water Related Regulations Fact Sheet: <https://vwrrc.wp.prod.es.cloud.vt.edu/wp-content/uploads/2014/08/AgencyGuide.pdf>

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Virginia Water Quality Monitoring Council (VWMC): <https://www.vwmc.vwrrc.vt.edu/>

Virginia Rural Water Association (VWRA): <https://www.vrwa.org/>

**Examples Local/Regional Water Supply Plans:**

Rivanna River: <https://www.rivanna.org/community-water-supply-plan/>

NOVA: <https://www.novaregion.org/1214/Northern-Virginia-Regional-Water-Supply->

Hampton Roads: <https://www.hrpdcva.gov/departments/water-resources/water-supply-planning>

Northern Neck: <http://www.kilmarnockva.com/wp-content/uploads/Northern-Neck-Water-Supply-Plan-FINAL-2010-07.pdf>

Example Source Water Assessment (Westmoreland County): <https://www.westmoreland-county.org/sites/default/files/press-release/files/Source%20Water%20Assessment%20-%20Monroe%20Hall%20Neighborhood%20Water.pdf>

Example Source Water Assessment (Fairfax County):  
[https://www.fairfaxwater.org/sites/default/files/swap/Redacted\\_FCWA\\_SWAP\\_Report.pdf](https://www.fairfaxwater.org/sites/default/files/swap/Redacted_FCWA_SWAP_Report.pdf)

Culpeper Consumer Confidence Report 2017:  
[https://www.culpeperva.gov/documents/Exhibit\\_D\\_Consumer\\_Confidence\\_Report.pdf](https://www.culpeperva.gov/documents/Exhibit_D_Consumer_Confidence_Report.pdf)

Culpeper Regional Water Supply Plan:  
[https://www.culpeperva.gov/documents/Exhibit\\_K\\_Regional\\_Water\\_Supply\\_Plan.pdf](https://www.culpeperva.gov/documents/Exhibit_K_Regional_Water_Supply_Plan.pdf)

Interactive Resources:

EPA Office of Water by National Environmental, Safety and Health Training Videos:  
<https://vimeo.com/channels/908357>

EPA Types of Septic Systems: <https://www.epa.gov/septic/types-septic-systems>

How a Septic System Works: <https://www.gbra.org/septic/index.html>

USGS Groundwater Monitoring Network: <https://cida.usgs.gov/ngwmn/index.jsp>

USGS Stream Flow Monitoring: <https://waterdata.usgs.gov/nwis>

Videos:

UGA Well Water and Maintenance:  
[https://youtu.be/4\\_nYUoSXwqM?list=PL4yU9BNFlwm7EVMouJ5qfFjCjvzMWeUzN](https://youtu.be/4_nYUoSXwqM?list=PL4yU9BNFlwm7EVMouJ5qfFjCjvzMWeUzN)

UGA Well Water Testing:  
<https://youtu.be/dT0LNRCIOSo?list=PL4yU9BNFlwm7EVMouJ5qfFjCjvzMWeUzN>

Greenville SC Illicit Discharge video: <https://youtu.be/16ubsys6AZY>

CWP IDDE: [https://youtu.be/AhiS\\_5ZNbLQ](https://youtu.be/AhiS_5ZNbLQ)

GWUDI Investigation: <https://vimeo.com/125302146>

**Vocabulary:**

Water Resources – water that is potentially useful

Water Resource Management – Harnessing the benefits of water by ensuring there is sufficient water of adequate quality for all beneficial uses.

Water Scarcity – the lack of freshwater to meet water demand

Water Security – the delivery of reliable water services and the mitigation of water-related risks such as drought, flood and contamination.

Water Conservation – maximize the benefit gained from each gallon of water used

**Water Supply:**

<sup>1</sup>State Water Resource Plan (SWRP) – the compilation and synthesis of the 48 local and regional water supply plans developed by local governments to assess their water supply needs 2010-2040, as well as information from other sources. The SWRP will assist DEQ in efficient and effective regulation and management of water resources by examining projected water demand, identifying water resources targeted to meet this demand, and analyzing potential impacts that may occur to meet this demand.

<sup>1</sup>Local and Regional Water Supply Planning Regulation (9VAC25-780) – established in 2002; in response to the prolong droughts of 1999-2002, and requires each locality to develop and submit a water supply plan either alone or in collaboration with other localities by 2011.

<sup>1</sup>Water Supply Plan – locally developed planning process that includes information concerning CWS and SSU, existing and potential sources of water supply, existing use and anticipated future water demand.

<sup>5</sup>Community Water System (CWS) – A public water system that serves the same people year-round.

Self-Supplied Users (SSU) – water withdrawn from a groundwater or surface-water source by a user rather than being obtained from a public supply.

Million Gallons per Day (MGD) – The measurement used to determine water demand for a water supply system.

<sup>1</sup>Beneficial Uses – protection of fish and wildlife habitat; maintenance of waste assimilation; recreation; navigation; cultural and aesthetic value; domestic (including public water supply); agricultural; electric power generation; and commercial and industrial uses.

<sup>1</sup>Consumptive Use – the portion of water withdrawal lost to evaporation, transpiration or consumption by human or animals that is not returned to the water system.

Interbasin Transfer – Water returned to a different watershed than the point of withdrawal

Instream water use – water that is used, but not withdrawn, from a surface-water source for such purposes as hydroelectric-power generation, navigation, water-quality improvement, fish propagation, and recreation. Instream uses may change the flow characteristics or increase evaporative losses due to impoundments and release schedules.

Offstream use – water withdrawn or diverted from a groundwater or surface-water source for aquaculture, commercial, domestic self-supply, industrial, irrigation, livestock, mining, public supply, thermoelectric power, and other uses.

Designated Use – uses specified in water quality standards for each water body or segment whether or not they are being attained. All Virginia waters are designated for the following uses: recreation; aquatic life; wildlife; fish consumption; and shellfish production.

Return Flow – water that reaches a groundwater or surface-water source after release from the point of use and thus becomes available for further use.

Water withdrawal – water removed from the ground or diverted from a surface-water source for use.

<sup>2</sup>WaterSense® - Voluntary partnership program sponsored by EPA for labeling water efficient products and a resource for water conservation. WaterSense-labeled products use at least 20% less water, saves energy, and perform well or better than regular products.

Environmental Protection Agency (EPA) – Federal agency that monitors pollutants and enforces pollution cleanup programs.

Virginia Department of Environmental Quality (DEQ) – State agency charged with the monitoring water quality in surface waters and enforcement of pollution control and cleanup programs. Administers the Virginia Water Protection Program, Virginia Stormwater Management Program (VSMP), Erosion and Sediment Control Programs and Chesapeake Bay Preservation Area Program. Manages the Water Supply Planning, and maintains the Impaired Waters List and Total Maximum Daily Load development.

Drought Monitoring Task Force – An interagency group of technical representatives from state and federal agencies responsible for monitoring natural resource conditions and the effects of drought on various segments of society. The Task Force meets to assess conditions and make recommendations regarding drought status. The Task Force periodically releases Drought Status Reports summarizing drought conditions in the Commonwealth. DEQ is the lead agency.

Drought – prolonged shortages in the water supply, whether atmospheric (below-average precipitation), surface water or ground water.

Critical Condition – A set of conditions during which a use is considered vulnerable or impacted. Drought is the most common cause of critical conditions followed by water pollution.

Surface Management Area (SMA) – geographically defined surface water area in which the Board has deemed the levels or supply of surface water to be potentially adverse to public welfare, health and safety. There are no defined areas currently in Virginia.

Impoundment Structure – a man-made device, whether a dam across a watercourse or other structure outside a watercourse, used or to be used to retain or store waters or other materials.

Groundwater Management Area (GMA) – geographically defined groundwater area in which the board has deemed the levels, supply or quality of groundwater to be adverse to public welfare,

health and safety. There are two areas defined as such in Virginia; Eastern Virginia GMA (counties and cities east of I-95); and Eastern Shore GMA (Accomack and Northampton).

Dug/Bored wells – Shallow wells dug by shovel or backhoe. They are lined (cased) with stones, brick, tile, or other material to prevent collapse. Dug wells have a large diameter, are shallow (approximately 10 to 30 feet deep) and are not cased continuously.

Driven wells – constructed by driving pipe into the ground. Driven wells are cased continuously and shallow (approximately 30 to 50 feet deep). Though driven wells are cased, they can be contaminated easily because they draw water from aquifers near the surface.

Drilled wells – constructed by percussion or rotary-drilling machines. Drilled wells can be thousands of feet deep and require the installation of casing. Drilled wells have a lower risk of contamination due to their depth and use of continuous casing.

Spring Development - collecting the water that flows out of a spring or seep in a reservoir box so that the water can flow through a pipe to a watering trough or for other beneficial uses.

### **Water and Wastewater Treatment:**

Wastewater Treatment Plant (WWTP) – a facility designed to make wastewater suitable for other uses such as surface or ground water discharge.

Water Treatment Plant (WTP) – a facility designed to make water suitable for drinking or industrial uses.

Sedimentation – a physical process using gravity to remove suspended solids from water

Flocculation – a physical process in which colloids come out of suspension in the form of floc or flake, either spontaneously or due to the addition of a clarifying agent.

Coagulation - a chemical process that promote the clumping of fines into larger floc or particles.

Volatile Organic Compounds (VOCs) – chemicals that are carbon-containing and evaporate, or vaporize, easily into air at normal air temperatures

Total Dissolved Solids (TDS) – inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides, and sulfates) and some small amounts of organic matter that are dissolved in water.

Biological Oxygen Demand (BOD) – amount of oxygen consumed by bacteria and other microorganisms while they decompose organic matter under aerobic (oxygen is present) conditions at a specified temperature.

Chemical Oxygen Demand (COD) – indicative measure of the amount of oxygen that can be consumed by reactions in a measured solution.

Aeration - increasing and/or maintaining the oxygen saturation of water for the aerobic decomposition of detritus and nutrients. This can be done with surface or subsurface aerators.

Filtration – The removal of impurities using a physical barrier such as activated charcoal, sand and gravel. Filters can use sieves, adsorption or ion exchange to achieve filtration.

Distillation or Desalination – Separating water from dissolved solids through evaporation and condensation.

Wastewater Purification – recycling wastewater that meets drinking water standards.

Assimilative Capacity – amount of contaminant load that can be discharged to a water body without exceeding water quality standards. Decrease flows due to withdrawals or drought stress can reduce the assimilative capacity.

Reclaimed Wastewater – wastewater-treatment plant effluent that has been diverted for beneficial uses such as irrigation, industry, or thermoelectric cooling instead of being released to a natural waterway or aquifer.

### **Drinking Water Protection:**

Safe Drinking Water Act (SDWA) – Federal law that protects public drinking water supplies throughout the United States. EPA sets standards for drinking water quality and with its partners implements various technical and financial programs to ensure drinking water safety. The law was passed in 1974 and amended in 1986 and 1996.

Source Water Protection Program (SWPP) – VDH Office of Drinking Water provides assistance to waterworks community to development and implement Source Water Protection Plans (SWPP); and funding through the Wellhead Protection Implementation Projects Grants.

Source Water Assessment Program (SWAP) – Every state conducts an assessment of its sources of drinking water to identify significant potential sources of contamination and to determine how susceptible the sources are to these threats.

Virginia Department of Health (VDH) – State agency that oversees public health and safety. VDH has three focus areas relating to Water Resource Management; Drinking Water; Environmental Health Services; and Environmental Epidemiology.

Cross Connections – actual or potential connections between the potable (drinking water) and non-potable water supply or any source of contamination.

Combined Sewer Overflow (CSO) – sewer systems that are designed to collect rainwater runoff, domestic sewage, and industrial wastewater in the same pipe. Combined sewer systems are designed to overflow occasionally and discharge excess wastewater directly to nearby streams, rivers, or other water bodies.

<sup>5</sup>Groundwater Under Direct Influence of Surface Water (GUDIS) – Any water beneath the surface of the ground with (i) significant occurrence of insects or other microorganisms, algae, or large-diameter pathogens such as *Giardia lamblia*, or (ii) significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlate to climatological or surface water conditions.

<sup>5</sup>Maximum Contaminant Level (MCL) – the highest legally allowable threshold of a chemical in drinking water.

<sup>5</sup>Sensitivity – the relative ease with which a contaminant applied near the land surface or to the subsurface can migrate to the delineated source water area.

## **Land Management Impacts:**

Land Disturbing Activity – Any man-made change to the land surface that may result in soil erosion or has the potential to change its runoff characteristics, including construction activity such as the clearing, grading, excavating, transporting or filling of land.

Best Management Practices (BMPs) – schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce pollution of surface waters and groundwater systems from the impacts of land-disturbing activities. These include structural and non-structural practices that improve soil and water quality.

Riparian Buffer - vegetated area near a stream or water body which helps shade, filter and protect the stream from the impact of adjacent land uses.

Resource Protection Area (RPA) – lands adjacent to water bodies with perennial flow that have an intrinsic water quality value due to the ecological and biological processes they perform or are sensitive to impacts which may result in significant degradation to the quality of state waters.

Resource Management Area (RMA) – contiguous area of land bordering the designated RPA

Municipal Separate Storm Sewer System (MS4) – publicly-owned conveyance or system of conveyances (including but not limited to streets, ditches, catch basins, curbs, gutters, and storm drains) that is designed or used for collecting or conveying stormwater and that discharges to surface waters.

Illicit Discharge – any discharge to the storm sewer system or natural waterway that is not composed entirely of storm water

Pollutant – An excess substance that negatively impacts the environment

Point Source Pollutant – Water contamination being discharged from a known pollutant source. Includes discharges from wastewater treatment plants, and industrial plants.

Nonpoint Source Pollutant – Water contamination occurring naturally or accelerated from multiple pollutant sources within the watershed due to runoff. Includes urban and agricultural runoff, mining waste, septic systems and atmospheric deposition.



**Quick FACTS:**

<sup>1</sup>The SWRP indicates there will be a 32% increase in water demand by the year 2040.

<sup>1</sup>Surface water sources account for 77% of the future water demand. Groundwater sources account for 23% of the future water demand.

<sup>1</sup>97% of the projected surface water demands are projected to come from 25% of the streams.

<sup>1</sup>Agriculture is the largest user of surface water.

<sup>1</sup>2,900 regulated groundwater well withdrawal and 1.6 million private groundwater wells.

<sup>1</sup>800 surface water withdrawals and 82% (or 4,440) of total surface water withdrawn in 2013 was excluded from permitting.

<sup>4</sup>A gastro-intestinal illness may indicate that the water test for coliform bacteria is needed.

<sup>4</sup>When soap has no lather and water fixtures accumulate a white residue, the water is most likely hard.

<sup>4</sup>Orange or black stains in the sink, toilet or tub indicate that the water has high amounts of iron and/or manganese.

<sup>4</sup>Blue stains in the sink, toilet or tub indicate problems with pH, copper or lead.

<sup>4</sup>Odors of gas or fuel indicate VOCs.

<sup>4</sup>Private well users should test their water for coliform bacteria every year. pH and TDS should be tested every three years.

<sup>4</sup>Agricultural operations could be a source of nitrate, coliform bacteria or pesticides.

<sup>4</sup>Coal mining could be a source of low pH, iron or manganese.

<sup>4</sup>Gas drilling could be a source of sodium, chlorides or barium.

<sup>4</sup>Landfills and factories could be a source of metals and VOCs.

<sup>4</sup>Roadways could be a source of sodium chloride or TDS.

<sup>4</sup>Safe Well Water Guidelines:

1. Make sure the well is properly constructed. Well casing should be 12" above ground with a clean and sealed well cap or secure concrete cover.
2. The ground should be sloped away from the well to prevent surface water from pooling around the casing.
3. The well should be 100 feet away from potential contamination sources such as chemical storage, oil tanks, septic tanks and livestock loafing areas.

4. Keep the area around the well clean and accessible. Do not dump waste near the well or any sinkholes.
5. Have your water tested once per year for total coliform bacteria. Every three years test for pH, TDS, nitrate and other contaminants of concern.
6. All water tests should be conducted by a certified lab. Compare the test results to the drinking water standards for public systems by the EPA.
7. Inspect the well annually for any cracks, holes or corrosion. Ensure the well cap is secure. If you suspect a problem have the well inspected by a licensed well drilling contractor with a Water Well and Pump classification.
8. Keep Records of well installation, maintenance, inspections and water tests.
9. When wells are no longer being used, have it properly abandoned by a licensed well contractor.
10. If you have a spring instead of a well, make sure the spring box is sealed and keep livestock away from the collection area.

<sup>5</sup>Ranking of Land use Activities is based on four factors; perceived risk of contaminant release; chance of transport of contaminant to the source water; impact on the treatment process; and relative public health risk of the contaminant.

<sup>1</sup>Virginia Water Supply Challenges:

1. Understanding the impact of unpermitted water withdrawals
2. Gaps in water withdrawal reporting: differences in reporting threshold between use and Virginia Water Withdrawal Regulations; and lack of adequate data.
3. Quantify current/future risks to groundwater availability outside of current groundwater management areas.
4. Reservoir Site Development
5. Threats to Water Quality
6. Understand impact of Consumptive Use on Supply
7. Promote increased conservation to reduce long and short term demands
8. Critical infrastructure deficiencies
9. Sea Level Rise, Changes in Precipitation Pattern and Land Subsidence
10. Source Water Protection
11. Conflict Resolution
12. Public Education and Outreach