

2010 West Virginia Envirothon

5th Topic Scenario – “The Protection of Groundwater – A Community Focus”

Background:

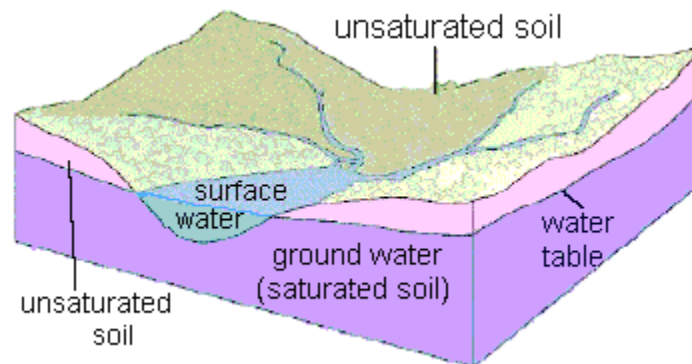
There is an immense amount of water in aquifers below the earth's surface. In fact, there is a hundred times more water in the ground than is in all the world's rivers and lakes.

Groundwater is an important part of the water cycle. It originates from precipitation that seeps downward through the soil until it reaches bedrock that is saturated with water, also known as the water table. Most commonly, groundwater is stored and transmitted in the cracks and pore spaces of the bedrock, however there are circumstances where water occurs in channels, fissures, caverns and loose deposits of gravel. Groundwater moves at varying rates to outlets such as springs, streams, rivers and wetlands. It follows gradients such as the slope of bedrock and pressure from the water table that is connected to it at higher elevations.

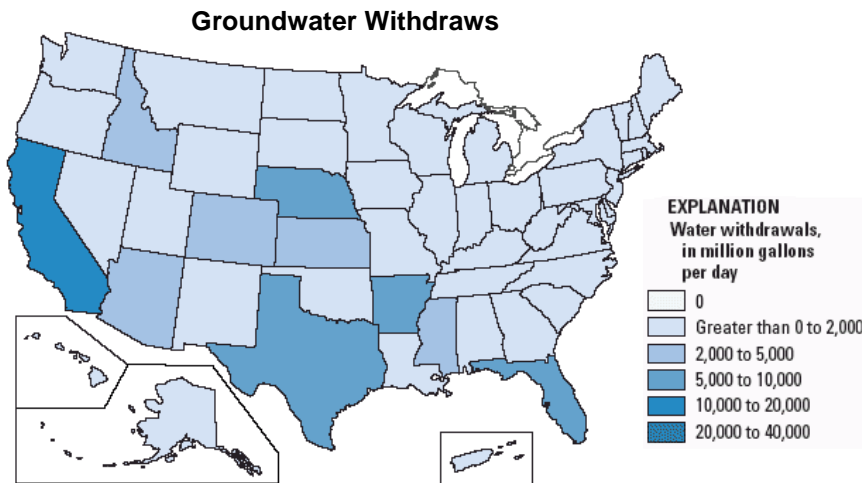
Groundwater exists almost everywhere, beneath hills, mountains, plains and deserts. It can be thought of, in a very general sense, as a continuous sheet of water underground that mirrors the shape of the earth's surface. It is not however always easily accessible or fresh enough for use without treatment. It is also sometimes difficult to locate in quantities large enough to meet the desired need, such as the gallons per minute suitable for household use. This water may occur close to the land surface, discharging into a marsh or bog and eventually forming a stream or river, or it may lie several hundred feet below the surface, as in many areas of West Virginia.

Groundwater is a valuable and sensitive resource, and in some locations not necessarily considered renewable. For example, at very shallow depths it might be just a few hours old, at moderate depths, it may be 100 years old, and at great depths or after having flowed long distances from places of entry, water may be several thousands of years old. Water from precipitation is filtered by the soil as it travels to the water table, being cleaned of excessive nutrients, pollutants and particles. Due to the depth and location in the earth, groundwater is stored and protected from most sources of contamination, however once it is contaminated it is almost impossible to clean up.

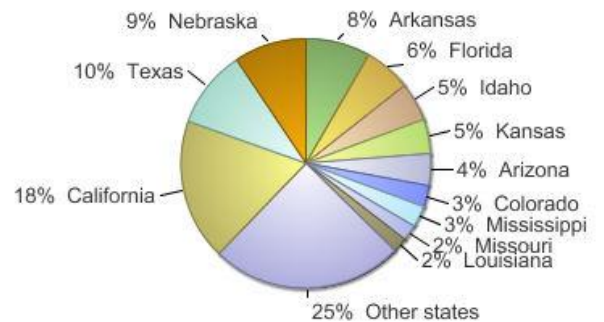
Below is a simplified diagram showing how the ground is saturated below the water table (the purple area). The ground above the water table (the pink area) may be wet to a certain degree, but it does not stay saturated. The dirt and rock in this unsaturated zone contain air and some water and support the vegetation on the Earth. The saturated zone below the water table has water that fills the tiny spaces (pores) between rock particles and the cracks (fractures) of the rocks. (<http://ga.water.usgs.gov/edu/earthgw.html>)



Groundwater withdrawals, by State, 2000



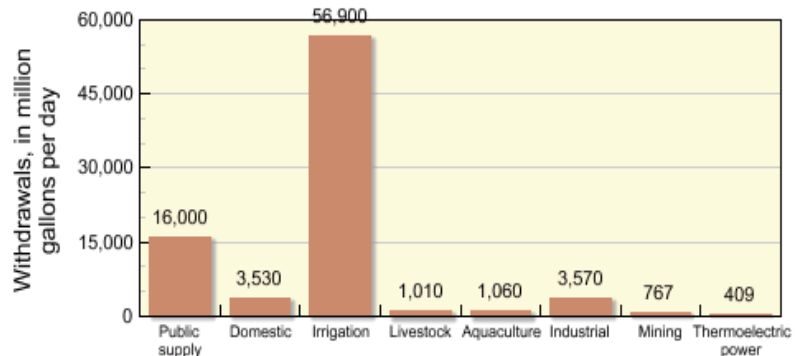
Total Fresh Groundwater Withdrawals, 2000



Groundwater use, by category of use, 2000

About 26% of the freshwater used in the United States in 2000 came from groundwater sources. The other 74% came from surface water. Groundwater is an important natural resource, especially in those parts of the country that don't have ample surface water sources, such as the arid West. It often takes more work and costs more to access ground water as opposed to surface water, but where there is little water on the land surface, groundwater can supply the water needs of people.

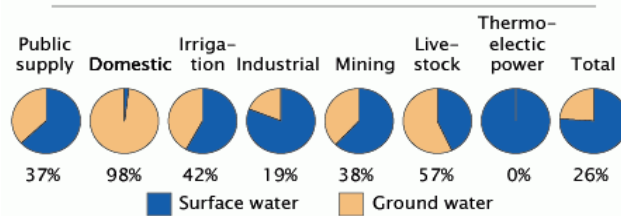
Fresh Groundwater Withdrawals, 2000



For 2000, most of the fresh water withdrawals, 68%, were for irrigation, while another 19% was used for public supply purposes, mainly to supply drinking water to much of the Nation's population. Groundwater is also crucial for those people who supply their own water (domestic use). Over 98% self-supplied domestic water withdrawals came from groundwater.

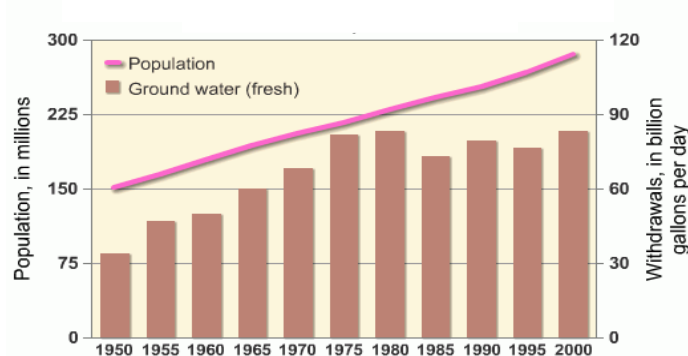
The pie charts below show the percentage of fresh water that was used in 2000 for various categories of water use. For most categories, surface water is used more than groundwater, although this pattern varies geographically across the United States. Domestic (self-supplied) water use is almost exclusively groundwater, whereas the water used to produce electricity comes totally from surface water (most of this water is used to cool equipment and often is a "pass-through" process). (<http://ga.water.usgs.gov/edu/wugw.html>)

**Fresh Surface Water and Groundwater Withdrawals, by Category, for the United States, 2000
(Groundwater Withdrawals, in Percent)**



Trends in groundwater withdrawals, 1950-2000

Trends in Population and Fresh Groundwater Withdrawals, 1950-2000



Senario:

The State of West Virginia has mandated that all counties do a comprehensive study of all potential water sources and ways to ensure safe water for expanding populations for the next 50 years. Your job is to develop a “Groundwater Protection and Management Plan” to supplement the Comprehensive Plan for Greenbrier County.

Your task as a county planner is to create a “Groundwater Protection and Management Plan” for the community pictured below. To create your plan you will utilize the “Profile of General Demographic Characteristics” for Greenbrier County and Lewisburg, WV.
















References: <http://quickfacts.census.gov/qfd/states/54/54025.html>
<http://censtats.census.gov/data/WV/1605446636.pdf>

In your plan please consider and/or include the following information:

1. Who will oversee the action plan?
2. Analysis of current and future groundwater supply.
3. Current demands on the system.
4. What are the current and potential environmental impacts?
5. Analysis of current and future activities that will utilize groundwater.
6. How will the governing bodies protect the groundwater supply from contamination?
7. Current and future threats to groundwater.
8. What is the role of storm water management?
9. What are the current groundwater protection regulations throughout Lewisburg, WV?

10. How will the prioritization of uses be established? Should a particular land use take precedent over other land uses (including agriculture, industrial, development, etc.).
11. What regulations, if any, will need to be created and implemented to ensure the protection of the groundwater within Lewisburg, WV.
12. Who will oversee these regulations?
13. What are the consequences if the “Groundwater Protection and Management Plan” is not carried out by the industries?
14. How will resource concerns, such as karst topography, affect groundwater plans?

Resources:

-  <http://www.nps.gov/brca/forteachers/images/groundwater.jpg>
-  <http://www.euwfd.com/html/groundwater.html>
-  http://www.gwpc.org/e-library/documents/state_fact_sheets/west%20Virginia.pdf
-  http://water.usgs.gov/nawqa/nutrients/pubs/wcp_v39_no12/
-  http://www.ngwa.org/gwscience/ground_water_use/faqs.aspx
-  <http://www.wvdep.org/item.cfm?ssid=11&sslid=165>
-  <http://www.legis.state.wv.us/WVCODE/Code.cfm?chap=22&art=12>
-  <http://www.kingcounty.gov/environment/waterandland/groundwater/education/animation.aspx>
-  <http://www.epa.gov/region1/students/teacher/groundw.html>
-  [http://oaspub.epa.gov/webimore/aboutepa.ebt4?search=22,62,](http://oaspub.epa.gov/webimore/aboutepa.ebt4?search=22,62)
-  <http://water.usgs.gov/ogw/>
-  <http://groundwaterwatch.usgs.gov/>
-  http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/County_Profiles/West_Virginia/cp54025.pdf
-  http://www2.wvdep.org/WebApp/_dep/search/Permits/PermitCountyQuery.cfm?office=HP
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MULTIPLE RISKS REQUIRE MULTIPLE BARRIERS

Safe drinking water is essential to the health of American citizens and the economic health of our communities. However, drinking water is vulnerable to contamination from many potential threats. These are programs and activities that when operated effectively form a protective web of multiple barriers to ensure the safety of our drinking water. The success of these barriers relies on the involvement and vigilance of local, state and federal officials, the private sector, public interest groups and individual citizens.

This poster identifies examples of

1. Surface and groundwater sources of drinking water (in blue),
2. Potential threats to these drinking water sources (in red), and
3. The multiple barriers that together protect our nation's public health (in green).

Risk Prevention Barrier
 Risk Management Barrier
 Risk Monitoring and Compliance Barrier
 Individual Action Barrier

