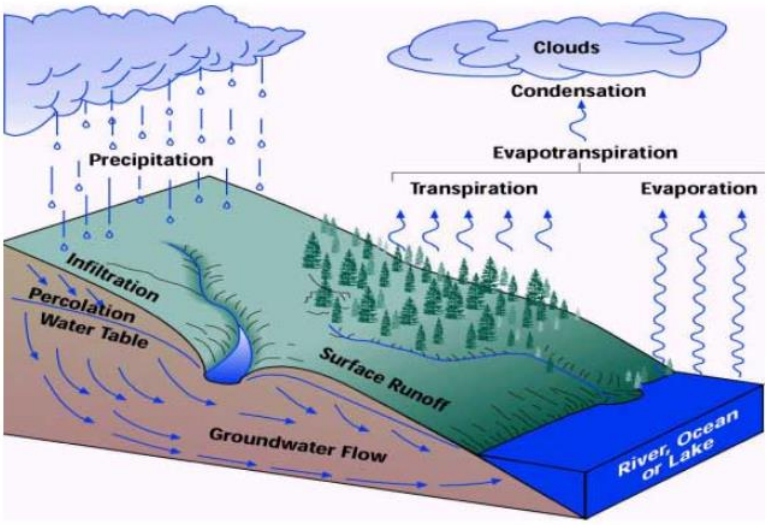
What is Groundwater?

Where does groundwater come from and how does it get into the earth?

Groundwater begins as rain or snow that falls to the ground. This is called precipitation.



The Hydrologic Cycle

Only a small portion of precipitation will become groundwater. Most will run off the land surface to become part of a stream, lake, or other body of water. This water we call "surface water."

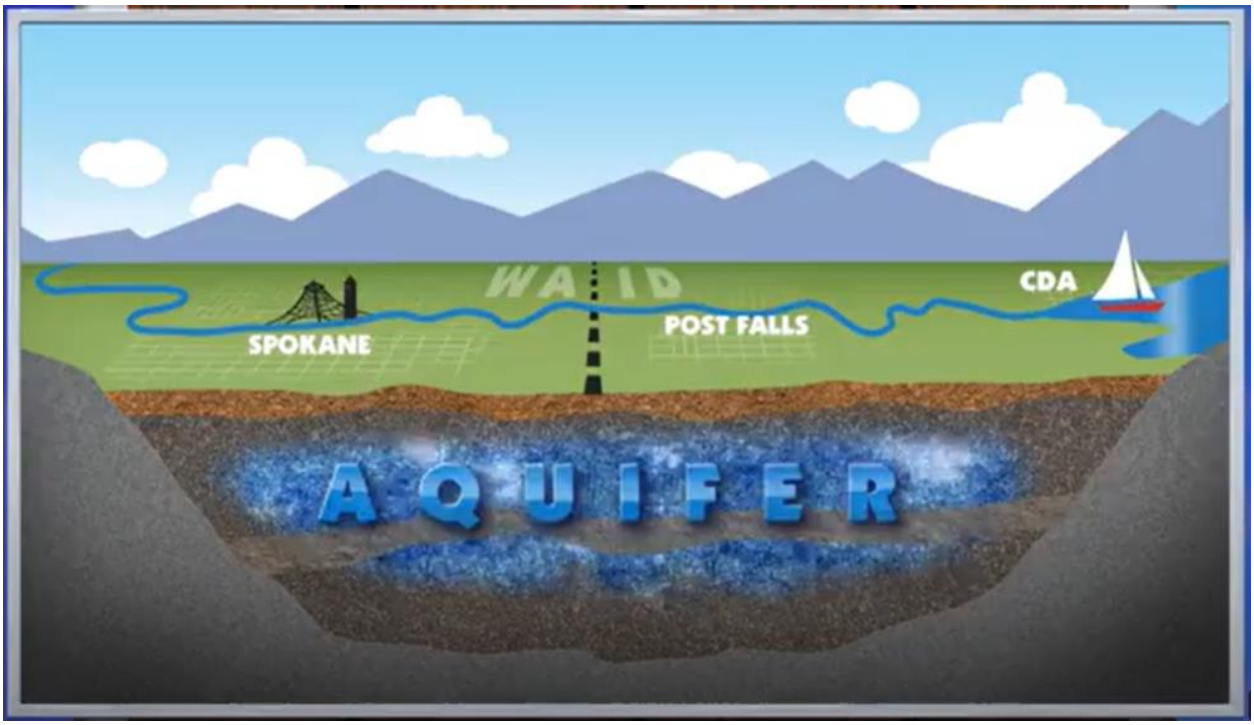
Some water is used by plants and returned to the atmosphere. This is called transpiration. Some water evaporates off the land to become water vapor once again. The remaining precipitation seeps, or percolates into the earth to become "groundwater." These actions make up the Hydrologic Cycle.

Water is in a constant cycle of change, from one form to another. From liquid to vapor to ice or snow and back to a liquid state. This same water from rain or snow continues down through the soil until it reaches an area saturated with water, called the "saturated zone." The top of the saturated zone is also known as the "water table." Above the water table is the unsaturated zone full of rocks, soil and earth through which water percolated. The saturated zone below the water table has water that fills the spaces between rock particles (pores) or the cracks (fractures) in the rocks. This is where the groundwater that you drink, bathe in, and use for daily chores comes from. We call this geologic area of groundwater an AQUIFER.

What Is an Aquifer?

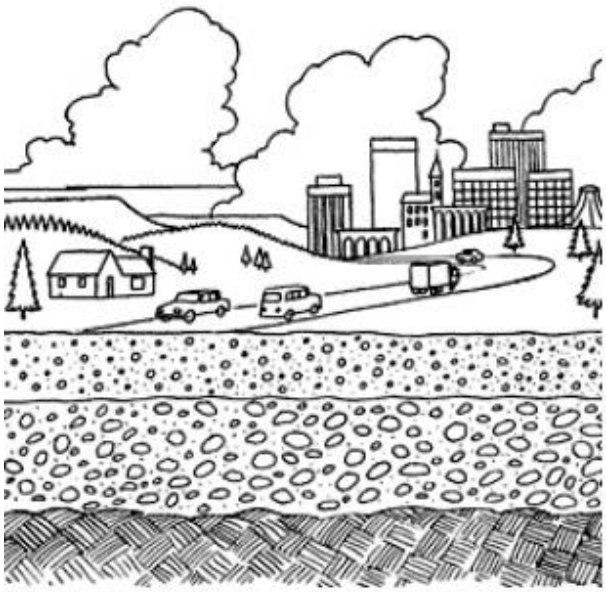
"We live, work, and play over our drinking water. Help us protect it."

An aquifer is a saturated underground rock layer with enough available water that can be pumped out or flow from underground as a spring.



Aquifers, like the Spokane Valley Rathdrum Prairie Aquifer are replenished by the hydrologic (water) cycle. Aquifers can span several hundred square miles, or be less than one square mile. They can have a thickness of just a few feet or several thousand feet. No matter the size of the aquifer there are several key elements required if it is to be useable by humans including the following:

1. An underground rock layer and zone of saturation that accumulates and stores water
2. Enough stored water is available to pump from the aquifer to the surface.



We live, work, and play over our drinking water.

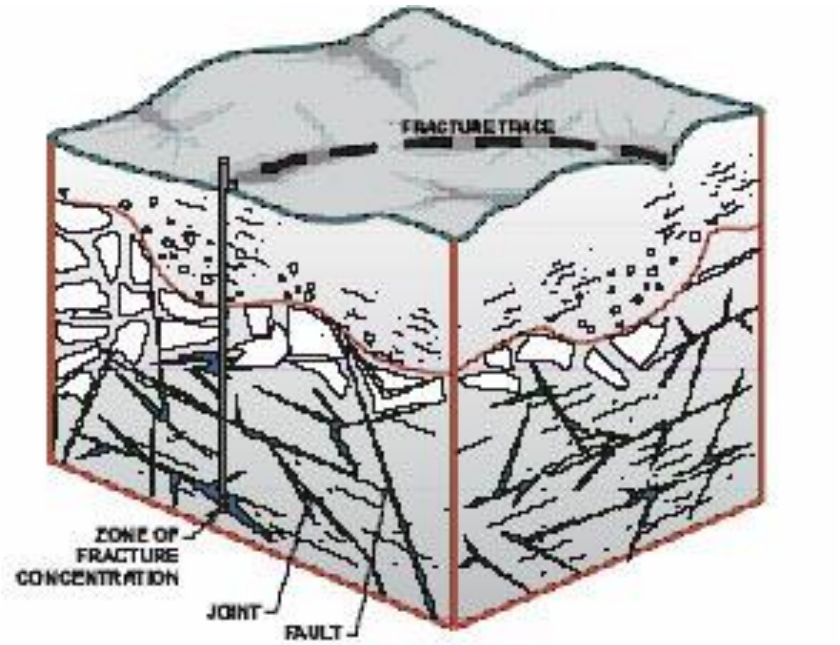
Types of Aquifers

Scientists who study groundwater are called “hydrologists” or “hydrogeologists” and distinguish between two types of aquifers.

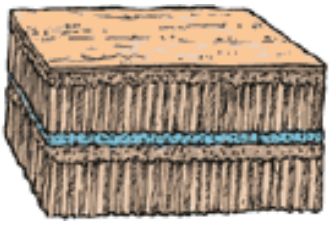
Porous Media Aquifers are made up of individual particles the size of sand or gravel up to large boulders. Groundwater moves through the openings, between the individual grains or rocks, called pore spaces.
Porous rock layers where grains are cemented to each other are called “consolidated.” Sandstones and limestones are examples of consolidated porous material.

Limestone

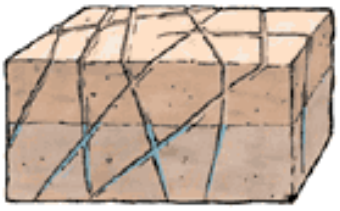
Fractured Aquifers are made up of solid rock layers where groundwater is found in fractures, joints, or cracks in the rock. Fractured aquifers are found in many different types of rocks including granite and basalt.



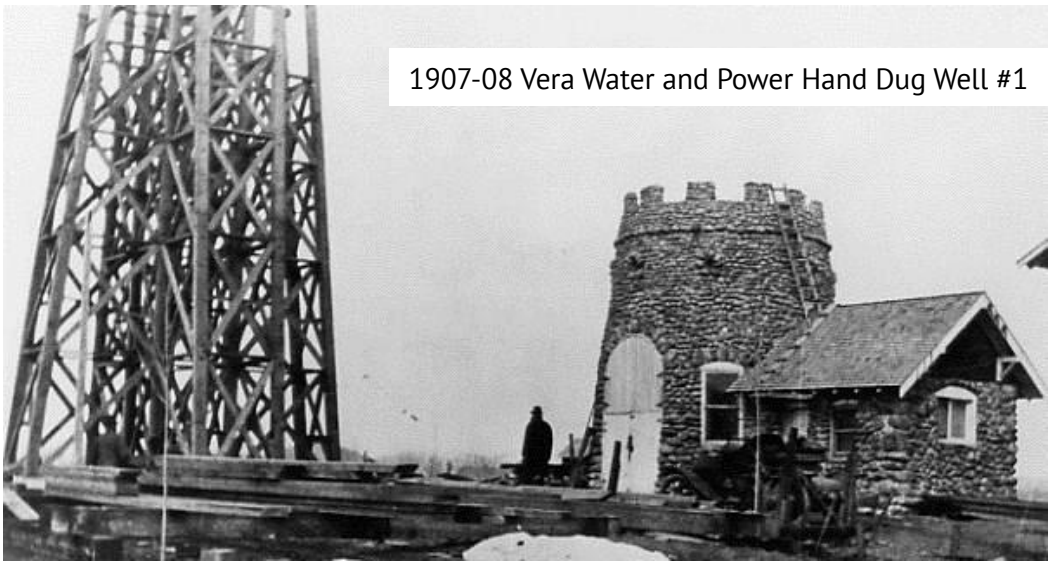
Typical Fractured Rock



Basalt



Wells

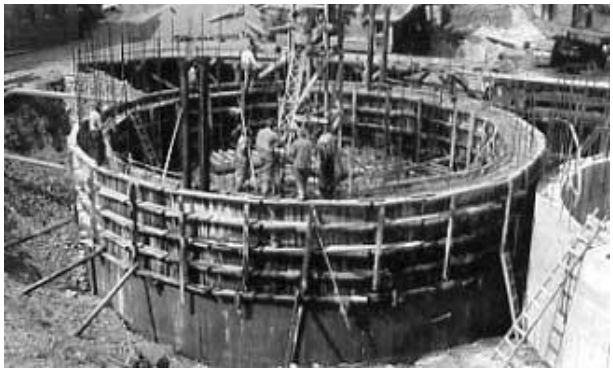


1907-08 Vera Water and Power Hand Dug Well #1

Water in aquifers is brought to the surface by wells, which are holes drilled into an aquifer. Pumps provides the force necessary to push water up from the earth below. A screen filters out unwanted particles that can clog the pipe.

How deep are wells?

1925 Well Electric Pump Station Construction



The depth of a well depends on how far the "saturated zone" is below the surface (or you may call this the "depth to the water table"). Wells can be a few feet or several hundred feet deep. Shallow wells that are less than 50 feet deep draw water that is close to the surface. In areas where the soil, sand and rock above the aquifer is permeable, pollutants can sink into the ground water. This is contamination, and can be dangerous. An aquifer can be contaminated by a well if it is improperly constructed, or if toxic materials enter the well.

Private Wells

Find out how to protect your source of drinking water.

- **Private Drinking Water Well Information** – EPA provides information to the private well owner
- **Washington State Department of Health** -Drinking Water Division – Everything you want to know about your drinking water from the state perspective, such as regulation, compliance, source water protection, contaminants, and publications.

Discharge – Recharge

Groundwater Discharge

Eventually, groundwater comes to the surface. It may be pumped from a well that feeds it through a garden hose or faucet in your home. Or it may flow into streams, rivers, lakes, marshes, or oceans as “discharge.”

Discharge from groundwater contributes to the flow of surface waters in rivers, streams and can fill lakes. For example, The Spokane Valley Rathdrum Prairie Aquifer discharges into the Spokane River. One discharge location is west of Sullivan Road. You can feel the water temperature drop as the cold aquifer water enters the river. In the hot summer months, aquatic life in the Spokane river depend on aquifer discharge to maintain healthy water temperatures..

Aquifer Recharge

An obvious question is

“Do aquifers ever run dry … or do they continue to get more water?”

The answers are “YES” and “YES.”

Groundwater supplies can actually run dry when the amount pumped to the surface by wells lowers the water table or when there is not enough recharge (thus making the zone of saturation smaller and lowering the water table). Groundwater supplies are replenished by rain and snowmelt that occur each year. We call this “recharge.” Water from melting snow and rainfall seeps into the soil and percolates down into the saturated zone. Places where this happens are called recharge areas. In the summer and fall months, recharge areas may appear as dry land. In the late winter and spring, the same areas are full of water that will eventually percolate down into the saturated zone of the aquifer below.

Climate changes are resulting in more variability in the amount of snowpack and when the snow melts. Earlier snow melt and higher temperatures contribute to less water in the river and more demand placed on pumping water from the aquifer.

Residence Time of Groundwater

The length of time water spends in the groundwater portion of the hydrologic cycle may be as little as days, or as much as 10,000 years or more. This is called "residence time." For example: A raindrop may fall to the earth's surface and seep down through the soil to a saturated zone or aquifer only to pumped back to the surface and sprayed from a garden hose and back down again.

Estimated depth and residence time of the world's water supply:

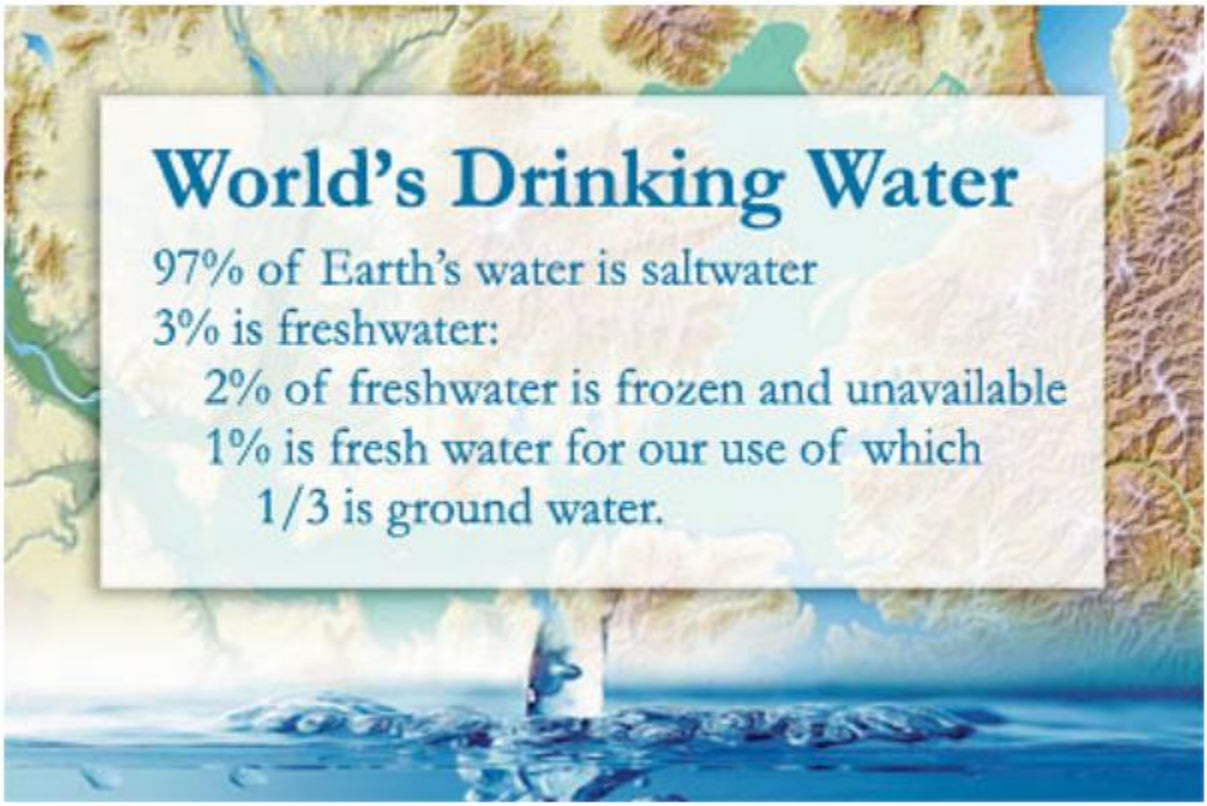
Water	Equivalent depth (meters)	Residence Time
Oceans/Seas	2500	~4000 years
Lakes/Reservoirs	0.25	~10 years
Swamps	0.007	~1-10 years
Rivers	0.003	~2 weeks
Soil moisture	0.13	~2 weeks-1 year
Groundwater	120	~2 weeks-10000 years
Ice caps/Glaciers	60	10-1000 years
Atmospheric water	0.025	~10 days
Biospheric water	0.001	~ 1 week

Source: Freeze, R.A. and Cherry, J.A., 1979, p.5, Groundwater, Prentice-Hall.

How Much Water Exists?

The Earth is 70% Water. Less than 1% is groundwater. In fact, over 99% of all water is not available for our use. So where is all the water? The Earth's water is all around you. Water is in streams, lakes, oceans, and rivers. This water is called "surface water." In addition to surface water, water is located beneath our feet, in the ground as soil moisture and in aquifers.

Where Is the Rest of Earth's Water?



Did you know that only 3% of Earth's total water supply is freshwater and not found in the oceans? Three percent is still A LOT OF WATER! There are approximately 2,030,000 cubic miles of fresh water. Most of this 3% of usable water is frozen in glaciers and ice caps, in the Arctic, Antarctica, and Greenland. This "frozen" water is 77% of the non-ocean supply.

Twenty-two percent of the Earth's water that is not in the oceans is "groundwater" and we use it for drinking, bathing, irrigation, and watering our plants. The remaining portion, less than 1%, is in rivers, lakes, and stored in the soil as moisture above aquifers (the unsaturated zone).

You can do your part to use water wisely.

For more information on what you can do to conserve water visit SAJB's Water Conservation pages and the Outdoor Watering Nerds

How is Groundwater Contaminated?

Septic Systems: Septic tanks that are above groundwater aquifers may fail to break down contaminants due to:

- Improper construction, design, or location
- Too many septic systems in one area
- Inadequate maintenance (Septic tanks should be pumped periodically to prevent overloading)
- Toxic materials, released in the septic system by pouring paints, solvents and other potential contaminants down the drain or toilet, may compromise the life of microbial organisms that break down contaminants.

Storm Drains

- Storm drains: The drains you find on streets are called “storm drains.” Water from rainfall and snow can wash contaminants off the surfaces of streets and sidewalks. These substances may be so harsh that normal microbial degradation cannot occur before reaching groundwater supplies below.

Hazardous Waste

- Household Hazardous Waste (HHW) : Simple acts around the house can affect the quality of our drinking water. Harsh chemicals that are poured down the drain, down the toilet, or on the ground can contaminate. In addition, improper disposal of hazardous chemicals like solvents and paints. Take toxic materials to the HHW area at one of the Solid Waste Transfer Station..
- Industrial Hazardous Waste: Manufacturing industries often use chemicals, solvents, cleaners, and fuels that must be disposed of as hazardous waste.

Improper disposal, storage or use of potential contaminants poses a serious threat to groundwater. Contamination may also occur as a result of accidents or natural disasters. Oil spills, tankers that leak or any disaster that permits contaminants to flow on surfaces or in the ground can have dangerous consequences.

Groundwater Protection Measures

Sewer Installation

Most homes and businesses are connected to public sewage systems that process wastewater at treatment plants under strict guidelines. Yet in many areas there are homes that use septic systems. Water from dishwashing, bathing, toilets, and laundry is collected in a septic tank or cesspool, and discharged into the ground. This household wastewater contains bacteria and viruses that can spread human disease, as well as harmful chemicals such as nitrates and anything else poured down the drain. In areas with only a few septic systems on large acreages, the wastes are adequately treated or diluted and do not harm people or the environment. In areas that are packed with one or more septic systems per acre, contamination can occur.

Sewer districting is the one sure way to protect from septic system contamination of groundwater. As rural areas grow into small towns, suburbs or even cities, the installation of a sewer system, where wastes are moved by pipes from homes to a central treatment facility to properly process human and household waste, is the correct action.

Septic Tank Maintenance

In areas where septic systems are adequate to treat waste, it is important to keep them working properly. Waste accumulates in septic tanks. They are not bottomless pits. It is important to "pump" excess waste out of the septic tank on a periodic basis —every one to three years depending on usage, demand, and size of property.

Stormwater Management

When it rains or snows, the oil and chemical contaminants on streets and sidewalks are washed down storm sewers or on the ground. These potential contaminants can slowly filter down to groundwater aquifers below. Grass, plants, and other vegetation are natural "filters" for contaminants. It is important to have ground cover like grass in areas where stormwater collects to remove many of the contaminants. We call these "grassy swales" or grass infiltration areas. This simple practice can reduce the potential for contaminants washed off streets and other impervious surfaces. Grassy swales biologically treat up to 90% of contaminants before they reach groundwater supplies below.

Other ways to protect from stormwater contamination are to keep automobiles leak free, keep herbicides, pesticides, and fertilizers only on the lawn surfaces where they belong, and avoid use of hazardous materials on or near surfaces that may drain into the ground or down storm sewers.

Groundwater Protection Measures

Household Chemical Management

According to the United States Environmental Protection Agency (EPA), the average American disposes of about one pound of household hazardous waste a year. Hazardous wastes in simple terms are toxic substances. Any of the below-mentioned substances can contaminate groundwater:

Paint thinners	Pesticides
Motor Oils	Furniture strippers
Oil-based paints	Anti-Freeze
Fertilizer	Chemical Spot Removers
Gasoline	Brake Cleaners
Solvents	

You can protect groundwater supplies from household chemical contamination by following a few simple rules:

1. Buy the least toxic product available. Read the label.
2. Buy only the amount you need.
3. Follow label directions—more is not necessarily better!

Properly dispose of Household Hazardous waste.

Store hazardous products in their original, sealed and labeled containers. Use the Waste and Recycle Directory to find an approved hazardous waste disposal location.

Residential hazardous wastes in Spokane County can be taken to the Waste to Energy Facility, the North County, Valley and Sunshine University Transfer Stations. In north Idaho, the Kootenai County Solid Waste Department operates the Prairie and Ramsey Transfer Stations that accept hazardous wastes.

If you do not have a hazardous waste disposal site in your community, check with your city or waste hauler to see if they have disposal events where marked HHW containers are accepted for proper disposal.