MIAMI CONSERVANCY DISTRICT

OUR REGION'S WATER:
PROTECTING. PRESERVING. PROMOTING.

# THE Source

A Report of Water Resources in the Great Miami River Watershed

FALL 2008

# Water's importance becoming apparent

Water. In places around the world, the lack of water is becoming an issue and – in some places – a crisis. Water managers in 36 U.S. States are predicting significant shortfalls within the next decade. Here in Southwest Ohio, most of us don't think twice about it. You turn on the spigot, water comes out. You trust that there's plenty of it, and it's clean and safe to drink.

*"People are beginning to see how important water is," says Janet Bly, MCD general manager. "In this region, it is truly becoming an economic driver, providing abundant water for drinking, industry and recreation."*

The aquifer in southwest Ohio provides high quality drinking water for an estimated 1.6 million people. Water from the aquifer is a reliable local source for agricultural and industrial use and geothermal energy. The aquifer sustains flow to the Great Miami River and its major tributaries which provide excellent outdoor opportunities for fishing and boating - even during periods of drought. "People are beginning to see how important water is," says Janet Bly, MCD general manager. "In this region, it is truly becoming an economic driver, providing abundant water for drinking, industry and recreation". That's why it's important we take care of this precious commodity – paying attention to quantity and quality.

Nine counties in the region fund the programs of the Miami Conservancy District's (MCD) Aquifer Preservation Subdistrict. The primary objective is to monitor groundwater and surface water and provide community leaders with information that helps them make sound decisions to maintain the supply of good, quality water.

"No one knows what changes we may see in this region as the result of global climate change," says Mike Ekberg, MCD water resources manager, "but by continuously monitoring our groundwater and surface water, we hope to be able to identify any changes early in the process."

This report highlights water quality and quantity data collected in 2007 in the Great Miami River Watershed, with an emphasis on the buried valley aquifer system.

**What is the APS?**

The Aquifer Preservation Subdistrict (APS) is a subdistrict of the Miami Conservancy District (MCD), which is a political subdivision of the state of Ohio. The APS encompasses all or portions of nine counties including Butler, Clark, Greene, Hamilton, Miami, Montgomery, Preble, Shelby and Warren counties.

The APS was created to develop and maintain an ongoing, watershed-wide program to support comprehensive protection and management of the Great Miami River Watershed's groundwater resources.

Partnering with federal, state and local governments, the APS programs help communities develop and implement source water protection plans; provide educational programs; and monitor, analyze and report on the conditions of the watershed.


**Legend**

- Aquifer Preservation Subdistrict
- Great Miami River Watershed Boundary
- Rivers and Streams
- Buried Valley Aquifer

**Download the complete 2007 Water Quality and Quantity Report for the Great Miami River Watershed at www.miamiconservancy.org/water/groundwater.asp**

**The Great Miami River Watershed***

- The Great Miami River is 170 miles long.
- It drains nearly 5,400 square miles, with nearly 4,000 square miles in Ohio.
- The watershed includes parts of 15 counties in Ohio.
- Altitudes in the watershed range from 1,550 feet in the northern parts of the watershed to just 450 feet where the Great Miami River meets the Ohio River in Hamilton County.

**A watershed is the geographic area in which the water that drains from the land flows to the same body of water, such as a river, stream, lake, pond, or aquifer.*


**To access MCD's Water Data Database go to www.miamiconservancy.org/water/data.asp**

GROUNDWATER QUALITY

# Despite seasonal drought water supply is stable

Despite higher than average precipitation in 2007, certain areas of the Great Miami River Watershed experienced drought conditions during summer and early fall.

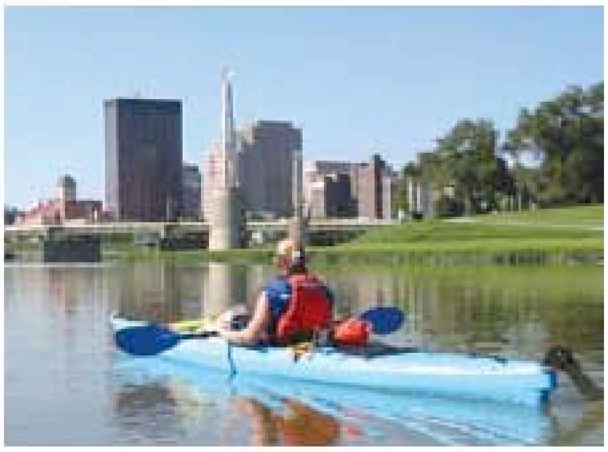
MCD measures and tracks precipitation data throughout the Great Miami River Watershed. The data is used to forecast flood events, is provided to the National Weather Service, and is analyzed along with groundwater level data to better understand how precipitation affects the water stored in the aquifer.

Over the past 30 years, the watershed averaged 38 inches of precipitation per year. In 2007, the watershed average was 42.7 inches. Even with the additional precipitation (whether as rainfall or snow), areas in Hamilton, Butler, Warren and Preble counties experienced drought conditions during the summer and early fall months.

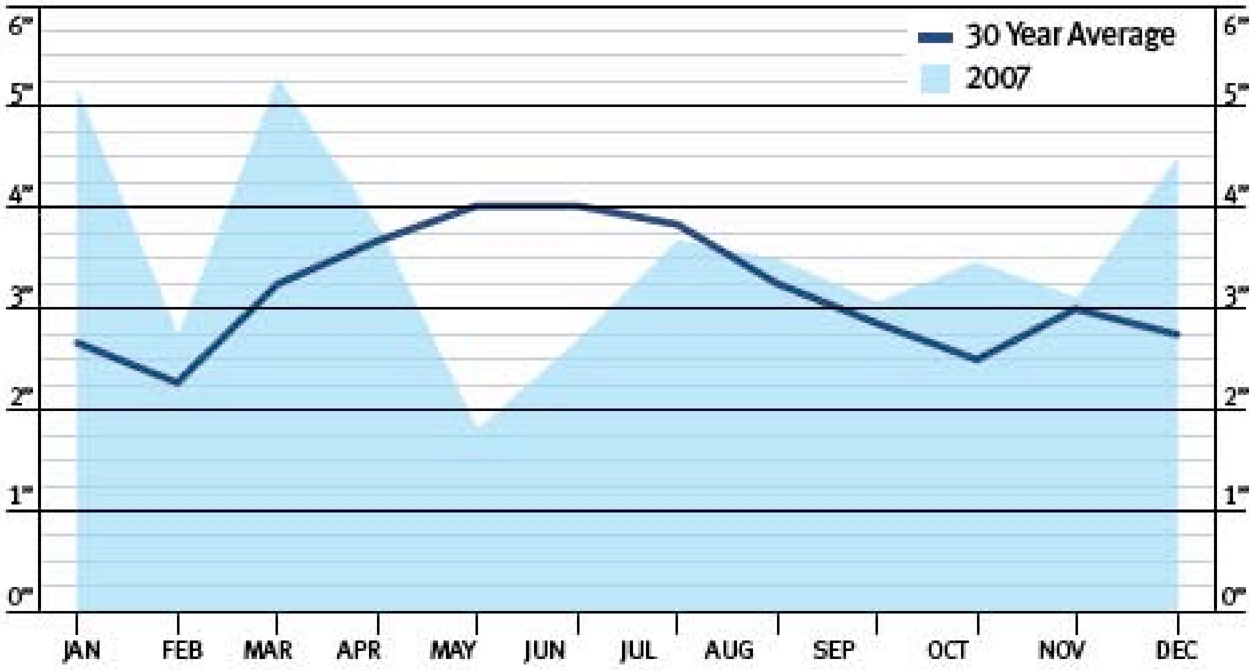
"Over the past couple of years, we've seen heavier precipitation in the winter and spring while May through August have been drier than usual," says Mike Ekberg, water resources manager for MCD. "Is this a trend? It's too early to know, but it appears we may be seeing an early indication of dramatic seasonal changes in precipitation. Overall, though, our water supply remains stable."

MCD maintains a network of 109 observation wells that spans 11 counties and is used to evaluate trends in water storage in the aquifers. Sixty of these wells are located within the buried valley aquifer.

"One-third of the wells in the buried valley aquifer showed upward trends in groundwater elevation, one-third maintained stable water levels and one-third had decreasing trends," says Krystal McNutt, MCD hydrotechnician.



## Precipitation in 2007 Compared to the 30-Year Average



# Groundwater tests show high quality water

After analyzing groundwater samples from 23 total wells – 22 municipal supply wells and one residential well – the results show overall groundwater in the buried valley aquifer continues to be of high quality. It consistently meets national standards for drinking water. Still, a few concerns do exist.

MCD conducts routine groundwater sampling to continually assess the presence or absence of pollutants in the buried valley aquifer. MCD works closely with communities to ensure they receive and understand the results of the sampling.

**Arsenic**

Naturally occurring arsenic continues to be present in groundwater. Arsenic was present at detectable levels in seven of the 23 groundwater samples collected. But only two samples were at levels above the US Environmental Protection Agency (USEPA) maximum contaminant level (MCL) of 10.0 micrograms per liter.

**What is arsenic?**

Arsenic is a naturally occurring metallic element. Its presence in groundwater is largely a result of arsenic-bearing minerals dissolving naturally over time as certain types of rocks and soils are weathered.

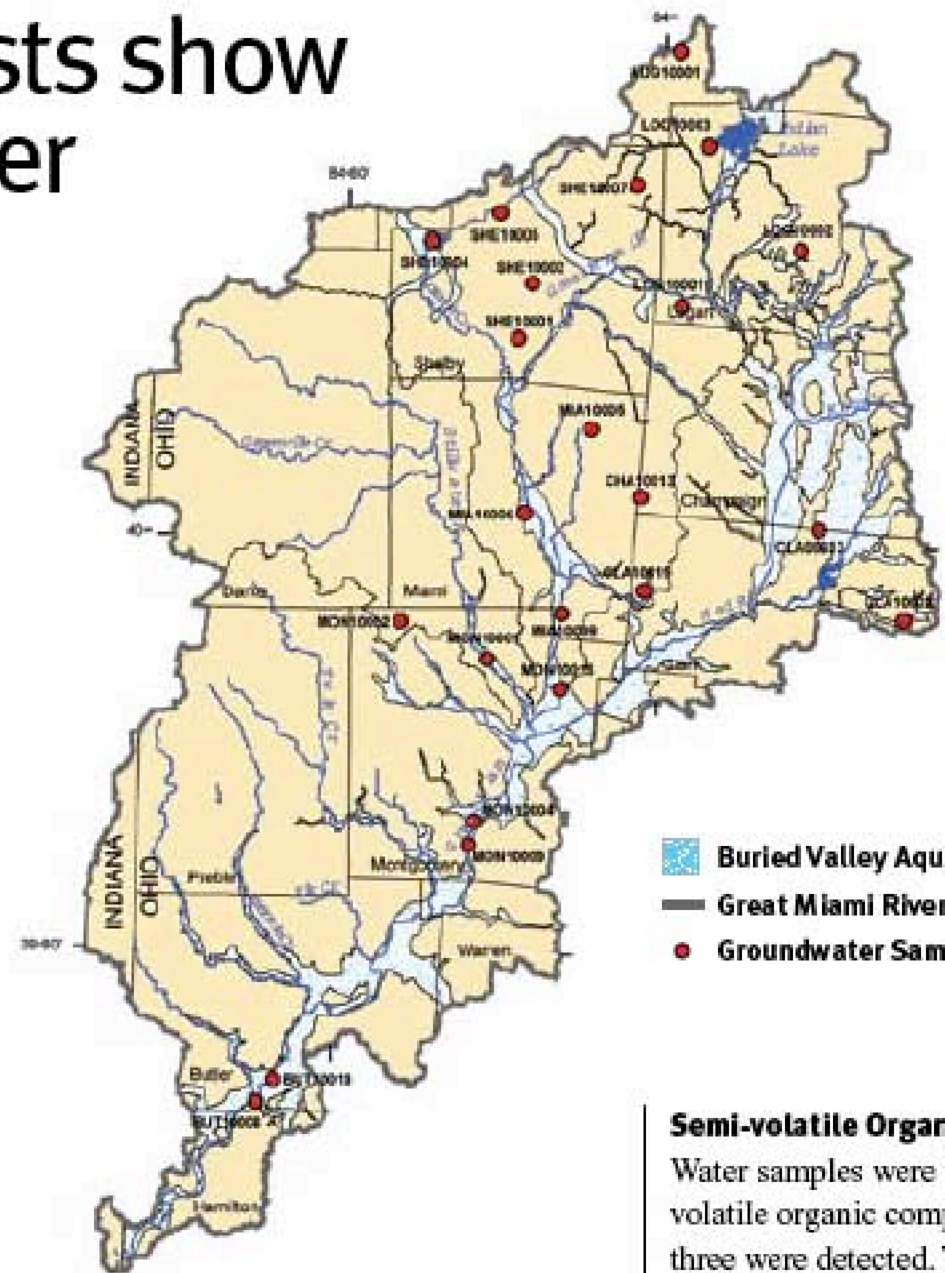
**What are the health effects of arsenic?**

Exposure to arsenic for long periods of time can increase a person's risk of developing bladder, lung and skin cancers; cardiovascular disease; pulmonary complications; and neurological dysfunction.

**What can be done about drinking water that has arsenic concentrations above the standard?**

Public water systems that have arsenic levels over the 10 micrograms per liter level will need to begin treating their water for arsenic.

Private well owners can contact their local health department for information to deal with arsenic.





**Volatile Organic Compounds**

Out of 53 volatile organic compounds (VOCs), only four – (bromodichloromethane, chloroform, dibromochloromethane, and tetrachloroethene [PCE]) – were detected in three of 23 samples. All but PCE are byproducts formed when chlorine is added to water supply systems. PCE is a chemical used in dry cleaning and metal degreasing. None of the samples were above the MCL set by USEPA.

Many VOCs – and semi-volatile organic compounds (SVOCs) – are human-made chemicals that are used to manufacture things like paints, pharmaceuticals, and refrigerants.

While each of the three locations has previously shown levels of VOCs, the concentration at two of the three locations has decreased since MCD's 2004 study.

**Semi-volatile Organic Compounds (SVOCs)**

Water samples were tested for 125 semi-volatile organic compounds (SVOCs) and only three were detected. They are:

- A plasticizer used in manufacturing PVC and commonly found in the environment
- A chemical used to make plastics more flexible
- Naphthalene, which is used in making plastics

The plasticizer was found in three samples while the other two SVOCs were found in one sample each. According to the USEPA, only naphthalene has been shown to cause health effects. Exposure to high levels naphthalene can cause anemia.

Naphthalene is the only one of the three that was previously detected. The other two either weren't detected in previous MCD studies or previous samples weren't analyzed for SVOCs.

Two samples containing the plasticizer, Bis (2-ethylhexyl) phthalate, slightly exceeded the federal drinking water standard.

# Better technology reveals emerging contaminants

With the technology to detect smaller and smaller quantities of chemicals comes the realization that some common products are making it into our rivers and streams. Known as emerging contaminants, they include:

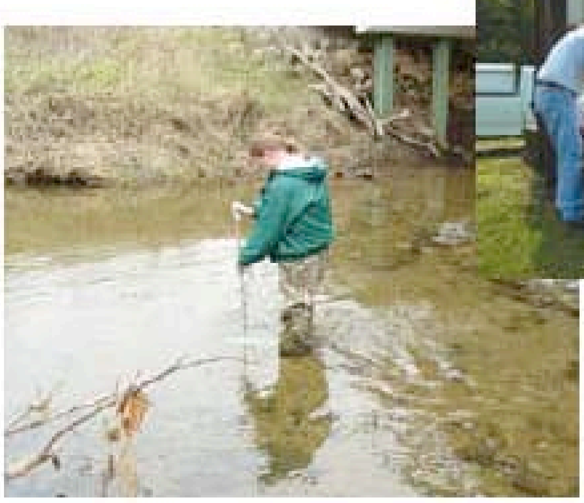
- Pharmaceuticals
- Personal care products
- Hormones
- Miscellaneous chemicals such as caffeine, cleansers, insect repellents, perfumes and fire retardants

"What is referred to as 'emerging contaminants' are emerging not because they are just starting to arrive, but because the ability to detect them has improved," says Bruce Pletsch, MCD hydrogeologist.

Once in the environment, emerging contaminants are a potential ecologic or public health risk. However, adequate data often do not exist to determine their risk. Currently, there are no standards set by USEPA for emerging contaminants. Recent research documents that emerging contaminants are present in the environment on a global scale. MCD is studying emerging contaminants to better understand their existence and quantities in the Great Miami River Watershed.

Surface water samples from eight locations in the Great Miami River and its major tributaries within the Upper Great Miami River Subwatershed were tested for 32 emerging contaminants. Sixteen different compounds were found including:

- ***Caffeine*** (found in colas, coffee and tea)
- ***Acetaminophen*** (active ingredient in pain medications such as Tylenol)
- ***Estradiol*** (form of estrogen used to treat menopause)
- ***Fluoxetine*** (Prozac, an antidepressant)
- ***Ibuprofen*** (anti-inflammatory drug such as Advil or Motrin)
- ***Progesterone*** (hormone involved in the female menstrual cycle and pregnancy)
- ***Testosterone*** (the principal male sex hormone and an anabolic steroid)
- ***Triclosan*** (an antibacterial agent found in soaps, deodorants, toothpastes and mouthwash)



**How do we dispose of pharmaceuticals without causing possible harm to our rivers and streams or the landfill?**

**According to the Office of National Drug Control Policy's federal guidelines:**

**Take advantage of community pharmaceutical take-back programs that allow the public to bring unused drugs to a central location for proper disposal.**

**OR**

**Take unused, unneeded or expired prescription drugs out of their original containers and mix them with an undesirable substance such as used coffee grounds or kitty litter. Place the material in an impermeable, non-descript container such as an empty can or sealable bag and place them in the trash.**

**OR**

**Flush prescription drugs down the toilet only if the label or accompanying patient information specifically instructs. The Food and Drug Administration has a list of drugs that should be flushed down the toilet rather than thrown in the trash including OxyContin and Percocet.**

# More study needed in southern part of watershed

Nutrient (phosphorus and nitrogen) load calculations determine the total amounts – or loads – of nutrients that move past a monitoring station during a period of time.

Calculating the loads that come from each subwatershed – Stillwater, Upper Great Miami River, Mad and Lower Great Miami River – can illustrate which subwatershed is providing the most nutrients downstream.

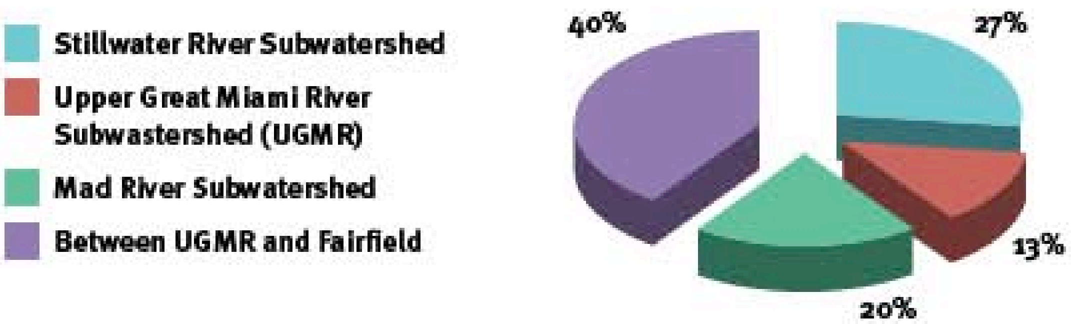
Nutrient data is used to track annual trends, establish a baseline for future studies, and verify nutrient reductions from landowner incentive programs.

Monitoring stations are located at the mouths of the Stillwater and Mad Rivers and at the base of the Upper Great Miami River subwatershed (near Dayton).

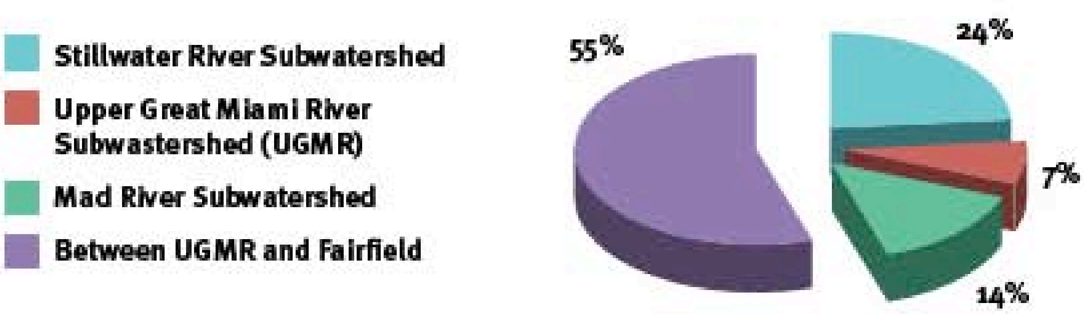
The area between the monitoring station at the Upper Great Miami River subwatershed and Fairfield contributes significant amounts of nitrogen and more than half of the phosphorus load in the watershed. (See figures below).

"There's a disproportionate amount of nitrogen and phosphorus entering the water between Dayton and Fairfield," says Bruce Pletsch, MCD hydrogeologist. "Now we need to conduct additional studies on the tributaries and the Great Miami River south of Dayton to determine where the majority of the loading occurs. Then, we can advise local officials about ways to reduce nitrogen and phosphorus."

## Total Nitrogen Load in the Great Miami River Watershed at Fairfield, Ohio




## Total Phosphorus Load in the Great Miami River Watershed at Fairfield, Ohio




**Nutrients aren't always healthy**

Normally, we think of nutrients as good – carbohydrates, proteins, and vitamins are just a few. But nutrients, which are essential for plant growth, can have a negative impact on the environment.

Because of nutrient over-enrichment, in 2007 the dead zone in the Gulf of Mexico off of the Louisiana coast was 7,903 square miles. That equals almost 20 percent of the area of Ohio.

Two plant nutrients – phosphorus and nitrogen – can be harmful to the environment and in some cases, people. That's why it's important not to apply too much on residential lawns, golf courses and farm fields. Water quality problems can occur when surpluses of nutrients leach down through the soil and contaminate groundwater or run into nearby rivers and streams.

Too much nitrogen and phosphorus in the rivers, streams, and lakes, can overstimulate aquatic plant and algae growth. When these plants decay, they rob the water of oxygen necessary for fish to live. This change in water chemistry is called eutrophication and can lead to hypoxia.

Hypoxia is a condition that forces fish and other aquatic wildlife to seek areas with higher oxygen levels, leaving dead zones behind. Animals that can't move away die.

**Hypoxic Zone in relationship to the size of Ohio**

**For more information on Gulf Hypoxia go to www.epa.gov/gmpo**

# Groundwater sustains rivers and streams

In the Great Miami River Watershed, precipitation flows towards rivers and streams as surface runoff, eventually flowing to the Ohio River. Some of the precipitation soaks into the ground, through the soil and into the water table. This water recharges the aquifer and helps to sustain the groundwater resources in the watershed (see figure below).

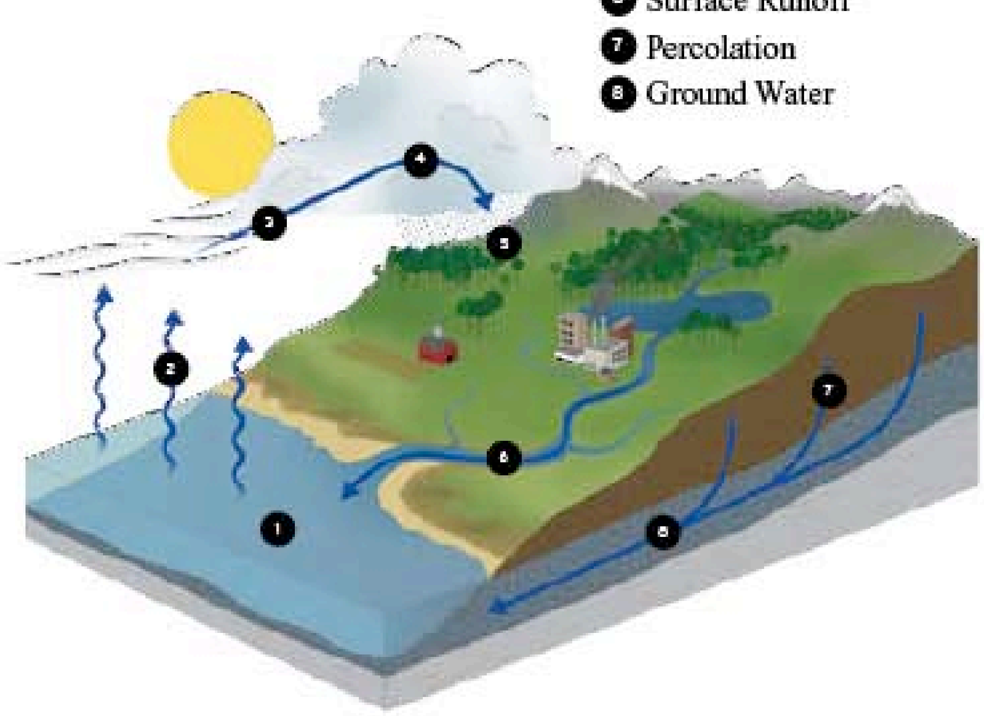
Although some of the precipitation stored in the aquifer remains underground and in storage for long periods of time, other water stays closer to the ground surface seeping into nearby streams and rivers as "baseflow."

MCD operates an extensive stream gaging network within the Great Miami River Watershed to calculate stream flow – which includes surface runoff and baseflow. The information is used for planning related to water supply, flood protection, construction, agriculture, commerce, and industry.

In the Great Miami River Watershed, baseflow provides anywhere from 25 to 80 percent of the total flow carried by streams in a year. That's why some of the streams and rivers in the watershed are able to have water flowing through them even during prolonged droughts.

Overall, 2007 annual runoff was above average at all stream gaging stations. The Mad River stations, located near Urbana and Eagle City, had the highest baseflow. The data from these stream gages indicates that baseflow provides, on average, more than 75% of the runoff in the Mad River at those stations. The table on the right lists four stations, the year that the gage was installed, and the lifetime average percentage of baseflow at each station.

1. Water Storage in Oceans
2. Evaporation
3. Condensation
4. Cloud Formation
5. Precipitation
6. Surface Runoff
7. Percolation
8. Ground Water



**For more information on the water cycle, the buried valley aquifer, or the Great Miami River Watershed, go to www.miamiconservancy.org/water/basics.asp**

| Monitoring Station (Year Data Collection Began) | Lifetime average % From Baseflow |
|---|---|
| Great Miami River at Sidney (1927) | 48.3% |
| Mad River near Urbana (1940) | 81.3% |
| Wolf Creek at Dayton (1987) | 42.5% |
| Great Miami River at Hamilton (1928) | 52.5% |

**To contact us...**
*By phone:* (937) 223-1271
*By fax:* (937) 223-4730
*By e-mail:* bgibson@miamiconservancy.org
*Internet:* www.miamiconservancy.org

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38 E. Monument Avenue
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