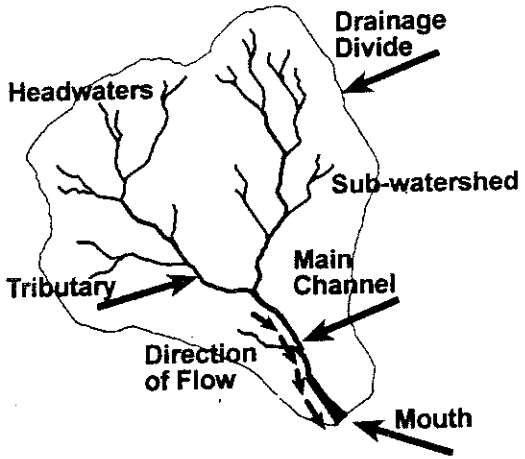
Background Information (Student Reading)

What Is a Watershed?

The area of land that drains to a common body of water, whether a stream, river, or lake, is called a **watershed** or **drainage basin**. Small streams, surrounded by small watersheds, flow into larger rivers with larger watersheds. The small stream's watershed is part of the larger river's watershed and is called a sub-watershed. The boundaries of a watershed are the higher elevation ridges and hills around a stream, river, or lake that separate it from the adjoining watershed. We call this boundary between two watersheds the **drainage divide**. From a drainage divide, water runs down gradient to a particular stream, river, or lake.

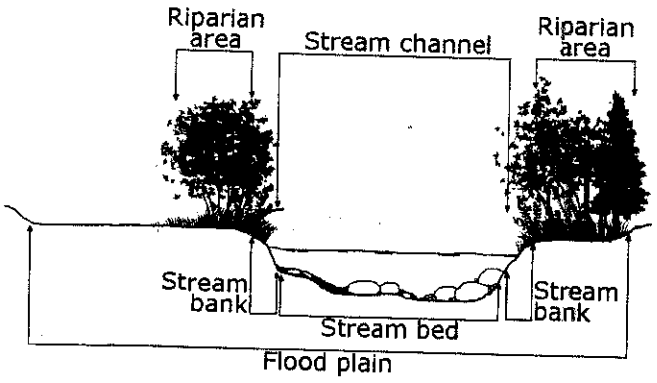
One way to understand watersheds is to go outside when it is raining and watch the flow of water on the parking lot, hillsides, and ditches. Recall from Lesson 1 that water falling to the ground as rain or snow can **evaporate, sublimate** (go from solid to water vapor), **transpire** through plants, **infiltrate** through the soil to the groundwater, or simply **run off.** If the ground is not frozen or saturated from previous rainstorms or snowmelt, much of the rain that falls on lawns, parks, farm fields, and forests will infiltrate, or seep, into the ground. Once the ground becomes saturated or frozen, most or all of the rain will runoff. Runoff moves from higher to lower elevations, traveling over a variety of surfaces or land cover types until it reaches a body of surface water, such as a stream, river, or lake. In Michigan, most of the surface water eventually runs into one of the Great Lakes.



Why Are Watersheds Important?
In order to effectively manage the land and protect water quality, we need to determine the boundaries of a particular watershed and define the land uses and land cover types in the watershed. The size of the watershed, the land cover types (grass, forest, pavement, etc.), and the land uses (farming, logging, residential, urban, etc.) affect the quantity and quality of water in the river, stream, lake, or groundwater. Because a single stream or river can flow through several towns, cities, counties, and even states, it is important to have all of these entities working together to protect water quality through a process called watershed planning.

Watershed Science
Streams receive their water from precipitation, groundwater, and runoff from the surrounding land in the watershed. The volume of streamflow typically increases with the increasing size of a watershed and will vary depending upon climate, soils, and slopes. **Hydrology** is the study of the quantity, distribution, and effects of water on the Earth's surface, in the soil and underlying rocks, and in the atmosphere.

The beginning of a stream is called its **headwaters.** In Michigan, this is typically a wetland or an area where groundwater comes to the surface; in mountainous areas, it would be an alpine lake or glacier. A stream then flows downstream from its headwaters to its **mouth**, where it empties into a larger river, lake, or ocean. Along the way, **tributaries** or smaller streams may join the main channel, bringing water from smaller, sub-watersheds. In Michigan, nearly all rivers flow into the Great Lakes.



A stream consists of three parts:

- **Stream channel** – area without vegetation containing the normal water flow. Stream channels vary in depth, width, roughness (bottom materials and obstructions which slow water velocity).
- **Stream bed** – the bottom of the stream channel usually clear of terrestrial vegetation.
- **Streambank** – the sides of the stream channel above the normal water line.
- **Floodplain** – relatively flat land adjacent to a stream, river, or lake that is periodically covered by flood overflows. The floodplain may be very broad or quite narrow.

Stream gradient is the change in elevation over a specific horizontal distance. The steepest gradients are usually in the upper watershed near the headwaters. The downstream portion of a stream tends to be flatter with more curves called **meanders**.

Stream velocity is the speed of the water (or distance the water travels over time) and is most often measured in meters/second. The velocity increases with steeper gradients. All streams transport sediments. Faster-moving water has more energy and more potential to erode streambanks. The rocks, logs, gravels, silt, and sand carried by the stream are the stream's **sediment or bed load**. When the velocity slows, sediments are deposited in pools and along the edges of stream channels.

Stream discharge or **steamflow** is the volume of water that passes a specific point on a stream within a certain period of time (usually expressed in cubic meters or cubic feet per second). Streamflow increases downstream because of the greater land area draining into a stream and the addition of many tributary streams. Stream discharge changes throughout the year in response to the local weather or climate. In Michigan, discharge rates are lowest in late summer (due to low rainfall) and during the winter (due to frozen snow and ice). Stream discharge is highest in spring due to snowmelt and rain. A **hydrograph** is a graph of streamflow versus time (usually months of the year). Hydrographs provide a way to compare monthly, seasonal, and annual changes in streamflow.