MODULE 2 | Overview of Watershed Systems

Module Outline

- What is a Watershed?
- Watersheds in New Jersey
- How do New Jerseyans Use Watersheds?
- Principles of Watershed Hydrology
- Natural Watershed
What is a Watershed?

- An area of land that water flows across, through, or under on its way to a stream, river, lake, ocean or other body of water.

- A watershed is like one big bathtub...
What makes up a Watershed?

What Do Watersheds Look Like?

- Watersheds come in many different shapes and sizes:
  - Can range in size from a few acres to a thousands of square miles
  - Can be flat or hilly, undeveloped or developed, farmland, or forests...
We find watersheds **EVERYWHERE**. **ALL** land area is part of a watershed. We **ALL** live in a watershed.

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  - Natural Watershed Functions and Features
New Jersey Watershed Management Areas

New Jersey has...
5 Watershed Regions
- Atlantic Coast
- Lower Delaware
- Upper Delaware
- Passaic
- Raritan

20 Watershed Management Areas
Watershed Management Area Representation

- #9 Lower Raritan, South River, and Lawrence - 8 Participants
- #12 Monmouth - 6 Participants
- #18 Lower Delaware — 4 Participants
- #14 Mullica and #20 Assiscunk, Crosswicks, and Doctors—3 Participants Each
- #19 Rancocas, #11 Central Delaware, #14 Mullica, and #17 Maurice, Salem and Cohansey, #16 Upper Passaic, Whippany, and Rockaway, #1 Upper Delaware — 1 Participant Each

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How Do New Jerseyans Use Watersheds?

% Land Use in New Jersey

3rd Generation, Statewide, Detailed Land Use Land Cover for New Jersey. Courtesy of NJDEP
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- Natural Watershed Features and Functions

Principles of Watershed Hydrology

- Hydrology = “study of water”
- Nearly 75% of the Earth’s surface is covered with water.
- Water is constantly cycling via an endless process known as the water cycle, or the hydrologic cycle.
The Water Cycle

- Evaporation
- Runoff
- Condensation
- Precipitation

Clouds & Water Vapor

Precipitation

Freshwater Storage

Surface Runoff

Infiltration

Evapotranspiration

Evaporation

Free Water Storage in Ice and Snow

Groundwater Flow

Freshwater Storage

Water Storage in Oceans

Water Table

Bedrock

Dr. Evie Shin and Credit: Image Wikipedia
Where Does Precipitation Go?

1. It can *run off*
Where Does Precipitation Go?

2. It can be absorbed by plants and used for photosynthesis and other biological processes.

Where Does Precipitation Go?

3. It can *infiltrate* through the soil surface and percolate downward to groundwater *aquifers*.
Where Does Precipitation Go?

4. It can evaporate

Where Does Precipitation Go?

5. It can be stored in ice caps, glaciers, lakes, reservoirs and other surface bodies of water
Land Use/Land Cover Changes

- **Land use**
  - How land is used by humans:
    - Agriculture
    - Industry
    - Urban
    - Residential
    - Recreation

- **Land cover**
  - Biological or physical features of land:
    - Forests
    - Grasslands
    - Agricultural fields
    - Rivers, lakes
    - Buildings, parking lots

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Natural Watershed Functions

- **Hydrological Functions**
  - Capture
  - Storage
  - Release

- **Ecological Functions**
  - Provide diverse sites for biogeochemical reactions
  - Provide habitat for plants and animals

Hydro Function #1: Capture

- $H_2O$ is transferred from atmosphere and is “captured” in the soil
- $H_2O$ can then infiltrate through soil surface and percolate downward into soil profile
Hydro Function #2: Storage

- Water is stored in the pores (air spaces) between soil particles in the soil profile.

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Hydro Function #2: Storage

<table>
<thead>
<tr>
<th>DEVELOPED AREA</th>
<th>UNDEVELOPED AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>55% runoff</td>
<td>10% runoff</td>
</tr>
<tr>
<td>10% shallow infiltration</td>
<td>25% shallow infiltration</td>
</tr>
<tr>
<td>30% evapotranspiration</td>
<td>40% evapotranspiration</td>
</tr>
<tr>
<td>5% deep infiltration</td>
<td>25% deep infiltration</td>
</tr>
</tbody>
</table>
Hydro Function #3: Release

- Water moves underground, through the soil profile, or across the land surface as runoff

Tributary to Oldmans Creek Eastern Box Turtle

Natural Watershed Functions

- Hydrological Functions
  - Capture
  - Storage
  - Release

- Ecological Functions
  - Provide diverse sites for biogeochemical reactions
  - Provide habitat for plants and animals
Eco Function #1: Biogeochemical Reactions

- **Biogeochemical cycling**
  - the biological, physical and chemical transformations of nutrients that are found in soil, water, and air.
- Very complex interactions that help maintain plant and microbial communities.

Eco Function #2: Habitat

- **Habitat = “home”**
- Watersheds provide critical habitat for all kinds of plants and animals
Watershed Feature #1: Upland

- **Upland** = area of land at a higher elevation above a water body
- Forms watershed boundaries, or *divides*
- Provides habitat, stabilizes soil, minimizes soil erosion, filters surface runoff
Watershed Feature #2: Floodplain

- *Floodplain* = flat area of land surrounding a water body that is subject to periodic flooding
- Holds excess water after precipitation events, filters out sediment, provides habitat, and recreation for wildlife.

Watershed Feature #3: Riparian Zone

- *Riparian* = “of the river”
- The non-cultivated, vegetated land that touches and immediately surrounds a body of water
- Often includes wetlands which help to:
Watershed Feature #4: Water Body

- Any stream, river, pond, lake estuary, ocean, or other body of water
- Water bodies can be flowing (*lotic*) or non-flowing (*lentic*)
- Flow of water greatly affected by topography, slope, soils and vegetation

Closing thoughts...

- ALL parts of a watershed are *EQUALLY* important.
- Proper care of the uplands, floodplains, riparian zones, and water bodies keeps the watershed functioning properly.
- The ideal condition will keep most water where it falls, reduce runoff, and allow for moderate streamflows.
Key Points to Remember...

- A watershed is an area of land that water flows across or under as it drains to a body of water.
- Watersheds are everywhere!
- Watersheds are used for many different purposes.
- Watersheds are a critical component of the water cycle, which is an endless process that cycles water and distributes it across the Earth.
- Watersheds have hydrological and ecological functions.
- Watersheds have natural features that help them perform their hydrological and ecological functions.
- Everyone LIVES in a watershed!