Impacts of Water Conservation and Storm Water Management in Oakland County, Michigan

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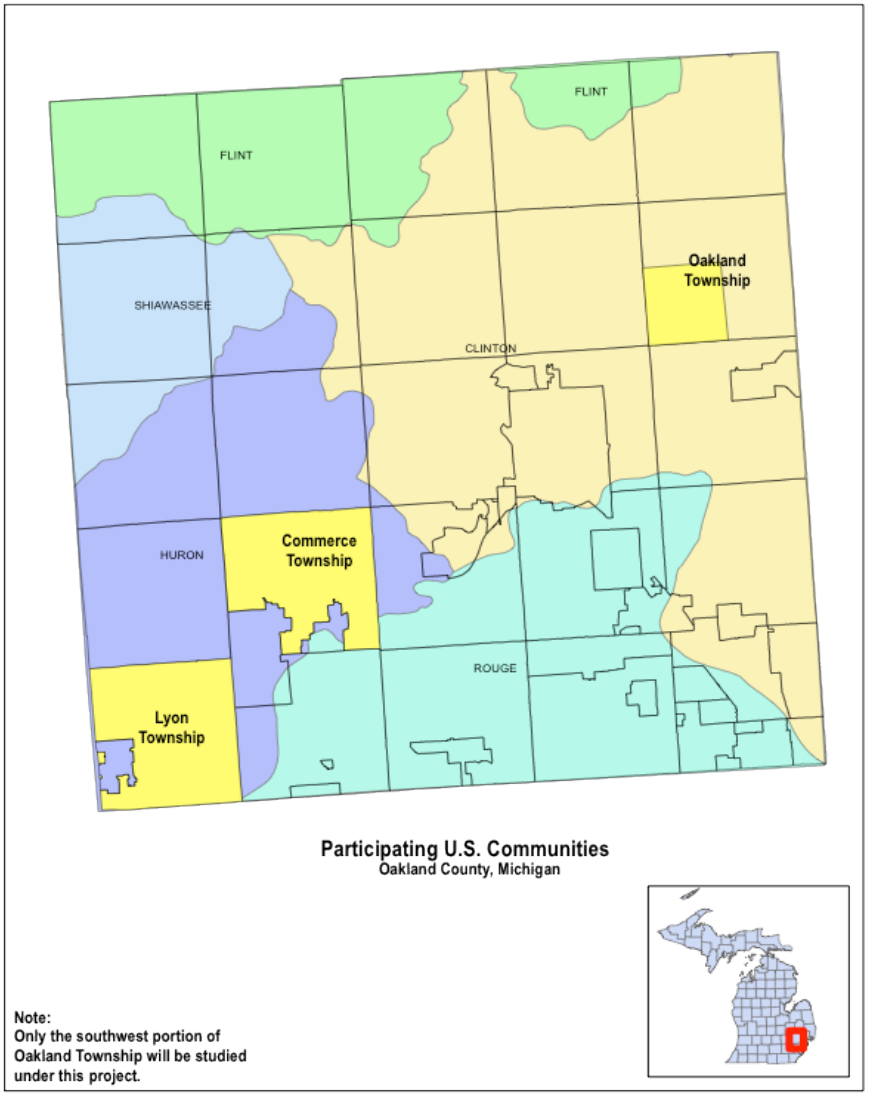
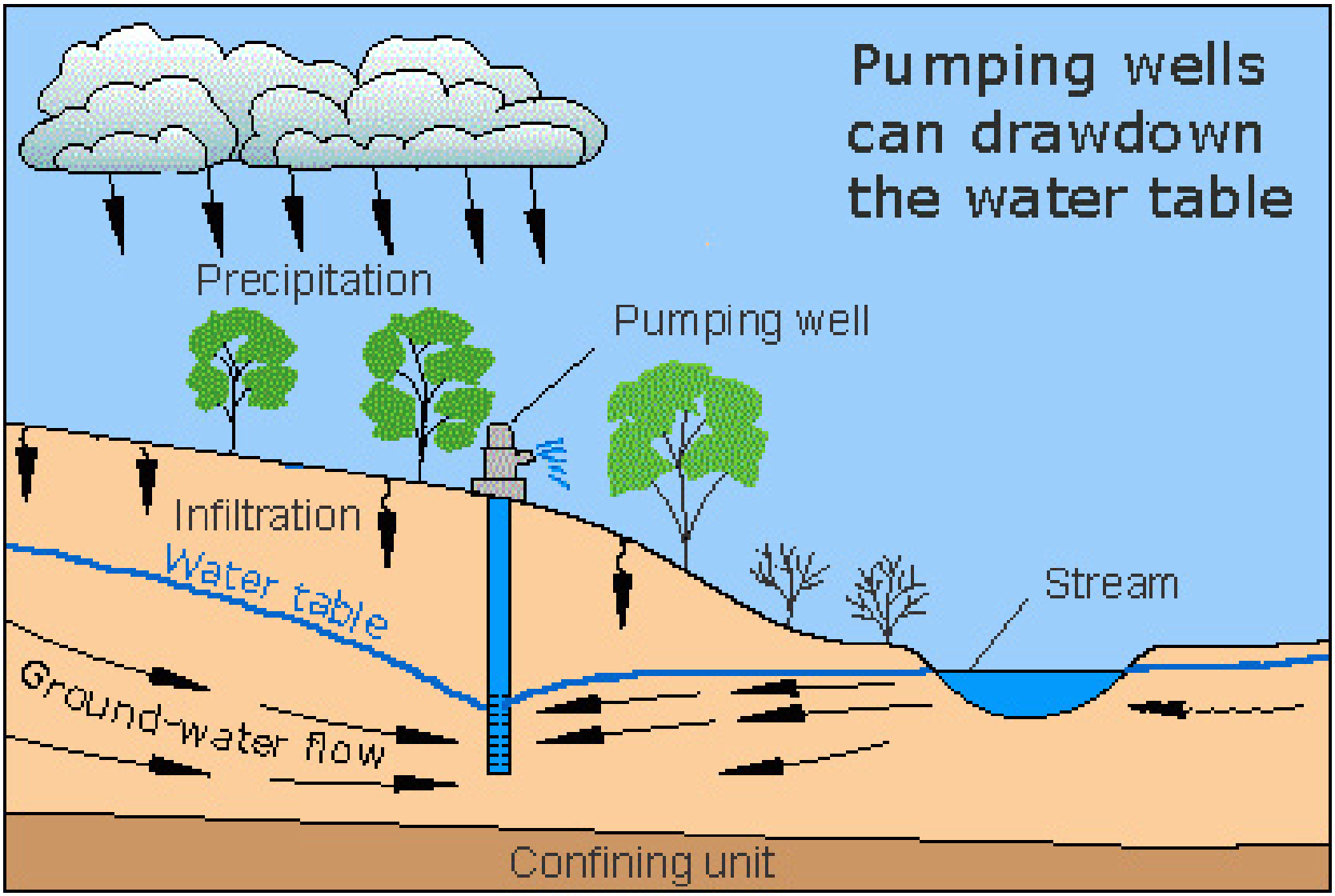
The Michigan Municipalities



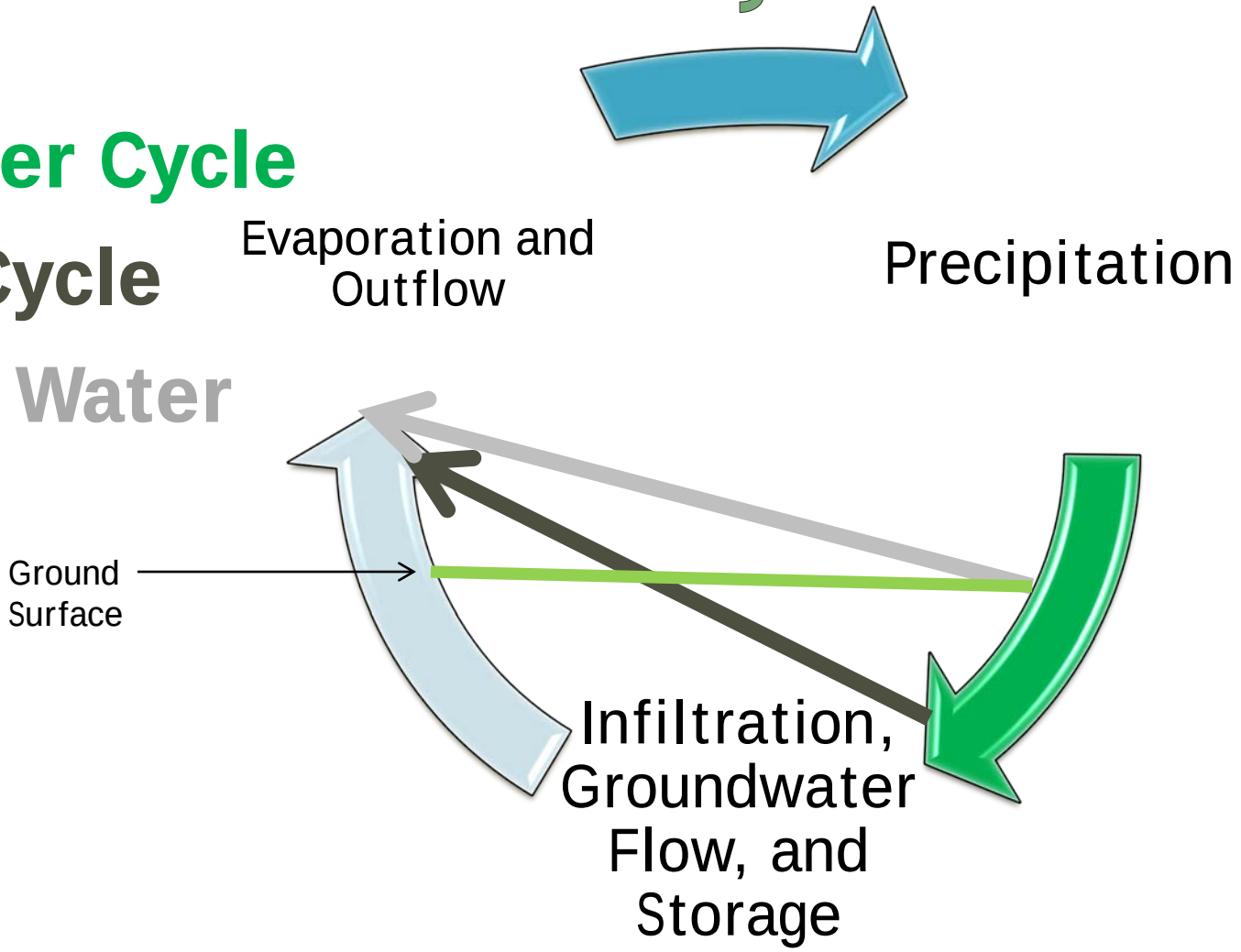

Pumping wells can drawdown the water table
Precipitation
Pumping well
Infiltration
Water table
Stream
Ground-water flow
Confining unit

The Three Water Cycles

Natural Water Cycle

Water Use Cycle

Interrupted Water Cycle



Factors that Dictate Water Use Impacts

- Type of water supply used
- Local hydrology
- Development patterns
- Upstream water use
- Storm water management design
- Wastewater discharge location

Different Water Sources Cause Different Impacts

- What are the impacts if 1 MGD of water is withdrawn from…
  - A Great Lake?
  - A groundwater aquifer?
  - A river source?

Broad vs. Concentrated Impacts of Stormwater

- Rain falls over a broad, large scale surface area.
- Water is pumped from wells – impact is concentrated in that specific area.
- When water falls on pavement, water is moved from a wider area and discharged to specific concentrated locations in a stream.

Urbanization Impacts

- More impervious surfaces
- More debris in runoff
- Less natural infiltration
- Increasing storm sewer and POTW flows
- Blacktop temperatures
- More CSO's

Runoff Gallons per Road Mile

Cover Type	Soil Type	Area (sf)	Area (ac)	Runoff Volume, V (ft^3)	Runoff Volume (gallons)	Yearly Average Volume (gal)
Assuming D Type Soils						
Pavement and Rooftop	D	126,720	2.9091	8,352	62,473	1,360,946

- 1-inch Rain
- 24 Foot Wide Road
- 1 mile long
- Does not include parking lots or runoff from land adjacent to roads

Rooftop Capture

- What size of cistern would capture rooftop runoff?
- Can the water be reused?
- Can it be released at later times to enter the system?

How much water runs off of a 1 mile road, 24 feet wide?

- Assuming a 1 inch rain event, approximately 400 Million Gallons of water runs off from impervious surfaces alone.
  - 5400 miles of roads in all of Oakland County = 7.3 million gallons per year
  - 450 miles of roads in Region of Waterloo = Over 600 million gallons per year
  - 330 miles of roads in Guelph = Almost 450 million gallons per year

Volume of Water Falling on a Roof

Cover Type	Area (sf)	Area (ac)	Runoff Volume, V (ft^3)	Runoff Volume (gallons)	Yearly Average Volume (gal)
Assuming D Type Soils					
Pavement and Rooftop	1,250	0.0287	82	616	13,425

- 1 inch rain
- 25 x 50 foot roof (1250 sq. ft.)

Wells Sensitive to Rainfall and Use

- Recharge comes primarily from snow melt and spring rains
- Summer rain is more likely to evaporate and not go to recharge
- Oakland County groundwater levels are generally very good.
- Static levels of water table can fluctuate based on rainfall and well use.
- Need to monitor storm water movement to ensure groundwater does not have significant water diverted to streams directly.

Recharge and Projecting Water Use Reductions

- Main recharge occurs primarily in winter snow melt and spring rains
- Summer rainfall more likely to evaporate off the surface
- Need to look at spring rainfall and impact on groundwater levels
  - Anticipate lower groundwater levels during main outdoor watering season
  - Provide public education on potential need for outdoor watering reductions

The Cost and Value of Green Infrastructure

Management Practice	Proposed Area (ac)	Area (sf)	Volume Captured (cf)	Volume Captured (gal)	Contractor
Urban Reforestation	1.00	43,560	489	3,659	$110,000
Forest Retention	1.00	43,560	6,850	51,932	$110,000
Wet Meadow	1.00	43,560	43,560	325,872	$80,000
Native Prairie	1.00	43,560	339	2,539	$30,000
Agriculture	1.00	43,560	339	339	$28,000
Rain garden	0.01	218	1,234	9,233	$3800
	20.00	linear feet			
Bioswales	0.01	420	420	3142	$900

Summary of Lessons Learned for Decision-Making

- Need to take integrated water system approach to planning
- Need to combine both water supply and water management in planning
- Central part of solution is a combination of water conservation/efficiency and green infrastructure programs

Broader Impacts Vision

- Understand the ecological and societal impacts of water withdrawals and distribution
- Understand how communities can benefit environmentally, economically using water conservation methods