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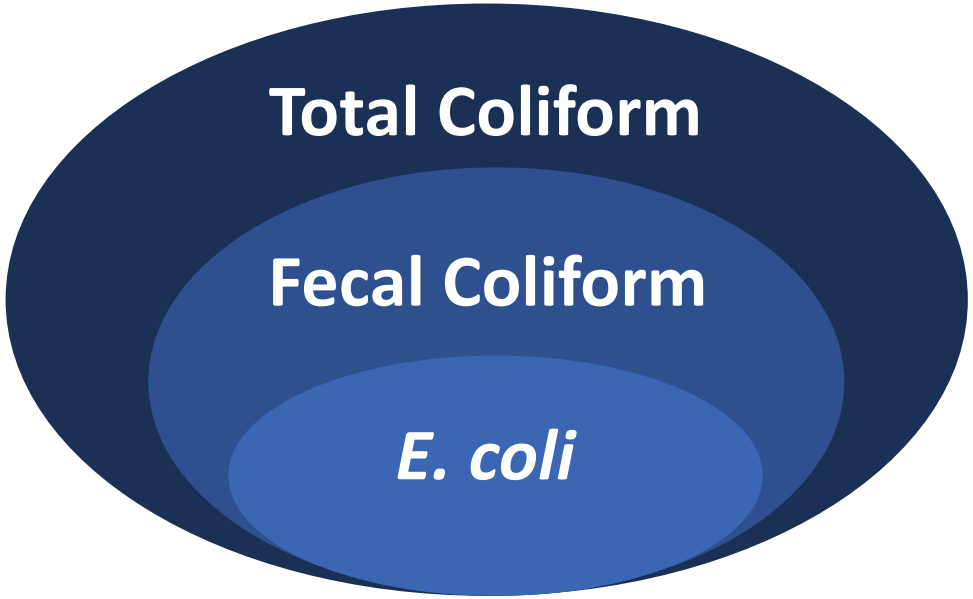
Bacteria in Storm Water

- Type of Bacteria
- Sources & Hot Spots
- TMDLs for Bacteria
- Modeling & Monitoring
- Reduction Approaches

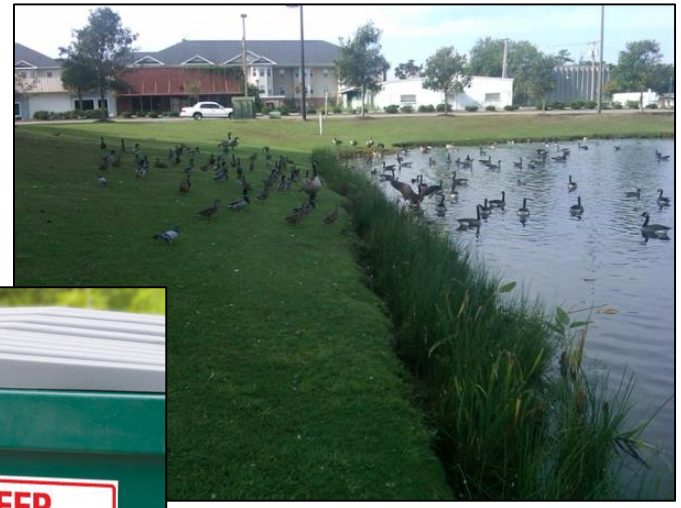
Bacteria in Storm Water

- Harmful bacteria in fecal matter
- Testing for specific bacteria is difficult & expensive
- Indicator bacteria: Fecal Coliform, *E. coli*



Bacterial Hot Spots

- Poorly maintained storm water ponds
- Pet walking paths
- Large rooftops & parking lots
- Uncovered dumpsters
- Illicitly connected sewers
- Damaged sewer pipes
- Business that raise/sell/keep animals



TMDL:

Maximum pollutant loading that a water body can receive while still meeting the Clean Water Act 303(d) water quality standards

TMDL: ΣWLA + ΣLA + MOS + RC

TMDL: $\boxed{\Sigma WLA}$ + ΣLA + MOS + RC

Wasteload Allocation

TMDL: ΣWLA + ΣLA + MOS + RC

Load Allocation

TMDL: ΣWLA + ΣLA + MOS + RC

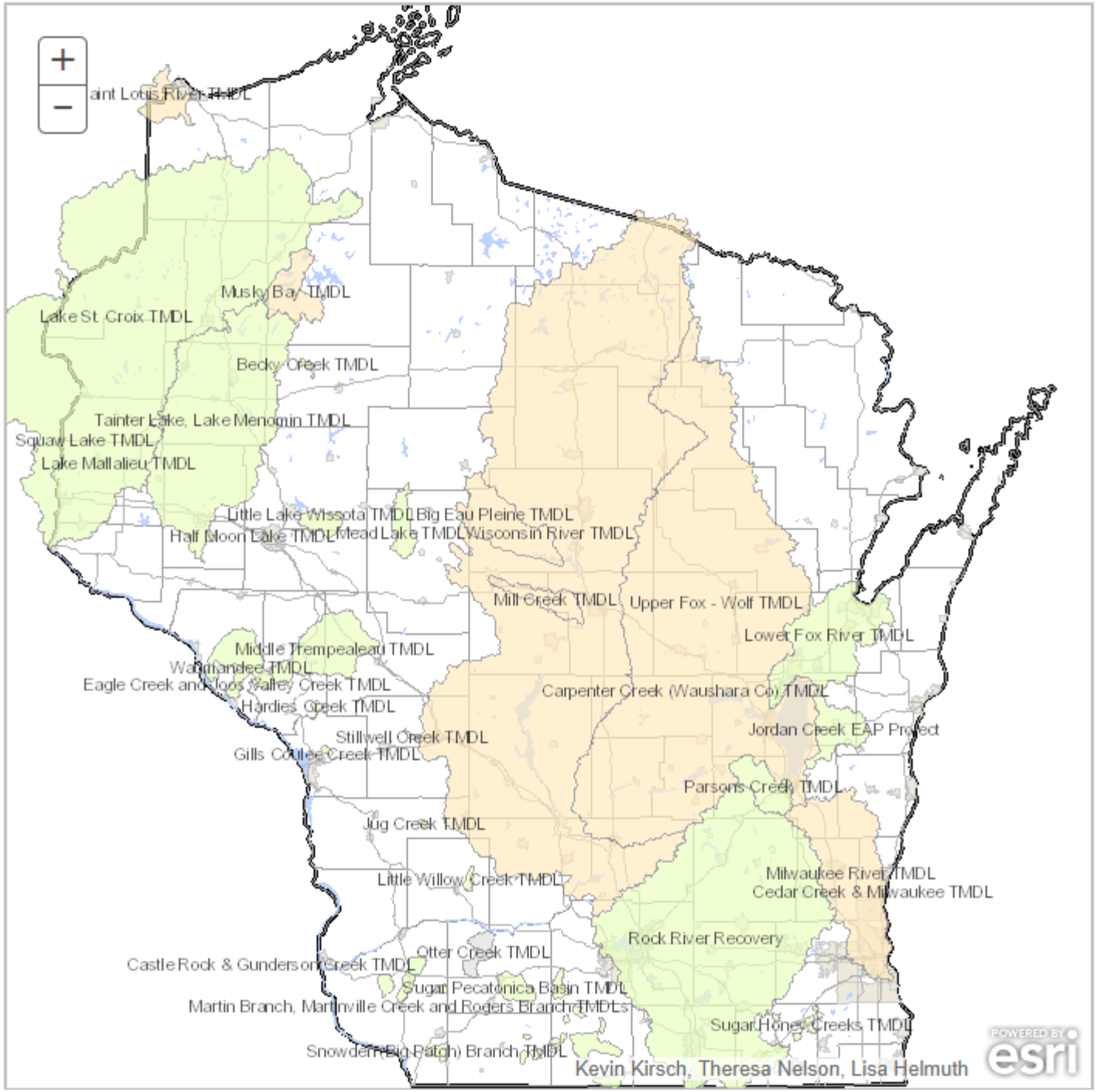
Margin of Safety

TMDL: $\Sigma WLA + \Sigma LA + MOS + \boxed{RC}$

Reserve Capacity

TMDL: $\boxed{\Sigma WLA} + \Sigma LA + MOS + RC$

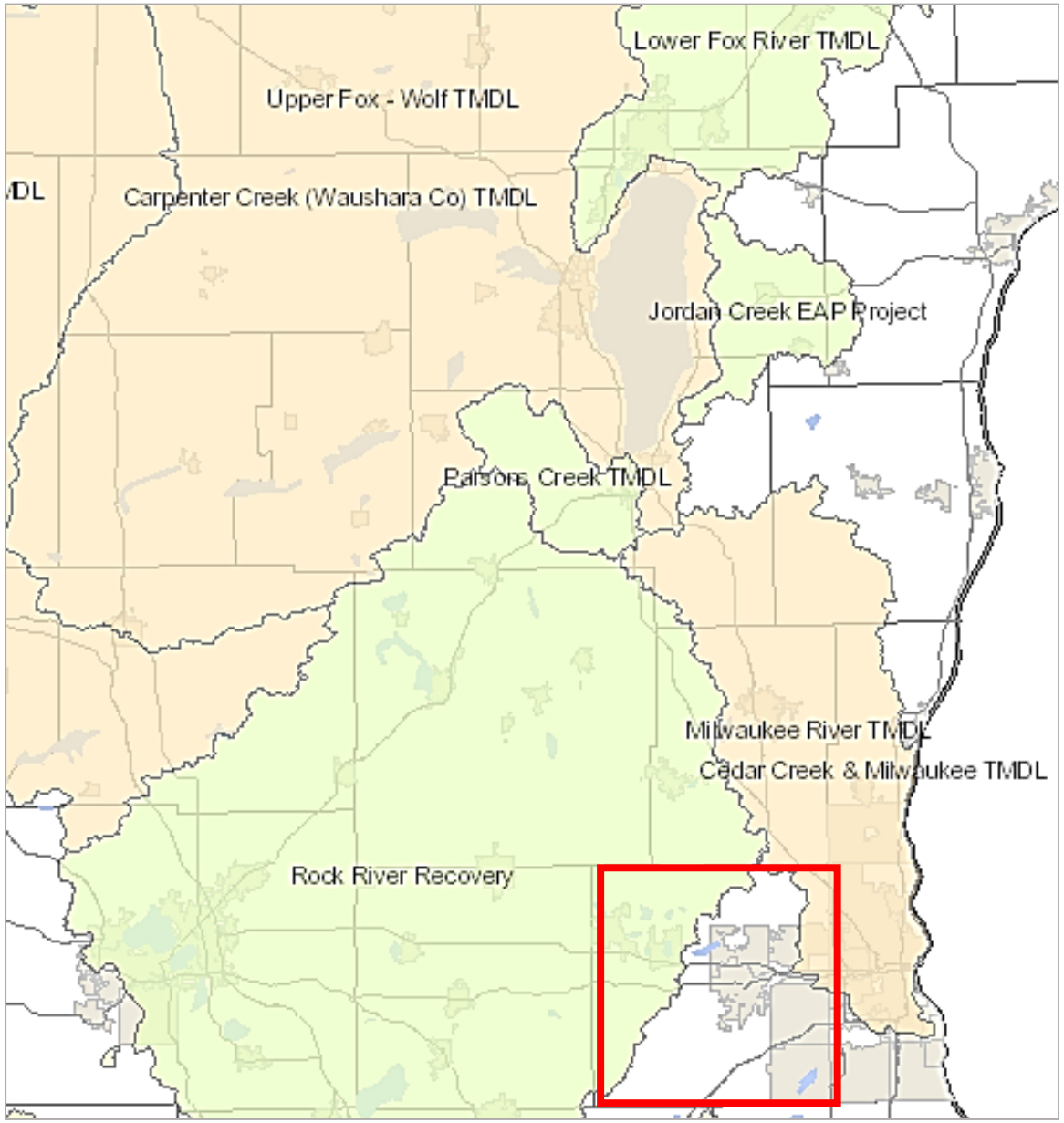
MS4 Permit Requires TMDL Compliance for TSS, phosphorus, AND bacteria



Wisconsin TMDL Status

- TMDL Approved
- TMDL Implementation
- TMDL Development

Wisconsin DNR
TMDL Status Map



Wisconsin TMDL Status

- TMDL Approved
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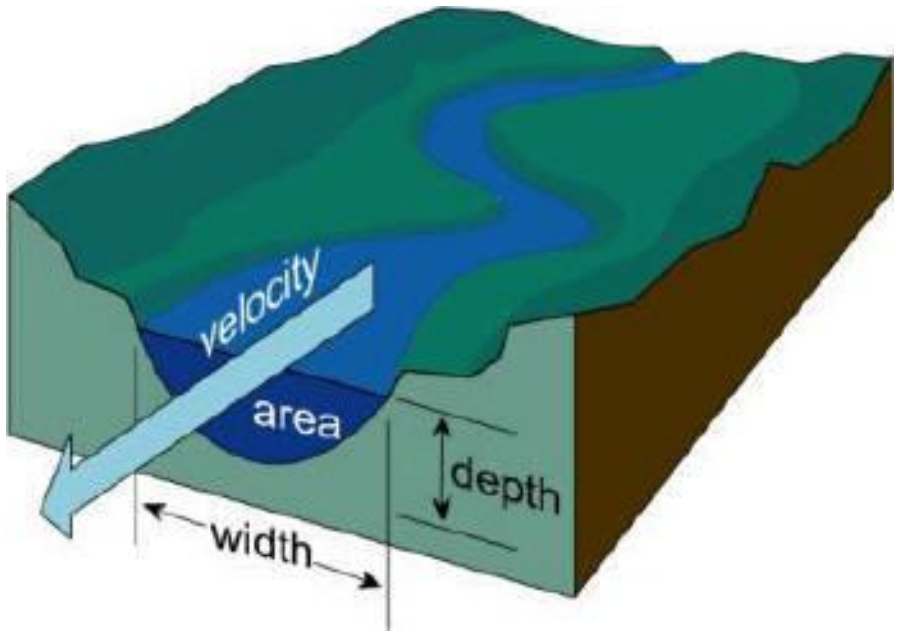
Wisconsin DNR
TMDL Status Map

TMDL:

1. **Critical values for flow conditions**
2. **Assimilative capacity of stream**
3. **Maximum exceedance value**
4. **Pollutant source**

Total Maximum Daily Load (TMDL)

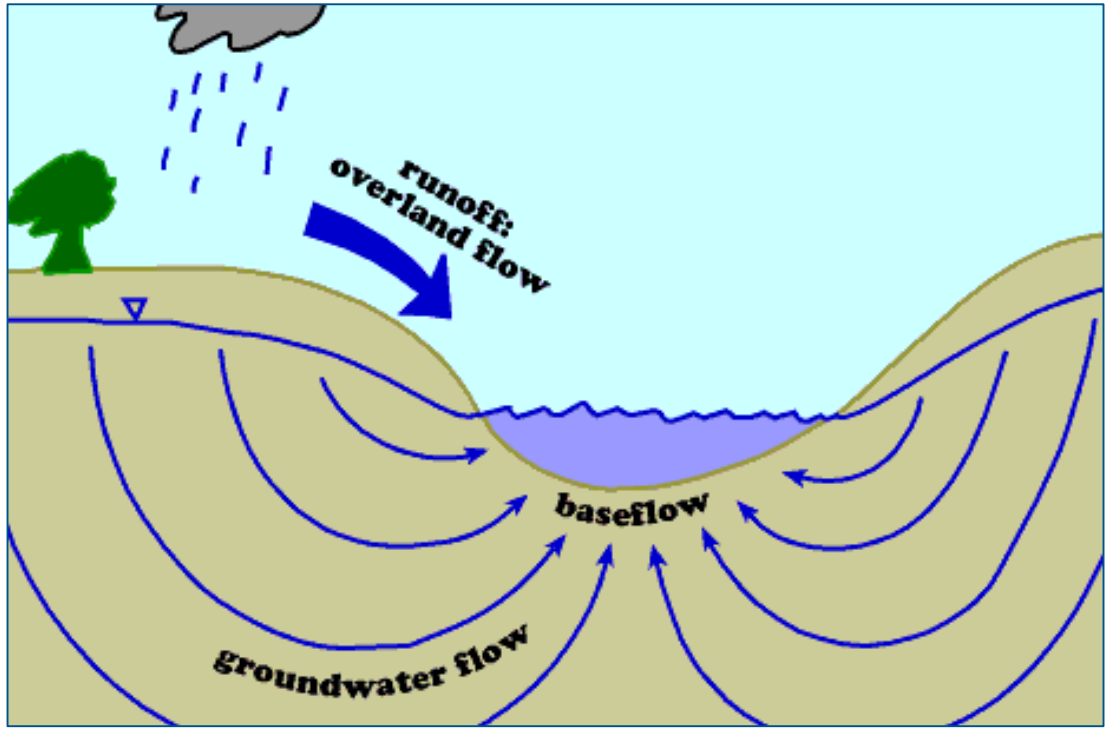


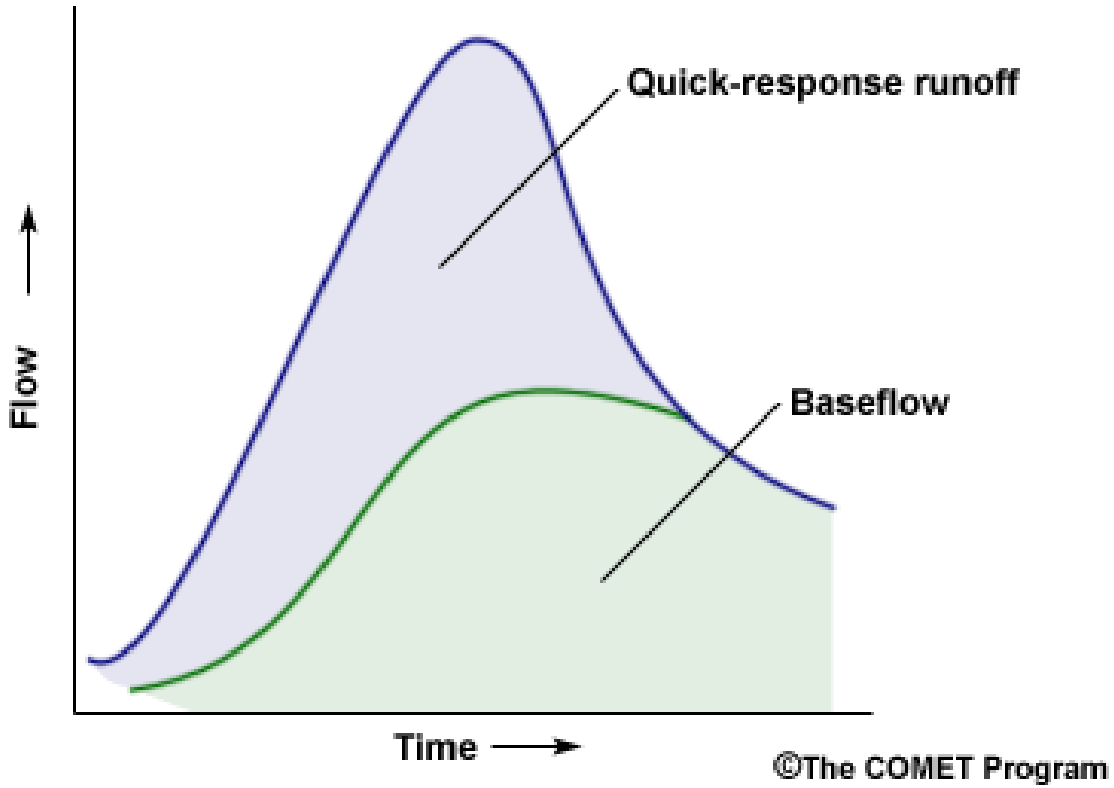
Low Flow Dry Conditions Mid-range Flow Moist Conditions High Flow

1. **Critical values for flow conditions**

Zaimes, George & Emanuel, Rober. (2006). Stream Processes for Watershed Stewards.

Total Maximum Daily Load (TMDL)

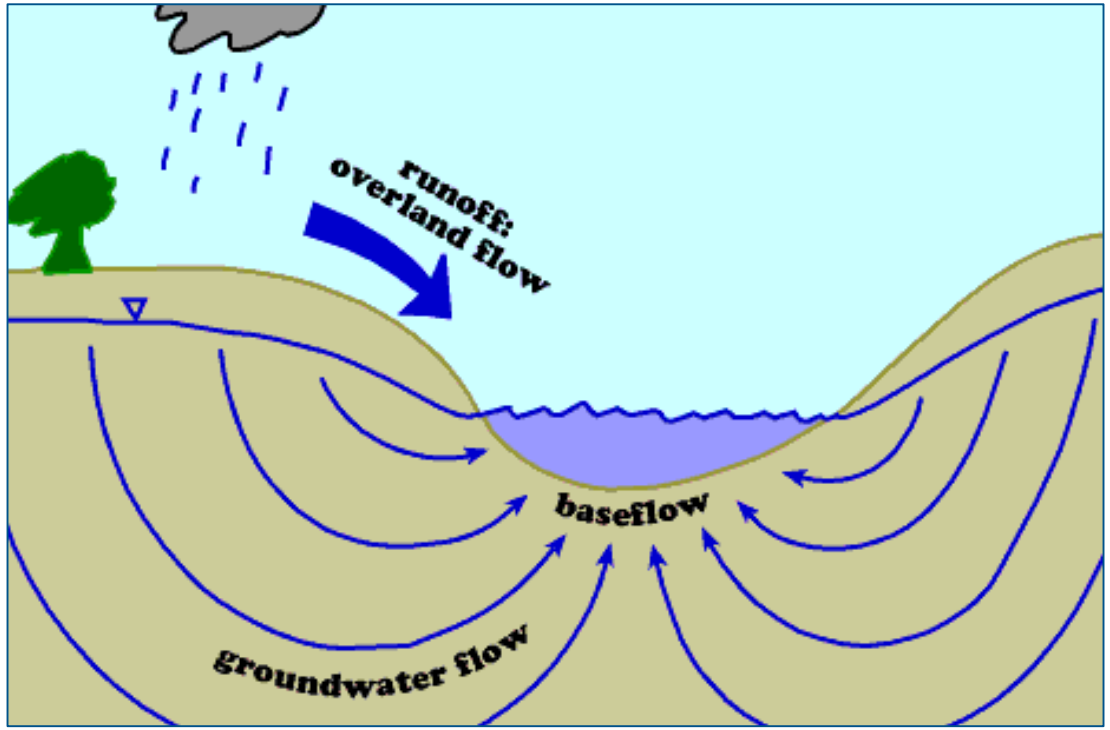


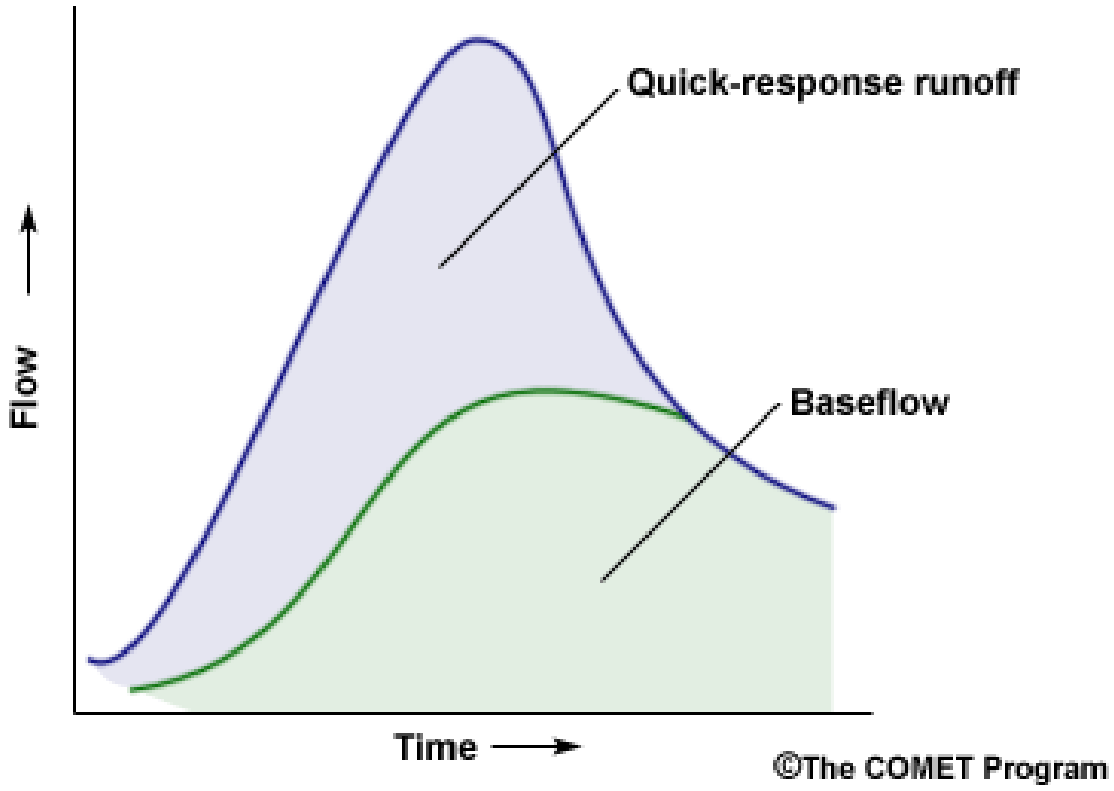


2. Assimilative capacity of stream

http://www.columbia.edu/~vjd1/streams_basic.htm
http://stream1.cmatc.cn/pub/comet/HydrologyFlooding/hydrograph/comet/hydro/basic/UnitHydrograph/print_version/02-terminology.htm

Total Maximum Daily Load (TMDL)

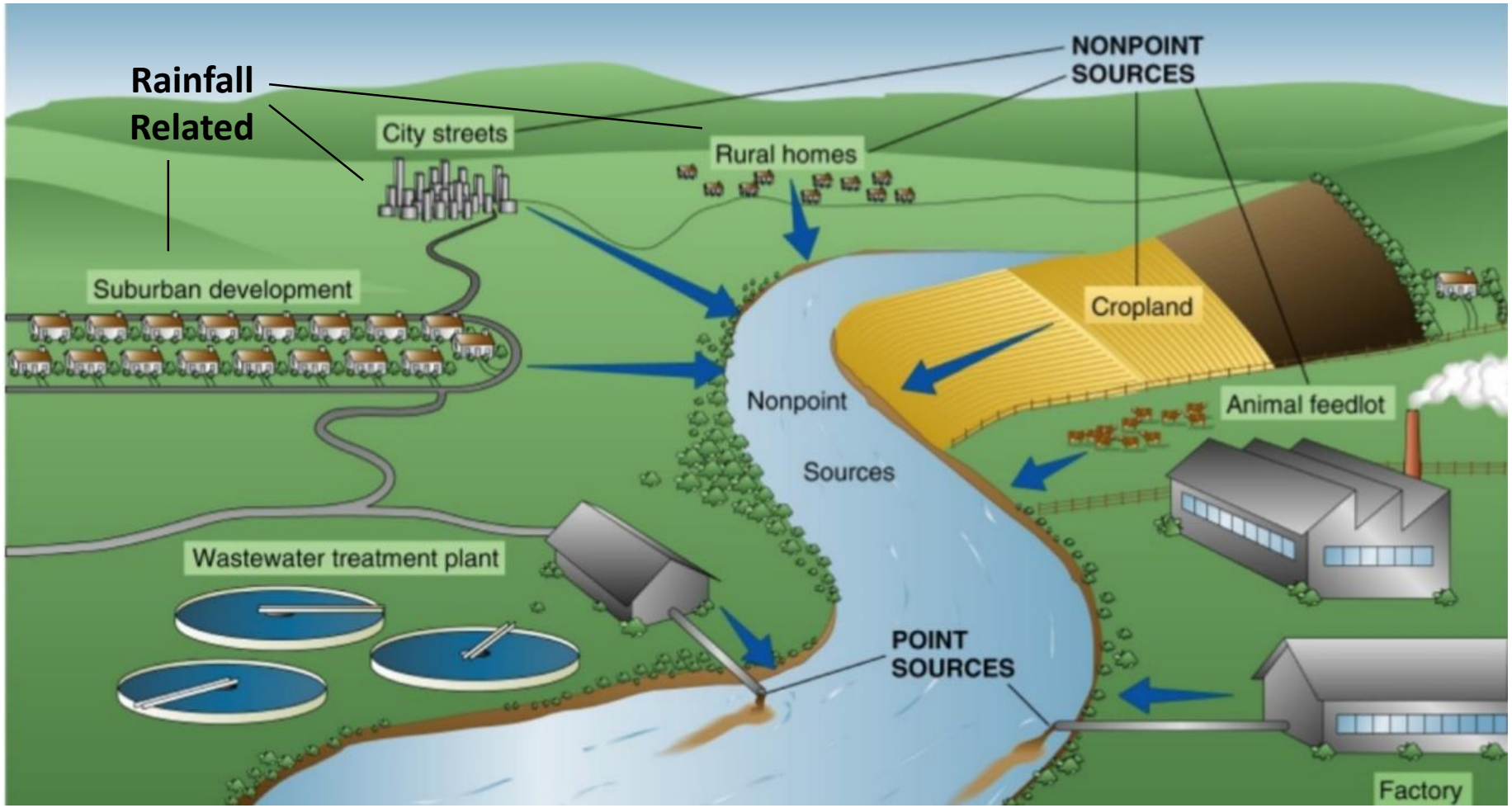




3. Maximum exceedance value

http://www.columbia.edu/~vjd1/streams_basic.htm
http://stream1.cmatc.cn/pub/comet/HydrologyFlooding/hydrograph/comet/hydro/basic/UnitHydrograph/print_version/02-terminology.htm

Total Maximum Daily Load (TMDL)



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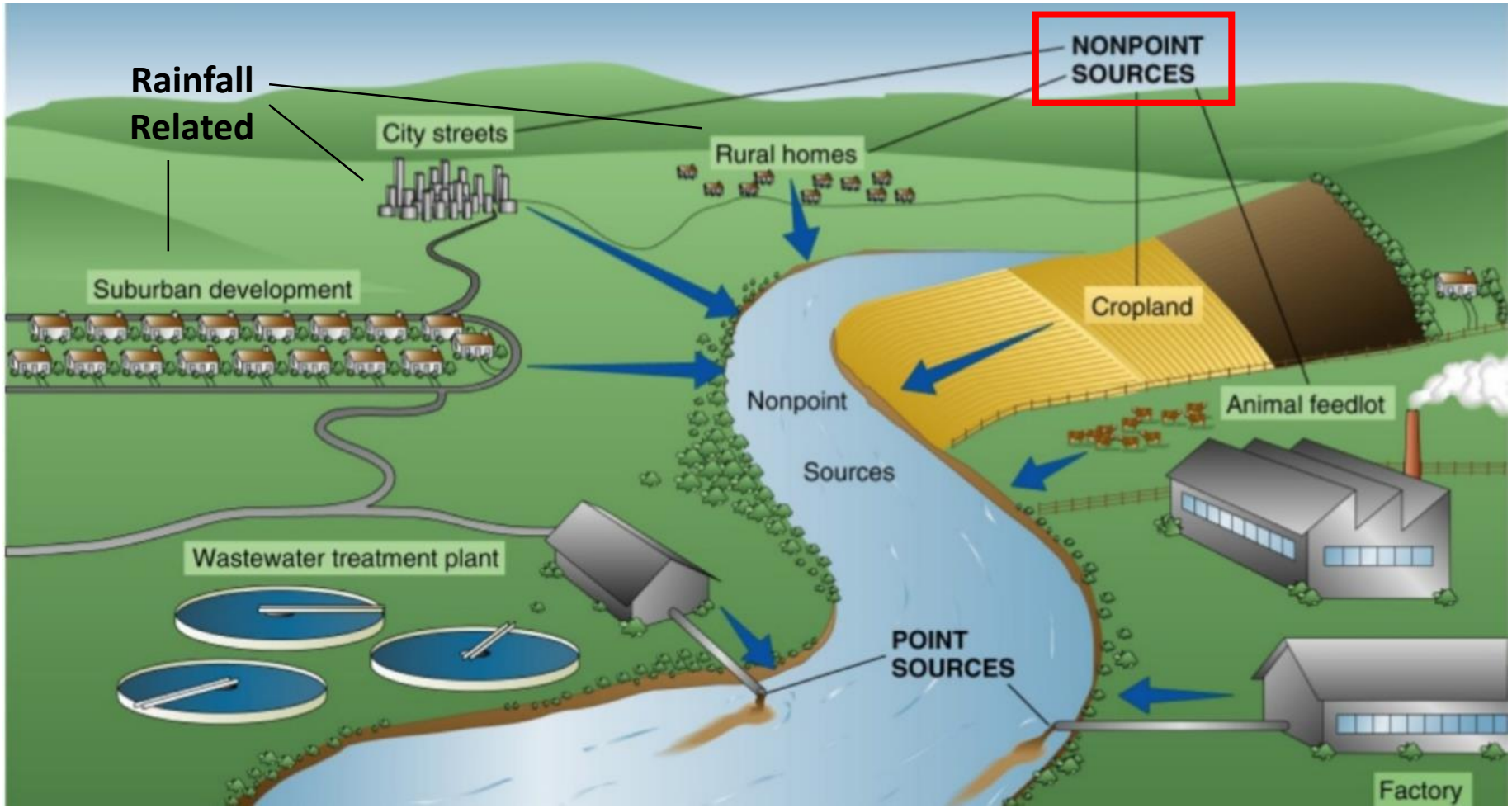
4. Pollutant source

Total Maximum Daily Load (TMDL)



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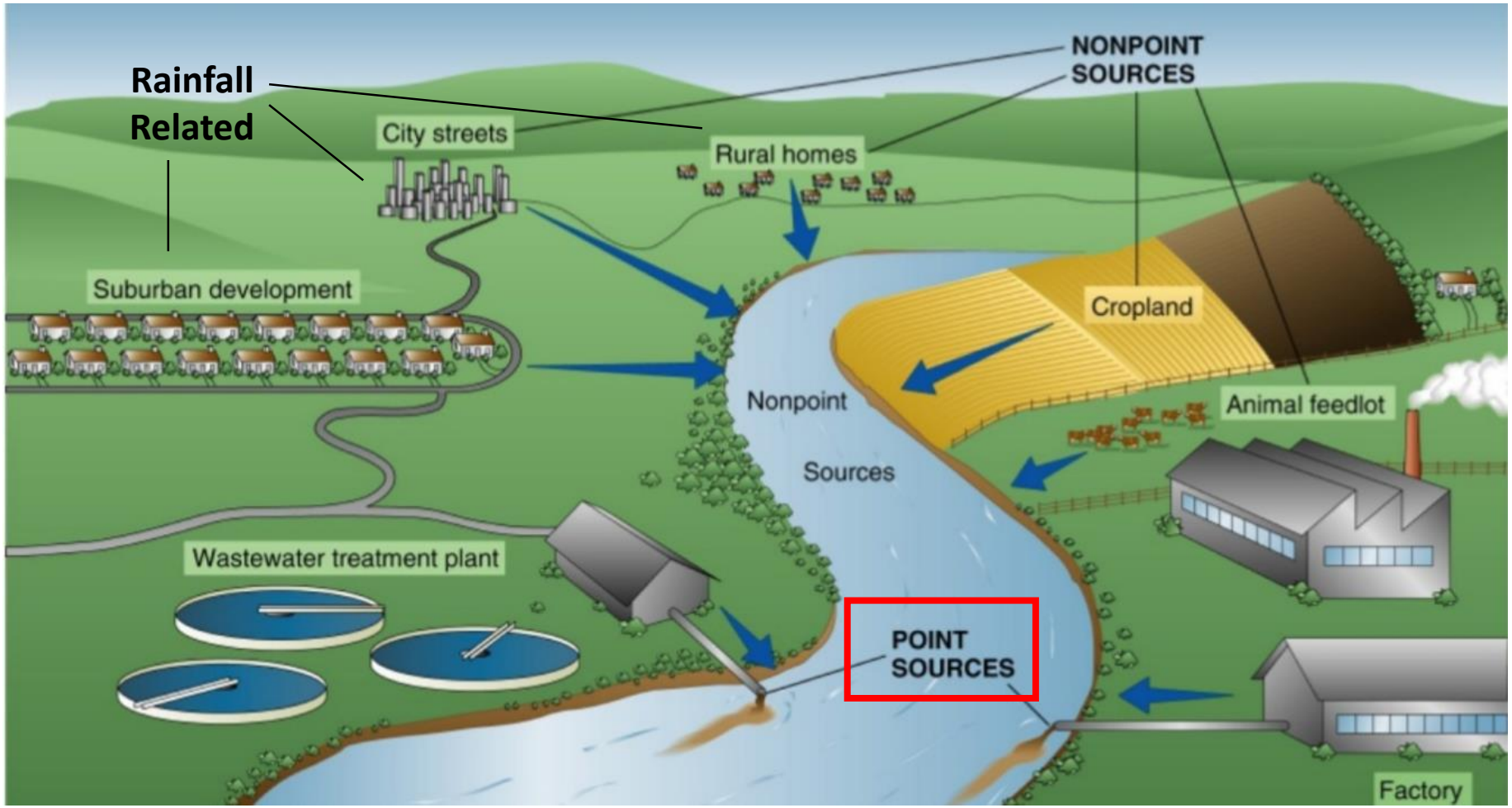

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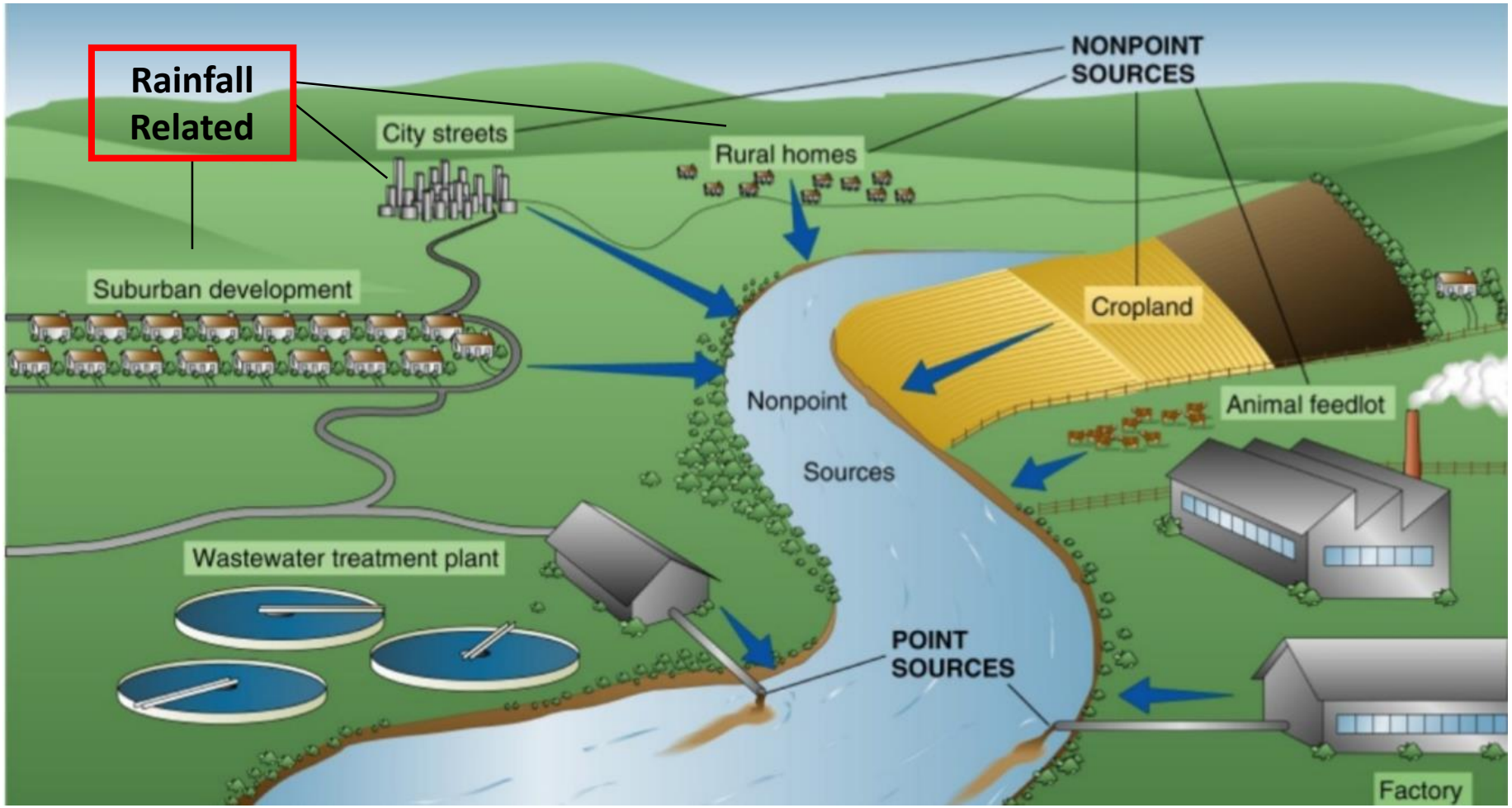

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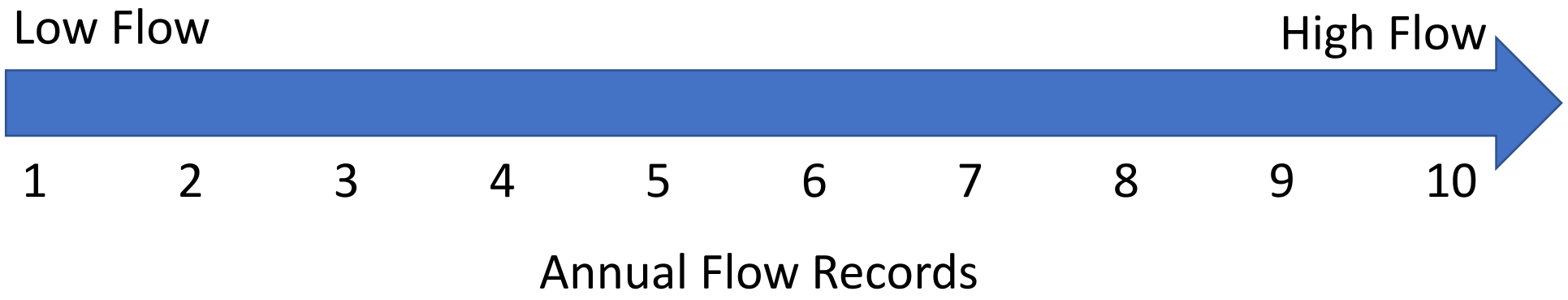
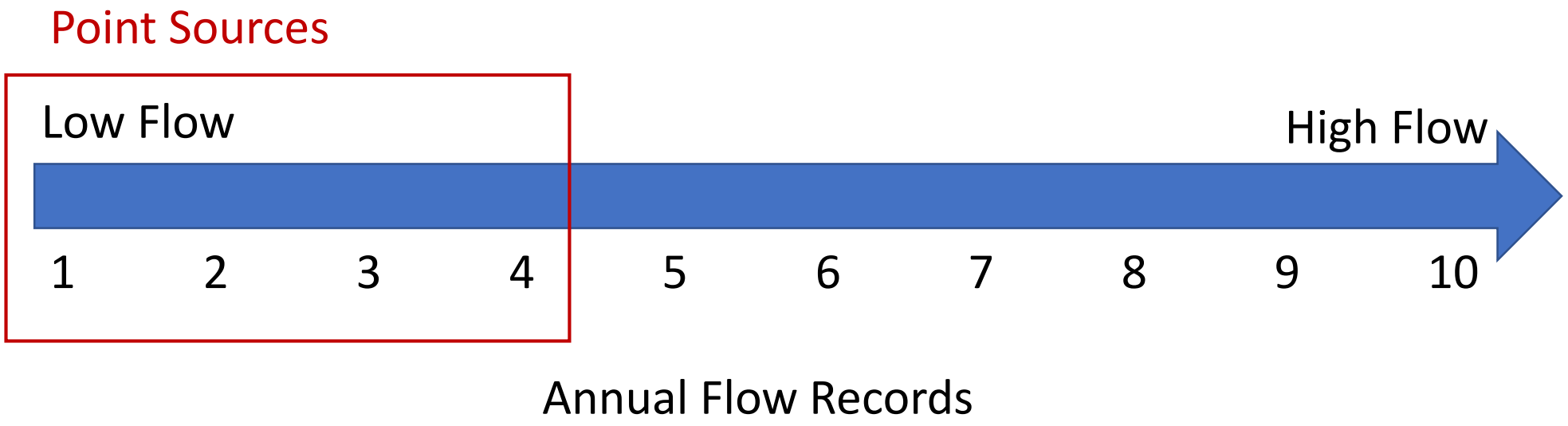


TSS and Phosphorus

Total Maximum Daily Load (TMDL)



TSS and Phosphorus

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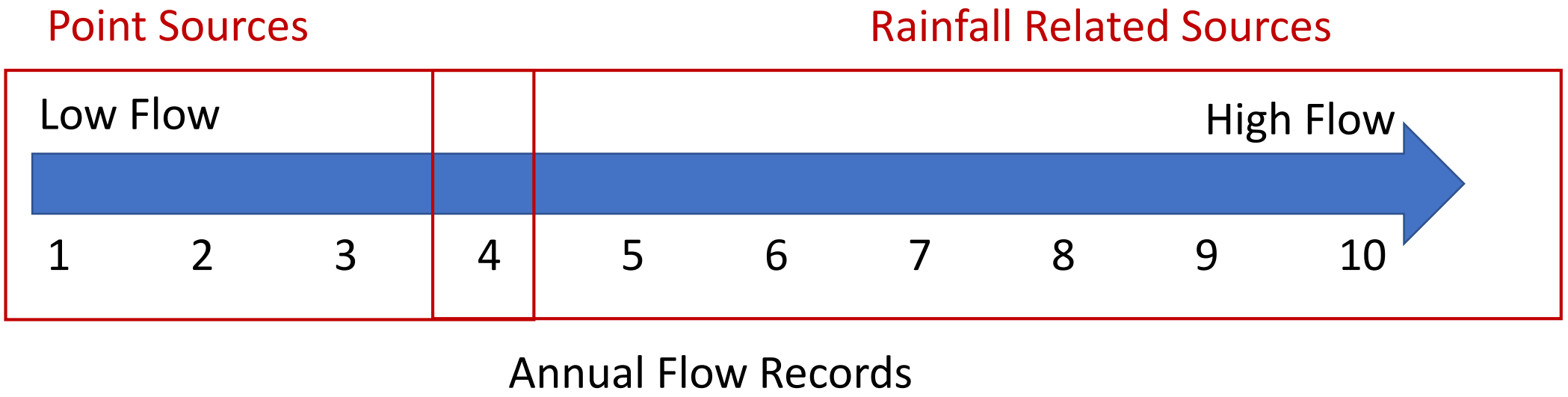

TSS and Phosphorus

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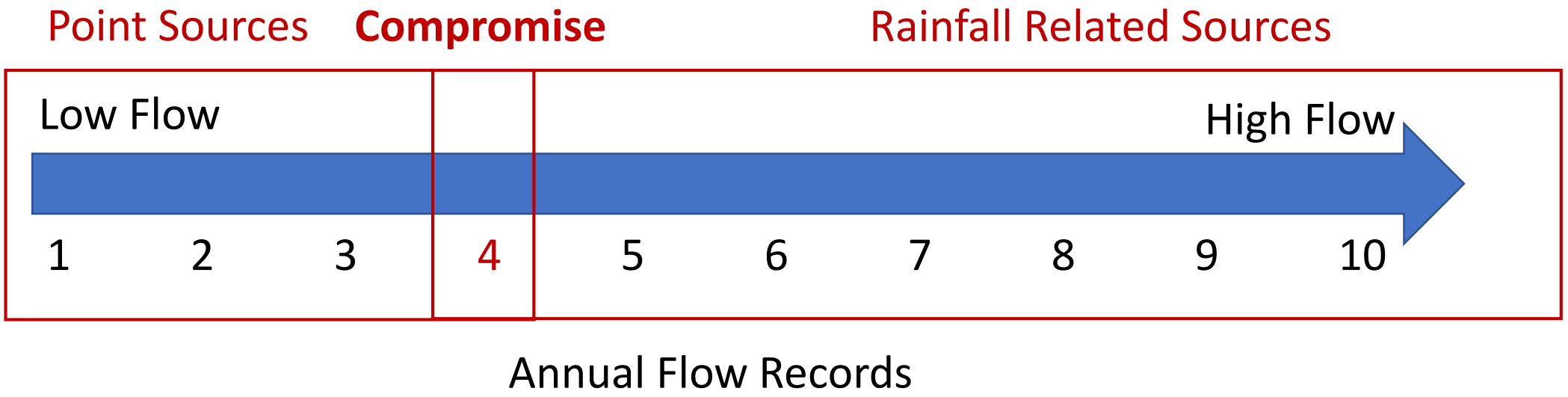

TSS and Phosphorus

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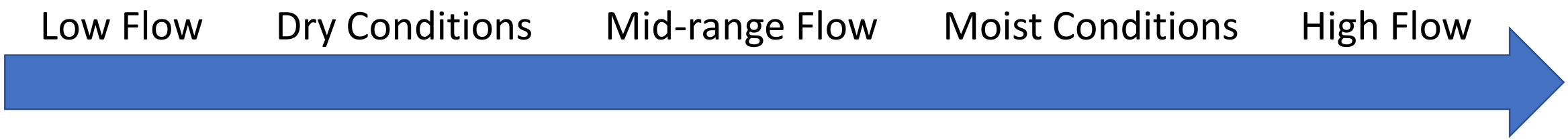
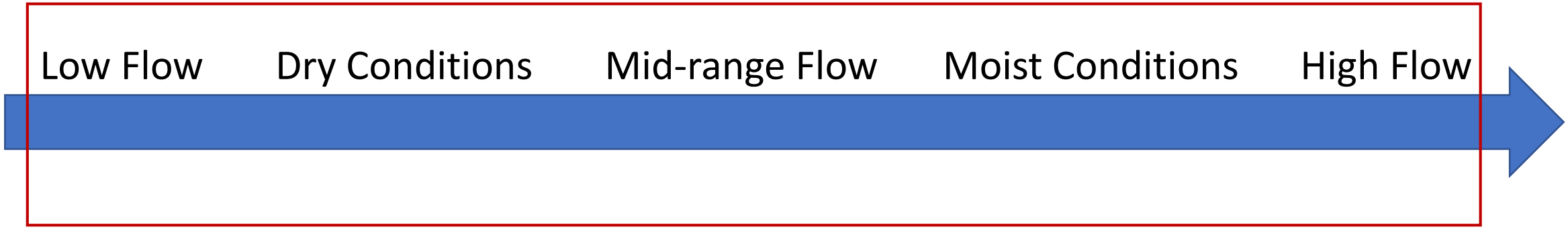


Fecal Coliform

Total Maximum Daily Load (TMDL)

Load Duration Curve



Fecal Coliform

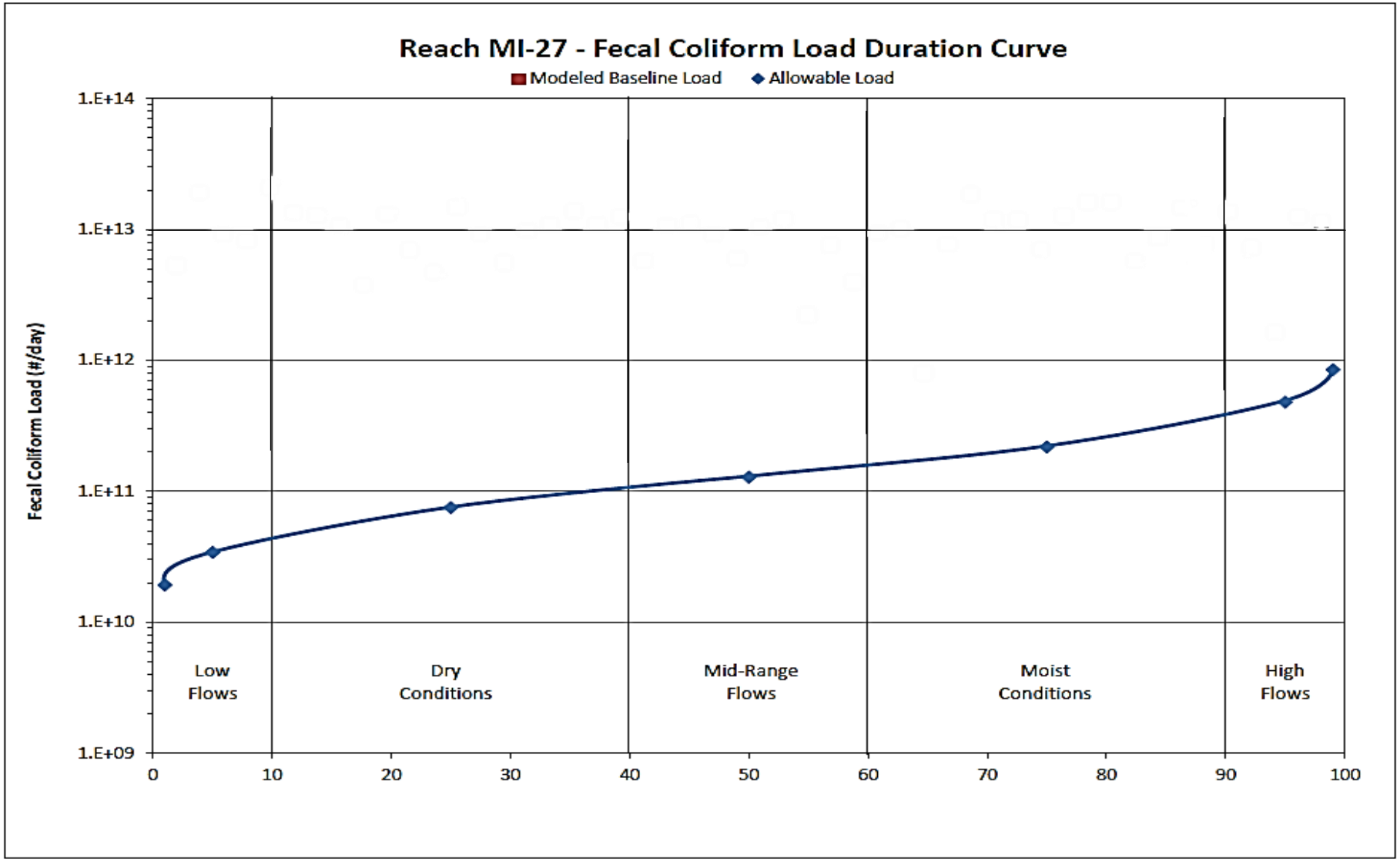
Total Maximum Daily Load (TMDL)

Critical Conditions	Percentile
Low Flow	5th
Dry Conditions	25th
Mid-range Flow	50th
Moist Conditions	75th
High Flow	95th

*The 1st and 99th percentile are used as upper and lower bounds

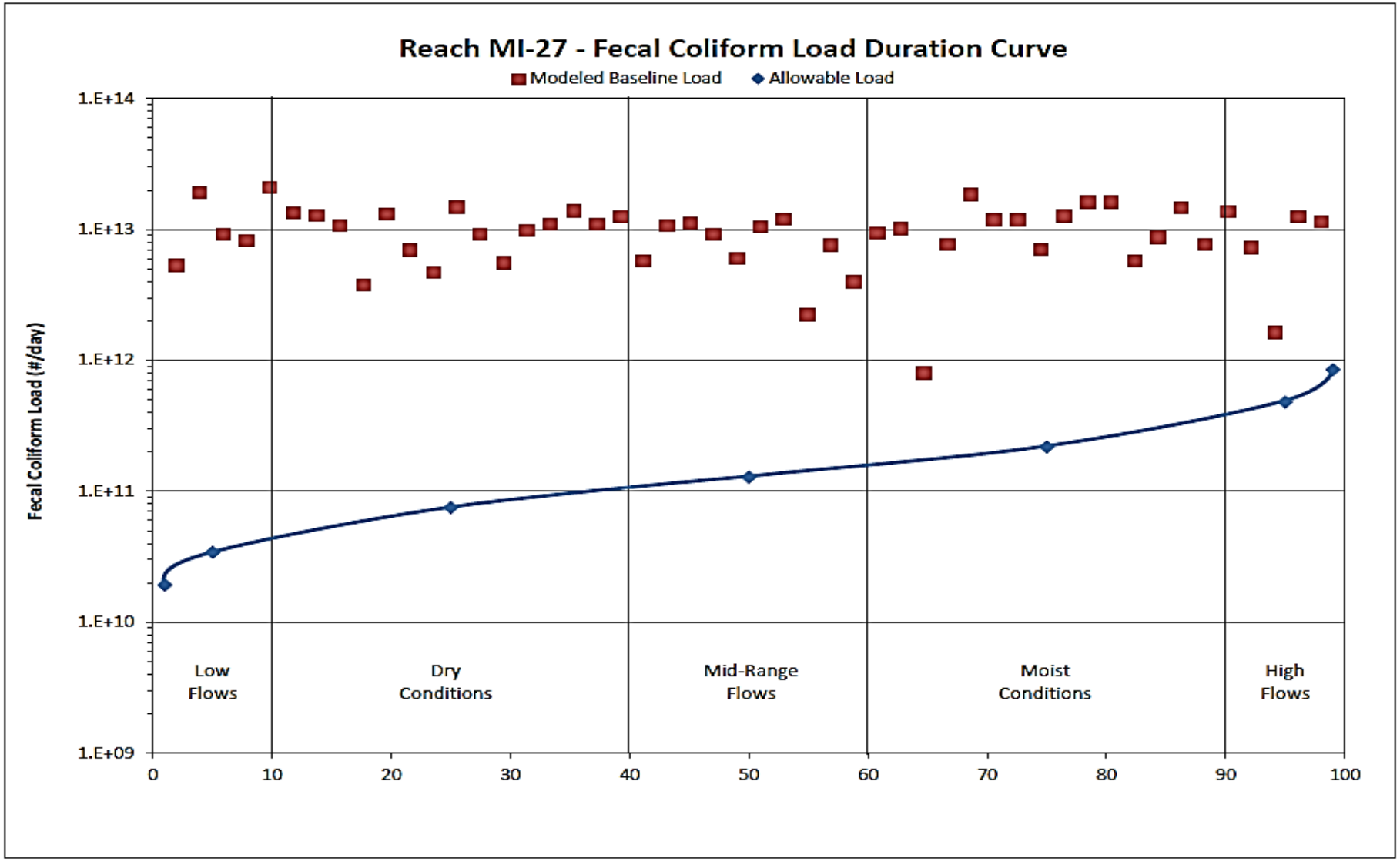
Total Maximum Daily Load (TMDL)

- Maximum exceedance standard (cells/volume)
- Flow records (volume/day)



Total Maximum Daily Load (TMDL)

- Modeled data from Water Quality Initiative (WQI)



Modeling & Monitoring

- **Currently:** issues with both at community level
- **Future:** collaboration between communities and entities

sweet water

- **Best Approach:** Remove pollutants before they reach water bodies

Pollutant Reduction

Public Outreach

Infiltrate & Capture

Minimize at Source

Upkeep & Maintenance

Enforce Ordinances

Take-Home Messages

- Bacterial TMDLs vary with flow conditions
- Monitoring and Modeling for bacteria is still difficult
- Current approach: address pollution before it reaches water bodies

QUESTIONS?

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