

# **Down the Drain: What are Combined Sewer Systems?**

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**Massachusetts Envirothon Training Session**  
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- What is runoff?
- What are combined storm sewers and combined sewer overflows?
- Where are these systems still in use?
- What can we do to reduce/eliminate sewer overflow?



# What is Runoff?

- Excess precipitation/snowmelt
- Occurs when soil infiltration capacity is exceeded



# Impervious Surfaces



White Mountains, NH



Boston, MA



Northampton, MA

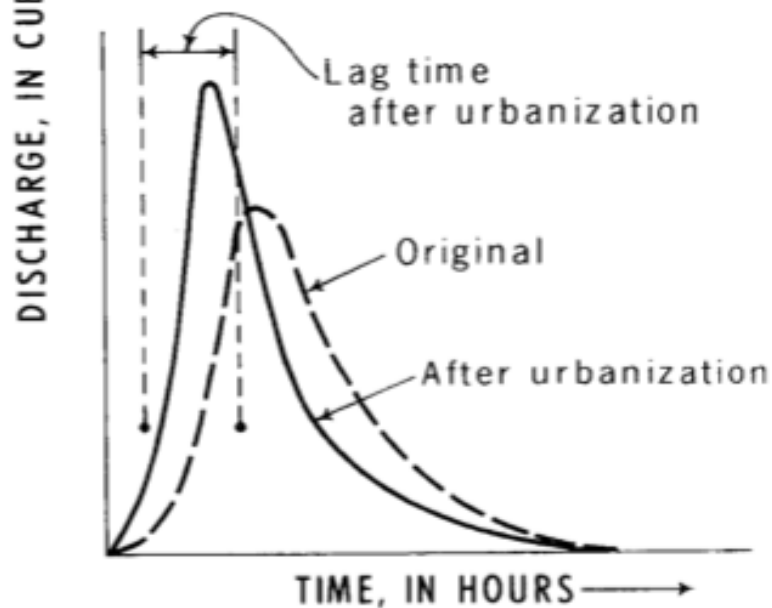
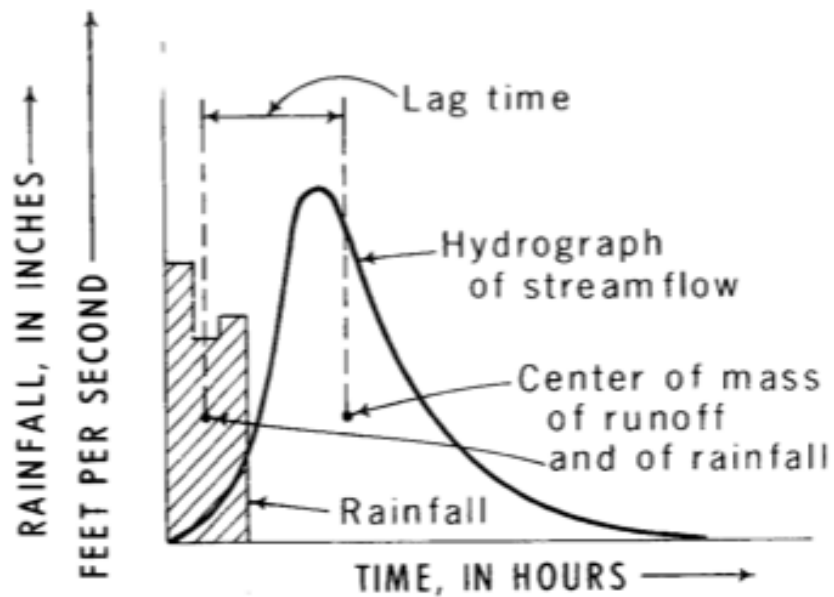


Figure 1.—Hypothetical unit hydrographs relating runoff to rainfall, with definitions of significant parameters.

# What's a SEWER?

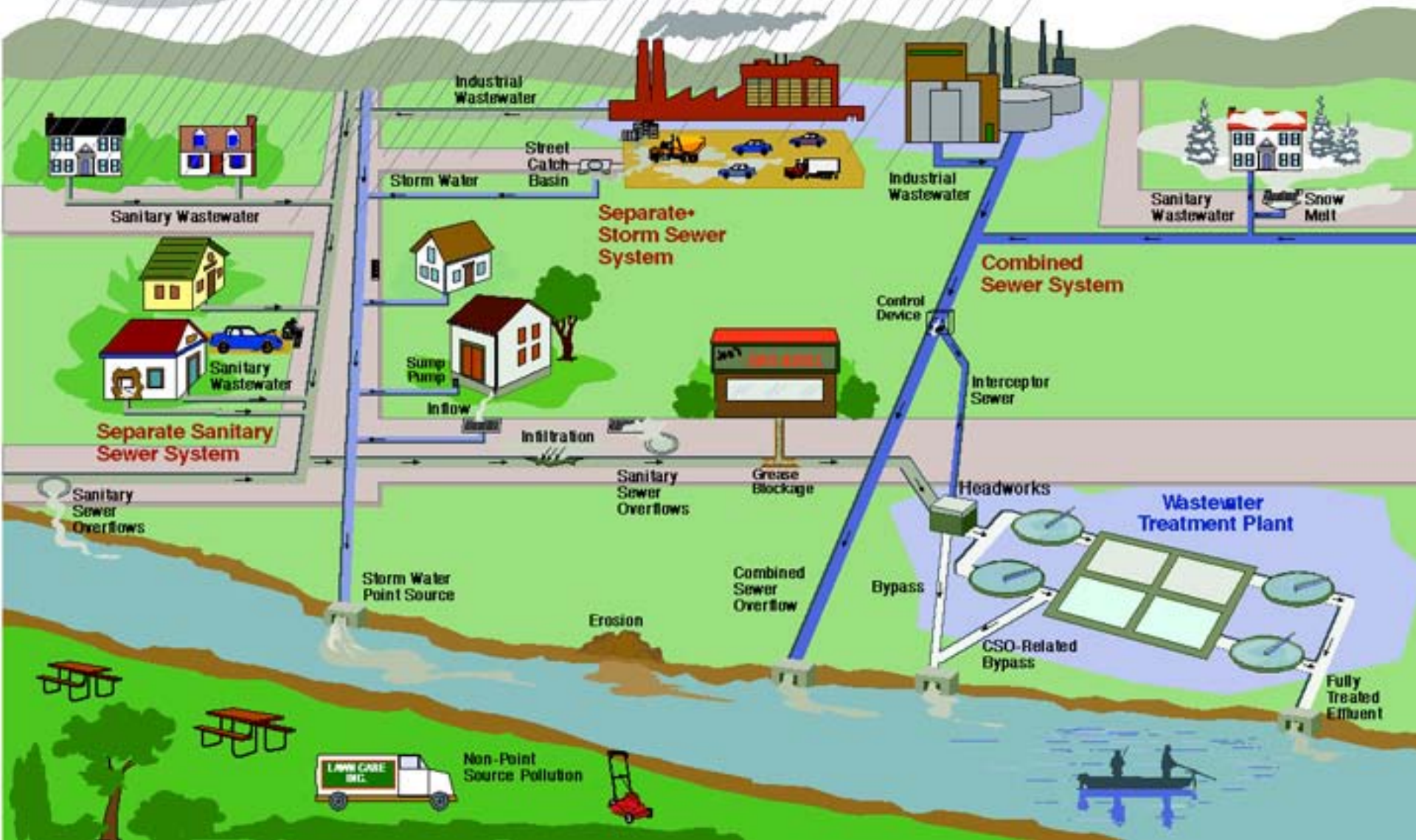


Storm drain that leads to a sewer



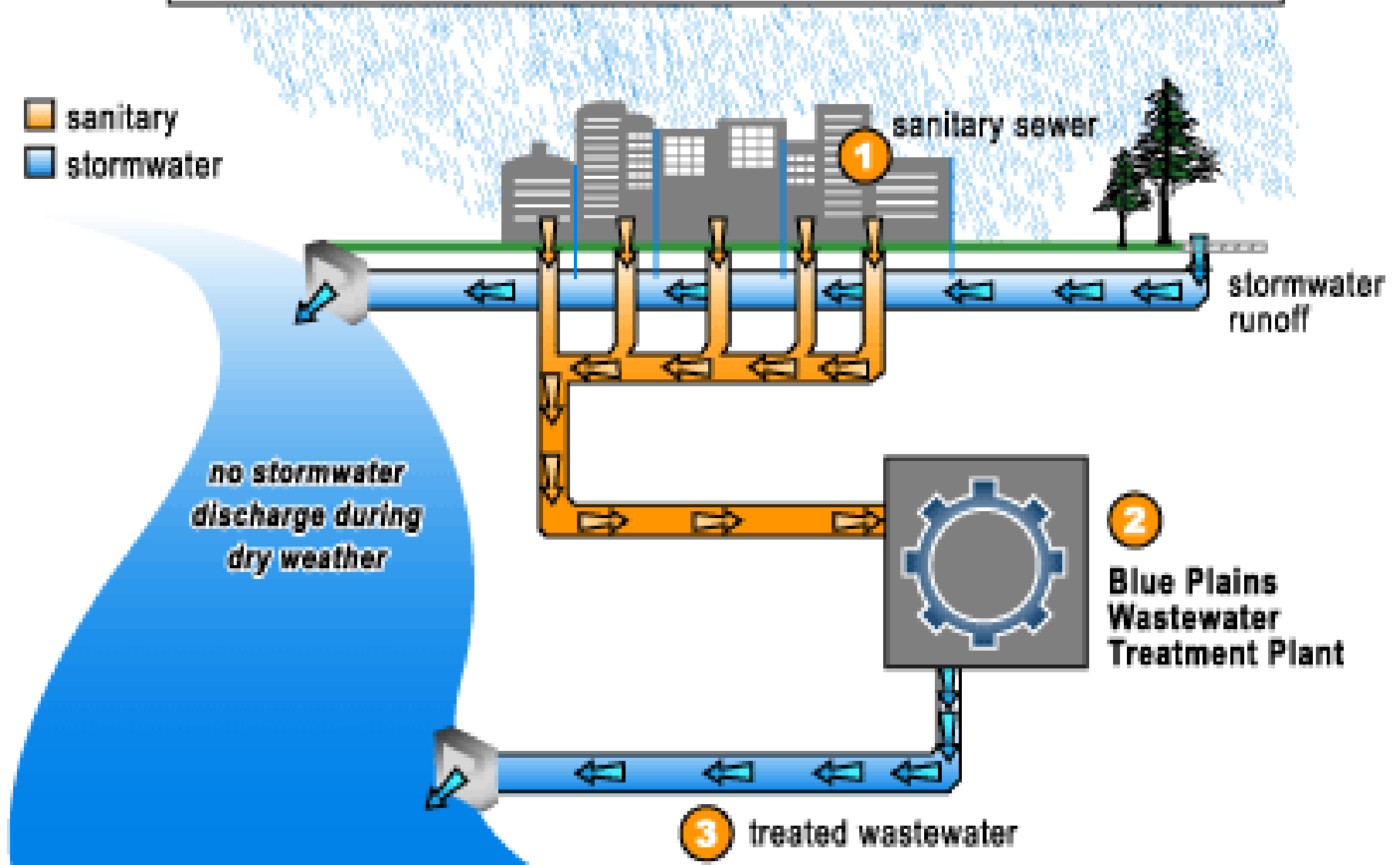
Sewer outfall along the Hudson River

# Urban Wet Weather Flows



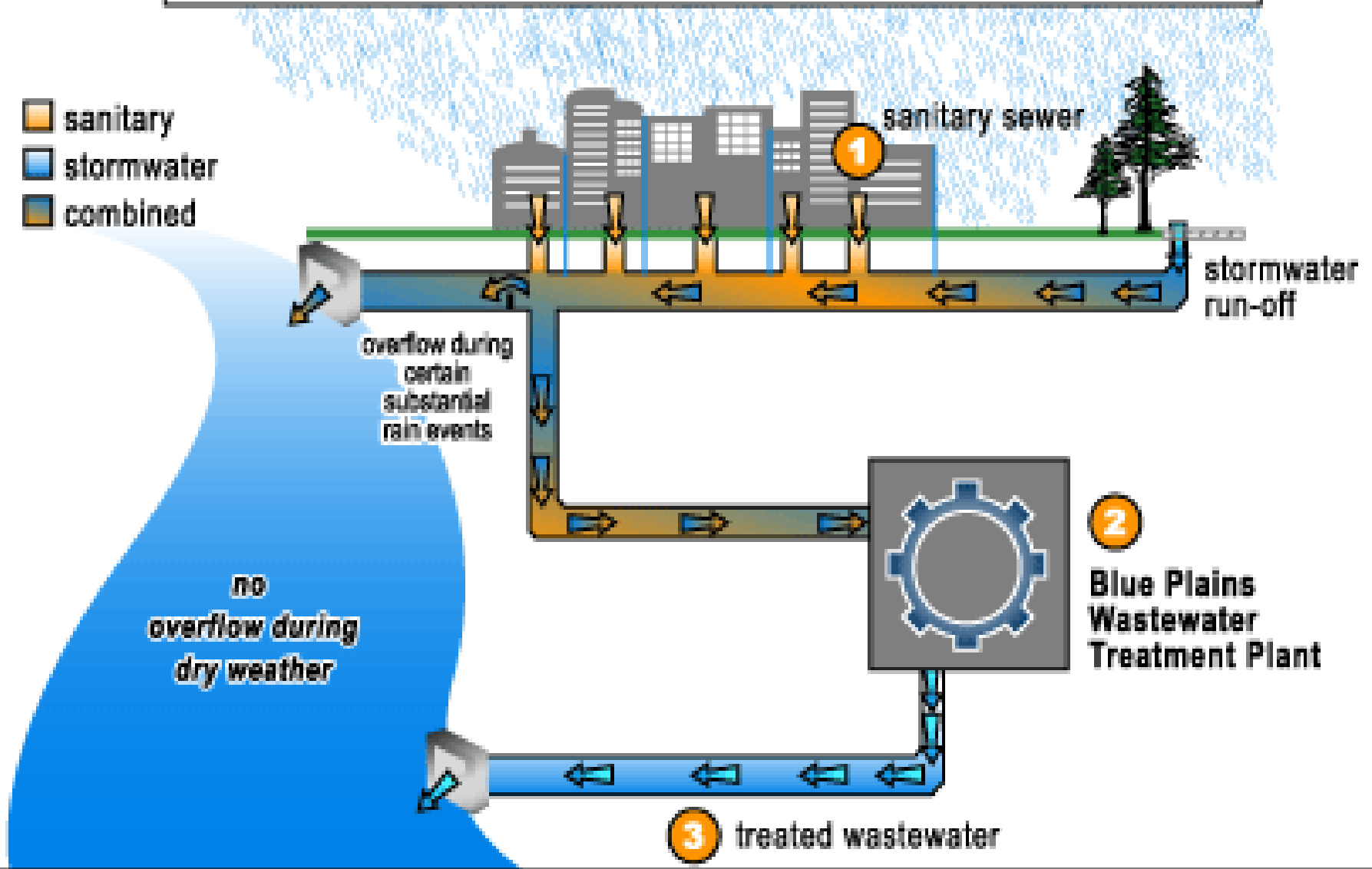
# SEPARATE SANITARY & STORMWATER SEWER SYSTEMS

- sanitary
- stormwater

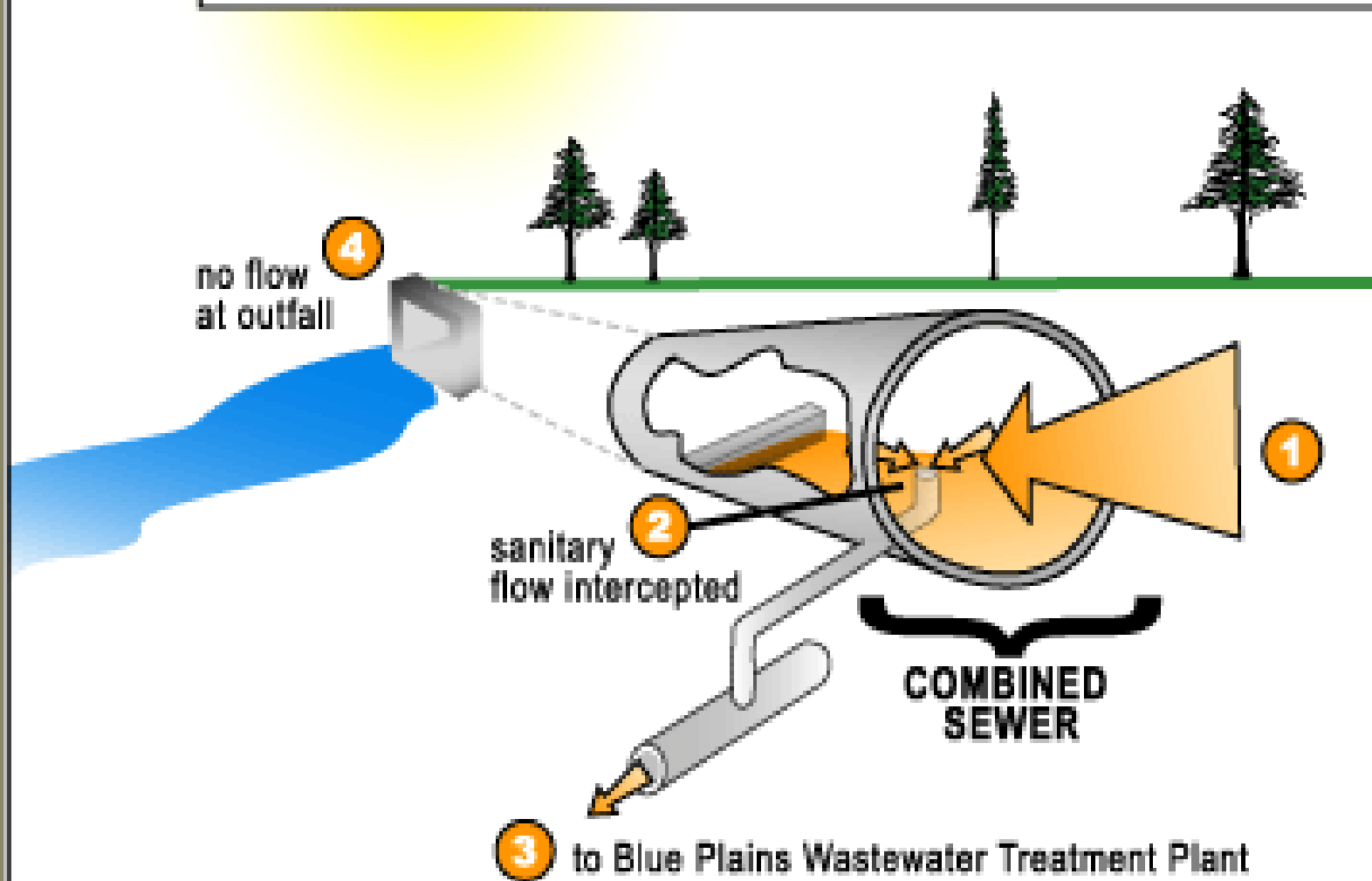


Separate Sanitary and Stormwater Sewer Systems

# COMBINED SEWER SYSTEMS

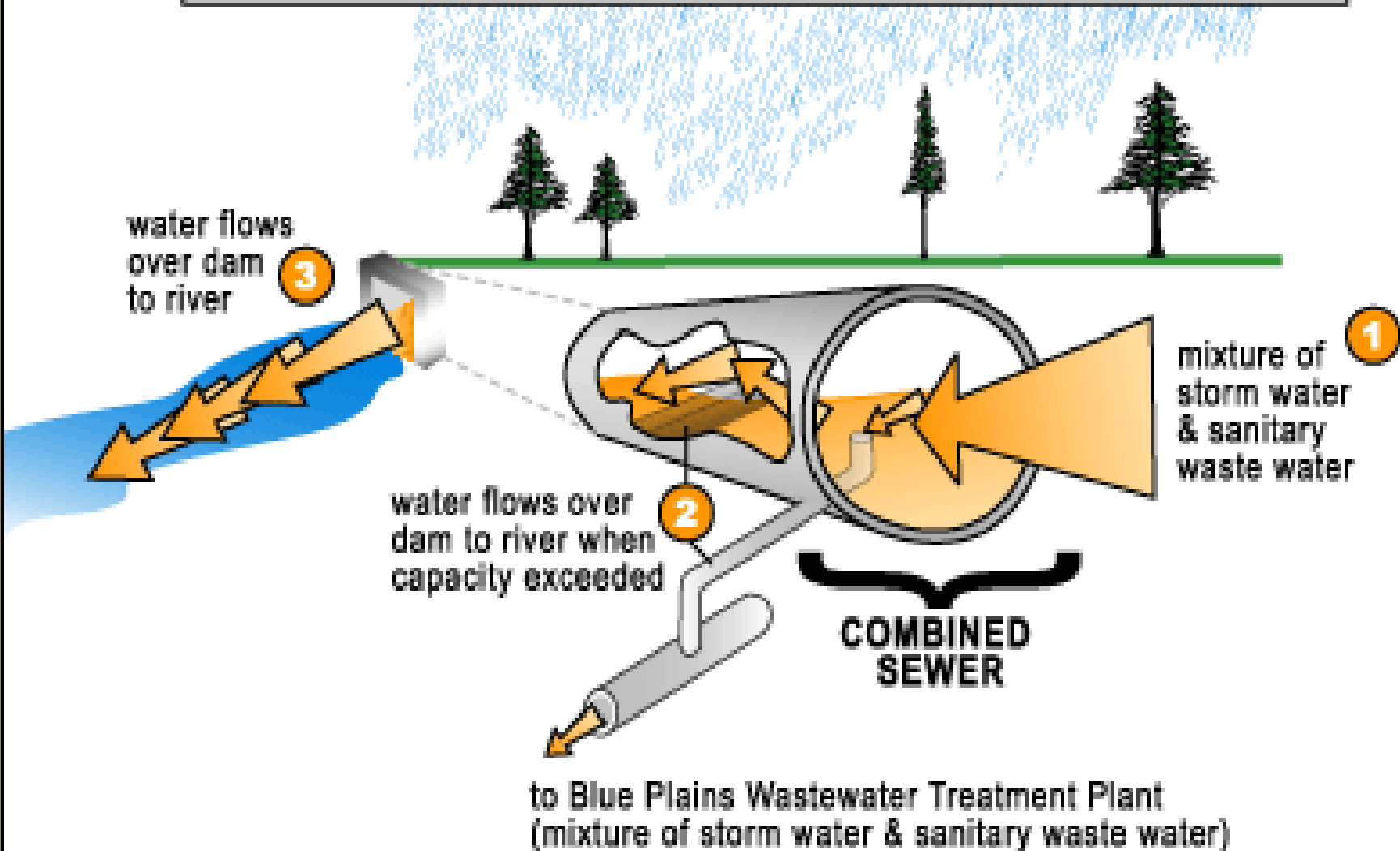


# TYPICAL "REGULATOR": DRY WEATHER NORMAL OPERATION



Typical Regulator: Dry Weather Normal Operation

# TYPICAL "REGULATOR": WET WEATHER NORMAL OPERATION



Typical Regulator: Wet Weather Normal Operation

# Environmental Pollutants

- Total Suspended Sediment (TSS)
- Sediment oxygen demand (SOD)
- Biological oxygen demand (BOD)
- Chemical oxygen demand (COD)
- Nitrogen
- Floatables
- Indicator bacteria - E. coli
- Heavy Metals



# Environmental Impact

- Poor downstream water quality
- Human health risk
- Fish death
- Erosion



# REVIEW: System Design

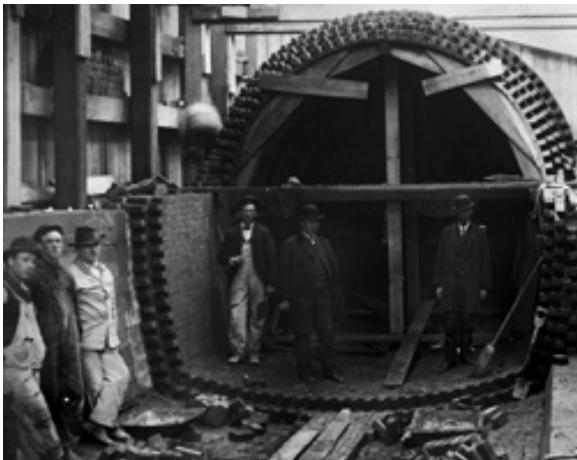
- Combined pipes for sanitary waste and runoff
- Flows bypass treatment during high volume
- Overflows alleviate overloading of the combined sewer system to prevent sewer backups
- Poor water quality, health risk



WWTP in Boston

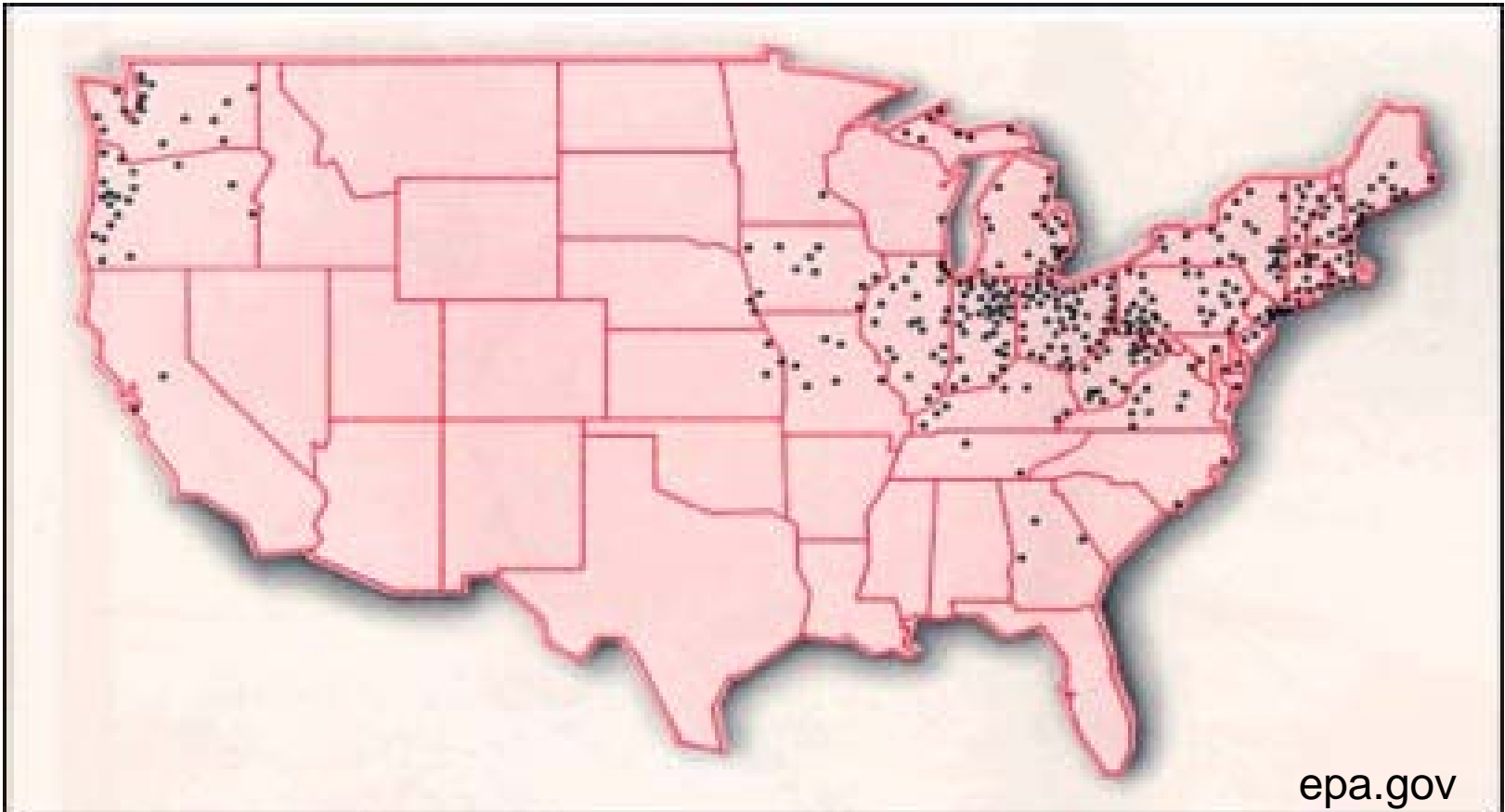
# History

- Most commonly built in late 1800's and early 1900's.
- Cheaply built - with only one collection line
- Impact of CSO's understood in 1960's - most dry weather pollution was reduced by WWTPs

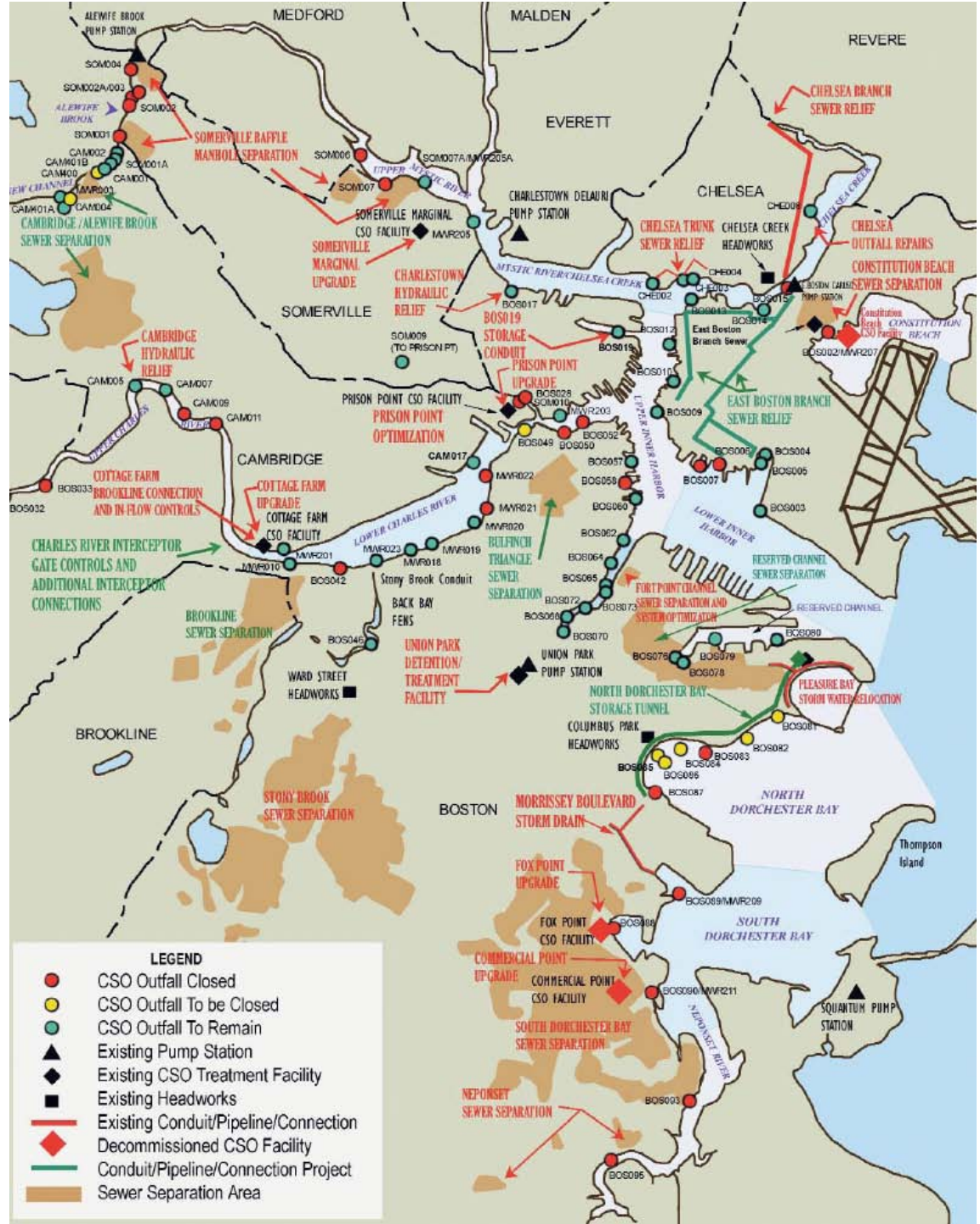


# Current Usage

- Currently online in 772 cities in the US serving 40 million people.



# BOSTON, MA



# Regulations

- Clean Water Act
  - Federal law that governs water quality
- EPA CSO Control Policy (1994) - improve or eliminate CSO related pollution thru NPDES permit program



**National Pollutant Discharge Elimination System (NPDES)**



# Solutions

- Complete or partial separation
- Underground/Online storage
- Increased WWTP capacity
- Real time control - optimize operations

Minneapolis Storm Tunnel Video

<http://youtube/c4i21sXi33g>



Storm tunnel below St. Paul, MN

# What can we do?

- Reduce water use
- Watch what goes down the drain
- Low Impact Development
- Better manage storm water



Questions?

