Understanding the New Paradigm for Wet Weather & Collection System Management

2011 Winter Conference

WET WEATHER TREATMENT TECHNOLOGIES—AN IMPORTANT TOOL FOR MEETING SSO CHALLENGES

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WHY ARE WE HERE TODAY?

- Recent interpretations of NPDES policies appear to conflict with sound science and good engineering judgment
- EPA is poised to update the SSO Policy
- Suggest how state-of-the-art high rate treatment (HRT) technologies might fit within existing regulations
- Discuss regulatory framework

WET-WEATHER FLOW TREATMENT CHALLENGES

Totally different set of technical and ecological issues than dry-weather flow treatment

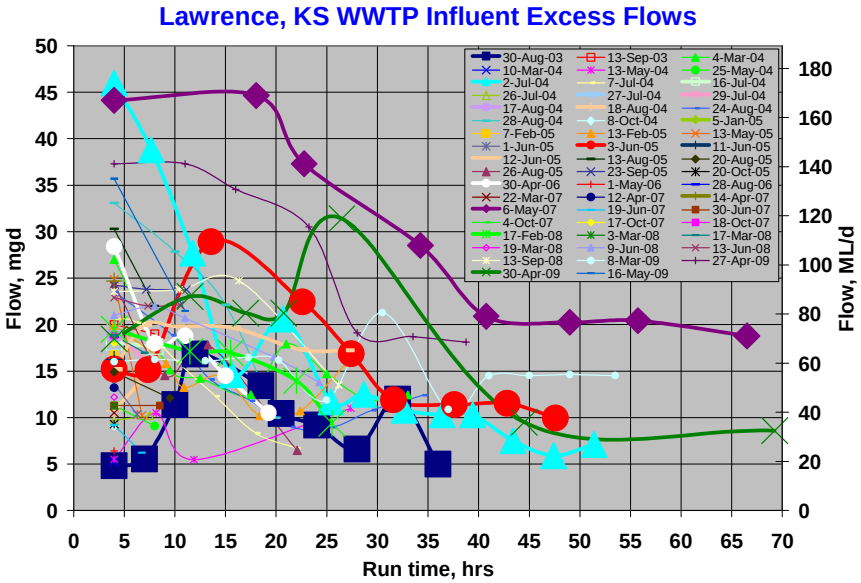
WET-WEATHER WATER QUALITY CONCERNS GENERALLY DIFFERENT THAN DRY-WEATHER

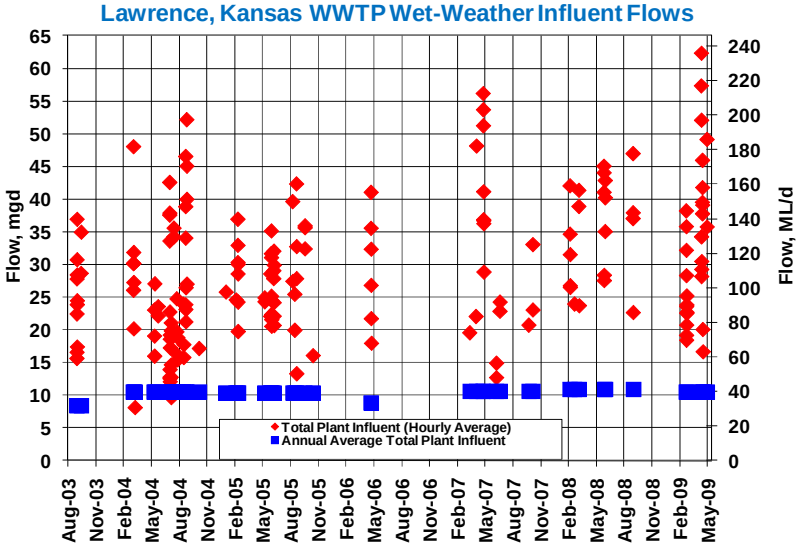
- **D.O. sags generally less concern vs. dry weather**
  - High flows/volumes, turbulence, etc. in receiving stream
  - Larger assimilative capacity
- **Main wet-weather POCs are generally:**
  - **Floatables** (Trash, plastics, etc.). Aesthetics; ingestion and entanglement by wildlife
  - **Solids**. Prevent silt and sediments from burying eggs and larvae
  - **Biological pathogens** (bacteria, viruses, etc.). Human health concern vs. aquatic toxicity concern
- **Predominantly non-point sources**

AGGRESSIVE SSO OR CSO CONTROL USUALLY RESULTS IN HIGHER PEAK FLOWS TO TREAT

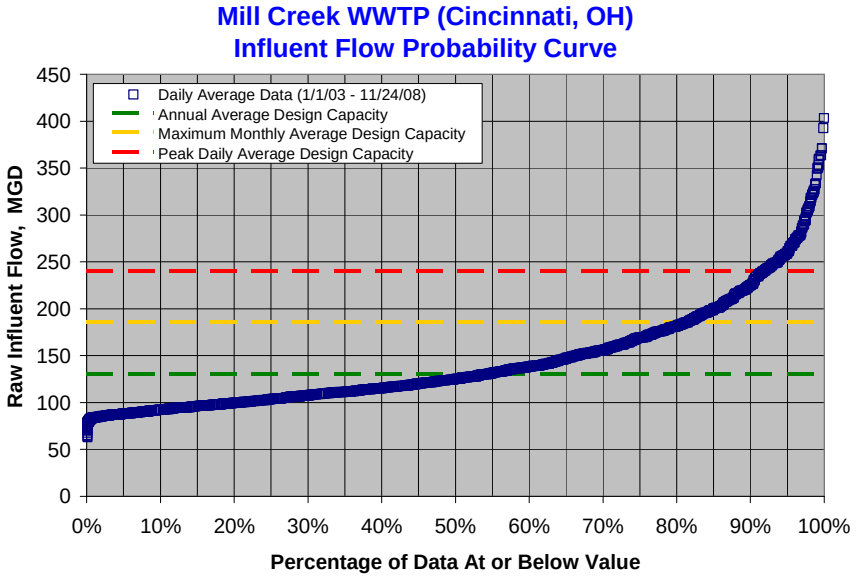
- **Realistic long-term I/I removal goals**
  - Old sewers leak, new sewers will degrade
  - Significant effort and continuous expense to fix
  - Private property issues
- **Increased storage may not eliminate need for auxiliary treatment**
  - Storage dewatering rates, back-to-back storms, etc.
  - Too much storage may be more detrimental to environment
- **Cost/benefit of I/I removal vs. conveyance & treatment determined through comprehensive analysis**

WET-WEATHER FLOWS ARE GENERALLY HIGHLY VARIABLE AND INFREQUENT…

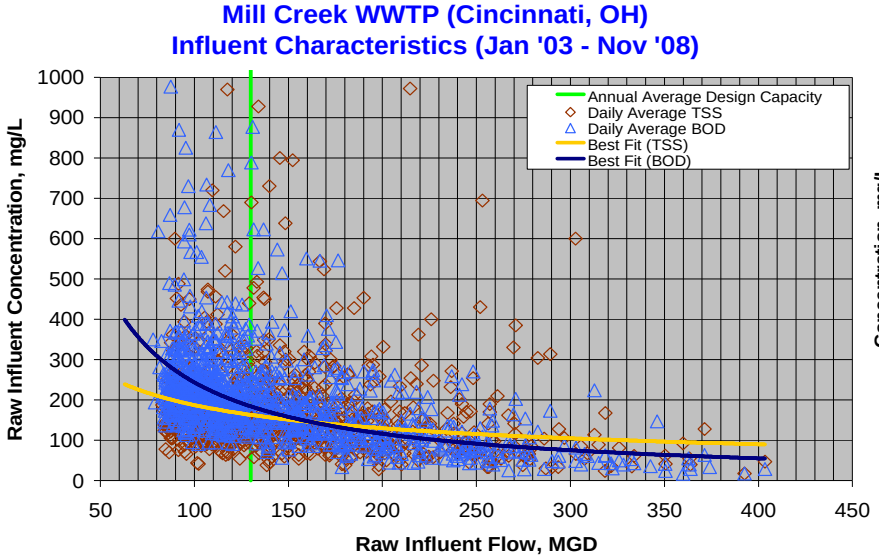


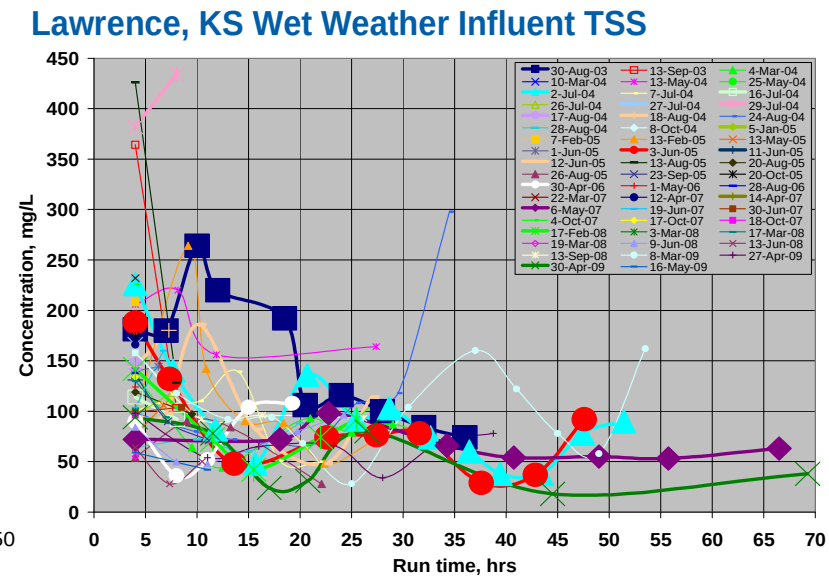


- $Q_{PKHR} \approx 5$ to 10 x Q_{AA}
- Similar for other CSS and SSS communities
- Site-specific climates and collection system responses

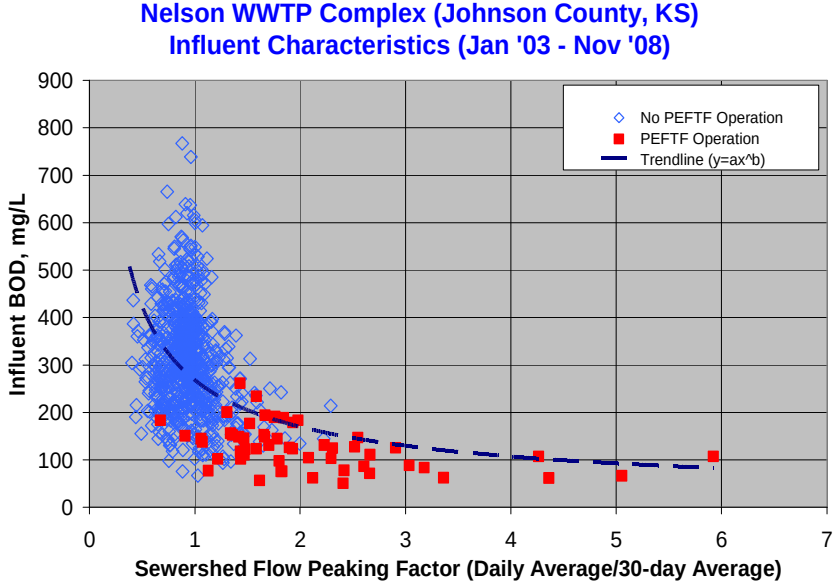


…WITH HIGHLY VARIABLE INFLUENT QUALITY





- $C << C_{AA}$ after first flush
- Similar for other CSS and SSS communities



BIOLOGICAL TREATMENT PROCESSES CAN BE OPTIMIZED, BUT HAVE INHERENT LIMITATIONS

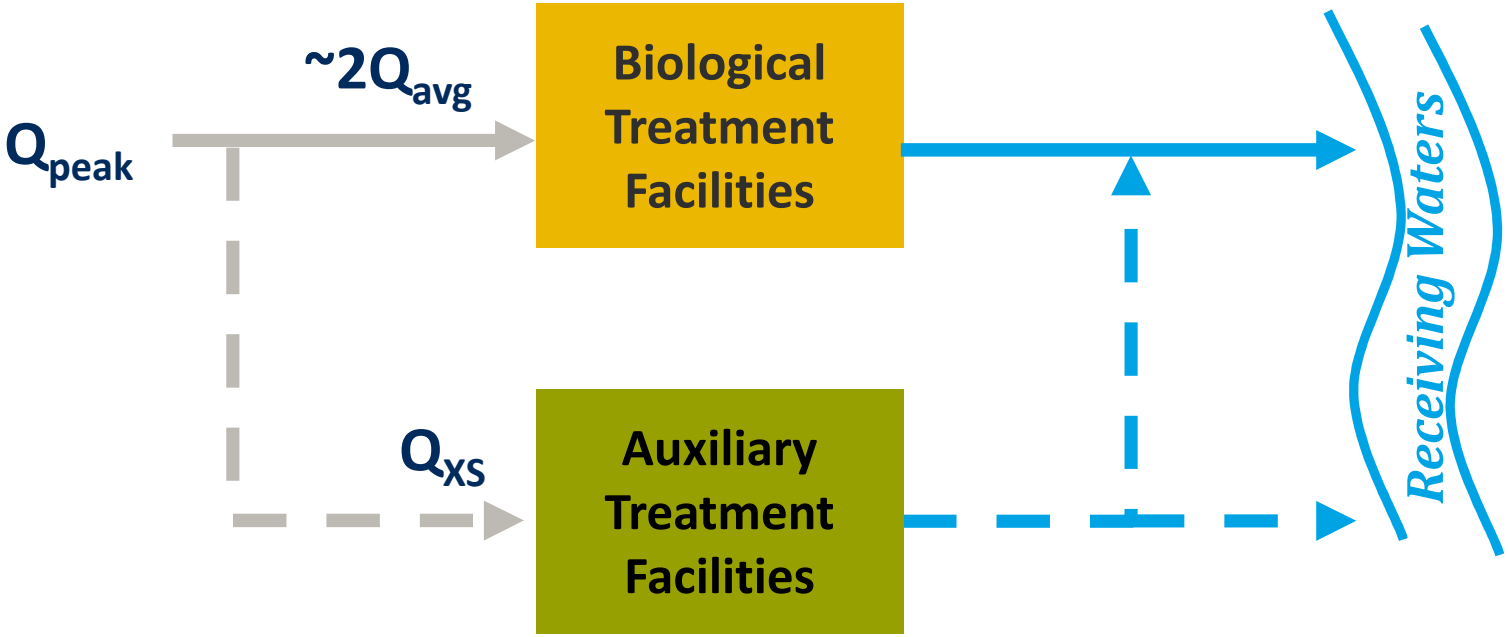
- **Inexact capacity - Different storm-to-storm, antecedent conditions, etc.**
- **Cold influent (snowmelt) challenges**
- **More treatment infrastructure won't necessarily increase biological capacity - slow kinetics – biomass has finite capacity**
- **Protect your biomass**
  - Absolutely critical treatment "equipment"
  - Recovery can take weeks or months
  - BNR biomass are particularly sensitive (slow growers)
- **Capacity bottleneck is usually existing clarifiers and/or filters (physical processes)**

AUXILIARY TREATMENT STRATEGY

A proven strategy for treating wet-weather flows…

…while minimizing SSOs or CSOs

PEAK FLOW AUXILIARY TREATMENT HAS A LONG TRACK RECORD AS AN EFFECTIVE WET-WEATHER STRATEGY



- Complement inherent limitations of biological processes
- Auxiliary facilities optimized for wet-weather influent
- Enable POTW to consistently achieve secondary treatment effluent quality during both dry and wet weather

WHAT ARE "AUXILIARY TREATMENT FACILITIES"?

- **Permitted alternative to bypass per 40 CFR 122.41(m)(4)(i)(B)**
- **Peak wet-weather influent characteristics are amenable to advanced physical or chemical treatment and not optimal for biological treatment.**
  - USEPA (2008), *Emerging Technologies for Wastewater Treatment and In-Plant Wet Weather Flow Management*, EPA 832-R-06-006
  - USEPA (2007), *Wastewater Management Fact Sheet, In-Plant Wet Weather Peak Flow Management*, EPA 832-F-07-016
  - WEF (2006), *Guide to Managing Peak Wet Weather Flows in Municipal Wastewater Collection and Treatment Systems*
  - USEPA (2004), *Report to Congress, Impacts and Control of CSOs and SSOs*, EPA 833-R-04-001

AUXILIARY FACILITIES GENERALLY CONSIST OF MULTIPLE PROCESS UNITS

- Influent or Effluent Pumping
- Screening
- Grit Removal
- BOD & TSS Removal
- Effluent Disinfection

Solids Handling Considerations

Various technology and design alternatives for each process unit

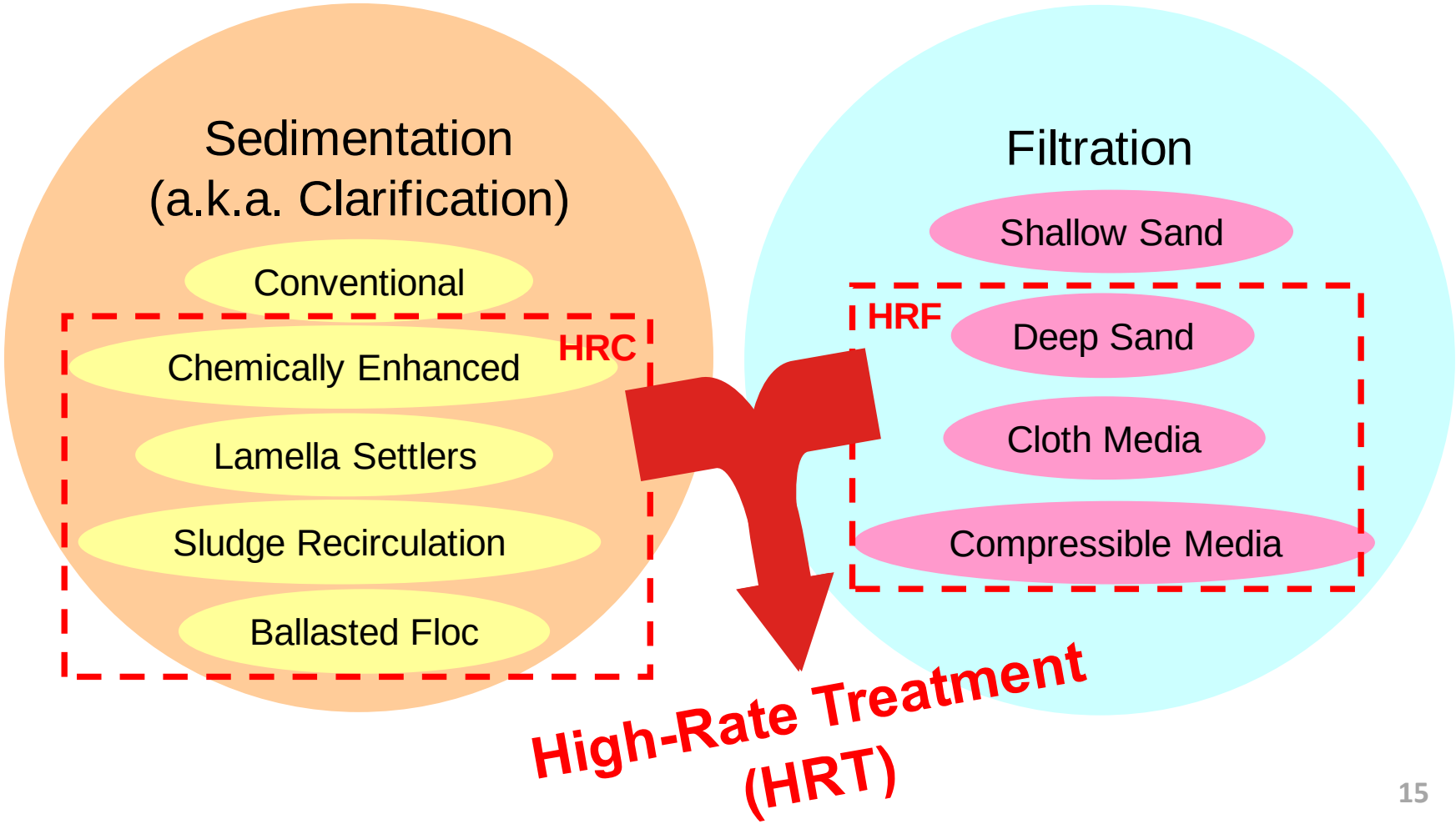
SOME PERSPECTIVE ON AUXILIARY TREATMENT TECHNOLOGIES…

- **Conventional sedimentation + floatables + disinfection**
  - Long understood by POTWs to generally support CWA and codified secondary effluent quality (40 CFR 133)
  - General consensus among scientists and engineers in the treatment profession - Perhaps some site specific exceptions
  - Supported by USEPA 1994 CSO Control Policy
- **Today's Advanced HRT Alternatives**
  - Built upon proven physical and chemical mechanisms
  - Produce high quality effluent…reliable disinfection
  - Small footprint…high capacity

HIGH-RATE TREATMENT TECHNOLOGIES

Today's advanced physical and chemical technologies were not envisioned when "blending" or "bypass" was defined.

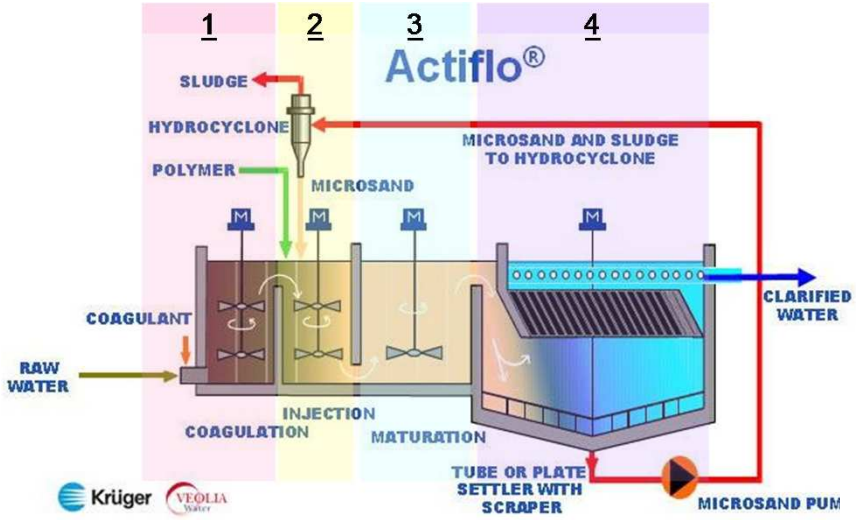
MANY OF TODAY'S TECHNOLOGIES WEREN'T ENVISIONED WHEN CWA REGULATIONS WERE FORMED

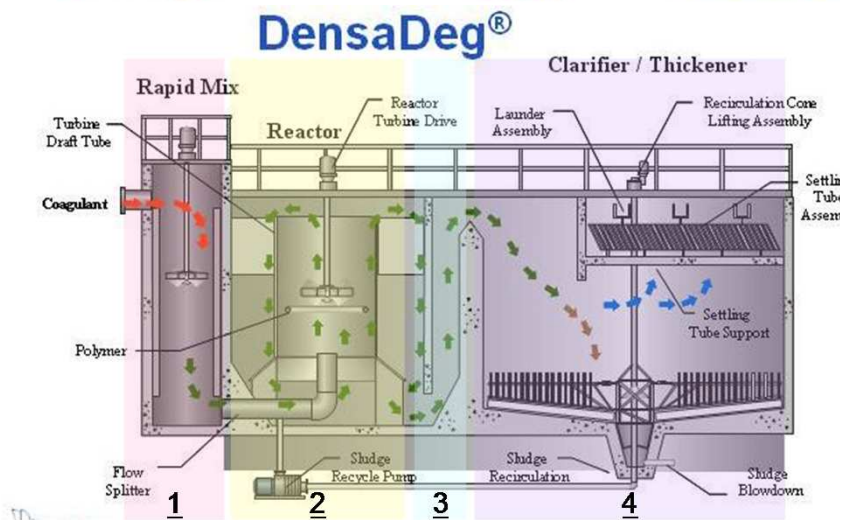


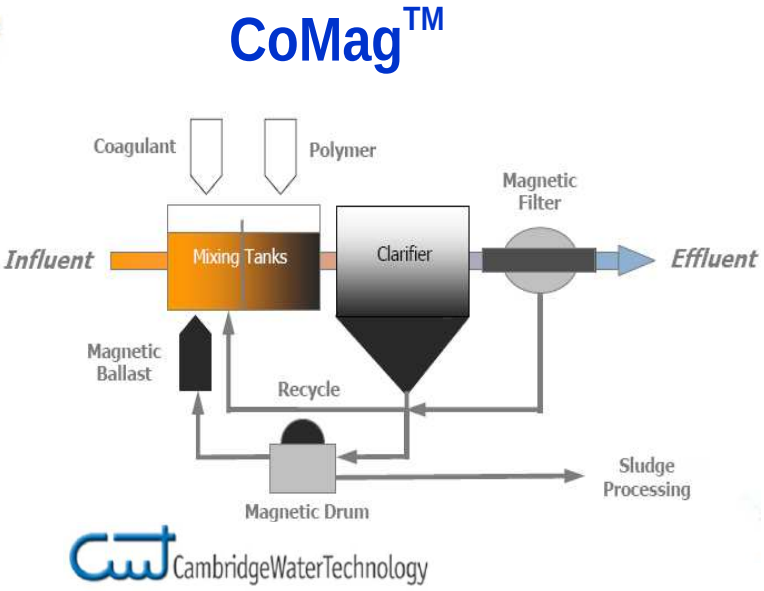
CHEMICALLY ENHANCED SEDIMENTATION CONTINUES TO PROVE ITS EFFECTIVENESS

- **1500 BC -** Alum coagulation by Egyptians
- **1740 AD -** Chemical sewage treatment in Paris
- **Today –** a.k.a. CEPT (Chemically Enhanced Primary Treatment) or CEC (Chemically Enhanced Clarification) or CES (Chemically Enhanced Settling or Sedimentation) or CAS (Chemically Assisted Settling)

SLUDGE RECIRCULATION AND BALLASTED FLOCCULATION CAN FURTHER ENHANCE SEDIMENTATION PERFORMANCE

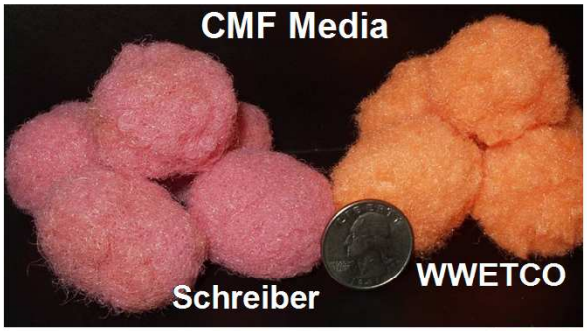


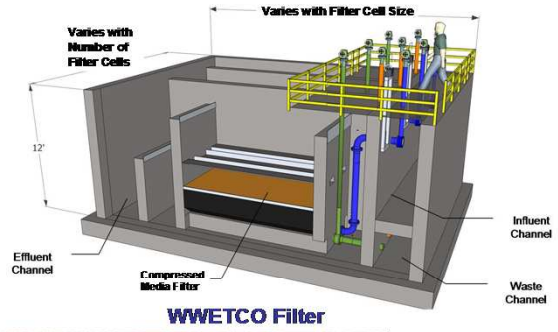




HRF ALTERNATIVES OFFER SIMILAR TSS & BOD AS HRC, BUT NO CHEMICALS REQUIRED

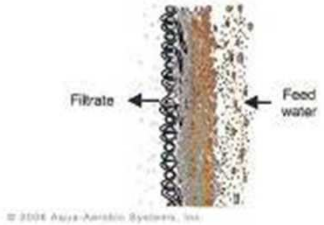
- **2000 BC - Granular filtration in ancient Sanskrit writings**
- **Today**
  - Deep-bed granular media
  - Compressible media
  - Cloth media

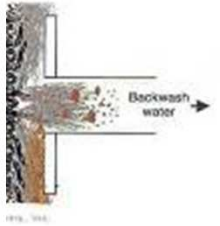




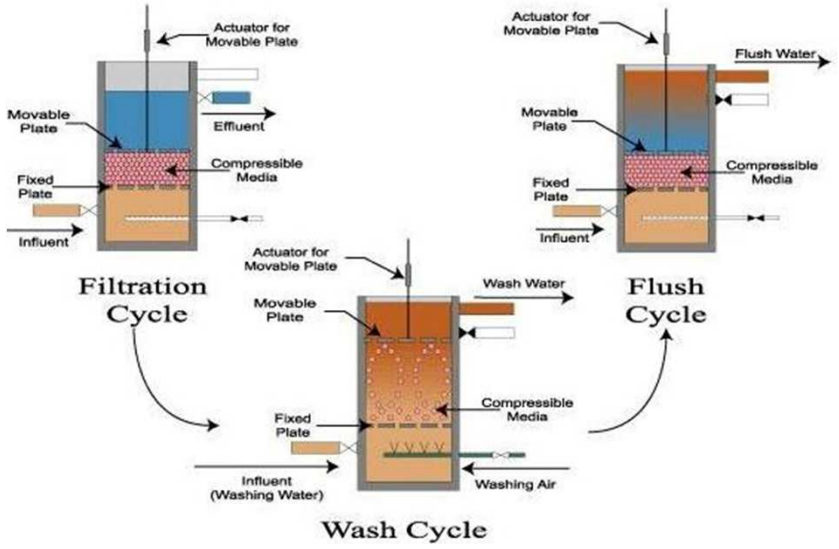
WWETCO Filter

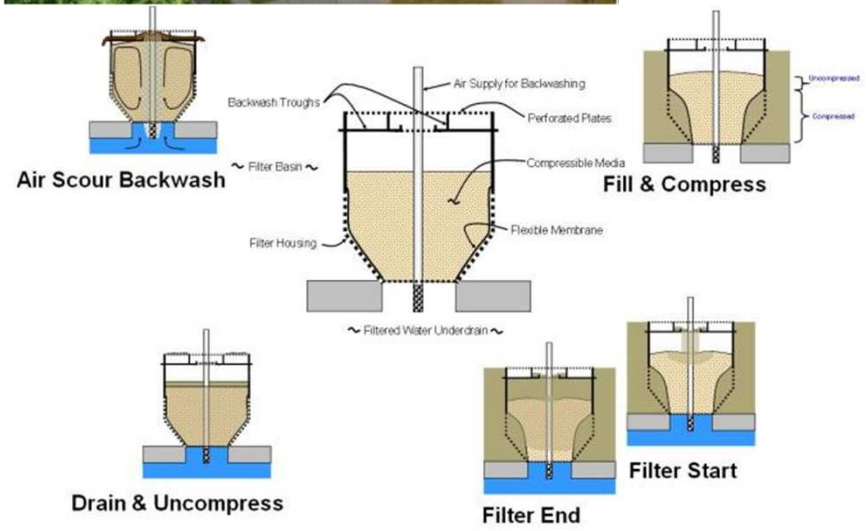

Schreiber Fuzzy Filter





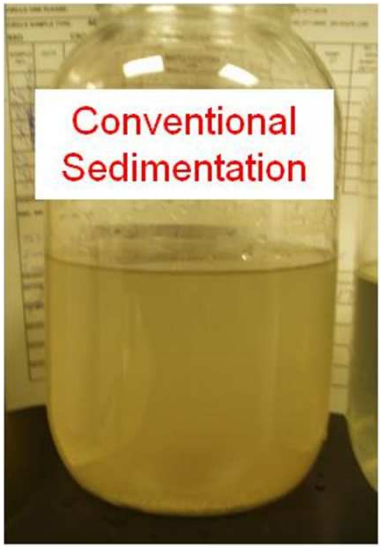
COMPRESSIBLE MEDIA FILTRATION HAS MADE RECENT ADVANCES IN WET-WEATHER TREATMENT

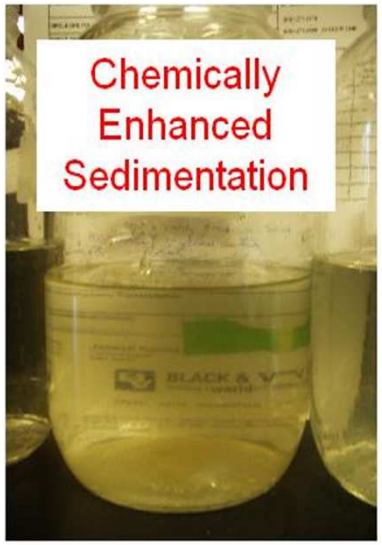




HRT EFFLUENT QUALITY IS CLEARLY SUPERIOR TO WHAT WAS CONSIDERED FOR "BYPASS" AND "BLENDING"

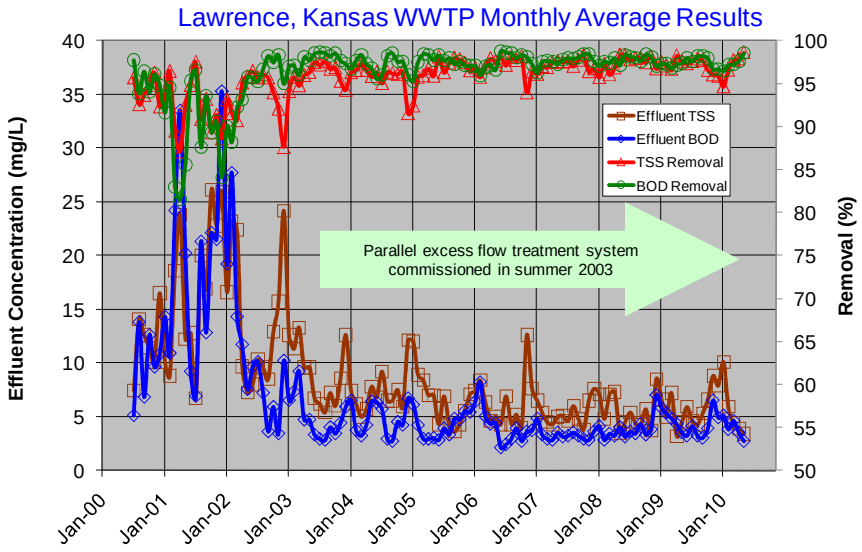
- Over a decade of successful full-scale HRT operations across the country: Columbus, GA; Lawrence, KS; Toledo, OH; and others

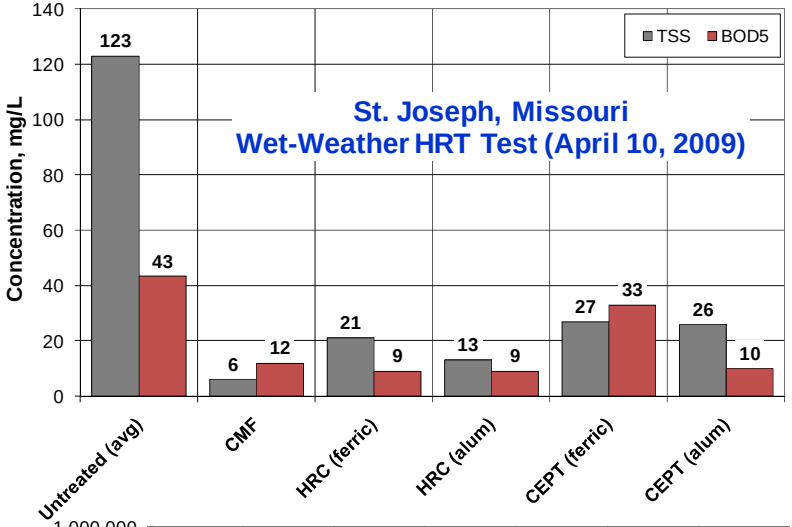


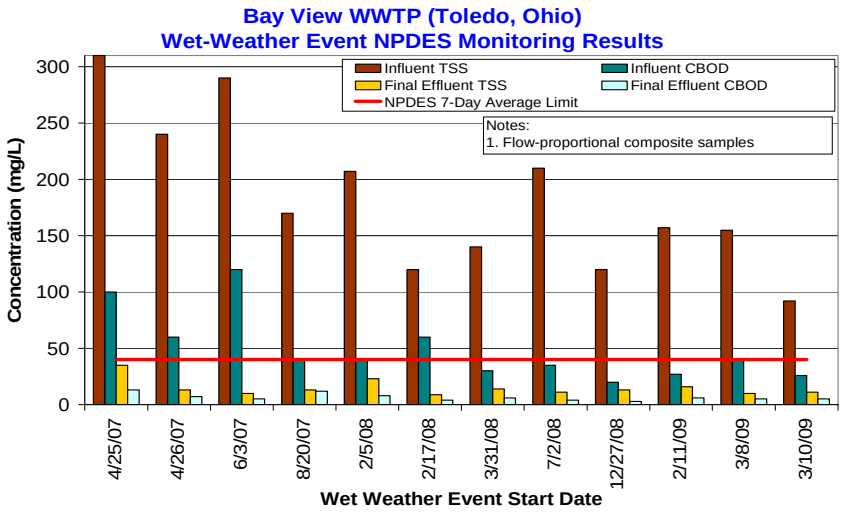


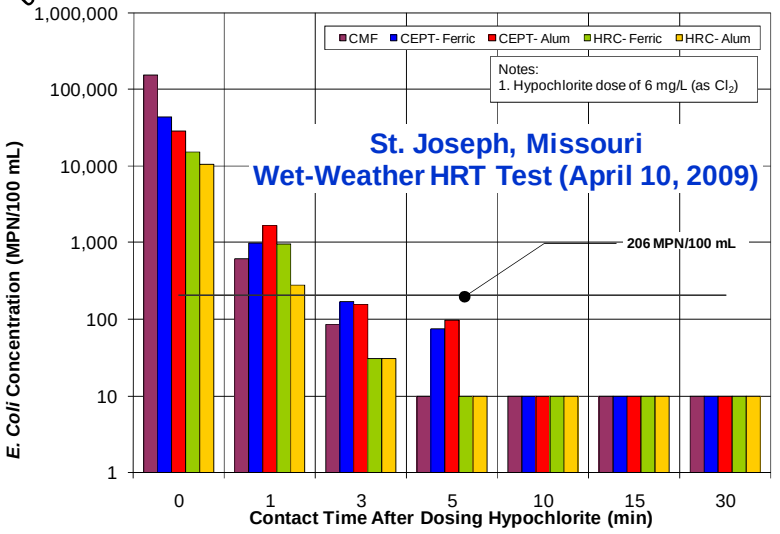
- Recent advances in HRT processes and technologies.

PROVEN PERFORMANCE FROM RECENT FULL-SCALE AND PILOT HRT OPERATIONS





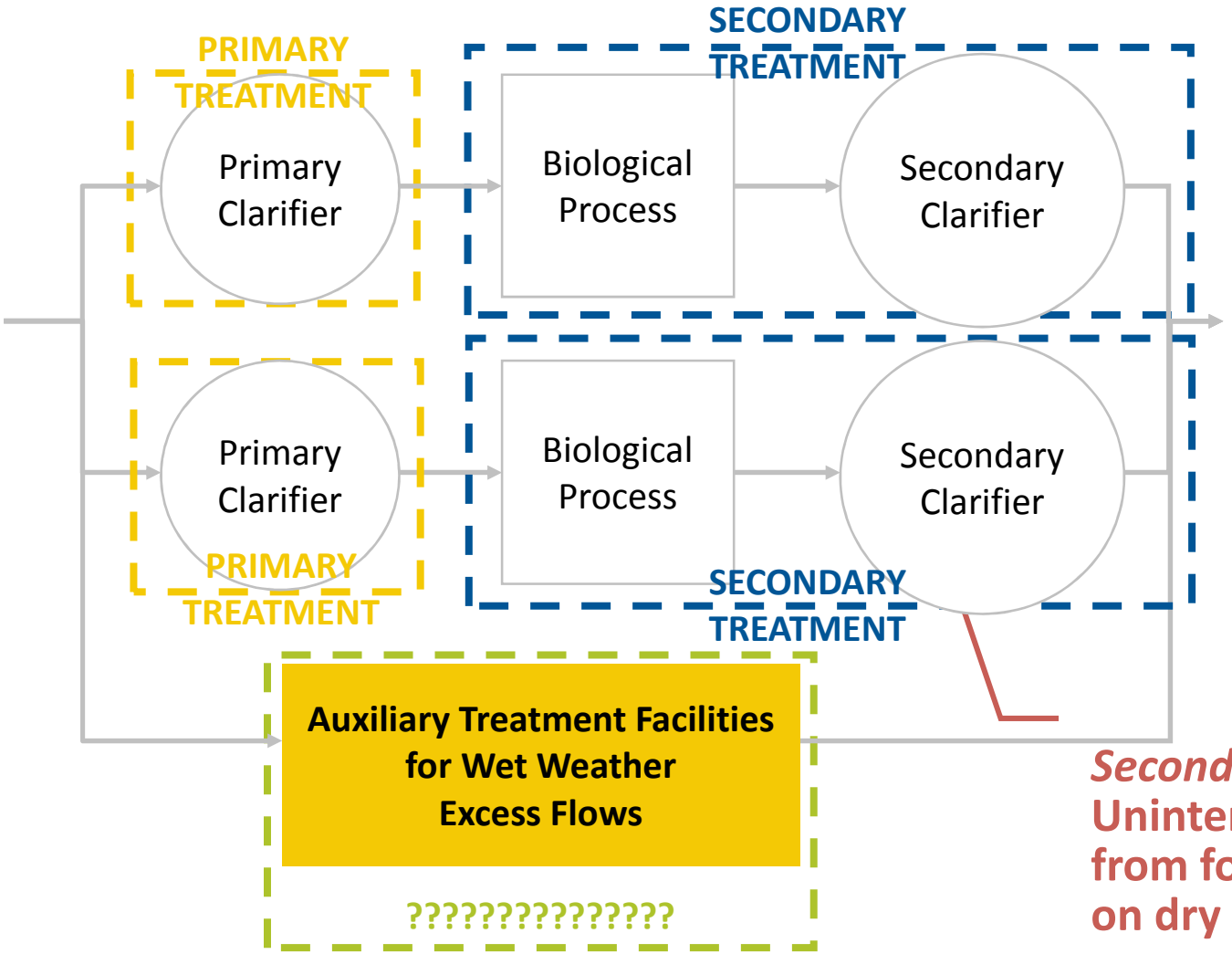




REGULATORY POLICY CONSIDERATIONS

Existing regulations should be interpreted in a holistic and sustainable fashion.

POTENTIAL MISINTERPRETATION OF "SECONDARY TREATMENT" IN RECENT POLICY INTERPRETATIONS



Secondary ≠ Biological.
Unintended consequence from focusing only on dry weather

"SECONDARY TREATMENT" BASED ON MUCH DIFFERENT RAW MATERIAL THAN WET-WEATHER FLOWS

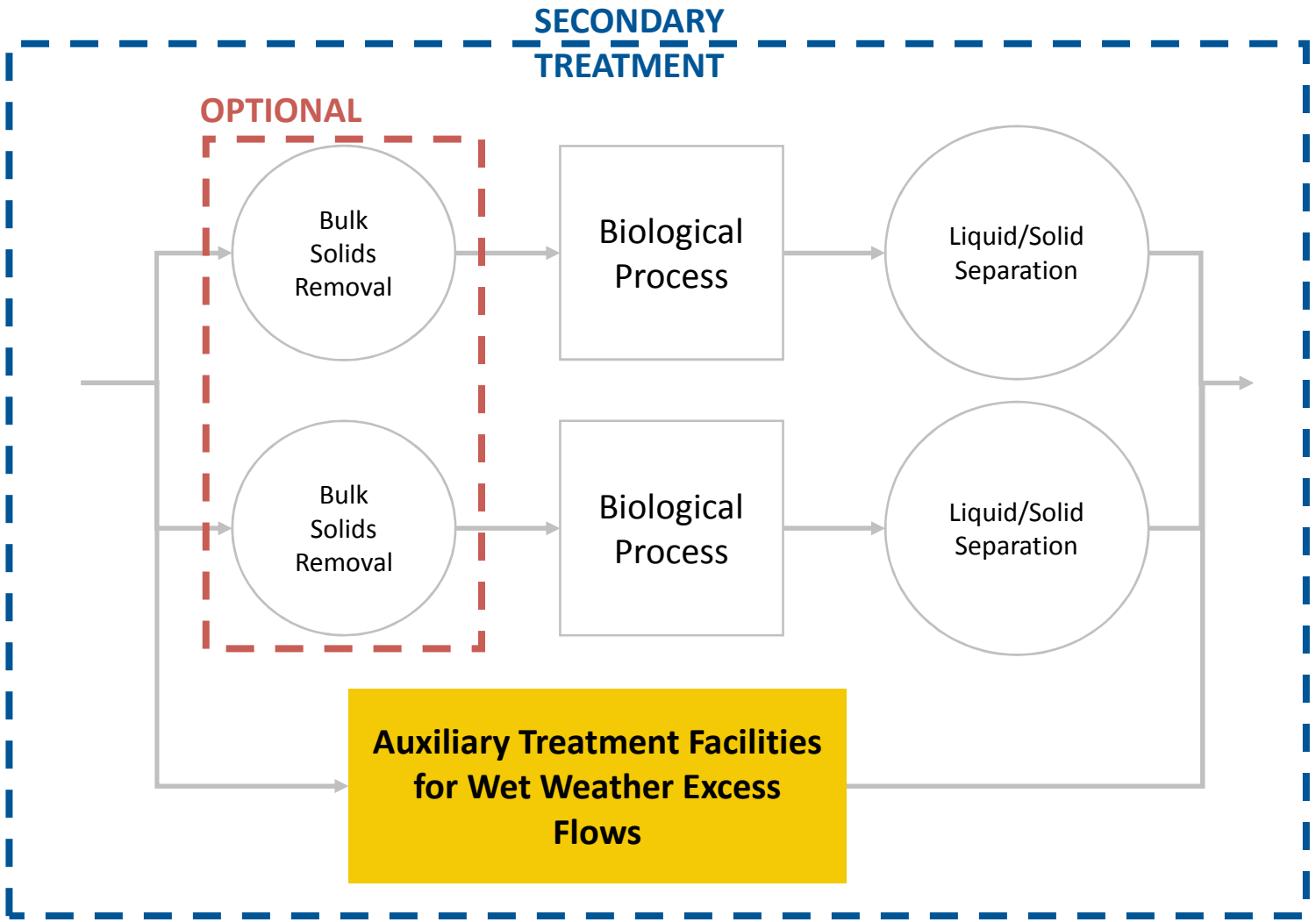
Parameter	Units	40 CFR 133.102 Secondary Treatment				40 CFR 133.105 Equivalent to Secondary Treatment			
		Max	Min	Weekly Average	Monthly Average	Max	Min	Weekly Average	Monthly Average
pH	SU	9.0	6.0	-	-	9.0	6.0	-	-
TSS	mg/L	-	-	≤45	≤30	-	-	≤65	≤45
	% Removal	-	-	-	≥85% [A]	-	-	-	≥65% [A]
BOD_5	mg/L	-	-	≤45	≤30	-	-	≤65	≤45
	% Removal	-	-	-	≥85% [A]	-	-	-	≥65% [A]

Notes:

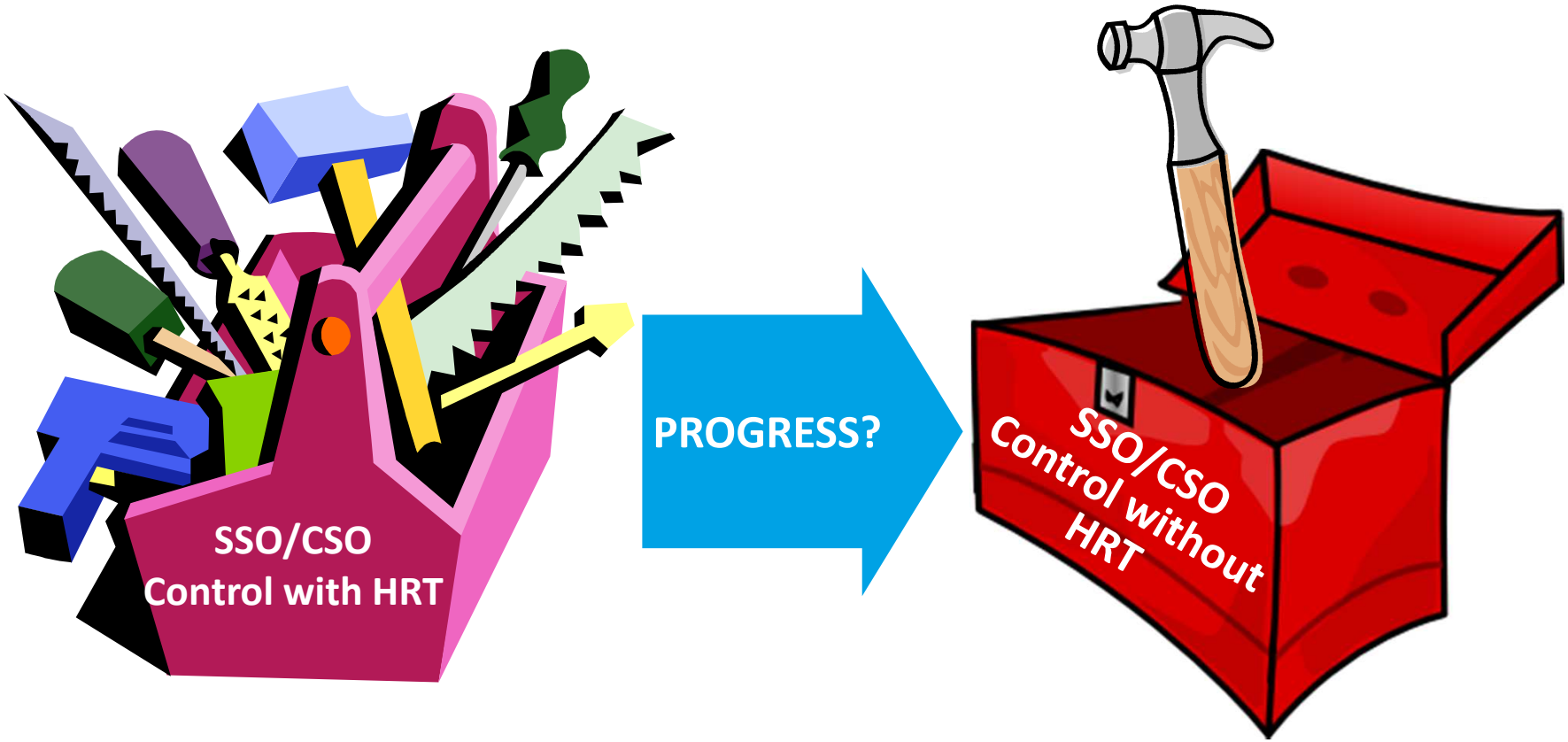
A. Based on monthly average influent and effluent concentrations only. Special considerations for lower requirements with combined sewers and less concentrated influent for separate sewers.

- **Assumes steady influent…TSS/BOD = 200/200 mg/L**
- **Long-term effluent from entire POTW…not short-term performance criteria for biological trains…not wet-weather influent conditions**

HOLISTIC VIEW OF "SECONDARY TREATMENT" PER 40 CFR 133 & 122.41(M)



REGULATORY POLICIES THAT DISCOURAGE HRT MAY ELIMINATE LEGITIMATE DESIGN ALTERNATIVES



- Wet-weather overflow control is a very complex problem
- No “one-size-fits-all” solution

Thank you, and for more information…

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JCW Johnson County Wastewater

City of Lawrence Department of Utilities

Our Water ... Our Future
PROTECTING THE MIGHTY MISSOURI
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Johnson County Environmental

Improving Our Sewer System
Toledo Waterways Initiative

METROPOLITAN SEWER DISTRICT of greater CINCINNATI