Water Quality Considerations: WQS, TMDLs & NPDES

Kansas
Department of Health and Environment

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Three Primary Prongs of the CWA

- Water Quality Standards

- Total Maximum Daily Loads

- NPDES Permitting

These Three Prongs Represent the Transition of Facts to Actions

- WQS = Aquatic Biological and Chemical Science
- TMDLs = Integrated, Strategic Planning & Allocation
- NPDES = Directed Implementation
- All Three Together Represent State Water Quality Policy; but TMDLs and NPDES are beholden to WQS

Water Quality Standards – Sec 303(c)

- National Goals customized State-by-State
- Designated Uses of Waters
  - Aquatic Life, Recreation, & Water Supply
  - Irrigation, Stockwater, Industrial & GroundWater Recharge
- Criteria
  - Narrative – Free from harmful effects of substances that originate from artificial sources
  - Numeric: Chloride – 250 mg/l PWS; 860 mg/l acute ALS
- Antidegradation Policy
  - Tiers of waters (1, 2, 2.5 & 3)
  - Conditions placed on new or expanding discharges

Total Maximum Daily Loads – Sec 303(d)

- Rebalance Loadings that have created exceedances in criteria (impairment), thereby implementing the applicable water quality standards
- Wasteload Allocations for Point Sources
  - Implemented by NPDES
- Load Allocations to Non-Point Sources
  - Implemented by Financial Incentives or Non-Federal Programs
- Margin of Safety provides a hedge
  - Protects the environment from overloading
- Not self – implementing
  - But can guide implementation efforts

NPDES Permits – Sec 402

- Effluent limitations in the permit implement the WLAs of TMDLs
  - 303(d)(4)(A): backsliding – revised effluent limits only if the cumulative effect of all such revisions based on TMDL will assure attainment of WQS, and:
  - 303(d)(4)(B): antidegradation – where waters exceeds necessary quality, revised effluent limits are consistent with antidegradation policy established under this section
- Within Sec 402, only (o) antibacksliding, ties back to Sec 303
- Backdoor tie-ins via Secs 301 & 401

NPDES Regulations Tied to WQS/TMDLs

- 40 CFR 122.44(d)(1): Permit requirements in place to achieve WQS, including narrative criteria – typically through effluent limits

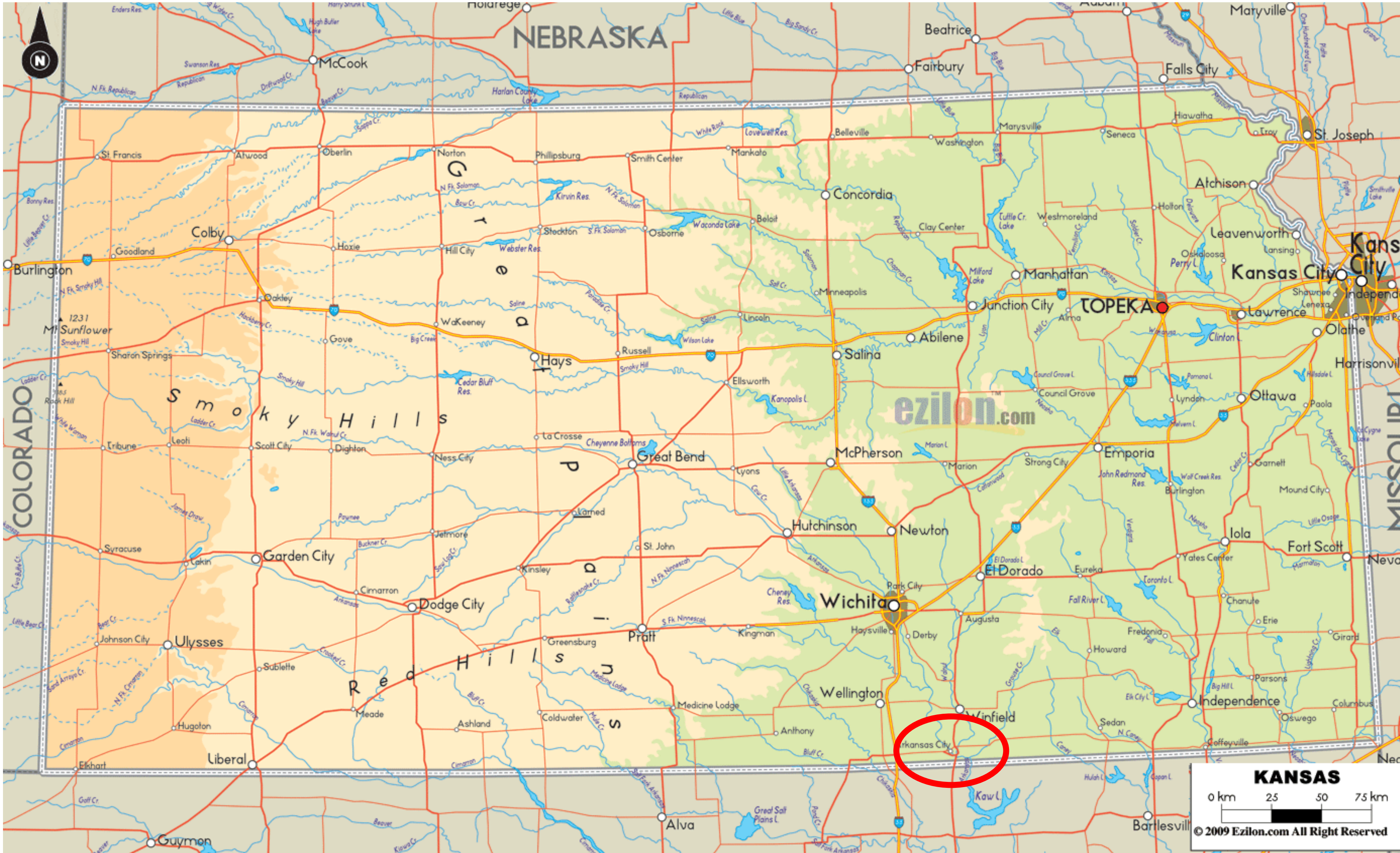
- 122.44(d)(1)(vii): Effluent limits shall ensure that:

  - **A. Limits are derived from and comply with WQS**

  - **B. Limits are consistent with assumptions and requirements of WLA for the discharge under a TMDL**

Kansas Example: Arkansas River Chloride

- Sidebar: How is “Arkansas” pronounced?
- Rest of World: **Ar′** ● *kan* ● *sah*
- Kansas: *Ar* ● **kan′** ● *sas*
- Today’s compromise: Ark River & Ark City



Our Mission: To protect and improve the health and environment of all Kansans.

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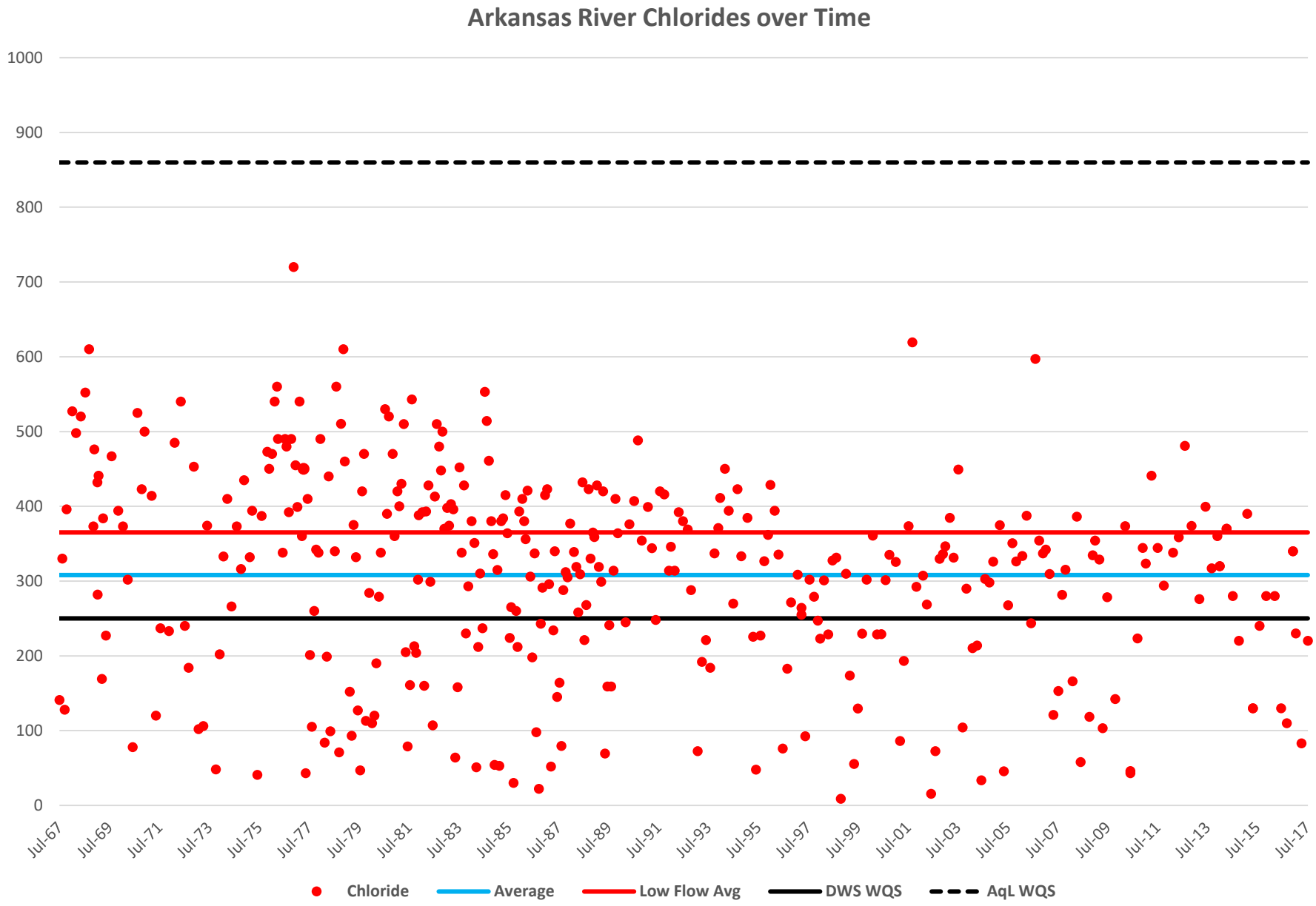
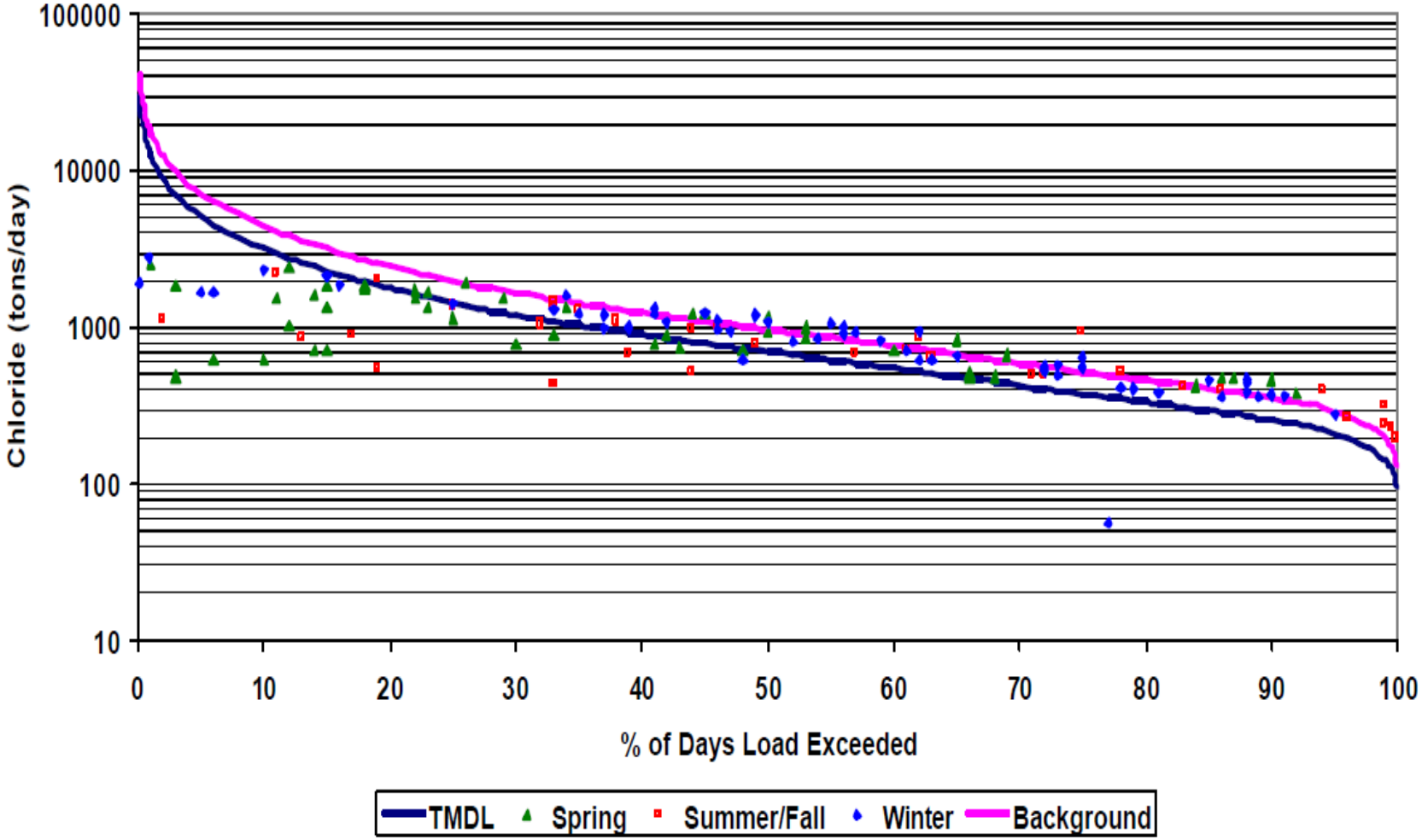

Arkansas River Chlorides over Time
1000
900
800
700
600
500
400
300
200
100
0
Jul-67
Jul-69
Jul-71
Jul-73
Jul-75
Jul-77
Jul-79
Jul-81
Jul-83
Jul-85
Jul-87
Jul-89
Jul-91
Jul-93
Jul-95
Jul-97
Jul-99
Jul-01
Jul-03
Jul-05
Jul-07
Jul-09
Jul-11
Jul-13
Jul-15
Jul-17
Chloride
Average
Low Flow Avg
DWS WQS
AqL WQS

WQS Provision for Natural Salts

- *In stream segments where background concentrations of naturally occurring substances, including chlorides and sulfates, exceed the water quality criteria, the existing water quality shall be maintained, and the newly established numeric criteria shall be the background concentration.*

Load Duration Curve - Arkansas City (SC218)



Ark City Chloride Current Output

- 2010 – 2017 average [Cl] = 210 mg/l
  - (159 – 256 mg/l)
- Design Flow of WWTP = 2.1 MGD
  - 2010-17 avg = 1.2 MGD
- 2006 WLA for Ark City = 1.34 tons per day
  - (avg [Cl] = 153 mg/l at design flow)
- 2010 – 2017 average WL = 1.13 tons per day
  - (25% of samples > WLA, indicative increasingly saline source water)
- Ground water source supply influenced by Permian deposits

Future PWS Planning

- City proposed a 3.1 MGD reverse osmosis PWS WT Plant
- RO waste stream would be 0.35 MGD at 1570 mg/l
  - (2.3 t/d > WLA)
- Represents a new source => antidegradation
  - Discharge to Ark River - too high in chloride
  - Land application - too high in chloride
  - Discharge to Walnut River - too high in chloride
  - Deep well injection - expensive, loss of water
- Looking at a "NO"

Solution lies within WQS & TMDL

- Resulting effluent from WWTP drops to 111 mg/l
- Ark River low flow has average background [Cl] of 365 mg/l
- KDHE proposed blending of RO waste with WWTP effluent
  - resulting combined waste stream to river = 360 mg/l
- WL increases to 3.76 t/d
- TMDL anticipated numerous ground water remediation projects in valley, each with a WLA of 2.5 t/d;
  - have not materialized
- Shifted Ark City WLA = 1.34 t/d + 2.5 t/d = 3.84 t/d

A Success Story

- Ambient Ark concentration is unchanged and increased loading is offset by absence of one GW remediation project
- No downstream impacts; and as river rises, dilution dominates
- Ark City can accommodate growth with an improved water supply but without environmental impact to the river

- We got to “YES”

Take Away Messages

- WQS are science, but science can't solely dictate policy
- TMDLs are more than math, have to create a strategic path into the future to create options for NPDES
- NPDES needs to escape thinking in a steady state, becoming more dynamic brings about flexibility to handle the unforeseen
- Communication between all three CWA sectors has to be constant and innovative
- We can't tell the future but it'll want "YES" answers

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