Implementation of a New Probabilistic Stream Monitoring Program in Kansas

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Stream Monitoring Symposium
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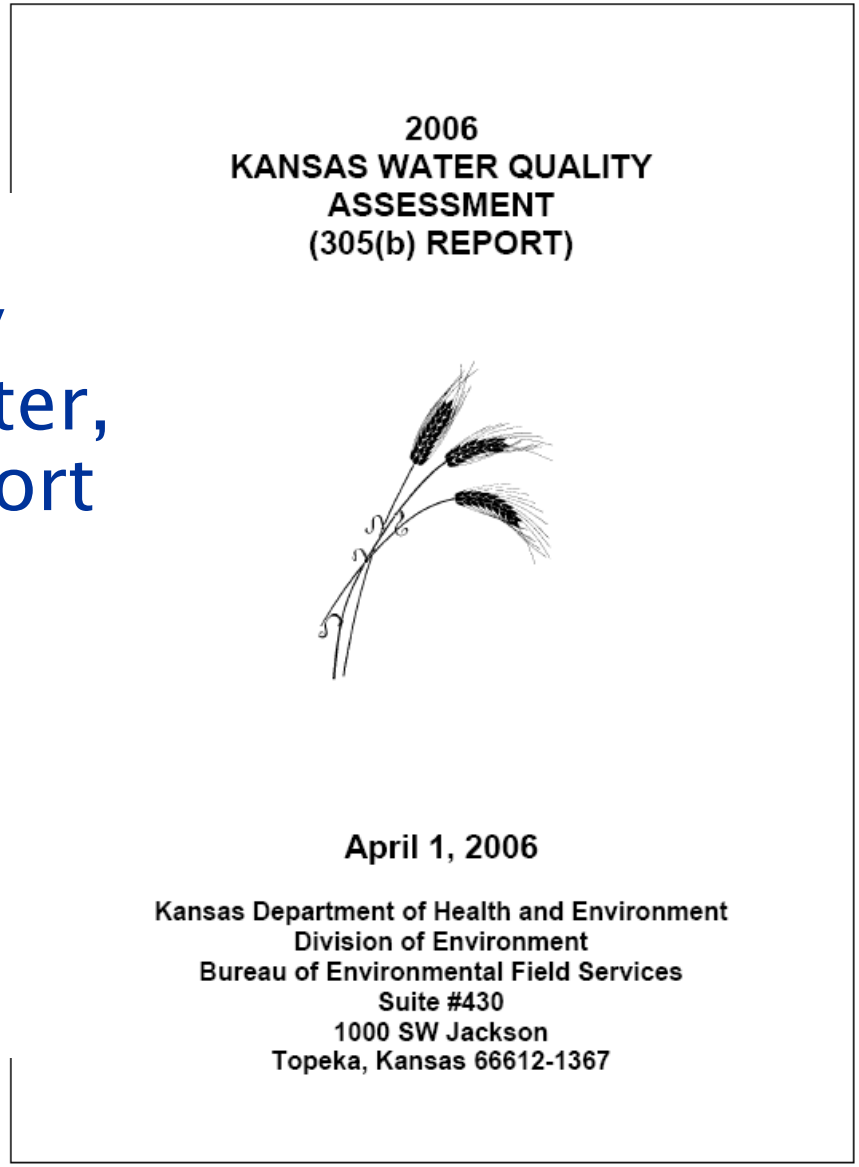
Overview

- Agency context
- Benefits of probabilistic program
- Survey design and site selection
- Sampling methodologies
- Preliminary results

Cow Creek, CR Co, 03OCT06

Context

- Our Bureau routinely monitors surface water, produces 305(b) report
- Two programs historically support streams assessment:
  - Chemistry
  - Biology
- New program is a hybrid of these



2006
KANSAS WATER QUALITY
ASSESSMENT
(305(b) REPORT)

April 1, 2006

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Context

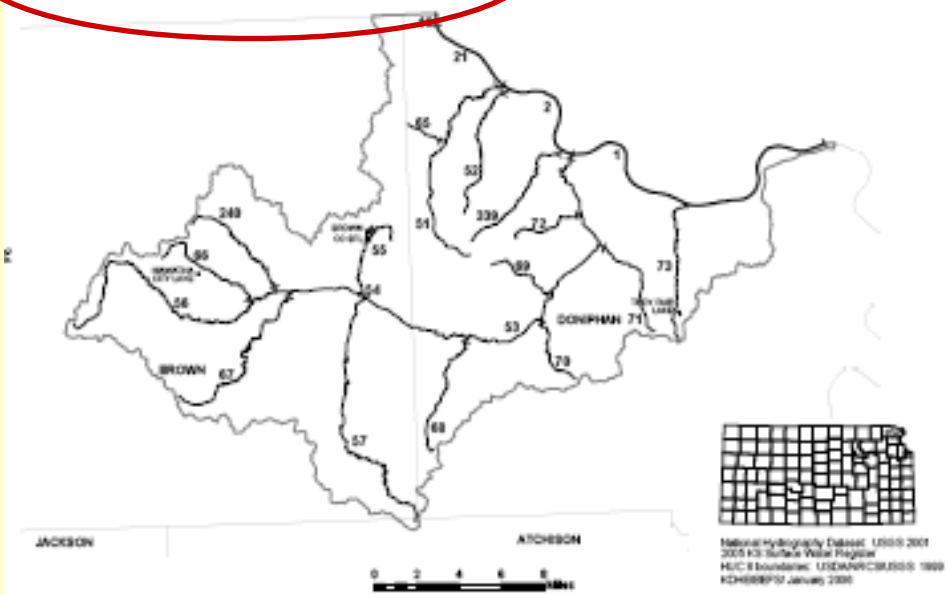
- All classified waters listed in KSWR (Kansas Surface Water Register)
- Explicit framework (map + list) defines resource
- ~30K stream miles
- Supplementary data available (USGS flow estimates, 2002)

Designated uses of major classified streams (continued)

MISSOURI RIVER BASIN

STREAM SEGMENT NAME	LATITUDE/LONGITUDE UPPER		LOWER		SEG	CLASS	AL	CR	DS	FP	GR	IW	IR	LW
SUBBASIN: TARKIO-WOLF (HUC 10240005)														
Cedar Cr	39.8329	95.2847	39.8476	95.2505	51	GP	E	C						
Cold Ryan Branch	39.7447	95.1940	39.7862	95.2244	70	GP	E	b						
Coon Cr	39.7759	95.1223	39.8373	95.1689	71	GP	E							
Halling Cr	39.6992	95.3225	39.7757	95.2890	68	GP	E	b						
Mill Cr	39.8617	95.2887	39.9454	95.2458	52	GP	E							
Mission Cr	39.8426	95.2828	39.9020	95.2003	339	GP	E	b	X	X	X	X	X	X
Missouri R	39.9000	95.1896	39.9008	94.9659	1	GP	S	B	X	X	X	X	X	X
Missouri R	39.9482	95.2489	39.9000	95.1896	2	GP	S	B	X	X	X	X	X	X
Missouri R	40.0000	95.3081	39.9903	95.3077	19	GP	S	B	X	X	X	X	X	X
Missouri R	39.9903	95.3077	39.9482	95.2489	21	GP	S	B	X	X	X	X	X	X
Mosquito Cr	39.7692	95.1010	39.8620	95.0901	73	GP	E	C						
Rittenhouse Branch	39.8251	95.2658	39.8029	95.2124	69	GP	E	b						
Spring Cr	39.9243	95.3367	39.9130	95.3024	65	GP	E	b						
Striker Branch	39.8429	95.2429	39.8591	95.1844	72	GP	E	b						
Unnamed Stream	39.8445	95.3547	39.8080	95.3827	55	GP	E	b	X	X		X	X	
Unnamed Stream	39.8600	95.5322	39.8120	95.4596	240	GP	E	b						
Wolf R	39.8051	95.3785	39.8989	95.1909	53	GP	E	C	X	X	X	X	X	X
Wolf R	39.8080	95.3827	39.8051	95.3785	54	GP	E	b	X	X	X	X	X	X
Wolf R	39.7940	95.6407	39.8080	95.3827	56	GP	E	b	X	X	X	X	X	X
Wolf R, Middle Fk	39.7416	95.5489	39.8118	95.4446	67	GP	E	C	X	X	X	X	X	X
Wolf R, N Fk	39.8371	95.5598	39.8053	95.4809	66	GP	E	C	X	X	X	X	X	X
Wolf R, S Fk	39.6500	95.3410	39.8051	95.3785	57	GP	E	b	X	X	X	X	X	X

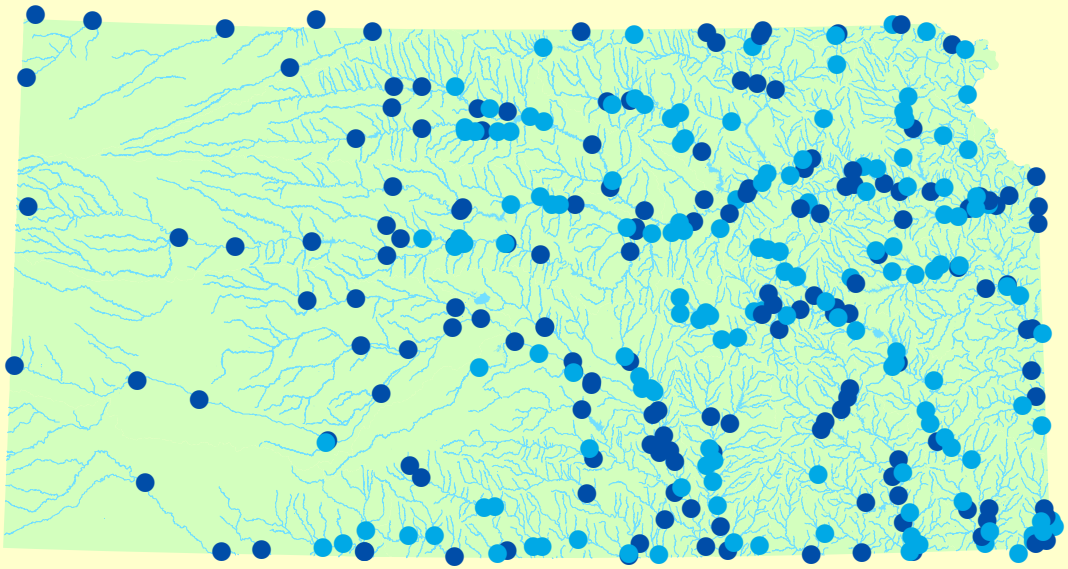
MISSOURI RIVER BASIN
SUBBASIN: TARKIO-WOLF (HUC 10240005)



Kansas Surface Water Register at: www.kdheks.gov/befs.
Flow data from "Estimates of Median Flows…" CA Perry et al, USGS WRI Rept. 02-4292, 2002.

Stream Chemistry Program

- 319 stations (165 core + 155 rotational)
  - About 200/yr sampled
- Integrator sites, mostly low in watersheds
- Each point represents reach of ~27 mi channel (barring point influences)



J. Gutierrez – photo by T. Stahl

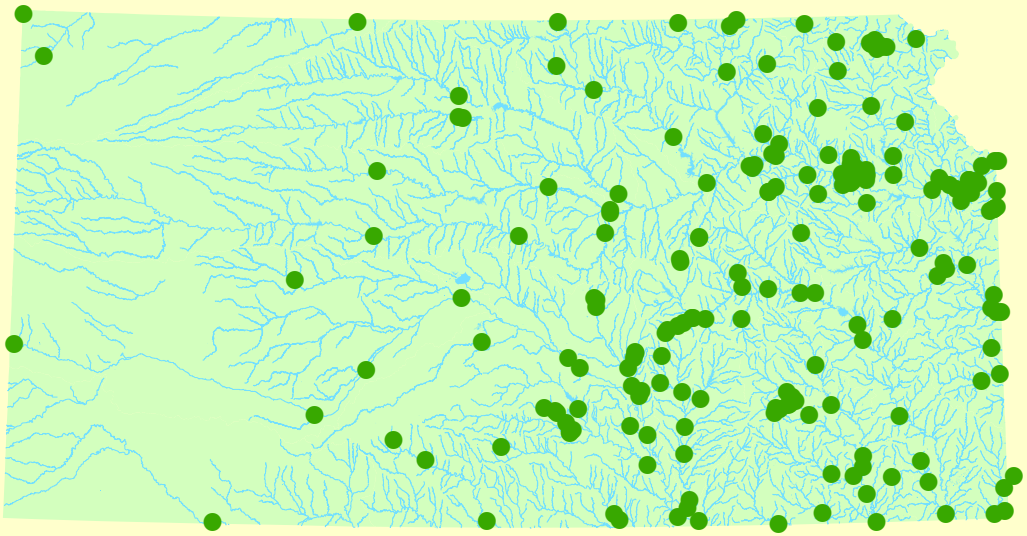
Stream Chemistry Program

- Bridge sampling
- Bimonthly (6x/yr)
- Over 80 analytes
- Flowing water *only*
- Stream Chem Program also does TMDL follow-up & special studies

G. Raab on Republican River – photo by T. Stahl

Stream Biology Program

- 100 stations = 45 core + 55 rotational
  - About 65/yr sampled
- Targeted
  - Reference, impacted, and integrator
- Perennial streams



South Fork Big Nemaha, NM Co., 2006

Stream Biology Program

- Methodology
  - Kick/sweep with D-net
  - Field pick (unaided eye)
  - Timed collection
    - 2 people x ≥30 min
    - Time ∝ habitat types
    - Minimum 200 organisms
  - Macroinverts identified to lowest practicable level, usually species
  - Several indices used in assessment (e.g., EPT, diversity, tolerance)

C. Goodrich – photo by S. Cringan

Stream Biology Program

- Mussel search
  - All sites
  - Directed search, ≥15 min
  - Live mussels recorded, valves collected
- Fish tissue monitoring
  - Screening: 15 sites/yr
  - Follow-up: as needed
  - Tissue metals & pesticides
- TMDL follow-ups

C. Goodrich and *Leptodea fragilis*, both at the Smoky Hill River, 2006

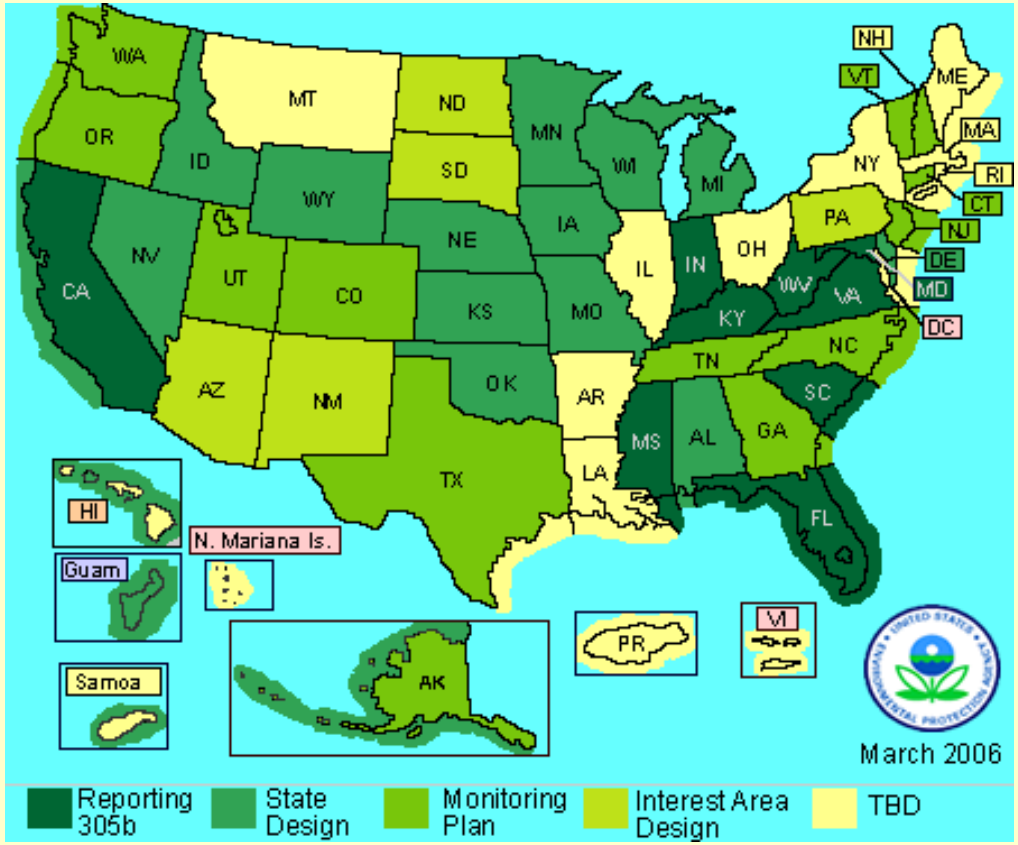
Improvements Needed

- New program considered since ~2000
- Smaller streams need to be monitored
  - Assessed mileage only **~61% of KSWR**
  - Use Assessment Section work* reflects importance of intermittent waters
- Level of bias unknown (site selection)
- Increased demands on parent programs
  - TMDL follow-up sampling (>1300 TMDLs)
  - New bacteriological sampling schedule
- New program est'd last year (3 staff)

*accelerated by passage and amendment of KSA 82a-2001

General Benefits of EMAP* Probabilistic Survey Design

- Unbiased, random
- Sites spatially balanced across resource
- Results with known confidence
- Stratifiable
- Comparability across states



*EMAP = USEPA Ecological Monitoring and Assessment Program, responsible for survey design and support. See www.epa.gov/emap


Delaware River, BR Co, 2006

Local Benefits

- Entire KSWR represented in assessment
- Advance our understanding of intermittent streams
- Other programs can reallocate resources to targeted studies (e.g., TMDL)

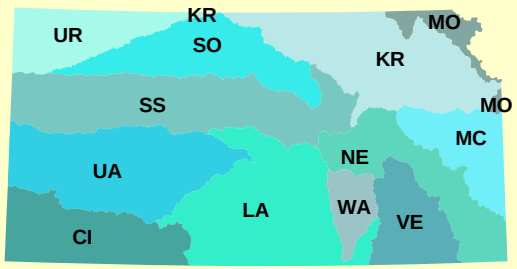
Additional Benefits (?) of Probabilistic Program

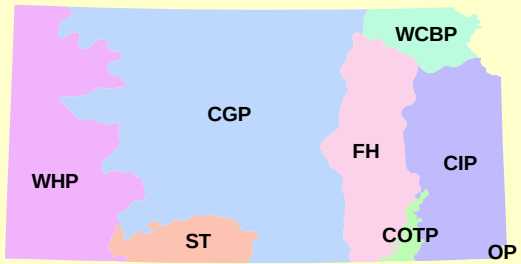
- Windshield time
- Good workouts (!)

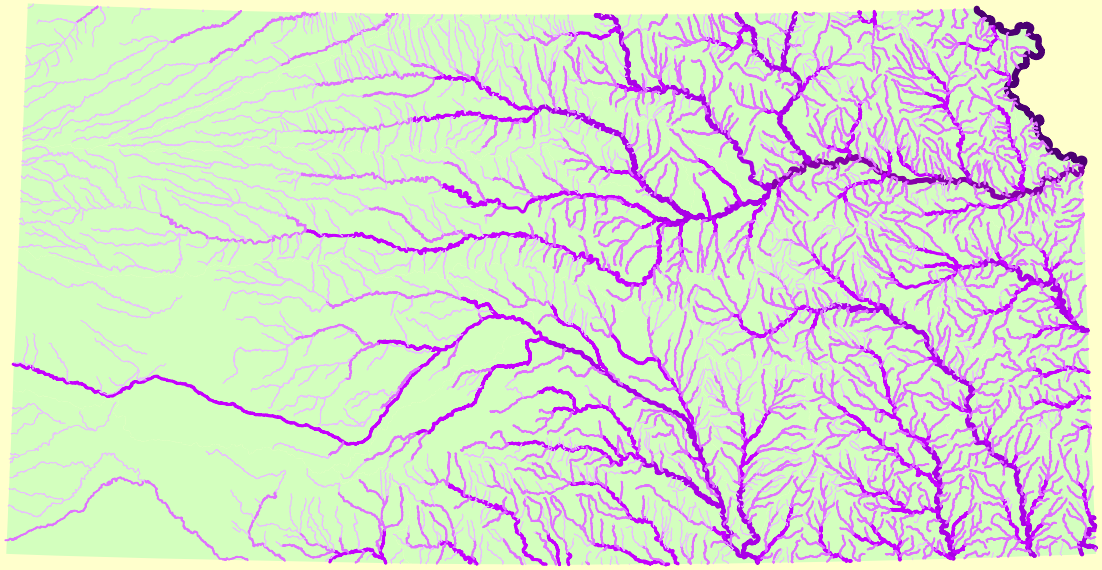

Smoky Hill River, GE Co., 2006

Survey design / Site selection

- Requires explicit graphical representation of resource
- Sample frame = Dec 2005 KSWR, trimmed at state boundaries (29,091 mi)
- Considered stratification by river basin, ecoregion, or discharge class (estimated median flow)





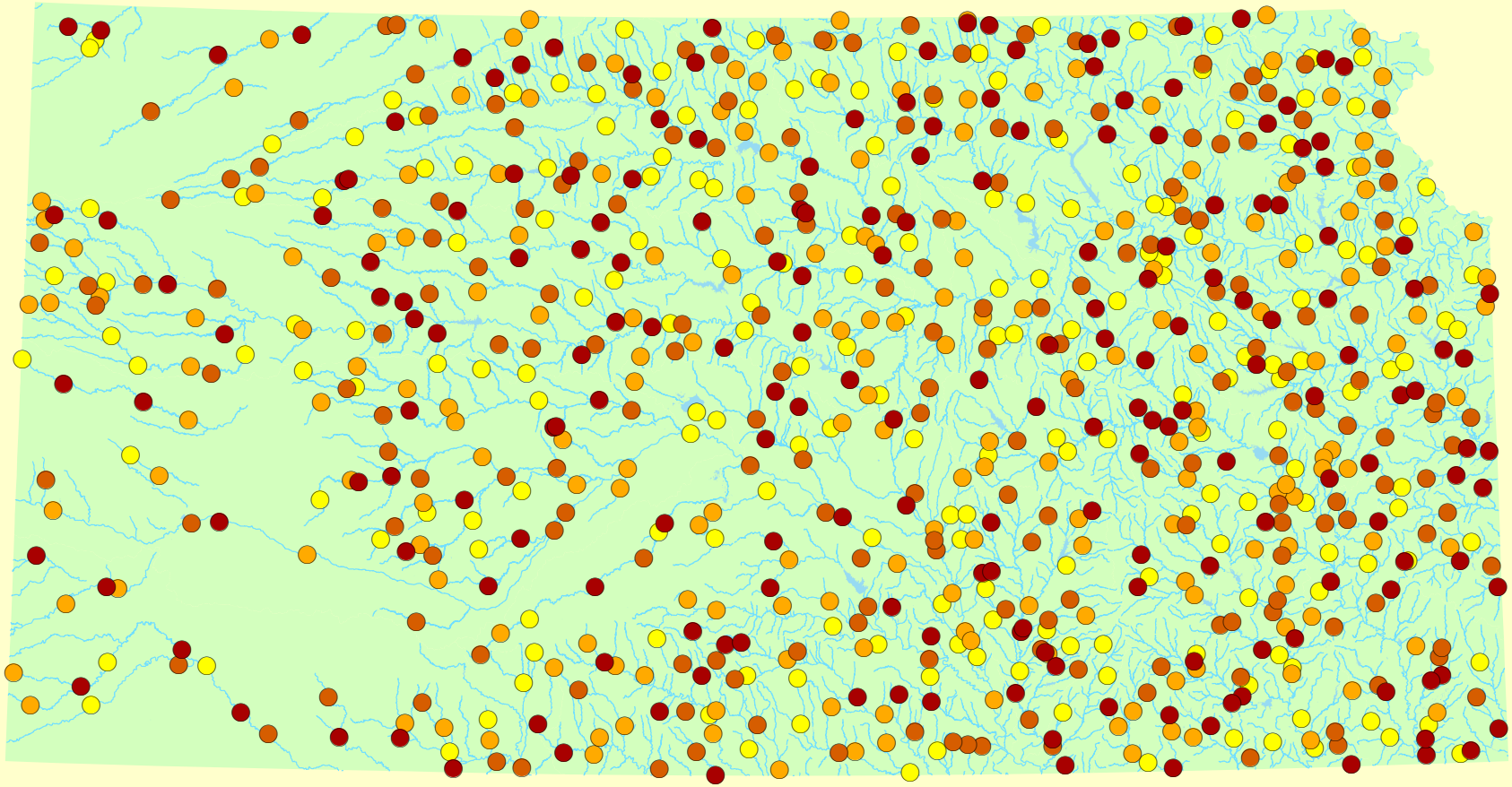


Kansas major river basins approx. equivalent to 6-digit HUCs. Kansas has 8 Omernik Level III ecoregions.
Median flow estimates in order-of-magnitude classes from <1 cfs to >10,000 cfs (USGS, 2002).

Survey design / Site selection

- Decided on unweighted design
  - To date, KS is only state to choose this
- Over 80% of KS streams est. ≤10 cfs
- Goal = 50 new sites each year
  - No repeat sampling across years
  - 200 in 4-yr assessment period
- USEPA EMAP design team created survey design to our specs
- List of 800 X-sites (sample coordinates) generated to last ~4 yrs

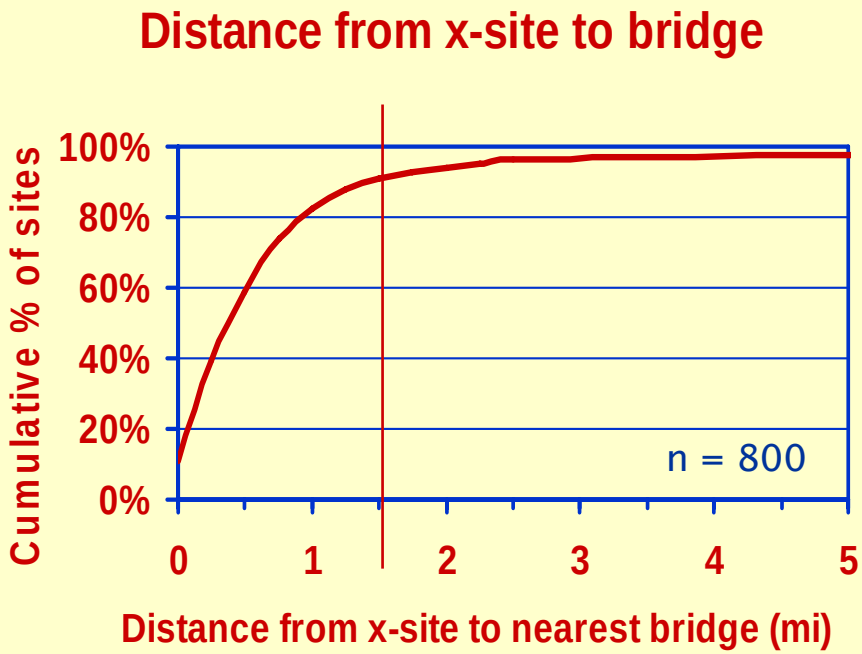
Survey design / Site selection



The 800 sites of KDHE Probabilistic Survey Design A (February 2006)

Survey and sampling design

- Establishing sites for biological sampling
  - Sites must be considered in order
  - Some sites rejected during permissions or reconnaissance
  - Exact X-site coordinates used, one visit
- Establishing sites for chem sampling
  - Multiple visits
  - Nearest crossing (up or down)
  - No confluences or land use changes
  - >90% at ≤1.5 mi



Sampling methodologies

- Based on protocols of existing programs
- Biological
  - No repeat visits to sites
  - 150m reach length imposed
  - Water column samples for chl-a and phytoplankton assemblage analysis
- Chemistry
  - Quarterly sampling
  - Collect from pooled sites

Sampling methodologies

- Physical habitat
  - Rapid Habitat Assessment (reach-wide)
  - Habitat Diversity Index (sampled habitat)
- Other observations
  - Channel dimensions at x-site, dominant substrates, flow condition, land use, and human influence
- Fish tissue at sites >3 cfs

Permissions

- Sought permission on first 200 sites
  - Yes or Limited on 140 sites (70%)
  - No or No Response on 60 sites (30%)
- Decided sampleability of 140 sites
  - 38 determined to be dry through reconnaissance
  - 102 left as viable sample sites (51% overall)
- First 50 selected for sampling in 2006

Reconnaissance

- Desk Recon

- Field Recon

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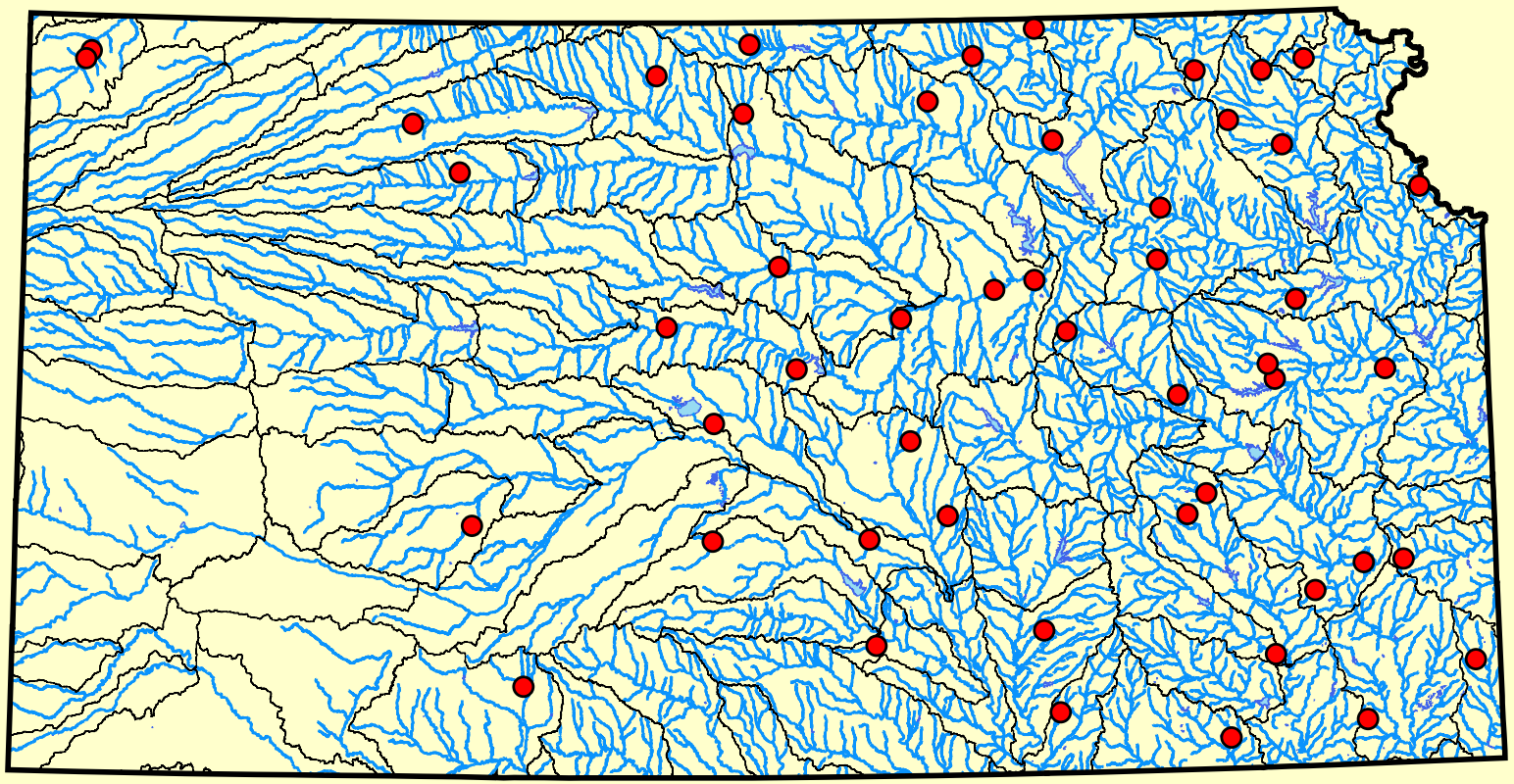
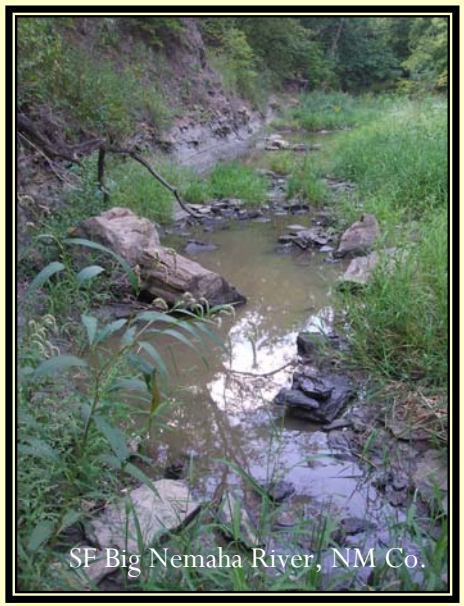
Survey and sampling design

- Sample sites visited in 2006



Preliminary results

- 10 of 50 sample sites were dry at time of visit



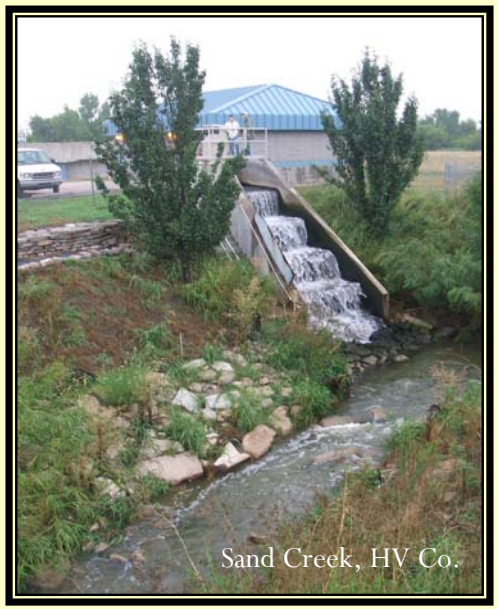
- 40 sites evaluated for biology, chemistry, and physical habitat

General Impressions

- Statewide drought
- Wide variety of site types


Running Turkey Creek, MP Co.


Mill Creek, WB Co.


Sand Creek, HV Co.


Smoky Hill River, GE Co.

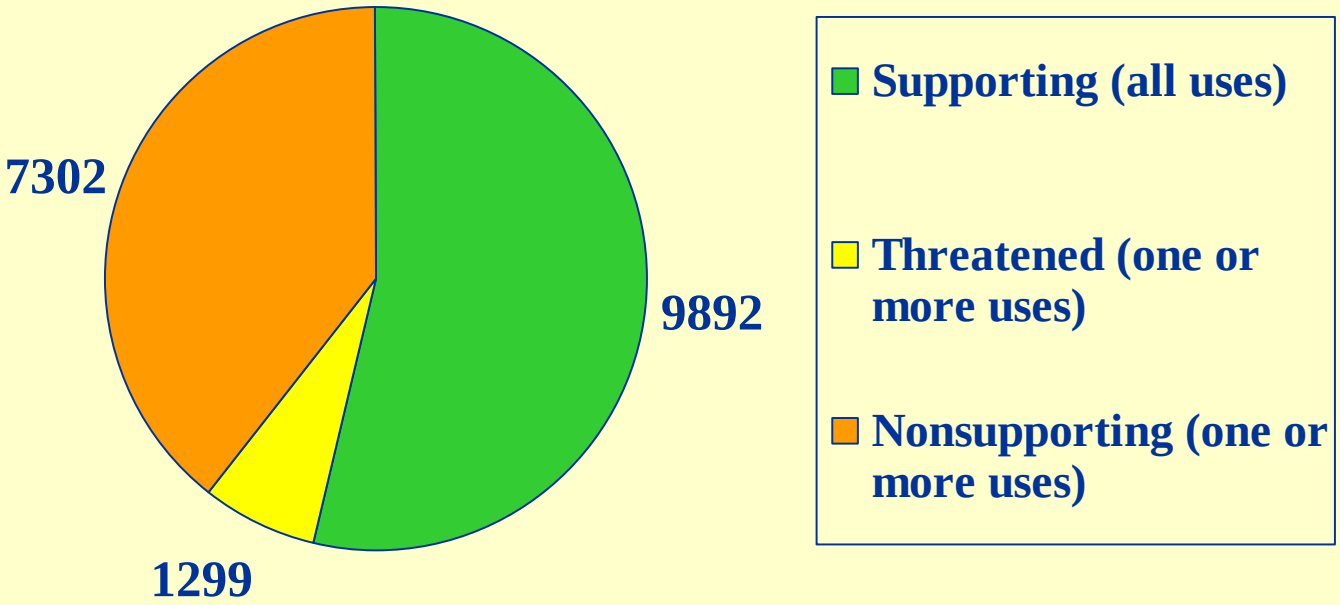
Future Considerations

- Plans
  - Summer recon completed, 2007 sites selected
  - Continue next round of permissions
  - Invertebrate identification and data analysis

- Challenges
  - Changes to KSWR/sampling frame (UAA)
  - Minimizing selection of non-reportable sites
  - Assessment using data from pooled sites


Questions or Comments?
Fivemile Cr., LV Co, 17JUL06

2006 Kansas Water Quality Assessment - stream summary



Out of 18,493 stream miles assessed.