



Application of Ambient Water Quality Criteria to Ephemeral and Effluent-dependent Waters

R.W. Gensemer & D. DeForest, *Parametrix*;
M. Gerath, *ENSR*; K.V. Brix, *EcoTox*; R. Santore,
HydroQual; E.F. Curley & K.R. Sierra,
Pima County Wastewater Management

Criteria Evaluation Project



- *Project goals:*
 - Evaluate relevance/application of National Ambient Water Quality Criteria (AWQC) to arid west
 - Models: Copper, Selenium, Diazinon, Ammonia
- *Today's talk:*
 - Overview of potential for AWQC modification for ephemeral and effluent-dependent waters
 - Application to proposed aquatic life classifications in Colorado

AWQC Modification

**Magnitude
(CMC, CCC)**

**Duration
(1 hr, 4 d)**

**Frequency
(1x every 3 yr)**

1. Recalculation
2. WER
3. Resident Spp.

**Not generally
modified**

Ephemeral & Effluent-dependent Waters

- Physically variable habitat
 - magnitude and duration of storm flows severe
 - significant periods of no-flow
- Unique water quality characteristics
 - elevated hardness, alkalinity
 - high background contaminant concentrations
- Unique aquatic communities
 - endemic communities may recover in < 3 yr

AWQC Magnitudes

How do we address these unique aquatic communities?

Minimum Data Required

- Final Acute Value (USEPA 1985)
 - *Salmonidae*
 - 2nd Osteichthyes
 - Chordata
 - *Planktonic crustacean (e.g., cladocerans)*
 - Benthic crustacean
 - Aquatic insect
 - Phylum other than Chordata
 - Other insect or phylum

Recalculation Procedure

- Adjusts AWQC magnitude for differences in species composition
- Ephemeral & effluent-dependent streams (HCS)
 - *Salmonids usually absent*
 - little impact: metals
 - significant: NH_4
 - *Poor record for cladocera at times*
 - significant: metals (e.g., 20% difference, Cu acute)
- Simplified recalculation if < 8 families at a site?
 - e.g., no fish or cladocera considered in ephemeral (A&We) streams; AZ
 - Acute criterion based on acute toxicity to most sensitive taxon (*Gammarus*)

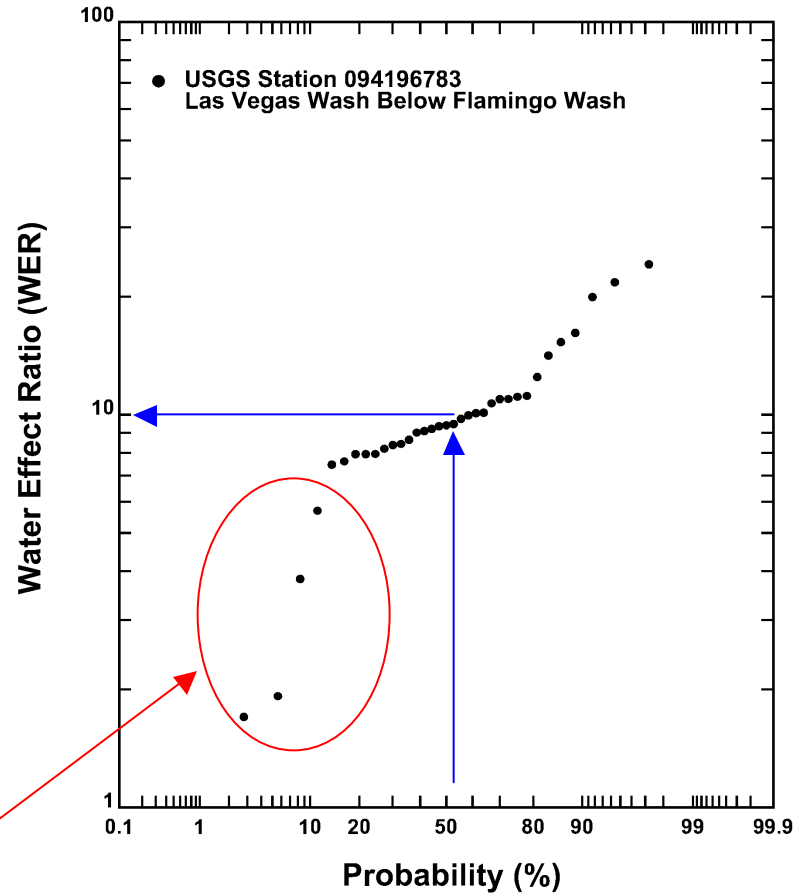
Resident Species Procedure

- Generates new criteria from resident species toxicity data
 - Only occasionally used
 - e.g., DO standard, S. Platte R. (CO)
 - But without resident species testing, following factors still not considered:
 - acclimation to local conditions
 - e.g., hardness, elevated background concentrations
 - adaptation
 - resident species can be less sensitive (Sappington et al. 2001)

AWQC Magnitudes

How might water quality characteristics influence contaminant bioavailability?

Biotic Ligand Model-predicted Water Effect Ratio (WER) Copper: Las Vegas Wash, NV

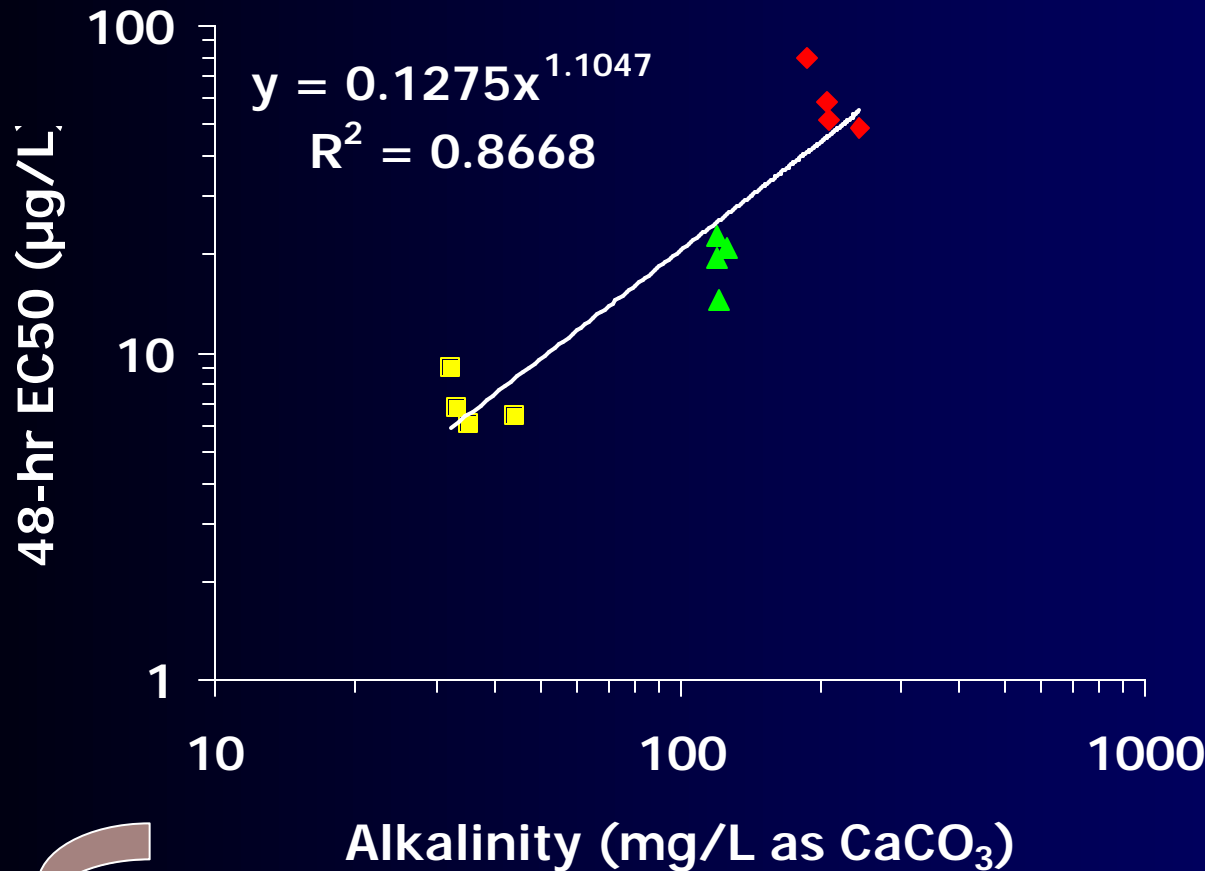
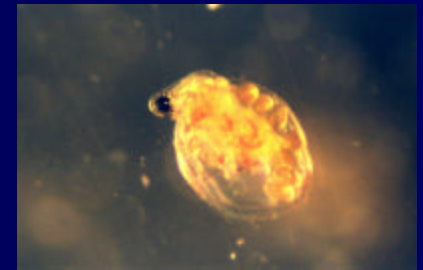


High discharges

Median WER
= ca. 10

**Criteria
potentially over-
protective?**

Cu Toxicity vs. Alkalinity



So...are hardness adjustments relevant?

Water-effect Ratio (WER)

- Empirically adjusts WQ standard to account for changes in bioavailability (inherently site-specific)
- However, regional water quality often leads to reduced contaminant bioavailability, thus supporting use of WER
 - elevated hardness
 - alkalinity important for metals toxicity (Cu)
 - WER magnitudes flow-dependent (may not be unique to arid west)

AWQC Duration and Frequency

If modified, what are the potential impacts on NPDES permit conditions?

Possible Modification

- Increased duration may be possible
 - chronic NH_4 (30 days); others?
- Decreased frequency (< 3 yr)
 - relatively unmodified ephemeral streams



Increased design flow



Less conservative NPDES permit limit

Duration and Frequency Impacts

Site	Recurrence Frequency	Design flow (CFS) *			
		1 d	4 d	7 d	30 d
Santa Fe R. (NM)	1.5 yr	0.8	1.1	1.2	1.8
	3 yr	0.14	0.7	0.6	1.2
Fountain Cr. (CO)	1.5 yr	37	41	44	54
	3 yr	35	38	40	46
S. Platte R. (CO)	1.5 yr	13	19	23	38
	3 yr	10	13	16	31

* *Biologically-based design flows (DFLOW)*

Is There a Need to Modify CO WQ Standards?

- “One-size fits all” approach to numerical standards may not provide most *accurate* * level of protection for aquatic life
- Proposed changes to aquatic life classifications provide good opportunities for modification
 - Recalculation (temperature, presence of fish)
 - Changes to acute standard calculation (effluent-dependent)?
 - Changes to frequency and duration (effluent dependent/dominated)?

* *Neither over-protective or under-protective*

Warm Water, Cold Water, Transitional

- Relatively straightforward application of “trout” vs. default TVS values as currently proposed
- E.g., salmonid-present vs. salmonid-absent ammonia standards (1999 AWQC)

Fish vs. No Fish Classifications

- CO 309 Study*
 - Acute standards only for warmwater and transitional streams without fish
 - To reflect more limited aquatic life uses
- Alternative?
 - Recalculate after removal of fish from toxicity database
 - Data from at least 8 families still required for acute
 - Unless < 8 families occur at the site
 - Both acute and chronic stds. depending on flow?

* 10 March draft

Effluent & Flow Modification

- If effluent/stream flows more constant:
 - Increase default duration?
- If stream flow duration short:
 - Decrease default frequency (no fish streams only)?
- If net ecological benefit demonstrated:
 - Change in level of protection proposed
 - Would require change to final acute value calculation