

Negotiated Rulemaking  
Docket No. 58-0102-1502

# Update to Copper Criteria for Aquatic Life Use

October 28, 2015



Idaho Department of Environmental Quality



# Review of rulemaking schedule



# Outline

- Background on existing copper criteria
- Why are we revising?
- What is the Biotic Ligand Model?
- How does it compare?
- Implementation questions and considerations



<http://www.wisegeek.org/what-is-copper.htm>



# Background

- Existing copper criteria are hardness based
  - Hardness- the amount of dissolved calcium and magnesium in water
  - High hardness mitigates toxicity of copper to aquatic organisms



# Background

- Existing copper criteria:

Acute

$$CMC = e^{(0.9422 * \ln[\text{hardness}] - 1.464)} * 0.96$$

Chronic

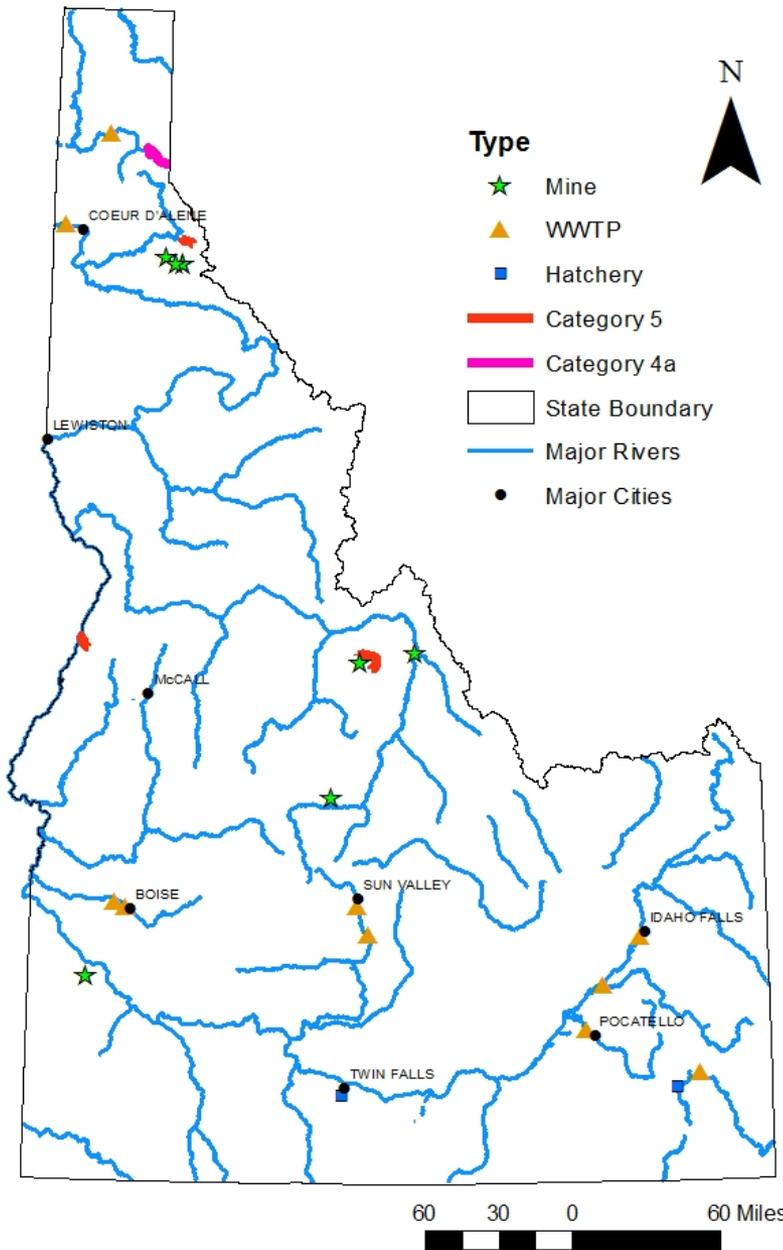
$$CCC = e^{(0.8545 * \ln[\text{hardness}] - 1.465)} * 0.96$$

- *Low-end hardness floor: 25 mg/L\**



# Background

- 2012 Integrated Report
  - 6 Assessment Units listed in 2012 IR, 20.5 miles
- One approved TMDL, 3 AUs, 12.4 miles (Clark Fork River)
- Permits
  - 20 individual with permit limits
  - 10 WWTP, 8 mines, 2 fish hatcheries





# Why Change?

- Current criteria were not revised in 2005, when other metals were
  - Knew EPA's 304(a) recommendation was coming
- 2007: EPA finalized their Aquatic Life Ambient Freshwater Quality Criteria – Copper
  - Use of the Biotic Ligand Model (BLM) to derive criteria



# Why Change?

- 2012- NWEA lawsuit against EPA- for Failure to Consult on Idaho's WQS
- EPA's Response- consultation with USFWS and NOAA
- Biological Opinions completed
  - NOAA- 2014
  - USFWS- 2015



# Why Change?

- NOAA Fisheries, US Fish and Wildlife Services Biological Opinion
  - Found jeopardy and adverse modification of critical habitat due to several criteria, including acute and chronic Cu criteria; low-end hardness floor
- Reasonable and Prudent Alternative:
  - New criteria by May 2017, no less stringent than EPA's 2007 304(a) copper criteria (BLM)



<https://www.idahopower.com/OurEnvironment/FishAquatic/snails/default.cfm>



# What is the BLM?

- Biotic Ligand Model
  - Toxicity of copper is affected by various chemical characteristics in the water





# What is the BLM?

- Analogous to Hardness-based, but uses additional parameters:

<b>Temperature</b>	<b>pH</b>	<b>Cu</b>
<b>DOC</b>	humic acid*	<b>Ca</b>
<b>Mg</b>	<b>Na</b>	<b>K</b>
<b>SO<sub>4</sub></b>	<b>Cl</b>	<b>Alkalinity</b>
<b>S*</b>		

\*HA and S are input as constants for copper



# What is the BLM?

- Model developed for toxicity of multiple metals, some parameters more important than others depending on metal
  - For copper - most important are:
    - » pH
    - » DOC



# How much does it cost?

Model is free, Data are not.

Parameter	Cost	Parameter	Cost
Temperature	<i>Field measure</i>	Mg	\$13.00
pH	<i>Field measure</i>	Na	\$13.00
Cu	\$13.00	K	\$13.00
DOC	\$40.00	SO4	\$19.00
HA%	<i>Constant</i>	Cl	\$19.00
Ca	\$13.00	Alkalinity	\$14.00
S	<i>Constant</i>		

**\$157.00 for BLM inputs**

*Costs estimated from Idaho State Bureau of Laboratories' price list*

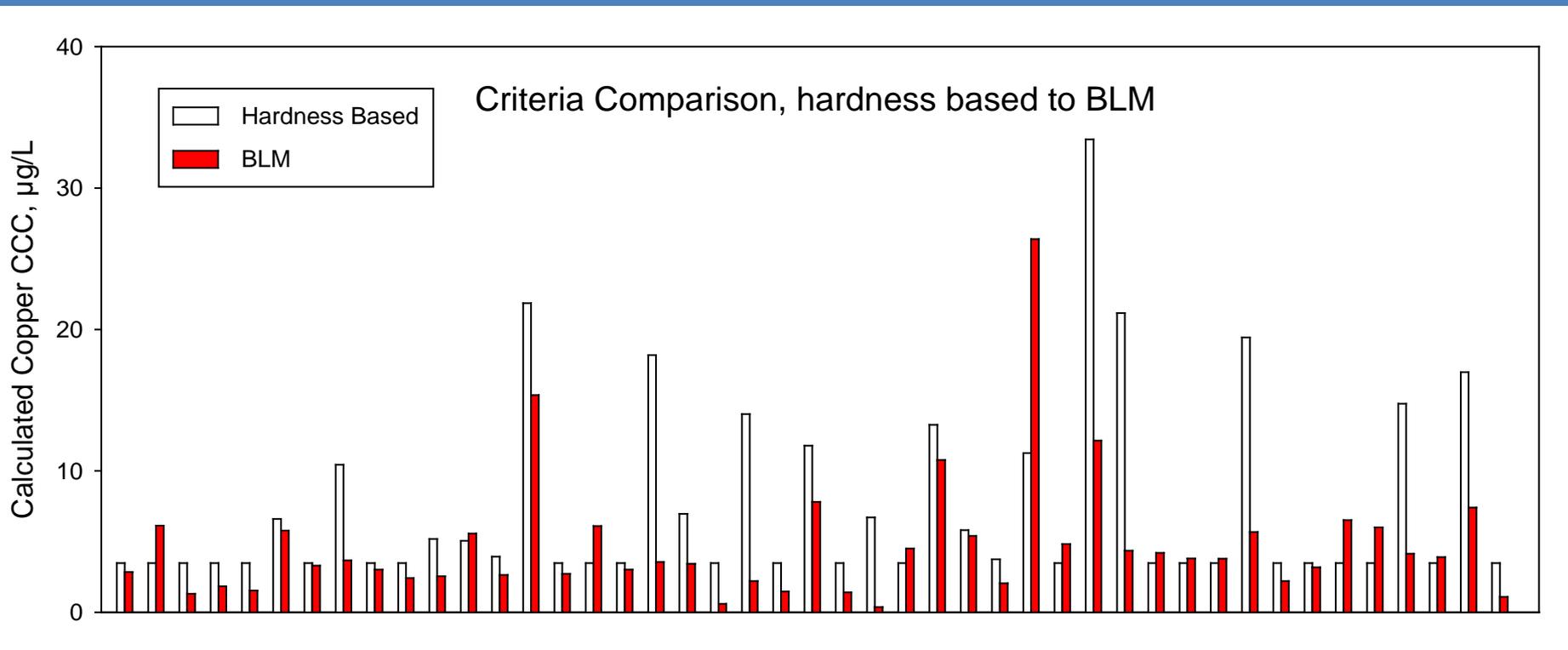


# How does BLM compare to Hardness based criteria?

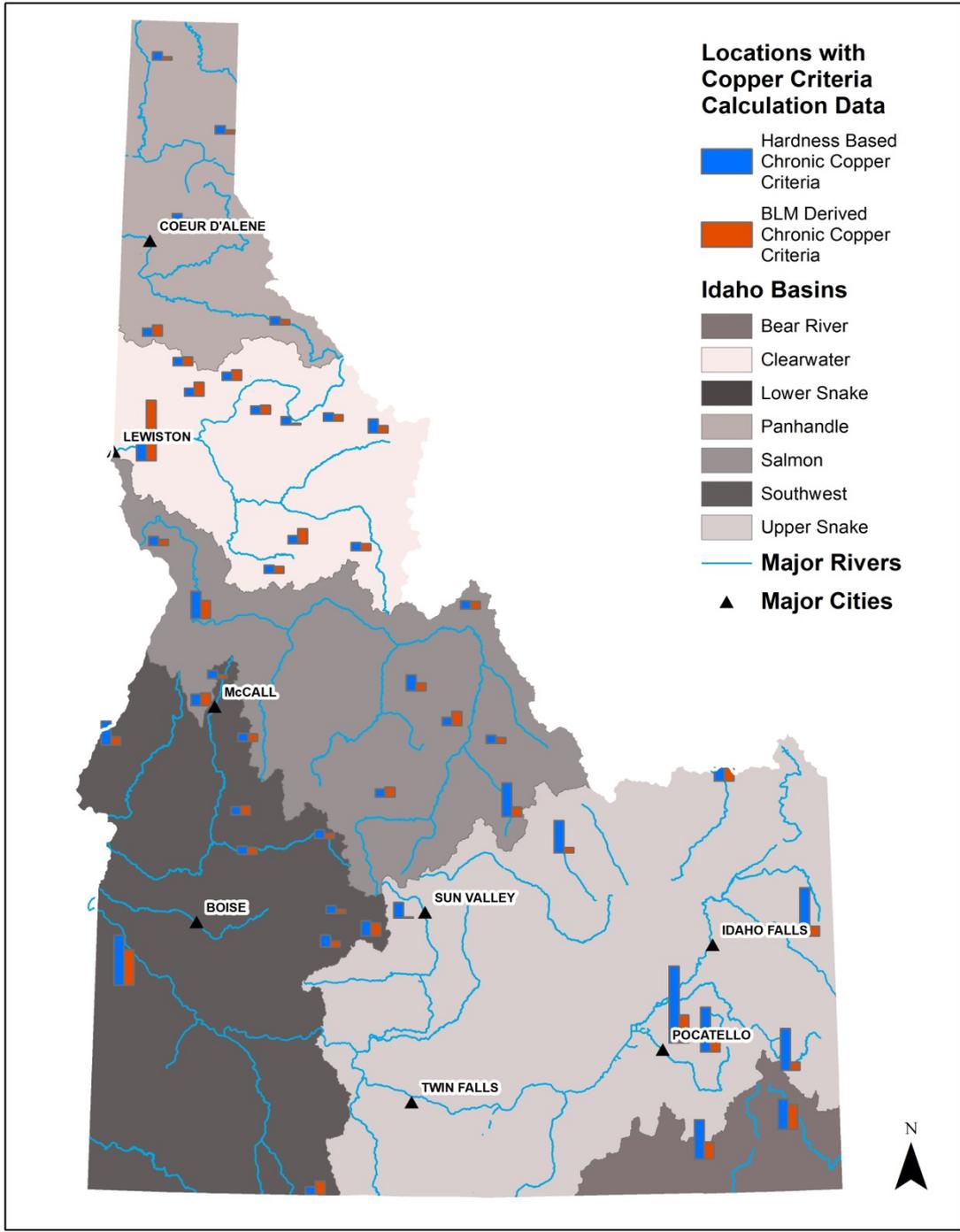
- It depends...
  - Site *and* time specific...
  - Copper BLM is sensitive to DOC and pH
  - Mining areas will likely see more stringent criteria
  - Municipal wastewater will likely see less stringent criteria



# How does BLM compare to Hardness based criteria?



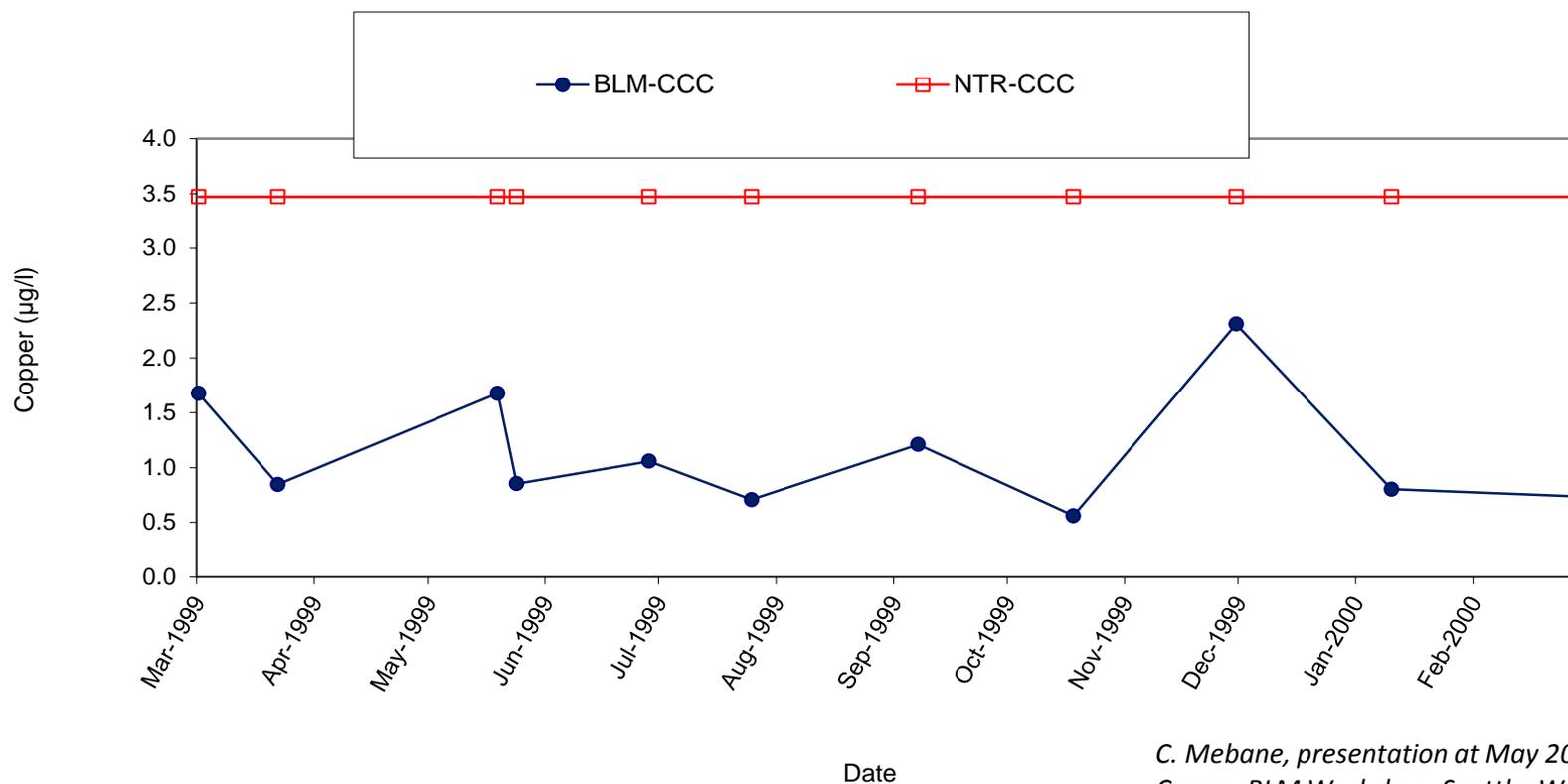
*Statewide stream data from 1999 Wadeable Streams Assessment*





# Mining area- Relatively Low DOC

BLM- and hardness based chronic copper criterion, NF Coeur d'Alene River (hardness 11-23 mg/L, DOC 0.4 - 1.1 mg/L)



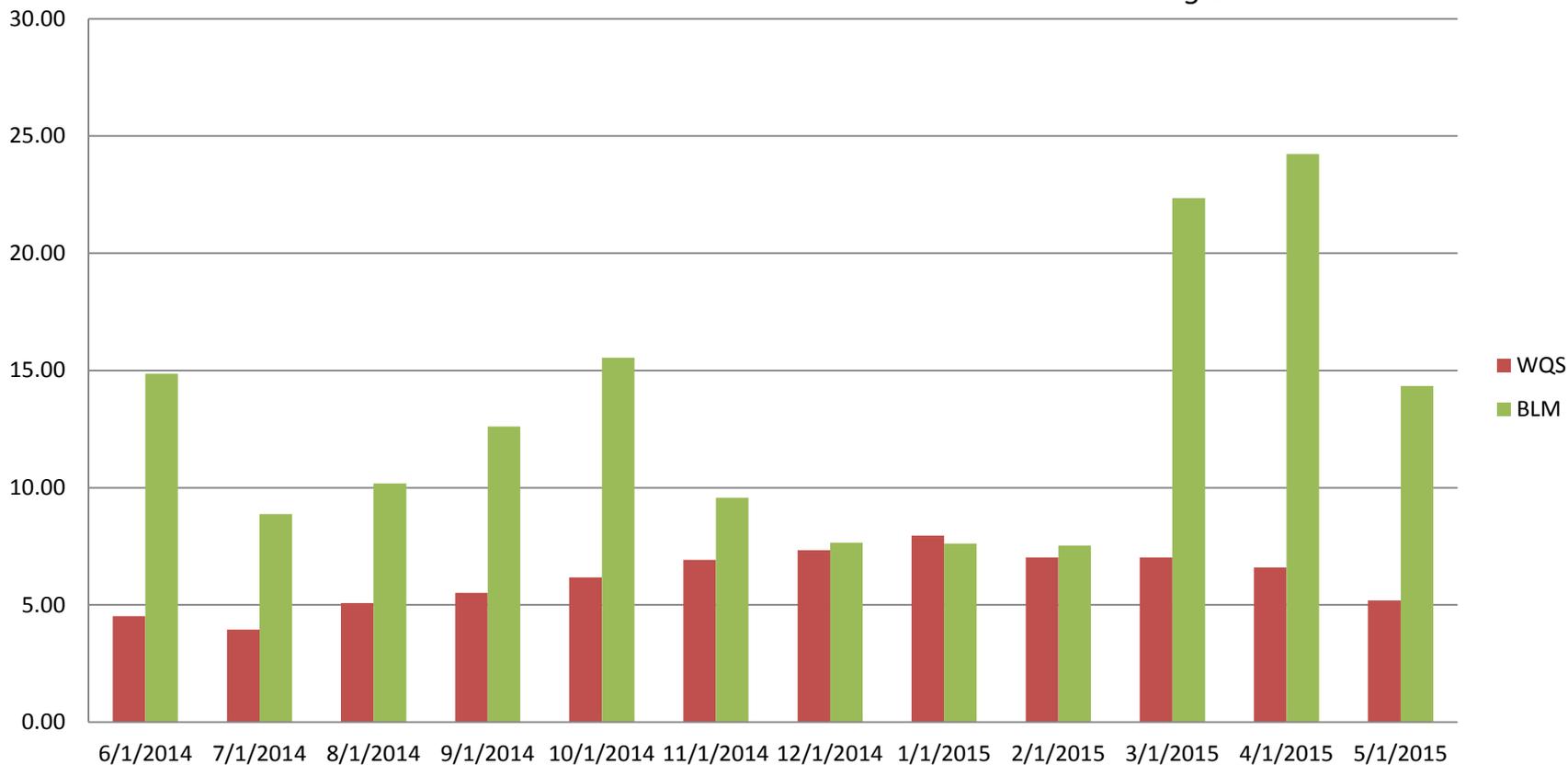
*C. Mebane, presentation at May 2015  
Copper BLM Workshop, Seattle, WA*



# Urban area, municipal wastewater- Relatively High DOC

**REB - Copper CCC (ug/L)**

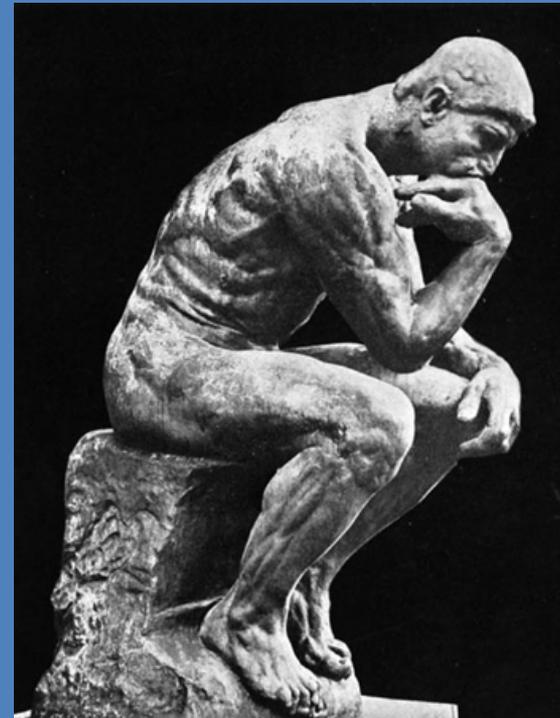
*City of Boise, Boise River at Eagle Road*





# Other Considerations

- Other things to think about...



<http://www.aaronartprints.org/rodin-thethinker.php>



# Implementation Issues

- Requires a model run to determine criteria (not a simple equation)
- Requires many different parameters (11)
  - some not commonly collected (e.g., DOC)
- Produces many instantaneous water quality criteria (IWQC)
  - So... what goes in a permit? What do you use for listing decisions?



# Implementation Issues

- What criteria do you use when data aren't available?
- What do you use for missing data?
  - Default values
- What do we do for site-specific criteria?

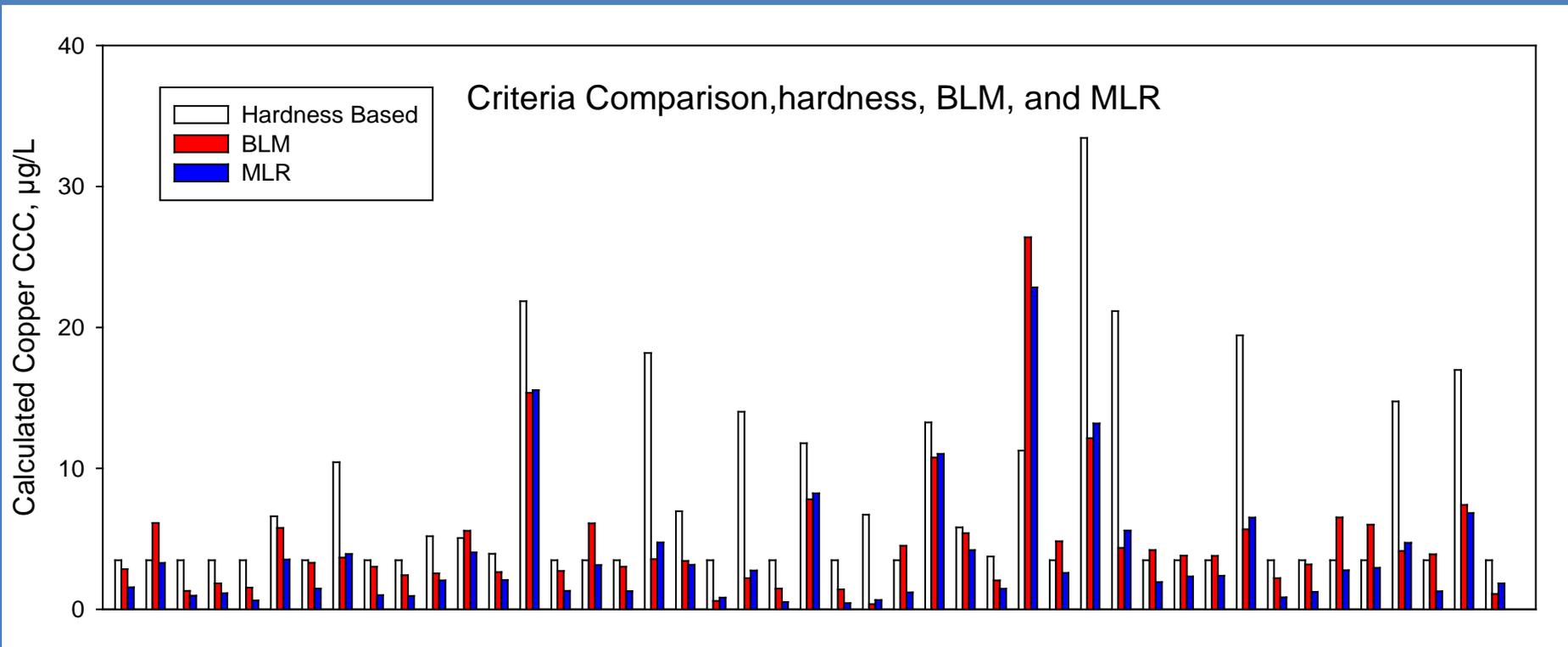


# Multiple Linear Regression

- Simple equation that uses only 3 (most important) parameters to calculate criteria
- Acute  
$$e^{[-14.23+(6.38067*\ln[pH])+(0.8947*\ln[DOC])+(0.4418*\ln[hard])]}$$
- Chronic  
CMC/1.615



# Multiple Linear Regression- Comparison to BLM



*Data from 1999 EPA Wadeable Streams Assessment*



# Fixed Monitoring Benchmark

- Compares copper data to BLM IWQC
- Based on the probability that the benchmark copper concentration will exceed BLM IWQC more than once in 3 years
- Requires *lots* of data, including copper and all BLM inputs across time (monthly, multiple years)



# Fixed Monitoring Benchmark

- Other options?
  - Identify a critical time (baseflow?)
  - Choose a number from distribution of IWQC (10<sup>th</sup> percentile?)



# Missing Data

- Defaults?
- Monitoring Requirement?



# Defaults

- Use regional default values for calculating BLM criteria when input parameters are missing
  - Can be somewhat accurate for geochemical ions (Ca, Mg, Na, K, Cl, SO<sub>4</sub>, Alkalinity)
  - Not very accurate for DOC, pH
    - Can be overly protective



# Monitoring Requirement

- What is the frequency of monitoring necessary to derive criteria?
- Can we use defaults to estimate missing parameters?
  - All, or just the geochemical ions?



# Chris Mebane, USGS

Protectiveness of the BLM and  
comparison to hardness-based  
criteria



## Next Steps...

- Comments due: 11/9/2015
- Next meeting: 12/11/2015

BiOp RPA: criteria no less stringent than EPA's 2007 304(a) copper criteria by **May 7, 2017**



# Considerations for Committee

- Should we stick with BLM or pursue multiple linear regression approach?
- What do we use for compliance? (FMB? 10<sup>th</sup> percentile?)
- How do we handle missing data? (Default values? Require monitoring?)
- Keep hardness-based, use it until data are available?