

# Aquatic Life Criterion for Selenium

## Preliminary Draft Negotiated Rule

### Docket No. 58-0102-1701

Stephanie Jenkins  
Water Quality Standards  
Idaho Department of Environmental Quality

April 27 2017



# Outline

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Background on Existing Criteria



Why Change?



Criteria Comparisons



Implementation Challenges

# Outline

Background on Existing Criteria



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Implementation Challenges

# Existing Aquatic Life Criteria

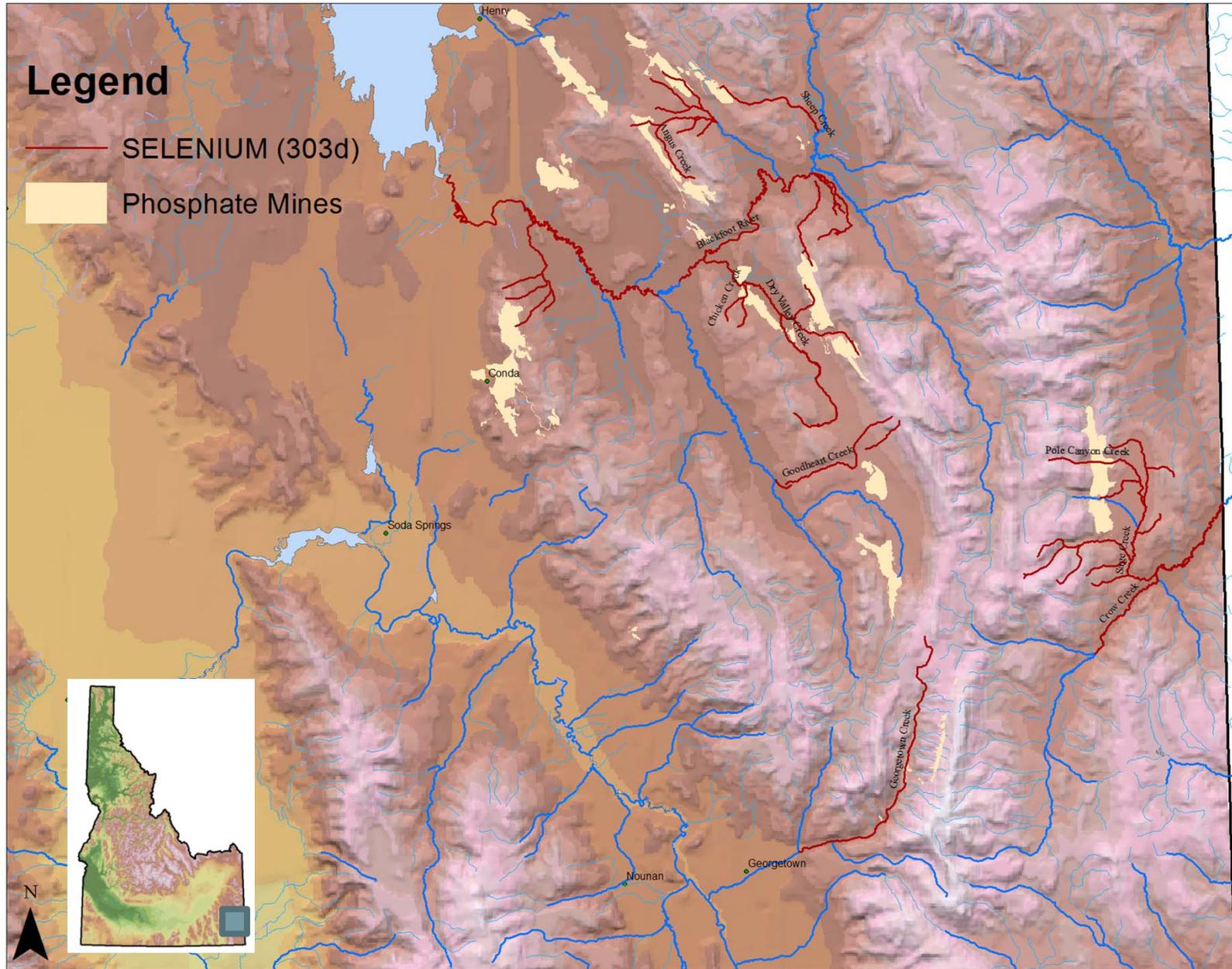
(Number) Compound	CAS Number	<u>Acute</u> <i>CMC</i> (µg/L)	<u>Chronic</u> <i>CCC</i> (µg/L)
10 Selenium	7782492	20	5

Acute: 1 hour average; Chronic: 4 day average

Criterion expressed as total recoverable (unfiltered) concentrations

# Legend

- SELENIUM (303d)
- Phosphate Mines



0 2.5 5 10 Miles

# Currently Listed Streams

- 2012 Integrated Report
  - 3 HUCs (Salt, Blackfoot, Bear)
  - 22 Assessment Units
  - 147 miles
- No approved TMDLs
- No NPDES Permits
  - All non-point source

P4 Production, LLC provided photo of Blackfoot Bridge Mine, Caribou County

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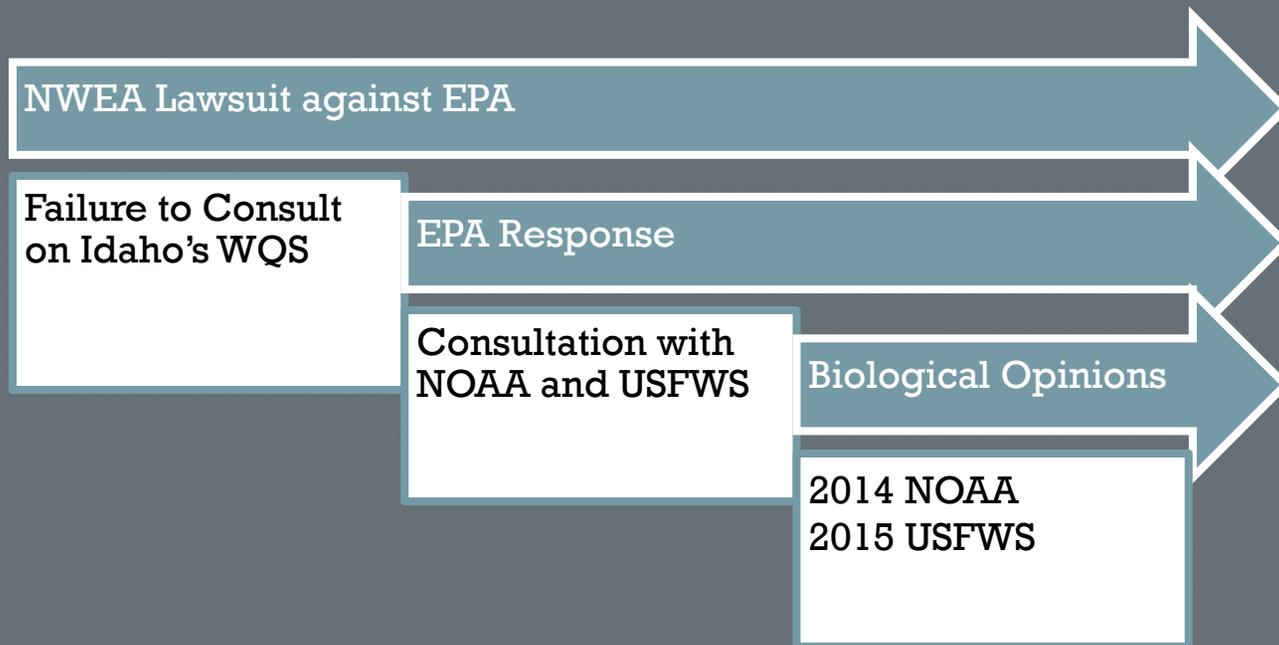
# Toxicity

- Bioaccumulative
- Fish-tissue based criterion



Photo by Margie English

# Why Change Selenium Criteria?



# Why Change Selenium Criteria?

NOAA and USFWS Biological Opinions

Found jeopardy and  
adverse modification of  
critical habitat

Reasonable and Prudent Alternative

No less stringent than  
EPA's 2016 304(a)  
selenium criterion

New criterion by May 2018

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# EPA Recommended Se Criterion

One Criterion

304(a) Chronic  
Criterion for  
Selenium

Two Media

Fish-Tissue  
Based

Water-Based

Four Elements

Fish Egg-Ovary

Fish Whole-  
Body or Muscle

Water Column  
Monthly (Lentic  
and Lotic)

Water Column  
Intermittent  
(Lentic or Lotic)

# Se Criterion

Selenium Criterion Version	Chronic		Short-term
	Water Column ( $\mu\text{g/L}$ )		Water Column ( $\mu\text{g/L}$ )
	Water (Lentic)	Water (Lotic)	Water
Idaho (Current)	5 (4 day)	5 (4 day)	20 (Instantaneous)
EPA 2016 (Current)			

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# Se Criterion

Selenium Criterion Version	Chronic					Short-term
	Egg-Ovary (mg/kg dw)	Fish Tissue (mg/kg dw)		Water Column (µg/L)		Water Column (µg/L)
	Egg-Ovary	Whole Body	Muscle	Water (Lentic)	Water (Lotic)	Water
Idaho (Current)	--	--	--	5 (4 day)	5 (4 day)	20 (Instantaneous)
EPA 2016 (Current)	15.1	8.5	11.3	1.5 (30 day)	3.1 (30 day)	Intermittent exposure equation

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# Intermittent-Exposure Equation

$$\frac{WQC_{30\text{-day}} - C_{\text{bkgrnd}} (1 - f_{\text{int}})}{f_{\text{int}}}$$

Where:  $WQC_{30\text{-day}}$  is the water column monthly element  
 $C_{\text{bkgrnd}}$  is the average background selenium concentration  
 $f_{\text{int}}$  is the fraction of any 30-day period during which elevated Se concentrations occur

# Intermittent-Exposure Equation

**Table 3.15. Representative Values of the Intermittent Water Criterion Element Concentration.**

Bkgrnd Conc, $C_{bkgrnd}$ ( $\mu\text{g/L}$ )	Fraction of Time, $f_{int}$ in a 30-day period					
	0.03333 (1 day)	0.05 (1.5 days)	0.1 (3 days)	0.2 (6 days)	0.5 (15 days)	1 (30 days)
	<b>Lotic Intermittent Criterion Element, <math>WQC_{int}</math> (<math>\mu\text{g/L}</math>)</b>					
0	93	62	31	15.5	6.2	3.1
1	64	43	22	11.5	5.2	3.1
2	35	24	13	7.5	4.2	3.1
2.5	20.5	14.5	8.5	5.5	3.7	3.1
3.1	3.1	3.1	3.1	3.1	3.1	3.1
	<b>Lentic Intermittent Criterion Element, <math>WQC_{int}</math> (<math>\mu\text{g/L}</math>)</b>					
0	45	30	15	7.5	3	1.5
0.5	30.5	20.5	10.5	5.5	2.5	1.5
1	16	11	6	3.5	2	1.5
1.25	8.8	6.3	3.8	2.5	1.8	1.5
1.5	1.5	1.5	1.5	1.5	1.5	1.5

# Comparison with Typical Aquatic Life Criteria

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- ◉ Fish-centric
- ◉ Four most sensitive genera used in EPA criterion
  - *Acipenser* – White sturgeon
  - *Lepomis* - Bluegill sunfish
  - *Salmo* - Brown trout
  - *Oncorhynchus* - Cutthroat trout/Rainbow trout

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# Implementation Challenges

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- Fish Tissue and Egg-Ovary Collection
  - Species Life History
  - Age/Size
  - Sample Size
  - Sampling Window
- Water Column Criterion
  - Listing/Delisting Requirements
- 'Never to be Exceeded' Frequency

# Implementation Challenges

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- Intermittent Exposure

- Fishless Waters

1. Extirpation due to changes in water quality
2. Insufficient habitat to support a **population** on a **continuing** basis.
  - How to define?
    - Hydrology, sampling methods, time-frame, frequency
    - Determination in rule or within Site-Specific Criteria

# Site Specific Criteria

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- ⦿ Remove non-occurring genera/species
  - Sturgeon (*Acipenser*)
  - Bluegill (*Lepomis*)
- ⦿ Most sensitive resident species
  - Cutthroat trout (*Oncorhynchus*)
  - Brown trout (*Salmo*)
- ⦿ Laboratory studies

# Criterion – Sturgeon Presence

Four most sensitive genera used in EPA criterion

Genus	Rank	Egg-Ovary
Acipenser	1	15.6
Lepomis	2	20.6
Salmo	3	21
Oncorhynchus	4	25.3
Micropterus	5	26.3
Cyprinodon	6	27
Esox	7	34
Salvelinus	8	56.2

Genus	Rank	Whole Body
Acipenser	1	9.2
Lepomis	2	9.9
Oncorhynchus	3	11.6
Salmo	4	13.2
Esox	5	14.2
Micropterus	6	18.5
Cyprinodon	7	22.6
Salvelinus	8	34.9

Genus	Rank	Muscle
Acipenser	1	11.9
Oncorhynchus	2	14.3
Lepomis	3	15.9
Salmo	4	18.5
Esox	5	21.7
Micropterus	6	22.2
Cyprinodon	7	28.7
Salvelinus	8	44.5

\*Fish tissue concentration units (mg/kg dw)

# Criterion – Sturgeon Absence

Four most sensitive genera used in EPA criterion

Genus	Rank	Egg-Ovary
Acipenser	1	15.6
Lepomis	2	20.6
Salmo	3	21
Oncorhynchus	4	25.3
Micropterus	5	26.3
Cyprinodon	6	27
Esox	7	34
Salvelinus	8	56.2

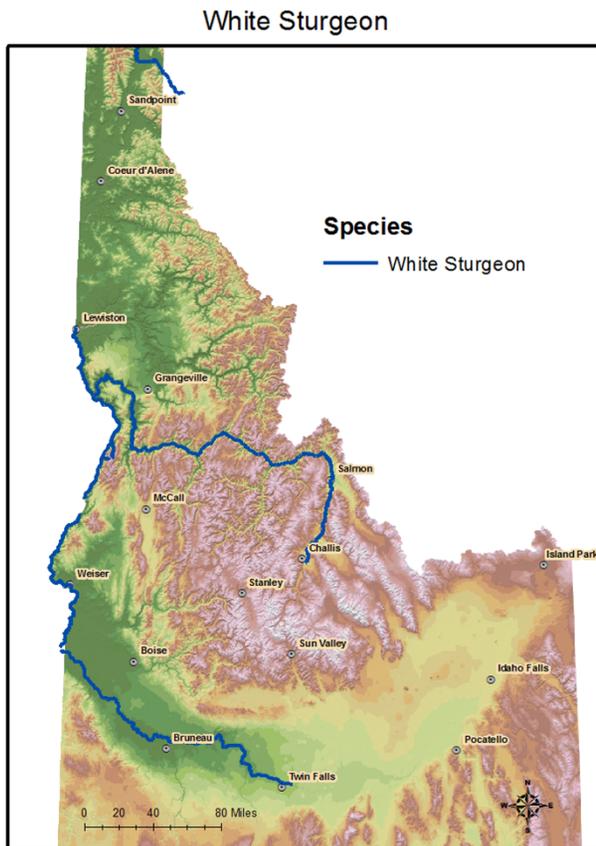
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\*Fish tissue concentration units (mg/kg dw)

Recalculation Procedure: (US EPA, 2013)

# Criterion – Sturgeon Presence



Selenium Criterion Version	Chronic		
	Egg-Ovary (mg/kg dw)	Fish Tissue (mg/kg dw)	
	Egg-Ovary	Whole Body	Muscle
EPA 2016	15.1	8.5	11.3
No Sturgeon	19.0	9.5	13.1

# Empirical Bioaccumulation Factor (BAF) Approach

$$C_{\text{water}} = \frac{\text{Tissue Criterion (ug/g)}}{\text{BAF (L/g)}}$$

$$C_{\text{lotic}} = \frac{9.5 \text{ ug/g}}{2.8 \text{ L/g}} = 3.4 \text{ ug/L}$$

$$C_{\text{lentic}} = \frac{9.5 \text{ ug/g}}{5.7 \text{ L/g}} = 1.7 \text{ ug/L}$$

$$\text{BAF} = \frac{\text{Fish, ppm}}{\text{SW, ppb}}$$

$$\text{BAF}_{\text{lotic}} = \frac{8.5 \text{ ug/g}}{3.1 \text{ ug/L}} = 2.8 \text{ L/g}$$

$$\text{BAF}_{\text{lentic}} = \frac{8.5 \text{ ug/g}}{1.5 \text{ ug/L}} = 5.7 \text{ L/g}$$

Selenium Criterion	Egg-Ovary (mg/kg dw)	Fish Tissue (mg/kg dw)		Water Column (µg/L)	
	Egg-Ovary	Whole Body	Muscle	Water (Lentic)	Water (Lotic)
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<http://www.deq.idaho.gov/media/60179856/58-0102-1701-preliminary-draft-0317.pdf>

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	Egg-Ovary (mg/kg dw)	Fish Tissue (mg/kg dw)		Water Column (µg/L)		Water Column (µg/L)
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EPA 2016	15.1	8.5	11.3	1.5 (30 day)	3.1 (30 day)	Intermittent exposure equation
EPA 2016 (No Sturgeon)	19.0	9.5	13.1	1.7 (30 day)	3.4 (30 day)	Intermittent exposure equation

# Site Specific Criteria Proposals

**Draft**

**Proposed Site-Specific Selenium Criterion for Hoopes Spring, Sage Creek, and Crow Creek near the Smoky Canyon Mine**

April 2017

Prepared for:

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J.R. Simplot Company

Prepared by:

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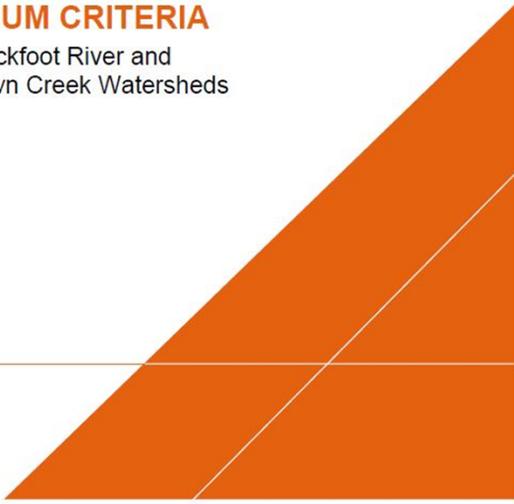
**ARCADIS** Design & Consultancy  
for natural and built assets

Nu-West Industries, Inc.

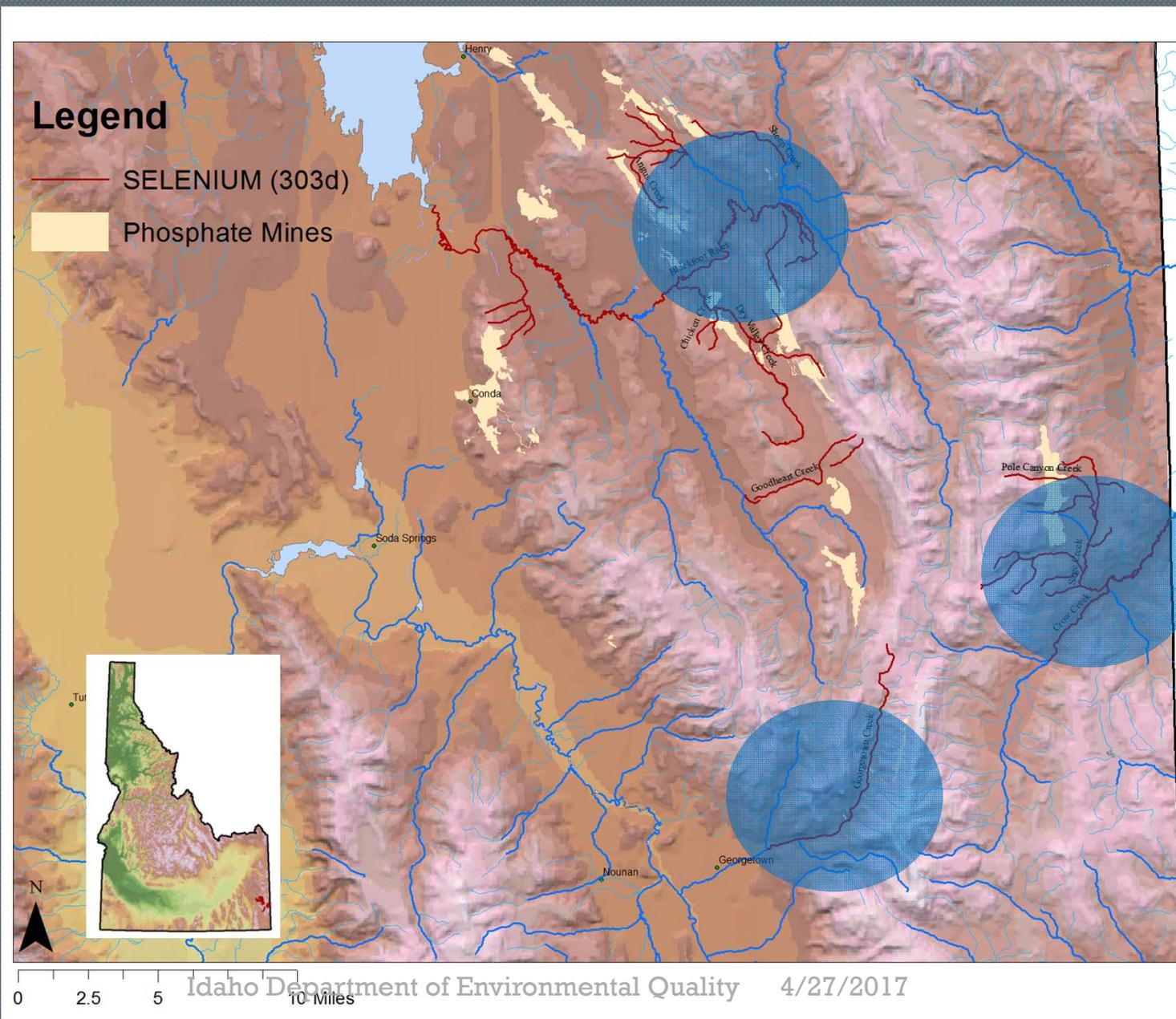
## **PROPOSAL FOR SITE-SPECIFIC SELENIUM CRITERIA**

Upper Blackfoot River and Georgetown Creek Watersheds

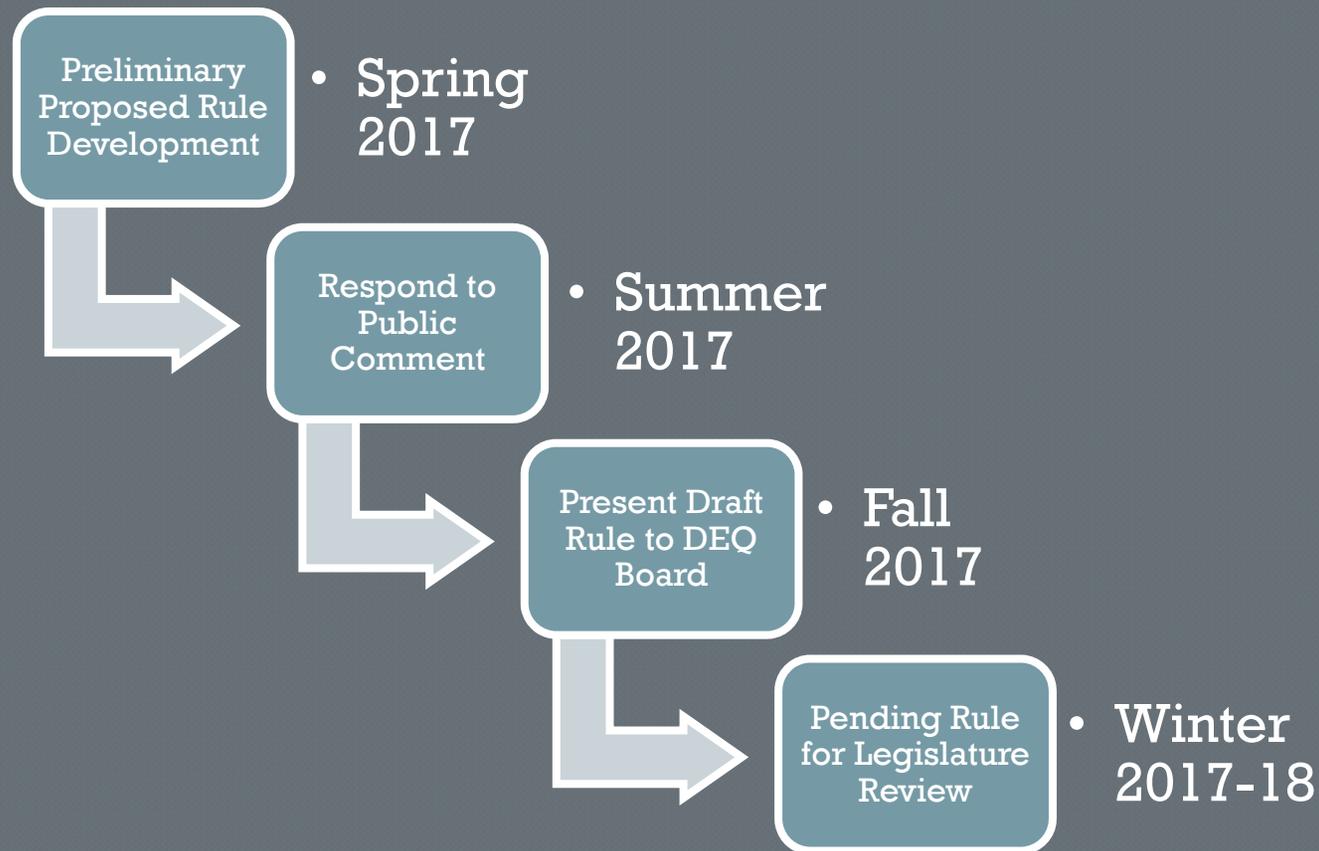
April 2017



# Site Specific Criteria Proposals



# Selenium Rulemaking Timeline



# Next Steps

- Comments due: 5/5/2017
- 2<sup>nd</sup> meeting: 6/13/2017 (SSC)
  - Comments due: 6/23/2017
- 3<sup>rd</sup> meeting: 7/25/2017 (Final)
  - Comments due: 8/1/2017
- September Bulletin: 9/6/2017
  - Deadline for Rule Publication: 8/4/2017
  
- BiOP RPA: Criterion by 5/7/2018

<http://www.deq.idaho.gov/laws-rules-etc/deq-rulemakings/docket-no-58-0102-1701/>

Idaho Department of Environmental Quality 4/27/2017

# Questions

