NU-WEST INDUSTRIES, INC.

Nu-West Proposal for Site-Specific Selenium Criteria

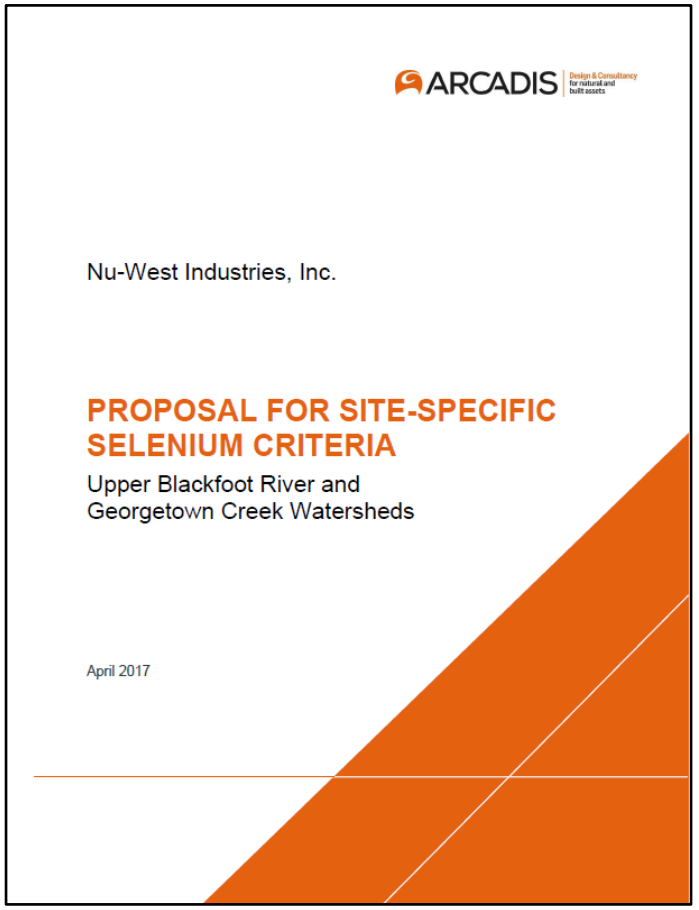
Idaho DEQ Rulemaking

June 13, 2017

Boise, Idaho

Outline for Nu-West SSC Proposal

I. Definition of "Sites"
   a. Upper Blackfoot River
   b. Georgetown Creek
II. Resident Fish Species
   a. Upper Blackfoot River
   b. Georgetown Creek
III. Nu-West Proposed Tissue SSC
   a. Upper Blackfoot River
   b. Georgetown Creek
IV. Protectiveness of Site-Specific Criterion
   a. Summary of toxicity data and field surveys
V. Water-Column Element



I. Definition of Sites

Per IDAPA 58.01.02

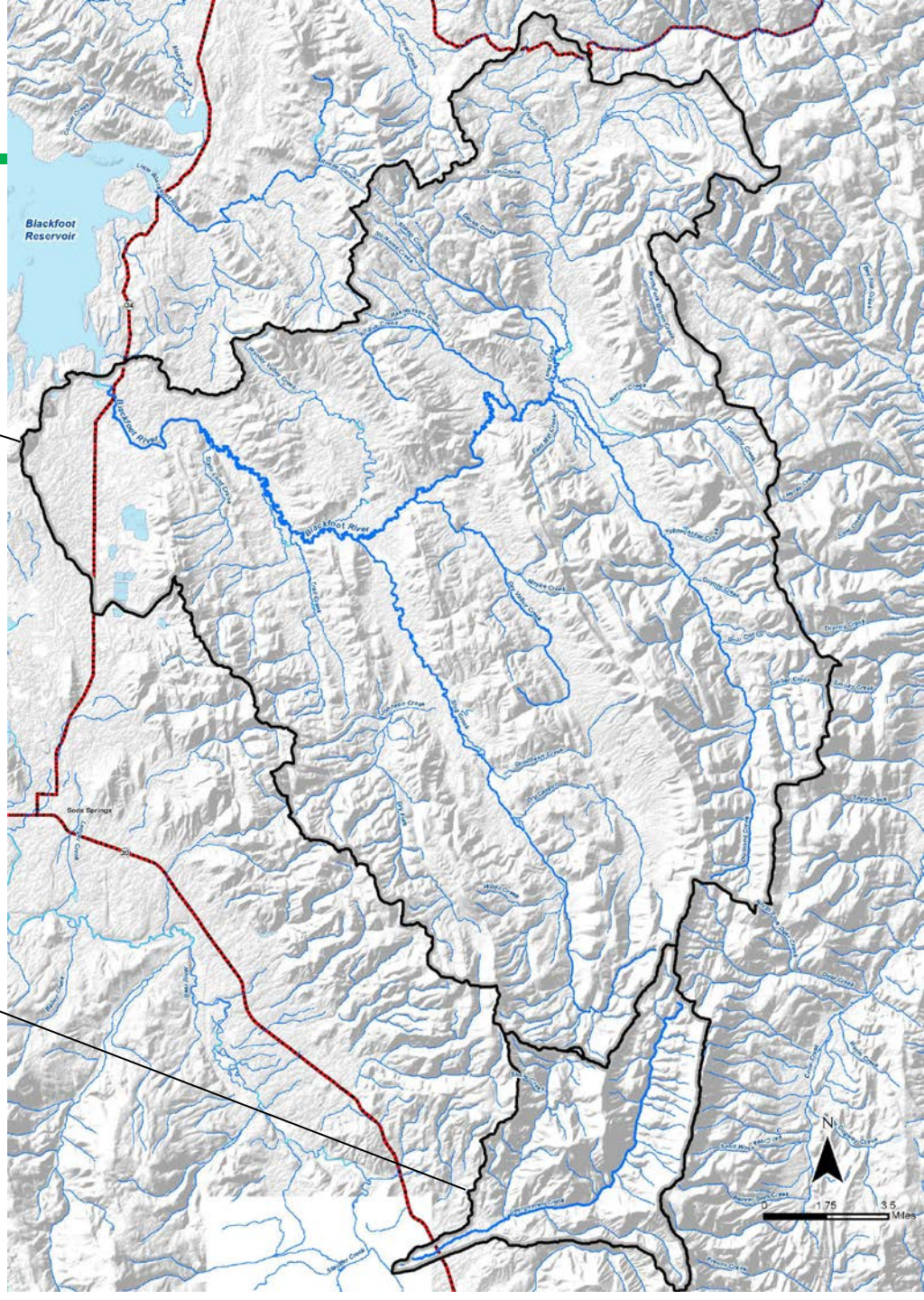
a. **Subsection of Blackfoot Sub-basin.** Blackfoot River – confluence of Lanes and Diamond Creeks to Blackfoot Reservoir (unit US-10), and all tributaries thereof

b. **Georgetown Creek** – source to mouth (unit B-22), and all tributaries thereof

I. Definition of Sites

Upper Blackfoot River

Georgetown Creek



prepared in collaboration with ARCADIS

II. Resident Fish Species – UBR Watershed

Table 1. Resident fish species that occur in the Upper Blackfoot River watershed.

Family	Genus	Species	Common Name
Salmonidae	Oncorhynchus	O. mykiss	Rainbow trout
		O. clarkii bouvieri	Yellowstone cutthroat trout
	Salvelinus	S. fontinalis	Brook trout
Cyprinidae	Rhinichthys	R. cataractae	Longnose dace
		R. osculus	Speckled dace
	Richardsonius	R. balteatus	Redside shiner
	Gila	G. atraria	Utah chub
	Lepidomeda	L. copei	N. leatherside chub
Catostomidae	Catostomus	C. ardens	Utah sucker
		C. platyrhynchus	Mountain sucker
Cottidae	Cottus	C. bairdii	Mottled sculpin
		C. beldingii	Paiute sculpin

II. Resident Fish Species – UBR Watershed

Surveys		Families			
Program	**Duration**	**Salmonidae**	**Cyprinidae**	**Catostomidae**	**Cottidae**
Idaho Department of Fish and Game - Surveys	1959-2007	●	●	●	●

II. Resident Fish Species – UBR Watershed

Surveys		Families			
Program	**Duration**	**Salmonidae**	**Cyprinidae**	**Catostomidae**	**Cottidae**
Idaho Department of Fish and Game - Surveys	1959-2007	●	●	●	●
Idaho Department of Fish and Game - Stocking	1967-2016	●			

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Program	**Duration**	**Salmonidae**	**Cyprinidae**	**Catostomidae**	**Cottidae**
Idaho Department of Fish and Game - Surveys	1959-2007	●	●	●	●
Idaho Department of Fish and Game - Stocking	1967-2016	●			
IDEQ BURP Program	1993-2016	●	●	●	●

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Surveys		Families			
Program	**Duration**	**Salmonidae**	**Cyprinidae**	**Catostomidae**	**Cottidae**
Idaho Department of Fish and Game - Surveys	1959-2007	●	●	●	●
Idaho Department of Fish and Game - Stocking	1967-2016	●			
IDEQ BURP Program	1993-2016	●	●	●	●
U.S. Forest Service - Surveys	2000-2002	●	●	●	●

II. Resident Fish Species – UBR Watershed

Surveys		Families			
Program	**Duration**	**Salmonidae**	**Cyprinidae**	**Catostomidae**	**Cottidae**
Idaho Department of Fish and Game - Surveys	1959-2007	●	●	●	●
Idaho Department of Fish and Game - Stocking	1967-2016	●			
IDEQ BURP Program	1993-2016	●	●	●	●
U.S. Forest Service - Surveys	2000-2002	●	●	●	●
GEI and Arcadis	2013-2016	●	●	●	●

= > 40,000 survey results (1959-2016)

> 30,000,000 stocking results (1967-2016)

II. Resident Fish Species – Georgetown Cr.

Resident fish species that occur in the Georgetown Creek watershed.

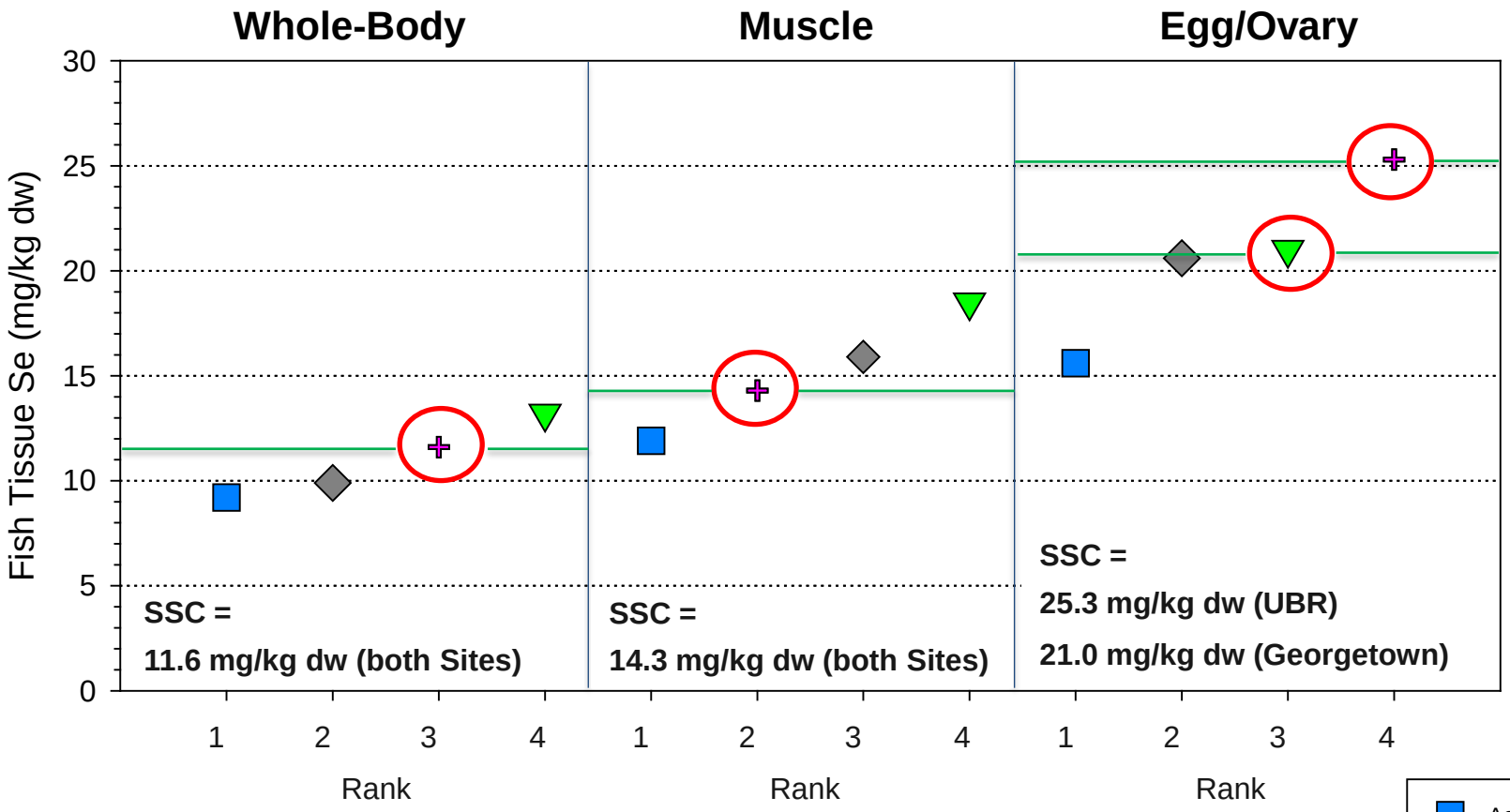
Family	Genus	Species	Common Name
Salmonidae	Oncorhynchus	O. mykiss	Rainbow trout
		O. clarkii utah	Bonneville cutthroat trout
	Salvelinus	S. fontinalis	Brook trout
	Salmo	S. trutta	Brown trout

II. Resident Fish Species – Georgetown Cr.

Surveys	Dates	Data Source	Streams	Total Fish Count	Fish Species
Idaho Department of Fish and Game - Surveys[1]	1994, 1997, 2003, 2007	Teuscher and Capurso (2007)	Left Hand Fork, Georgetown Creek	Not Reported	Brook trout, cutthroat trout, cutthroat/rainbow hybrids, rainbow trout.
Idaho Department of Fish and Game - Stocking Records	1968-2011	IDFG (2017)	Left Hand Fork, Georgetown Creek	81,923	Brook trout, cutthroat trout, rainbow trout.
Idaho Department of Environmental Quality Surveys	1997, 2012, 2013	IDEQ (2017)	Left Hand Fork, Georgetown Creek	58	Brook trout, cutthroat trout, rainbow trout, brown trout
US Forest Service Surveys[1]	1994	Cowley (1994)	Georgetown Creek	Upper: 9 Lower: Not Reported	Brook trout, cutthroat trout, cutthroat/rainbow hybrids, rainbow trout.
	2000, 2001, 2007	USFS (2003); Teuscher and Capurso (2007)	Left Hand Fork, Georgetown Creek	Not Reported	Brook trout, cutthroat/rainbow hybrids, rainbow trout.
GEI and Arcadis	2015-2016	GEI (2016); Arcadis (2017)	Left Hand Fork, Georgetown Creek	661	Brook trout, Cutthroat trout, Cutthroat/Rainbow hybrids, Rainbow trout.

III. Site-Specific Tissue Elements

Nu-West Proposed Site-Specific Tissue Criteria



III. Site-Specific Tissue Elements

a. Upper Blackfoot River

IDEQ proposed aquatic life selenium criteria values (default) and Nu-West proposed site-specific criteria (SSC) values.

Fish Tissue (mg/kg dw)					
Egg-Ovary[1,2]		Whole Body [2,3]		Muscle[2,3]	
Default	SSC	Default	SSC	Default	SSC
15.1	25.3	8.5	11.6	11.3	14.3

Final USEPA (2016) *Oncorhynchus* Chronic Values

III. Site-Specific Tissue Elements

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IDEQ proposed aquatic life selenium criteria values (default) and Nu-West proposed site-specific criteria (SSC) values.

Fish Tissue (mg/kg dw)					
Egg-Ovary[1,2]		Whole Body [2,3]		Muscle[2,3]	
Default	SSC	Default	SSC	Default	SSC
15.1	25.3	8.5	11.6	11.3	14.3

Notes:

1. Egg/ovary supersedes any whole-body, muscle, or water column element when fish egg/ovary concentrations are measured.

III. Site-Specific Tissue Elements

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IDEQ proposed aquatic life selenium criteria values (default) and Nu-West proposed site-specific criteria (SSC) values.

Fish Tissue (mg/kg dw)					
Egg-Ovary[1,2]		Whole Body [2,3]		Muscle[2,3]	
Default	SSC	Default	SSC	Default	SSC
15.1	25.3	8.5	11.6	11.3	14.3

Notes:

1. Egg/ovary supersedes any whole-body, muscle, or water column element when fish egg/ovary concentrations are measured.
2. Frequency: Average not to be exceeded.

III. Site-Specific Tissue Elements

a. Upper Blackfoot River

IDEQ proposed aquatic life selenium criteria values (default) and Nu-West proposed site-specific criteria (SSC) values.

Fish Tissue (mg/kg dw)					
Egg-Ovary[1,2]		Whole Body [2,3]		Muscle[2,3]	
Default	SSC	Default	SSC	Default	SSC
15.1	25.3	8.5	11.6	11.3	14.3

Notes:

1. Egg/ovary supersedes any whole-body, muscle, or water column element when fish egg/ovary concentrations are measured.
2. Frequency: Average not to be exceeded.
3. Fish whole-body or muscle tissue supersedes water column element when both fish tissue and water concentrations are measured.

III. Site-Specific Tissue Elements

a. Georgetown Creek

IDEQ proposed aquatic life selenium criteria values (default) and Nu-West proposed site-specific criteria (SSC) values.

Fish Tissue (mg/kg dw)					
Egg-Ovary[1,2]		Whole Body[3,2]		Muscle[3,2]	
Default	SSC	Default	SSC	Default	SSC
15.1	21.0	8.5	11.6	11.3	14.3

Final USEPA (2016) *Salmo* Chronic Value

Final USEPA (2016) *Oncorhynchus* Chronic Values

III. Site-Specific Tissue Elements

a. Georgetown Creek

IDEQ proposed aquatic life selenium criteria values (default) and Nu-West proposed site-specific criteria (SSC) values.

Fish Tissue (mg/kg dw)					
Egg-Ovary[1,2]		Whole Body[3,2]		Muscle[3,2]	
Default	SSC	Default	SSC	Default	SSC
15.1	21.0	8.5	11.6	11.3	14.3

Notes:

1. Egg/ovary supersedes any whole-body, muscle, or water column element when fish egg/ovary concentrations are measured.
2. Frequency: Average not to be exceeded.
3. Fish whole-body or muscle tissue supersedes water column element when both fish tissue and water concentrations are measured.

IV. Protectiveness of Tissue-Based SSC

a. Salmonidae Family

i. Oncorhynchus Genus

Maternal Transfer Reproductive Toxicity Studies for *Oncorhynchus* (from EPA 2016)

Genus	Species	SMCV [6] (mg Se/kg dw E/O)	GMCV [6] (mg Se/kg dw E/O)
Oncorhynchus	Rainbow Trout[1,2,3]	24.5	25.3
	Cutthroat Trout[4,5]	26.2	

Notes:

[1]Holm (2002)

[2]Holm et al. (2003)

[3]Holm et al. (2005)

[4]Rudolph et al. (2008)

[5]Nautilus Environmental (2011)

[6]USEPA (2016) Final Chronic Value

Proposed SSC
(for Upper Blackfoot River)

= **USEPA's final chronic value for *Oncorhynchus***

IV. Protectiveness of Tissue-Based SSC

Resident fish species that occur in the Upper Blackfoot River watershed.

Family	Genus	Species	Common Name	SSC Protective of Resident?
Salmonidae	Oncorhynchus	O. mykiss	Rainbow trout	✓
		O. clarkii bouvieri	Yellowstone cutthroat trout	
	Salvelinus	S. fontinalis	Brook trout	
Cyprinidae	Rhinichthys	R. cataractae	Longnose dace	
		R. osculus	Speckled dace	
	Richardsonius	R. balteatus	Redside shiner	
	Gila	G. atraria	Utah chub	
	Lepidomeda	L. copei	N. leatherside chub	
Catostomidae	Catostomus	C. ardens	Utah sucker	
		C. platyrhynchus	Mountain sucker	
Cottidae	Cottus	C. bairdii	Mottled sculpin	
		C. beldingii	Paiute sculpin	

USEPA (2016) & other pertinent toxicity info

IV. Protectiveness of Tissue-Based SSC

b. Salmonidae Family

iii. Salvelinus Genus

Maternal Transfer Reproductive Toxicity Studies for Salvelinus (from EPA 2016)

Genus	Species	SMCV [3] (mg Se/kg dw E/O)	GMCV [3] (mg Se/kg dw E/O)
Salvelinus	Dolly Varden[1]	56.2	56.2
	Brook Trout[2]	>49	

[1] Golder 2009

[2] Holm et al. 2005

[3] USEPA (2016) Final Chronic Value

IV. Protectiveness of Tissue-Based SSC

c. Cyprinid Family

i. Pimephales Genus

Maternal Transfer Reproductive Toxicity Studies for *Pimephales* (from EPA 2016)

Genus	Species	SMCV[3] (mg Se/kg dw)	GMCV (mg Se/kg dw)
Pimephales	Fathead Minnow	<25.6 (E/O)[1] 35-65 (WB)[2]	--

Notes:

[1] Schultz and Hermanutz (1990). Value not used in EPA's 5th percentile calculation due to high uncertainty; but counted towards N=15.

[2] GEI (2008)

[3] USEPA (2016)

-- Not calculated due to high uncertainty in final chronic value. However, cyprinids were determined by EPA (2016) to be less sensitive than salmonids.

IV. Protectiveness of Tissue-Based SSC

c. Cyprinid Family

i. Pimephales Genus

Maternal Transfer Reproductive Toxicity Studies for *Pimephales* (from EPA 2016)

Genus	Species	SMCV[3] (mg Se/kg dw)	GMCV (mg Se/kg dw)
Pimephales	Fathead Minnow	<25.6 (E/O)[1] 35-65 (WB)[2]	--

Notes:

[1] Schultz and Hermanutz (1990). Value not used in EPA's 5th percentile calculation due to high uncertainty; but counted towards N=15.

[2] GEI (2008)

[3] USEPA (2016)

-- Not calculated due to high uncertainty in final chronic value. However, cyprinids were determined by EPA (2016) to be less sensitive than salmonids.

ii. Other data from EPA (2016)

- "Available studies (Hamilton et al (1998), NAMC (2008), Presser (2013), USGS (2012)) indicate that native cyprinids as a family are not expected to be overly sensitive to selenium when compared with other families of freshwater fish." (p. E-41)
- "Cyprinids appear to have a tolerance to selenium that is greater than salmonid species." (p. E-48)
- Cyprinids will be protected by a criterion based on salmonid sensitivity (p. E-48)

IV. Protectiveness of Tissue-Based SSC

d. *Catostomidae* Family

i. *Catostomus* Genus

Maternal Transfer Reproductive Toxicity Studies for Catostomidae (from EPA 2016)

Genus	Species	SMCV[2] (mg Se/kg dw E/O)	GMCV (mg Se/kg dw E/O)
Catostomus	White Sucker[1]	>40.3	--

Notes:

[1]de Rosemound et al. (2005)

[2] USEPA (2016)

-- Not calculated by EPA (2016) because no fish/eggs collected from reference site.

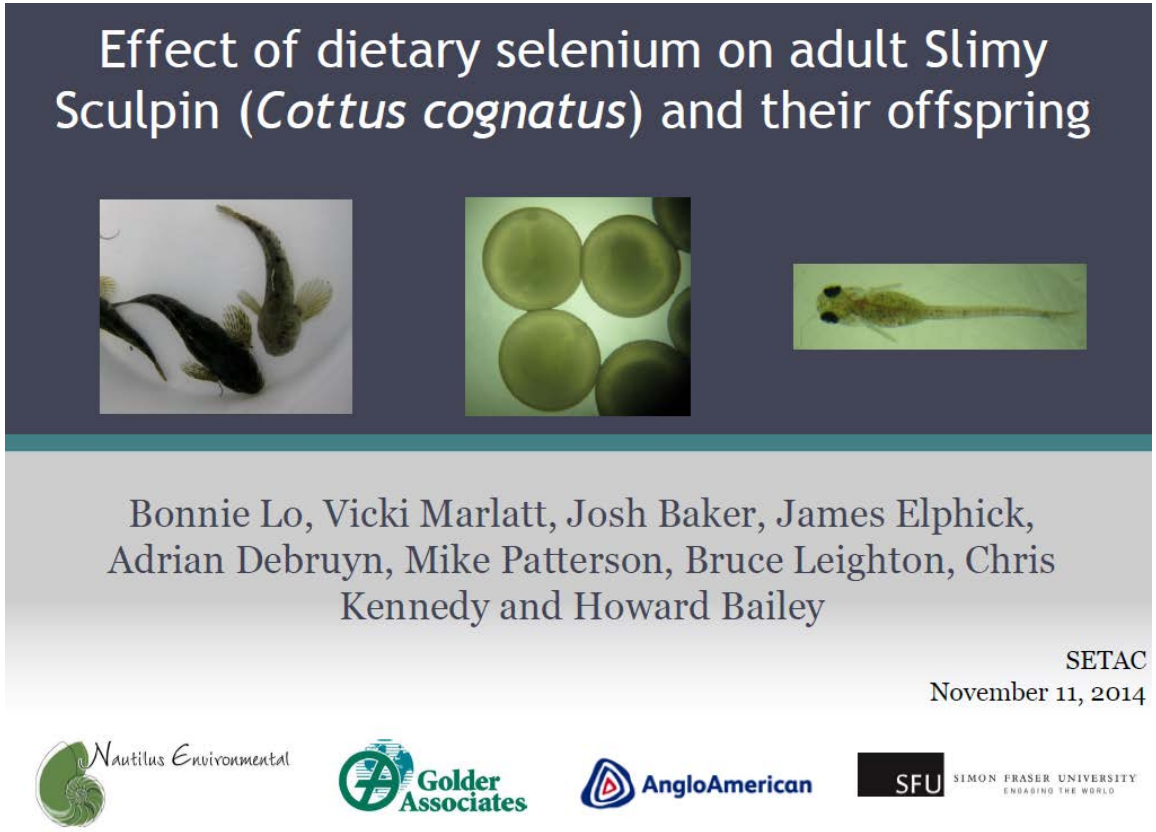
ii. Other data from EPA (2016)

- "Species such as stoneroller species, creek chub, blackside dace, and white sucker have documented tolerance to selenium and can be found in selenium contaminated systems (NAMC 2008, Presser 2012)." (p. K-19)

IV. Protectiveness of Tissue-Based SSC

c. Cottidae Family

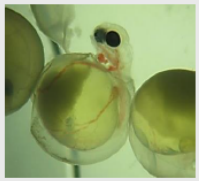
i. *Cottus* Genus



IV. Protectiveness of Tissue-Based SSC

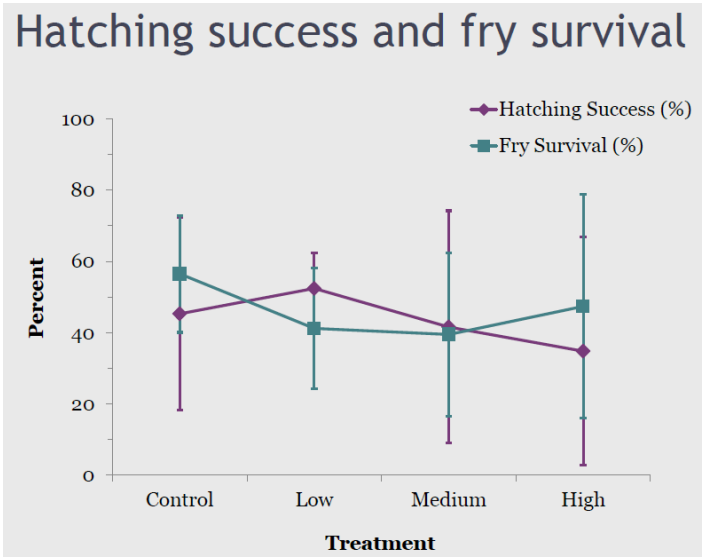
c. Cottidae Family

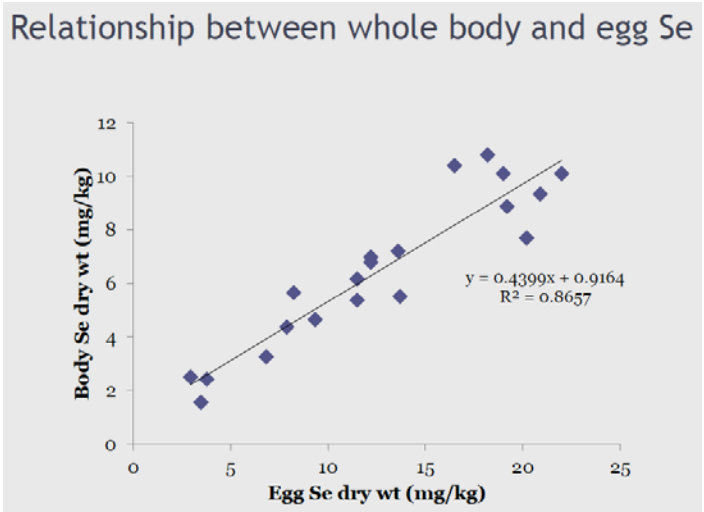
i. *Cottus* Genus



Discussion and summary

- Field collected sculpin fed Se-dosed diet for 7 months and successfully brought to spawning condition
  - Endpoints: hatch success, fry survival, cumulative survival, fry deformities, fry length and weight
- No adverse effects observed for the parameters measured at concentrations up to 22 mg/kg dw Se in eggs
  - Similar results reported for Westslope cutthroat trout
    - no effect threshold for deformity >20.6 µg/g dw (Rudolph et al., 2008)





IV. Protectiveness of Tissue-Based SSC

c. Cottidae Family

i. Cottus Genus

Maternal Transfer Reproductive Toxicity Studies for Cottidae

Genus	Species	SMCV (mg Se/kg dw E/O)	GMCV (mg Se/kg dw E/O)
Cottus	Slimy Sculpin[1]	>19.4 ± 1.8	--

Notes:

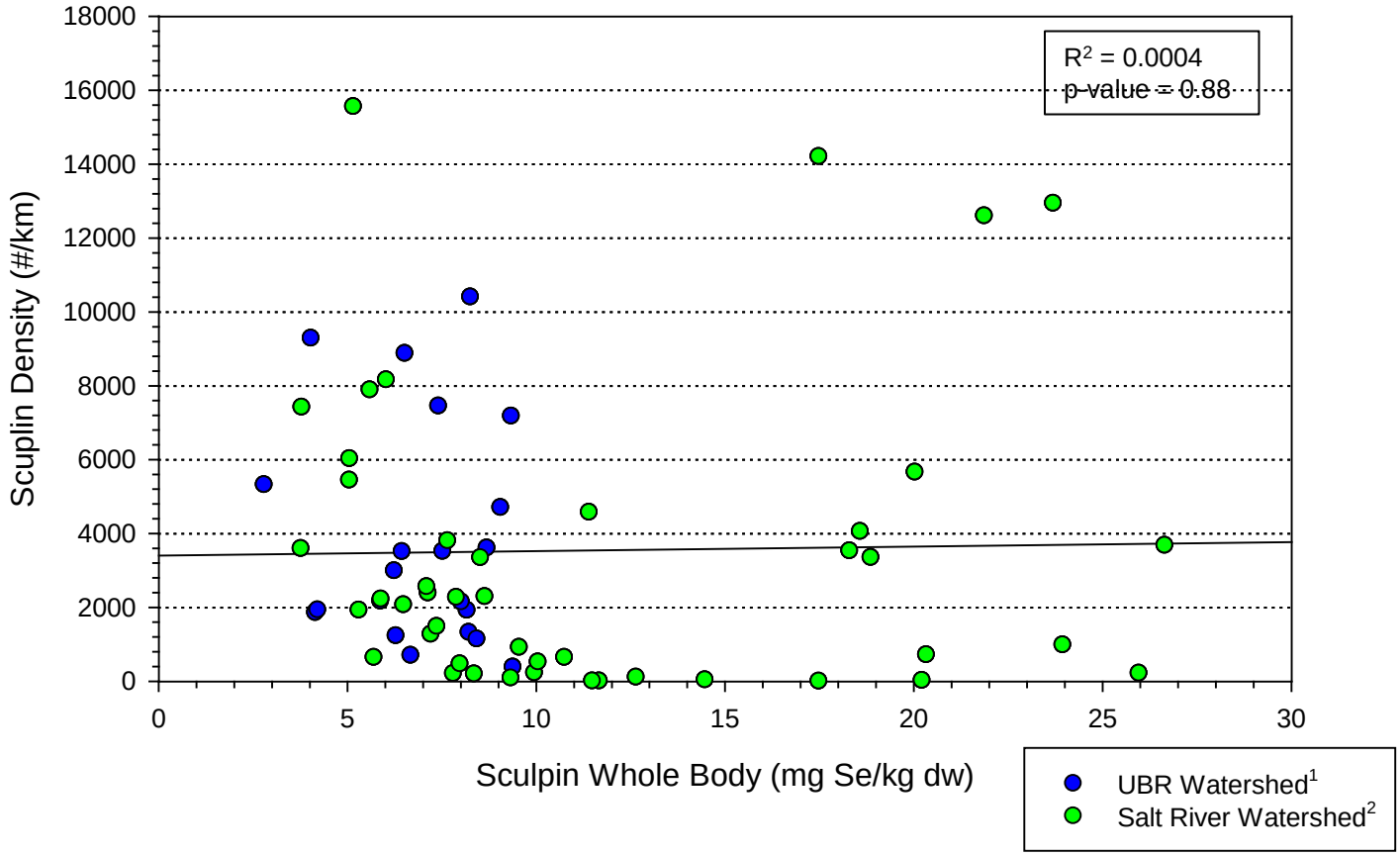
[1]Lo et al. (2014)

-- Study not presented in EPA (2016)

ii. Other relevant data on sculpin sensitivity

- Formation (2012): Sculpin abundance, density, age-classes not significantly related to water-borne or tissue Se concentrations.
- UBR Field Data: GEI (2013, 2014, 2015) & Arcadis (2016)
- NAMC (2008) sculpin population densities not significantly related to surface-water Se or sculpin-tissue Se (up to > 39 µg/L or > 25 mg/kg WB dw)

IV. Protectiveness of Tissue-Based SSC



Notes:

[1] GEI (2016a,b); Arcadis (2017a,b)

[2] Formation and HabiTech (2012)

IV. Protectiveness of Tissue-Based SSC

Resident fish species that occur in the Upper Blackfoot River watershed.

Family	Genus	Species	Common Name	SSC Protective of Resident?
Salmonidae	Oncorhynchus	O. mykiss	Rainbow trout	✓
		O. clarkii bouvieri	Yellowstone cutthroat trout	
	Salvelinus	S. fontinalis	Brook trout	
Cyprinidae	Rhinichthys	R. cataractae	Longnose dace	✓
		R. osculus	Speckled dace	
	Richardsonius	R. balteatus	Redside shiner	
	Gila	G. atraria	Utah chub	
	Lepidomeda	L. copei	N. leatherside chub	
Catostomidae	Catostomus	C. ardens	Utah sucker	✓
		C. platyrhynchus	Mountain sucker	
Cottidae	Cottus	C. bairdii	Mottled sculpin	✓
		C. beldingii	Paiute sculpin	

IV. Protectiveness of Tissue-Based SSC

Resident fish species that occur in the Georgetown Creek watershed.

Family	Genus	Species	Common Name	SSC Protective of Resident?
Salmonidae	Salmo	S. trutta	Brown trout	✓
	Oncorhynchus	O. mykiss O. clarkii utah	Rainbow trout Bonneville cutthroat trout	✓
	Salvelinus	S. fontinalis	Brook trout	✓

V. Water-Column Calculations

a. Performance-based approach using methods from USEPA (2016) Appendix K

b. Ephemeral / intermittent fishless streams

V. Water-Column Calculations

Water Column (µg/L)[1,2]	
Water Lotic	
Default	SSC[3,4]
3.1 (30 day)	--

Notes:

1. Frequency: Not to be exceeded more than once in three years on average.

V. Water-Column Calculations

Water Column (µg/L)[1,2]	
Water Lotic	
Default	SSC[3,4]
3.1 (30 day)	--

Notes:

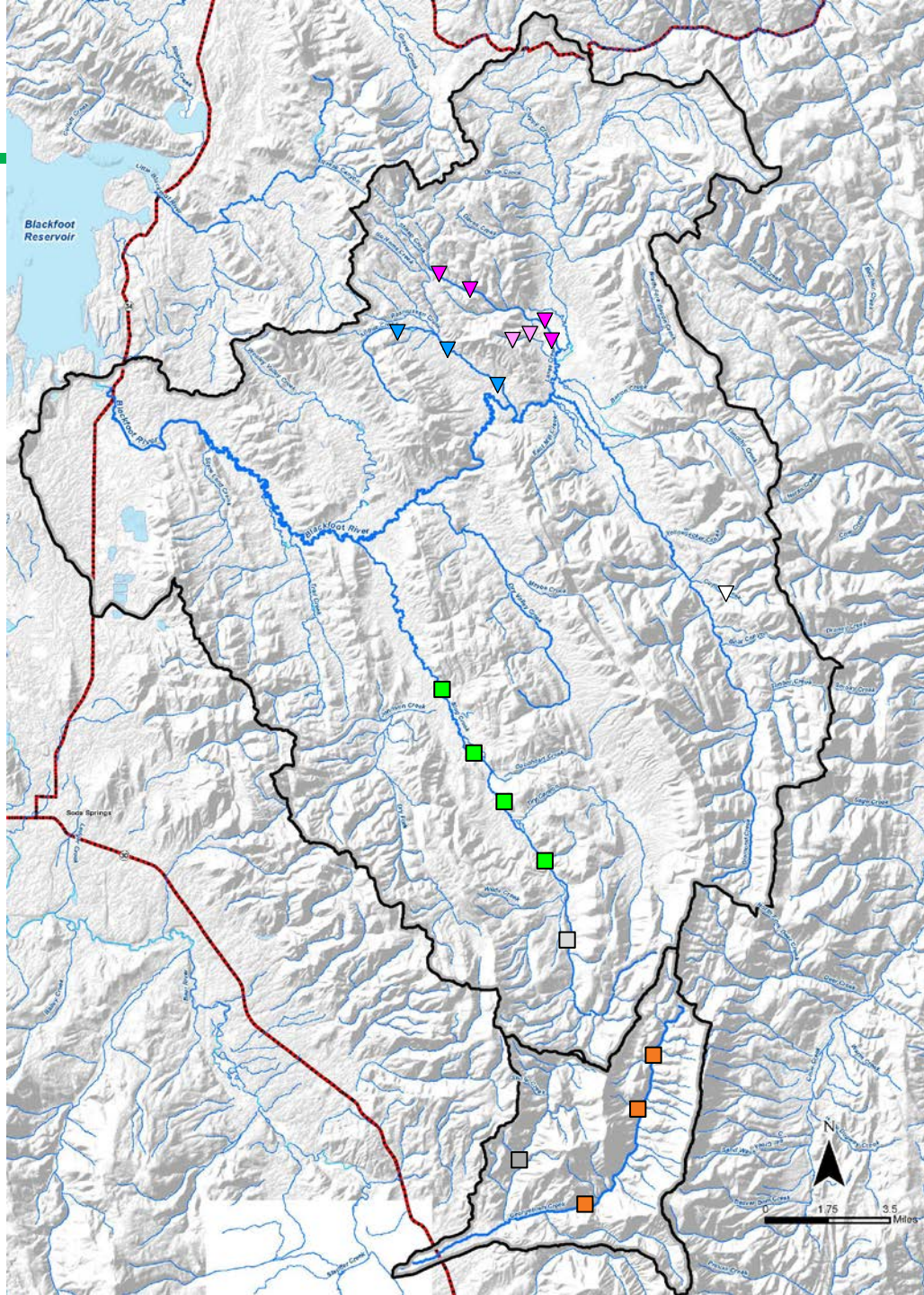
1. Frequency: Not to be exceeded more than once in three years on average.

2. Site-specific water column values (30-day) are based on dissolved total selenium in water and are derived from fish tissue values via mechanistic or bioaccumulation modeling methods in Appendix K from EPA (2016).

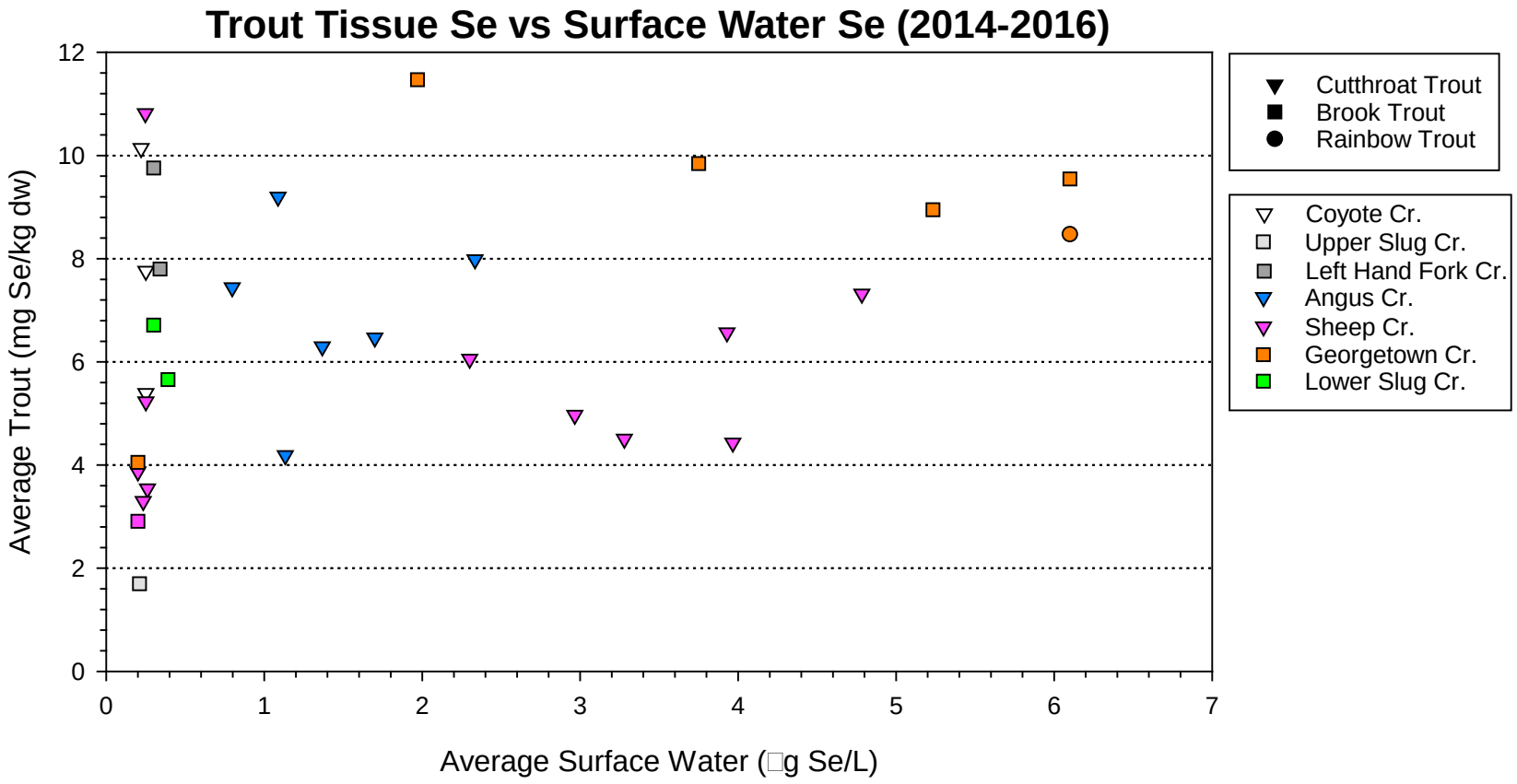
V. Water-Column Calculations

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

$$\text{BAF} = \frac{\text{Fish-Tissue Se } (\mu g/g)}{\text{Surface-Water Se } (\mu g/L)}$$

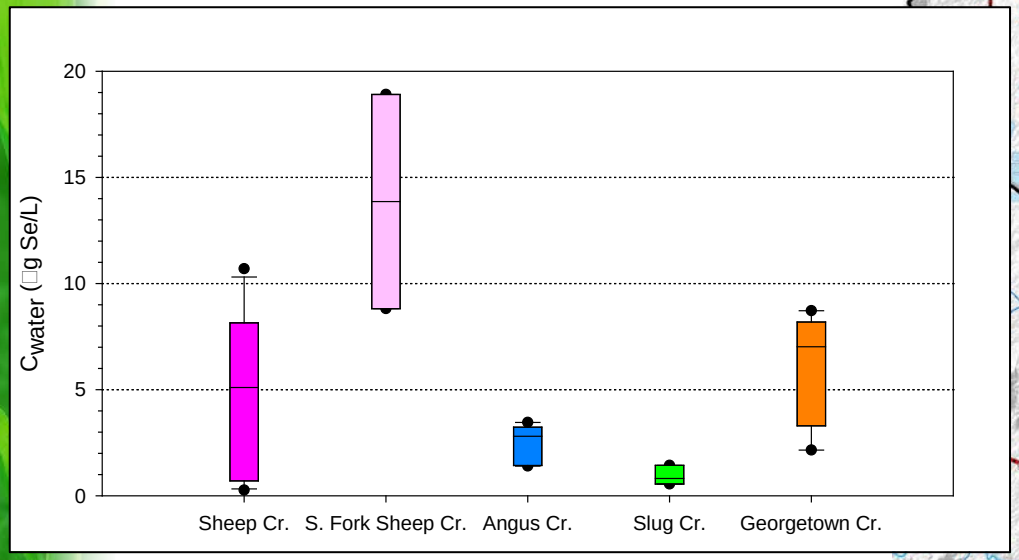


V. Water-Column Calculations

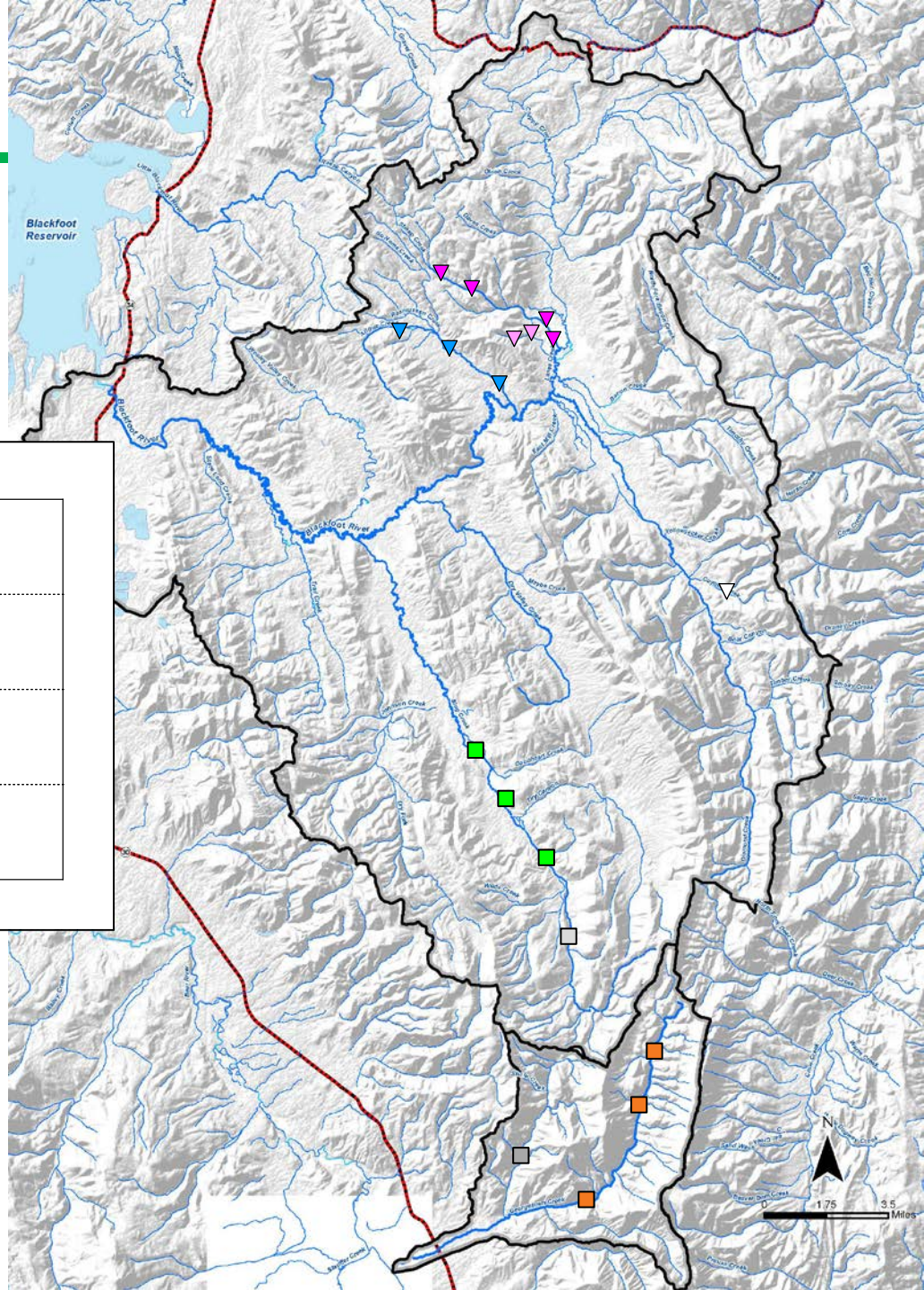


- Surface-water Se is a poor predictor of fish-tissue Se

V. Water-Column Calculations



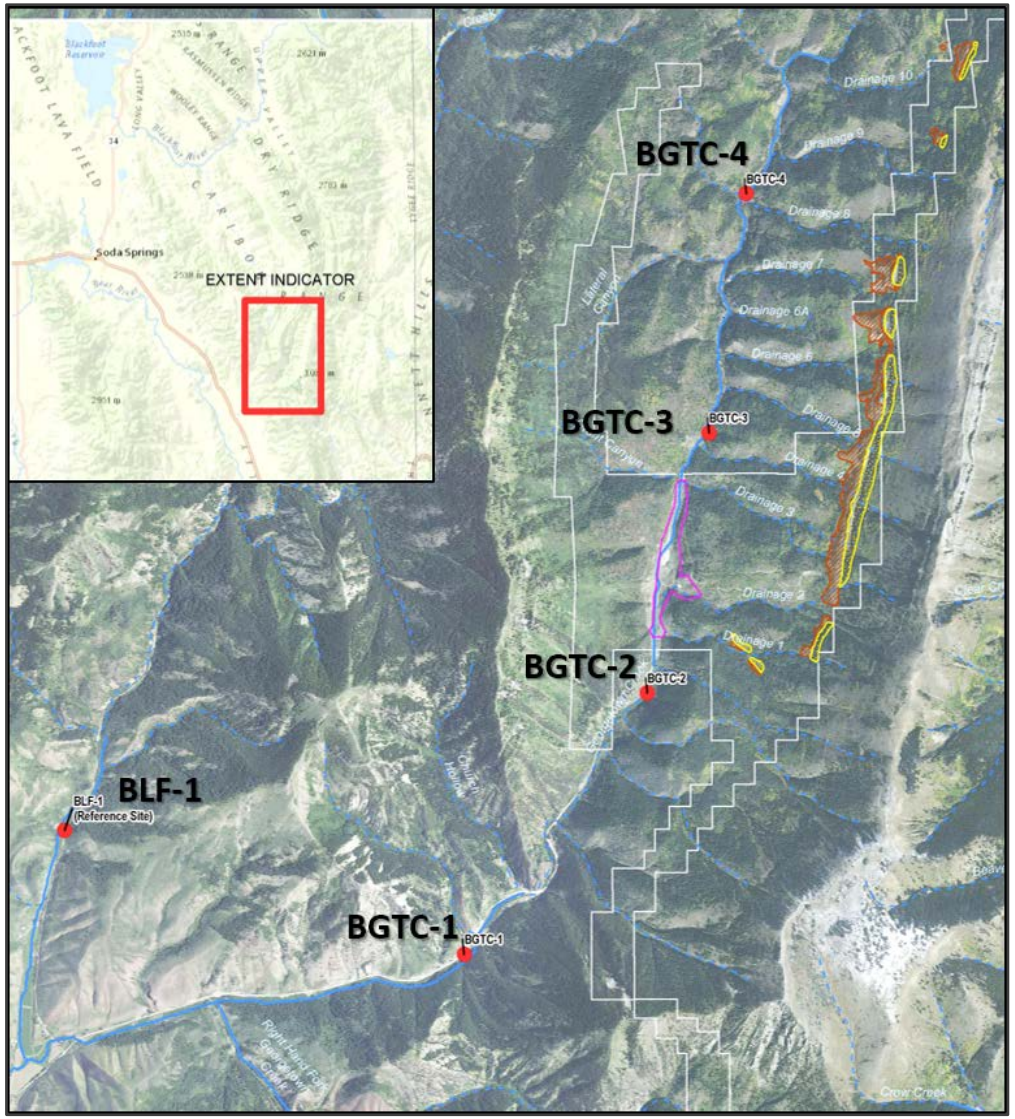
$$C_{water} = \frac{11.6(\mu g/g)}{BAF\ (L/g)}$$



prepared in collaboration with ARCADIS

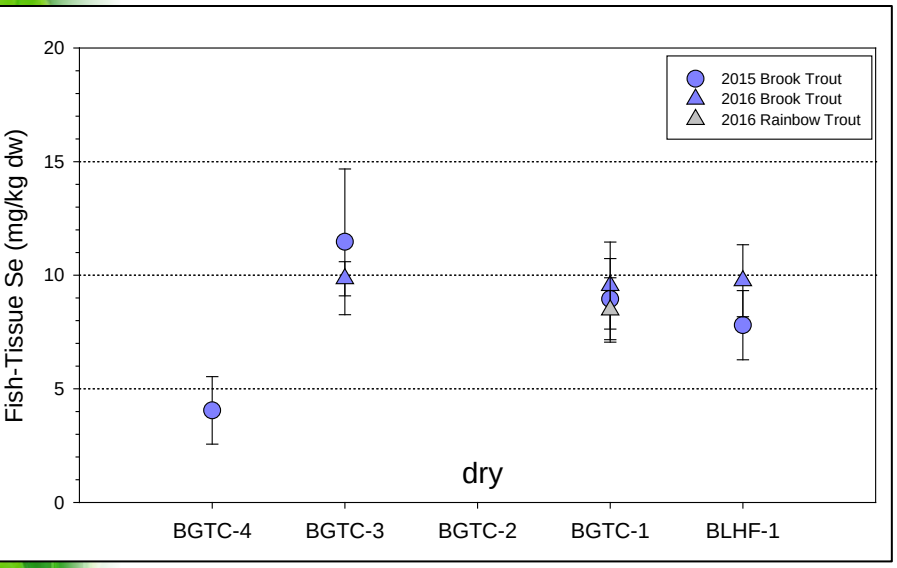
V. Water-Column Calculations

Georgetown Creek



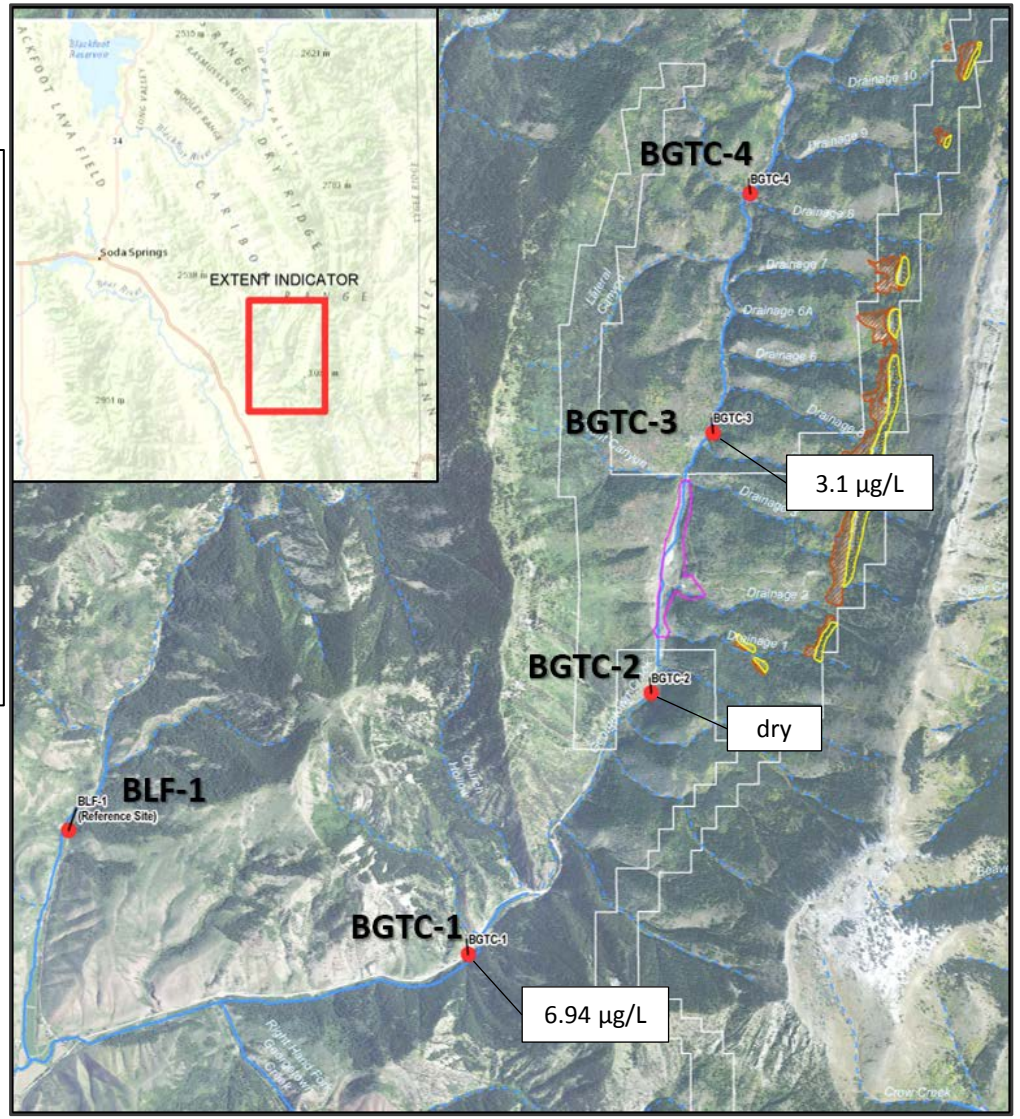
V. Water-Column Calculations

Average ± SD Whole Body Se (mg/kg dw)



$$C_{water} = \frac{11.6(\mu g/g)}{BAF\ (L/g)}$$

$$BAF = \frac{\text{Fish-Tissue Se } (\mu g/g)}{\text{Surface-Water Se } (\mu g/L)}$$



V. Water-Column Calculations

b. Fishless streams

V. Water-Column Calculations

b. Fishless streams

U.S. EPA (2016), p. 101:

- "Waters with insufficient stream habitat and/or flow to support a population of any fish species on a continuing basis"; or

- "Waters that once supported populations of one or more fish species but no longer support fish (i.e., extirpation) due to temporary or permanent changes in water quality (e.g., due to selenium pollution), flow, or instream habitat."

V. Water-Column Calculations

Tissue Chemistry

- Fish-Tissue Se
- Macroinvertebrate Se
- Periphyton Se
- Detritus Se

Abiotic Chemistry

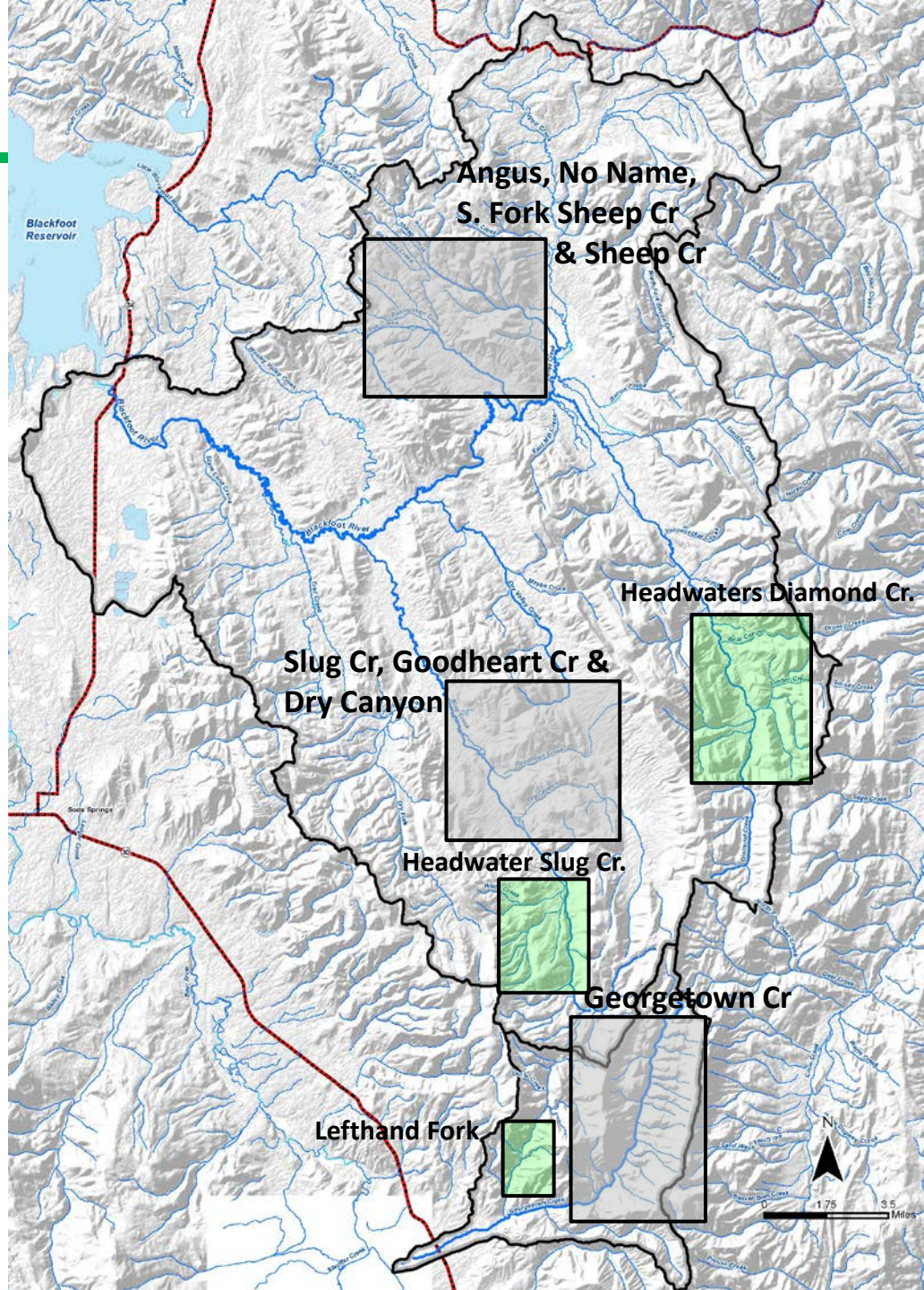
- Water-Column Se
- Sediment Se

Community Data

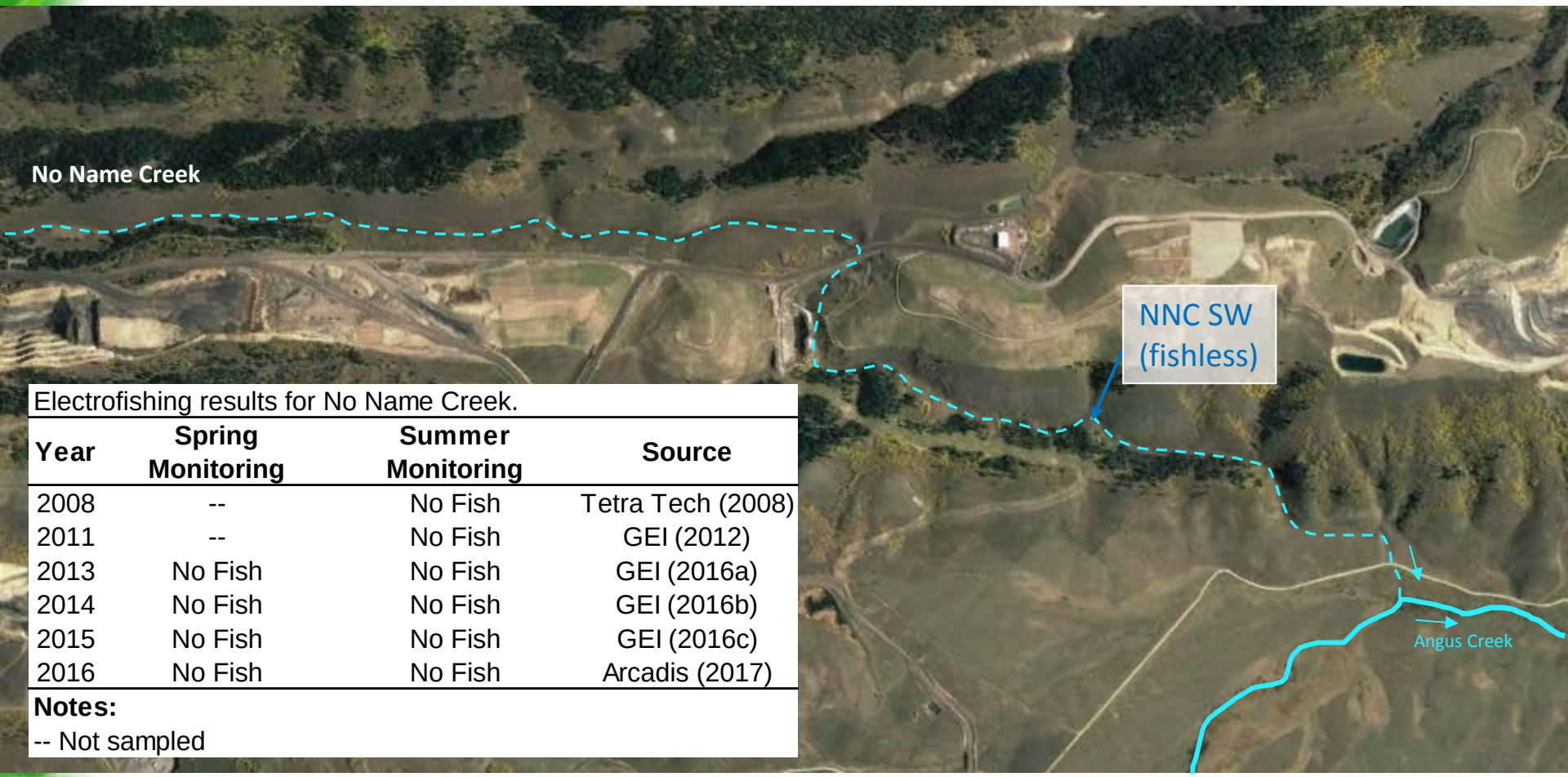
- Fish Surveys
- Macroinvertebrate Surveys

Physical Habitat

- Discharge (or dry channels)
- Substrate
- Width, depth, etc



No Name Creek – Fishless Stream



Electrofishing results for No Name Creek.

Year	Spring Monitoring	Summer Monitoring	Source
2008	--	No Fish	Tetra Tech (2008)
2011	--	No Fish	GEI (2012)
2013	No Fish	No Fish	GEI (2016a)
2014	No Fish	No Fish	GEI (2016b)
2015	No Fish	No Fish	GEI (2016c)
2016	No Fish	No Fish	Arcadis (2017)

Notes:
-- Not sampled

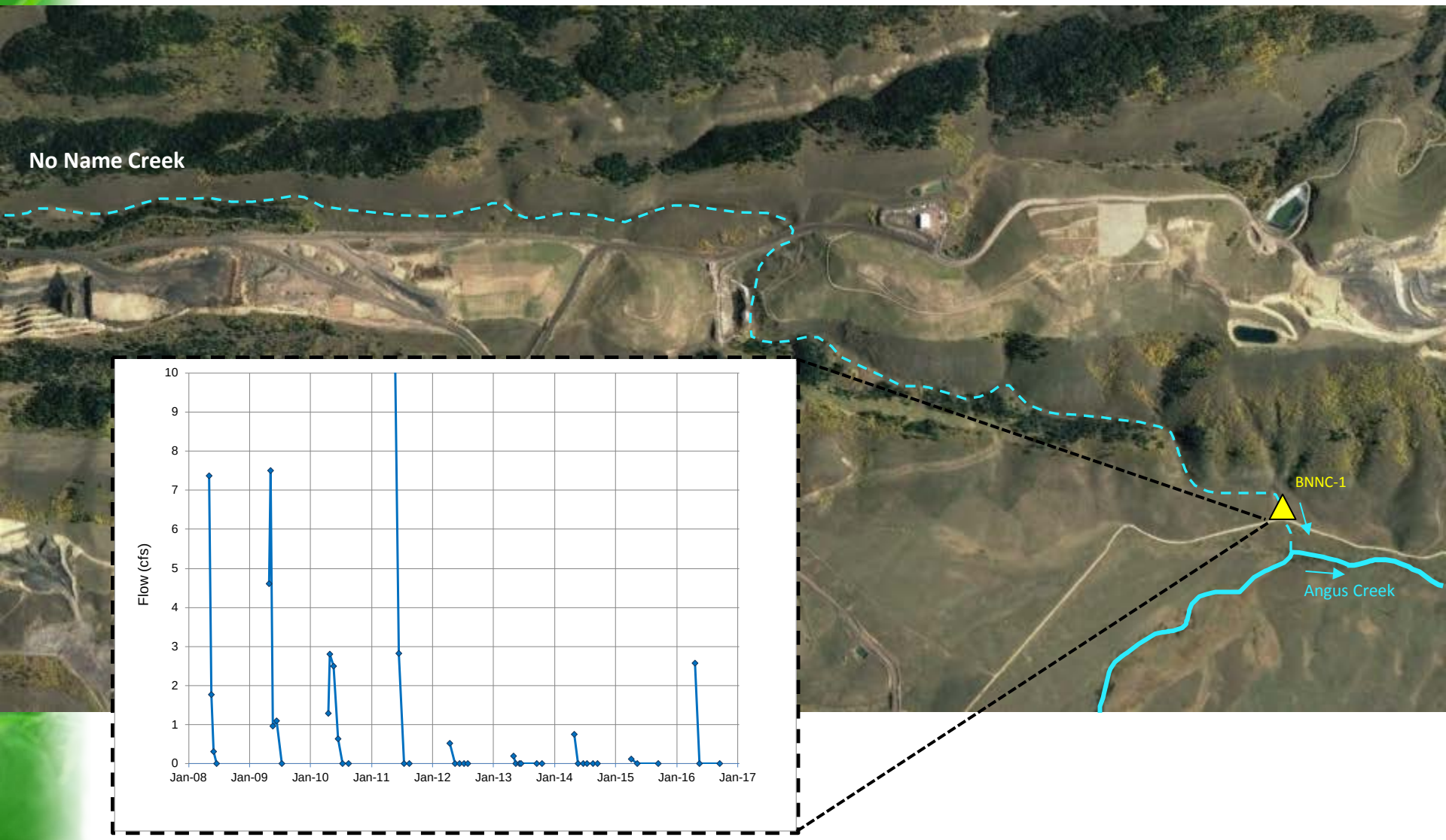
No Name Creek – Fishless Stream

BNNC-1: April 2015


BNNC-1: May 2016


BNNC-1: Sept 2016

No Name Creek – Fishless Stream



V. Water-Column Calculations

b. Fishless streams

Water Column (µg/L)[1,2]	
Water Lotic	
Default	SSC[3,4]
3.1 (30 day)	--

3. In streams where fish are naturally absent due to low-flow conditions, surface water from the fishless stream and fish tissue measured at the first occurrence of a continuous fish population are used for bioaccumulation modeling.

Appendix K – Site-Specific Criteria, p. K-13 (USEPA 2016):

- ***Sample most sensitive fish in most proximate downstream waters***
- ***Measure conditions in fishless streams to evaluate possible impact to downstream fish***

Appendix K – Site-Specific Criteria, p. K-13 (USEPA 2016)

- "When fish are absent from a waterbody, consideration of sampling the **most sensitive fish species** inhabiting nearby, **most proximate downstream waters** may be useful in order to understand Se bioaccumulation in such systems."

- "Although the upper reaches of some aquatic systems may not support fish communities, the invertebrate organisms that reside there may tolerate high concentrations of Se and pose a **Se risk to predator fish if transported downstream**."

- "Users may choose to evaluate upstream waters without fish by measuring the Se concentration in water, biotic and/or abiotic particulate material, and/or the tissues of invertebrate aquatic organisms that reside there. Because Se associated with particulate material and invertebrate organisms can be transported downstream during intermittent high flows, elevated concentrations of **Se in the tissues of downstream fish** could indicate upstream sources of Se that require a more detailed evaluation of upstream conditions."

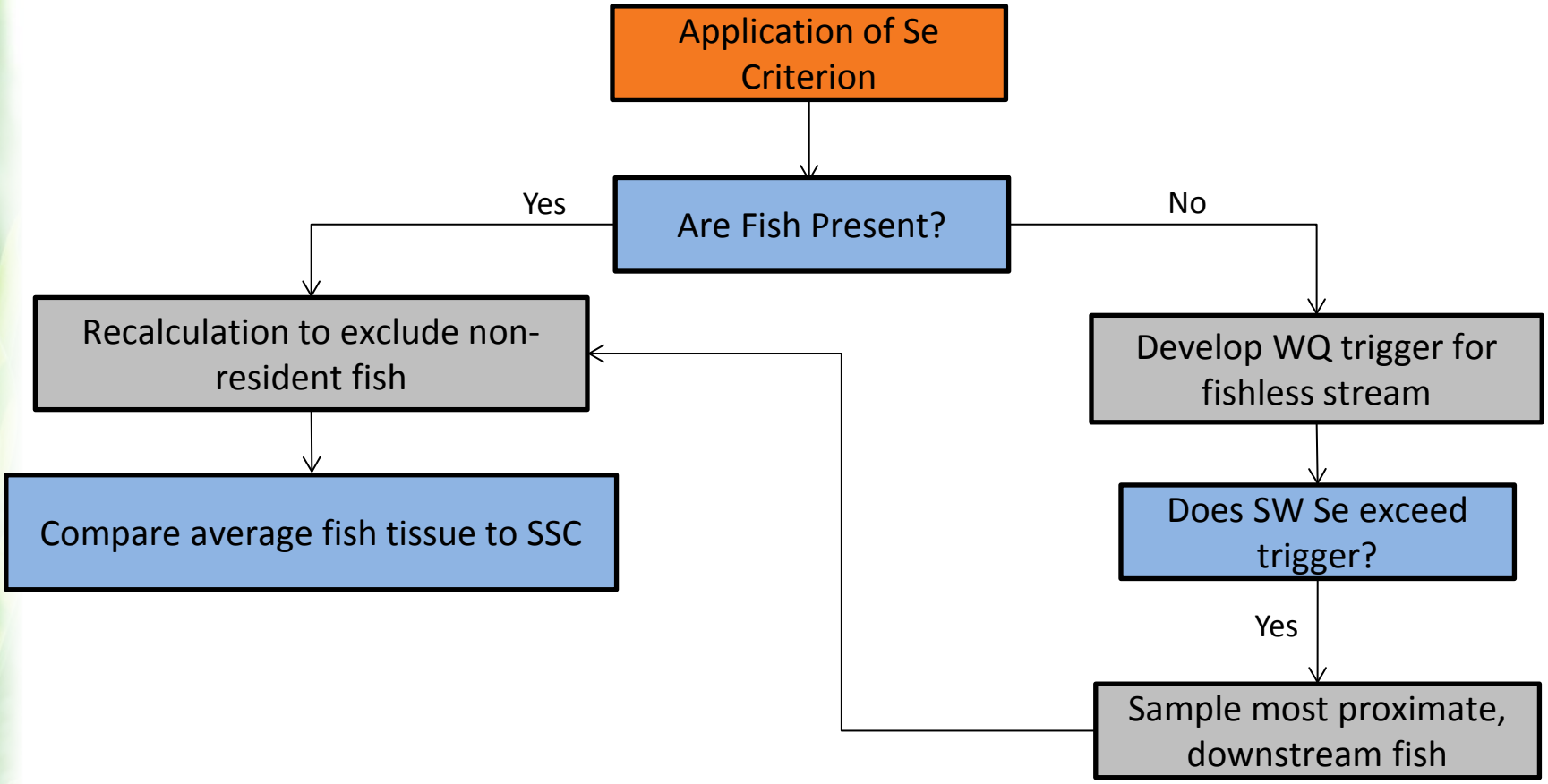
V. Water-Column Calculations

b. Fishless streams

Water Column (µg/L)[1,2]	
Water Lotic	
Default	SSC[3,4]
3.1 (30 day)	--

3. In streams where fish are naturally absent due to low-flow conditions, surface water from the fishless stream and fish tissue measured at the first occurrence of a continuous fish population are used for bioaccumulation modeling.
4. Fish tissue supersedes any site-specific water column values when fish are sampled downstream of the fishless stream or reach of fishless stream, at the first occurrence of a continuous fish population.

Simplified Implementation Flowchart



V. Water-Column Calculations

b. Fishless streams

$$C_{water} = \frac{\text{Tissue Criterion}}{\text{Fish BAF}}$$

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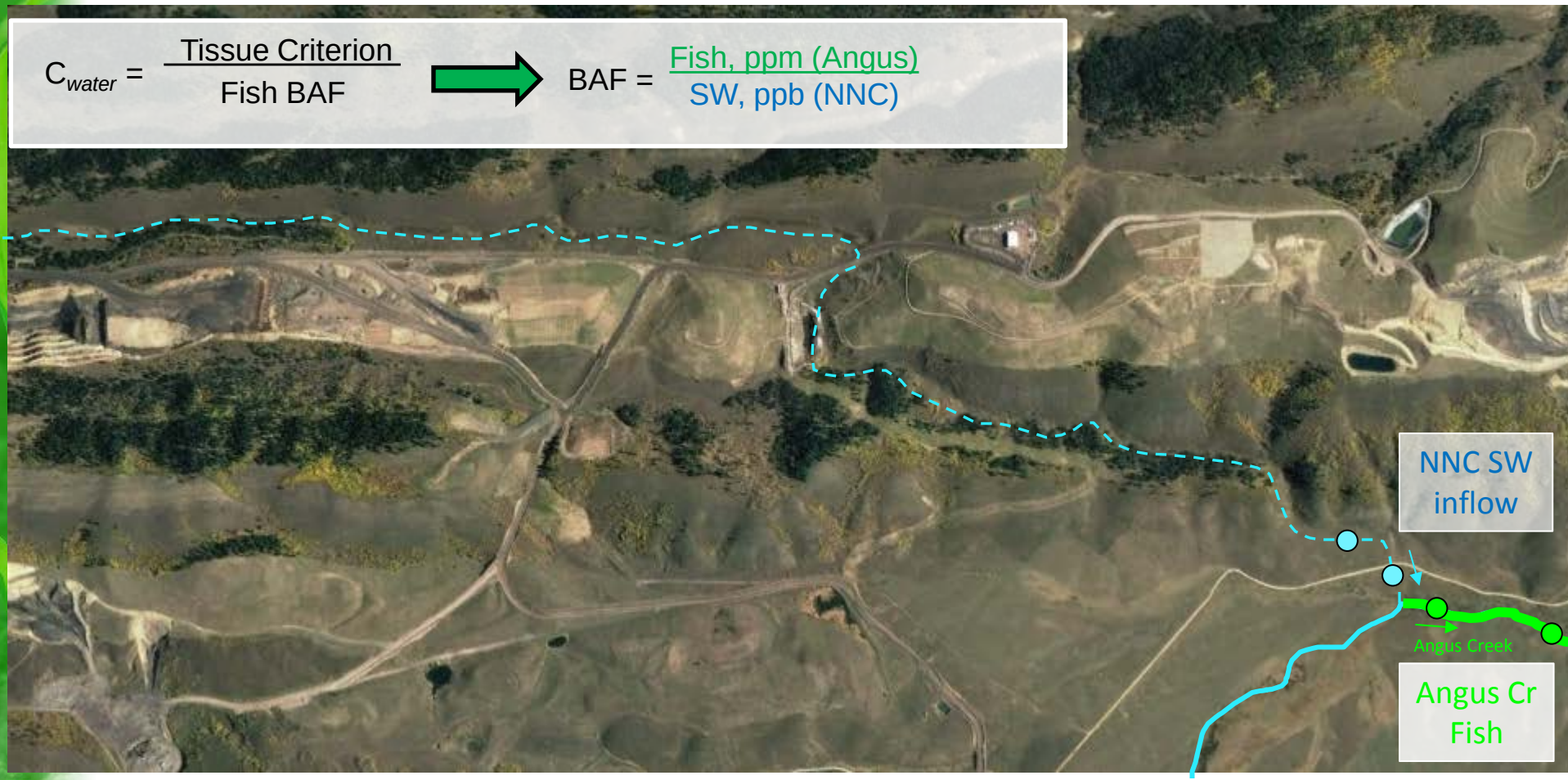
$$C_{water} = \frac{\text{Tissue Criterion}}{\text{Fish BAF}} \Rightarrow \text{BAF} = \frac{\text{Fish, ppm (Angus)}}{\text{SW, ppb (NNC)}}$$



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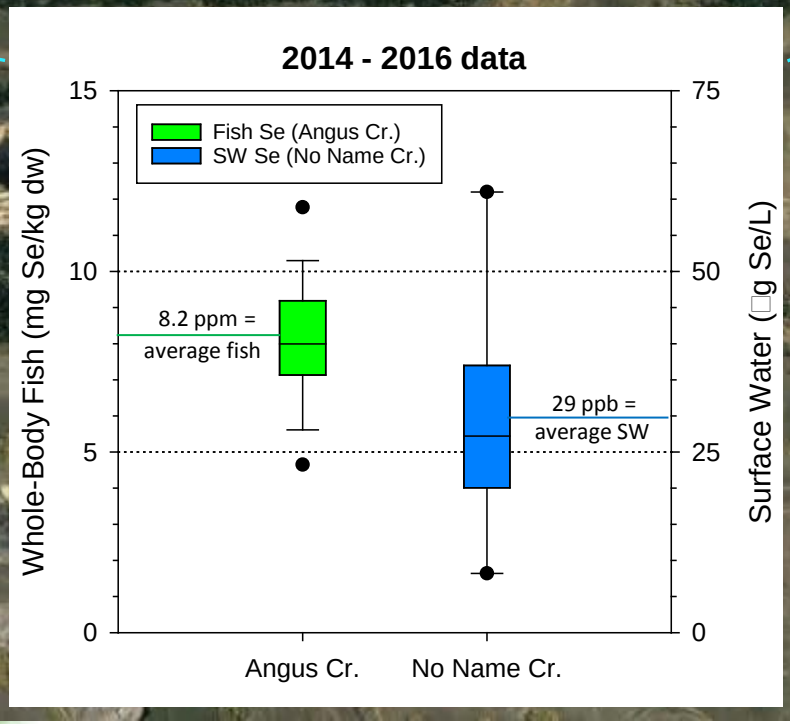


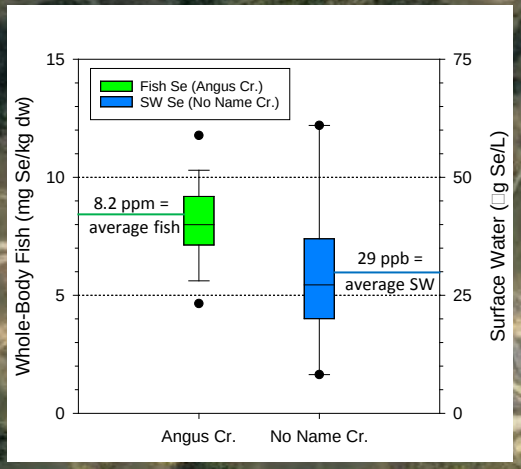
- Fish-tissue data: Angus Cr trout & sculpin (September 2014-2016)
- Surface-water data: No Name Cr (April-May 2014-2016)

V. Water-Column Calculations

b. Fishless streams

$$C_{water} = \frac{\text{Tissue Criterion}}{\text{Fish BAF}} \Rightarrow \text{BAF} = \frac{\text{Fish, ppm (Angus)}}{\text{SW, ppb (NNC)}}$$

$$\text{BAF} = \frac{8.2\ \mu g/g}{29\ \mu g/L} = 0.28\ L/g$$



NNC SW inflow

Angus Creek

Angus Cr Fish

- Fish-tissue data: Angus Cr trout & sculpin (September 2014-2016)
- Surface-water data: No Name Cr (April-May 2014-2016)

V. Water-Column Calculations

b. Fishless streams

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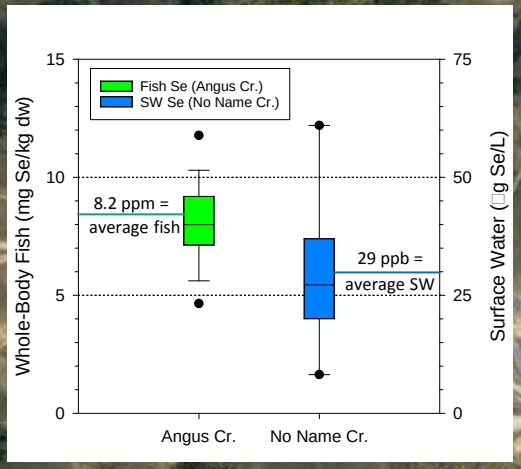

$$\text{BAF} = \frac{8.2\ \mu g/g}{29\ \mu g/L} = 0.28\ L/g$$

$$C_{water} = \frac{11.6\ \mu g/g}{0.28\ L/g} = 41\ \mu g/L\ (30\text{-d})$$

NNC SW inflow

Angus Creek

Angus Cr Fish

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- Surface-water data: No Name Cr (April-May 2014-2016)

V. Water-Column Calculations

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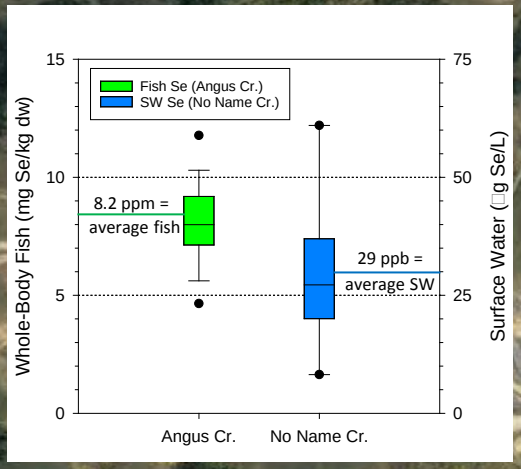

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$$C_{water} = \frac{11.6\ \mu g/g}{0.28\ L/g} = 41\ \mu g/L\ (30\text{-d})$$

41 µg/L = WQ Trigger for No Name Cr. (30-d)
(for fish sampling in Angus Cr.)

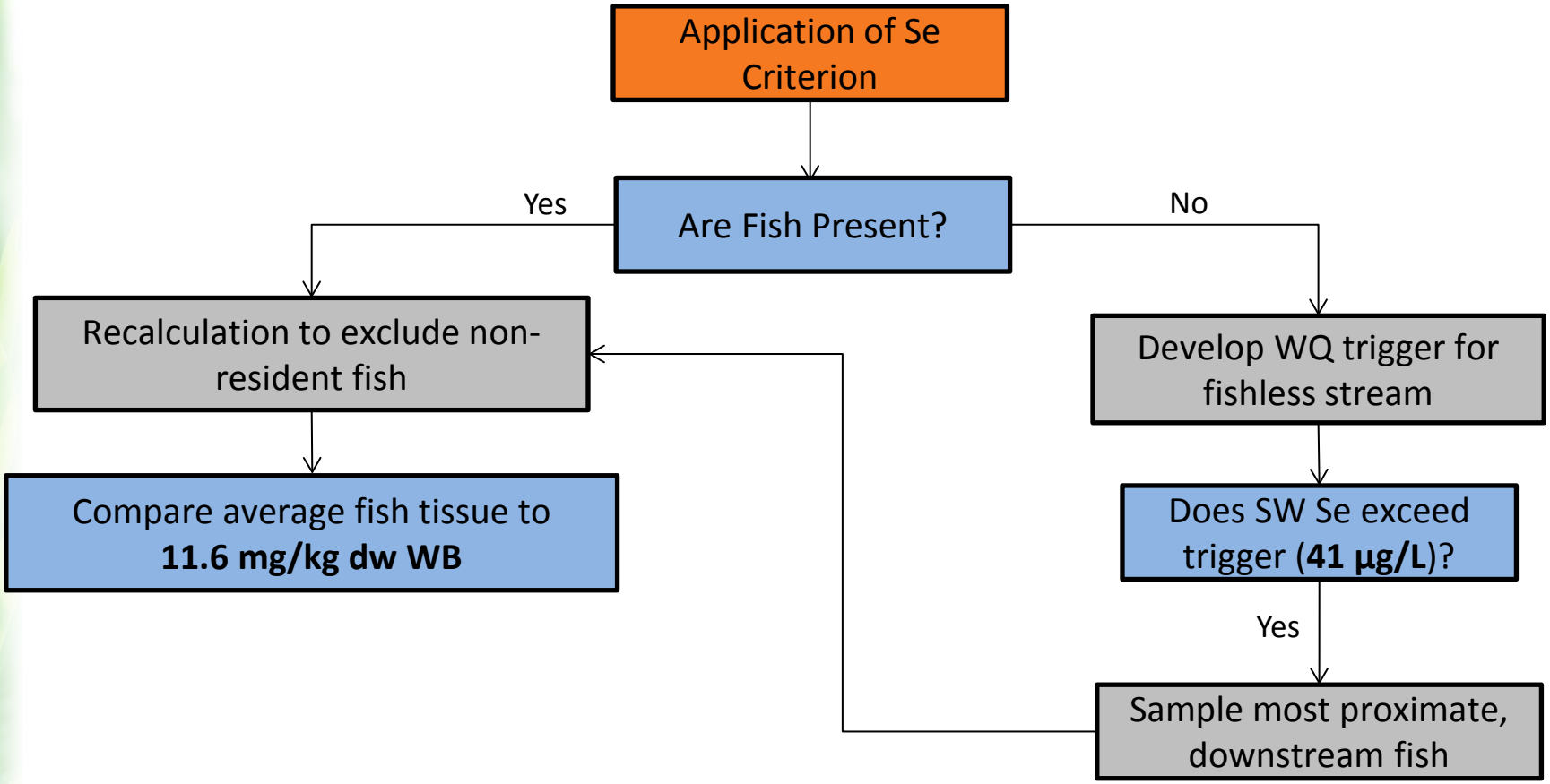
NNC SW inflow

Angus Creek

Angus Cr Fish

- Fish-tissue data: Angus Cr trout & sculpin (September 2014-2016)
- Surface-water data: No Name Cr (April-May 2014-2016)

No Name Creek – Example Flowchart



Other Fishless Streams in Upper Blackfoot River Watershed

Other Fishless Streams[1] in Upper Blackfoot River Watershed		
Fishless Stream	**Surface-Water Trigger**	**Receiving Water**
Goodheart Cr.	**--**	Slug Cr.
Dry Canyon Cr.	**--**	Slug Cr.
Dry Basin Cr.	**--**	Slug Cr.

Notes:

[1] Fishless Streams = waters with insufficient habitat and/or flow to support a fish population on a continuing basis, determined from:

- Electrofishing, habitat, discharge, and survey records.

-- Will be determined with additional data.

Dry Canyon Creek: May 2016

Discussion