



Little Spokane River TMDL

Technical Report Status

Summaries

- New water quality criteria set review:
 - Core salmon & extraordinary primary contact recreation
 - Temperature
 - Dissolved Oxygen
 - Fecal coliform
- Progress on fecal coliform, temperature, and turbidity TMDLs
- Field work plan for pH & dissolved oxygen TMDLs

Little Spokane River TMDL: New Criteria Set

Little Spokane River & its tributaries flow into Long Lake without specific designated uses in older or newer versions of the Water Quality Standards

but now

Spokane River from Long Lake dam to Nine Mile Bridge is designated core summer salmonid habitat and extraordinary primary contact recreation (Chapter 173-201A-602 WAC)

so

All fresh surface waters that are tributaries to waters designated core summer salmonid habitat; or extraordinary primary contact will also protect those uses (Chapter 173-201A-600)

Little Spokane River TMDL: Criteria Changes

NEW

Core summer salmon

7-day average daily
maximum temperature:

16°C (61 F)

1-day minimum dissolved
oxygen:

9.5 mg/L

OLD

Salmon spawning, rearing, and migration

7-day average daily
maximum temperature:

17.5 °C (64 F)

1-day minimum dissolved
oxygen:

8.0 mg/L

Little Spokane River TMDL: Criteria Changes

NEW

Extraordinary Primary Contact Recreation

Fecal coliform geometric
mean count:

50 cfu/100 mL

with less than 10% of
counts:

100 cfu/100 mL

OLD

Primary Contact Recreation

Fecal coliform geometric
mean count:

100 cfu/100 mL

with less than 10% of
counts:

200 cfu/100 mL

Little Spokane River TMDL 2008 303(d) Listings

- Fecal Coliform (12)

- Deadman Creek (3), Deer Creek, Dragoon Creek (2), Dry Creek, West Branch Dragoon Creek, Little Deep Creek, Little Spokane River (2), Otter Creek

- Temperature (16)

- Bear Creek, Beaver Creek, Buck Creek, Deadman Creek, Deer Creek, Dragoon Creek (2), West Branch Dragoon Creek, Little Deep Creek, Little Spokane River (2), West Branch Little Spokane River (3), Moon Creek, Peone Creek

- Dissolved oxygen (12)

- Beaver Creek, Buck Creek, Deadman Creek, Dragoon Creek, Little Spokane River (2), West Branch Little Spokane River (3), Moon Creek, Peone Creek, Unnamed Creek (Spring near Kaiser outfall)

- pH (10)

- Dartford Creek, Deadman Creek (3), Dragoon Creek, Dry Creek, Little Deep Creek, Little Spokane River (2), West Branch Little Spokane River

- Turbidity (1)

- Little Spokane River

Little Spokane River TMDL Report

- Revised WSU fecal coliform findings based on new criteria
- Revised WSU temperature to match new criteria
- Developing turbidity and total suspended solids TMDL
- Decided additional dissolved oxygen and pH field work are needed to address eutrophication.

Little Spokane River TMDL Report

- Other revisions to the WSU report findings
 - Improved water balance description to integrate seasonal patterns with more detail in various sub-basins and the influence of groundwater inputs
 - More comparisons to historical data to evaluate trends & increase data sets
 - Added a natural conditions discussion since it is key for setting temperature loading capacities in some reaches
 - Added a description of aquatic life including results from redband trout & macroinvertebrate studies

Available Data and Reports

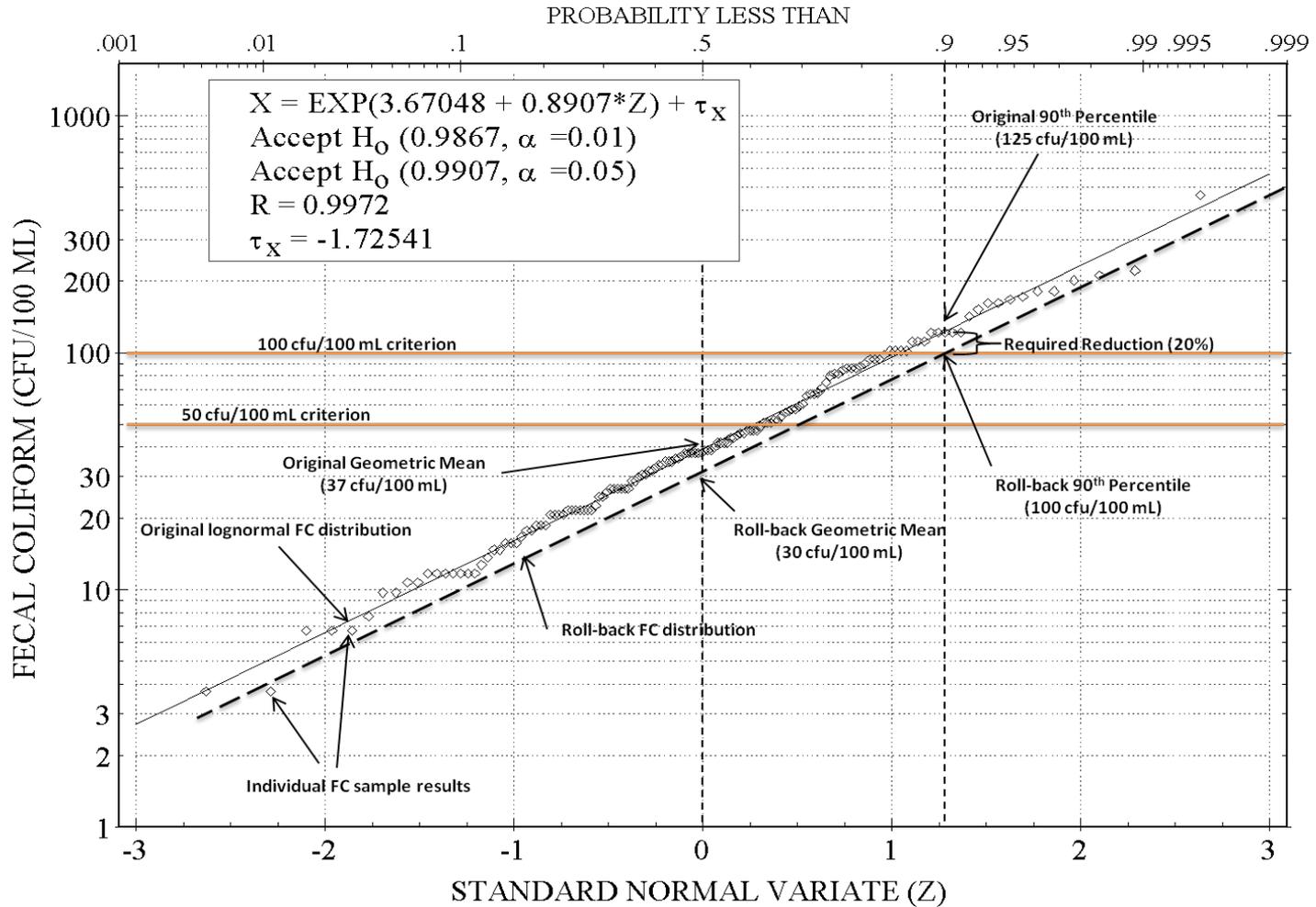
- Long-term monitoring
 - Ecology ambient monitoring stations
 - USGS gaging stations
 - SCCD gaging and temperature monitoring
- Project-specific monitoring
 - 1999 water year POCD LSR Watershed Study
 - 2001 – 2002 SCCD LSR Watershed Projects
 - 2005 – 2006 WSU TMDL Technical Study
 - 2001 – 2002 WDFW Fish studies
 - Various lake, WWTP/point source, and groundwater studies

Analytical Tools

- Fecal coliform
 - Statistical roll-back by site
 - Mass balance check on critical season average flow
- Temperature
 - ODEQ Shade Tool and vegetation site calibration
 - QUAL2Kw model on critical condition
 - Public Lands Survey vegetation estimates for site potential shade
- Turbidity and TSS
 - Multiple regression modeling
 - Impact on trout: duration and concentration severity scores

Fecal Coliform

LITTLE SPOKANE RIVER AT MOUTH (MAY - SEPTEMBER)



Number of Samples	Location	All data		Critical period data (May-September)		Meet/Fail Standard
		Geometric mean	90 th percentile	Geometric mean	90 th percentile	
		cfu/100 mL	cfu/100 mL	cfu/100 mL	cfu/100 mL	
41	Little Spokane River at Scotia	13	71	30	86	Meet
12	Little Spokane River at Elk	17	81	41	108	Fail
28	Little Spokane River at Milan	7	44	17	43	Meet
41	Little Spokane River ab. Deadman Cr	30	202	65	253	Fail
28	Little Spokane River at Painted Rock	16	68	26	61	Meet
363	Little Spokane River at mouth	28	99	37	125	Fail
28	Moon Creek	8	79	32	121	Fail
16	West Branch LSR blw. Sacheen Lake	4	15	15	45	Meet
18	Buck Creek	4	21	11	38	Meet
16	Beaver Creek	5	36	30	105	Fail
16	West Branch LSR above Eloika Lake	2	12	11	46	Meet
28	West Branch LSR below Eloika Lake	5	35	23	89	Meet
16	Dry Creek	14	184	31	184	Fail
15	Otter Creek	47	289	181	1014	Fail
17	Bear Creek	9	63	58	131	Fail
16	Deer Creek	33	360	260	784	Fail
32	Dragoon Creek at Oregon Road	102	980	312	1640	Fail
16	Dragoon Creek at Dahl Road	11	57	38	157	Fail
34	Dragoon Creek at Crawford Road	137	903	369	1972	Fail
24	Dragoon Creek at Monroe Road	41	232	153	443	Fail
44	Dragoon Creek (West Branch)	43	380	146	887	Fail
59	Dragoon Creek at Crescent Road	30	239	81	338	Fail
11	Deadman Creek at Holcomb Rd	15	211	52	672	Fail
17	Deadman Creek at Heglar Road	20	241	190	328	Fail
11	Peone Creek	14	344	166	889	Fail
22	Deadman Creek above Little Deep Cr	26	132	95	243	Fail
16	Little Deep Creek	172	2100	470	1150	Fail
27	Deadman Creek at mouth	41	266	174	519	Fail
17	Dartford Creek	35	271	108	221	Fail

Little Spokane River at Scotia Road	-
Little Spokane River at Elk	7%
Little Spokane River at Deer Park – Milan	-
Little Spokane River above Deadman Cr.	60%
Little Spokane River at Painted Rock	-
Little Spokane River at mouth	20%
Moon Creek	17%
West Branch LSR below Sacheen Lake	-
Buck Creek	-
Beaver Creek	5%
West Branch LSR above Elioka Lake	-
West Branch LSR below Elioka Lake	-
Dry Creek	46%
Otter Creek	90%
Bear Creek	24%
Deer Creek	87%
Dragoon Creek at Oregon Road	94%
Dragoon Creek at Dahl Road	36%
Dragoon Creek at Crawford Road	95%
Dragoon Creek at Monroe	77%
West Branch Dragoon Creek	89%
Dragoon Creek at mouth	70%
Deadman Creek at Holcomb Road	85%
Deadman Creek at Heglar Road	74%
Peone Creek	71%
Deadman Creek above Little Deep Creek	59%
Little Deep Creek	95%
Deadman Creek at mouth	81%
Dartford Creek	55%

Rules of Thumb

Sample size

Less than 24 random samples:
low confidence in statistic

Reductions

1% - 30% : low effort/wildlife sources

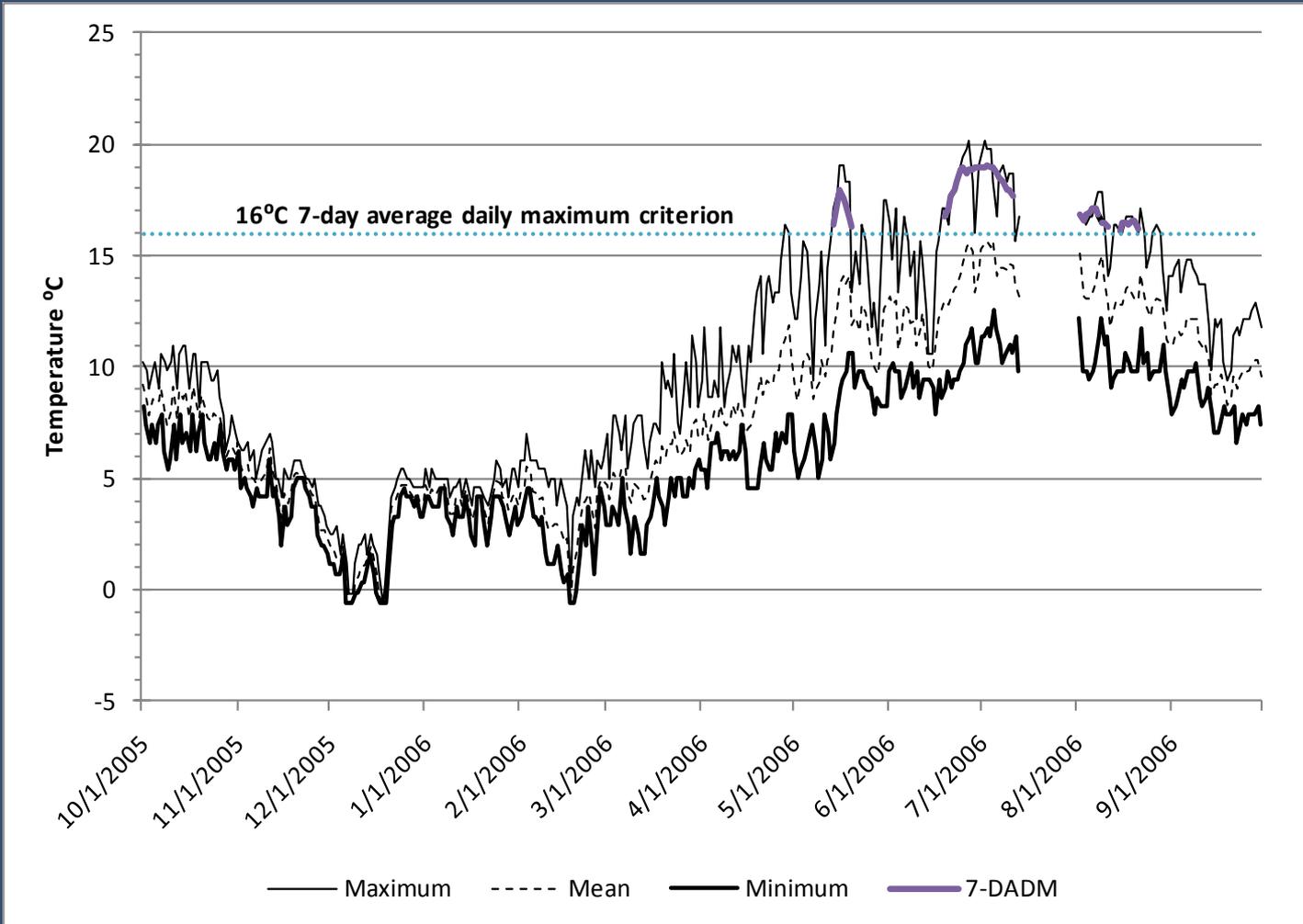
30% - 60%: some implementation

60% - 99%: priority implementation area

Potential Fecal Coliform Sources

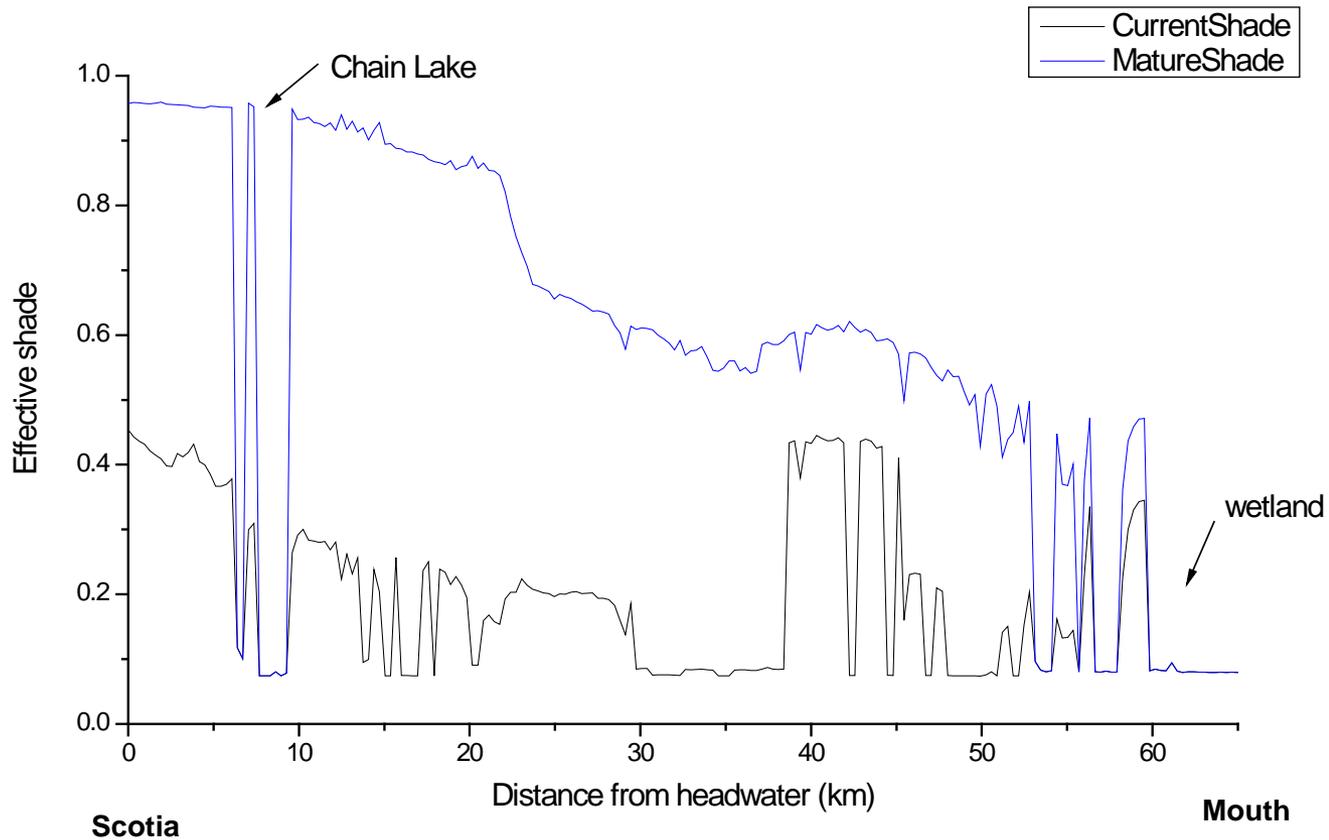
- ◉ Residential on-site septic systems
- ◉ Livestock access
- ◉ Wildlife & waterfowl
- ◉ Agricultural manure spreading
- ◉ Stormwater runoff
- ◉ Pets

Temperature

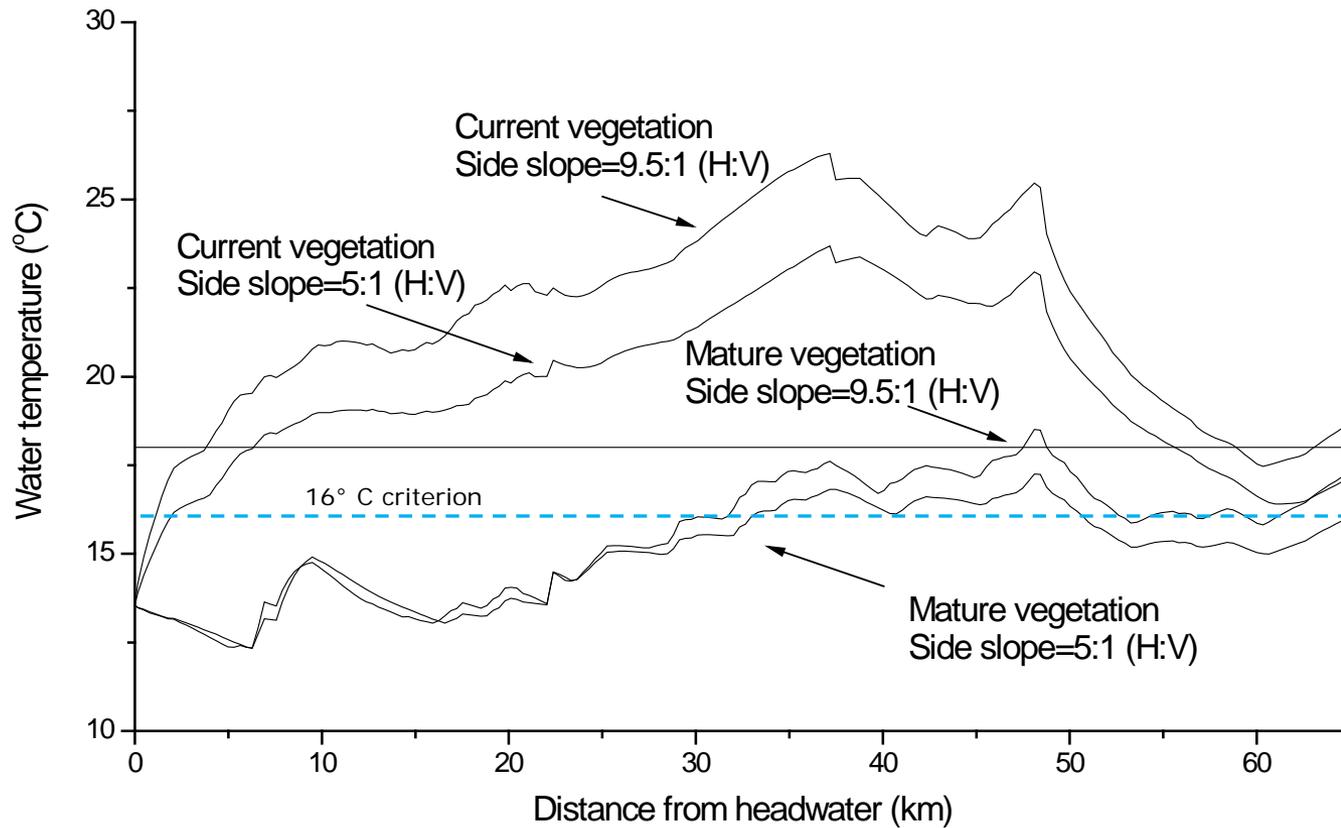


	55B070 Little Spokane River at Mouth			LS-4 Little Spokane River at Deer-Milan			LS-1 Little Spokane River at Scotia		
Year	Maximum Temp. °C	7-Day Avg. Daily Maximum Temp. °C	Date	Maximum Temp. °C	7-Day Avg. Daily Maximum Temp. °C	Date	Maximum Temp. °C	7-Day Avg. Daily Maximum Temp. °C	Date
2007	18.5	18.2	July 8						
2005	17.8	17.4	July 21						
2004	18	17.7	July 23						
2003	18.1	17.9	July 21						
2002	19.1	18.4	July 14	23.2	22.1	July 15	20.9	19.8	July 12
2001	18.3	17.2	July 13				20.3	19.8	Aug 8

Temperature



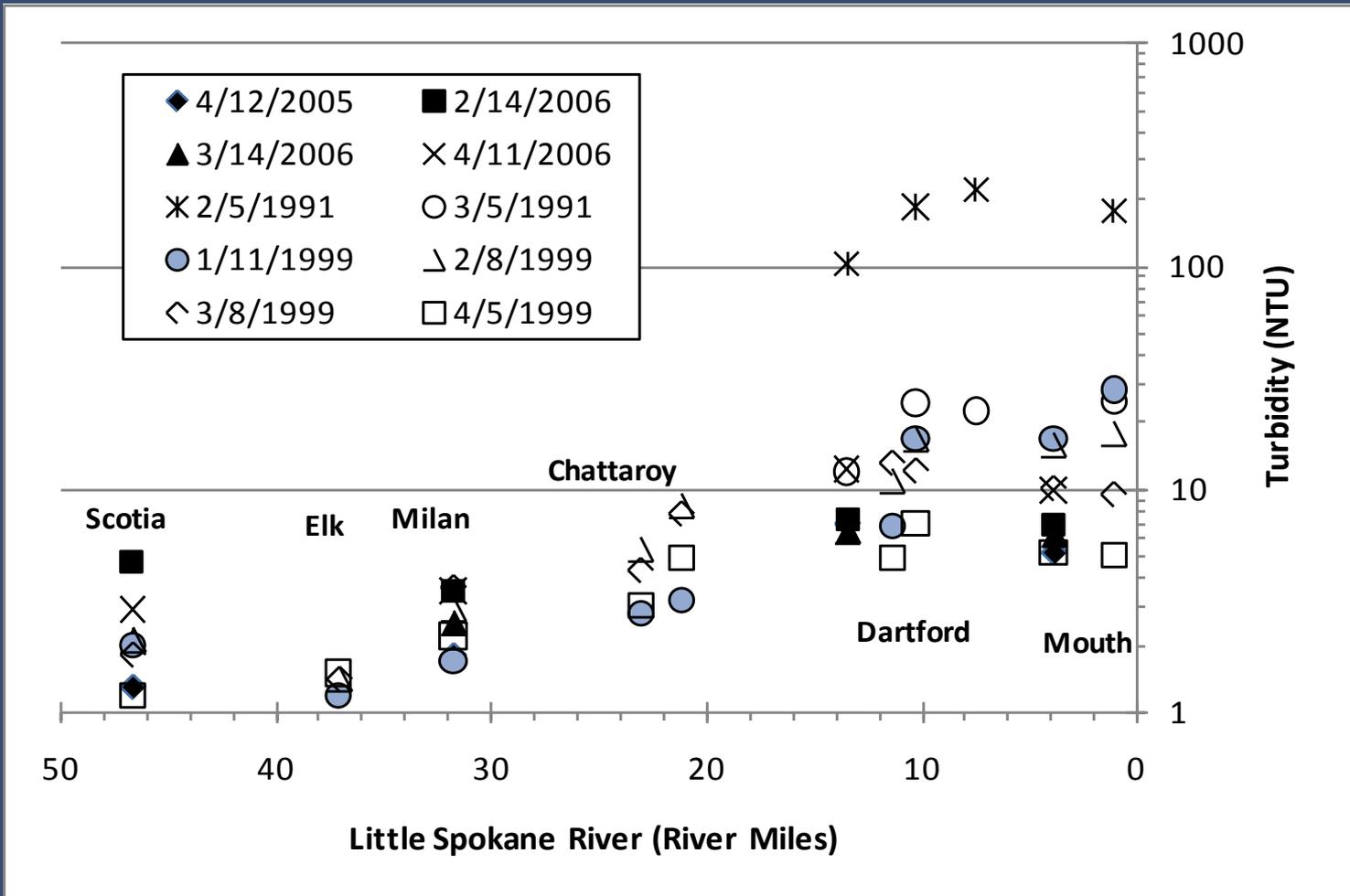
Temperature



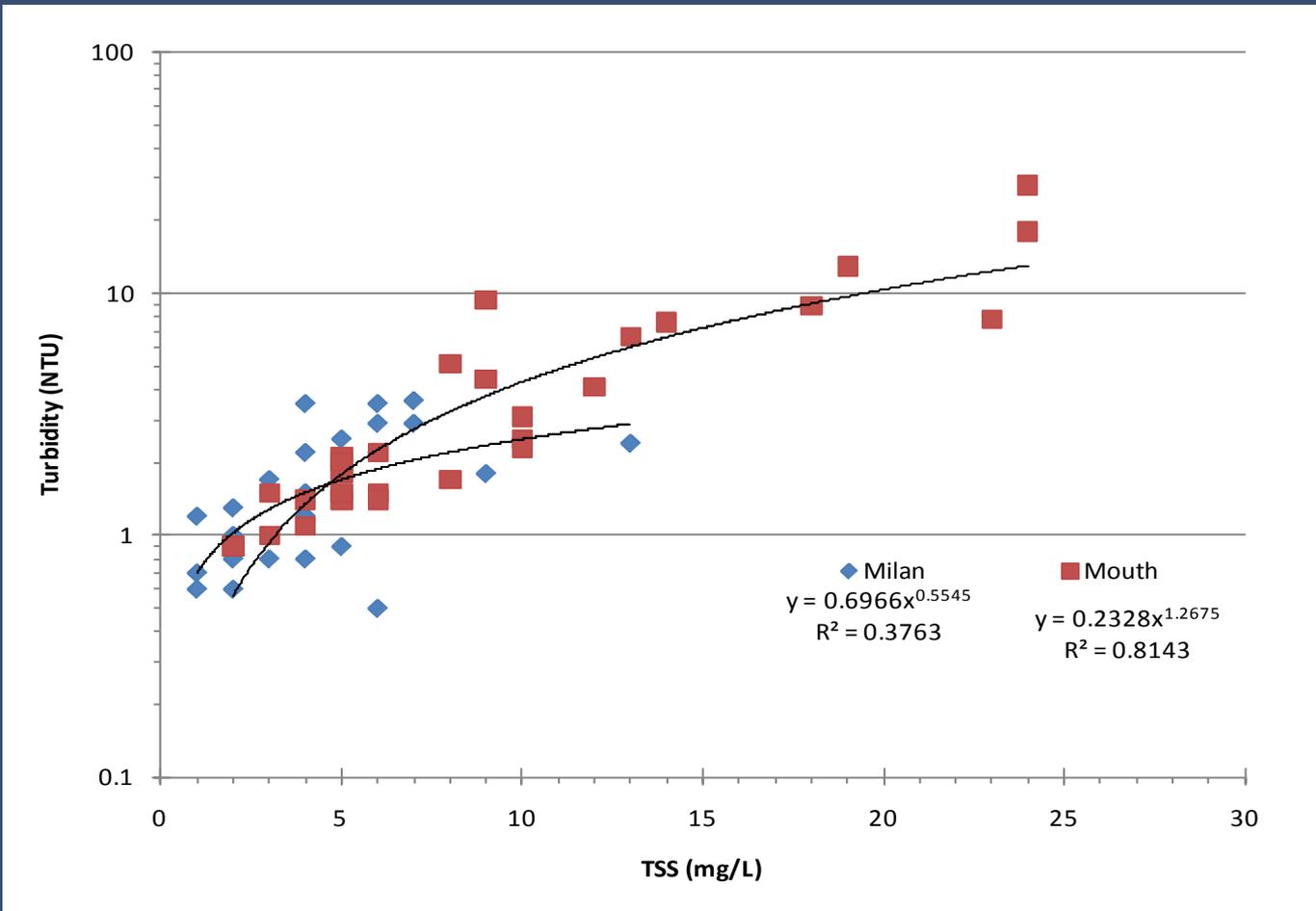
Temperature

- ◉ Lake exposures in upper watershed make meeting 16°C (61°F) difficult in downstream reaches — natural condition
- ◉ Effective riparian shade key to cooling upper and mid-LSR reaches & some reaches will probably not meet criteria with maximum effective shade – natural condition
- ◉ Groundwater cooling effect important in lower Deadman Creek and LSR below Dartford
- ◉ Colbert Landfill treated effluent and Little Spokane Hatchery outflow will have temperature wasteload allocations as will stormwater for Spokane County and WDOT

Turbidity / Total Suspended Solids



Turbidity / Total Suspended Solids



Effects of Sediments & Turbidity on Aquatic Communities

- (1) acting directly on the fish swimming in the water and either killing them or reducing their growth rate, resistance to disease, etc.;
- (2) preventing the successful development of fish eggs and larvae;
- (3) modifying behavior, natural movements, and migrations; and
- (4) reducing the abundance of available food.

Aquatic Biota Severity Scores

Severity Scale	Description of Effect
No Effect	
0	No behavioral effects
Behavioral Effects	
1	Alarm reaction
2	Abandonment of cover
3	Avoidance response
Sub-lethal Effects	
4	Short-term reduction in feeding rates or feeding success
5	Minor physiological stress; increased coughing, increased respiration rate
6	Moderate physiological stress
7	Moderate habitat degradation; impaired homing
8	Indications of major physiological stress; long-term
Lethal and Para-lethal Effects	
9	Reduced growth rate; delayed hatching; reduced fish density
10	0 – 20% mortality; increased predation; moderate to severe habitat degradation
11	>20 – 40% mortality
12	>40 – 60% mortality
13	>60 – 80% mortality
14	>80 – 100% mortality

Other Effects of Sediments & Turbidity

- **Sediments transport phosphorus, some pesticides, metals, and polynuclear aromatic hydrocarbons**
- **Sediments fill creek channels and river pools:**
 - Flooding hazard
 - Decrease pool capacity for river and dam operations

Turbidity and Total Suspended Solids LSR Biological Assessments

Benthic Macroinvertebrates: Ecology (1994; 2003)
Canwell & Lang (2003)

Fish:

WDFW - McLellan (2005)

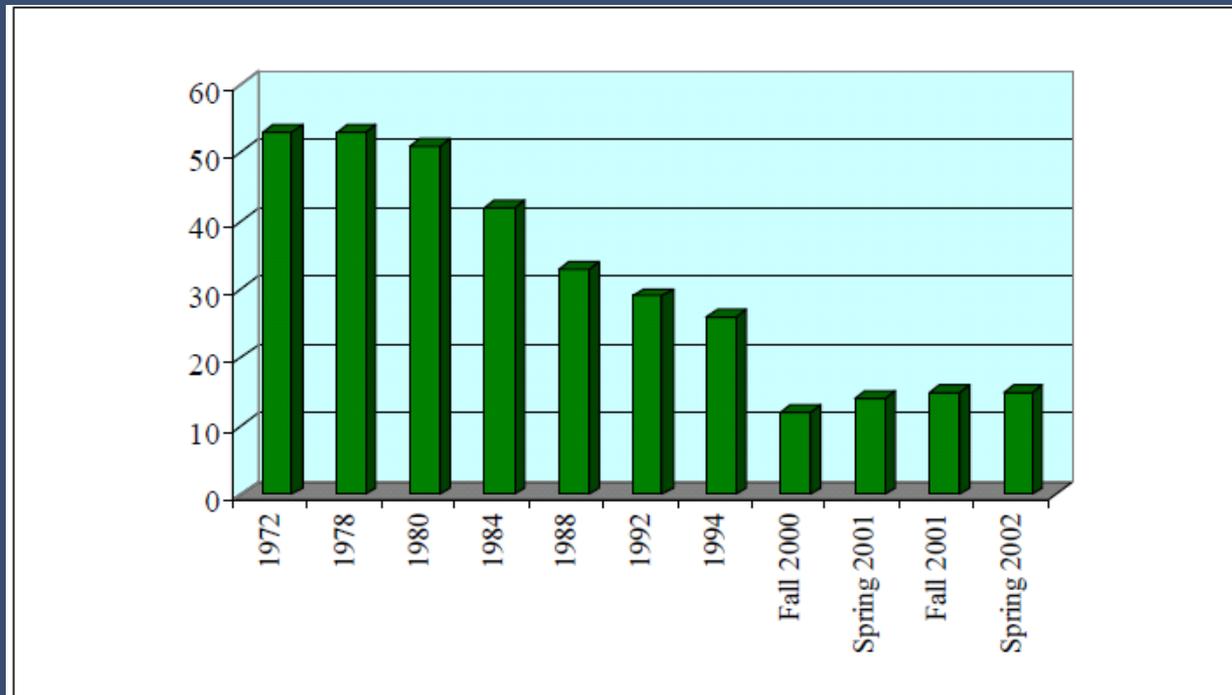
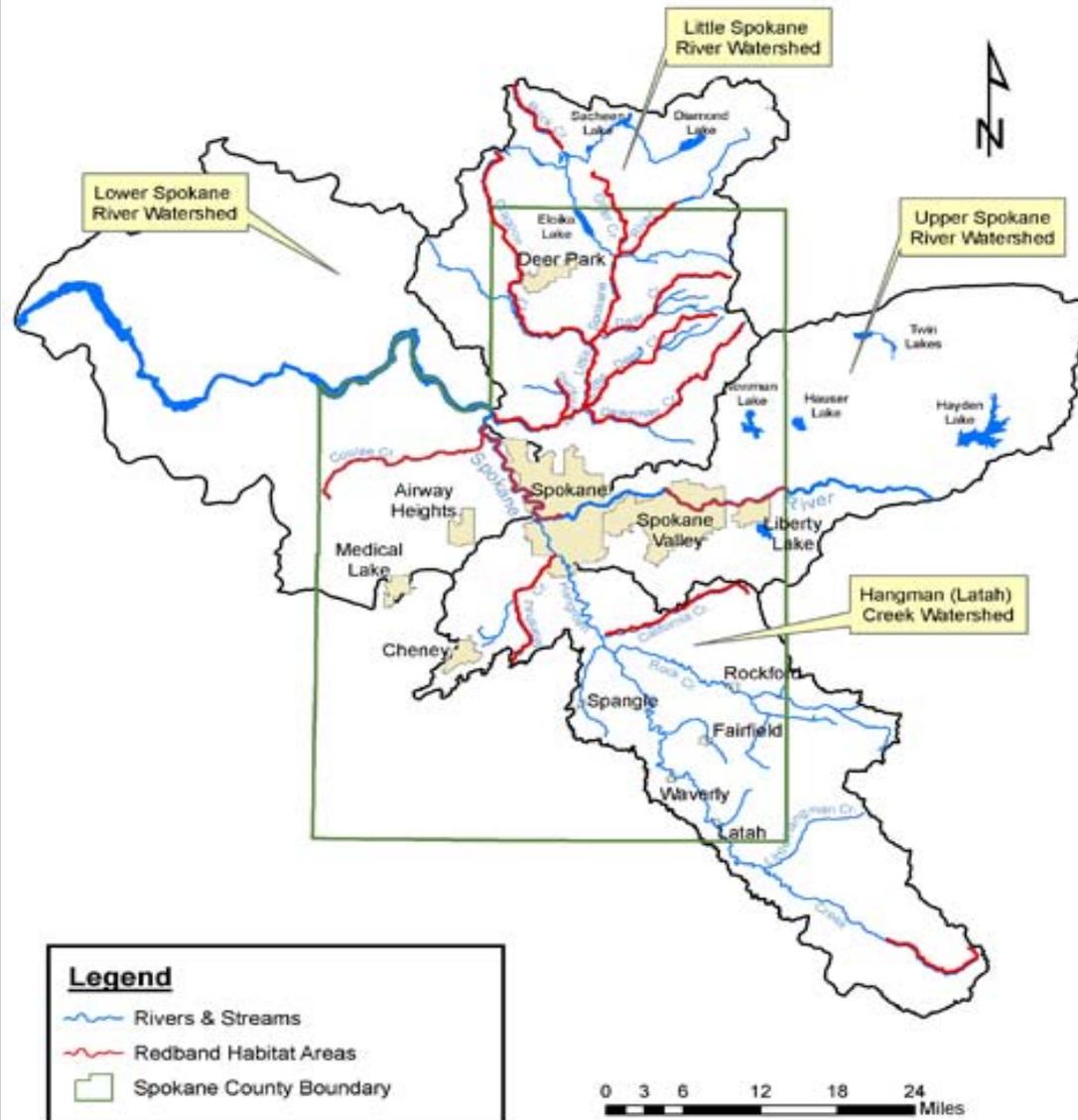
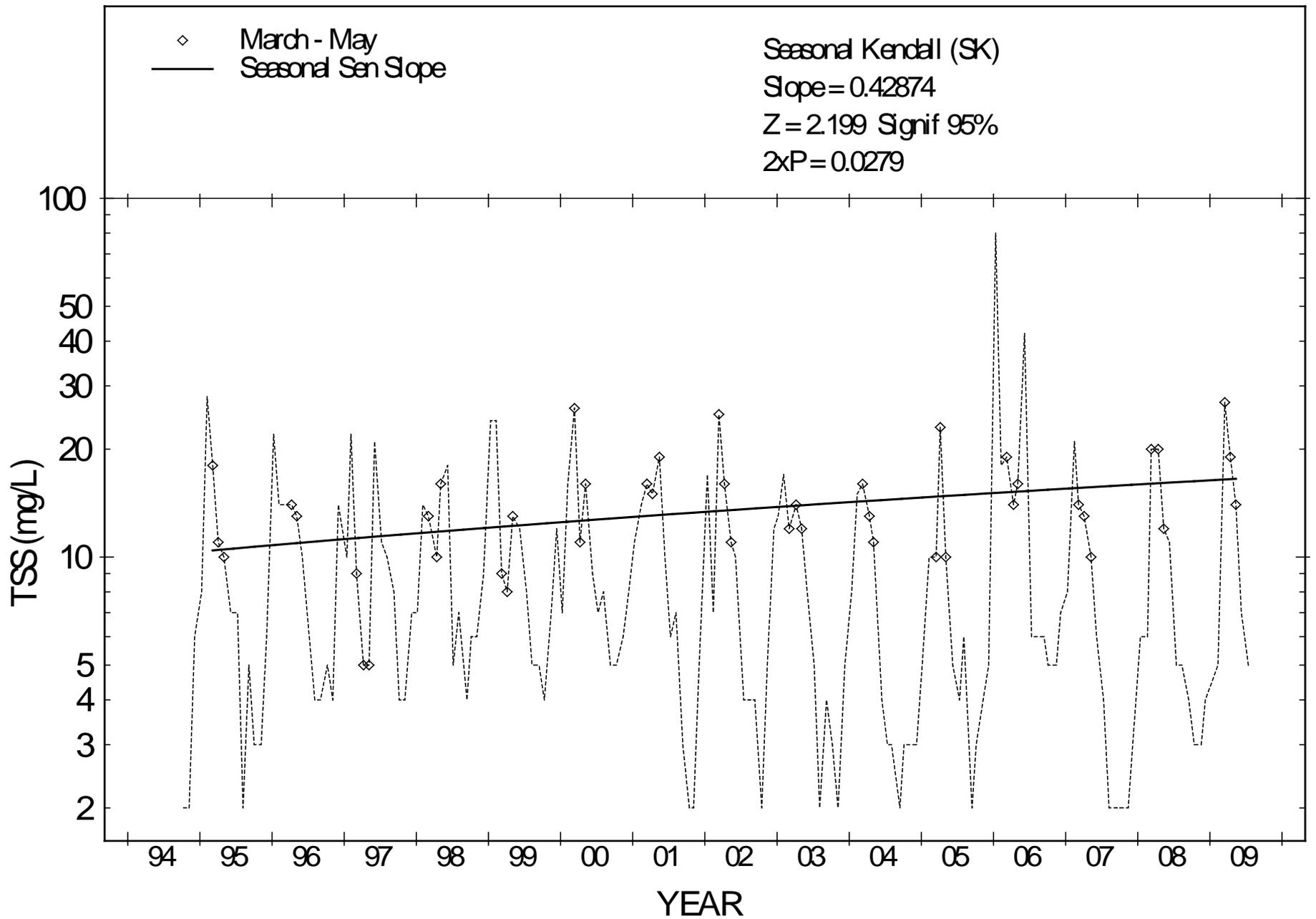
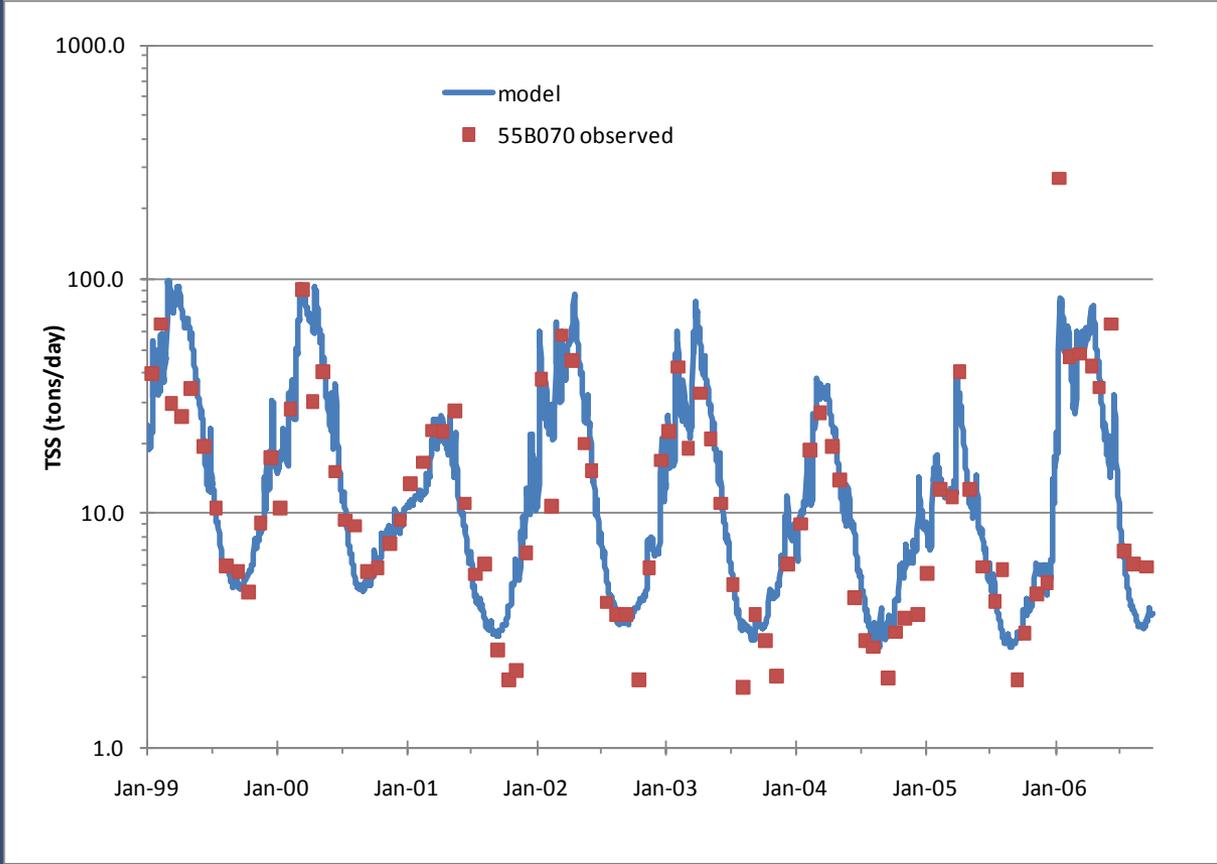


Figure 6: Total EPT Species at Pine River Park, Little Spokane River

Redband Trout Habitat Locations







Site	Deer Park-Milan Road		Painted Rock (55B075)		Mouth (55B070)	
Study	Multiple Regression	Beales Estimator	Multiple Regression	Beales Estimator	Multiple Regression	Beales Estimator
POCD 1998- 1999	2.6 tons/day	2.5 tons/day	19 tons/day	22 tons/day	29 tons/day	23 tons/day
WSU/SCCD 2005 – 2006	1.6 tons/day	1.4 tons/day	12 tons/day	8.2 tons/day	16 tons/day	17 tons/day

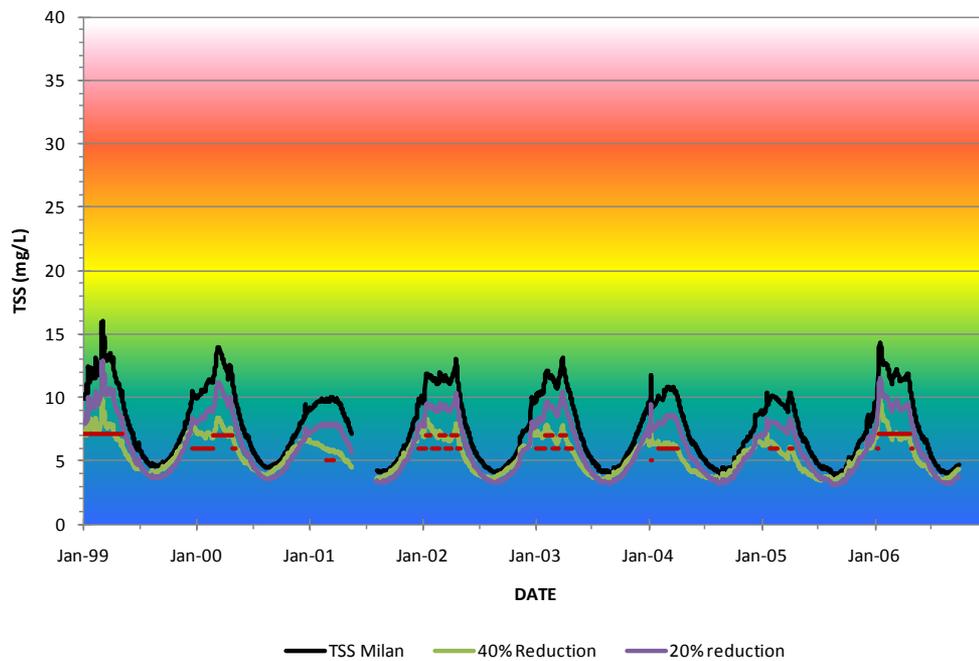
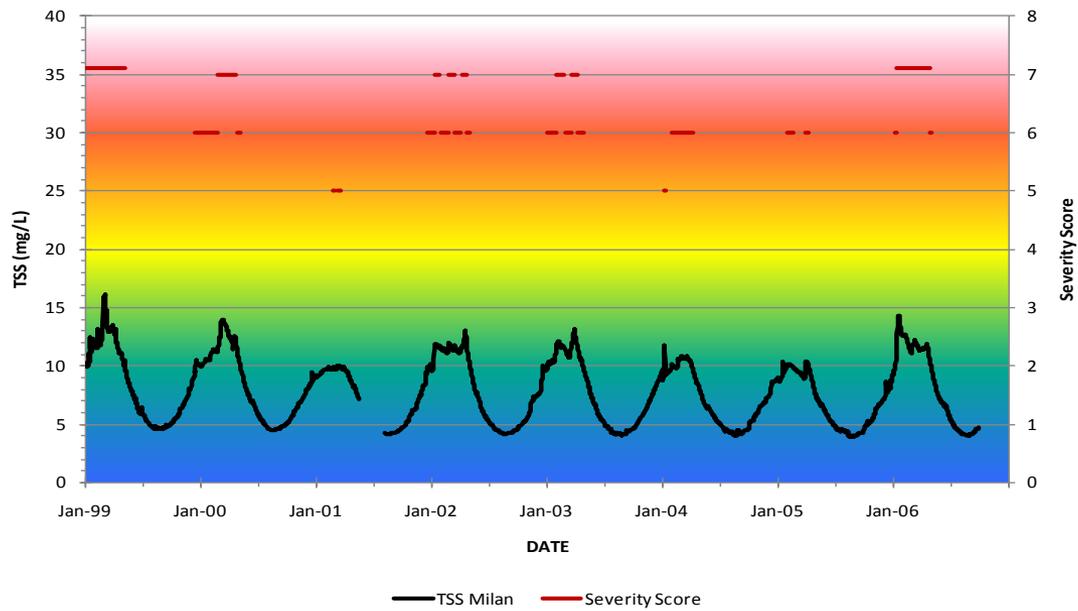
Juvenile & Adult Salmonid Severity Score Equation

$$\text{Severity Score} = 1.0642 + 0.6068 (\log_e \text{ Hours of exposure}) + 0.738(\log_e \text{ TSS mg/L})$$



If TSS = 20 mg/L, then Severity Score for :

- 12 hours = 4.8 (Short-term reduction in feeding rates & success)
- 5 days = 6.2 (Moderate physiological stress)
- 20 days = 9.4 (Reduced growth, delayed hatching, reduced fish densities)



Synoptic Surveys for DO and pH Evaluations

Tentative approval to sample this year:

- 2 summer surveys each over a 2 or 3 day period
- Nutrient samples and instream measurements taken twice each day
- Move through approximately 30 sites - upstream to downstream, including some tributaries and point sources
- Continuous monitoring of temperature, DO and pH at several key sites

Lab and field data will be evaluated after Hangman TMDL is finished unless additional staff are assigned.