Appendices B - J

Surface Water Monitoring Program for Pesticides in Salmonid-Bearing Streams, 2006-2008 Triennial Report

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Appendix B. Monitoring Sites and Duration of Sampling

Table B-1. Station locations, duration of monitoring, and site location descriptions, 2006-2008.

Site	Duration	Latitude	Longitude	Location Description
Cedar-Sammamish Watershed				
Thornton 1	Feb-Sept	47.7082	122.2897	NE 110th Street upstream of pedestrian footbridge.
Thornton 3	Feb-Sept	47.6958	122.2757	Downstream of pedestrian footbridge near Mathews Beach Park.
Skagit-Samish Watershed				
BD-1	Feb-Sept	48.3086	122.3473	Upstream side of bridge at Milltown Road.
BD-2	Feb-Sept	48.3887	122.3329	Upstream side of bridge at Lenor Lane.
BS-1	Feb-Sept	48.3406	122.4140	Downstream of tidegate on Fir Island Road.
IS-1	Feb-Sept	48.4506	122.4651	Inside upstream side of tidegate at Bayview-Edison Road.
SR-1	Feb-Sept	48.5209	122.4113	Upstream side of bridge at Thomas Road.
Lower Yakima Watershed				
Marion 2	Feb-Oct	46.3306	120.1989	Approximately 15 meters upstream of bridge at Indian Church Road.
Spring 2	Feb-Sept	46.2583	119.7101	Downstream side of culvert on McCready Road.
Spring 3	Feb-Sept	46.2344	119.6845	Approximately 3 meters downstream of Chandler Canal overpass.
Sulphur 1	Feb-Sept	46.2509	120.0202	Downstream side of bridge at Holaday Road.
Wenatchee Watershed				
WE-1	Feb-Sept	47.4721	120.3710	Upstream side of Sleepy Hollow bridge.
MI-1	Feb-Sept	47.4893	120.4815	Above Woodring Canyon Road and Mission Creek Road.
PE-1	Feb-Sept	47.5570	120.5825	Approximately 30 meters downstream of bridge at Saunders Road.
BR-1	Feb-Sept	47.5211	120.4862	Upstream side of culvert at Evergreen Drive.
Entiat Watershed				
EN-1	Feb-Sept	47.6633	120.2506	Upstream side of bridge at Keystone Road.

Datum in NAD 83.

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Appendix C. Land Use Area Estimates and Crop Totals for Agricultural Sites

Reference: Homer, C.C. Huang, L. Yang, B. Wylie and M. Coan, 2004. Development of a 2001 National Landcover Database for the United States. Photogrammetric Engineering and Remote Sensing, Vol. 70, No. 7. July 2004. pp. 829-840.

Table C-1. Land use estimates and crop totals for Thornton Creek WRIA 8.

Site and Land Use	Area (acres)	Percent of Watershed Area
Open Water	7	0.09%
Developed, Open Space	578	7.48%
Developed, Low Intensity	4214	54.5%
Developed, Medium Intensity	1904	24.6%
Developed, High Intensity	717	9.27%
Deciduous Forest	22	0.29%
Evergreen Forest	209	2.71%
Mixed Forest	50	0.65%
Shrub/Scrub	20	0.25%
Wetlands	7	0.09%
Watershed Area	7728	--

Table C-2. Land use estimates and crop totals for Skagit-Samish WRIA 3.

Site and Land Use (Area in acres)*	Big Ditch	Indian Slough	Browns Slough	Samish River
Open Water	0	0	0	882
Developed, Open Space	383	641	6	3,341
Developed, Low Intensity	1043	692	93	2,645
Developed, Medium Intensity	734	377	67	345
Developed, High Intensity	154	193	1	45
Barren Land (Rock/Sand/Clay)	0	0	1	242
Deciduous Forest	94	195	0	7,262
Evergreen Forest	586	52	0	20,391
Mixed Forest	289	299	0	12,757
Shrub/Scrub	27	69	24	4,254
Grassland/Herbaceous	54	163	33	2,928
Pasture/Hay	2578	1,606	1,943	3,599
Cultivated Crops	1930	564	1,255	2,437
Wetlands (Woody and Emergent Herbaceous)	139	171	21	3949
Watershed Area	8012	5025	3446	65076

* It is not possible to delineate accurate basin measurements for the irrigation drainage areas due to the low topographic relief of the Skagit delta. As a result, all land-use statistics should be considered estimates.

Table C-3. Land use estimates and crop totals for Lower Yakima WRIA 37.

Site and Land Use (Area in acres)	Marion Drain	Sulphur Creek Wasteway	Spring Creek
Open Water	177	101	4
Perennial Ice/Snow	0	0	0
Developed, Open Space	5757	4175	1258
Developed, Low Intensity	3823	3243	387
Developed, Medium Intensity	985	968	42
Developed, High Intensity	135	81	8
Barren Land (Rock/Sand/Clay)	0	0	0
Deciduous Forest	8	0	0
Evergreen Forest	2	0	0
Mixed Forest	3	0	0
Shrub/Scrub	6232	40977	11949
Grassland/Herbaceous	261	8760	1783
Pasture/Hay	4273	5159	1320
Cultivated Crops	56966	39489	10592
Wetland	1867	56	29
Watershed Area	80491	103009	27373

Table C-4. Land use estimates and crop totals for Wenatchee-Entiat WRIA 45 and 46.

Site and Land Use (Area in acres)	Wenatchee River	Mission Creek	Brender Creek	Peshastin River	Entiat River
Open Water	5494	0	0	0	120
Perennial Ice/Snow	3320	0	0	17	363
Developed, Open Space	5867	122	54	1071	619
Developed, Low Intensity	13610	706	411	1951	2491
Developed, Medium Intensity	2253	72	39	522	1859
Developed, High Intensity	391	17	8	72	522
Barren Land (Rock/Sand/Clay)	31868	436	0	3281	5793
Deciduous Forest	1233	64	13	62	310
Evergreen Forest	526597	34525	2852	50942	142387
Mixed Forest	870	20	2	83	65
Shrub/Scrub	143620	9659	1045	13188	82889
Grassland/Herbaceous	94789	5921	1339	14056	25736
Pasture/Hay	3802	425	36	0	1053
Cultivated Crops	6120	30	1032	683	0
Wetland	10070	390	36	323	1227
Watershed Area	849905	52386	6866	86250	265434

Crop Totals

Reference: 2008 crop totals based on the WSDA 2008 crop geodatabase. Washington State Department of Agriculture, Olympia Washington. (WSDA, 2009).

Table C-5. Crop totals for the Lower Skagit-Samish WRIA 3.

Site and Land Use	Area (acres)	Percent of Watershed Area
Big Ditch		
Apple	7	0.09%
Barley	29	0.37%
Bean, Dry	2	0.03%
Beet, Seed	15	0.18%
Blueberry	8	0.10%
Cabbage	5	0.06%
Caneberry	19	0.23%
Cereal Grain, Unknown	103	1.29%
Clover, Hay	16	0.19%
Corn	519	6.475%
Cucumber	36	0.45%
Fallow	199	2.49%
Golf Course	6	0.07%
Grape, Wine	4	0.04%
Grass, Hay	582	7.262%
Market Crops	3	0.04%
Mint	11	0.14%
Mustard, Seed	4	0.05%
Nursery, Greenhouse	2	0.02%
Nursery, Ornamental	64	0.80%
Pasture	30	0.38%
Pea, Green	122	1.53%
Pear	1	0.01%
Potato	829	10.4%
Pumpkin	9	0.11%
Ryegrass, Seed	350	4.37%
Sod Farm	63	0.79%
Spinach, Seed	140	1.75%
Strawberry	21	0.26%
Wheat	810	10.1%
Total	4008	--
Watershed Area	8012	--
Percent Agriculture	--	50.0%

Site and Land Use	Area (acres)	Percent of Watershed Area
Indian Slough		
Barley	36	0.73%
Beet, Seed	10	0.20%
Blueberry	145	2.89%
Bulb, Daffodil	28	0.56%
Cabbage, Seed	10	0.21%
Caneberry	5	0.11%
Corn	17	0.33%
Cucumber	15	0.29%
Fallow	37	0.74%
Golf Course	73	1.45%
Grass, Hay	454	9.03%
Nursery, Ornamental	77	1.54%
Pea, Green	40	0.80%
Potato	284	5.66%
Ryegrass, Seed	5	0.11%
Sod Farm	124	2.47%
Spinach, Seed	51	1.01%
Strawberry	35	0.70%
Wheat	195	3.87%
Total	1,643	--
Watershed Area	5,025	--
Percent Agriculture	--	32.7%
Browns Slough		
Barley	21	0.61%
Beet, Seed	46	1.34%
Broccoli	32	0.93%
Cabbage, Seed	38	1.10%
Caneberry	6	0.18%
Carrot	81	2.34%
Cauliflower	37	1.08%
Corn	222	6.45%
Cucumber	348	10.11%
Fallow	22	0.63%
Grass, Hay	136	3.96%
Market Crops	2	0.05%
Nursery, Ornamental	22	0.65%
Pea, Green	283	8.21%
Potato	1271	36.90%
Ryegrass, Seed	47	1.37%
Spinach, Seed	74	2.14%
Strawberry	4	0.11%

Site and Land Use	Area (acres)	Percent of Watershed Area
Wheat	467	13.54%
Total	3160	--
Watershed Area	3446	--
Percent Agriculture	--	91.7%
Samish River		
Apple	30	0.05%
Beet, Seed	19	0.03%
Blueberry	35	0.05%
Broccoli	100	0.15%
Cabbage, Seed	13	0.02%
Caneberry	152	0.23%
Clover, Hay	90	0.14%
Corn	564	0.87%
Fallow	115	0.18%
Golf Course	178	0.27%
Grass, Hay	1101	1.69%
Green Manure	48	0.07%
Kale	1	0.00%
Market Crops	21	0.03%
Nursery, Ornamental	25	0.04%
Pasture	176	0.27%
Pea, Green	48	0.07%
Potato	764	1.17%
Pumpkin	44	0.07%
Sod Farm	70	0.11%
Spinach, Seed	58	0.09%
Strawberry	27	0.04%
Tea	7	0.01%
Wheat	334	0.51%
Total	4020	--
Watershed Area	65076	--
Percent Agriculture	--	6.2%

Table C-6. Crop totals for the Wenatchee-Entiat WRIAs 45 and 46.

Site and Land Use	Area (acres)	Percent of Watershed Area
Peshastin Creek		
Apple	33	0.04%
Cherry	10	0.01%
Fallow	14	0.02%
Pear	488	0.57%
Total	545	--
Watershed Area	86250	--
Percent Agriculture	--	0.63%
Mission Creek		
Alfalfa/Grass, Hay	12	0.02%
Cherry	7	0.01%
Christmas Tree	5	0.01%
Pear	177	0.34%
Total	202	--
Watershed Area	52386	--
Percent Agriculture	--	0.38%
Brender Creek		
Apple	112	1.63%
Cherry	59	0.87%
Fallow	23	0.33%
Golf Course	36	0.52%
Pear	525	7.64%
Total	719	--
Watershed Area	6866	--
Percent Agriculture		10.48%
Wenatchee River		
Alfalfa/Grass, Hay	19	0.002%
Apple	1018	0.120%
Apricot	1	< 0.001%
Cherry	326	0.038%
Christmas Tree	5	0.001%
Developed	284	0.033%
Fallow	166	0.020%
Golf Course	113	0.013%
Grape, Wine	10	0.001%
Grass, Hay	91	0.011%
Nectarine/Peach	10	0.001%
Nursery, Lavender	1	< 0.001%
Pear	6509	0.766%
Total	8323	--

Site and Land Use	Area (acres)	Percent of Watershed Area
Watershed Area	849905	--
Percent Agriculture	--	0.979%
Entiat River		
Alfalfa/Grass, Hay	1	< 0.001%
Apple	170	0.064%
Cherry	31	0.012%
Fallow	66	0.025%
Grass, Hay	6	0.002%
Pasture	2	0.001%
Pear	529	0.199%
Unknown	3	0.001%
Total	805	--
Watershed Area	265434	--
Percent Agriculture	--	0.303%

Table C-7. Crop totals for the Lower Yakima WRIA 37.

Site and Land Use	Area (acres)	Percent of Watershed Area
Marion Drain		
Alfalfa/Grass, Hay	4634	5.76%
Apple	7338	9.12%
Apricot	7	0.01%
Asparagus	755	0.94%
Bean, Dry	205	0.25%
Bean, Green	25	0.03%
Blueberry	13	0.02%
Cabbage	44	0.05%
Cherry	322	0.40%
Corn	9529	11.84%
Cucumber	38	0.05%
Fallow	1541	1.92%
Golf Course	89	0.11%
Grape, Concord	2756	3.42%
Grape, Wine	10	0.01%
Grass, Hay	671	0.83%
Hops	10536	13.09%
Market Crops	592	0.74%
Mint	4556	5.66%
Nectarine/Peach	404	0.50%
Nursery, Ornamental	66	0.08%

Site and Land Use	Area (acres)	Percent of Watershed Area
Oat	131	0.16%
Onion	234	0.29%
Pasture	629	0.78%
Pear	534	0.66%
Pepper	137	0.17%
Plum	54	0.07%
Potato	808	1.00%
Pumpkin	28	0.04%
Sorghum	127	0.16%
Squash	139	0.17%
Sunflower, Seed	22	0.03%
Tomato	56	0.07%
Unknown	20	0.02%
Vegetable, Unknown	32	0.04%
Watermelon	22	0.03%
Wheat	6334	7.87%
Total	53327	--
Watershed Area	80491	--
Percent Agriculture	--	66.25%
Sulphur Creek Wasteway		
Alfalfa/Grass, Hay	3612	3.51%
Apple	5233	5.08%
Apricot	16	0.02%
Asparagus	1057	1.03%
Barley	81	0.08%
Bulb, Iris	5	0.00%
Carrot, Seed	13	0.01%
Cherry	920	0.89%
Corn	4925	4.78%
CRP	1259	1.22%
Fallow	1056	1.03%
Golf Course	108	0.11%
Grape, Concord	7842	7.61%
Grape, Wine	3547	3.44%
Grass, Hay	174	0.17%
Green Manure	49	0.05%
Hay/Silage, Unknown	11	0.01%
Hops	986	0.96%
Market Crops	26	0.02%
Mint	606	0.59%
Nectarine/Peach	146	0.14%
Nursery, Orchard/Vineyard	32	0.03%

Site and Land Use	Area (acres)	Percent of Watershed Area
Nursery, Ornamental	113	0.11%
Oat	48	0.05%
Pasture	32	0.03%
Pear	203	0.20%
Plum	54	0.05%
Pumpkin	19	0.02%
Rye	64	0.06%
Sorghum	542	0.53%
Squash	157	0.15%
Triticale	166	0.16%
Unknown	110	0.11%
Watermelon	75	0.07%
Wheat	2711	2.63%
Total	34630	--
Watershed Area	103009	--
Percent Agriculture	--	33.62%
Spring Creek		
Alfalfa/Grass, Hay	108	0.40%
Apple	1058	3.87%
Asparagus	27	0.10%
Blueberry	57	0.21%
Caneberry	20	0.07%
Cherry	373	1.36%
Corn	34	0.13%
CRP	3415	12.48%
Currant	58	0.21%
Fallow	104	0.38%
Grape, Concord	1614	5.90%
Grape, Wine	1822	6.66%
Hops	818	2.99%
Nursery, Orchard/Vineyard	6	0.02%
Pasture	85	0.31%
Potato	57	0.21%
Pumpkin	68	0.25%
Research Station	471	1.72%
Sorghum	92	0.34%
Squash	91	0.33%
Triticale	40	0.15%
Wheat	3376	12.33%
Total	13796	--
Watershed Area	27373	--
Percent Agriculture	--	50.40%

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Appendix D. Quality Assurance

Data may be qualified if one or more analytical factors affect confidence in the prescribed data value. Manchester Environmental Laboratory qualifies data according to the National Functional Guidelines for Organic Data Review (EPA, 1999, 2007). Definitions of data qualifiers are presented in Table D-1.

Table D-1. Data qualification.

Qualifier	Definition
no qualifier	The analyte was detected at the reported concentration. Data is not qualified.
E	Reported result is an estimate because it exceeds the calibration range.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified," and the associated numerical value represents its approximate concentration.
NAF	Not analyzed for.
NC	Not calculated.
REJ	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
U	The analyte was not detected at or above the reported sample quantitation limit.
UJ	The analyte was not detected at or above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately measure the analyte in the sample.

MEL, 2000, 2008; EPA, 1999, 2007.

Performance measures for quality assurance and control are presented in Table D-2. Lowest concentrations of interest for surface water grab samples are below reporting limits. Detections quantified below reporting limits are qualified as estimates.

Table D-2. Performance measures for quality assurance and quality control.

Analysis Method[1]	Analysis[2]	Field/Lab Replicates, MS/MSD[3], and Lab. Control Samples	MS/MSD[3], Surrogates and Lab. Control Samples
		RPD[4]	% Recovery
GCMS	Pesticide-Cl	±40	30-130
	Pesticide-N	±40	30-130
	Pesticide-OP	±40	30-130
	Pesticide-Py	±40	30-130
GCMS-H	Herbicides	±50	40-130
LCMS	Pesticide-C	±40	50-150
EPA method 2540D	TSS	±20	80-120
EPA method 415.1	TOC	±20	80-120
EPA method 415.1	DOC	±20	80-120

[1]GCMS = Gas chromatography/mass spectroscopy, EPA method (modified) SW 846 3535M/8270M.
GCMS-H = Derivitizable acid herbicides by GCMS, EPA method (modified) SW 846 3535M/8270M.
LCMS = Liquid chromatography/mass spectroscopy, EPA method (modified) SW 846 3535M/8321AM.
TSS = Total suspended solids.
TOC = Total organic carbon.
DOC = Dissolved organic carbon.

[2]Cl=chlorinated, N=nitrogen containing, OP=organophosphorus, Py=pyrethroid, C=carbamate.

[3]MS/MSD = Matrix spike and matrix spike duplicate.

[4]RPD = Relative percent difference.

Lower Practical Quantitation Limits

Lower practical quantitation limits (LPQLs) are the limits at which laboratories may report data without classifying the concentration as an estimate below the lowest calibration standard. The LPQL is determined by averaging the lower reporting values, per analyte, for all batches over each study period. LPQL data are presented in Table D-3.

Table D-3. Mean performance Lower Practical Quantitation Limits (µg/L).

Chemical	[1]Use	Parent	[2]Analysis Method	LPQL[3]		
				2006	2007	2008
1-Naphthol	D-C	(several)	LCMS	0.065	0.051	0.053
2,3,4,5-Tetrachlorophenol	D-WP	Tetrachlorophenol	GCMS-H	0.080	0.062	0.063
2,3,4,6-Tetrachlorophenol	D-WP	Tetrachlorophenol	GCMS-H	0.080	0.062	0.063
2,4,5-T	H		GCMS-H	0.080	0.062	0.063
2,4,5-TP	H		GCMS-H	0.080	0.062	0.063
2,4,5-Trichlorophenol	F		GCMS-H	0.080	0.062	0.063
2,4,6-Trichlorophenol	F		GCMS-H	0.080	0.062	0.063
2,4-D	H		GCMS-H	0.080	0.062	0.063
2,4-DB	H		GCMS-H	0.080	0.062	0.063
2,4'-DDD	D-OC	DDT	GCMS	0.032	0.033	0.033
2,4'-DDE	D-OC	DDT	GCMS	0.032	0.033	0.033
2,4'-DDT	D-OC	DDT	GCMS	0.032	0.033	0.033
3,5-Dichlorobenzoic Acid	H		GCMS-H	0.080	0.062	0.063
3-Hydroxycarbofuran	D-C	Carbofuran	LCMS	0.063	0.040	0.050
4,4'-DDD	D-OC	DDT	GCMS	0.032	0.033	0.033
4,4'-DDE	D-OC	DDT	GCMS	0.032	0.033	0.033
4,4'-DDT	I-OC		GCMS	0.032	0.033	0.033
4-Nitrophenol	D-H	(several)	GCMS-H	0.080	0.062	0.063
Acephate	I-OP		GCMS	0.032	--	--
Acifluorfen	H		GCMS-H	0.080	0.062	0.063
Alachlor	H		GCMS	0.032	0.033	0.033
Aldicarb	I-C		LCMS	0.063	0.074	0.100
Aldicarb Sulfone	D-C	Aldicarb	LCMS	0.094	0.060	0.050
Aldicarb Sulfoxide	D-C	Aldicarb	LCMS	0.070	0.017	0.020
Aldrin	I-OC		GCMS	0.032	0.033	0.033
Alpha-BHC	I-OC		GCMS	0.032	0.033	0.033
Atrazine	H		GCMS	0.032	0.033	0.033
Azinphos Ethyl	I-OP		GCMS	0.032	0.033	0.033
Azinphos Methyl	I-OP		GCMS	0.032	0.033	0.033
Benefin	H		GCMS	0.032	0.033	0.033
Bensulide	H		GCMS	0.032	0.033	0.033
Bentazon	H		GCMS-H	0.080	0.062	0.063
Benthiocarb	H-C		GCMS	--	0.099	0.100
Beta-BHC	I-OC		GCMS	0.032	0.033	0.033
Bromacil	H		GCMS	0.032	0.034	0.033
Bromoxynil	H		GCMS-H	0.080	0.062	0.063
Butylate	H		GCMS	0.032	0.033	0.033
Captan	F		GCMS	0.032	0.033	0.033

Chemical	[1]Use	Parent	[2]Analysis Method	LPQL[3]		
				2006	2007	2008
Carbaryl	I-C		LCMS	0.054	0.017	0.020
Carbofuran	I-C		LCMS	0.063	0.017	0.020
Carboxin	F		GCMS	0.032	0.033	0.034
Chlorothalonil	F		GCMS	0.032	0.033	0.033
Chlorpropham	H		GCMS	0.032	0.033	0.033
Chlorpyrifos	I-OP		GCMS	0.032	0.033	0.033
Cis-Chlordane	I-OC		GCMS	0.032	0.033	0.033
Cis-Nonachlor	I-OC		GCMS	0.032	0.033	0.033
Cis-Permethrin	I-Py		GCMS	--	0.050	0.050
Clopyralid	H		GCMS-H	--	0.062	0.063
Coumaphos	I-OP		GCMS	0.032	0.033	0.033
Cyanazine	H		GCMS	0.032	0.033	0.033
Cycloate	H		GCMS	0.032	0.033	0.033
DCPA	H		GCMS-H	0.080	0.062	0.063
DDVP	I-OP		GCMS	--	0.059	0.050
Delta-BHC	I-OC		GCMS	0.032	0.033	0.033
Deltamethrin	I-Py		GCMS	--	0.099	0.100
Diallate	H		GCMS	0.032	0.033	0.033
Diazinon	I-OP		GCMS	0.032	0.033	0.033
Dicamba I	H		GCMS-H	0.080	0.062	0.063
Dichlobenil	H		GCMS	0.032	0.033	0.033
Dichlorprop	H		GCMS-H	0.080	0.062	0.063
Diclofop-Methyl	H		GCMS-H	0.080	0.062	0.063
Dieldrin	I-OC		GCMS	0.080	0.050	0.050
Dimethoate	I-OP		GCMS	0.032	0.033	0.033
Dinoseb	H		GCMS-H	0.080	0.062	0.063
Dioxocarb	I-C		LCMS	--	0.050	--
Diphenamid	H		GCMS	0.032	0.033	0.033
Disulfoton	I-OP		GCMS	0.032	0.033	0.052
Disulfoton sulfone	I-OP		GCMS	--	0.099	0.100
Diuron	H		GCMS	0.032	0.060	0.050
Diuron	H		LCMS	0.055	--	--
Endosulfan I	I-OC		GCMS	0.080	0.050	0.050
Endosulfan II	I-OC		GCMS	0.080	0.050	0.050
Endosulfan Sulfate	D-OC	Endosulfan	GCMS	0.032	0.033	0.033
Endrin	I-OC		GCMS	0.080	0.050	0.050
Endrin Aldehyde	D-OC	Endrin	GCMS	0.080	0.050	0.050
Endrin Ketone	D-OC	Endrin	GCMS	0.032	0.033	0.033
EPN	I-OP		GCMS	0.032	0.033	0.033
Eptam	H		GCMS	0.032	0.033	0.033
Ethalfluralin	H		GCMS	0.032	0.033	0.033
Ethion	I-OP		GCMS	0.032	0.033	0.033
Ethoprop	I-OP		GCMS	0.032	0.033	0.033
Fenamiphos	I-OP		GCMS	0.032	0.033	0.033
Fenarimol	F		GCMS	0.032	0.033	0.033
Fensulfothion	I-OP		GCMS	--	--	0.033
Fenthion	I-OP		GCMS	--	--	0.048

Chemical	[1]Use	Parent	[2]Analysis Method	LPQL[3]		
				2006	2007	2008
Fenvalerate (2 isomers)	I-Py		GCMS	0.032	0.033	0.033
Fluridone	H		GCMS	0.065	0.099	0.100
Fonofos	I-OP		GCMS	0.032	0.033	0.033
Heptachlor	I-OC		GCMS	0.032	0.033	0.033
Heptachlor Epoxide	D-OC	Heptachlor	GCMS	0.032	0.033	0.033
Hexachlorobenzene	F		GCMS	0.032	0.033	0.034
Hexazinone	H		GCMS	0.080	0.050	0.050
Imidacloprid	I-N		LCMS	--	--	0.020
Imidan	I-OP		GCMS	--	0.033	0.033
Ioxynil	H		GCMS-H	0.080	0.062	0.063
Kelthane	I-OC		GCMS	0.321	0.295	0.314
Lindane	I-OC		GCMS	0.032	0.033	0.033
Linuron	H		GCMS	0.064	0.059	0.050
Malathion	I-OP		GCMS	0.032	0.033	0.033
MCPA	H		GCMS-H	0.080	0.062	0.063
MCPP	H		GCMS-H	0.080	0.062	0.063
Metalaxyl	F		GCMS	0.032	0.033	0.033
Methamidophos	I-OP		GCMS	0.032	--	--
Methidathion	I-OP		GCMS	0.321	0.295	0.293
Methiocarb	I-C		LCMS	0.100	0.017	0.020
Methomyl	I-C		LCMS	0.055	0.037	0.050
Methomyl oxime	D-C	Thiodicarb	LCMS	0.067	0.017	0.020
Methoxychlor	I-OC		GCMS	0.032	0.033	0.033
Methyl Chlorpyrifos	I-OP		GCMS	0.032	0.033	0.033
Methyl Paraoxon	D-OP	Methyl parathion	GCMS	--	0.099	0.100
Methyl Parathion	I-OP		GCMS	0.032	0.033	0.033
Metolachlor	H		GCMS	0.032	0.033	0.033
Metribuzin	H		GCMS	0.032	0.033	0.033
Mevinphos	I-OP		GCMS	--	0.050	0.050
MGK264	Sy-I		GCMS	0.032	0.033	0.033
Mirex	I-OC		GCMS	0.032	0.033	0.033
Monocrotophos	I-OP		GCMS	--	0.050	0.050
Naled	I-OP		GCMS	0.032	0.042	0.059
Napropamide	H		GCMS	0.080	0.050	0.050
Norflurazon	H		GCMS	0.032	0.033	0.033
Oryzalin	H		GCMS	--	0.099	0.100
Oxamyl	I-C		LCMS	0.072	0.042	0.050
Oxamyl oxime	D-C	Oxamyl	LCMS	0.091	0.017	0.020
Oxychlordane	D-OC	Chlordane	GCMS	0.032	0.033	0.033
Oxyfluorfen	H		GCMS	0.032	0.033	0.033
Parathion	I-OP		GCMS	0.032	0.033	0.033
Pebulate	H		GCMS	0.032	0.033	0.033
Pendimethalin	H		GCMS	0.032	0.033	0.033
Pentachlorophenol	WP		GCMS-H	0.080	0.062	0.063
Phenothrin	I-Py		GCMS	0.032	0.033	0.033
Phorate	I-OP		GCMS	0.321	0.296	0.299
Phosmet	I-OP		GCMS	0.032	--	--

Chemical	[1]Use	Parent	[2]Analysis Method	LPQL[3]		
				2006	2007	2008
Picloram	H		GCMS-H	0.080	0.062	0.063
Promecarb	I-C		LCMS	0.100	0.031	0.020
Prometon	H		GCMS	0.032	0.033	0.033
Prometryn	H		GCMS	0.032	0.033	0.033
Pronamide	H		GCMS	0.032	0.033	0.033
Propachlor	H		GCMS	0.032	0.033	0.033
Propargite	I-SE		GCMS	0.032	0.033	0.033
Propazine	H		GCMS	0.032	0.033	0.033
Propoxur	I-C		LCMS	0.054	0.040	0.050
Resmethrin	I-Py		GCMS	0.065	0.050	0.050
Simazine	H		GCMS	0.032	0.033	0.033
Simetryn	H		GCMS	--	0.099	0.100
Sulfotepp	I-OP		GCMS	0.032	0.033	0.033
Sulprofos	I-OP		GCMS	--	--	0.033
Tebuthiuron	H		GCMS	0.041	0.033	0.033
Terbacil	H		GCMS	0.032	0.033	0.033
Tetrachlorvinphos	I-OP		GCMS	--	0.050	0.050
Thiodicarb	I-C		LCMS	--	--	0.020
Tokuthion	I-OP		GCMS	--	0.050	0.050
Tralomethrin	I-Py		GCMS	--	0.099	0.100
Trans-Chlordane	I-OP		GCMS	0.032	0.033	0.033
Trans-Nonachlor	I-OC		GCMS	0.032	0.033	0.033
Triadimefon	F		GCMS	0.032	0.033	0.033
Triallate	H		GCMS	0.032	0.033	0.033
Trichloronat	I-OP		GCMS	--	0.050	0.050
Triclopyr	H		GCMS-H	0.080	0.062	0.063
Trifluralin	H		GCMS	0.032	0.033	0.033

[1] C = Carbamate, D = Degradate, F=Fungicide, I = Insecticide, H = Herbicide, OC = Organochlorine, OP = Organophosphorus, Py = Pyrethroid, SE = Sulfite Ester, Sy = Synergist, WP = Wood Preservative.

[2] GCMS = Gas chromatography/mass spectroscopy, EPA method (modified) SW 846 3535M/8270M.
GCMS-H = Derivitizable acid herbicides by GCMS, EPA method (modified) SW 846 3535M/8270M.
LCMS = Liquid chromatography/mass spectroscopy, EPA method (modified) SW 846 3535M/8321AM.

[3] Blank cells indicate no analysis for the compound in that year.

Quality Assurance Samples

Quality assurance (QA) samples were collected each year to assure consistency and accuracy of sample analysis.

For this project, QA samples included field replicates, field blanks, and matrix spike and matrix spike duplicates (MS/MSD). QA samples for the laboratory included split sample duplicates, laboratory control samples, surrogate spikes, and method blanks.

Field QA samples as a percentage of standard samples increased yearly from 2006 to 2008. Each year, more than 10% of field samples had an associated QA sample (Table D-4).

The total count of field QA samples is in Table D-4. The total count of laboratory QA samples is in Table D-5.

Table D-4. Total field QA samples per analysis type, 2006-2008.

QA Type	Field Replicates				Field Blanks				MS/MSD[2]			Field QA% of samples
Analysis[1]	GCMS	GCMS-H	LCMS	TSS	GCMS	GCMS-H	LCMS	TSS	GCMS	GCMS-H	LCMS	
2006	10	10	10	11	7	6	6	2	16	15	15	10%
2007	28	26	24	25	12	12	11	13	25	23	24	11%
2008	33	30	32	32	17	17	16	16	17	16	16	15%
Total	71	66	66	68	36	35	33	31	58	54	55	12%

[1] GCMS = Gas chromatography/mass spectroscopy, EPA method (modified) SW 846 3535M/8270M.
GCMS-H = Derivitizable acid herbicides by GCMS, EPA method (modified) SW 846 3535M/8270M.
LCMS = Liquid chromatography/mass spectroscopy, EPA method (modified) SW 846 3535M/8321AM.
TSS = Total suspended solids, EPA method 2540D.
[2]MS/MSD = Matrix spike and matrix spike duplicates.

Table D-5. Total laboratory QA samples per analysis type, 2006-2008.

QA Type	LDP[2]	Lab Blanks				Surrogates			Laboratory Control Samples			
Analysis[1]	TSS	GCMS	GCMS-H	LCMS	TSS	GCMS	GCMS-H	LCMS	GCMS	GCMS-H	LCMS	TSS
2006	41	72	61	28	52	397	374	341	37	32	32	53
2007	76	92	71	74	89	679	659	663	46	67	43	89
2008	76	35	31	28	66	557	529	526	59	47	44	66
Total	193	199	163	130	207	1633	1562	1530	142	146	119	208

[1] GCMS = Gas chromatography/mass spectroscopy, EPA method (modified) SW 846 3535M/8270M.
GCMS-H = Derivitizable acid herbicides by GCMS, EPA method (modified) SW 846 3535M/8270M.
LCMS = Liquid chromatography/mass spectroscopy, EPA method (modified) SW 846 3535M/8321AM.
TSS = Total suspended solids, EPA method 2540D.
[2] LDP = Laboratory duplicates.

Results for each QA sample method are outlined in the sections below.

Field Replicates

Results for pesticide field replicates are presented in Tables D-6 and D-7. Table D-6 presents the data value, data qualification (if assigned), and relative percent difference (RPD) between the results for compounds which were consistently identified in both the grab sample and replicate.

Consistent identification refers to compounds which were identified in both the original sample and field replicate. Inconsistently identified replicate pairs are those in which the compound was identified in one sample, but not the other. Inconsistently identified grab sample replicates are presented in Table D-7.

Field replicates were used with 3.8%, 5.2%, and 7.8% of all field samples in 2006, 2007, and 2008, respectively. 3.0% of the analysis pairs had a detection in at least one replicate.

Including tentative (NJ) detections, 56 chemicals were detected in 303 replicate pairs. Of these, 75% were consistently identified in both samples. 95% of consistent pairs were within the 40% RPD criterion.

The rate of consistent to inconsistent replicate sets is similar to results from this program's 2003-2005 surveys (71%; Burke et al., 2006) and the USGS-NAWQA replicate analysis (1992-1997 samples) when the average pesticide concentration was less than 0.1 µg/L (approximately 20%; Martin, 2002). In both the USGS and our studies, the associated error of inconsistent replicate sets precludes use in variability analysis.

The average RPD of consistent field replicate pairs was very low, 11% (Table D-6). Similarly, the median pooled relative standard deviation (RSD) of all replicates was 8%. This variation is lower than our 2003-2005 results (14%; Burke et al., 2006) and the NAWQA median pooled RSD of 15% at concentrations <0.01 µg/L and 12% at concentrations near 0.1 µg/L (Martin, 2002).

Among consistent replicates, nine chemicals had a maximum RPD over 40% (Table D-5):

- 2,4-D
- 4-Nitrophenol
- DCPA
- Dichlobenil
- Diuron
- Methomyl
- Oxamyl
- Simazine
- Triclopyr

RPD for these pairs ranged from 0% to 100%. RPDs for other analyte pairs ranged from 0% to 37%. The failure of these samples to fall within the acceptable range is most likely due to the high amount of variability in detections near the minimum reporting limit (Martin, 2002, Mathieu, 2006).

Table D-6. Detected pairs within field replicate results, 2006-2008 (µg/L).

Chemical	Sample		Replicate		RPD
1-Naphthol	0.064		0.069	J	8
	0.140	J	0.120		15
	Mean=				11
2,4-D	0.130		0.098		28
	0.130		0.150		14
	0.082		0.072		13
	0.084		0.075		11
	0.190		0.170		11
	0.075		0.068		10
	0.520		0.570		9
	0.110		0.120		9
	0.190		0.180		5
	0.073		0.076		4
	0.068		0.068		0
	0.240		0.240		0
	0.040	J	0.046	J	14
	0.022	J	0.022	J	0
	0.023	J	0.025	NJ	8
	0.084	NJ	0.130		**43**
	0.034	NJ	0.023	J	39
	0.015	NJ	0.017	NJ	13
	0.028	NJ	0.025	NJ	11
	0.050	NJ	0.049	NJ	2
	0.160	NJ	0.160	NJ	0
	0.023	NJ	0.023	NJ	0
	0.110	NJ	0.110	NJ	0
	Mean=				11
3-Hydroxycarbofuran	0.047	J	0.038	J	21
4,4'-DDD	0.005	J	0.005	J	11
	0.015	J	0.016	J	6
	0.019	J	0.019	J	0
	Mean=				6
4,4'-DDE	0.032	J	0.034		6
	0.010	J	0.014	J	34
	0.012	J	0.016	J	29
	0.017	J	0.019	J	11
	Mean=				20
4,4'-DDT	0.010	J	0.009	J	6
	0.023	J	0.024	J	4
	0.025	J	0.025	J	0
	0.022	J	0.022	J	0
	Mean=				3
4-Nitrophenol	0.091	NJ	0.092		1
	0.110	NJ	0.081	J	30
	0.032	NJ	0.061	NJ	**62**
	Mean=				31
Aldicarb Sulfone	0.026	J	0.030	J	14
Carbofuran	0.023		0.022		4
Chlorpropham	2.300		2.200		4
Chlorpyrifos	0.074		0.075		1
	0.005	J	0.006	J	14
	0.023	J	0.025	J	8

Chemical	Sample		Replicate		RPD
Atrazine	0.034		0.034		0
	0.010	J	0.012	J	22
	0.008	J	0.008	J	9
	0.014	J	0.013	J	7
	0.009	J	0.009	J	4
	0.008	J	0.008	J	4
	0.021	J	0.021	J	0
	0.009	J	0.009	J	0
	0.020	J	0.020	J	0
	0.012	J	0.012	J	0
	0.013	NJ	0.014	J	7
	0.019	NJ	0.018	J	5
	0.019	NJ	0.020	J	5
	0.007	NJ	0.007	NJ	0
	Mean=				5
Azinphos Methyl	0.530	J	0.520	J	2
Bentazon	0.140		0.130		7
	0.072		0.070		3
	0.120		0.120		0
	0.120		0.120		0
	0.140		0.140		0
	0.110		0.110	NJ	0
	0.056	J	0.064		13
	0.036	J	0.029	J	22
	0.030	J	0.026	J	14
	0.066	J	0.075	J	13
	0.048	J	0.044	J	9
	0.041	NJ	0.044	J	7
	0.047	NJ	0.050	J	6
	0.029	NJ	0.030	J	3
	0.110	NJ	0.100	NJ	10
	0.091	NJ	0.086	NJ	6
	Mean=				7
Bromacil	0.088		0.075		16
	0.046		0.053		14
	0.063		0.067		6
	0.072	J	0.062	J	15
	0.027	J	0.029	J	7
	0.019	J	0.019	NJ	0
	0.038	NJ	0.038		0
	Mean=				8
Bromoxynil	0.019	NJ	0.016	NJ	17
	0.056	NJ	0.063	NJ	12
	Mean=				14
Carbaryl	0.026	J	0.022	J	17
	0.188	J	0.208	J	10
	Mean=				13
Disulfoton sulfone	0.023	J	0.021	J	9
	0.056	NJ	0.049	NJ	13
	Mean=				11
Diuron	0.079		0.063		23
	1.400		1.400		0

Chemical	Sample		Replicate		RPD
	0.006	J	0.006	J	5
	0.029	J	0.030	J	3
	0.027	J	0.027	J	0
	0.020	J	0.020	NJ	0
	0.005	NJ	0.005	J	0
	0.025	NJ	0.025	NJ	0
	Mean=				4
Clopyralid	0.046	NJ	0.040	J	14
DCPA	0.110		0.120		9
	0.075		0.072		4
	0.047	J	0.072		**42**
	0.020	J	0.027	J	30
	0.074	NJ	0.074		0
	Mean=				17
Diazinon	0.011	J	0.012	J	9
Dicamba I	0.003	J	0.004	J	26
	0.017	J	0.020	J	16
	0.029	J	0.026	J	11
	0.035	J	0.039	J	11
	0.049	J	0.046	J	6
	0.019	J	0.020	J	5
	0.031	J	0.030	J	3
	0.031	J	0.032	J	3
	0.033	J	0.034	J	3
	0.033	NJ	0.032	NJ	3
	0.029	NJ	0.029	NJ	0
	Mean=				8
Dichlobenil	0.044		0.038		15
	0.011	J	0.008	J	30
	0.024	J	0.026	J	8
	0.019	J	0.018	J	5
	0.022	J	0.021	J	5
	0.019	NJ	0.022	J	15
	0.019	NJ	0.039	NJ	**69**
	0.019	NJ	0.022	NJ	15
	0.037	NJ	0.035	NJ	6
	0.037	NJ	0.036	NJ	3
	0.013	NJ	0.013	NJ	0
	Mean=				15
Diphenamid	0.006	J	0.008	J	36
	0.018	J	0.015	J	18
	0.022	J	0.023	J	4
	0.018	J	0.018	J	0
	Mean=				15
Metolachlor	0.460		0.410		11
	0.045		0.045		0
	0.020	J	0.021	J	5
	0.110	J	0.110	J	0
	Mean=				4
Metribuzin	0.025	NJ	0.025	NJ	0
Norflurazon	0.019	J	0.017	J	11
	0.041	J	0.042	J	2
	0.018	J	0.022	NJ	20
	0.028	NJ	0.030	NJ	7

Chemical	Sample		Replicate		RPD
	0.019	J	0.011	J	**53**
	0.023	J	0.015	J	**42**
	0.030	J	0.033	J	10
	0.078	NJ	0.230	NJ	**99**
	0.033	NJ	0.025	NJ	28
	0.041	NJ	0.037	NJ	10
	0.130	NJ	0.120	NJ	8
	0.093	NJ	0.087	NJ	7
	0.063	NJ	0.063	NJ	0
	Mean=				25
Endosulfan I	0.100		0.092		8
Endosulfan II	0.067		0.074		10
Endosulfan Sulfate	0.072		0.074		3
	0.037		0.035	NJ	6
	0.029	J	0.025	NJ	15
	0.029	NJ	0.030	NJ	3
	Mean=				7
Eptam	0.130		0.120		8
	0.160		0.150		6
	0.610		0.620		2
	0.130		0.130		0
	0.170		0.150	J	13
	0.024	J	0.023	J	4
	Mean=				5
Ethoprop	0.140		0.130		7
Imidacloprid	0.015	J	0.015	J	0
Malathion	0.082		0.081		1
	0.020	J	0.020	J	0
	Mean=				1
MCPA	0.071		0.077		8
	0.170		0.170		0
	0.026	J	0.029	J	11
	0.015	NJ	0.013	NJ	14
	Mean=				8
MCPP	0.046	J	0.045	J	2
	0.026	NJ	0.032	J	21
	0.028	NJ	0.021	NJ	29
	0.065	NJ	0.076	NJ	16
	0.006	NJ	0.006	NJ	9
	Mean=				15
Metalaxyl	0.035		0.042		18
	0.230		0.220		4
	Mean=				11
Methomyl	0.032	NJ	0.017	NJ	**61**
Simazine	0.180		0.190		5
	0.010	J	0.011	J	12
	0.048	NJ	0.031	NJ	**43**
	0.027	NJ	0.027	NJ	0
	Mean=				15
Tebuthiuron	0.110		0.120		9
	0.130		0.140		7
	0.094		0.094		0
	0.180	J	0.150	J	18
	0.055	J	0.066	J	18

Chemical	Sample		Replicate		RPD
	0.053	NJ	0.050	NJ	6
	0.034	NJ	0.033	NJ	3
	Mean=				8
Oxamyl	0.210	J	0.120	J	**55**
Pendimethalin	0.035		0.034		3
	0.050		0.049		2
	0.021	J	0.022	J	5
	Mean=				3
Pentachlorophenol	0.024	J	0.021	J	13
	0.019	J	0.018	J	5
	0.029	NJ	0.020	NJ	37
	0.011	NJ	0.014	NJ	24
	0.014	NJ	0.013	NJ	7
	0.014	NJ	0.015	NJ	7
	Mean=				16
Picloram	0.340		0.360		6
	0.140	NJ	0.110	NJ	24
	0.049	NJ	0.060	NJ	20
	0.026	NJ	0.027	NJ	4
	0.077	NJ	0.075	NJ	3
	Mean=				11
Prometon	0.034		0.031	NJ	9
	0.024	NJ	0.030	J	22
	0.014	NJ	0.012	NJ	15
	Mean=				16

Chemical	Sample		Replicate		RPD
	0.028	J	0.029	J	4
	Mean=				9
Terbacil	0.110		0.084		27
	0.034		0.038		11
	0.160		0.170		6
	0.040		0.042		5
	0.310		0.300		3
	0.180		0.180		0
	0.120		0.120		0
	0.034		0.029	J	16
	0.025	J	0.024	NJ	4
	Mean=				8
Triclopyr	0.120		0.110		9
	0.096		0.100		4
	0.043	J	0.047	J	9
	0.084	NJ	0.028	J	**100**
	0.015	NJ	0.014	NJ	7
	0.009	NJ	0.009	NJ	7
	0.023	NJ	0.022	NJ	4
	Mean=				20
Trifluralin	0.021	J	0.022	J	5
	0.004	J	0.004	J	2
	0.025	J	0.025	J	0
	0.003	NJ	0.003	NJ	3
	Mean=				3

Inconsistent replicate detections are an indicator of sampling uncertainty. Table D-7 compares inconsistent replicate detections to the Lower Practical Quantitation Limit (LPQL) for non-detections in the paired replicate. Most inconsistent detections were found at concentrations near or below the LPQL.

Table D-7. Inconsistent field replicate detections compared to the LPQL[1], 2006-2008 (µg/L).

Chemical	Sample		Replicate	
1-Naphthol	0.110		<0.050	U
	0.073		<0.050	U
	0.011	J	<0.050	U
	0.069	J	<0.050	U
	0.064	J	<0.050	UJ
	0.048	J	<0.050	UJ
	<0.050	U	0.035	J
	<0.050	UJ	0.057	J
2,4-D	0.260		<0.061	U
	0.023	NJ	<0.060	U
	<0.065	U	0.061	NJ
3-Hydroxycarbofuran	<0.050	UJ	0.050	
4,4'-DDE	<0.032	U	0.004	NJ
4-Nitrophenol	0.077		<0.063	U
	0.110	NJ	<0.062	U
	0.037	NJ	<0.078	UJ
Aldicarb Sulfoxide	0.045		<0.020	UJ
	0.033	J	<0.020	U
Atrazine	0.006	NJ	<0.032	U
	<0.033	U	0.020	J
Bentazon	0.026	J	<0.063	U
	0.047	NJ	<0.064	U
	<0.063	U	0.034	NJ
Bromacil	0.027	J	<0.033	U
	0.029	J	<0.033	U
	<0.033	U	0.024	J
	<0.033	U	0.030	J
Carbaryl	0.014	J	<0.020	UJ
Chlorothalonil	<0.032	U	0.019	J
Chlorpyrifos	0.021	NJ	<0.032	U
Cycloate	0.029	NJ	<0.031	U
DCPA	<0.064	U	0.022	J
	<0.063	U	0.050	J
	<0.078	U	0.009	NJ
Diazinon	<0.032	U	0.038	NJ
Dichlobenil	0.005	NJ	<0.033	U
	<0.033	U	0.011	NJ
Eptam	0.015	J	<0.032	U
	0.030	NJ	<0.035	U

Chemical	Sample		Replicate	
Hexazinone	0.051		<0.053	U
	<0.050	U	0.070	J
Imidacloprid	0.010	J	<0.020	U
	<0.020	U	0.028	
MCPA	0.026	J	<0.063	U
	0.025	NJ	<0.061	U
	<0.061	U	0.015	NJ
Metalaxyl	<0.034	U	0.030	NJ
Methiocarb	0.016	J	<0.020	U
	0.017	J	<0.020	U
	<0.020	UJ	0.017	J
Methomyl	0.180	NJ	<0.050	U
	<0.050	U	0.015	J
	<0.050	UJ	0.120	
	<0.050	UJ	0.018	J
Metolachlor	0.012	NJ	<0.033	U
Metribuzin	<0.031	U	0.140	J
Norflurazon	<0.032	U	0.027	J
Oxamyl	<0.050	UJ	0.010	J
Oxamyl oxime	<0.020	U	0.018	J
Pendimethalin	0.023	NJ	<0.032	U
Pentachlorophenol	0.003	NJ	<0.079	U
	0.003	NJ	<0.078	U
	0.029	NJ	<0.062	U
	<0.079	U	0.000	NJ
Promecarb	0.015	J	<0.020	U
Prometon	0.010	J	<0.032	U
	0.020	J	<0.034	U
	<0.033	U	0.017	NJ
	<0.031	U	0.016	NJ
Simazine	0.007	J	<0.031	U
	0.019	J	<0.033	U
	<0.033	U	0.021	NJ
Tebuthiuron	<0.032	UJ	0.036	J
Terbacil	<0.032	U	0.015	NJ
Trifluralin	0.014	J	<0.033	U
	<0.033	U	0.021	NJ

[1] Non-detections are listed as less than the Lower Practical Quantitation Limit (<LPQL).

Laboratory Duplicates

Manchester Environmental Laboratory used laboratory split sample duplicates to ensure consistency of TSS analyses. Boxplots of relative percent difference (RPD) for TSS lab duplicates are presented in Figure D-1.

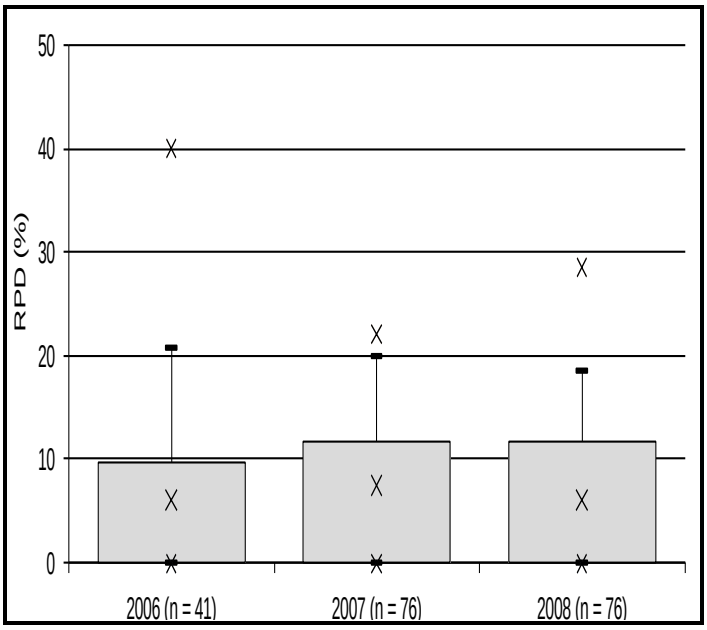

Figure D-1. TSS laboratory duplicate relative percent difference (%).

Boxes show 25th and 75th percentiles, whiskers show 5th and 95th percentiles, and 'X' indicates the minimum, median, and maximum values.

From 2006-2008, 95% of all TSS lab duplicate RPDs were less than or equal to the 20% RPD criteria. Some outlier pairs exceeded 20%, but did not represent overall recovery.

Field Blanks

Field blank detections indicate the potential for sample contamination in the field and laboratory and the potential for false detections due to analytical error.

Field blank detections for 2006-2008 are listed in Table D-8.

No field blank contamination was detected in 2006.

In 2007, dichlobenil was found in one field blank at a concentration higher than the sample and above the LPQL. Thus dichlobenil was qualified as tentatively undetected (UJ) in the associated sample. One 2007 TSS field blank was contaminated, but the associated sample concentration was greater than 5 times the blank concentration. Thus, the TSS detection was unqualified, but the detected concentration was qualified as approximate (Table D-8).

In 2008, promecarb contamination was found in 3 field blanks above the LPQL, and 1-naphthol was found in 2 field blanks below the LPQL. Neither promecarb nor 1-naphthol was found in the associated samples. Thus, no sample detections were qualified.

Table D-8. Grab sample field blank detections, 2006-2008 (µg/L).

Analysis[1]	Chemical	Field_Date	Site	Sample		Blank	
GCMS	Dichlobenil	3/20/2007	TC-3	0.034	UJ[2]	0.046	
TSS	Total Suspended Solids (mg/L)	6/5/2007	SP-2	37.5	J[2]	3.0	
LCMS	Promecarb	7/1/2008	SP-3	0.020	U	0.029	
	Promecarb	7/9/2008	SU-1	0.020	U	0.072	
	Promecarb	7/16/2008	EN-1	0.020	U	0.063	
	1-Naphthol	8/4/2008	BS-1	0.050	UJ	0.037	J
	1-Naphthol	9/8/2008	PE-1	0.050	UJ	0.037	J

[1] GCMS = Gas chromatography/mass spectroscopy, EPA method (modified) SW 846 3535M/8270M.
LCMS = Liquid chromatography/mass spectroscopy, EPA method (modified) SW 846 3535M/8321AM.
TSS = Total suspended solids, EPA method 2540D.

[2] The analyte was detected in the sample at the listed concentration. Sample qualifiers are due to field blank contamination.

Laboratory Blanks

Manchester Environmental Laboratory (MEL) uses laboratory blanks to assess the precision of equipment and the potential for internal laboratory contamination. If lab blank detections occur, the sample LPQL may be increased, and detections may be qualified as estimates.

Laboratory blank detections for all years are presented in Table D-9.

All but one lab blank detection were carbamate compounds analyzed by LCMS (Table D-9). Problems with LCMS lab blanks were due to an unidentified low-level interference in the LCMS equipment that resembled the compounds in question (D. Huntamer, 2009, personal communication).

For all lab blank detections, any analytes found in associated samples below 5 times the lab blank detection were reported at the level detected, but qualified as not detected at an estimated detection limit (UJ).

No associated sample detections were found at concentrations more than 5 times any lab blank detection.

Table D-9. Laboratory blank detections, 2006-2008 (µg/L).

Analysis[1]	Chemical	Analysis Date	Value		Analysis[1]	Chemical	Analysis Date	Value	
GCMS	Fenarimol	10/6/2006	0.017	J	LCMS	1-Naphthol	7/24/2008	0.038	J
LCMS	1-Naphthol	6/12/2007	0.014	J			8/27/2008	0.031	J
		5/6/2008	0.046	J		3-Hydroxycarbofuran	7/22/2008	0.014	J
		6/2/2008	0.023	J			8/28/2008	0.023	J
		6/5/2008	0.026			Aldicarb	7/11/2006	0.110	J
		7/22/2008	0.024				4/4/2007	0.038	J
LCMS	Aldicarb Sulfone	7/31/2006	0.120	J	LCMS	Aldicarb Sulfone	8/23/2007	0.092	J
		8/28/2006	0.110	J				0.100	J
		4/4/2007	0.087	J			8/29/2007	0.046	J
			0.060	J				0.073	J
		4/10/2007	0.041	J			9/4/2007	0.060	J
		4/11/2007	0.027	J				0.049	J
		4/18/2007	0.031	J			9/11/2007	0.068	J
		5/8/2007	0.053	J				0.066	J
		5/9/2007	0.013	J			9/12/2007	0.085	J
		5/17/2007	0.064	J				0.100	J
			0.064	J			9/25/2007	0.028	J
			0.056	J				0.026	J
			0.056	J			4/10/2008	0.019	J
			0.058	J			4/24/2008	0.110	J

Analysis[1]	Chemical	Analysis Date	Value	
			0.058	J
		6/19/2007	0.038	J
			0.038	J
		6/26/2007	0.017	J
		7/2/2007	0.042	J
			0.066	J
		7/4/2007	0.014	J
			0.015	J
		7/28/2007	0.050	J
			0.061	J
		8/1/2007	0.052	J
		8/2/2007	0.057	J
			0.039	J
			0.032	J
		8/8/2007	0.064	J
			0.077	J
		8/14/2007	0.023	J
			0.048	J
		8/15/2007	0.045	J
			0.067	J
		8/21/2007	0.052	J
			0.047	J

Analysis[1]	Chemical	Analysis Date	Value	
		4/29/2008	0.013	J
		5/6/2008	0.053	J
		5/12/2008	0.070	
		5/15/2008	0.018	J
		5/21/2008	0.039	J
		6/16/2008	0.031	J
		6/23/2008	0.044	J
	Imidacloprid	6/2/2008	0.006	J
	Methomyl	4/14/2008	0.013	J
	Oxamyl	7/28/2007	0.041	J
			0.012	J
		8/23/2007	0.078	J
			0.110	J
		9/25/2007	0.013	J
	Oxamyl oxime	9/11/2007	0.018	J
	Promecarb	3/22/2007	0.032	
		3/23/2007	0.026	J
		3/30/2007	0.098	J
			0.110	J
		4/6/2007	0.100	
		4/18/2007	0.046	J
		4/19/2007	0.110	J

[1] GCMS = Gas chromatography/mass spectroscopy, EPA method (modified) SW 846 3535M/8270M.
LCMS = Liquid chromatography/mass spectroscopy, EPA method (modified) SW 846 3535M/8321AM.

Surrogates

Surrogates are compounds that are spiked into field samples at the laboratory. They are used to evaluate accuracy of recovery for a group of compounds. For instance, triphenyl phosphate is a surrogate for organophosphorus insecticides (Table D-10).

High pesticide surrogate recovery requires related detections to be qualified as estimates. Low pesticide surrogate recovery requires all related data to be qualified as estimates.

Grab sample surrogate recoveries are presented in Figure D-2.

The majority of surrogate recoveries fell within the control limits established by MEL for all compounds except dioxocarb (Figure D-2). Dioxocarb was used as a surrogate for carbamate pesticides in early 2006. For this period, all carbamate analyses were qualified as estimates. carbaryl C13 then replaced dioxocarb as the carbamate surrogate.

Outlier recoveries were outside of control limits for all surrogates. However, outliers represented a small part of overall surrogate recovery and did not qualify the majority of data.

Table D-10. Pesticide surrogates.

Surrogate Compound	Surrogate for...
Dioxocarb (early 2006 only)	Carbamate pesticides
C-13 Carbaryl (after early 2006)	Carbamate pesticides
2,4,6-Tribromophenol	Acid-derivitizable herbicides
2,4-Dichlorophenylacetic acid	Acid-derivitizable herbicides
4,4'-DDE-d8	Chlorinated pesticides
Decachlorobiphenyl	Chlorinated pesticides
gamma-BHC-d6	Chlorinated pesticides
1,3 Dimethyl-2-nitrobenzene	Nitrogen pesticides
Triphenyl phosphate	Organophosphorus pesticides

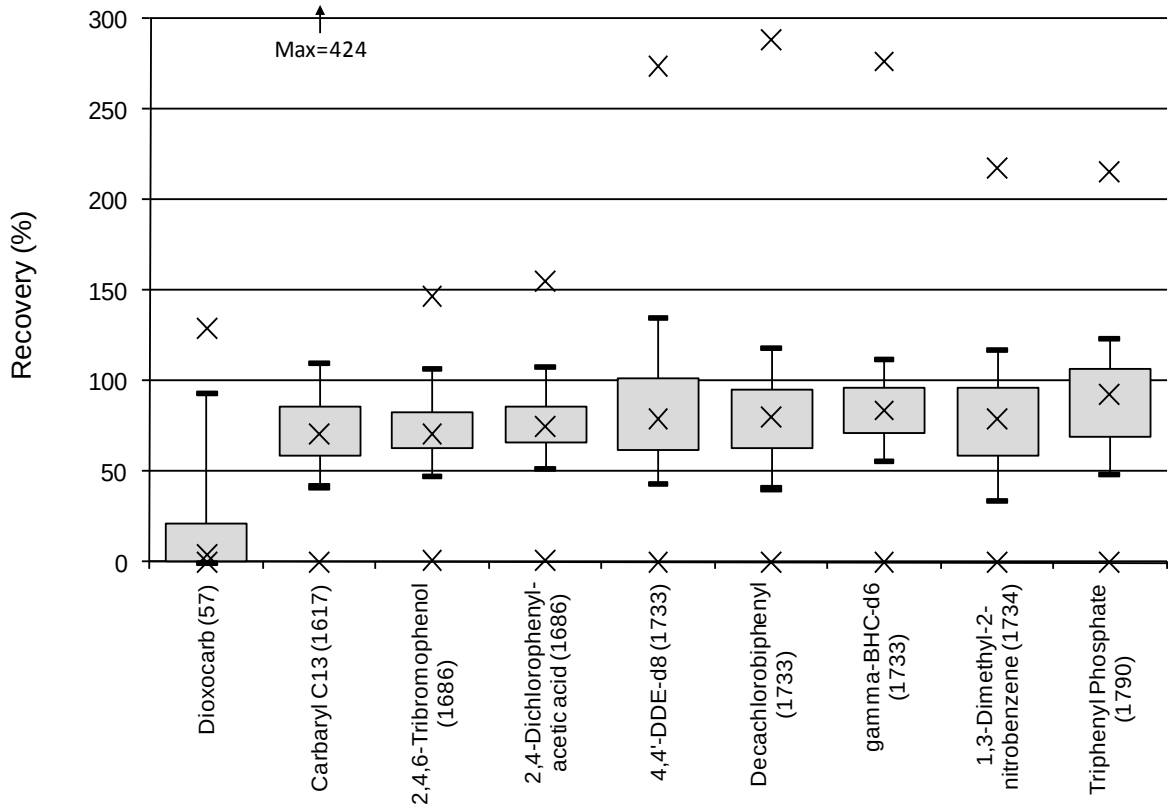

Figure D-2. Grab sample surrogate recoveries (%).

Boxes show 25th and 75th percentiles, whiskers show 5th and 95th percentiles, and 'X' indicates the minimum, median, and maximum values.

Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD results reflect the process of sample duplication (field), analyte degradation, matrix interaction (sample/standard), extraction efficiency, and analyte recovery. This measure is the best overall indicator of accuracy and reproducibility of the entire sampling process.

Figure D-3 shows percent matrix spike recovery for selected pesticides. Figure D-4 shows the relative percent difference (RPD) between the matrix spike and the matrix spike duplicate for the same set.

The average recovery of matrix-spiked compounds was 82.4%, and the average RPD between MS/MSD pairs was 17.2%. For most compounds, the RPD and recovery of MS/MSD pairs showed acceptable performance, and were within defined limits for the project. Due to high variability, dinoseb and dioxocarb had an average RPD outside the ± 40% criteria and were qualified as estimates.

Diuron recovered very high in some matrix spikes (Figure D-3). In these cases, diuron was reanalyzed using derivitization confirmation and passed quality control (J. Westerlund, 2009, pers. comm.). No diuron detections were associated with these high matrix spike recoveries.

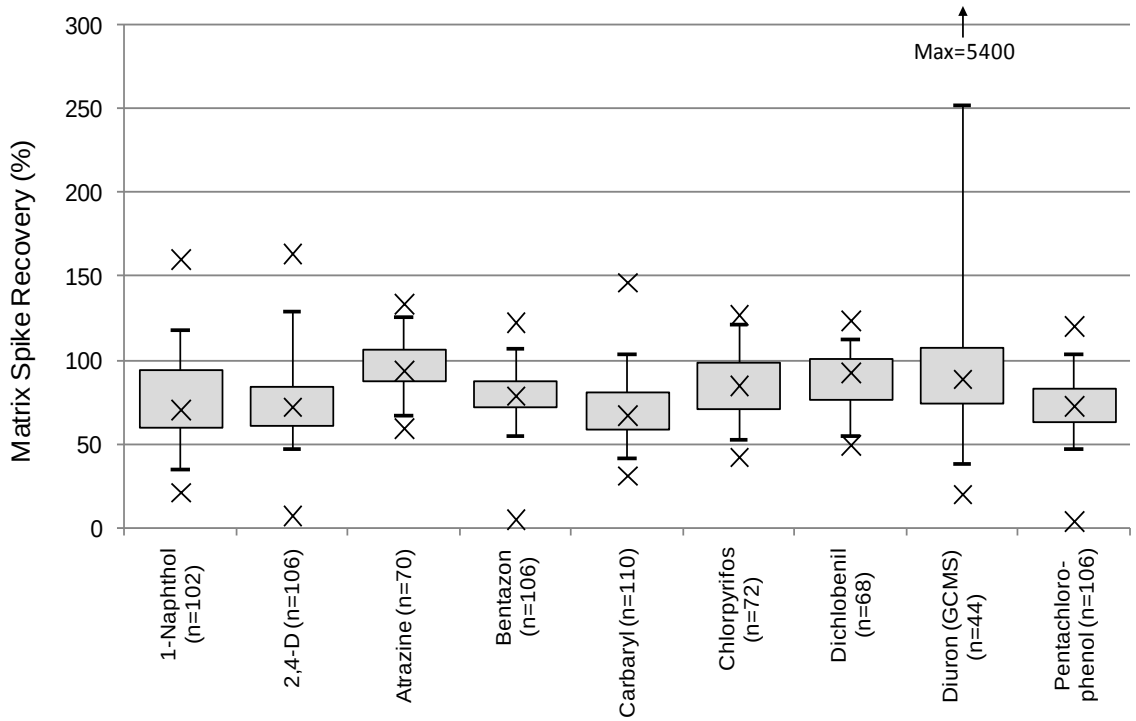

Figure D-3. Matrix spike recovery for selected pesticides.

Boxes show 25th and 75th percentiles, whiskers show 5th and 95th percentiles, and 'X' indicates the minimum, median, and maximum values.

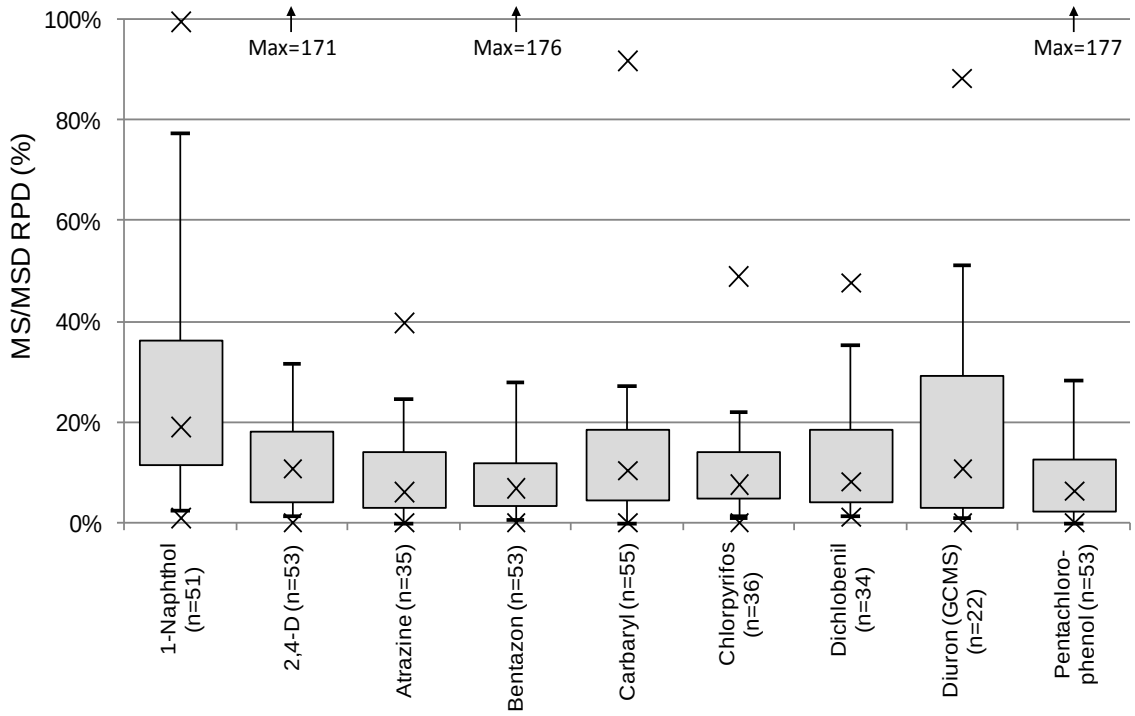

Figure D-4. Paired matrix spike relative percent differences for selected pesticides.

Boxes show 25th and 75th percentiles, whiskers show 5th and 95th percentiles, and 'X' indicates the minimum, median, and maximum values.

Laboratory Control Samples

Laboratory control samples (LCS) are analyte compounds spiked into deionized water at known concentrations and subjected to analysis. They are used to evaluate accuracy of pesticide residue recovery for a specific analyte. Detections may be qualified based on low LCS recovery and/or high relative percent difference between paired LCS.

Figures D-5 through D-8 show LCS recovery results. LCS tests were conducted with each grab sample analysis. Specific analytes were tested on a rotating basis.

Most grab sample LCS recoveries for pesticide analyses fell within the acceptance criteria established by MEL (Table D-2). Results associated with high or low LCS recoveries were qualified as estimates.

Diuron recovered very high in some LCS (Figure D-5). In these cases, diuron was reanalyzed using derivitization confirmation and passed quality control (J. Westerlund, 2009, personal communication). No diuron detections were associated with these high LCS recoveries.

All conventional parameter LCS recoveries fell within the criteria of 80 to 120% recovery (Table D-7).

Figures D-9 through D-12 show paired LCS relative percent differences (RPD). Paired LCS tests were conducted for a subset of LCS to understand recovery consistency. If paired LCS show inconsistent recoveries, additional pairs may be tested. If paired LCS recoveries are still inconsistent, associated sample detections may be qualified as tentative or not detected.

The majority of LCS pairs showed acceptable recovery for all analytes. Diuron, 4-nitrophenol, and aldicarb tended to show high variability between pairs. Sample detections associated with high RPD between LCS pairs were qualified as estimates.

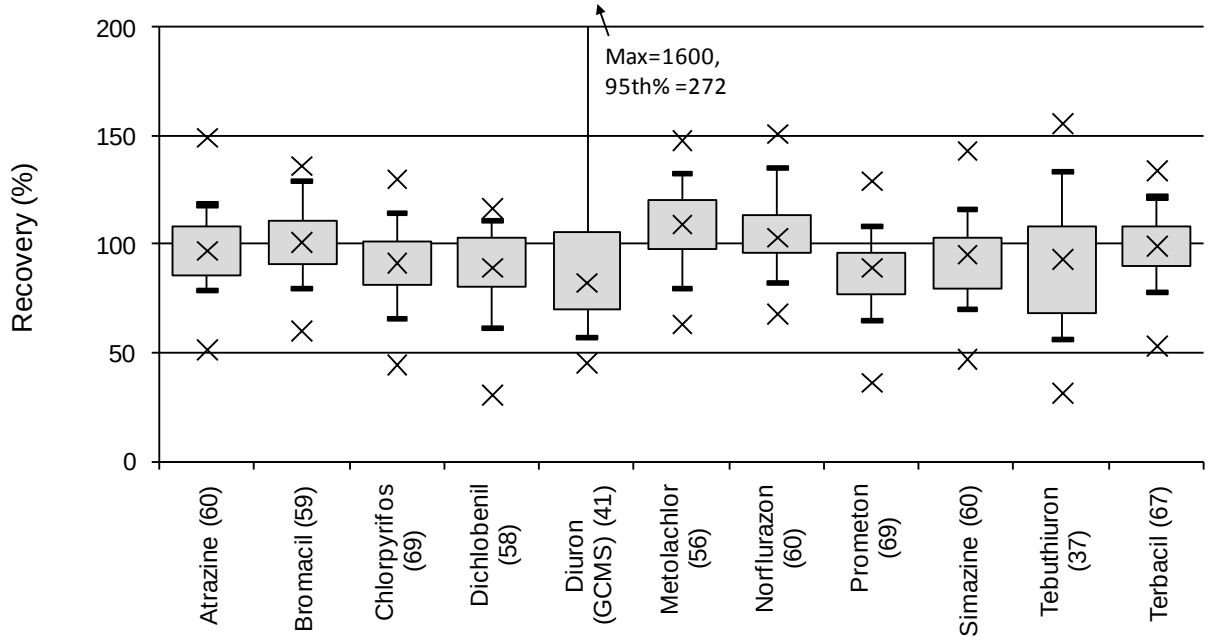

Figure D-5. Laboratory control sample recoveries (%) for selected pesticides by GCMS.[1,2]

[1]Boxes show 25th and 75th percentiles, whiskers show 5th and 95th percentiles, and 'X' indicates the minimum, median, and maximum values.

[2]GCMS = Gas chromatography/mass spectroscopy, EPA method (modified) SW 846 3535M/8270M.

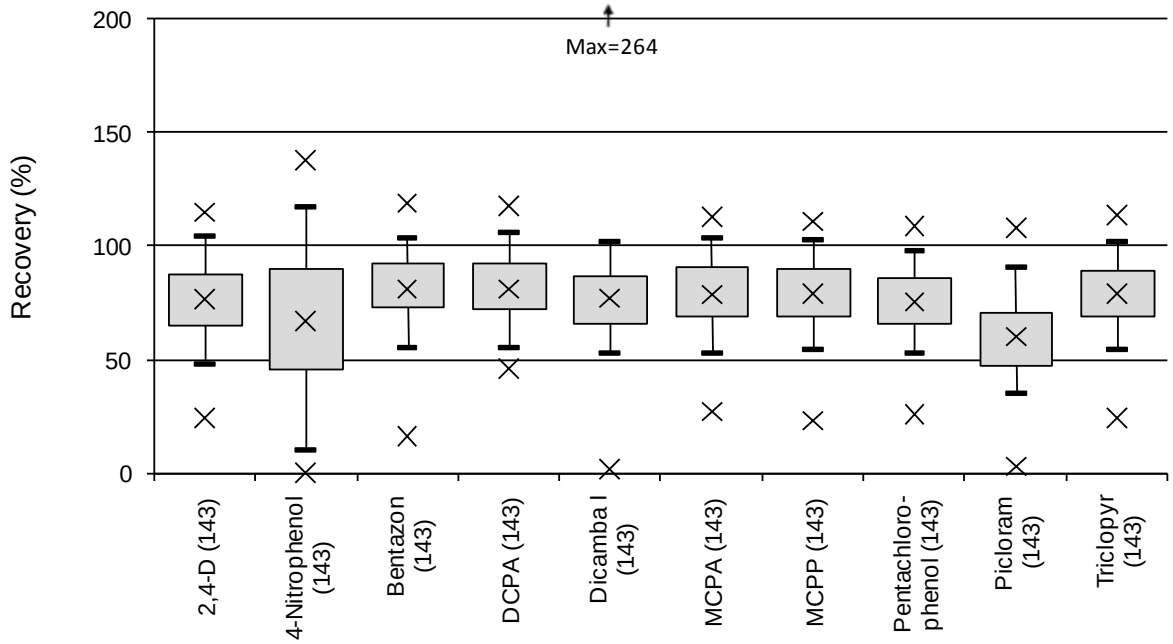

Figure D-6. Laboratory control sample recoveries (%) for selected herbicides by GCMS-H.[1,2]

[1]Boxes show 25th and 75th percentiles, whiskers show 5th and 95th percentiles, and 'X' indicates the minimum, median, and maximum values.

[2]GCMS-H = Derivitizable acid herbicides by GCMS, EPA method (modified) SW 846 3535M/8270M.

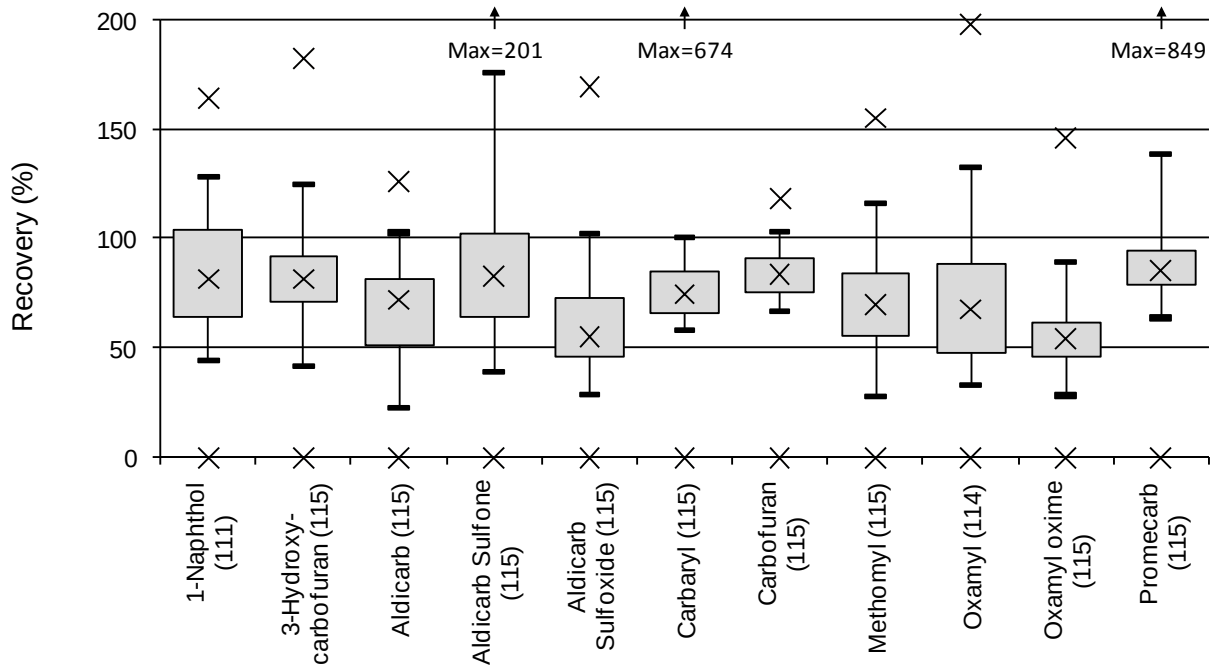

Figure D-7. Laboratory control sample recoveries (%) for selected pesticides by LCMS.[1,2]

[1]Boxes show 25th and 75th percentiles, whiskers show 5th and 95th percentiles, and 'X' indicates the minimum, median, and maximum values.

[2]LCMS = Liquid chromatography/mass spectroscopy, EPA method (modified) SW 846 3535M/8321AM.

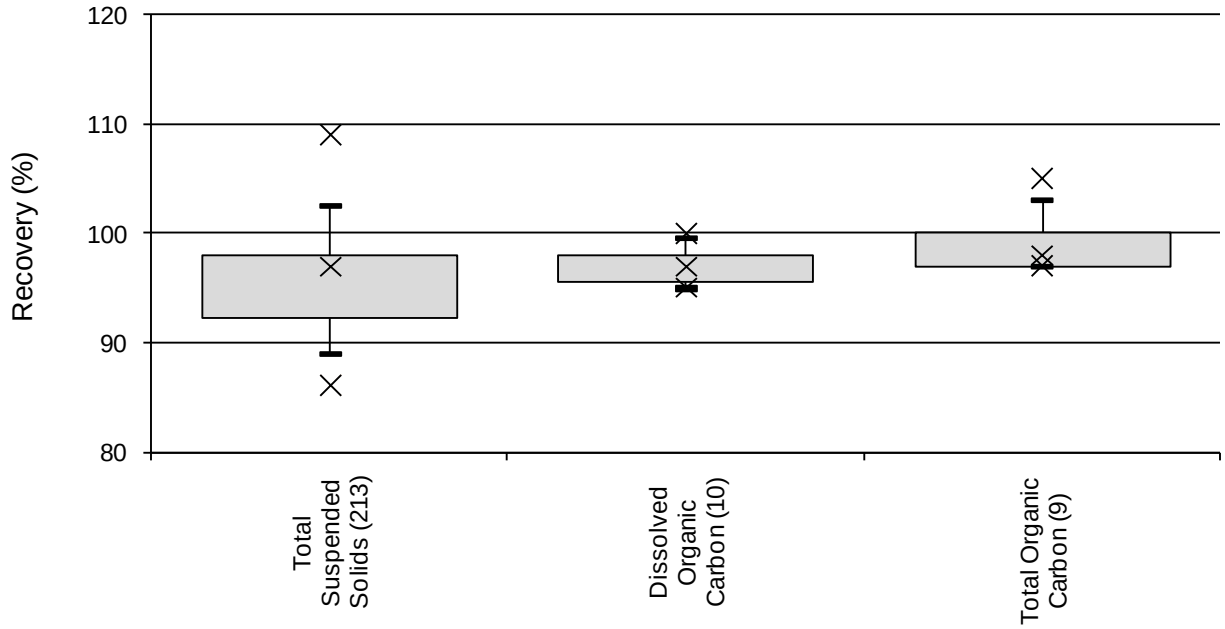

Figure D-8. Laboratory control sample recoveries (%) for conventional parameters.[1]

[1]Boxes show 25th and 75th percentiles, whiskers show 5th and 95th percentiles, and 'X' indicates the minimum, median, and maximum values.

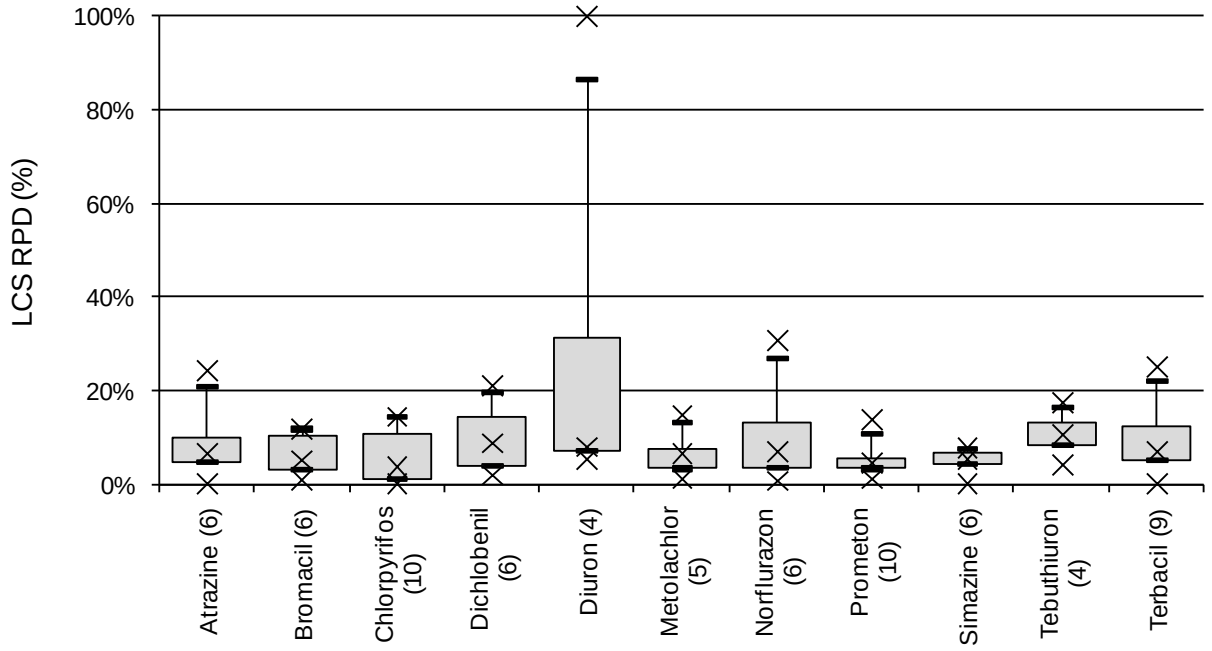

Figure D-9. Paired LCS relative percent differences (%) for pesticides by GCMS.[1,2]

[1]Boxes show 25th and 75th percentiles, whiskers show 5th and 95th percentiles, and 'X' indicates the minimum, median, and maximum values.

[2]GCMS = Gas chromatography/mass spectroscopy, EPA method (modified) SW 846 3535M/8270M.

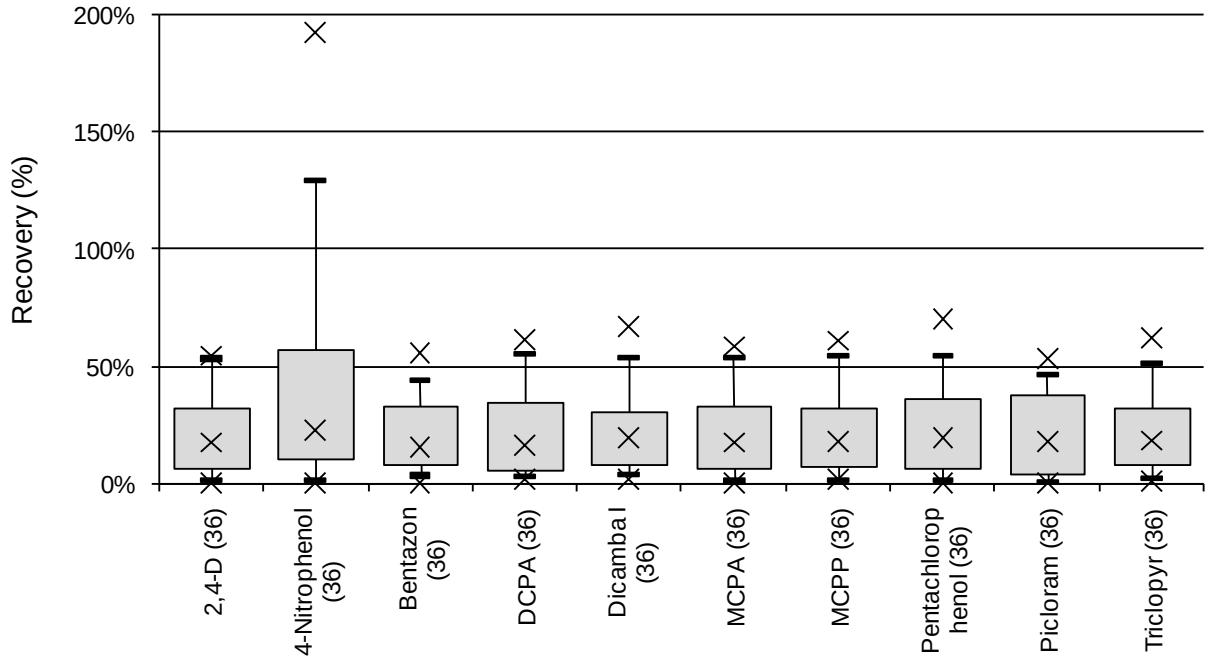

Figure D-10. Paired LCS relative percent differences (%) for pesticides by GCMS-H.[1,2]

[1]Boxes show 25th and 75th percentiles, whiskers show 5th and 95th percentiles, and 'X' indicates the minimum, median, and maximum values.

[2]GCMS-H = Derivitizable acid herbicides by GCMS, EPA method (modified) SW 846 3535M/8270M.

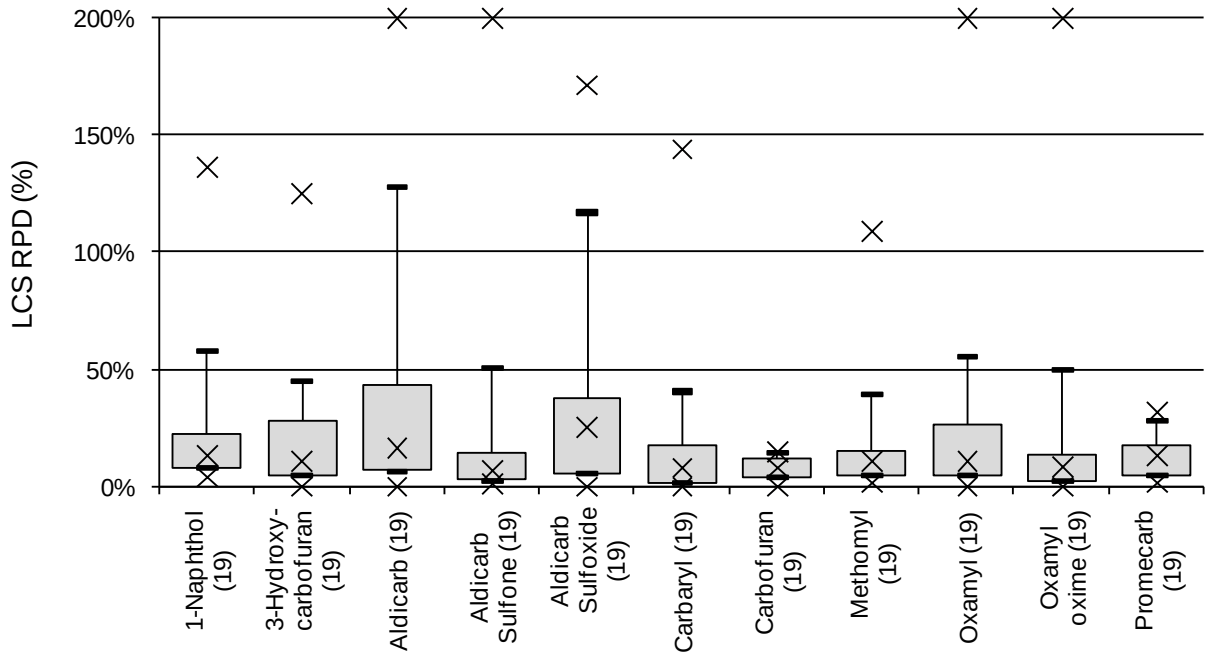

Figure D-11. Paired LCS relative percent differences (%) for pesticides by LCMS.[1,2]

[1]Boxes show 25th and 75th percentiles, whiskers show 5th and 95th percentiles, and 'X' indicates the minimum, median, and maximum values.

[2]LCMS = Liquid chromatography/mass spectroscopy, EPA method (modified) SW 846 3535M/8321AM.

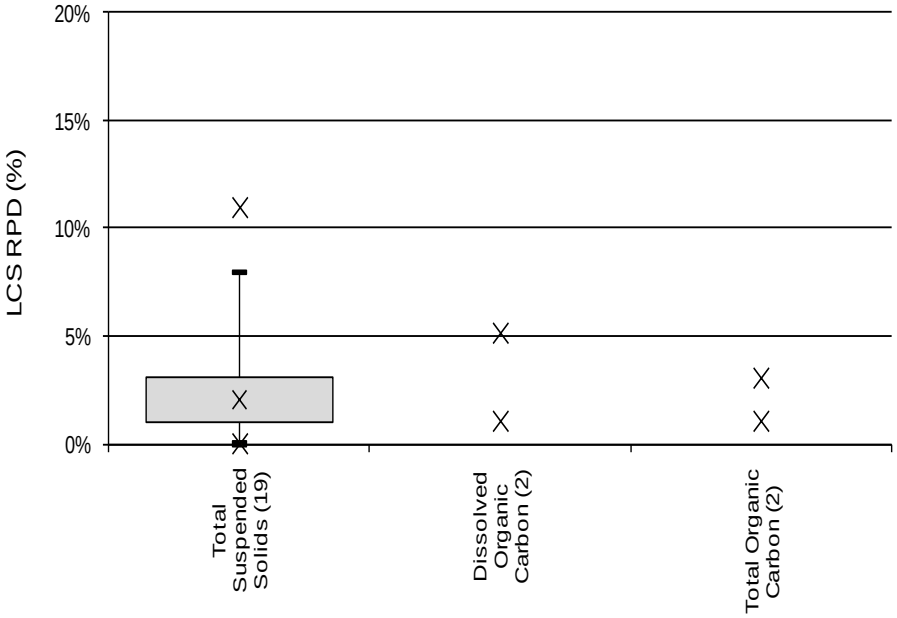

Figure D-12. Paired LCS relative percent differences (%) for conventional parameters.

Boxes show 25th and 75th percentiles, whiskers show 5th and 95th percentiles, and 'X' indicates the minimum, median (if the number of pairs is greater than 2), and maximum values.

Appendix E. Assessment Criteria and Water Quality Standards

EPA pesticide assessment documents were reviewed to determine the most comparable and up-to-date toxicity guidelines for freshwater (Table E-1) and marine species (Table E-2). The 2006-2008 maximum concentration for each chemical is listed on the table, and values in bold indicate the result was above aquatic species toxicity or water quality criteria.

Toxicity Criteria

Rainbow trout are a surrogate for freshwater endangered and threatened species. *Daphnia magna* (invertebrate) and *Selenastrum capricornutum* (green algae also called pseudokirchneria subcapitata) represent components of the aquatic food web that may be affected by pesticide use. Alternative species are used only if no data are available for rainbow trout, *Daphnia magna,* or *Selenastrum capricornutum.*

Marine toxicity criteria were evaluated for detections at Brown Slough (Skagit-Samish basin). Salinity at this site is > 1 ppt, making it a marine site. Criteria were generated for marine species including (1) sheepshead minnow and tidewater silverside for fish; (2) pink shrimp, Eastern Oyster, Grass Shrimp, *Acartia tonsa* (copepod), and Mysid shrimp for invertebrates; and (3) *Isochrysis galbana* and *Skeletonema costatum* for aquatic plants.

The EPA classifies a laboratory study as 'core' if it meets guidelines appropriate for inclusion in pesticide registration. Usually, a core designation may be made if the study is appropriately designed and monitored, conditions are controlled, and duration of exposure is consistent with other studies. Core study criteria are used in the assessment table. In keeping with pesticide review precedent, the most toxic, acceptable criteria from core studies are used.

Water Quality Standards

The most recent versions of Washington State water quality standards and EPA National Recommended Water Quality Criteria (NRWQC) were applied. The NRWQC remained largely unchanged from the 2003 update through 2008.

The toxic standards for Washington State waters also remain essentially unchanged following the 1997 rule and 2003 updates (Washington Administrative Code (WAC), Chapter 173-201A).

Table E-1. Freshwater toxicity and regulatory guideline values. All values reported in µg/L.

Chemical	Max Detection 2006-8	[1]Freshwater Toxicological and Reregistration Criteria													Freshwater Standards and Criterion			
		Fisheries					Invertebrate				Plant				[2]WAC		[3]NRWQC	
		Acute	Chronic	ESLOC	Spp.	Ref	Acute	Chronic	Spp.	Ref	Acute	Chronic	Spp.	Ref	Acute	Chronic	CMC	CCC
1-Naphthol	0.641*	1400		70	RT	10	700		DM	10	1100		SC	10				
2,4-D (Acids, Salts, Amines)[m]	6.57	101000	14200	5050	RT; FM	1	25000	16050	DM	1	3880	1440	ND	1				
2,4-D (BEE Ester)[m]		428		21.4	BS	1	4970	200	DM	1	1020	538	ND	1				
2,4'-DDD	0.018*																	
2,4'-DDT	0.053																	
3-Hydroxycarbofuran	0.34	362	5.7	18.1	RT	54; 60	2.23	0.75	CD	54								
		88		4.4	BG	54	29	9.8/27	DM	60								
4,4'-DDD	0.025																	
4,4'-DDE	0.071														1.1[a,b]	0.001[a,c]	1.1[a]	0.001[a]
4,4'-DDT	0.3														1.1[a,b]	0.001[a,c]	1.1[a]	0.001[a]
4-Nitrophenol	0.78																	
Alachlor	0.15	2100	187	105	RT	2	1550	110	DM	2	1.64	0.35	SC	2				
Aldicarb	0.22	560	78	28	RT;FM	3	410	20	DM	3								
Aldicarb Sulfone	0.51*	42000	78	2100	RT;FM	3	280	20	DM	3								
Aldicarb Sulfoxide	0.15*	7140	78	357	RT-A; FM-C	3	696	20	DM	3								
Atrazine	0.15	5300	65	265	RT; BT	4	6900	140	DM	4	49		SC	4				
Azinphos Methyl	0.53*	2.9	0.23	0.145	RT	5	1.1	0.25	DM	5								0.01
		3.2		0.16	Coho	5												
Bentazon	0.28	>100000		>5000	RT	6	>100000		DM	6	4500		SC	6				
Bromacil	0.75	36000		1800	RT	7	121000		DM	7	6.8		SC	7				
Bromoxynil	0.64	50	18/ 39	2.5	RT-A; FM-C	8	11	2.5/5.9	DM	8	80		SC	8				
Carbaryl	1.26	1200		60	RT	9	5.6	1.5	DM	10	1100	370	SC	10				
		2400		120	Chinook	10												
		2400		120	Coho	10												
Carbofuran	0.16	362	5.7	18.1	RT	54; 60	2.23	0.75	CD	54								
		88		4.4	BG	54	29	9.8/27	DM	60								
Chlorothalonil	0.024*	42.3	3	2.12	RT; FM	46	68	39	DM	46	190		SC	46				
Chlorpropham	5.6	5700		285	RT	47	3700		DM	47								
Chlorpyrifos	0.27	3	0.57	0.15	RT; FM	11; 12	0.1	0.04	DM	11					0.083d	0.041e	0.083	0.041

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Table E-1 (continued). Freshwater toxicity and regulatory guideline values.

Chemical	Max Detection 2006-8	[1]Freshwater Toxicological and Reregistration Criteria													Freshwater Standards and Criterion			
		Fisheries					Invertebrate				Plant				[2]WAC		[3]NRWQC	
		Acute	Chronic	ESLOC	Spp.	Ref	Acute	Chronic	Spp.	Ref	Acute	Chronic	Spp.	Ref	Acute	Chronic	CMC	CCC
cis-Permethrin[n]	0.11*	2.9;17	0.30/ 0.41	0.145	RT;CS-A FM-C	58	0.039	0.039/ 0.084	DM	58								
		0.79		0.0395	BG	58												
Clopyralid	0.065*	1968000	N/A	98400	RT	59, 64	113000	N/A	DM	59, 64	6900		SC	59				
Cycloate	1.2	4500		225	RT	48	24000		DM	48								
DCPA	0.55	6600	N/A	330	RT	56	27000	N/A	DM	56	>12380		SC	56				
Diazinon	0.7	90	0.8	4.5	RT; BT	13; 14	0.8	0.17	DM	13	3700		SC	13			0.17	0.17
Dicamba I	0.11*	28000		1400	RT	15	34600	16400	DM	15	3700	5	SC; AFA	15				
Dichlobenil	0.36	4930	330	246.5	RT	16; 17	6200	560	DM	17	1500	160	SC	17				
Dimethoate	0.45*	6200	430	310	RT	18	3320	40	DM	18								
Diphenamid	0.033*	97000		4850	RT	59	58000		DM	59								
Disulfoton sulfone	0.039*	9200		460	RT	20, 66	35.2	0.14/ 0.27	DM	20, 66								
Diuron	4.1	1950	26.4	97.5	RT; FM	21; 22	1400	200	DM	22	2.4		SC	22				
Endosulfan I	0.13	0.8	0.1	0.04	RT	23	166	2	DM	23					0.22[b,f]	0.056[c,f]	0.22[i]	0.056[i]
Endosulfan II	0.12	0.8	0.1	0.04	RT	23	166	2	DM	23					0.22[b,f]	0.056[c,f]	0.22[i]	0.056[i]
Endosulfan Sulfate	0.16	2.2		0.11	ND	23	580		DM	23								
Endrin Aldehyde	0.027*																	
Eptam	0.99*	14000		700	ND	24	6500		ND	24	1360		SC	24				
Ethoprop	0.14	1020	180	51	RT; FM	25	44	0.8	DM	25								
Fenarimol	0.038*	2100	430	105	RT	67	6800	113	DM	67		100	SC	67				
Hexachlorobenzene	0.016*	1000	3.68	50	CH-A; RT-C	59, 26	30	16	DM	26	30		SC	26				
Hexazinone	0.12	180000	17000	9000	RT; FM	27; 28	151600	20000	DM	27	7	4	SC	27				
		317000		15850	Chinook	27												
		246000		12300	Coho	27												
		317000		15850	Sockeye	27												
Imidacloprid	0.11	>83000	1200/ 2500	4150	RT	61	69	1800/ 3600	CT-A; DM-C	61								
							85200		DM	59								
Linuron	0.054*	3000	<42	150	RT	49	120		DM	50	67		SC	49				

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Table E-1 (continued). Freshwater toxicity and regulatory guideline values.

Chemical	Max Detection 2006-8	[1]Freshwater Toxicological and Reregistration Criteria													Freshwater Standards and Criterion			
		Fisheries					Invertebrate				Plant				[2]WAC		[3]NRWQC	
		Acute	Chronic	ESLOC	Spp.	Ref	Acute	Chronic	Spp.	Ref	Acute	Chronic	Spp.	Ref	Acute	Chronic	CMC	CCC
Malathion	0.082	4.1	21	0.205	RT	30	1	0.06	DM	30								0.1
		170		8.5	Coho	31												
MCPA	0.67	1150	916	57.5	RT	32	280	77	DM	32	250	32	SC	32				
MCPP	0.14	93000	N/A	4650	RT	65	91000	50800/ 102700	DM	65	14	9	SC	65				
Metalaxyl	0.51	132000	9100	6600	RT; FM	51	29000	1270	DM	51	140000		SC	51				
Methiocarb	0.034*	436		21.8	RT	C	19		DM	C								
Methomyl	0.17*	860	57/ 117	43	RT-A; FM-C	57	5	>0.4	DM	57								
Methomyl oxime	0.039*																	
Metolachlor	31	3900	780	195	ND	33	25100		DM	33								
Metribuzin	0.23	77000		3850	RT	52	4200	1290	DM	52	11.9	8.9	NP	51				
Napropamide	0.24	6400	1100	320	RT	53	14300	1100	DM	53	3400		SC					
Norflurazon	0.25	8100	770/ 1500	405	RT	34	15000	1000/ 2600	DM	34	9.7	3.2	SC	34-A 59-C				
Oryzalin	0.44*	3260		163	RT	D	1400		DM	D								
Oxamyl	0.21	4200	770/ 1500	210	RT	62	180	1000/ 4200	CP-A; DM-C	62	120	4.6	SC	62				
Oxamyl oxime	0.14																	
Oxyfluorfen	0.034*	250	38/74	12.5	RT-A; FM-C	35, 36	80	13/28	DM	35, 36	0.29	0.1	SC	35, 36				
Pendimethalin	0.098*	138	6.3	6.9	RT; FM	37	280	14.5	DM	37	5.4	3	SC	37				
Pentachlorophenol	0.053*	15	11	0.75	RT	38	450	240	DM	38	50		SC	38	8.2 to 41.0[d,g]	5.2-25.9[e,h]	7.9-107.6[j]	6.1-82.6[k]
Picloram	0.58	5500	N/A	275	RT	53	34400	N/A	DM	53								
Promecarb	0.2*																	
Prometon	0.12	12000	9500	600	RT-A; FM-C	68	25700	3500/ 6800	DM	68	98	32	SC	68				
Propargite	0.043*	118	16	5.9	RT; FM	40	74	9	DM	40	66.2	5	SC	40				
Propoxur	0.03*	3700		185	RT	63	11		DM	63								
Simazine	1.6	70500	1200	3525	RT; FM	41	1100		DM	41	100		SC	41				

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Table E-1 (continued). Freshwater toxicity and regulatory guideline values.

Chemical	Max Detection 2006-8	[1]Freshwater Toxicological and Reregistration Criteria													Freshwater Standards and Criterion			
		Fisheries					Invertebrate				Plant				[2]WAC		[3]NRWQC	
		Acute	Chronic	ESLOC	Spp.	Ref	Acute	Chronic	Spp.	Ref	Acute	Chronic	Spp.	Ref	Acute	Chronic	CMC	CCC
Tebuthiuron	0.31*	143000	9300	7150	RT; FM	42	297000	21800	DM	42	50	13	SC	42				
Terbacil	0.68	46200		2310	RT	43	65000		DM	43	18	4	SC	43				
Triadimefon	0.019*	4100	41/ 116	205	RT	55	1600	52/119	DM	55	100/1710		SC	55				
Triclopyr	1.3	650		32.5	RT	44	12000		DM	44	2300	2	SC; NP	44				
Trifluralin	0.047	41	1.14	2.05	RT	45	560	2.4	DM	45	7.52	5.37	SC	45				

*Values are not analytically qualified. Non-asterisk values have been J-qualified as estimates, normally below the practical quantitation limit.
1 Criteria identified in EPA reregistration and review documents, or peer reviewed literature. References listed separately.
Time component of standards explained in body of report.
ESLOC refers to Endangered Species Level of Concern.
Species abbreviated in table include: RT-Rainbow Trout, CS-Coho Salmon, CH-Chinook salmon, FM- Fathead Minnow, BT-Brook Trout, BS-Bluegill Sunfish, ND-Not Described, DM-Daphnia magna, CD-Ceriodaphnia dubia, SC-Selenastrum capricornutum (aka; Pseudokirchneria subcapitata), Anabaena flos-aquae, and Navicula pellicosa, SM-sheepshead Minnow, CT-Chironomus tentans (midge).
2 WAC: Promulgated standards according to Chapter 173-201AWAC
3 EPA National Recommended Water Quality Criteria (EPA-822-R-02-047)
CMC: Criteria Maximum Concentration; estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect.
CCC: Criteria Continuous Concentration; estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect.
a Criteria applies to DDT and its metabolites (ΣDDT).
b An instantaneous concentration not to be exceeded at any time.
c A 24-hour average not to be exceeded.
d A 1-hour average concentration not to be exceeded more than once every three years on average.
e A 4-day average concentration not to be exceeded more than once every three years on average.
F Chemical form of Endosulfan is not defined in WAC 173-201A. Endosulfan sulfate may be applied in this instance.
g ≤ e[1.005(pH)-4.830], pH range of 6.9 to 9.5 shown.
h ≤ e[1.005(pH)-5.29], pH range of 6.9 to 9.5 shown.
i Value refers to ∑α and β-endosulfan.
j ≤ e[1.005(pH)-4.869], pH range of 6.9 to 9.5 shown.
k ≤ e[1.005(pH)-5.134], pH range of 6.9 to 9.5 shown.
l There are many forms of 2,4-D that include acids, salts, amines and esters all of which have unique toxicity values. The criteria presented are in acid equivalents and are intended to provide a range of possible effects. Toxicity values for each form of 2,4-D are available in the referenced document.
m Assessment criteria for permethrin are based on a formulation of cis and trans-permethrin isomers. MEL analysis includes only the cis-permethrin isomer, the more toxic of the two; and cis-permethrin concentrations are compared to the assessment criteria for permethrin.

Table E-2. Marine toxicity and regulatory guideline values for three estuarine sites. All values reported in µg/L.

Chemical	Max Detection 2006-8	Marine Toxicological and Registration Criteria													Marine Standards and Criterion			
		Fisheries					Invertebrate				Plant				[2]WAC		[3]NRWQC	
		Acute	Chronic	ESLOC	Spp.	Ref	Acute	Chronic	Spp.	Ref	Acute	Chronic	Spp.	Ref	Acute	Chronic	CMC	CCC
1-Naphthol	0.641*	1200		60	SM	10	2100		EO	10								
2,4-D (Acids, Salts, Amines) [m]	6.57	>80,000 (175,000 definitive)	no data	4000	TS	1	57000	no data	EO	1								
2,4-D (BEE Ester)[m]		no data	555		SM	1	1800	no data	EO	1								
2,4'-DDD	0.018*																	
2,4'-DDT	0.053																	
3-Hydroxycarbofuran	0.34	33	2.6	1.65	AS; SM	60	4.6	0.4	PS; MS	60								
4,4'-DDD	0.025																	
4,4'-DDE	0.071														0.13[a]	0.001[b]		
4,4'-DDT	0.3														0.13[a]	0.001[b]		
4-Nitrophenol	0.78																	
Alachlor	0.15																	
Aldicarb	0.22																	
Aldicarb Sulfone	0.51*																	
Aldicarb Sulfoxide	0.15*																	
Atrazine	0.15	2000	2542	100	SM	4	94	80	AT; M	4	22		IG	4				
Azinphos Methyl	0.53*																	
Bentazon	0.28	136		6.8	SM	6	>132.5; >109		PS; EO	6								
Bromacil	0.75	162		8.1	SM		12.9; 130		M; EO	7								
Bromoxynil	0.64																	
Carbaryl	1.26	2600		130	SM	10	32; >2		PS; EO	10								
Carbofuran	0.16	33	2.6	1.65	AS; SM	60	4.6	0.4	PS; MS	60								
Chlorothalonil	0.024*	32		1.6	SM	46	154; 3.6	1.2	PS; EO; M	46								
Chlorpropham	5.6																	
Chlorpyrifos	0.27	270	0.38	13.5	SM; TS	11	2.4	<0.0046	PS; M	11					0.011[c]	0.0056[d]	0.011[G]	0.0056[G]
cis-Permethrin[n]	0.11*	2.2	0.83	0.11	AS; SM	58	0.019	0.011	M	58								
Clopyralid	0.065*																	
Cycloate	1.2																	

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Table E-2 (continued). Marine toxicity and regulatory guideline values for three estuarine sites.

Chemical	Max Detection 2006-8	Marine Toxicological and Registration Criteria													Marine Standards and Criterion			
		Fisheries					Invertebrate				Plant				[2]WAC		[3]NRWQC	
		Acute	Chronic	ESLOC	Spp.	Ref	Acute	Chronic	Spp.	Ref	Acute	Chronic	Spp.	Ref	Acute	Chronic	CMC	CCC
DCPA	0.55	>1000		50	SM	56	620		EO	56	>11000		SkC	56				
Diazinon	0.7						4.2	0.23	M	13							0.82	0.82
Dicamba I	0.11*	>180000		>9000	SM	15												
Dichlobenil	0.36	14000		700	SM	16	>1000; 2500		PS; EO	16								
Dimethoate	0.45*																	
Diphenamid	0.033*																	
Disulfoton sulfone	0.039*																	
Diuron	4.1	6700		335	SM	22		270	M	22								
Endosulfan I	0.13														0.034[a]	0.0087[b]	0.034[a]	0.0087[b]
Endosulfan II	0.12														0.034[a]	0.0087[b]	0.034[a]	0.0087[b]
Endosulfan Sulfate	0.16																	
Endrin Aldehyde	0.027*																	
Eptam	0.99*																	
Ethoprop	0.14																	
Fenarimol	0.038*																	
Hexachlorobenzene	0.016*																	
Hexazinone	0.12																	
Imidacloprid	0.11	163000		8150	SM	61	37	>0.6/1.3	MS	61								
Linuron	0.054*	890		44.5	SM	49	4500; 890		M; EO									
Malathion	0.082																	
MCPA	0.67	>4100	4100	>205	SM	32	150000	115000	EO	32	300	15	SkC	32				
MCPP	0.14																	
Metalaxyl	0.51						25700; 4600		M; EO	51								
Methiocarb	0.034*																	
Methomyl	0.17*	1160		58	SM	57	>140000; 230		EO; M	57								
Methomyl oxime	0.039*																	
Metolachlor	31	7900	1000	395	ND	33												

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Table E-2 (continued). Marine toxicity and regulatory guideline values for three estuarine sites.

Chemical	Max Detection 2006-8	Marine Toxicological and Registration Criteria													Marine Standards and Criterion			
		Fisheries					Invertebrate				Plant				[2]WAC		[3]NRWQC	
		Acute	Chronic	ESLOC	Spp.	Ref	Acute	Chronic	Spp.	Ref	Acute	Chronic	Spp.	Ref	Acute	Chronic	CMC	CCC
Metribuzin	0.23	85000		4250	SM	52	48300; 49800		M; EO	52	8.7	5.8	SkC	52				
Napropamide	0.24	14000		700	SM	53	4200; 1400		M; EO									
Norflurazon	0.25																	
Oryzalin	0.44*																	
Oxamyl	0.21	2600		130	SM	62	0.4		EO	62								
Oxamyl oxime	0.14																	
Oxyfluorfen	0.034*																	
Pendimethalin	0.098*																	
Pentachlorophenol	0.053*	240		12	SM	38	48		PO	38	27		SkC	38	13.0[c]	7.9[d]		
Picloram	0.58																	
Promecarb	0.2*																	
Prometon	0.12	47300		2365	SM	68	18000		MS	68								
Propargite	0.043*																	
Propoxur	0.03*																	
Simazine	1.6	>4300		215	SM	41	113000; >3700		PS; EO	41	600		SkC	41				
Tebuthiuron	0.31*						62000		PS	42	31		SkC	42				
Terbacil	0.68																	
Triadimefon	0.019*																	
Triclopyr	1.3	450		22.5	TS	44	2470		GS	44	1170	209	SkC	44				
Trifluralin	0.047	190		9.5	SM	45	638.5		GS	45	28		SkC	45				

*Values are not analytically qualified. Non-asterisk values have been J-qualified as estimates, normally below the practical quantitation limit.
[1] Criteria identified in EPA reregistration and review documents, or peer reviewed literature. References listed separately.
Time component of standards explained in body of report.
ESLOC refers to Endangered Species Level of Concern.
Species abbreviated in table include: ND-Not determined, AS-Atlantic silverside, IS-Inland silverside, TS-Tidewater silverside, PS-Pink Shrimp, EO-Eastern Oyster, AT-Acartia tonsa (copepod), M-Mysid, IG-Isochrysis galbana, LG-Lemna gibba, CT-Chironomus tentans (midge), GS - Grass Shrimp, SkC-Skeletonema costatum, PO-Pacific Oyster.
[2] WAC: Promulgated standards according to Chapter 173-201AWAC.
[3] EPA National Recommended Water Quality Criteria (EPA-822-R-02-047).
CMC: Criteria Maximum Concentration; estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect.
CCC: Criteria Continuous Concentration; estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect.

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a Criteria applies to DDT and its metabolites (ΣDDT).
b An instantaneous concentration not to be exceeded at any time.
c A 24-hour average not to be exceeded.
d A 1-hour average concentration not to be exceeded more than once every three years on average.
e A 4-day average concentration not to be exceeded more than once every three years on average.
f Chemical form of Endosulfan is not defined in WAC 173-201A. Endosulfan sulfate may be applied in this instance.
g ≤ e[1.005(pH)-4.830], pH range of 6.9 to 9.5 shown.
h ≤ e[1.005(pH)-5.29], pH range of 6.9 to 9.5 shown.
i Value refers to ∑α and β-endosulfan.
j ≤ e[1.005(pH)-4.869], pH range of 6.9 to 9.5 shown.
k ≤ e[1.005(pH)-5.134], pH range of 6.9 to 9.5 shown.
l There are many forms of 2,4-D that include acids, salts, amines, and esters, all of which have unique toxicity values. The criteria presented are in acid equivalents and are intended to provide a range of possible effects. Toxicity values for each form of 2,4-D are available in the referenced document.
m Assessment criteria for permethrin are based on a formulation of cis and trans-permethrin isomers. MEL analysis includes only the cis-permethrin isomer, the more toxic of the two; and cis-permethrin concentrations are compared to the assessment criteria for permethrin.

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Appendix F. Historical Information Review

Pesticide residues have historically been detected at project sites or sites with similar land use. The following is a summary of previous pesticide-related studies and a summary of pertinent findings at these sites.

For the project *Surface Water Monitoring Program for Pesticides in Salmonid-Bearing Streams*, several reports are available. These include the 2003-2005 triennial report describing the first three years of sampling (2003-2005), annual data summary reports, and intensive sampling report on Marion Drain. All of these reports can be found on the following web-site: www.ecy.wa.gov/programs/eap/toxics/pesticides.htm.

Statewide Studies

Washington State's Water Quality Assessment [303(d)] (Ecology, 2009)

Washington State's Water Quality Assessment lists the status of water quality for a particular location in one of 5 categories recommended by EPA. The 303(d) list reports on Category 5 waters, the impaired waters of the state (or water that does not meet water quality standards). Several of the waters sampled for this project are on the 303(d) list for one or more water quality parameters.

Table F-1 describes sites on the 303(d) list, the water quality parameter of concern, and the category (5 or 2). Category 2 describes waters of concern where there are not enough data available to make a determination. Category 4 indicates a plan has been developed to address the water quality impairment.

Table F-1. Washington State Water Quality Assessment data for 2003-2008 sampling sites including parameter(s) of concern and category.

Waterbody Name	Parameter(s)	Category
Thornton Creek, WRIA 8		
Thornton Creek	Dissolved oxygen, temperature, fecal coliform bacteria	5
	Mercury	2
Lower Skagit-Samish, WRIA 3		
Samish River	Turbidity, FC, temperature	5
	Dissolved oxygen, pH	2
Indian Slough	Dissolved oxygen, fecal coliform	5
	temperature	2
Browns Slough	FC, dissolved oxygen	5
	Temperature	2
Big Ditch/Maddox Slough	Temperature, Fecal Coliform, dissolved oxygen, pH	5
Lower Yakima, WRIA 37		
Marion Drain	Temperature, pH, chlorpyrifos	5
	Dissolved oxygen	2
Sulphur Creek Wasteway	Temperature, pH, FC, DDT, 4,4'-DDE, 4,4' DDD, dieldrin, endosulfan, chlorpyrifos	5
	Ammonia-N	2
Spring Creek	Temperature, pH, dissolved oxygen, DDT, 4,4'-DDE, 4,4' DDD, chlorpyrifos	5
	FC, dieldrin, chlorpyrifos	2
Wenatchee-Entiat, WRIAs 45 and 46		
Lower Wenatchee River	pH, PCB, 4,4'-DDE	5
	Temperature, pH	2
	Temperature	4
Peshastin Creek	Temperature, instream flow	4
Mission Creek	pH	5
	Dissolved oxygen	2
	Instream flow, FC, temperature, DDT, 4,4'-DDE, 4,4' DDD,	4
Brender Creek	Dissolved oxygen	5
	Temperature, FC, DDT, 4,4'-DDE, 4,4' DDD	4
	Chlorpyrifos	2
Entiat River	pH	5
	Temperature	2
	Instream flow	4

FC = Fecal coliform bacteria.

Washington State Pesticide Monitoring Program, 1994 Surface Water Sampling Report (Davis, 1996)

As part of the Washington State Pesticide Monitoring Program, Ecology sampled eight sites statewide for 161 pesticides and breakdown products. Surface water was sampled in April, June, and October 1994. Sites of interest for this project include: Joe Leary Slough (Skagit-Samish, WRIA 3); Mission and Stemilt Creeks (Wenatchee, WRIA 45). Mission Creek exceeded state water quality standards for total DDT and EPA criteria for azinphos-methyl. In Joe Leary Slough, diazinon was above National Academy of Sciences recommended maximum concentration to protect aquatic life and wildlife.

Washington State Pesticide Monitoring Program, 1993 Surface Water Sampling Report (Davis and Johnson, 1994)

As part of the Washington State Pesticide Monitoring Program, Ecology sampled nine sites statewide for 162 pesticides and breakdown products. Surface water was sampled in April, June, August, and October 1993. Sites of interest for this project include: Joe Leary Slough (Skagit-Samish, WRIA 3); Mission Creek (Wenatchee, WRIA 45); and Moxee Drain (Yakima, WRIA 37). Results of the study include: Mission Creek exceeded EPA criteria for azinphos-methyl and exceeded state water quality standards for chlorpyrifos and total DDT. Moxee Drain exceeded EPA criteria for azinphos-methyl and state water quality standards for chlorpyrifos and total DDT.

Washington State Pesticide Monitoring Program, Reconnaissance Sampling of Surface Waters (Davis, 1993)

In 1992, Ecology conducted a reconnaissance survey to identify sites for the Washington State Pesticide Monitoring Program. Sites were sampled once during the typical pesticide-use season for 162 pesticides and breakdown products. Sites of interest for this project include: Thornton Creek (Cedar-Samish, WRIA 8); Sullivan Slough (Skagit-Samish, WRIA 3; Mission Creek (Wenatchee, WRIA 45); and Moxee Drain (Yakima, WRIA 37). Five pesticides were detected at levels above the EPA criteria: azinphos-methyl in Mission Creek; malathion and DDT and its two derivatives in Moxee Drain. Pesticides detected in Thornton Creek include: dacthal (DCPA), diazinon, dichlobenil, dichlorprop, glyphosate, and 2,4-D.

Thornton Creek WRIA 8

Surface-Water Quality of the Skokomish, Nooksack, and the Green-Duwamish Rivers and Thornton Creek (Embrey and Frans, 2003)

From November 1995 through April 1998, USGS collected stormwater and monthly water quality and streamflow samples from a surface-water network in the Puget Sound Basin. Thornton Creek was sampled for a variety of conventional parameters as well as pesticides.

A total of 20 pesticides and breakdown compounds were detected in samples collected from March 1996 through April 1998. Most of the compounds detected were herbicides. The herbicide prometon was detected most frequently, in 45 of 46 samples at concentrations as high

as 0.201 µg/L and with a median of 0.025 µg/L. Simazine and dichlobenil were the next most frequently detected, in 23 and 21 samples, respectively. Of the 20 pesticide compounds detected, five were insecticides: carbaryl, chlorpyrifos, diazinon, lindane, and malathion. Diazinon the most frequently detected insecticide (detected in 85% of the samples collected) at concentrations ranging from 0.003 – 0.501 µg/L.

Fifteen of the samples collected exceeded 0.04 µg/L, a limit recommended for protection of aquatic life by Menconi and Cox. Two samples had concentrations of carbaryl that exceeded 0.017 µg/L, a limit recommended for the protection of aquatic life by Norris and Dost. One detection of chlorpyrifos (0.074 µg/L) exceeded the EPA aquatic-life criterion of 0.041 µg/L. One sample containing lindane (0.02 µg/L) exceeded the International Joint Commission Canada and United States aquatic life guideline of 0.01 µg/L.

Pesticides Detected in Urban Streams During Rainstorms and Relation to Retail Sales in King County, Washington (Voss et al., 1999)

Two to four surface water samples were collected at 12 study sites in King County, including Thornton Creek. Sampling occurred when pesticide applications to residential areas were high and pesticide transport to surface water would be likely (during rainstorms). During rainstorms 23 pesticides were detected at the 12 sites. Concentrations of five insecticides exceeded recommended maximum concentrations set by the National Academy of Sciences and National Academy of Engineering. In a few samples, concentrations of diazinon, carbaryl, and lindane exceeded EPA and other chronic aquatic-life criteria.

Pesticides in Selected Small Streams in the Puget Sound Basin, 1987-1995 (Bortleson and Davis, 1997)

From 1987-1995, Ecology and EPA conducted a study of pesticides in selected small stream in the Puget Sound basin, including Thornton Creek. Findings described were not specific for Thornton Creek, but significant findings included that urban use of pesticides was three times greater than agricultural use. Pesticide concentrations were generally low. The most frequently detected pesticides were the herbicides 2,4-D and dicamba and the insecticide diazinon.

Lower Skagit-Samish WRIA 3

Fish Use and Water Quality Associated with a Levee Crossing the Tidally Influenced Portion of Browns Slough, Skagit River Estuary, Washington (Beamer and LaRock, 1998)

In April and May 1995, an evaluation of fish abundance, habitat type, and water quality was conducted at six sites distributed throughout the tidally influenced portion of Browns Slough. Eleven species of fish were captured including anadromous fish - chinook, chum, coho, and cutthroat - and estuarine fish. Grab samples for conventional water quality parameters exceeded the water quality standard for temperature and dissolved oxygen at select sites.

Washington State Pesticide Monitoring Program Pesticide Residues in Skagit Delta Surficial Aquifer, Pesticides in Ground Water Report No. 8 (Larson, 1996)

Twenty-seven wells were sampled near Mt. Vernon, Washington for pesticides and nitrate-nitrite as nitrogen. Wells were located in the Skagit Delta Surficial Aquifer underlying the Skagit River delta. Nine pesticides were detected in the initial samples: dacthal (DCPAs), atrazine, prometon, bromacil, 3,5-dichlorobenzoic acid, dicamba, 4-nitrophenol, pentachlorophenol, and total xylenes. Only atrazine, prometon, and bromacil were confirmed by verification sampling. Pesticides were detected in 11 of the 27 study wells with concentrations of all pesticides below the Lifetime Health Advisory Level set by EPA for public drinking water.

Potential for Agricultural Pesticide Runoff to a Puget Sound Estuary, Padilla Bay, Washington (Mayer and Elkins, 1990)

The purpose of the study was to quantify pesticide runoff in an agricultural environment and to access ecological impacts to Padilla Bay. In 1987-88, sediment and water samples were analyzed at several sites in Padilla Bay, Joe Leary Slough, and Big Indian and Little Indian sloughs. Four sample events occurred during the spring and summer. Of the 14 pesticide studied, only two were found in water or sediment: dicamba and 2,4-D. Results of the study showed no ecologically significant levels of any of the 14 pesticides studied.

Lower Yakima WRIA 37

Lower Yakima River Suspended Sediment Total Maximum Daily Load (TMDL) Study, Water Quality Effectiveness Monitoring Report (Coffin et al., 2006).

Water sampling occurred in 2003 for turbidity, TSS, and total fixed and volatile solids to determine if sediment reduction targets recommended in the Lower Yakima River TMDL study had been met. Sampling occurred in the lower Yakima and tributaries such as Sulphur Creek Wasteway, Marion Drain, and Spring Creek. Results showed that sediment loads had been reduced in the agricultural drains and river, but improvement is needed to meet all of the target reductions.

Water Quality in the Yakima River Basin, Washington, 1999-2000 (Fuhrer et al., 2004)

Report includes general description and findings of 1999-2000 USGS National Water Quality Assessment (NAWQA) sampling effort in Yakima basin. Report includes findings on topics such as irrigation-water delivery and drainage system controls, water quality conditions, and aquatic health in the basin. Major findings include:

- Historically used organochlorine insecticides were frequently detected in agricultural streams and drains.
- Organochlorine insecticides such as DDT, DDE, DDD, dieldrin, and heptachlor epoxide exceeded the EPA chronic water quality criteria for the protection of aquatic life.
- Concentrations of DDT have decreased since 1991. Reductions are associated with decreases in suspended sediment concentrations and implementation of erosion-control practices.

- Concentrations of azinphos-methyl routinely exceeded the EPA freshwater chronic-toxicity criterion for the projection of aquatic life.
- Shallow groundwater underlying agricultural areas contribute soluble pesticides.
- The types of pesticides detected in streams reflect the types of crops grown in the areas they drain.
- Transport of a pesticide to streams depends on the pesticide's tendency to dissolve in water or adhere to soil.

Concentrations and Loads of Suspended Sediment and Nutrients in Surface Water of the Yakima River Basin, Washington, 1999-2000 – With an Analysis of Trends in Concentrations (Ebbert et al., 2003)

Spatial and temporal variation in suspended sediment and nutrients was assessed using data collected from 34 sites in August 1999, and from three sites collected weekly and monthly from 1999-2000. During the irrigation season (mid-March to mid-October), concentrations of suspended sediment and nutrients in the Yakima River increased from the headwaters downstream.

Pesticides in Surface Water of the Yakima River Basin, Washington, 1999-2000—Their Occurrence and an Assessment of Factors Affecting Concentrations and Loads (Ebbert and Embrey, 2002)

The occurrence, distribution, and transport of pesticides in surface water of the Yakima River basin were assessed using data collected during 1999–2000 as part of the USGS NAWQA Program. Samples were collected at 34 sites throughout the basin (including Marion Drain, Sulphur Creek Wasteway, and Spring Creek) in August 1999 using a Lagrangian sampling design. Samples were also collected weekly and monthly from May 1999 through January 2000 at three sites.

Twenty pesticide compounds were detected during sampling in August 1999. Atrazine was the most widely detected herbicide, and azinphos-methyl was the most widely detected insecticide. The median number of sites at which a particular pesticide compound was detected was six. Pesticide compounds detected at more than six sites include atrazine, simazine, terbacil, trifluralin, deethylatrazine, azinphos-methyl, carbaryl, diazinon, malathion, and p,p'-DDE. The highest detection frequencies and concentrations of pesticides generally occurred during the irrigation season, mid-March to mid-October.

Surface Water Quality Assessment of the Yakima River Basin, Washington Distribution of Pesticides and Other Organic Compounds in Water, Sediment, and Aquatic Biota, 1987-91 (Rinella et al., 1999)

For the Yakima basin, the highest concentrations of hydrophilic and hydrophobic organic compounds generally occurred near or during peak irrigation (June-July) and during storm runoff from agricultural land. Highest concentration of suspended sediment also occurred in June and July and in storm runoff in March.

During a synoptic survey of 29 stations in the basin, the most frequently detected compounds are listed below:

- Organochlorine compounds: chlordane, DDT+DDE+DDD, dieldrin, and endosulfan I.
- Organophosphorus compounds: chlorpyrifos, diazinon, dimethoate, malathion, parathion, phorate, phosphamidon.
- Thiocarbamate and sulfite compounds: EPTC, propargite.
- Acetamide compounds: alachlor and metolachlor.
- Triazine compounds: atrazine, prometon, and simazine.
- Chlorophenoxy-acetic and benzoic compounds: 2,4-D and dicamba.

Quantifiable concentrations of these compounds generally ranged from 1-100 nanograms per liter.

The pesticides that most frequently exceeded chronic-toxicity water quality criteria or guidelines for the protection of freshwater aquatic life included DDT+DDE+DDD, dieldrin, diazinon, and parathion. Most of the exceedances occurred in agricultural return flows and in the Yakima River downstream of the city of Yakima.

Surface-Water-Quality Assessment of the Yakima River Basin, Washington Overview of Major Findings, 1987-91 (Morace et al., 1999)

The report includes a summary and analysis of NAWQA surface water quality data collected in Rinella et al (1992b) for the Yakima basin, including Marion Drain, Sulphur Creek Wasteway, and Spring Creek. In the report, the Yakima River was separated into three reaches, with the middle and lower reaches being most influenced by agriculture, irrigation activities, and highly erosive soils. Most of the middle and lower reach sites (including tributaries) failed to meet dissolved oxygen, temperature, and pH state water quality standards. Agricultural drains are significant sources of nutrients, suspended sediment, pesticides, and fecal indicator bacteria. The east side of the lower valley is the source of the most suspended sediment, and pesticides. Agriculture was the primary cause of biological impairment. Primary physical and chemical indicators of agricultural effects were nutrients, pesticides, dissolved solids, and substrate embeddedness. Three sites were heavily affected by agriculture (Granger Drain, Moxee Drain, and Spring Creek) and were listed as severely impaired by most of the physical, chemical, and biological condition indices.

Washington State Pesticide Monitoring Program, 1995 Surface Water Sampling Report (Davis et al., 1998)

As a part of the Washington State Pesticide Monitoring Program, Ecology analyzed groundwater, surface water, fish tissue, and sediment for 161 pesticides and breakdown products. Seven sites were sampled in April, June, August, and September including the Yakima River and tributaries Sulphur Creek Wasteway, and Spring Creek. The Yakima River and Spring Creek did not meet (exceeded) state water quality standards for: total DDT, azinphos-methyl, and chlorpyrifos. Sulfur Creek Wasteway exceeded state water quality standards for total DDT and azinphos-methyl.

A Suspended Sediment and DDT Total Maximum Daily Load Evaluation Report for the Yakima River (Joy and Patterson, 1997).

A Total Maximum Daily Load (TMDL) evaluation of the lower Yakima River basin was conducted in 1994-1995. The lower Yakima River and tributaries such as Sulphur Creek Wasteway, Marion Drain, and Spring Creek were sampled for flow, turbidity, TSS, and pesticides. Recommendations in the TMDL included reductions in TSS or turbidity and t-DDT and a time table to accomplish reductions.

Surface Water Quality Assessment of the Yakima River Basin, Washington: Analysis of Available Water Quality Data through 1985 Water Year (Rinella et al., 1992)

This report summarizes historical water quality data collected by USGS, EPA, Ecology, and the U.S. Forest Service for the Yakima River and select tributaries. About 85 percent of the organic-compound concentrations from 1968-83 were reported as below the minimum analytical reporting levels (historical reporting levels are 1-2 orders of magnitude larger than are currently (1990) available. Concentrations of several trace organic compounds in water exceed state water quality standards for chronic toxicity of freshwater aquatic life. These compounds included aldrin/dieldrin, endosulfan, DDT and metabolites, endrin, and parathion. The highest concentrations occurred during the irrigation season in agricultural-return flows that also contained the largest suspended sediment concentrations.

Surface Water Quality Assessment of the Yakima River Basin, Washington; Pesticide and Other Trace-Organic-Compound Data for Water, Sediment, Soil, and Aquatic Biota, 1987-91 (Rinella et al., 1992b)

The report presents the sampling plan, field techniques, quality assurance, and raw data for the 1987-92 USGS NAWQA study of the Yakima basin. Surface water pesticide data are included in the report for Marion Drain, Sulphur Creek Wasteway, and Spring Creek.

Occurrence and Significance of DDT Compounds and Other Contaminants in Fish, Water, and Sediment from the Yakima River Basin (Johnson et al., 1986)

Ecology analyzed fish tissue, water, and sediment for target chemicals including DDT, DDE, DDD, and 15 persistent organochlorine pesticides. Sampling occurred in 1985 in the Yakima River and 11 tributaries including Spring Creek and Sulphur Creek Wasteway. Of the tributaries monitored, Sulphur Creek Wasteway and Spring/Snipes Creek were identified as sources of DDT compounds, with Sulphur Creek contributing the largest load of total DDT to the Yakima River. Concentrations of DDT compounds, dieldrin, and endosulfan were below acute toxicity criteria for aquatic life, but a number of tributaries exceeded chronic criteria.

Washington State Toxics Monitoring Program, Trends Monitoring for Chlorinated Pesticides, PCBs, and PBDEs in Washington Rivers and Lakes, 2007 (Sandvik, 2009)

In 2007 Ecology began a trend monitoring program for persistent, bioaccumulative, and toxic chemicals. Semipermeable membrane devices (passive samplers) were deployed at 12 sites statewide including the Wenatchee River at Monitor (RM 7.1). Passive samplers were deployed for a one-month period during spring high-flow conditions and fall low-flow conditions. Analysis occurred for over 30 chlorinated pesticides and breakdown products. The Wenatchee River had high concentrations of endosulfan (dissolved fraction) and detections of DDT and DDT derivatives.

Washington State Toxics Monitoring Program, Toxic Contaminants in Fish Tissue and Surface Water in Freshwater Environments, 2002 (Seiders and Kinney, 2004)

In 2002 Ecology conducted a statewide sampling effort to investigate the occurrence of toxic contaminants in edible fish tissue and surface water. Nine sites were sampled in May, June, and August including Peshastin Creek. Water samples were analyzed for 115 chlorinated, organophosphorus, and nitrogen pesticides. One detection of dialifor was found in Peshastin Creek.

DDT Contamination and Transport in the Lower Mission Creek Basin, Chelan County, Total Maximum Daily Load Assessment (Serdar and Era-Miller, 2004)

In 2003 Ecology conducted a TMDL study on Mission Creek for DDT and ancillary parameters. Orchard soils, bed sediments, suspended particulate matter, and surface water were sampled in Mission, Brender, and Yaksum Creeks. Results suggest that sediment re-suspension is the primary form of instream transport under a spring flow regime. Approximately 75% of the DDT in the water column is particle-bound. A recommendation in the TMDL included reducing total suspended solids by reducing bank erosion or by limiting transport of upland soils to streams.

Pesticide Monitoring in the Mission Creek Basin, Chelan County (Serdar and Era-Miller, 2002)

Ecology conducted pesticide monitoring at several sites on Mission Creek from April through October 2000. Several chlorinated insecticides, organophosphorus insecticides, and nitrogen herbicides were found in areas located within or downstream of agricultural and urban areas. DDT (and metabolites), endosulfan compounds, azinphos-methyl, and chlorpyrifos were detected in most samples. Methoxychlor, diazinon, dimethoate, bromacil, dichlobenil, and atrazine were detected much less frequently, generally in only one instance each. Concentrations of azinphos-methyl (0.001 – 0.043 µg/l), chlorpyrifos (0.001 – 0.047 µg/l), and DDT compounds (0.001 – 0.048 µg/l) were, at times, above criteria to protect aquatic life from chronic exposure. In addition, total DDT was above levels derived to protect human health from consumption of contaminated fish tissue.

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Appendix G. Pesticide Detection Summary Tables, 2006-2008.

Abbreviations used in Appendix G tables:

ALPQL = Average practical quantitation limit
US = upstream
DS = downstream
n = number
DET = detected
Freq = frequency
Max = maximum
ND = not detected

Table G-1. Summary of pesticide detections in Thornton Creek, 2006-2008. Concentrations reported as µg/L.

Chemical Name and Type	ALPQL	Site	2006			2007			2008		
			US n=12 DS n=24			US n=16 DS n=30			US n=13 DS n=27		
			# Det	Freq	Max	# Det	Freq	Max	# Det	Freq	Max
Diazinon	0.033	Upstream	ND			ND			2	15.4%	0.084
(Insecticide-Organophosphate)		Downstream	2	8.3%	0.076	ND			2	7.4%	0.130
Aldicarb	0.079	Upstream	1	8.3%	0.220	ND			ND		
(Insecticide-Carbamate)		Downstream	ND			ND			ND		
Carbaryl	0.030	Upstream	ND			3	18.8%	0.048	ND		
(Insecticide-Carbamate)		Downstream	ND			3	10.0%	0.039	ND		
Carbofuran	0.033	Upstream	ND			ND			ND		
(Insecticide-Carbamate)		Downstream	ND			1	3.3%	0.160	ND		
Methiocarb	0.046	Upstream	ND			ND			1	7.7%	0.017
(Insecticide-Carbamate)		Downstream	ND			ND			ND		
Methomyl	0.047	Upstream	ND			1	6.3%	0.170	1	7.7%	0.018
(Insecticide+Degradate-Carbamate)		Downstream	ND			1	3.3%	0.057	3	11.1%	0.120
Oxamyl (Vydate)	0.054	Upstream	ND			ND			ND		
(Insecticide-Carbamate)		Downstream	ND			1	3.3%	0.011	2	7.4%	0.165
Promecarb	0.050	Upstream	ND			1	6.3%	0.063	ND		
(Insecticide-Carbamate)		Downstream	ND			ND			ND		
Propoxur	0.048	Upstream	ND			1	6.3%	0.030	ND		
(Insecticide-Carbamate)		Downstream	ND			ND			ND		

Chemical Name and Type	ALPQL	Site	2006			2007			2008		
			US n=12 DS n=24			US n=16 DS n=30			US n=13 DS n=27		
			# Det	Freq	Max	# Det	Freq	Max	# Det	Freq	Max
Cis-Permethrin	0.050	Upstream	Laboratory Analysis for Cis-Permethrin began in 2007			1	6.3%	0.110	ND		
(Insecticide-Pyr)		Downstream				ND			ND		
1-Naphthol	0.056	Upstream	ND			1	6.3%	0.641	2	15.4%	0.330
(Degradate)		Downstream	ND			1	3.3%	0.072	5	18.6%	0.330
3-Hydroxycarbofuran	0.051	Upstream	ND			ND			2	15.4%	0.019
(Degradate)		Downstream	ND			ND			2	7.4%	0.035
4-Nitrophenol	0.068	Upstream	ND			ND			1	7.7%	0.270
(Degradate)		Downstream	ND			3	10.0%	0.780	2	7.4%	0.390
Oxamyl oxime	0.043	Upstream	ND			1	6.3%	0.013	ND		
(Degradate\Oxime)		Downstream	ND			4	13.3%	0.120	ND		
Pentachlorophenol	0.068	Upstream	1	8.3%	0.007	ND			ND		
(Wood Preservative)		Downstream	1	4.2%	0.008	ND			1	3.7%	0.016
2,4-D	0.068	Upstream	3	25.0%	0.030	2	12.5%	0.220	ND		
(Herbicide)		Downstream	5	20.8%	0.120	3	10.0%	0.150	4	14.8%	0.570
Dacthal (DCPA)	0.068	Upstream	ND			ND			ND		
(Herbicide)		Downstream	ND			1	3.3%	0.020	3	11.1%	0.050
Dicamba	0.068	Upstream	ND			ND			1	7.7%	0.010
(Herbicide)		Downstream	ND			ND			2	7.4%	0.022
Dichlobenil	0.033	Upstream	6	50.0%	0.020	8	50.0%	0.068	5	38.5%	0.160
(Herbicide)		Downstream	15	62.5%	0.031	20	66.7%	0.069	14	51.9%	0.047
Diuron	0.047	Upstream	ND			ND			ND		
(Herbicide)		Downstream	ND			1	3.3%	0.032	1	3.7%	0.040
Mecoprop (MCPP)	0.068	Upstream	2	16.7%	0.018	2	12.5%	0.076	2	15.4%	0.043
(Herbicide)		Downstream	2	8.3%	0.049	3	10.0%	0.069	3	11.1%	0.140
Pendimethalin	0.033	Upstream	1	8.3%	0.023	ND			ND		
(Herbicide)		Downstream	ND			ND			ND		
Prometon (Pramitol 5p)	0.033	Upstream	1	8.3%	0.018	2	12.5%	0.031	2	15.4%	0.048
(Herbicide)		Downstream	1	4.2%	0.039	5	16.7%	0.029	1	3.7%	0.030
Triclopyr	0.068	Upstream	2	16.7%	0.043	ND			ND		
(Herbicide)		Downstream	6	25.0%	0.097	ND			2	7.4%	0.053
Trifluralin (Treflan)	0.033	Upstream	ND			ND			ND		
(Herbicide)		Downstream	ND			1	3.3%	0.016	ND		

Table G-2. Summary of pesticide detections in Big Ditch, 2006-2008. Maximum concentrations in µg/L.

Pesticide Name and Type	ALPQL	Site	2006 n=29			2007 n=31			2008 n=27		
			# Det	Freq	Max	# Det	Freq	Max	# Det	Freq	Max
Insecticides											
Chlorpyrifos	0.033	Upstream				ND			ND		
(Organophosphate)		Downstream	2	6.9%	0.013	1	3.2%	0.020	1	3.7%	0.015
Diazinon	0.033	Upstream				1	3.2%	0.030	1	3.7%	0.032
(Organophosphate)		Downstream	2	6.9%	0.070	1	3.2%	0.052	1	3.7%	0.060
Dimethoate	0.033	Upstream				ND			ND		
(Organophosphate)		Downstream	ND			1	3.2%	0.077	ND		
Ethoprop	0.033	Upstream				1	3.2%	0.140	ND		
(Organophosphate)		Downstream	ND			1	3.2%	0.032	3	11.1%	0.058
Aldicarb	0.079	Upstream				1	3.2%	0.021	ND		
(Carbamate)		Downstream	ND			ND			ND		
Baygon (Propoxur)	0.048	Upstream				ND			ND		
(Carbamate)		Downstream	ND			ND			1	3.7%	0.015
Carbaryl	0.030	Upstream				ND			1	3.7%	0.024
(Carbamate)		Downstream	ND			ND			1	3.7%	0.014
Carbofuran	0.033	Upstream				1	3.2%	0.028	1	3.7%	0.023
(Carbamate)		Downstream	ND			ND			3	11.1%	0.100
Methiocarb	0.046	Upstream				ND			ND		
(Carbamate)		Downstream	ND			ND			1	3.7%	0.017
Methomyl	0.047	Upstream				ND			ND		
(Carbamate and Degradate)		Downstream	ND			ND			2	7.4%	0.058
Oxamyl (Vydate)	0.054	Upstream				1	3.2%	0.013	1	3.7%	0.190
(Carbamate)		Downstream	ND			1	3.2%	0.046	1	3.7%	0.019
Imidacloprid	0.020	Upstream	Laboratory added Imidacloprid analysis in 2008						20	74.1%	0.110
(Neonicotinoid)		Downstream							4	14.8%	0.018
Degradates											
1-Naphthol	0.056	Upstream				1	3.2%	0.220	3	11.1%	0.120
(Carbamate)		Downstream	1	3.4%	0.130	1	3.2%	0.057	2	7.4%	0.058
3-Hydroxycarbofuran	0.051	Upstream				2	6.5%	0.150	3	11.1%	0.340
(Carbamate		Downstream	ND			ND			1	3.7%	0.012

Pesticide Name and Type	ALPQL	Site	2006 n=29			2007 n=31			2008 n=27		
			# Det	Freq	Max	# Det	Freq	Max	# Det	Freq	Max
4-Nitrophenol	0.068	Upstream				2	6.5%	0.560	1	3.7%	0.092
(Multiple)		Downstream	ND			2	6.5%	0.081	ND		
Aldicarb Sulfone	0.068	Upstream				2	6.5%	0.510	4	14.8%	0.100
(Aldicarb)		Downstream	ND			ND			1	3.7%	0.055
Aldicarb Sulfoxide	0.036	Upstream				ND			2	7.4%	0.150
(Aldicarb)		Downstream	ND			ND			ND		
Methomyl Oxime	0.035	Upstream				1	3.2%	0.039	ND		
(Carbamate)		Downstream	ND			ND			ND		
Oxamyl oxime	0.043	Upstream				5	16.1%	0.068	ND		
(Oxamyl)		Downstream	ND			ND			ND		
Fungicides											
Chlorothalonil (Daconil)	0.033	Upstream				ND			ND		
(Fungicide)		Downstream	2	6.9%	0.019	ND			ND		
Metalaxyl	0.033	Upstream				10	32.3%	0.510	8	29.6%	0.225
(Fungicide)		Downstream	11	37.9%	0.130	5	16.1%	0.140	4	14.8%	0.039
Triadimefon	0.033	Upstream				1	3.2%	0.019	ND		
(Fungicide)		Downstream	ND			ND			ND		
Wood Preservative											
Pentachlorophenol	0.068	Upstream				ND			5	18.5%	0.053
(Wood Preservative)		Downstream	6	20.7%	0.022	ND			3	11.1%	0.023
Herbicides											
2,4-D	0.068	Upstream				7	22.6%	0.740	11	40.7%	0.690
(Herbicide)		Downstream	12	41.4%	0.240	2	6.5%	0.072	13	48.1%	0.700
Alachlor	0.033	Upstream				ND			ND		
(Herbicide)		Downstream	ND			1	3.2%	0.150	ND		
Atrazine	0.033	Upstream				ND			ND		
(Herbicide)		Downstream	7	24.1%	0.150	3	9.7%	0.084	1	3.7%	0.044
Baygon (Propoxur)	0.048	Upstream				ND			ND		
(Herbicide)		Downstream	ND			ND			1	3.7%	0.015
Bentazon	0.068	Upstream				ND			ND		
(Herbicide)		Downstream	9	31.0%	0.280	4	12.9%	0.087	16	59.3%	0.240

Pesticide Name and Type	ALPQL	Site	2006 n=29			2007 n=31			2008 n=27		
			# Det	Freq	Max	# Det	Freq	Max	# Det	Freq	Max
Bromacil	0.033	Upstream				17	54.8%	0.130	11	40.7%	0.280
(Herbicide)		Downstream	1	3.4%	0.040	4	12.9%	0.081	16	59.3%	0.360
Bromoxynil	0.068	Upstream				ND			ND		
(Herbicide)		Downstream	ND			ND			2	7.4%	0.090
Chlorpropham	0.033	Upstream				ND			ND		
(Herbicide)		Downstream	4	13.8%	2.25	ND			6	22.2%	5.60
Cycloate	0.033	Upstream				ND			ND		
(Herbicide)		Downstream	1	3.4%	0.017	ND			ND		
Dicamba [1]	0.068	Upstream				2	6.5%	0.040	5	18.5%	0.050
(Herbicide)		Downstream	1	3.4%	0.110	ND			6	22.2%	0.084
Dichlobenil	0.033	Upstream				16	51.6%	0.059	14	51.9%	0.360
(Herbicide)		Downstream	11	37.9%	0.041	4	12.9%	0.047	7	25.9%	0.076
Diuron	0.047	Upstream				ND			15	55.6%	0.580
(Herbicide)		Downstream	5	17.2%	0.140	11	35.5%	0.160	12	44.4%	0.959
Eptam	0.033	Upstream				1	3.2%	0.170	1	3.7%	0.046
(Herbicide)		Downstream	13	44.8%	0.470	7	22.6%	0.250	6	22.2%	0.180
Hexazinone	0.060	Upstream				ND			ND		
(Herbicide)		Downstream	ND			ND			1	3.7%	0.081
Linuron	0.058	Upstream				1	3.2%	0.054	ND		
(Herbicide)		Downstream	ND			ND			ND		
MCPA	0.068	Upstream							3	11.1%	0.190
(Herbicide)		Downstream	6	20.7%	0.180	ND			7	25.9%	0.670
MCPP (Mecoprop)	0.068	Upstream				3	9.7%	0.300	4	14.8%	0.130
(Herbicide)		Downstream	6	20.7%	0.046	ND			3	11.1%	0.061
Metolachlor	0.033	Upstream				ND			3	11.1%	0.018
(Herbicide)		Downstream	10	34.5%	0.110	5	16.1%	0.048	17	63.0%	31.0
Metribuzin	0.033	Upstream				ND			ND		
(Herbicide)		Downstream	3	10.3%	0.230	2	6.5%	0.024	3	11.1%	0.140
Picloram	0.068	Upstream				22	71.0%	0.580	15		0.350

Pesticide Name and Type	ALPQL	Site	2006 n=29			2007 n=31			2008 n=27		
			# Det	Freq	Max	# Det	Freq	Max	# Det	Freq	Max
Herbicide		Downstream	ND			1	3.2%	0.110	ND		
Prometon (Pramitol 5p)	0.033	Upstream				12	38.7%	0.120	5	18.5%	0.110
(Herbicide)		Downstream	1	3.4%	0.010	2	6.5%	0.024	ND		
Tebuthiuron	0.036	Upstream				20	64.5%	0.220	12	44.4%	0.135
Herbicide)		Downstream	3	10.3%	0.029	ND			ND		
Triclopyr	0.068	Upstream				ND			6	22.2%	0.420
(Herbicide)		Downstream	7	24.1%	0.220	ND			6	22.2%	0.120

Results as reported by Manchester Environmental Laboratory.
--Test for pesticide yielded no detections.
[1]Average Lower Practical Quantitation Limit.

Table G-3. Summary of pesticide detections in Indian Slough, 2006-2008. Maximum concentrations in µg/L.

Pesticide Name and Type	ALPQL	2006 n=29			2007 n=31			2008 n=27		
		# Det	Freq	Max	# Det	Freq	Max	# Det	Freq	Max
Insecticides										
Diazinon (Organophosphate)	0.033	1	3.4%	0.024	1	3.2%	0.034	2	7.4%	0.067
Aldicarb (Carbamate)	0.079	ND			1	3.2%	0.027	ND		
Carbaryl (Carbamate)	0.030	1	3.4%	0.077	ND			1	3.7%	0.120
Methomyl (Carbamate and Degradate)	0.047	ND			ND			2	7.4%	0.048
Fungicide										
Metalaxyl	0.033	1	3.4%	0.034	ND			ND		
Degradate Compounds										
1-Naphthol (Carbamate)	0.056	ND			ND			4	14.8%	0.170
3-Hydroxycarbofuran (Carbamate)	0.051	ND			ND			4	14.8%	0.130
4-Nitrophenol (multiple)	0.068	ND			1	3.2%	0.061	ND		
Oxamyl oxime (Carbamate-Oxime)	0.043	ND			ND			1	3.7%	0.015
Wood Preservative										
Pentachlorophenol	0.068	6	20.7%	0.019	ND			1	3.7%	0.022
Herbicides										
2,4-D	0.068	16	55.2%	0.430	6	19.4%	0.260	14	51.9%	1.65
Alachlor	0.033	ND			1	3.2%	0.022	ND		
Bentazon	0.068	10	34.5%	0.053	5	16.1%	0.038	3	11.1%	0.040
Bromacil	0.033	1	3.4%	0.110	2	6.5%	0.110	19	70.4%	0.750
Chlorpropham	0.033	ND			ND			1	3.7%	0.042
Clopyralid	0.063	ND			ND			1	3.7%	0.032
Cycloate	0.033	ND			ND			1	3.7%	0.160
Dicamba I	0.068	1	3.4%	0.012	ND			7	25.9%	0.043
Dichlobenil	0.033	14	48.3%	0.130	8	25.8%	0.037	10	37.0%	0.090
Diphenamid	0.033	21	72.4%	0.024	19	61.3%	0.033	12	44.4%	0.023

Pesticide Name and Type	ALPQL	2006 n=29			2007 n=31			2008 n=27		
		# Det	Freq	Max	# Det	Freq	Max	# Det	Freq	Max
Diuron	0.047	3	10.3%	0.096	4	12.9%	0.060	11	40.7%	1.400
Eptam	0.033	1	3.4%	0.024	ND			ND		
Hexazinone	0.060	ND			ND			5	18.5%	0.120
MCPA	0.068	2	6.9%	0.110	ND			2	7.4%	0.074
MCPP (Mecoprop)	0.068	5	17.2%	0.036	ND			4	14.8%	0.075
Metolachlor	0.033	6	20.7%	0.020	12	38.7%	0.052	10	37.0%	0.130
Napropamide	0.060	1	3.4%	0.018	ND			2	7.4%	0.240
Oxyfluorfen	0.033	ND			1	3.2%	0.034	ND		
Prometon (Pramitol 5p)	0.033	5	17.2%	0.036	ND			5	18.5%	0.053
Simazine	0.033	1	3.4%	0.035	1	3.2%	0.008	6	22.2%	0.380
Tebuthiuron	0.036	9	31.0%	0.310	21	67.7%	0.150	12	44.4%	0.094
Treflan (Trifluralin)	0.033	ND			1	3.2%	0.017	ND		
Triclopyr	0.068	13	44.8%	0.730	ND			12	44.4%	1.3

Table G-4. Summary of pesticide detections in Browns Slough, 2006-2008. Maximum concentrations in µg/L.

Pesticide Name and Type	ALPQL	2006 n=29			2007 n=31			2008 n=27		
		# Det	Freq	Max	# Det	Freq	Max	# Det	Freq	Max
Insecticides										
Chlorpyriphos (Organophosphate)	0.033	ND			2	6.5%	0.038	2	7.4%	0.016
Diazinon (Organophosphate)	0.033	ND			5	16.1%	0.700	2	7.4%	0.019
Dimethoate (Organophosphate)	0.033	ND			1	3.2%	0.430	1	3.7%	0.075
Carbaryl (Carbamate)	0.030	ND			1	3.2%	0.013	ND		
Carbofuran (Carbamate)	0.033	ND			1	3.2%	0.080	ND		
Methomyl (Carbamate and Degradate)	0.047	ND			2	6.5%	0.018	1	3.7%	0.015
Oxamyl (Carbamate)	0.054	ND			5	16.1%	0.140	1	3.7%	0.041
Imidacloprid (Neonicotinoid)	0.020	Laboratory added Imidacloprid analysis in 2008						4	14.8%	0.037
Fungicide										
Metalaxyl	0.033	3	10.3%	0.12	1	3.2%	0.037	1	3.7%	0.028
Degradate Compounds										
1-Naphthol (Carbamate)	0.056	1	3.4%	0.084	ND			4	14.8%	0.190
4-Nitrophenol (multiple)	0.068	ND			4	12.9%	0.120	1	3.7%	0.044
Aldicarb Sulfoxide (Carbamate)	0.036	ND			1	3.2%	0.030	1	3.7%	0.057
Endosulfan sulfate	0.033	ND			1	3.2%	0.025	ND		
Wood Preservative										
Pentachlorophenol	0.068	2		0.017	ND			ND		
Herbicides										
2,4-D	0.068	10	34.5%	0.100	4	12.9%	0.190	5	18.5%	0.190
Atrazine	0.033	1	3.4%	0.037	3	9.7%	0.110	ND		

Pesticide Name and Type	ALPQL	2006 n=29			2007 n=31			2008 n=27		
		# Det	Freq	Max	# Det	Freq	Max	# Det	Freq	Max
Bentazon	0.068	11	37.9%	0.190	8	25.8%	0.140	8	29.6%	0.080
Bromoxynil	0.068	ND			1	3.2%	0.640	ND		
Chlorpropham	0.033	1	3.4%	0.012	ND			ND		
Cycloate	0.033	3	10.3%	1.2	ND			ND		
Dacthal (DCPA)	0.068	ND			6	19.4%	0.220	14	51.9%	0.550
Dicamba I	0.068	ND			4	12.9%	0.086	ND		
Dichlobenil	0.033	1	3.4%	0.003	3	9.7%	0.034	2	7.4%	0.008
Diuron	0.047	5	17.2%	0.096	15	48.4%	4.1	ND		
Eptam	0.033	9	31.0%	1.8	6	19.4%	0.240	5	18.5%	0.990
MCPA	0.068	ND			2	6.5%	0.480	1	3.7%	0.210
Metolachlor	0.033	1	3.4%	0.014	ND			8	29.6%	0.590
Metribuzin	0.033	1	3.4%	0.009	1	3.2%	0.058	2	7.4%	0.033
Norflurazon	0.033	ND			1	3.2%	0.040	ND		
Simazine	0.033	11	37.9%	1.6	7	22.6%	0.190	5	18.5%	0.210
Tebuthiuron	0.036	ND			1	3.2%	0.069	ND		
Terbacil	0.033	ND			ND			6	22.2%	0.200
Treflan (Trifluralin)	0.033	2	6.9%	0.015	2	22.6%	0.031	ND		
Triclopyr	0.068	7	24.1%	0.070	ND			ND		

Table G-5. Summary of pesticide detections in Samish River, 2006-2008. Maximum concentrations in µg/L.

Pesticide Name and Type	ALPQL	Site	2006 n=29			2007 n=31			2008 n=27		
			# Det	Freq	Max	# Det	Freq	Max	# Det	Freq	Max
Carbaryl	0.030	Upstream	ND								
(Insecticide-Carbamate)		Downstream	ND			1	3.2%	0.011	ND		
Oxamyl (Vydate)	0.054	Upstream	ND								
(Insecticide-Carbamate)		Downstream	ND			1	3.2%	0.015	ND		
Chlorothalonil (Daconil)	0.033	Upstream	ND								
(Fungicide)		Downstream	ND			ND			1	3.7%	0.024
1-Naphthol	0.056	Upstream	ND								
(Degradate-Carbamate)		Downstream	ND			ND			3	11.1%	0.110
4-Nitrophenol	0.068	Upstream	1	3.4%	0.038						
(Degradate-Multiple)		Downstream	ND			ND			1	3.7%	0.044
Pentachlorophenol	0.068	Upstream	1		0.001						
(Wood Preservative)		Downstream	ND			ND			ND		
2,4-D	0.068	Upstream	2	6.9%	0.160						
(Herbicide)		Downstream	3	10.3%	0.120	ND			4	14.8%	0.400
Bromacil	0.033	Upstream	ND								
(Herbicide)		Downstream	ND			9	29.0%	0.150	ND		
Dicamba I	0.068	Upstream	ND								
(Herbicide)		Downstream	1	3.4%	0.029	ND			2	7.4%	0.034
Diuron	0.047	Upstream	ND								
Herbicide		Downstream	ND			1	3.2%	0.061	ND		
Hexazinone	0.060	Upstream	ND								
(Herbicide)		Downstream	ND			ND			1	3.7%	0.070
Linuron	0.058	Upstream	1	3.4%	0.030						
(Herbicide)		Downstream	ND			ND			ND		

Table G-6. Summary of pesticide detections in Spring Creek, 2006-2008. Maximum concentrations in µg/L.

Pesticide Name and Type	ALPQL[1]	Site	2006 Upstream=12 Downstream=24			2007 Upstream=16 Downstream=31			2008 Upstream=14 Downstream=27		
			#Det	Freq	Max	#Det	Freq	Max	#Det	Freq	Max
Insecticides											
Endosulfan II	0.06	Upstream	ND			ND			ND		
(Organochlorine)		Downstream	ND			ND			1	4%	0.036
Azinphos Methyl	0.033	Upstream	2	17%	0.120	1	6%	0.079	ND		
(Organophosphate		Downstream	3	13%	0.091	2	6%	0.048	ND		
Chlorpyrifos	0.033	Upstream	4	33%	0.034	3	19%	0.030	3	21%	0.025
(Organophosphate		Downstream	7	29%	0.060	6	19%	0.270	4	15%	0.120
Diazinon	0.033	Upstream	1	8%	0.010	ND			2	14%	0.022
(Organophosphate		Downstream	1	4%	0.012	1	3%	0.015	3	11%	0.090
Malathion	0.033	Upstream	1	8%	0.013	ND			ND		
(Organophosphate		Downstream	1	4%	0.017	1	3%	0.016	ND		
Aldicarb	0.079	Upstream	1	8%	0.160	ND			ND		
(Carbamate		Downstream	1	4%	0.065	1	3%	0.034	ND		
Carbaryl	0.03	Upstream	ND			1	6%	0.027	ND		
(Carbamate		Downstream	1	4%	1.260	2	6%	0.028	ND		
Methiocarb	0.046	Upstream	ND			ND			ND		
(Carbamate		Downstream	ND			1	3%	0.016	ND		
Oxamyl	0.054	Upstream	ND			2	13%	0.026	ND		
(Carbamate		Downstream	ND			1	3%	0.089	ND		
Promecarb	0.05	Upstream	ND			ND			ND		
(Carbamate		Downstream	ND			1	3%	0.015	ND		
Degradates											
4,4'-DDE	0.033	Upstream	1	8%	0.003	1	6%	0.010	ND		
Organochlorine		Downstream	ND			1	3%	0.010	ND		

Pesticide Name and Type	ALPQL[1]	Site	2006 Upstream=12 Downstream=24			2007 Upstream=16 Downstream=31			2008 Upstream=14 Downstream=27		
			#Det	Freq	Max	#Det	Freq	Max	#Det	Freq	Max
Endosulfan Sulfate	0.033	Upstream	ND			ND			ND		
(Organochlorine		Downstream	ND			1	3%	0.033	ND		
1-Naphthol	0.056	Upstream	1	8%	0.100	ND			3	21%	0.060
(Carbamate		Downstream	ND			ND			2	7%	0.220
Aldicarb Sulfone	0.068	Upstream	1	8%	0.130	ND			ND		
(Carbamate		Downstream	ND			ND			ND		
Aldicarb Sulfoxide	0.036	Upstream	ND			ND			ND		
(Carbamate		Downstream	ND			ND			1	4%	0.033
Oxamyl oxime	0.043	Upstream	ND			ND			ND		
(Carbamate		Downstream	ND			1	3%	0.013	ND		
Fungicide											
Hexachlorobenzene	0.033	Upstream	ND			ND			ND		
		Downstream	ND			1	3%	0.016	ND		
Wood Preservative											
Pentachlorophenol	0.068	Upstream							3	21%	0.021
		Downstream	1	4%	0.044				3	11%	0.031
Herbicides											
2,4-D	0.068	Upstream	4	33%	0.120	4	25%	0.330	6	43%	0.230
		Downstream	13	54%	0.870	7	23%	6.570	14	52%	0.490
Atrazine	0.033	Upstream	10	83%	0.015	7	44%	0.030	8	57%	0.020
		Downstream	17	71%	0.017	14	45%	0.034	14	52%	0.020
Bentazon	0.068	Upstream	4	33%	0.036	4	25%	0.060	4	29%	0.048
		Downstream	2	8%	0.029	1	3%	0.048	3	11%	0.037
Bromacil	0.033	Upstream	3	25%	0.022	ND			ND		
		Downstream	8	33%	0.045	10	32%	0.069	8	30%	0.190

Pesticide Name and Type	ALPQL[1]	Site	2006 Upstream=12 Downstream=24			2007 Upstream=16 Downstream=31			2008 Upstream=14 Downstream=27		
			#Det	Freq	Max	#Det	Freq	Max	#Det	Freq	Max
Dicamba I	0.068	Upstream	ND			1	6%	0.014	2	14%	0.033
		Downstream	ND			2	6%	0.015	5	19%	0.036
Diuron	0.047	Upstream	ND			ND			ND		
		Downstream	1	4%	0.022	3	10%	0.081	ND		
MCPA	0.068	Upstream	ND			1	6%	0.040	ND		
		Downstream	ND			1	3%	0.140	ND		
Norflurazon	0.033	Upstream	6	50%	0.055	1	6%	0.024	1	7%	0.014
		Downstream	7	29%	0.057	ND			3	11%	0.025
Oryzalin	0.099	Upstream	ND			1	6%	0.440	ND		
		Downstream	ND			ND			ND		
Prometon	0.033	Upstream	ND			ND			ND		
		Downstream	ND			2	6%	0.055	1	4%	0.016
Simazine	0.033	Upstream	10	83%	0.160	ND			ND		
		Downstream	21	88%	0.160	2	6%	0.031	1	4%	0.014
Terbacil	0.033	Upstream	ND			1	6%	0.032	ND		
		Downstream	1	4%	0.028	ND			ND		
Trifluralin	0.033	Upstream	ND			ND			ND		
		Downstream	1	4%	0.014	ND			1	4%	0.033

Table G-7. Summary of pesticide detections in Marion Drain, 2006-2008. Maximum concentrations in µg/L.

Chemical Name and Type	ALPQL	2006 n = 31			2007 n = 56			2008 n = 34		
		#Det	Freq	Max	#Det	Freq	Max	#Det	Freq	Max
Insecticides										
Chlorpyriphos (Organophosphate)	0.033	21	68%	0.120	29	52%	0.120	11	32%	0.024
Disulfoton sulfone (Organophosphate)	0.099	ND			3	5%	0.039	1	4%	0.023
Ethoprop (Organophosphate)	0.033	2	6%	0.022	2	4%	0.036	ND		
Malathion (Organophosphate)	0.033	4	13%	0.024	6	11%	0.082	2	6%	0.015
Carbaryl (Carbamate)	0.036	2	8%	0.090	7	14%	0.035	ND		
Methomyl (Carbamate and Degradate)	0.044	ND			1	2%	0.050	1	4%	0.014
Oxamyl (Carbamate)	0.042	ND			3	6%	0.048	ND		
Propargite (Sulfite ester)	0.033	ND			1	2%	0.043	ND		
Fungicide										
Fenarimol	0.033	ND			ND			1	4%	0.038
Degradate Compounds										
1-Naphthol (Carbamate)	0.053	ND			ND			4	15%	0.16
Endrin Aldehyde (Organochlorine)	0.05	ND			ND			1	4%	0.027
Oxamyl oxime (Carbamate)	0.017	ND			4	8%	0.033	ND		
Wood Preservative										
Pentachlorophenol	0.063	ND			ND			1	4%	0.015
Herbicides										
2,4-D	0.068	13	54%	0.530	9	18%	0.500	15	56%	0.140
Alachlor	0.032	4	13%	0.110	ND			ND		
Atrazine	0.033	19	61%	0.078	28	50%	0.036	3	11%	0.021
Bentazon	0.068	7	29%	0.270	16	33%	0.170	16	59%	0.140

Chemical Name and Type	ALPQL	2006 n = 31			2007 n = 56			2008 n = 34		
		#Det	Freq	Max	#Det	Freq	Max	#Det	Freq	Max
Bromoxynil	0.071	2	8%	0.066	ND			7	26%	0.084
Clopyralid	0.062	ND			6	12%	0.065	ND		
Dicamba I	0.062	ND			16	33%	0.061	15	56%	0.032
Diuron	0.057	2	8%	0.110	5	9%	0.047	ND		
Eptam	0.033	2	6%	0.022	8	14%	0.071	1	4%	0.041
MCPA	0.068	3	13%	0.033	10	20%	0.130	1	4%	0.031
Metolachlor	0.033	8	26%	0.033	4	7%	0.210	ND		
Metribuzin	0.032	1	3%	0.049	ND			ND		
Pendimethalin	0.033	5	16%	0.061	27	48%	0.098	11	41%	0.078
Simazine	0.033	2	6%	0.018	4	7%	0.033	ND		
Terbacil	0.033	26	84%	0.680	43	77%	0.490	24	71%	0.510
Trifluralin	0.033	10	32%	0.034	21	38%	0.047	7	26%	0.023

Table G-8. Summary of pesticide detections in Sulphur Creek Wasteway, 2006-2008. Maximum concentrations in µg/L.

Chemical Name and Type	ALPQL	2006 n = 24			2007 n = 31			2008 n = 27		
		#Det	Freq	Max	#Det	Freq	Max	#Det	Freq	Max
Insecticides										
Azinphos Methyl (Organophosphate)	0.032	3	13%	0.037	ND			ND		
Chlorpyriphos (Organophosphate)	0.033	7	29%	0.100	4	13%	0.170	1	4%	0.026
Diazinon (Organophosphate)	0.032	2	8%	0.010	ND			ND		
Dimethoate (Organophosphate)	0.033	1	4%	0.450	1	3%	0.049	ND		
Malathion (Organophosphate)	0.033	ND			2	6%	0.021	ND		
Aldicarb (Carbamate)	0.063	1	4%	0.070	ND			ND		
Carbaryl (Carbamate)	0.018	ND			13	42%	0.208	4	15%	0.023
Imidacloprid (Neonicotinoid)	0.02	Laboratory added Imidacloprid analysis in 2008						1	4%	0.028
Degradate Compounds										
1-Naphthol (Carbamate)	0.052	ND			1	3%	0.013	1	4%	0.022
4,4'-DDE (Organochlorine)	0.033	2	8%	0.005	3	10%	0.010	ND		
Aldicarb Sulfone (Carbmate)	0.094	1	4%	0.130	ND			ND		
Oxamyl oxime (Carbamate)	0.017	ND			2	6%	0.022	ND		
Wood Preservative										
Pentachlorophenol	0.063	ND			ND			2	8%	0.030
Herbicides										
2,4-D	0.068	18	75%	1.24	12	39%	0.220	19	73%	0.570
Atrazine	0.033	10	42%	0.016	10	32%	0.050	9	33%	0.063
Bentazon	0.071	3	13%	0.100	ND			5	19%	0.056

Chemical Name and Type	ALPQL	2006 n = 24			2007 n = 31			2008 n = 27		
		#Det	Freq	Max	#Det	Freq	Max	#Det	Freq	Max
Bromacil	0.033	4	17%	0.041	20	65%	0.160	5	19%	0.047
Chlorpropham	0.033	ND			ND			5	19%	0.063
DCPA	0.062	ND			12	39%	0.079	8	31%	0.140
Dicamba I	0.062	ND			5	16%	0.039	15	58%	0.037
Dichlobenil	0.033	1	4%	0.004	4	13%	0.034	2	7%	0.016
Diuron	0.055	4	17%	0.056	13	42%	0.270	2	7%	0.120
MCPA	0.062	ND			2	6%	0.038	2	8%	0.052
Norflurazon	0.033	3	13%	0.130	3	10%	0.083	1	4%	0.024
Pendimethalin	0.033	ND			1	3%	0.046	ND		
Prometon	0.033	1	4%	0.015	1	3%	0.061	1	4%	0.019
Simazine	0.033	1	4%	0.027	3	10%	0.045	ND		
Terbacil	0.033	7	29%	0.035	7	23%	0.064	4	15%	0.041
Trifluralin	0.033	3	13%	0.015	5	16%	0.028	3	11%	0.035

Table G-9. Summary of pesticide detections in Peshastin Creek, 2007-2008. Maximum concentrations in µg/L.

Pesticide Name and Type	ALPQL	2007 n=31			2008 n=27		
		# Det	Freq	Max	# Det	Freq	Max
Insecticides							
Azinphos-methyl (Organophosphate)	0.033	1	3.2%	0.024	ND		
Endosulfan I (Organochlorine)	0.050	ND			1	3.7%	0.130
Endosulfan II (Organochlorine)	0.050	ND			1	3.7%	0.046
Carbaryl (Carbamate)	0.019	1	3.2%	0.019	ND		
Methomyl (Carbamate and Degradate)	0.044	1	3.2%	0.023	ND		
Oxamyl (Carbamate)	0.046	1	3.2%	0.026	1	3.7%	0.010
Degradate Compounds							
1-Naphthol (Carbamate)	0.052	1	3.2%	0.010	2	7.4%	0.073
Aldicarb Sulfone (Carbamate)	0.055	ND			1	3.7%	0.120
Oxamyl Oxime (Carbamate)	0.019	1	3.2%	0.012	ND		

Table G-10. Summary of pesticide detections in Mission Creek, 2007-2008. Maximum concentrations in µg/L.

Pesticide Name and Type	ALPQL	2007 n=31			2008 n=27		
		# Det	Freq	Max	# Det	Freq	Max
Insecticides							
Chlorpyrifos (Organophosphate)	0.033	1	3.2%	0.024	ND		
Endosulfan I (Organochlorine)	0.050	1	3.2%	0.017	1	3.7%	0.047
Endosulfan II (Organochlorine)	0.050	1	3.2%	0.022	ND		
Carbaryl (Carbamate)	0.019	ND			1	3.7%	0.014
Methiocarb (Carbamate)	0.019	2	6.5%	0.034	ND		
Methomyl (Carbamate and Degradate)	0.044	1	3.2%	0.019	ND		
Degradate Compounds							
Aldicarb Sulfone (Carbamate)	0.055	ND			1	3.7%	0.028
Oxamyl Oxime (Carbamate)	0.019	2	6.5%	0.018	ND		
Herbicides							
Norflurazon	0.033	2	6.5%	0.041	4	14.8%	0.034
Simazine	0.033	ND			1	3.7%	0.019

Table G-11. Summary of pesticide detections in Brender Creek, 2007-2008. Maximum concentrations in µg/L.

Pesticide Name and Type	ALPQL	2007 n=31			2008 n=27		
	2007-08	# Det	Freq	Max	# Det	Freq	Max
Insecticides							
4,4'-DDT (Organochlorine)	0.033	28	90.3%	0.050	26	96.3%	0.300
2,4'-DDT (Organochlorine)	0.033	7	22.6%	0.017	2	7.4%	0.053
Azinphos-methyl (Organophosphate)	0.033	4	12.9%	0.530	ND		
Chlorpyriphos (Organophosphate)	0.033	10	32.3%	0.110	5	18.5%	0.028
Diazinon (Organophosphate)	0.033	1	3.2%	0.021	ND		
Endosulfan I (Organochlorine)	0.050	8	25.8%	0.100	5	18.5%	0.089
Endosulfan II (Organochlorine)	0.050	8	25.8%	0.074	8	29.6%	0.120
Carbaryl (Carbamate)	0.019	4	12.9%	0.040	1	3.7%	0.024
Methomyl (Carbamate and Degradate)	0.044	1	3.2%	0.017	ND		
Oxamyl (Carbamate)	0.046	1	3.2%	0.027	ND		
Imidacloprid (Neonicotinoid)	0.020	Lab added in 2008			2	7.4%	0.060
Degradate Compounds							
4,4'-DDE (Organochlorine)	0.033	31	100.0%	0.071	22	81.5%	0.045
4,4'-DDD (Organochlorine)	0.033	17	54.8%	0.025	20	74.1%	0.025
2,4'-DDD (Organochlorine)	0.033	2	6.5%	0.018	1	3.7%	0.015
Endosulfan Sulfate (Organochlorine)	0.033	18	58.1%	0.100	24	88.9%	0.160
1-Naphthol (Carbamate)	0.052	1	3.2%	0.011	1	3.7%	0.049
Oxamyl oxime (Carbamate)	0.019	ND			1	3.7%	0.140
Fungicide							
Triadimefon	0.033	1	3.2%	0.015	ND		
Herbicides							
Dichlobenil	0.033	ND			1	3.7%	0.008
Diuron	0.055	1	3.2%	0.120	1	3.7%	0.036
MCPA	0.063	1	3.2%	0.072	ND		
Norflurazon	0.033	10	32.3%	0.160	10	37.0%	0.250
Prometon (Pramitol 5p)	0.033	1	3.2%	0.009	ND		
Simazine	0.033	2	6.5%	0.028	1	3.7%	0.012

Table G-12. Summary of pesticide detections in the Wenatchee River.
Maximum concentrations in µg/L.

Pesticide Name and Type	ALPQL 2007-08	2007 n=31			2008 n=27		
		# Det	Freq	Max	# Det	Freq	Max
Insecticides							
Chlorpyrifos (Organophosphate)	0.033	1	3.2%	0.035	ND		
Endosulfan I (Organochlorine)	0.050	1	3.2%	0.014	2	7.4%	0.079
Endosulfan II (Organochlorine)	0.050	ND			2	7.4%	0.076
Methomyl (Carbamate and Degradate)	0.044	1	3.2%	0.016	ND		
Oxamyl (Carbamate)	0.046	1	3.2%	0.016	ND		
Imidacloprid (Neonicotinoid)	0.020	Lab added in 2008			1	3.7%	0.028
Degradate Compounds							
1-Naphthol (Carbamate)	0.052	ND			4	12.9%	0.130
Aldicarb Sulfoxide (Carbamate)	0.019	ND			1	3.2%	0.045

Table G-13. Summary of pesticide detections in the Entiat River.
Maximum concentrations in µg/L.

Pesticide Name and Type	ALPQL 2007-08	2007 n=31			2008 n=27		
		# Det	Freq	Max	# Det	Freq	Max
Insecticides							
Chlorpyrifos (Organophosphate)	0.033	1	3.2%	0.034	ND		
Carbaryl (Carbamate)	0.019	1	3.2%	0.016	ND		
Degradate Compounds							
1-Naphthol (Carbamate)	0.052	ND			2	7.4%	0.082
3-Hydroxycarbofuran (Carbamate)	0.045	ND			1	3.7%	0.014
Oxamyl Oxime (Carbamate)	0.019	ND			ND		
Herbicides							
Dichlobenil	0.033	1	3.2%	0.065	ND		

Appendix H. Pesticide Calendars

To determine if water quality concentrations were healthy for aquatic life, monitoring data were compared to pesticide registration toxicity criteria, and EPA National Recommended Water Quality Criteria (NRWQC), referred to as *assessment criteria*. Data were also compared to the Washington State numeric water quality standards, referred to as *water quality standards*. Refer to Appendix E, *Assessment Criteria and Water Quality Standards*, in this report for information on assessment criteria development.

Table H-1 presents the color codes used to compare detected pesticide concentrations to assessment criteria.

Table H-1. Color codes for comparison to assessment criteria in the pesticide calendars.

	Each square represents the period when a sample was taken. If blank, no pesticide residue was detected.
	Analysis not completed.
	Pesticide residue detected. Assessment criteria not available.
	Detection of pesticide residue, concentration below regulatory or toxicological criteria.
	Magnitude of detection above water quality standard.
	Magnitude of detection above chronic or acute invertebrate criteria.
	Magnitude of detection above chronic fish criteria.
	Magnitude of detection above Endangered Species Level of Concern for fish, which is 1/20th of the acute toxicity criteria.

[1] EPA = United States Environmental Protection Agency.
[2] WAC = Washington Administrative Code.
[3] NRWQC = EPA's National Recommended Water Quality Criteria.
[4] ESLOC = Endangered Species Level of Concern.

Detection of a pesticide concentration above an assessment criterion does not indicate an exceedance of the regulatory criteria. The temporal component of the criteria must also be exceeded. WSDA advises pesticide-user groups and other stakeholders on the results of this study and determines if assessment criteria are exceeded. If an exceedance is determined, WSDA advises stakeholders of appropriate measures to reduce pesticide concentrations.

For additional information on pesticide assessment criteria, contact the Washington State Department of Agriculture, Natural Resources Assessment Section, toll free at (877) 301-4555, #6 or (360) 902-2067, e-mail: nras@agr.wa.gov Web site: http://agr.wa.gov/PestFert/natresources/SWM/.

Thornton Creek WRIA 8

Thornton Creek

A total of 23 pesticides and degradates were detected in Thornton Creek from 2006 to 2008. Of these, 18 of these were detected in the upper Thornton Creek site, and 18 were detected in the lower Thornton Creek site.

In April 2007, a single detection of cis-permethrin at the upstream site was above EPA's acute and chronic registration criteria for invertebrates. No other detections were above criteria or standards.

Comparison of Upper Thornton Creek to Lower Thornton Creek, 2006-2008

From 2006 to 2008, the upper site on Thornton Creek was sampled biweekly, and the lower site was sampled weekly. Dichlobenil, MCPP, and prometon were detected at both sites in all three years. 2,4-D and methomyl were detected at both sites in two of the three sample years.

Five compounds were detected only at the upper site: aldicarb, cis-permethrin, methiocarb, pendimethalin, and propoxur.

Five compounds were detected only at the lower site: carbofuran, DCPA, diuron, oxamyl, and trifluralin.

Table H-2. Upper Thornton Creek, 2006.

Month	April		May			June		July		August		September
Calendar Week	14	16	18	20	22	24	26	28	30	32	34	36
2,4-D		0.016	0.030		0.024							
Aldicarb						0.220						
Dichlobenil		0.020	0.016	0.007	0.011		0.003				0.006	
MCPP			0.018		0.012							
Pendimethalin		0.023										
Pentachlorophenol							0.007					
Prometon			0.018									
Triclopyr			0.024		0.043							

Table H-3. Lower Thornton Creek, 2006.

Month	April				May					June				July				August					September	
Calendar Week	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D			0.024		0.077			0.120	0.022		0.028													
Diazinon	0.018	0.076																						
Dichlobenil		0.002		0.011	0.031	0.006	0.009	0.027	0.016	0.016	0.014	0.006	0.007	0.005	0.004						0.007	0.009		
MCPP					0.036			0.049																
Pentachlorophenol													0.008											
Prometon					0.039																			
Triclopyr			0.025		0.052	0.025		0.097	0.046	0.021														

Table H-4. Upper Thornton Creek, 2007.

Month	February		March		April		May		June		July		August			September
Calendar Week	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37
2,4-D					0.220			0.120								
Carbaryl	0.028	0.048	0.020													
cis-Permethrin						0.110										
Dichlobenil		0.017						0.023	0.009	0.009	0.043	0.068			0.010	0.009
MCPP					0.076			0.068								
Methomyl						0.170										
Oxamyl oxime						0.013										
Prometon	0.022	0.031														
Propoxur						0.030										

Table H-5. Lower Thornton Creek, 2007.

Month	February			March				April				May					June				July				August					September	
Calendar Week	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D															0.150					0.120									0.130		
4-Nitrophenol	0.080		0.120							0.780																					
Carbaryl	0.020		0.039		0.019																										
Carbofuran																										0.160					
DCPA													0.020																		
Dichlobenil		0.019	0.023	0.014		0.034		0.017	0.052	0.060					0.055		0.009	0.010	0.016	0.019	0.042	0.044	0.069	0.037	0.033	0.067	0.065	0.022	0.013		
Diuron								0.032																							
MCPP															0.069					0.061									0.045		
Methomyl											0.057																				
Oxamyl																												0.011			
Oxamyl oxime					0.011																					0.120	0.017			0.037	
Prometon					0.019		0.029	0.025							0.019																0.026
Trifluralin						0.016																									

Table H-6. Upper Thornton Creek, 2008.

Month	March		April		May		June		July			August		September
Calendar Week	11	13	15	17	19	21	23	25	27	29	31	33	35	37
3-Hydroxycarbofuran							0.019							
4-Nitrophenol				0.270										
Diazinon				0.069		0.084								
Dicamba I							0.010							
Dichlobenil							0.160	0.015		0.006	0.003		0.015	
MCPP							0.043						0.027	
Methiocarb														0.017
Methomyl							0.018							
Prometon		0.016				0.048								

Table H-7. Lower Thornton Creek, 2008.

Month	March				April				May				June				July					August				September	
Calendar Week	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D								0.570					0.089					0.038									0.027
3-Hydroxycarbofuran								0.050					0.035												0.018		
4-Nitrophenol							0.260	0.390																			
DCPA																0.022			0.050	0.048							
Diazinon							0.130	0.110																			
Dicamba I								0.022					0.012														
Dichlobenil				0.020				0.110	0.032			0.018	0.047	0.011		0.014	0.016	0.011		0.008	0.005		0.010	0.011		0.015	0.022
Diuron													0.040														
MCPP								0.140					0.056					0.028									
Methomyl							0.031	0.120					0.018														
Oxamyl					0.130			0.165																			
Pentachlorophenol																										0.016	
Prometon											0.030																
Triclopyr																									0.053		0.047

Lower Skagit-Samish WRIA 3

Big Ditch

A total of 42 pesticides and degradates were detected in Big Ditch from 2006 to 2008. Of these, 28 were identified at the upper Big Ditch site from 2007 to 2008, and 37 pesticides and degradates were found in the lower Big Ditch site between 2006 and 2008.

No detected concentrations were above freshwater criteria or standards at either the upper or lower sites.

Comparison of Upper Big Ditch to Lower Big Ditch, 2007-2008

In 2007 and 2008, the upper and lower sites on Big Ditch were sampled weekly. Within the same year, 22 pesticides were detected in common between the two sites. 2,4-D, bromacil, diazinon, dichlobenil, eptam, metalaxyl, and oxamyl were detected at both sites in both years.

Five compounds were detected only at the upper site: aldicarb, linuron, methomyl oxime, oxamyl oxime, and triadimefon.

Twelve compounds were detected only at the lower site: alachlor, atrazine, bentazon, bromoxynil, chlorpropham, chlorpyrifos, dimethoate, hexazinone, methiocarb, methomyl, metribuzin, and propoxur.

Table H-8. Lower Big Ditch, 2006 – Freshwater Criteria.

Month	March					April				May					June				July				August					September	
Calendar Week	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D					0.160	0.076	0.058	0.046	0.110	0.240	0.050			0.058	0.054	0.110	0.043				0.059								
Atrazine	0.018					0.016				0.018				0.027	0.096	0.150	0.024												
Bentazon	0.120	0.140	0.120	0.120		0.091	0.110		0.110						0.110	0.280												
Bromacil																0.040													
Chlorothalonil		0.019																		0.010									
Chlorpropham	0.360	2.250	0.058		0.015																								
Chlorpyrifos								0.013	0.012																				
Cycloate																	0.017												
Diazinon						0.070										0.021													
Dicamba I					0.110																								
Dichlobenil					0.023	0.025	0.041	0.033	0.012	0.041	0.027			0.030	0.014	0.010											0.005		
Diuron						0.031	0.028	0.057	0.025							0.140													
Eptam	0.011	0.015			0.470	0.049	0.022	0.014	0.260	0.155	0.100	0.270	0.045	0.026		0.035													
MCPA						0.021	0.090	0.056	0.180	0.170				0.033															
MCPP					0.016	0.032	0.019	0.027		0.046				0.014															
Metalaxyl									0.022		0.062	0.019	0.017								0.029		0.066	0.023	0.050	0.092	0.028	0.130	
Metolachlor									0.018	0.110	0.029		0.017	0.035	0.017	0.015			0.010				0.009		0.009				
Metribuzin										0.140					0.230	0.091													
Pentachlorophenol	0.016	0.019	0.014	0.014	0.015			0.022																					
Prometon		0.010																											
Tebuthiuron	0.013	0.029		0.020																									
Triclopyr					0.030		0.042	0.039		0.115				0.220	0.052	0.050													

Table H-9. Upper Big Ditch, 2007 – Freshwater Criteria.

Month	February			March				April				May					June				July				August						September	
Calendar Week	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D									0.230				0.078		0.210					0.170	0.074							0.410		0.740	
3-Hydroxycarbofuran	0.150											0.095																			
4-Nitrophenol		0.050																												0.560	
Aldicarb	0.021																														
Bromacil									0.091	0.049			0.089		0.032	0.042	0.044	0.042		0.043		0.067	0.074	0.045	0.047	0.063	0.064		0.098		0.130
Carbofuran												0.028																			
Diazinon																			0.030												
Dicamba I									0.040																			0.037			
Dichlobenil			0.024	0.020	0.013	0.030	0.059	0.027	0.054		0.011	0.025	0.034		0.028	0.008	0.008	0.009			0.045			0.039							
Eptam												0.170																			
Ethoprop												0.135																			
Linuron							0.054																								
MCPA									0.300																						
MCPP															0.051													0.100			
Metalaxyl													0.096	0.031	0.024				0.310		0.170		0.220			0.370		0.140	0.066	0.510	
Methomyl oxime																											0.039				
Oxamyl															0.013																
Oxamyl oxime																						0.032	0.021	0.015	0.018					0.068	
Picloram		0.160	0.160	0.250	0.160		0.210	0.450		0.370	0.380		0.310	0.580	0.220	0.320	0.360	0.350	0.220	0.270	0.340	0.350	0.330	0.160	0.310	0.310					
Prometon		0.034	0.033	0.022	0.022		0.036		0.120			0.034	0.035		0.026	0.013	0.017							0.015							
Tebuthiuron	0.075							0.140		0.130	0.120	0.036	0.045	0.140	0.078	0.130	0.130	0.150	0.160	0.170		0.165	0.220	0.110	0.099	0.130	0.130				0.130
Triadimefon																									0.019						

Table H-10. Lower Big Ditch, 2007 – Freshwater Criteria.

Month	February			March				April				May					June				July				August					September	
Calendar Week	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D													0.071												0.072						
4-Nitrophenol		0.081							0.054																						
Alachlor												0.150																			
Atrazine		0.036	0.028									0.084																			
Bentazon								0.087		0.067				0.046	0.044																
Bromacil									0.041			0.078	0.081																		0.033
Chlorpyrifos			0.020																												
Diazinon										0.052																					
Dichlobenil		0.019	0.018				0.047	0.017																							
Dimethoate														0.077																	
Diuron	0.120	0.160		0.040	0.058	0.035	0.110	0.040	0.140	0.078	0.067				0.020																
Eptam									0.025	0.110	0.044	0.039	0.090	0.250	0.022																
Ethoprop															0.032																
Metalaxyl	0.040		0.037													0.043												0.140	0.120		
Metolachlor					0.022	0.019								0.012	0.014	0.048															
Metribuzin														0.020	0.024																
Oxamyl																													0.046		
Picloram															0.110																
Prometon								0.024																			0.009				

Table H-11. Upper Big Ditch, 2008 – Freshwater Criteria.

Month	March				April				May				June				July					August				September	
Calendar Week	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D				0.036	0.190	0.140		0.640	0.110	0.130	0.690		0.590		0.570			0.041							0.160		
3-Hydroxycarbofuran						0.034							0.340								0.019						
4-Nitrophenol																					0.092						
Bromacil					0.065	0.260	0.280	0.240	0.120	0.077	0.150	0.036				0.046	0.069	0.047									
Carbaryl											0.024																
Carbofuran											0.023																
Diazinon											0.032																
Dicamba I								0.030			0.050		0.028		0.019										0.030		
Dichlobenil				0.050					0.016	0.015	0.360	0.023	0.062	0.027	0.030	0.017		0.014		0.004				0.013	0.032	0.015	
Diuron								0.500	0.580	0.350	0.450	0.092	0.300	0.076	0.088	0.130	0.200	0.062	0.069	0.110	0.042						
Eptam												0.046															
Imidacloprid			0.026			0.025	0.046	0.032	0.035	0.052		0.060	0.033	0.038	0.012	0.024	0.054	0.090	0.110	0.029	0.020	0.015	0.065	0.055			0.016
MCPA		0.010						0.190			0.034																
MCPP				0.009				0.087			0.130		0.097														
Metalaxyl					0.225	0.067				0.039		0.016			0.059				0.045	0.028							0.052
Metolachlor											0.018		0.016	0.008													
Oxamyl					0.190																						
Pentachlorophenol		0.007									0.053												0.023	0.028	0.051		
Picloram					0.190	0.340		0.230	0.210	0.350		0.320			0.180	0.260	0.270	0.100	0.190	0.170		0.160		0.250			0.140
Prometon			0.022		0.020		0.019							0.017	0.025												
Tebuthiuron												0.027		0.031	0.045	0.055	0.100	0.093	0.086	0.085		0.135	0.110	0.072			0.130
Triclopyr							0.073	0.300			0.420		0.170		0.170										0.140		

Table H-12. Lower Big Ditch, 2008 – Freshwater Criteria.

Month	March				April				May				June				July					August				September	
Calendar Week	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D				0.023	0.270	0.100	0.490	0.270	0.072	0.650	0.700			0.320		0.039		0.140							0.185		0.027
3-Hydroxycarbofuran								0.012																			
Atrazine																									0.044	0.038	
Bentazon	0.079	0.070		0.071	0.120	0.160		0.120	0.084			0.110	0.069	0.240	0.018	0.110		0.046							0.120	0.140	0.086
Bromacil				0.310	0.360	0.072	0.082		0.083	0.170	0.120	0.052	0.059	0.130	0.083	0.027		0.023					0.029		0.044	0.100	
Bromoxynil						0.090				0.058																	
Carbaryl											0.014																
Carbofuran										0.049	0.100		0.013														
Chlorpropham	1.100	5.600	0.690	0.083	0.043	0.038																					
Chlorpyrifos		0.015																									
Diazinon											0.060																
Dicamba I										0.016	0.057			0.084	0.024										0.048	0.018	
Dichlobenil				0.044							0.076	0.017		0.017		0.013									0.023	0.013	
Diuron								0.130	0.270	0.370	0.130	0.082	0.100	0.120	0.074	0.046											
Eptam									0.036	0.110	0.180	0.035		0.045	0.037												
Ethoprop										0.038	0.058		0.027														
Hexazinone											0.081																
Imidacloprid													0.012					0.014							0.018	0.010	
MCPA							0.160	0.220		0.670	0.074	0.070						0.031							0.028		
MCPP											0.061			0.041											0.032		
Metalaxyl					0.039															0.005					0.021		0.039
Methiocarb																										0.017	
Methomyl								0.058												0.057							
Metolachlor				0.020					0.038	6.200	31.00	18.00	0.059	8.600	1.300	0.950	0.022	0.064	0.003	0.006			0.006		0.280	3.600	0.435
Metribuzin												0.027		0.140		0.033											
Oxamyl																				0.019							
Pentachlorophenol																0.012									0.023	0.017	
Propoxur					0.015																						
Triclopyr											0.120					0.029		0.020							0.098	0.047	0.041

Browns Slough

A total of 32 pesticides and degradates were detected in Browns Slough from 2006 to 2008. The site at Brown's Slough must meet marine water quality standards and criteria. Salinity at this site is > 1 ppt (part per thousand).

In each of the early growing seasons of 2007 and 2008, chlorpyrifos was detected numerically above the acute and chronic marine water quality standard.

Two detections of diazinon were found numerically above the marine acute and chronic invertebrate NRWQC during May and June of 2007.

Table H-13. Browns Slough, 2006 – Freshwater and Marine Criteria.

Month	March					April				May					June				July				August					September	
Calendar Week	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D							0.022	0.051	0.064	0.078			0.030	0.100	0.087		0.037	0.031	0.067										
Atrazine																0.037													
Bentazon	0.090	0.065				0.049	0.071	0.098	0.044		0.030	0.019			0.190		0.041												
Chlorpropham	0.012																												
Cycloate					1.200	0.042				0.056																			
Dichlobenil									0.003																				
Diuron						0.016	0.019	0.096	0.031																				
Eptam							0.125		0.140	1.800	0.615	0.060	0.110	0.018															
Metalaxyl								0.016									0.030		0.120										
Metolachlor										0.014																			
Metribuzin	0.009																												
Pentachlorophenol	0.002							0.017																					
Simazine	0.044	0.032	0.034			0.037	0.185	0.068						1.600	0.440	0.230	0.038												
Triclopyr						0.015	0.045	0.050		0.022				0.070	0.028														
Trifluralin						0.010			0.015																				

Table H-14. Browns Slough, 2007 – Freshwater and Marine Criteria.

Month	February			March				April				May					June				July				August						September	
Calendar Week	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D															0.049		0.030			0.190	0.120										
4-Nitrophenol		0.110	0.060	0.077					0.110																						
Atrazine																	0.110	0.057	0.021												
Bentazon		0.110		0.110	0.076		0.140										0.042	0.110	0.042	0.061											
Bromoxynil										0.640																					
Carbaryl																					0.013										
Carbofuran	0.080																														
Chlorpyrifos	0.038				0.015																										
DCPA		0.086	0.110	0.074		0.074	0.220																								
Diazinon												0.170	0.034						0.700	0.017										0.079	
Dicamba I																				0.086	0.059			0.026		0.010					
Dichlobenil		0.012		0.014																					0.034						
Dimethoate																						0.430									
Diuron	0.130	0.180	0.120	0.063	0.033	0.071	4.100	0.160	0.230	0.130	0.120		0.026				0.036			0.048											
Endosulfan Sulfate															0.025																
Eptam										0.022	0.024	0.240	0.022	0.140	0.018																
MCPA										0.480	0.400																				
Metalaxyl			0.037																												
Methomyl											0.015																0.018				
Metribuzin																0.058															
Norflurazon							0.040																								
Oxamyl									0.031		0.140				0.015								0.032				0.012				
Simazine			0.045				0.079												0.190	0.076	0.065	0.041	0.043								
Tebuthiuron																									0.069						
Trifluralin						0.014	0.031																								

Table H-15. Browns Slough, 2008 – Freshwater and Marine Criteria.

Month	March				April				May				June				July					August				September	
Calendar Week	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D	0.095		0.100	0.019	0.190		0.160																				
4-Nitrophenol			0.044																								
Bentazon		0.041	0.055	0.053					0.048			0.058	0.042	0.072	0.080												
Chlorpyrifos	0.016	0.012																									
DCPA	0.550	0.077	0.240	0.120	0.360	0.093	0.500	0.140	0.130	0.115	0.037			0.180	0.230	0.040											
Diazinon																									0.019		0.008
Dichlobenil																			0.008			0.008					
Dimethoate												0.075															
Eptam								0.990	0.130		0.290	0.055	0.056														
Imidacloprid	0.009		0.012	0.037	0.016																						
MCPA								0.210																			
Metalaxyl	0.028																										
Methomyl		0.015																									
Metolachlor								0.590	0.045	0.028	0.017		0.017	0.048	0.021	0.018											
Metribuzin												0.033			0.027												
Oxamyl										0.041																	
Simazine	0.180	0.032	0.210	0.190			0.190																				
Terbacil			0.038				0.200				0.027	0.034		0.034	0.022												

Indian Slough

A total of 32 pesticides and degradates were detected in Indian Slough from 2006 to 2008. No detected concentrations were above assessment criteria or water quality standards.

Table H-16. Indian Slough, 2006 – Freshwater Criteria.

Month	March					April				May					June				July				August					September	
Calendar Week	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D	0.055	0.027	0.047		0.056	0.240	0.077	0.049	0.023	0.430	0.430	0.024		0.170	0.230	0.090		0.027			0.064								
Bentazon	0.035	0.047	0.042	0.045	0.044	0.032	0.031		0.044	0.032							0.053												
Bromacil										0.110																			
Carbaryl							0.077																						
Diazinon																0.024													
Dicamba I														0.012															
Dichlobenil	0.014				0.017	0.031	0.120	0.026	0.010	0.094	0.014		0.005	0.130	0.035	0.010	0.003	0.003											
Diphenamid			0.016	0.015		0.017			0.017	0.015	0.019	0.014	0.017			0.020		0.018	0.024	0.021	0.014	0.012	0.014	0.018	0.012	0.018	0.016	0.012	0.013
Diuron							0.096	0.038	0.015																				
Eptam																0.024													
MCPA										0.110				0.085															
MCPP	0.019						0.013	0.018		0.036				0.017															
Metalaxyl																						0.034							
Metolachlor																	0.014				0.011		0.012	0.020	0.011	0.013			
Napropamide	0.018																												
Pentachlorophenol	0.014	0.015	0.012	0.009		0.016		0.019																					
Prometon					0.026		0.015	0.009		0.036				0.032															
Simazine										0.035																			
Tebuthiuron	0.046	0.074	0.068	0.095	0.065	0.074	0.036	0.033				0.310																	
Triclopyr	0.098	0.041	0.061		0.096	0.210	0.270	0.087		0.190	0.240	0.032		0.730	0.500	0.150													

Table H-17. Indian Slough, 2007 – Freshwater Criteria.

Month	February			March				April				May					June				July				August					September	
Calendar Week	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D										0.140					0.048				0.071		0.070			0.100						0.260	
4-Nitrophenol									0.061																						
Alachlor										0.022																					
Aldicarb	0.027																														
Bentazon													0.038		0.037			0.021	0.021		0.025										
Bromacil															0.029																0.110
Diazinon													0.034																		
Dichlobenil		0.016	0.018	0.020	0.015						0.011										0.036			0.037						0.010	
Diphenamid	0.018							0.027	0.025	0.027	0.018	0.026	0.033	0.015	0.018	0.017	0.018	0.025	0.024	0.020	0.015	0.016	0.022				0.005			0.018	
Diuron			0.035		0.030		0.060				0.042																				
Metolachlor	0.020	0.052	0.033	0.043	0.043	0.030	0.033	0.023	0.015	0.023								0.015		0.010											
Oxyfluorfen										0.034																					
Simazine																									0.008						
Tebuthiuron	0.072	0.100	0.140					0.140	0.072	0.120		0.047	0.084		0.115	0.110	0.072	0.110	0.150	0.120			0.150			0.085	0.100	0.110	0.086	0.088	0.099
Trifluralin										0.017																					

Table H-18. Indian Slough, 2008 –Freshwater Criteria.

Month	March				April				May				June				July					August				September	
Calendar Week	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D	0.120	0.114			1.650		0.320		0.130	0.250	0.570		1.100	0.120	0.150	0.180		0.099							1.400	0.047	
3-Hydroxycarbofuran		0.030		0.043		0.025							0.130														
Bentazon																0.040		0.034									0.038
Bromacil	0.120	0.096	0.100	0.110	0.690	0.084	0.190	0.077	0.120	0.230	0.750	0.068	0.500	0.150	0.050	0.028	0.027								0.230	0.300	
Carbaryl													0.120														
Chlorpropham						0.042																					
Clopyralid																					0.032						
Cycloate									0.160																		
Diazinon											0.024		0.067														
Dicamba I							0.043		0.042	0.022	0.019		0.007						0.030						0.029		
Dichlobenil											0.032	0.010	0.090	0.014		0.010		0.010	0.004			0.009			0.028	0.017	
Diphenamid												0.010			0.007	0.006	0.023	0.023	0.010	0.009	0.016		0.015	0.015		0.013	0.018
Diuron											0.310	0.037	0.300	0.062	1.400	0.086		0.050							0.170	0.091	
Hexazinone			0.079												0.051										0.095	0.120	0.095
MCPA							0.052				0.074																
MCPP									0.075				0.041					0.036							0.039		
Methomyl				0.018									0.048														
Metolachlor	0.041	0.053	0.038	0.027	0.026		0.009			0.023	0.130			0.009	0.021												
Napropamide	0.240		0.120																								
Oxamyl oxime								0.015																			
Pentachlorophenol																									0.022		
Prometon	0.053	0.049	0.024		0.019						0.040																
Simazine	0.190	0.022	0.380	0.180			0.039							0.049													
Tebuthiuron										0.080		0.038		0.036	0.061	0.051	0.094	0.076	0.052	0.048	0.047		0.055	0.056			
Triclopyr		0.028			1.300		0.150		0.350		0.170		0.140			0.170	0.032	0.068							0.990	0.140	0.033

Samish River

A total of 10 pesticides and one degradate compound were detected in the Samish River from 2006 to 2008: four in the upper Samish River site and nine in the lower Samish River site. None were above assessment criteria or water quality standards. The upper Samish River site was sampled only in 2006.

Comparison of Upper Samish River to Lower Samish River

In 2006, the upper Samish River site had five pesticide detections, and the lower Samish River site had four. The herbicide, 2,4-D, was found at both sites. Linuron and pentachlorophenol were only at the upper site. Dicamba I was only at the lower site.

Table H-19. Upper Samish River, 2006.

Month	March					April				May					June				July				August					September	
Calendar Week	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D											0.160	0.041																	
4-Nitrophenol													0.038																
Linuron	0.030																												
Pentachlorophenol		0.001																											

Table H-20. Lower Samish River, 2006.

Month	March					April				May					June				July				August					September	
Calendar Week	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D											0.120	0.037																	0.220
Dicamba I																													0.029

Table H-21. Lower Samish River, 2007.

Month	February			March				April				May					June				July				August					September	
Calendar Week	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Bromacil													0.150	0.016	0.017	0.022	0.017	0.015	0.038	0.019	0.019										
Carbaryl																					0.011										
Diuron							0.061																								
Oxamyl																											0.015				

Table H-22. Lower Samish River, 2008.

Month	March				April				May				June				July					August				September	
Calendar Week	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D													0.400	0.086				0.025		0.069							
4-Nitrophenol																					0.044						
Chlorothalonil																							0.024				
Dicamba I																				0.034	0.017						
Hexazinone											0.070																

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Spring Creek

A total of 27 pesticides and degradates were detected in Spring Creek from 2006 to 2008. Nineteen of these were detected in the upper Spring Creek site, and 26 were detected in the lower Spring Creek site.

At the upper Spring Creek site, 4,4'-DDE was found numerically above water quality standards chronic freshwater criteria for DDT (and metabolites). Concentrations also exceeded EPA's chronic NRWQC once each in 2006 and 2007. Azinphos methyl was detected twice numerically above the chronic NRWQC in 2006 and once in 2007. No detections were above assessment criteria at the upper Spring Creek site in 2008.

At the lower Spring Creek site, 4,4'-DDE was detected above water quality standards chronic freshwater criteria for DDT (and metabolites) in 2007. Azinphos methyl was numerically above the chronic NRWQC in three consecutive samples in 2006, and in two consecutive samples in 2007. Chlorpyrifos was numerically above the Endangered Species Level of Concern (ESLOC) once in 2007. Chlorpyrifos also exceeded water quality standards: in 2006 with one exceedance of the chronic criteria; in 2007 with one exceedance of the acute and chronic criteria, and one of the chronic criteria; and in 2008 with one exceedance of the acute and chronic criteria. In addition, each of the preceding Spring Creek chlorpyrifos detections was above the EPA chronic invertebrate criteria.

Comparison of Upper Spring Creek to Lower Spring Creek, 2006-2008

From 2006 to 2008, the upper Spring Creek site was sampled biweekly and the lower site was sampled weekly. Within the same year, 17 pesticides were detected in common between the two sites. 2,4-D, atrazine, bentazon, and chlorpyrifos were detected at both sites in all three years. Azinphos methyl, diazinon, dicamba I, and norflurazon were detected at both sites in two of the three sample years.

One pesticide, oryzalin was detected only at the upper site.

Eight compounds were detected only at the lower site: diuron, endosulfan II, endosulfan sulfate, hexachlorobenzene, methiocarb, oxamyl oxime, prometon, and trifluralin.

Table H-23. Upper Spring Creek, 2006.

Month	April		May			June		July		August		Sep
Calendar Week	14	16	18	20	22	24	26	28	30	32	34	36
2,4-D			0.039	0.027	0.047	0.120						
4,4'-DDE									0.003			
Aldicarb						0.160						
Atrazine	0.013		0.015		0.011	0.012	0.014	0.010	0.011	0.012	0.010	0.011
Azinphos Methyl					0.052	0.120						
Bentazon	0.033	0.033	0.031			0.029						
Bromacil										0.022	0.022	0.020
Chlorpyrifos	0.034	0.016	0.013	0.010								
Diazinon											0.010	
Malathion							0.013					
Norflurazon			0.055			0.032		0.025	0.025	0.030	0.027	
Simazine	0.130	0.071	0.160	0.032		0.037	0.018	0.013		0.012	0.008	0.013

Table H-24. Lower Spring Creek, 2006.

Month	April				May					June				July				August					Sep	
Calendar Week	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D		0.021			0.041	0.110	0.044	0.120	0.048		0.120	0.034	0.080	0.035		0.029		0.870	0.110					
Aldicarb																					0.065			
Atrazine					0.014	0.014		0.013	0.011		0.012	0.014		0.017	0.011	0.011	0.010	0.014	0.011	0.010	0.008	0.007	0.011	0.008
Azinphos Methyl									0.043	0.050	0.091													
Bentazon	0.029										0.020													
Bromacil																	0.032	0.032	0.036	0.028	0.045	0.033	0.032	0.028
Carbaryl							1.260																	
Chlorpyrifos	0.060	0.035	0.012	0.015	0.013	0.011						0.024												
Diazinon																								0.012
Diuron		0.022																						
Malathion														0.017										
Norflurazon					0.057					0.028					0.022	0.023	0.022	0.028	0.022					
Pentachlorophenol										0.044														
Simazine	0.120	0.160	0.150	0.100	0.140	0.084	0.024	0.034	0.021	0.061	0.031	0.020	0.021	0.023	0.015	0.016	0.010		0.013	0.012	0.013			0.010
Terbacil								0.028																
Trifluralin								0.014																

Table H-25. Upper Spring Creek, 2007.

Month	February		March		April		May		June		July			August		Sep
Calendar Week	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37
2,4-D							0.047	0.052	0.330	0.023						
4,4'-DDE									0.010							
Atrazine	0.019	0.030	0.013		0.016		0.013	0.009		0.013						
Azinphos Methyl									0.079							
Bentazon			0.059	0.060			0.026	0.023								
Carbaryl									0.027							
Chlorpyrifos				0.030	0.021	0.025										
Dicamba I							0.014									
MCPA							0.040									
Norflurazon									0.024							
Oryzalin					0.440											
Oxamyl			0.026									0.017				
Terbacil							0.032									

Table H-26. Lower Spring Creek, 2007.

Month	February			March				April				May					June					July					August				Sep	
Calendar Week	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D								6.570					0.051		0.120		0.130	0.030									0.097				0.120	
4,4'-DDE																0.010																
Aldicarb	0.034																															
Atrazine	0.018		0.034	0.027		0.031		0.025		0.023	0.015		0.011		0.009			0.011	0.009		0.012			0.024	0.010							
Azinphos Methyl																	0.048	0.024														
Bentazon						0.046																										
Bromacil																						0.034	0.036	0.044	0.021	0.015	0.046	0.041	0.023	0.030		0.069
Carbaryl																	0.028					0.012										
Chlorpyrifos						0.034	0.270	0.051	0.019	0.020				0.006																		
Diazinon																									0.015							
Dicamba I												0.007	0.015																			
Diuron								0.027		0.042													0.081									
Endosulfan Sulfate		0.033																														
Hexachlorobenzene						0.016																										
Malathion																			0.016													
MCPA																	0.140															
Methiocarb														0.016																		
Oxamyl																															0.089	
Oxamyl oxime																							0.013									
Prometon							0.027		0.055																							
Simazine		0.026								0.031																						

Table H-27. Upper Spring Creek, 2008.

Month	March		April		May		June		July			August		Sep
Calendar Week	11	13	15	17	19	21	23	25	27	29	31	33	35	37
2,4-D					0.084	0.091			0.180	0.071		0.045		0.230
Atrazine					0.020	0.017	0.013	0.014	0.018	0.015	0.008			0.012
Bentazon	0.048	0.040	0.038						0.028					
Chlorpyrifos			0.022	0.011	0.024									
Diazinon										0.022			0.001	
Dicamba I					0.033							0.023		
Norflurazon										0.014				
Pentachlorophenol												0.019	0.016	0.021

Table H-28. Lower Spring Creek, 2008.

Month	March			April					May				June				July					August				Sep	
Calendar Week	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D			0.029						0.097							0.043	0.150	0.190	0.115	0.490	0.086	0.190	0.057	0.330	0.200	0.027	0.280
Atrazine									0.020	0.020	0.020	0.007	0.013	0.012	0.011	0.011	0.017	0.016	0.014	0.006			0.009			0.012	
Bentazon	0.037				0.036												0.021										
Bromacil		0.023								0.024											0.190	0.140	0.130	0.044	0.041	0.049	
Chlorpyrifos			0.120	0.039	0.030	0.018																					
Diazinon																		0.090	0.011	0.005							
Dicamba I									0.026	0.013		0.011									0.036		0.023				
Endosulfan II			0.036																								
Norflurazon		0.024						0.025												0.016							
Pentachlorophenol																					0.031		0.017				0.018
Prometon			0.016																								
Simazine		0.014																									
Trifluralin			0.033																								

Marion Drain

A total of 28 pesticides and degradates were detected in Marion Drain from 2006 to 2008.

Chlorpyrifos did not meet (exceeded) the acute and chronic water quality standards twice in 2006 and once in 2007. Chlorpyrifos was above the EPA acute invertebrate criteria once each in 2006 and 2007. In fall 2007, four weekly consecutive detections of chlorpyrifos were detected above the chronic water quality standard and the EPA chronic invertebrate criteria.

A single detection of malathion was numerically above the chronic invertebrate criteria in 2007.

No detections were above assessment criteria or standards in 2008.

Table H-29. Marion Drain, 2006.

Month	April				May					June				July				August					September				October				
Calendar Week	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
2,4-D			0.024		0.049	0.089	0.047	0.042		0.024	0.087	0.035		0.035	0.044	0.061			0.150			0.530										
Alachlor						0.110		0.015							0.013		0.006														
Atrazine						0.018		0.013			0.014			0.078	0.013		0.009		0.011	0.010	0.008	0.007	0.012	0.009	0.007	0.009	0.009	0.009	0.014	0.014	0.015
Bentazon											0.090	0.093	0.270		0.100	0.077	0.140	0.200													
Bromoxynil					0.044	0.066																									
Carbaryl																			0.069					0.090							
Chlorpyrifos	0.024			0.010		0.011	0.011	0.013			0.010	0.011	0.012		0.009					0.017	0.009	0.016	0.035	0.120	0.037	0.086	0.028	0.027	0.013	0.011	0.012
Diuron				0.010				0.110																							
Eptam							0.022	0.015																							
Ethoprop								0.022	0.018																						
Malathion										0.013	0.017	0.019			0.024																
MCPA					0.033	0.028	0.020																								
Metolachlor								0.033					0.013	0.011	0.011	0.006		0.008		0.007	0.012										
Metribuzin								0.049																							
Pendimethalin						0.035	0.035	0.061	0.023		0.029																				
Simazine						0.018		0.017																							
Terbacil					0.066	0.120	0.210	0.120	0.037	0.084	0.110	0.081	0.092	0.059	0.110	0.110	0.100	0.066	0.047	0.042	0.026	0.026	0.190	0.680	0.170	0.340	0.170	0.165	0.083	0.017	
Trifluralin	0.009							0.034	0.015		0.015	0.016		0.015	0.016					0.008	0.010	0.010									

Table H-30. Marion Drain, 2007.

Intensive Sampling: calendar weeks 17–20.

Month	February			March				April				May					June				
Calendar Week	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**26**
2,4-D															0.052		0.120		0.049		
Atrazine	0.019	0.027	0.026	0.021					0.016			0.021		0.009			0.012	0.015	0.008	0.008	
Bentazon													0.053	0.022	0.028	0.051	0.110	0.038	0.014	0.170	
Carbaryl																					
Chlorpyrifos						0.022	0.044	0.038				0.020		0.006	0.028	0.030	0.028	0.026			
Clopyralid																0.037	0.065	0.027			
Dicamba I												0.016									
Disulfoton sulfone																					
Diuron								0.028			0.028									0.027	
Eptam														0.024							
Ethoprop															0.036	0.034					
Malathion														0.082		0.018	0.021	0.018			
MCPA													0.043		0.040	0.043					
Methomyl																					
Metolachlor																					
Oxamyl					0.027														0.048	0.020	
Oxamyl oxime																			0.033	0.027	
Pendimethalin												0.035	0.074	0.050	0.069	0.068	0.047	0.034	0.019		
Propargite																0.043					
Simazine												0.019		0.007				0.011			
Terbacil											0.034	0.097	0.280	0.120	0.140	0.120	0.100	0.071	0.040	0.058	
Trifluralin												0.022	0.028	0.025	0.025	0.025	0.027	0.020			

Month	July					August				September				October				
Calendar Week	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**
2,4-D					0.081		0.058											
Atrazine	0.009	0.014	0.023	0.010										0.028	0.020	0.014	0.014	
Bentazon	0.036	0.050		0.060				0.064										
Carbaryl						0.022	0.019	0.016										
Chlorpyrifos			0.039	0.031	0.032	0.015		0.012	0.037	0.047	0.059	0.050	0.075	0.039	0.120			
Clopyralid		0.040				0.054	0.032											
Dicamba I	0.012		0.016	0.017			0.006	0.019										
Disulfoton sulfone					0.029		0.014				0.039							
Diuron																		
Eptam																		
Ethoprop																		
Malathion						0.009								0.041				
MCPA																		
Methomyl				0.050														
Metolachlor	0.210	0.012	0.022			0.014												
Oxamyl																		
Oxamyl oxime	0.014			0.012														
Pendimethalin	0.023	0.024																
Propargite																		
Simazine																		
Terbacil	0.033	0.055	0.100	0.070	0.034	0.032	0.025		0.028	0.180	0.380	0.340	0.305	0.220	0.180	0.025		
Trifluralin			0.047															

Table H-31. Marion Drain, 2008.

Month	March			April					May				June			
Calendar Week	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**
2,4-D									0.095	0.070		0.057		0.091	0.085	0.028
Atrazine									0.021	0.018		0.006				
Bentazon	0.016											0.031	0.081	0.047	0.076	0.085
Bromoxynil						0.084	0.073	0.068	0.082	0.035	0.043	0.030				
Chlorpyrifos			0.017	0.024	0.009				0.022					0.005		
Dicamba I								0.010	0.019	0.013		0.011	0.006	0.007		
Disulfoton sulfone																
Endrin Aldehyde							0.027									
Eptam											0.041					
Fenarimol							0.038									
Malathion												0.015				
MCPA											0.031					
Methomyl													0.014			
Pendimethalin							0.012	0.049	0.038	0.026	0.078	0.035	0.040	0.022	0.033	0.020
Pentachlorophenol																
Terbacil						0.093		0.085	0.160	0.140	0.140	0.043	0.077	0.041	0.054	
Trifluralin											0.023	0.012	0.012	0.004	0.020	0.018

Month	July					August				September				October				
Calendar Week	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**
2,4-D	0.062	0.140	0.068	0.077	0.024	0.029	0.080	0.046	0.030									
Atrazine																		
Bentazon	0.081		0.135	0.100	0.075	0.110	0.120	0.056	0.062	0.051	0.040							
Bromoxynil																		
Chlorpyrifos										0.004	0.018	0.023	0.009	0.006	0.010			
Dicamba I	0.010	0.009	0.032	0.032	0.015	0.017	0.031	0.018	0.017									
Disulfoton sulfone							0.022											
Endrin Aldehyde																		
Eptam																		
Fenarimol																		
Malathion					0.006													
MCPA																		
Methomyl																		
Pendimethalin	0.027																	
Pentachlorophenol										0.015								
Terbacil	0.047	0.073	0.084	0.088	0.042	0.052	0.034	0.041	0.021	0.031	0.220	0.460	0.510	0.180	0.080			
Trifluralin	0.021																	

Sulphur Creek Wasteway

A total of 27 pesticides and degradates were detected in Sulphur Creek Wasteway from 2006 to 2008.

4,4'-DDE did not meet chronic water quality standards in 2006 and 2007. Azinphos methyl was detected only in 2006, numerically above the chronic NRWQC.

Chlorpyrifos had one detection above the ESLOC for fish in 2007 and single detections above the acute and chronic water quality standard and the EPA chronic invertebrate criteria in 2006 and 2007. Chlorpyrifos was above the chronic water quality standard and the EPA chronic invertebrate criteria once in 2008.

Table H-32. Sulphur Creek Wasteway, 2006.

Month	April				May					June				July				August					Sep	
Calendar Week	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D		0.023	0.027	0.094	0.048	0.091	0.059	0.087	0.038	0.094	0.210	0.035	0.048	0.042	0.230	0.100		0.300	1.240			0.180		
4,4'-DDE																0.004		0.005						
Aldicarb																								0.070
Atrazine	0.016							0.012								0.012	0.011		0.012	0.011	0.010	0.007	0.011	0.007
Azinphos Methyl									0.037	0.033				0.029										
Bentazon			0.024								0.100								0.090					
Bromacil											0.041						0.034				0.031	0.026		
Chlorpyrifos	0.100	0.037	0.011	0.013		0.011		0.015				0.013												
Diazinon			0.008																		0.010			
Dichlobenil											0.004													
Dimethoate										0.450														
Diuron	0.020	0.056	0.018	0.020																				
Norflurazon					0.130		0.023				0.056													
Prometon	0.015																							
Simazine	0.027																							
Terbacil						0.028	0.020	0.022					0.033			0.035					0.021			0.025
Trifluralin								0.015							0.013		0.009							

Table H-33. Sulphur Creek Wasteway, 2007.

Month	February			March				April				May					June					July					August				Sep	
Calendar Week	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D													0.062	0.066	0.074	0.033	0.150	0.087					0.063			0.072	0.190	0.120	0.140	0.220		
4,4'-DDE						0.008											0.010	0.009														
Atrazine			0.032	0.025	0.017		0.050		0.019								0.023	0.012	0.008	0.008			0.013									
Bromacil					0.160			0.038	0.044			0.038	0.041	0.015	0.016	0.026	0.028	0.018	0.018	0.019		0.026	0.035	0.043	0.018	0.013		0.018			0.035	0.035
Carbaryl	0.081	0.198	0.110		0.200		0.094	0.043			0.036			0.087	0.024	0.017	0.017		0.012	0.041												
Chlorpyrifos						0.100	0.170		0.018	0.016																						
DCPA			0.069	0.074	0.079					0.020			0.040		0.023	0.024									0.016			0.030	0.024		0.036	0.036
Dicamba I			0.015									0.012													0.011			0.007	0.037			
Dichlobenil													0.033	0.012								0.007	0.034									
Dimethoate																0.049																
Diuron		0.270	0.045	0.053	0.048	0.100	0.068	0.026	0.110	0.060	0.058						0.095					0.025	0.034								
Malathion																			0.021	0.020												
MCPA												0.035	0.038																			
Norflurazon													0.083		0.029	0.032																
Oxamyl oxime			0.017		0.022																											
Pendimethalin																								0.046								
Prometon								0.061																								
Simazine							0.045									0.015	0.022															
Terbacil												0.027		0.018		0.017							0.064	0.055	0.014						0.027
Trifluralin						0.021	0.028							0.016								0.012								0.020		

Table H-34. Sulphur Creek Wasteway, 2008.

Month	March			April					May				June				July					August				Sep	
Calendar Week	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4-D	0.440	0.150		0.057					0.150	0.120		0.083		0.062	0.250	0.077	0.069		0.545	0.130	0.140	0.075	0.480	0.230	0.065	0.021	0.052
Atrazine										0.019		0.005	0.012	0.063		0.016	0.017	0.014								0.011	0.011
Bentazon	0.028												0.031			0.026				0.023			0.056			
Bromacil	0.047										0.030		0.017	0.011		0.013											
Carbaryl		0.016		0.023				0.020									0.013										
Chlorpropham			0.026																								
Chlorpyrifos		0.018	0.063	0.032	0.033	0.020																					
DCPA	0.140			0.025	0.045	0.043	0.050												0.072	0.038				0.051			
Dicamba I								0.028	0.037	0.024		0.028	0.004	0.011		0.028	0.005		0.034	0.033	0.027	0.028	0.036	0.018	0.022		
Dichlobenil													0.016	0.007													
Diuron										0.120	0.032																
Imidacloprid																	0.028										
MCPA								0.052								0.026											
Norflurazon																								0.024			
Pentachlorophenol																				0.030					0.014		
Prometon				0.019																							
Terbacil																			0.018	0.014	0.041						0.036
Trifluralin			0.035							0.024										0.012							

Peshastin Creek

A total of six pesticides and one degradate compound were detected in Peshastin Creek from 2007 to 2008.

In 2008, a detection of endosulfan was numerically above (failed to meet) the ESLOC criteria for fish. This detection was also above chronic water quality standards and EPA chronic criteria for fish. In 2007, a single detection of azinphos methyl was numerically above the chronic NRWQC.

Table H-35. Peshastin Creek, 2007.

Month	February			March				April				May					June				July					August				September	
Calendar Week	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Azinphos Methyl																0.024															
Carbaryl									0.019																						
Methomyl																													0.023		
Oxamyl																												0.026			
Oxamyl oxime																											0.012				

Table H-36. Peshastin Creek, 2008.

Month	March				April				May				June				July					August				September	
Calendar Week	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Endosulfan I					0.130																						
Endosulfan II					0.046																						
Total Endosulfan					0.176																						
Oxamyl						0.010																					

Mission Creek

A total of eight pesticides and one degradate compound were detected in Mission Creek from 2007 to 2008.

A single detection of endosulfan I was numerically above the ESLOC criteria for fish in 2008.

Table H-37. Mission Creek, 2007.

Month	February			March				April				May					June				July					August				September	
Calendar Week	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**
Chlorpyrifos							0.024																								
Endosulfan I								0.017																							
Endosulfan II								0.022																							
Total Endosulfan								0.039																							
Methiocarb										0.034				0.015																	
Methomyl																		0.019													
Norflurazon																												0.027	0.041		
Oxamyl oxime																									0.017					0.018	

Table H-38. Mission Creek, 2008.

Month	March				April				May				June				July					August				September	
Calendar Week	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**
Carbaryl												0.014															
Endosulfan I					0.047																						
Norflurazon																							0.034		0.018	0.018	
Simazine																							0.019				

Brender Creek

A total of 23 pesticides and degradates were detected in Brender Creek from 2007 to 2008.

Endosulfan was detected above the ESLOC for rainbow trout in 14 samples between March and May in 2007 and 2008. The pattern of detections indicates that the ESLOC time and concentration criterion for total endosulfan were exceeded in each year at Brender Creek.

Azinphos methyl was numerically above the ESLOC criteria once and the chronic NRWQC twice in 2007. A single detection of chlorpyrifos in 2007 was numerically above the acute and chronic water quality standard and the EPA acute and chronic exposure criteria for invertebrates.

All DDT and DDT metabolite detections did not meet chronic water quality standards. The chronic standard is based on a 24-hour average concentration. DDT and DDT degradates were detected in every sample from Brender Creek for both years, except for week 15 in 2008. This exception coincided with the lowest concentration of total suspended solids (TSS) at Brender Creek in all years. This may indicate that DDT presence is associated with stream sediment in Brender Creek.

Table H-39. Brender Creek, 2007.

Month	February			March				April				May					June				July					August				September	
Calendar Week	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4'-DDD								0.018										0.008													
2,4'-DDT												0.017		0.011	0.009	0.011		0.015	0.016	0.009											
4,4'-DDD		0.025	0.024	0.023	0.020	0.018		0.020		0.016			0.013		0.012		0.009	0.009	0.010			0.011	0.022					0.004			0.012
4,4'-DDE		0.046	0.032	0.034	0.036	0.036	0.019	0.034	0.022	0.014	0.024	0.071	0.026	0.027	0.042	0.030	0.019	0.039	0.032	0.029	0.015	0.017	0.026	0.021	0.011	0.003	0.012	0.030		0.017	0.021
4,4'-DDT	0.016	0.036	0.027	0.026	0.021	0.019	0.023	0.023		0.024		0.050	0.021	0.019	0.025	0.027	0.017	0.025	0.033	0.027	0.017	0.013	0.020	0.018	0.013		0.025	0.029		0.017	0.018
DDT and metabolites	0.016	0.107	0.083	0.083	0.077	0.073	0.042	0.095	0.022	0.053	0.024	0.138	0.060	0.057	0.088	0.068	0.045	0.096	0.091	0.065	0.032	0.041	0.068	0.039	0.024	0.003	0.037	0.063		0.034	0.051
Azinphos Methyl																0.033								0.034			0.525				
Carbaryl													0.010	0.023	0.040						0.012										
Chlorpyrifos							0.110	0.038	0.027	0.030	0.027	0.019	0.015	0.007	0.007																
Diazinon									0.021																						
Diuron															0.120																
Endosulfan I							0.096	0.020		0.096	0.026	0.050	0.019		0.014																
Endosulfan II							0.071			0.071	0.030	0.060	0.031	0.015	0.040																
Total Endosulfan							0.167	0.020		0.167	0.056	0.110	0.050	0.015	0.054																
Endosulfan Sulfate		0.034				0.015	0.043	0.032	0.041	0.073	0.034	0.100	0.043	0.038	0.057	0.032	0.021	0.027	0.024	0.024		0.020									
MCPA															0.072																
Methomyl					0.017																										
Norflurazon													0.029	0.027	0.055		0.035	0.031	0.160	0.023			0.140		0.027		0.027				
Oxamyl																												0.027			
Prometon															0.009																
Simazine															0.022								0.028								
Triadimefon															0.015																

Table H-40. Brender Creek, 2008.

Month	March				April				May				June				July					August				September	
Calendar Week	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
2,4'-DDD															0.015												
2,4'-DDT									0.019	0.053																	
4,4'-DDD			0.007					0.007		0.015	0.017	0.013	0.011	0.004	0.025	0.020	0.015	0.019	0.006	0.002	0.003	0.005	0.005	0.001	0.001	0.008	0.008
4,4'-DDE	0.023					0.019	0.019	0.014	0.023		0.018	0.040	0.030	0.024	0.045	0.030	0.027	0.034	0.010	0.019	0.025	0.018	0.019	0.021	0.036	0.009	0.018
4,4'-DDT	0.019	0.021	0.020	0.018		0.021	0.015	0.013	0.025	0.300	0.023	0.026	0.020	0.010	0.027	0.020	0.025	0.022	0.010	0.010	0.012	0.010	0.009	0.008	0.009	0.014	0.016
Total DDT	0.042	0.021	0.027	0.018		0.040	0.034	0.034	0.067	0.368	0.058	0.079	0.061	0.038	0.112	0.070	0.067	0.075	0.026	0.031	0.040	0.032	0.033	0.030	0.046	0.031	0.042
Carbaryl												0.024															
Chlorpyrifos						0.028	0.015	0.009	0.025	0.019																	
Dichlobenil												0.008															
Diuron														0.220		0.036											
Endosulfan I			0.060		0.049	0.046	0.048	0.089																			
Endosulfan II			0.058				0.049	0.084	0.120	0.045	0.040	0.036	0.026														
Total Endosulfan			0.118		0.049	0.046	0.097	0.173	0.120	0.045	0.040	0.036	0.026														
Endosulfan Sulfate		0.016	0.016	0.018	0.032	0.045	0.047	0.110	0.160	0.066	0.066	0.061	0.050	0.026		0.033	0.048	0.037	0.022	0.017		0.029	0.023	0.013	0.011	0.016	0.014
Imidacloprid						0.060																0.012					
Norflurazon						0.110			0.032		0.047			0.250		0.110						0.042	0.029	0.028		0.032	0.023
Oxamyl oxime						0.140																					
Simazine													0.012														

Wenatchee River

A total of six pesticides were detected in the Wenatchee River between 2007 and 2008.

Endosulfan I and II were detected numerically above the ESLOC for rainbow trout in one sample in 2008. This sample also exceeded the chronic water quality standard and the EPA chronic criteria for fish. No detected concentrations were above any regulatory criteria in 2007.

Table H-41. Wenatchee River, 2007.

Month	February			March				April				May					June				July					August				September	
Calendar Week	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Chlorpyrifos								0.035																							
Endosulfan I								0.014																							
Methomyl										0.016																					
Oxamyl																												0.016			

Table H-42. Wenatchee River, 2008.

Month	March				April				May				June				July					August				September	
Calendar Week	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Endosulfan I				0.079	0.024																						
Endosulfan II			0.025	0.076																							
Total Endosulfan			0.025	0.155	0.024																						
Imidacloprid						0.028																					

Entiat River

Three pesticides and one degradate compound were detected in the Entiat River in both 2007 and 2008. Each pesticide was detected only once. No detected concentrations were above any regulatory criteria.

Table H-43. Entiat River, 2007.

Month	February			March				April				May					June				July					August				September	
Calendar Week	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Carbaryl													0.016																		
Chlorpyrifos								0.034																							
Dichlobenil																										0.065					

Table H-44. Entiat River, 2008.

Month	March				April				May				June				July					August				September	
Calendar Week	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
3-Hydroxycarbofuran			0.014																								

Marion Drain Intensive Sampling

The Washington State Department of Ecology and the Washington State Department of Agriculture conducted an intensive sampling of Marion Drain for 22 days in the spring of 2007. Grab samples were collected daily and passive samplers, Semi-Permeable Membrane Devices (SPMDs) and Polar Organic Chemical Integrative Samplers (POCISs), were deployed for the full sample period. The objectives were (1) to evaluate short-term variation in pesticide occurrence and concentration, and (2) assess the adequacy of the current weekly sampling regime.

A total of 21 pesticide compounds were detected during the study. Grab sample results are presented in Table H-45. Daily grab sampling detected only one more pesticide than the number observed during four pre-scheduled weekly sampling events. Detection frequency and median values were similar between daily and weekly sets. Weekly sampling failed to detect some isolated peaks in concentration and some rarely detected compounds found in the daily samples.

Full details, analysis, and recommendations for this study are presented in Dugger et al. (2008). Maximum weekly concentrations for this intensive sampling study are summarized in weeks 17 to 20 of Table H-30.

Table H-45. Marion Drain Intensive Sampling, 2007 – Daily Grab Sample Results.

Month	**April**							**May**														
Calendar Week	**17**					**18**							**19**							**20**		
Day	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
2,4-D									0.075		0.150	0.500								0.046		
Atrazine			0.023	0.034	0.026			0.021								0.030	0.022	0.036	0.017	0.016	0.018	0.009
Bentazon															0.053	0.040			0.032	0.024	0.024	0.022
Carbaryl				0.035												0.011	0.010		0.014			
Chlorpyrifos					0.022			0.020	0.010			0.020		0.013		0.022	0.018	0.014	0.013			0.006
Dicamba I					0.004	0.006	0.010	0.016	0.020	0.020	0.061	0.033		0.013		0.013			0.009			
Diuron	0.028	0.047																		0.015		
Eptam												0.016				0.022	0.048	0.071	0.064	0.043	0.030	0.024
Malathion																						0.082
MCPA			0.020						0.074	0.076	0.130	0.079		0.049	0.043	0.044						
Pendimethalin			0.033	0.031	0.046	0.036	0.035	0.035	0.081	0.082	0.090	0.098	0.074	0.056	0.074	0.054	0.072	0.066	0.066	0.050	0.051	0.050
Simazine				0.033				0.019														0.007
Terbacil	0.034	0.031	0.110	0.082	0.200	0.092	0.120	0.097	0.420	0.310	0.350	0.490	0.230	0.350	0.280	0.220	0.210	0.180	0.200	0.170	0.220	0.120
Trifluralin			0.021					0.022	0.032	0.039	0.040	0.031	0.025	0.020	0.028	0.021	0.029	0.031	0.026	0.020	0.018	0.025

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Appendix I. Flow, Precipitation, and Pesticide Detection Graphs

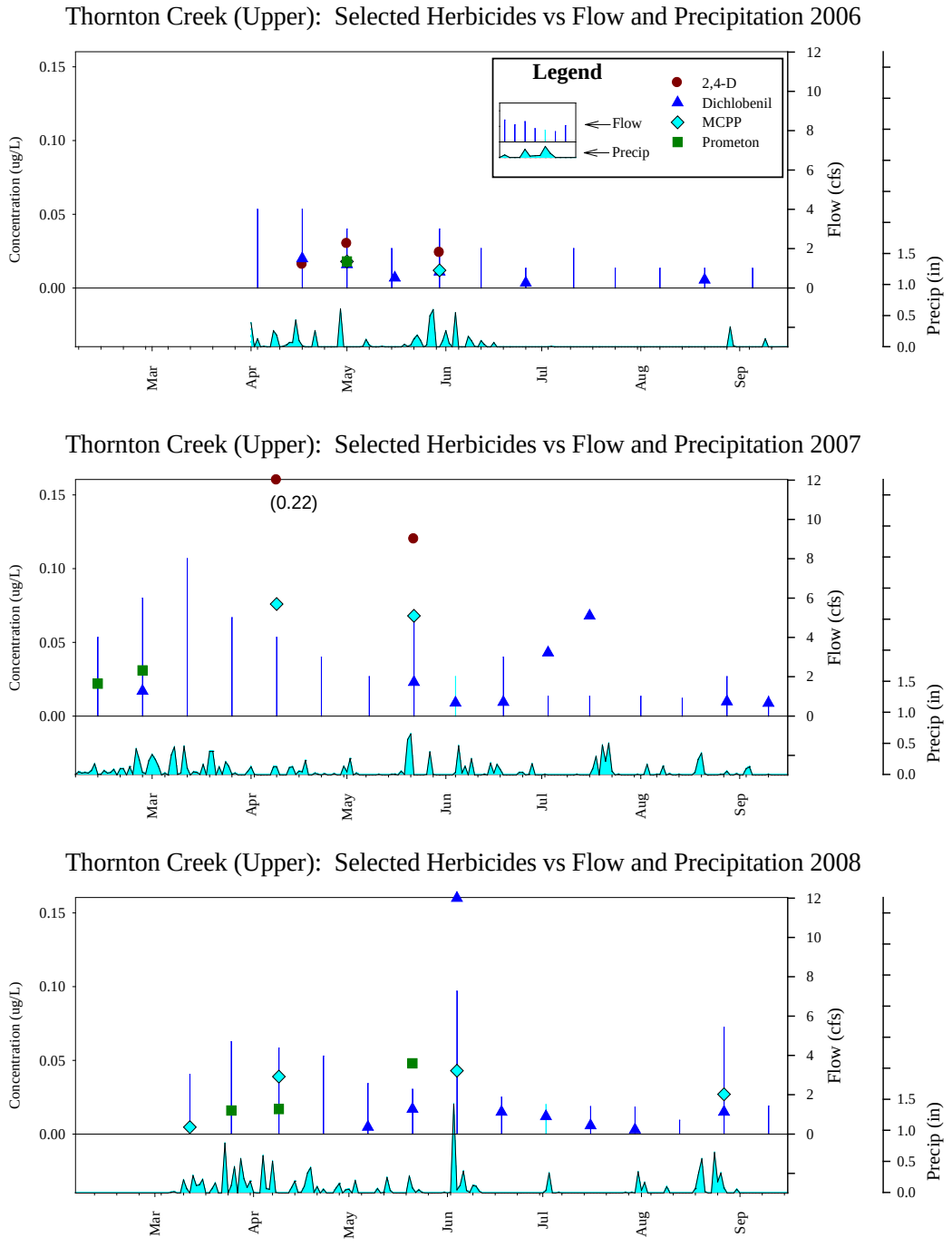

Figure I-1. Flow, precipitation, and most commonly seen herbicide concentrations for upstream Thornton Creek, 2006-2008.

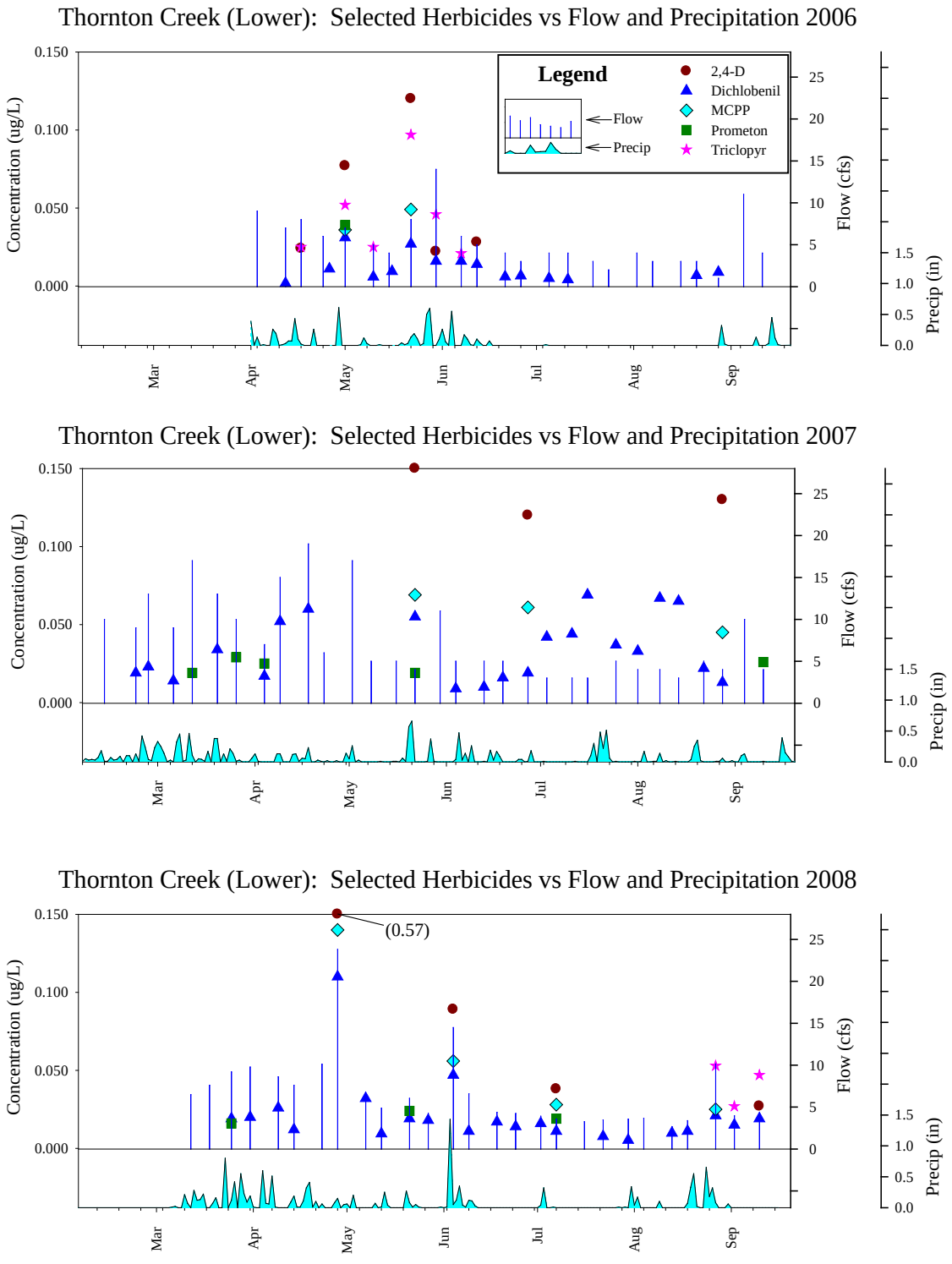

Figure I-2. Flow, precipitation, and most commonly seen herbicide concentrations for downstream Thornton Creek, 2006-2008.

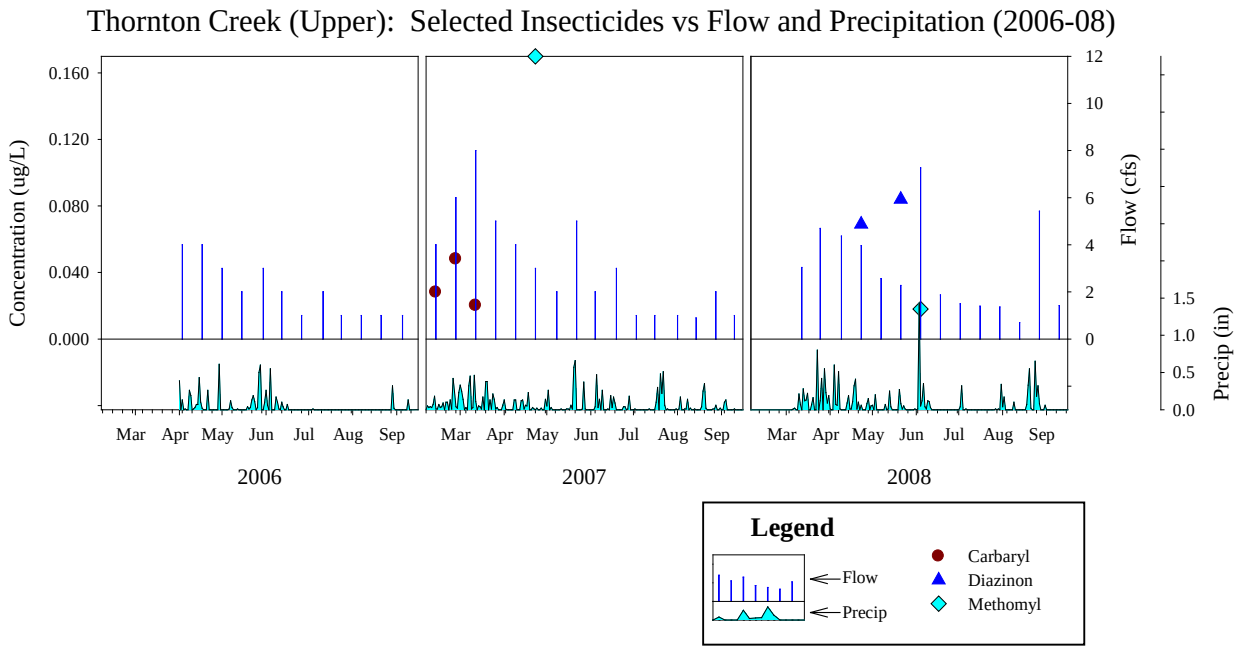

Table I-3. Flow, precipitation, and most commonly seen insecticide concentrations for upstream Thornton Creek, 2006-2008.

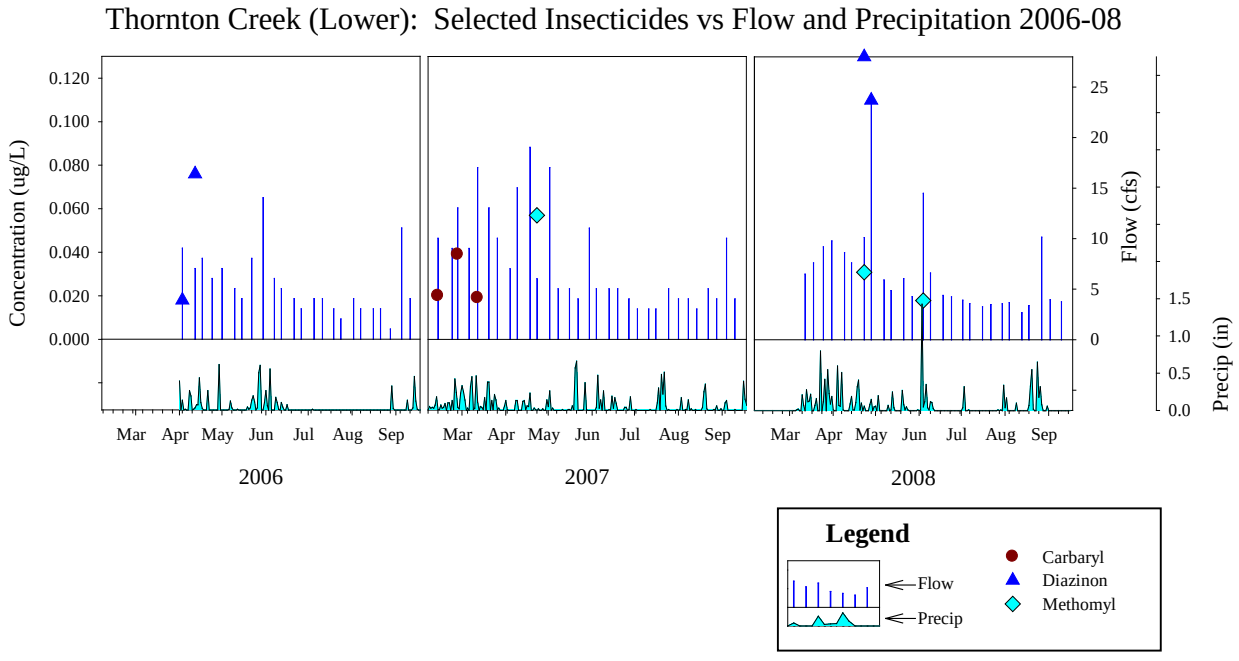

Table I-4. Flow, precipitation, and most commonly seen insecticide concentrations for downstream Thornton Creek, 2006-2008.

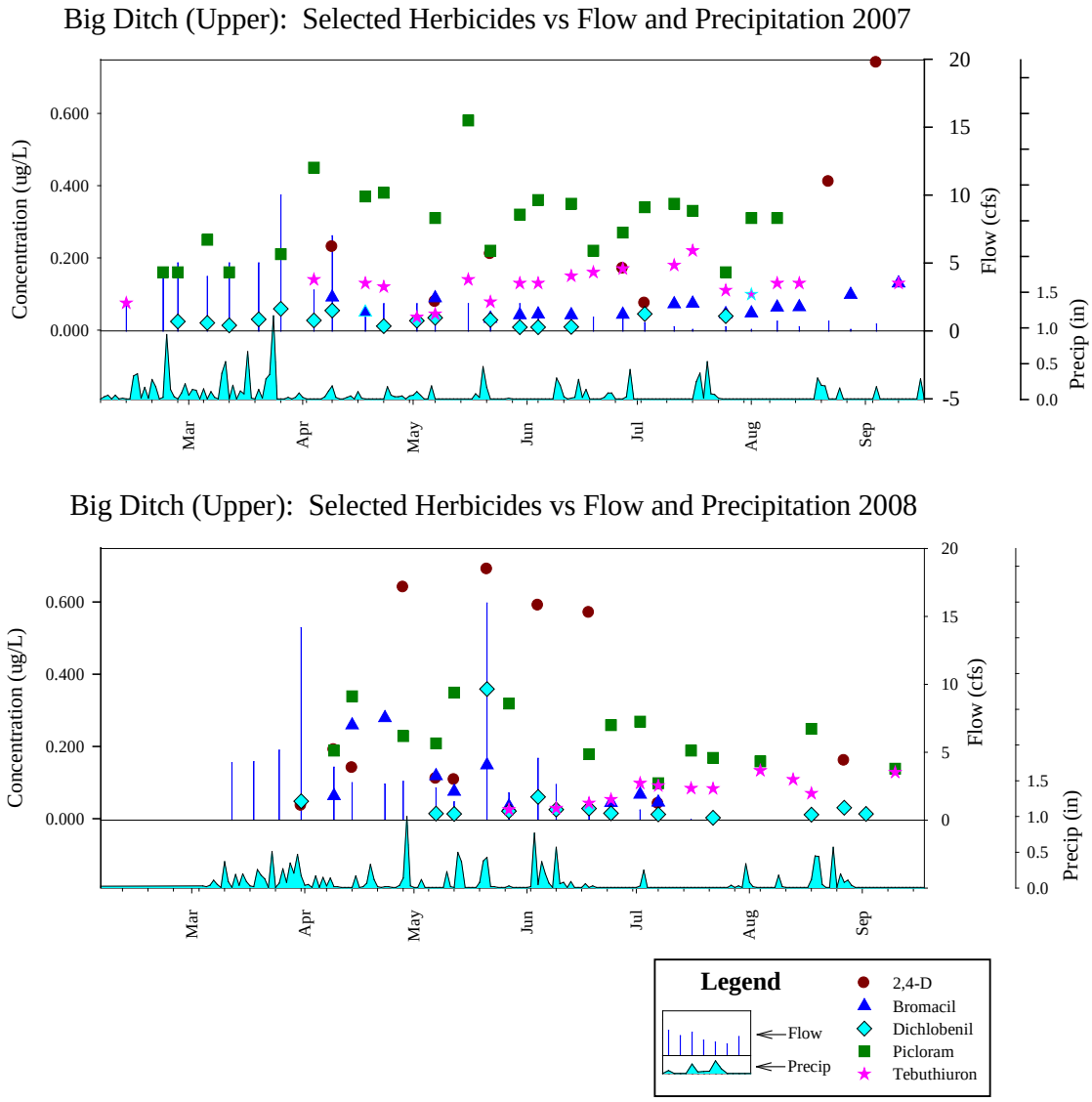

Figure I-5. Flow, precipitation, and most commonly seen herbicide concentrations for upstream Big Ditch, 2007-2008.

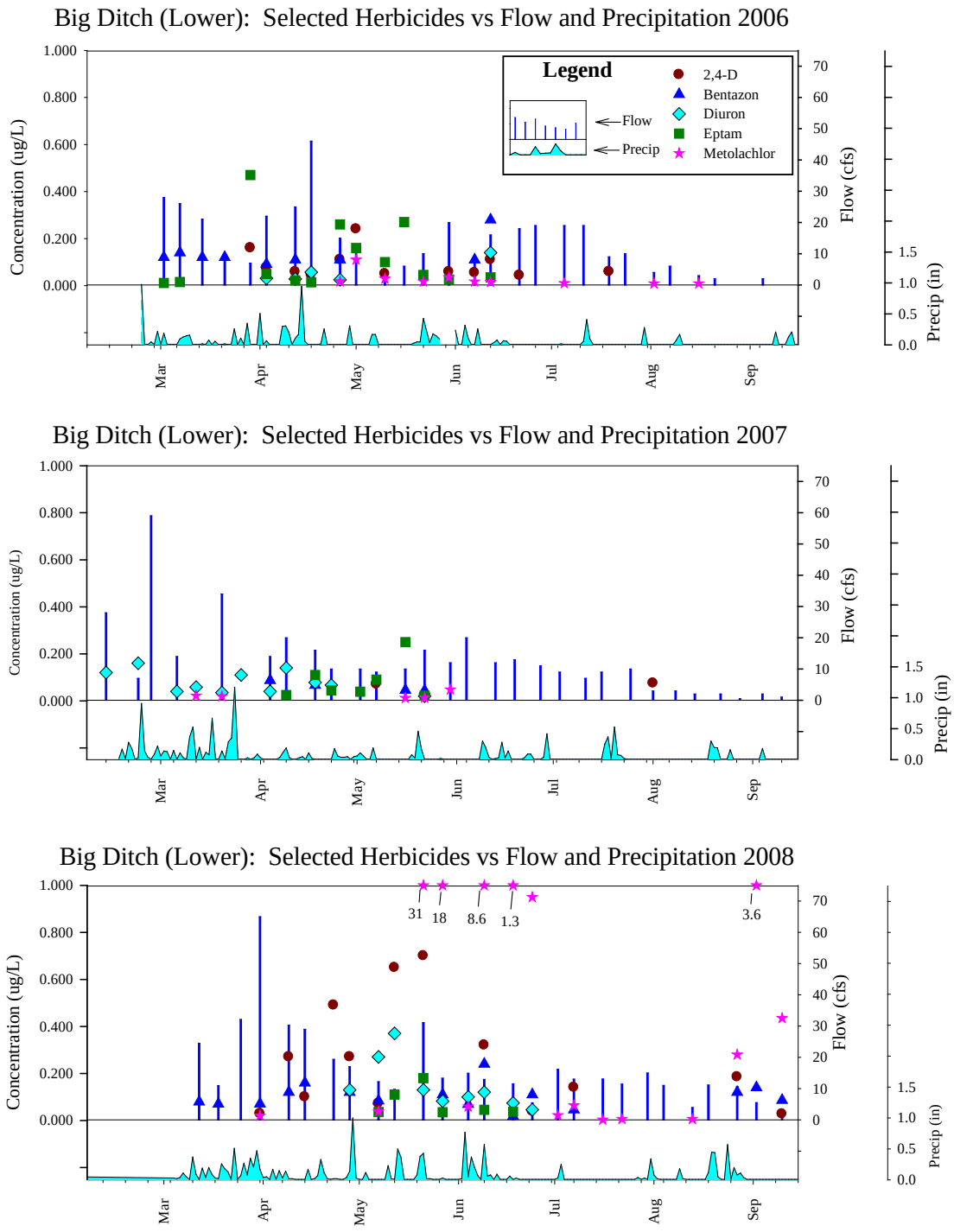

Figure I-6. Flow, precipitation, and most commonly seen herbicide concentrations for downstream Big Ditch, 2006-2008.

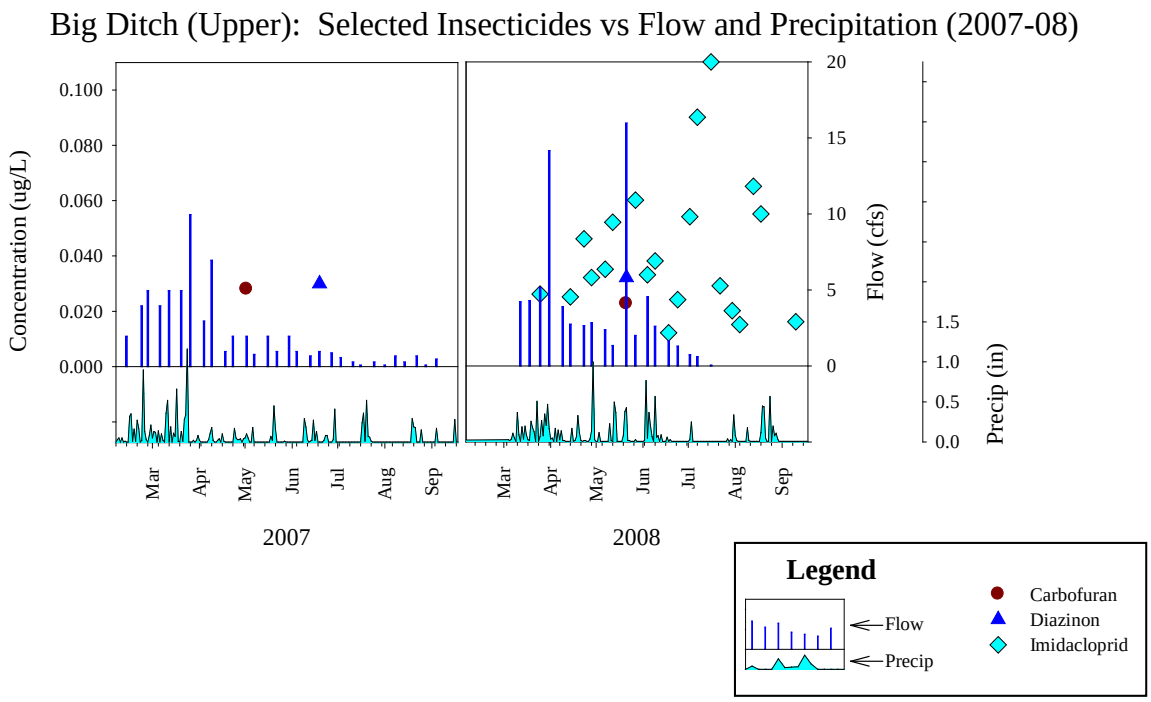

Figure I-7. Flow, precipitation, and most commonly seen insecticide concentrations for upstream Big Ditch, 2007-2008.

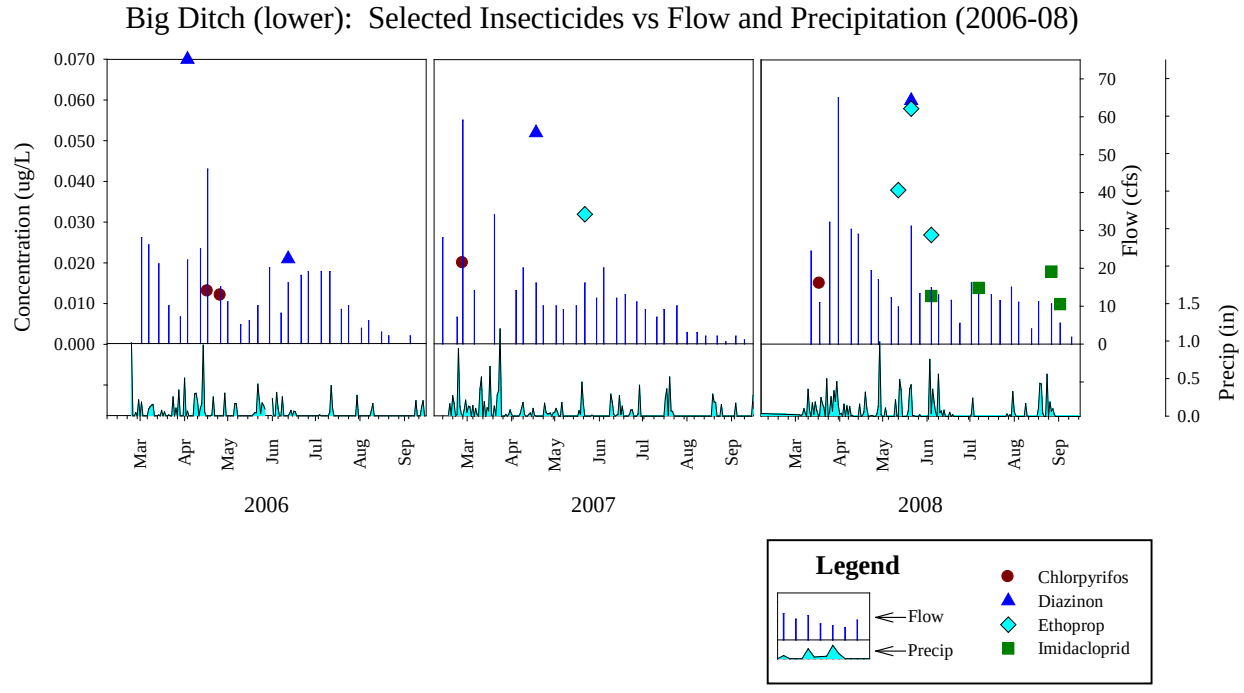

Figure I-8. Flow, precipitation, and most commonly seen insecticide concentrations for downstream Big Ditch, 2006-2008.

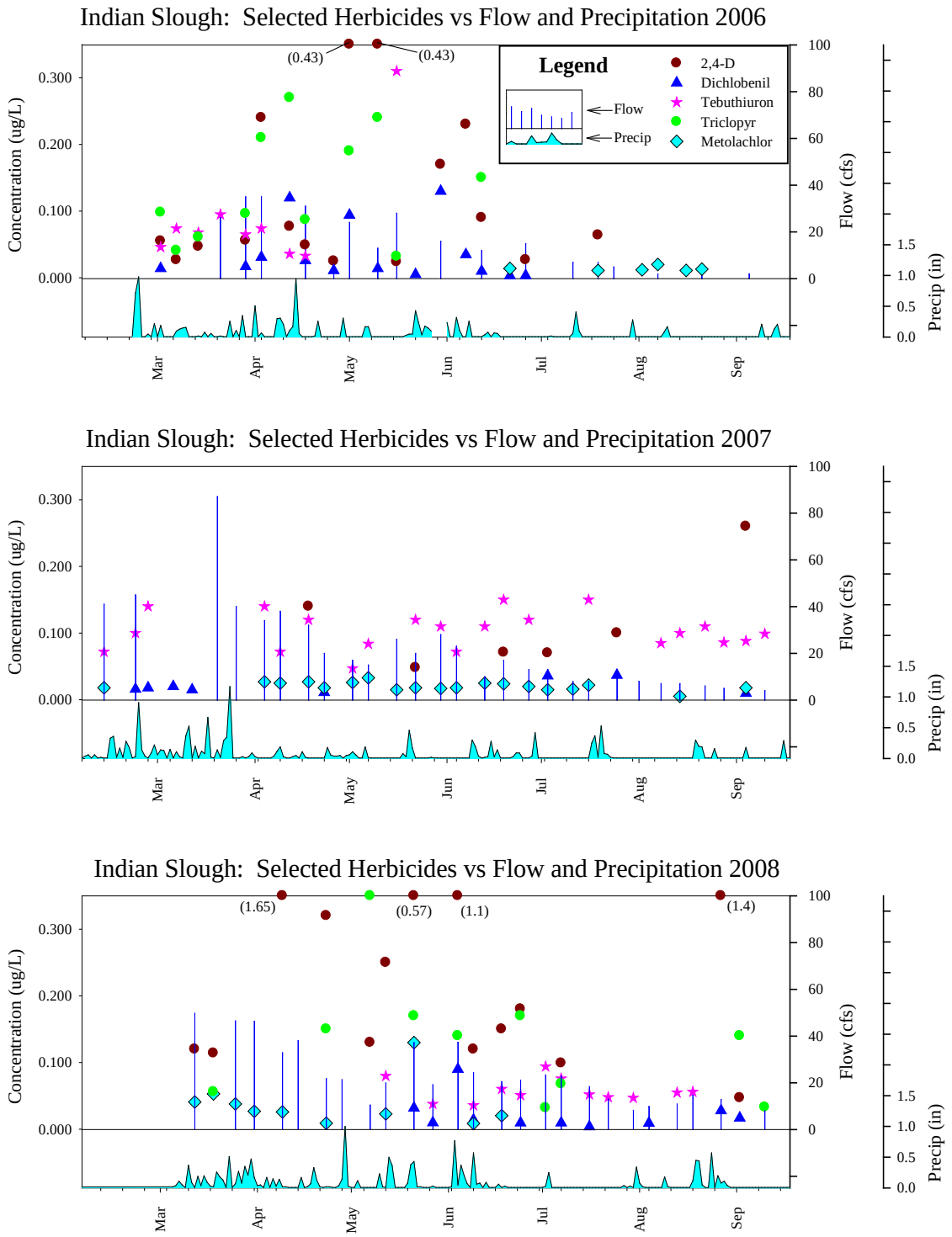

Figure I-9. Flow, precipitation, and most commonly seen herbicide concentrations for Indian Slough, 2006-2008.

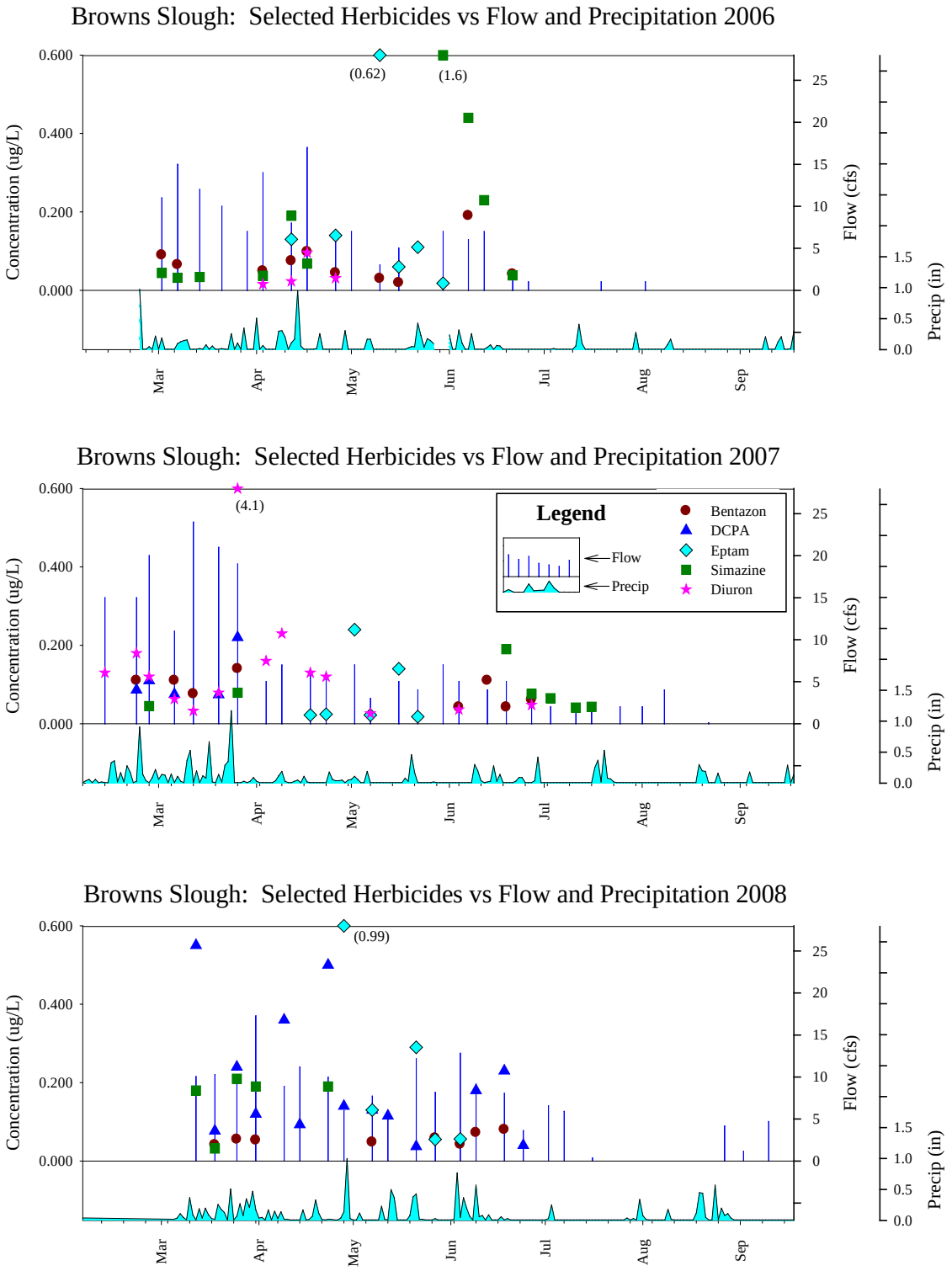

Figure I-10. Flow, precipitation, and most commonly seen herbicide concentrations for Browns Slough, 2006-2008.

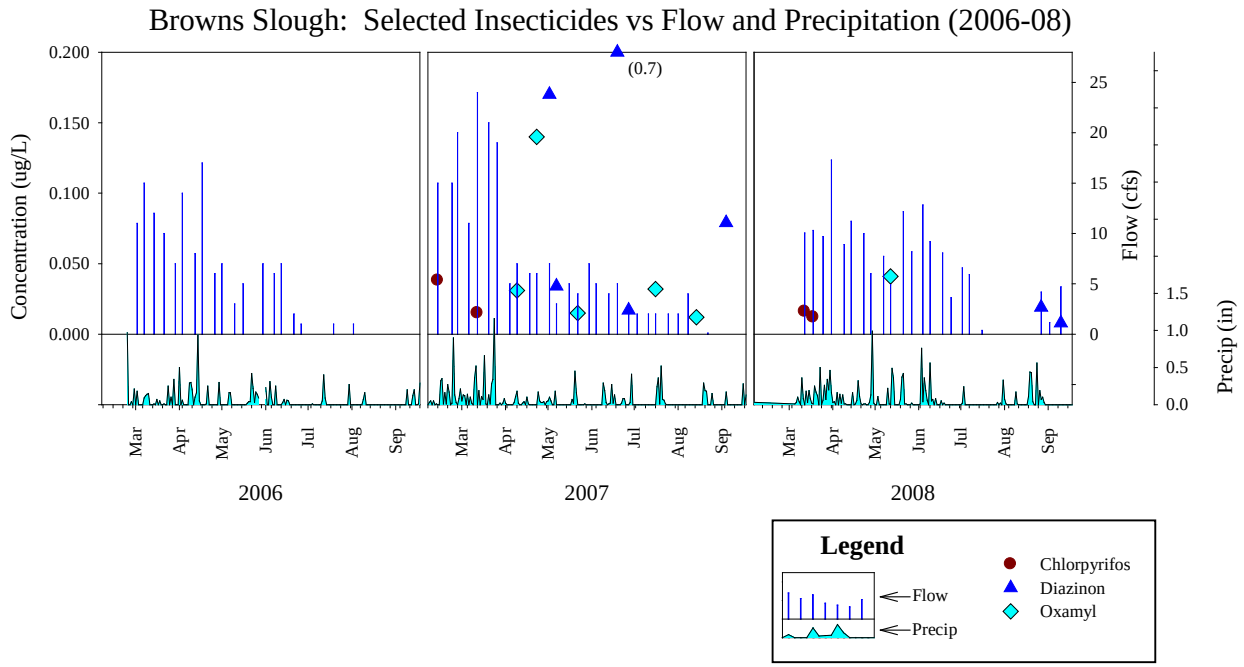

Figure I-11. Flow, precipitation, and most commonly seen insecticide concentrations for Browns Slough, 2006-2008.

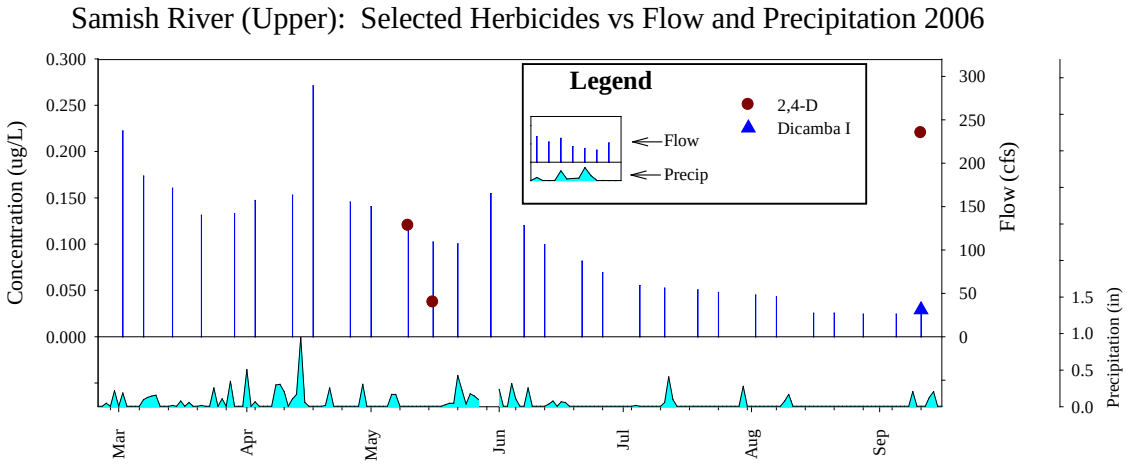

Figure I-12. Flow, precipitation, and most commonly seen herbicide concentrations for Samish River, 2006.

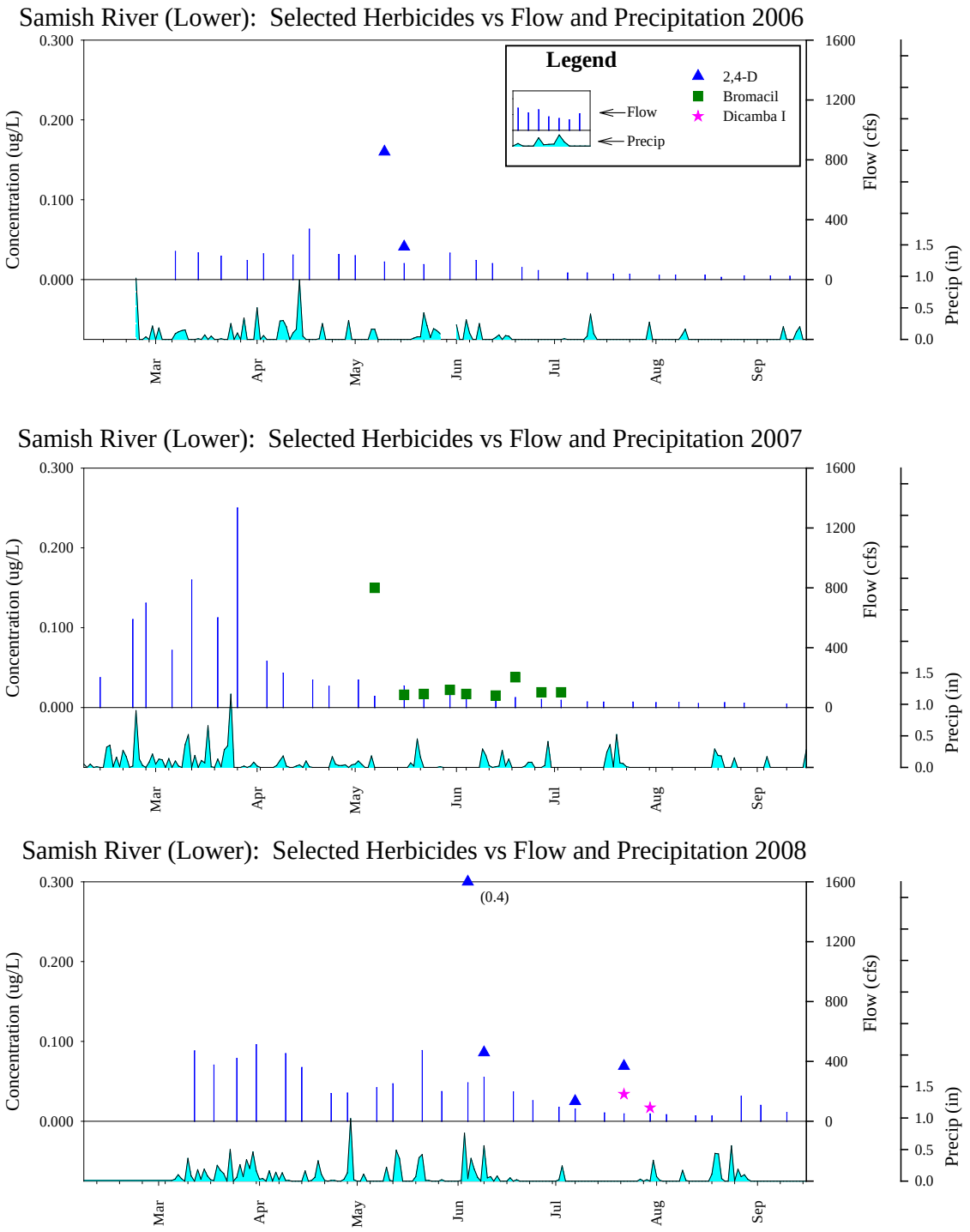

Figure I-13. Flow, precipitation, and most commonly seen herbicide concentrations for Samish River, 2006-2008.

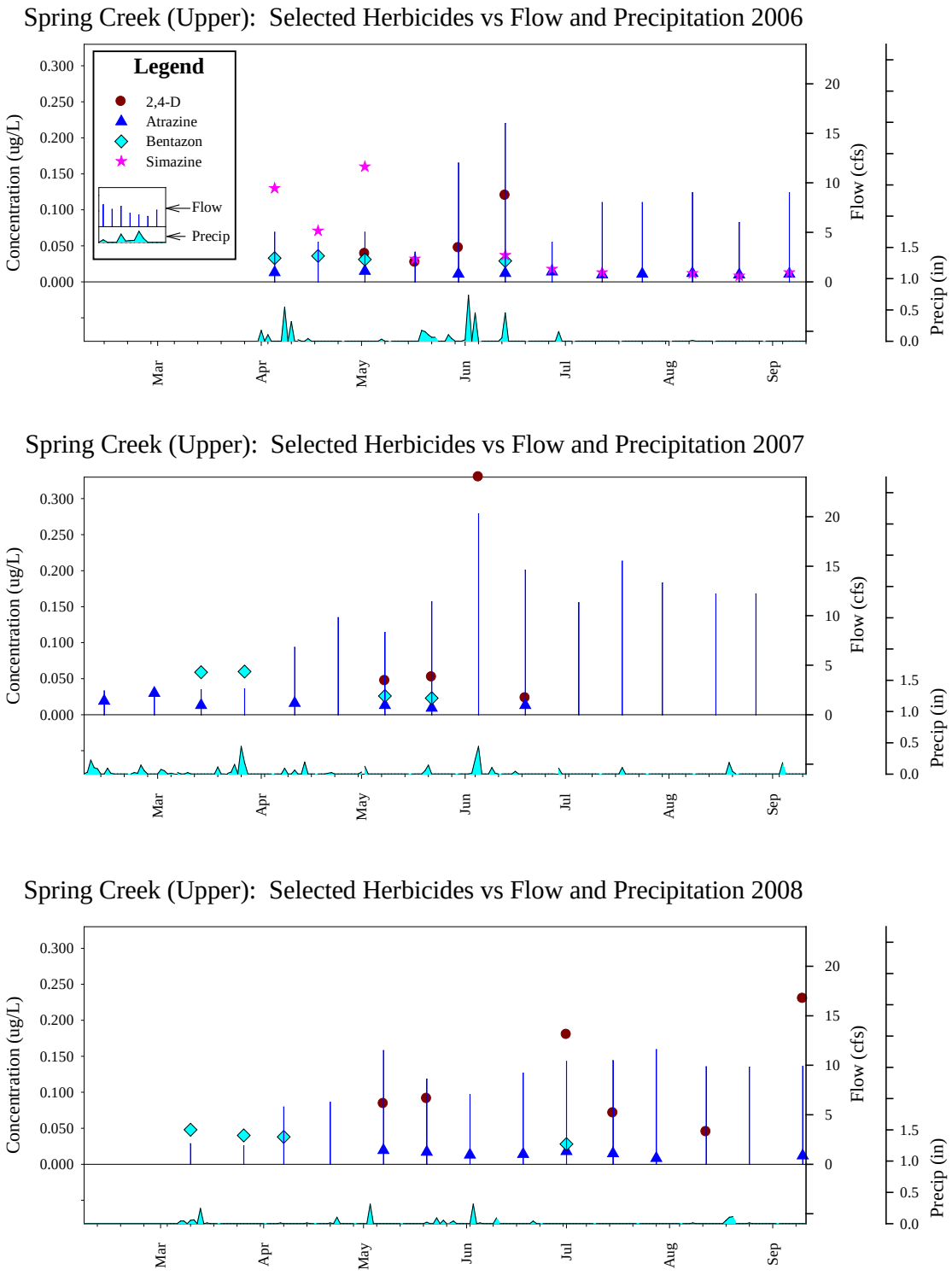

Figure I-14. Flow, precipitation, and most commonly seen herbicide concentrations for upstream Spring Creek, 2006-2008.

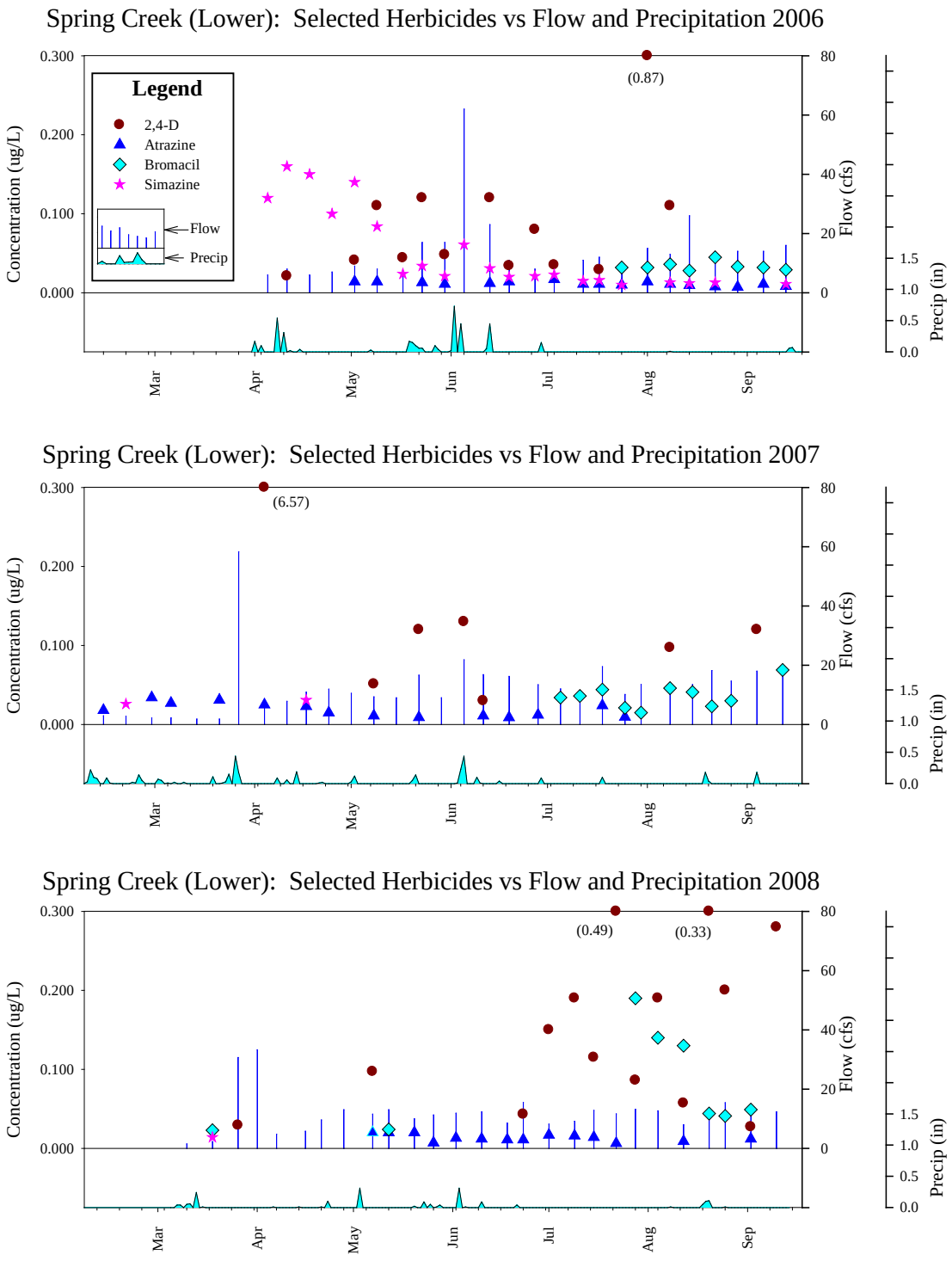

Figure I-15. Flow, precipitation, and most commonly seen herbicide concentrations for downstream Spring Creek, 2006-2008.

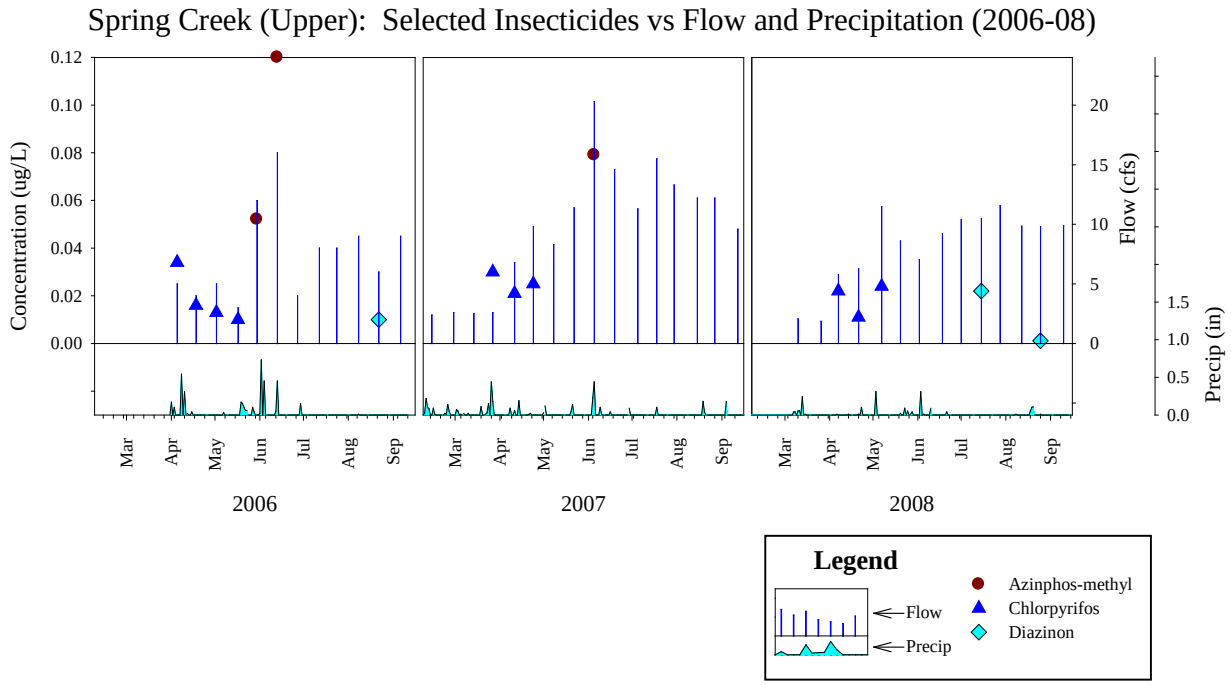

Figure I-16. Flow, precipitation, and most commonly seen insecticide concentrations for upstream Spring Creek, 2006-2008.

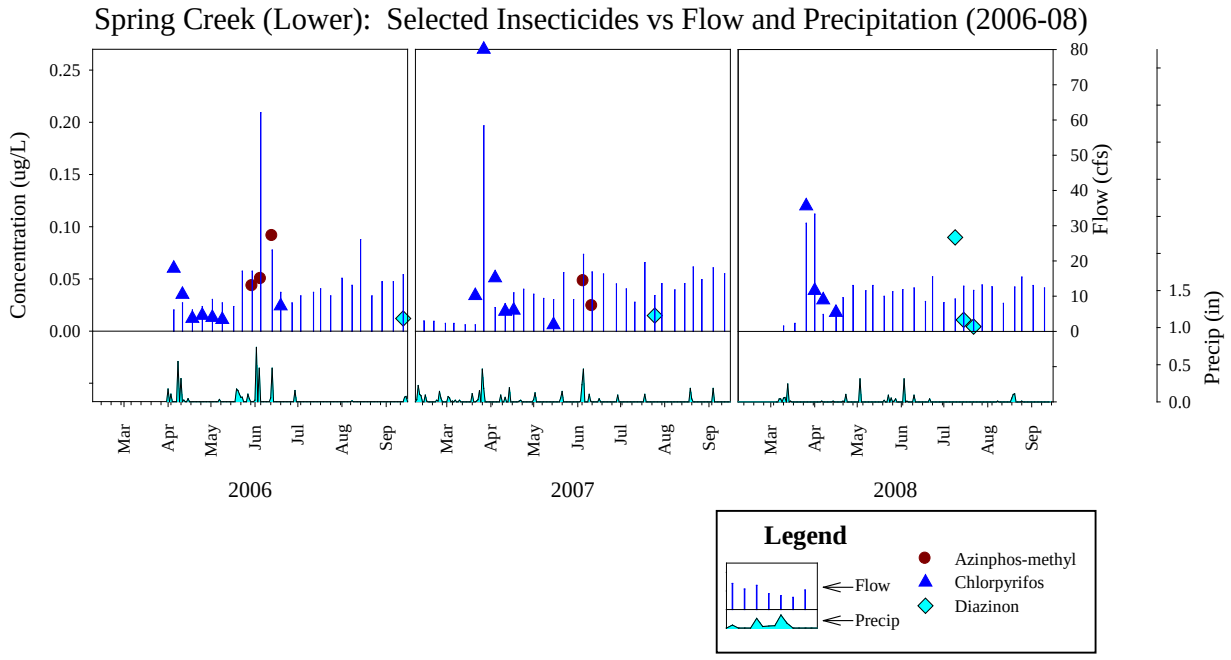

Figure I-17. Flow, precipitation, and most commonly seen insecticide concentrations for downstream Spring Creek, 2006-2008.

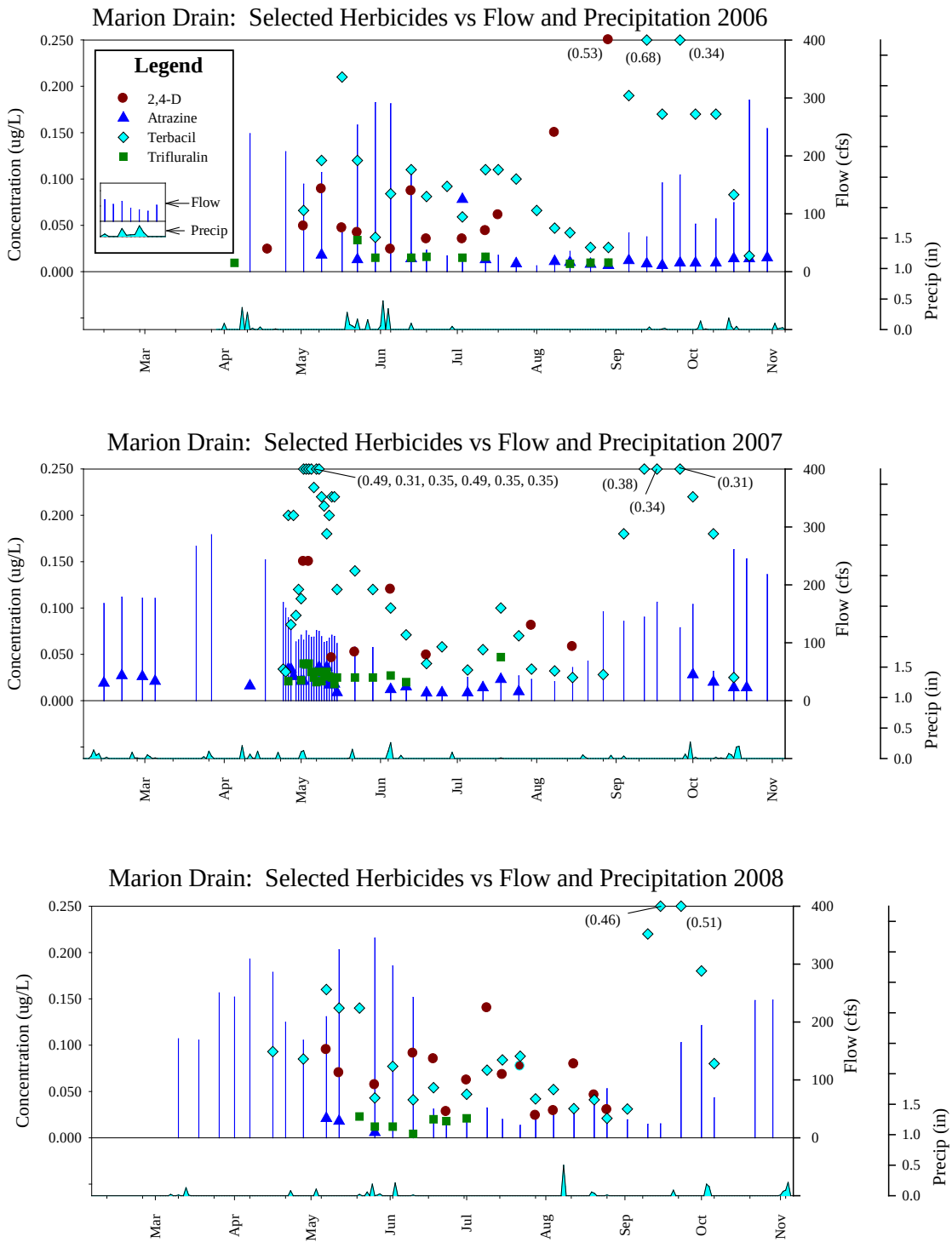

Figure I-18. Flow, precipitation, and most commonly seen herbicide concentrations for Marion Drain, 2006-2008.

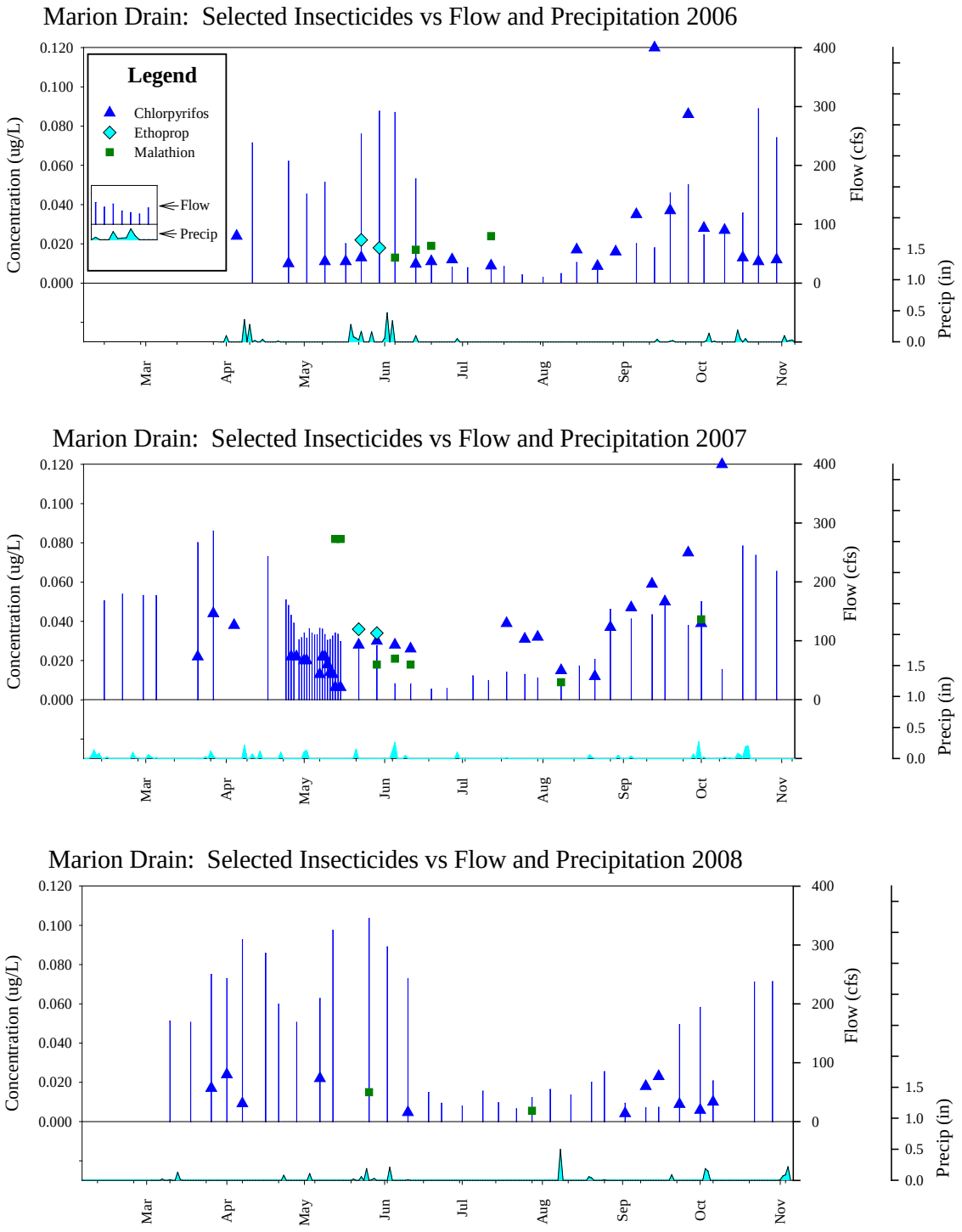

Figure I-19. Flow, precipitation, and most commonly seen insecticide concentrations for Marion Drain, 2006-2008. Late April early May 2007 includes Marion Drain Intensive sampling.

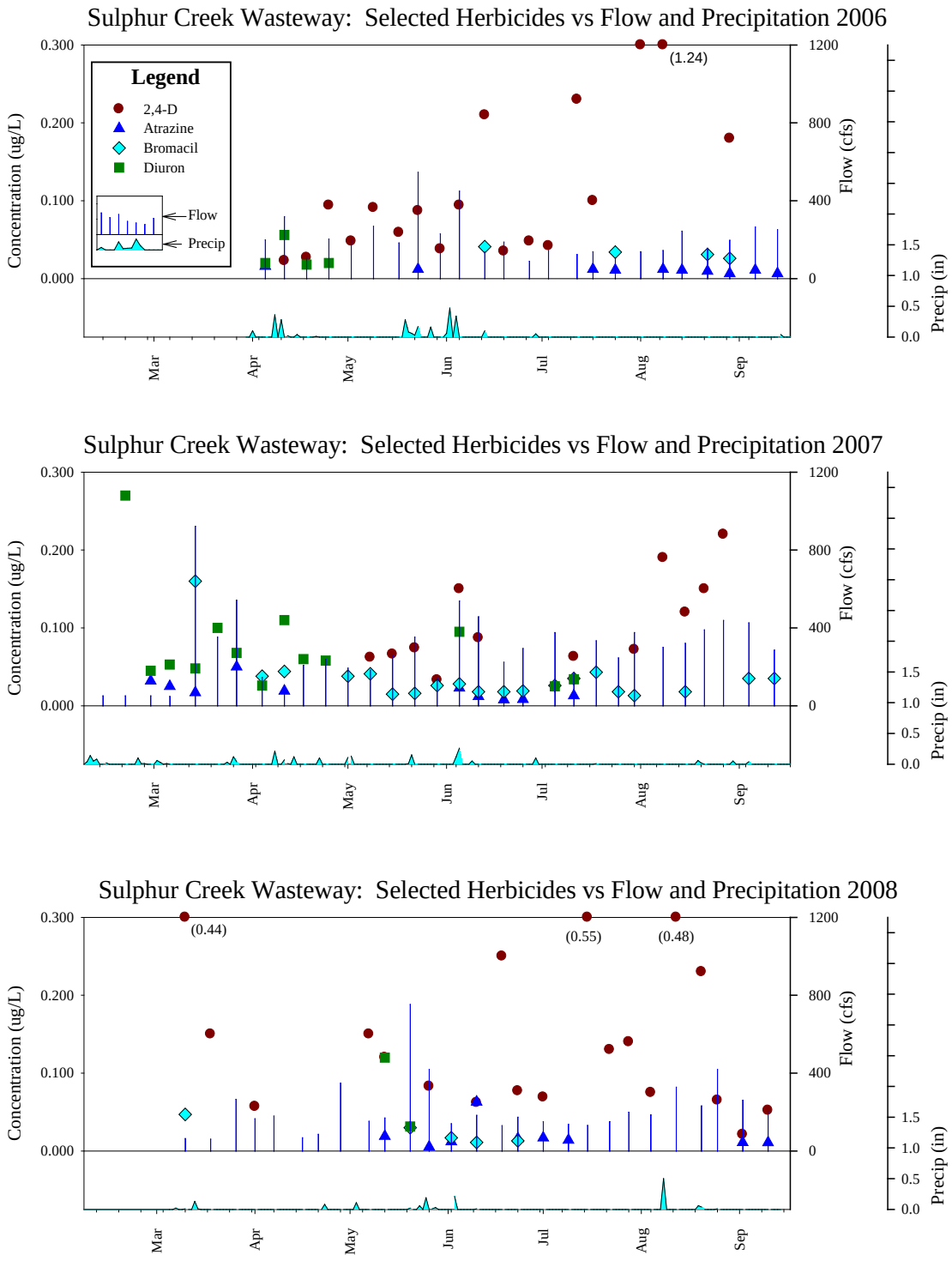

Figure I-20. Flow, precipitation, and most commonly seen herbicide concentrations for Sulphur Creek Wasteway, 2006-2008.

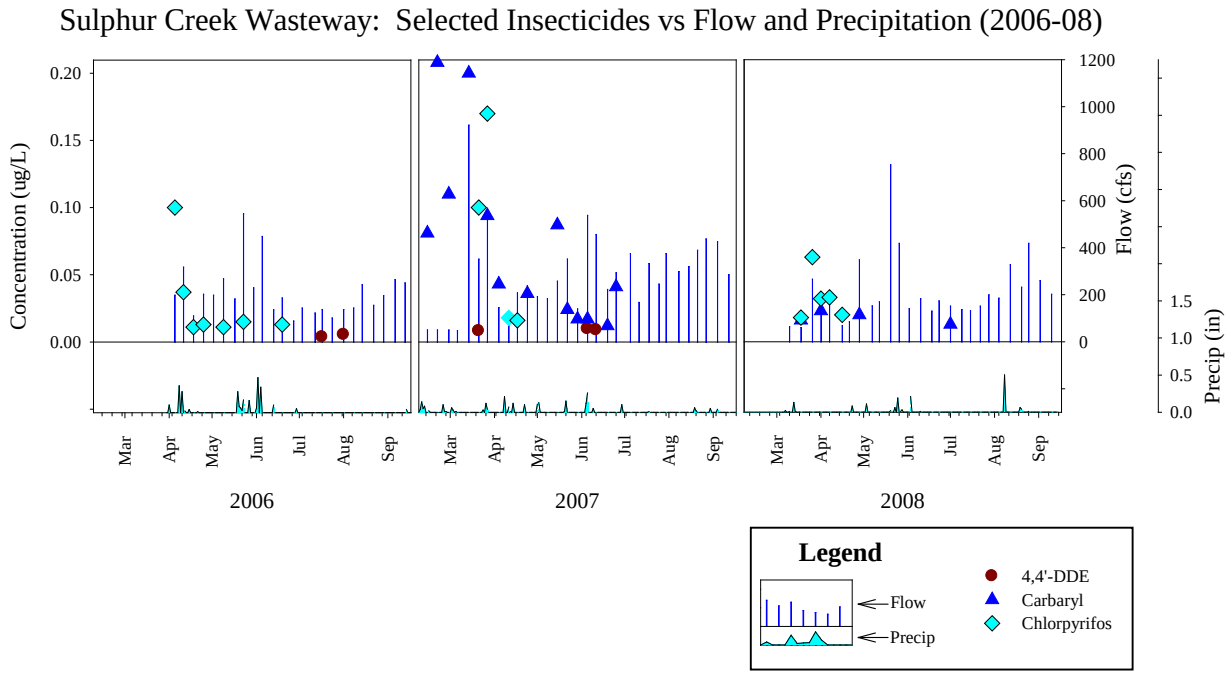

Figure I-21. Flow, precipitation, and most commonly seen insecticide concentrations for Sulphur Creek Wasteway, 2006-2008.

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Appendix J. Continuous Temperature Profiles

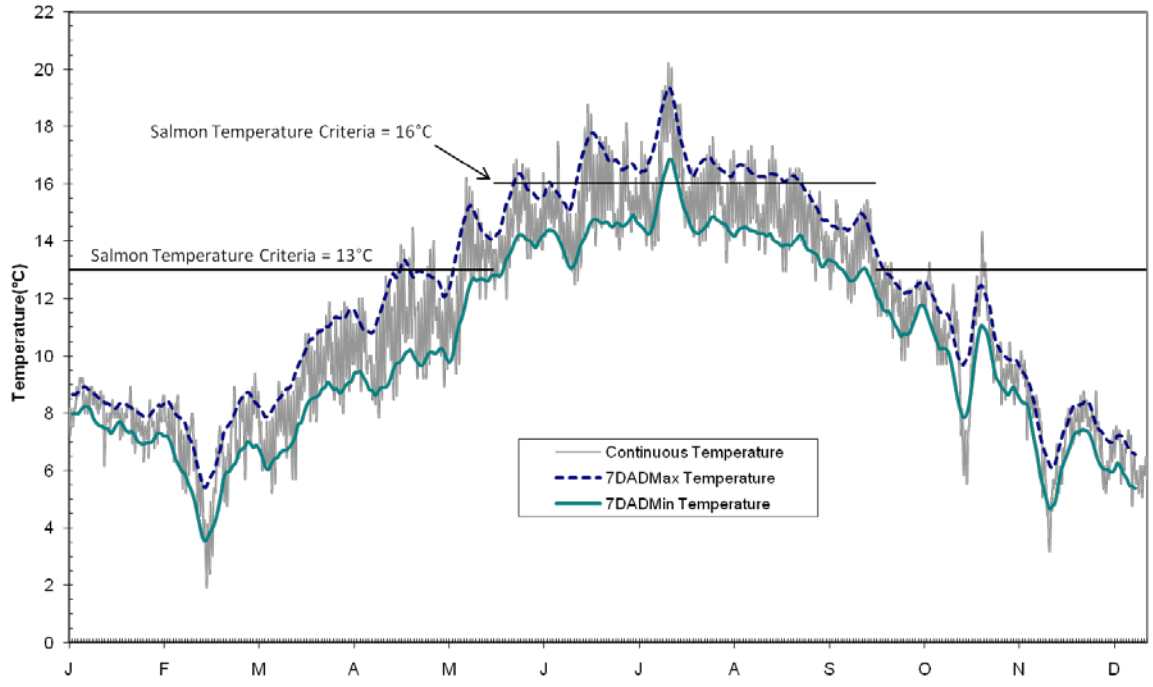

Figure J-1. 2006 continuous temperature profile for upstream Thornton Creek.

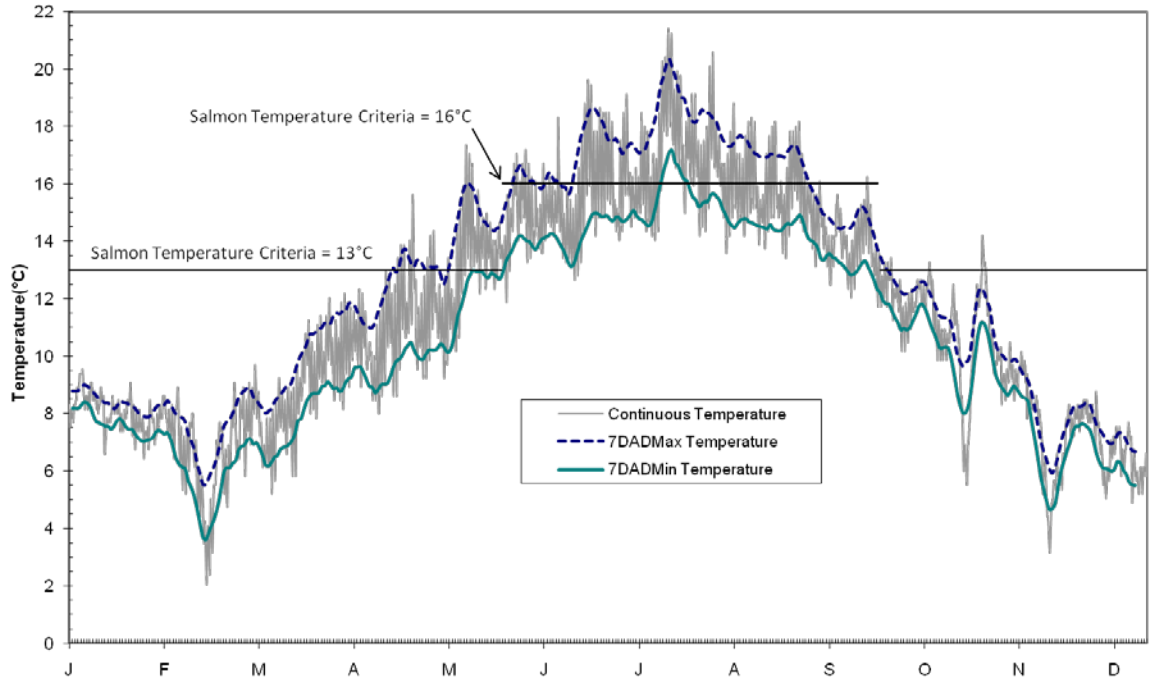

Figure J-2. 2006 continuous temperature profile for downstream Thornton Creek.

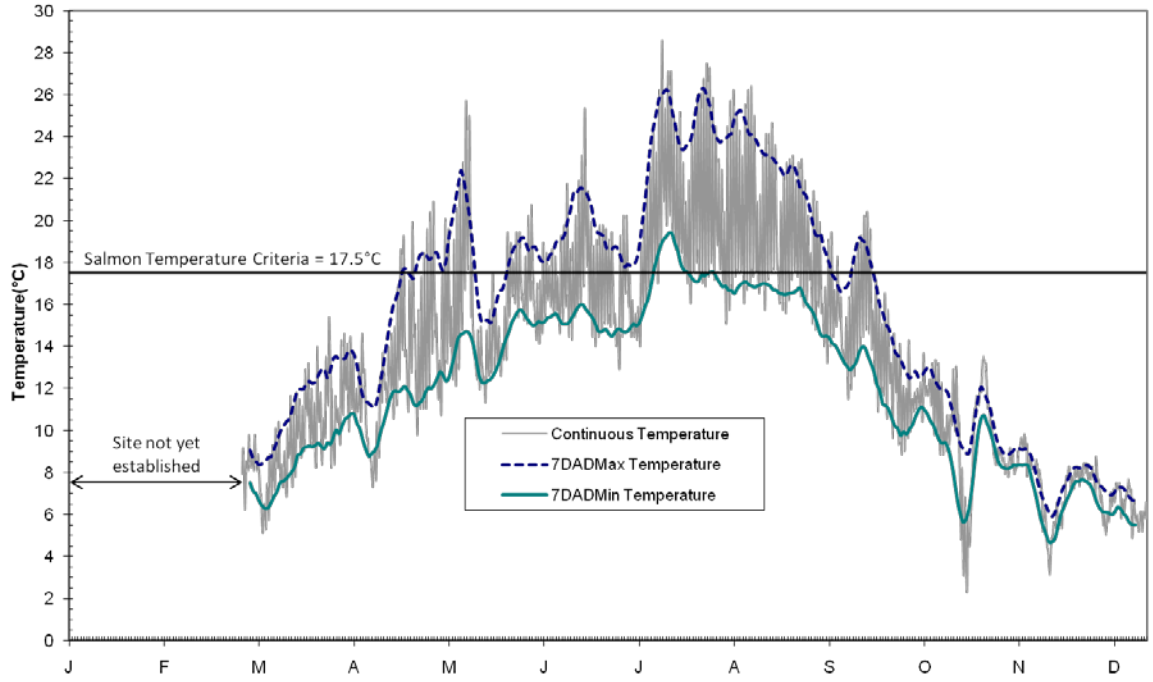

Figure J-3. 2006 continuous temperature profile for lower Big Ditch.

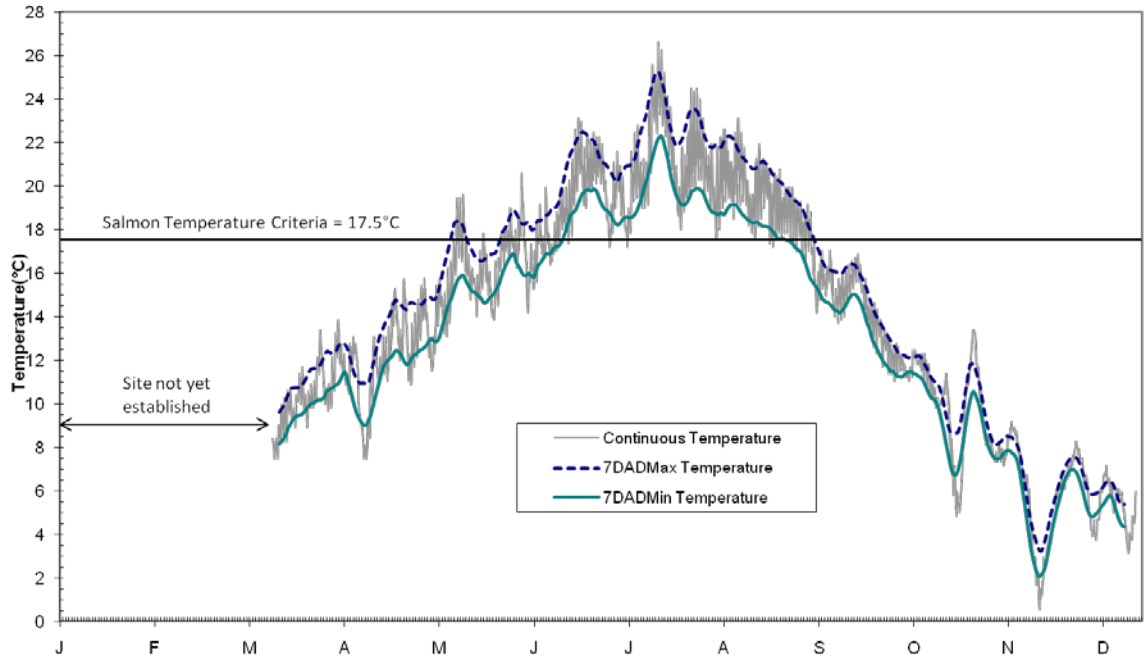

Figure J-4. 2006 continuous temperature profile for Indian Slough.

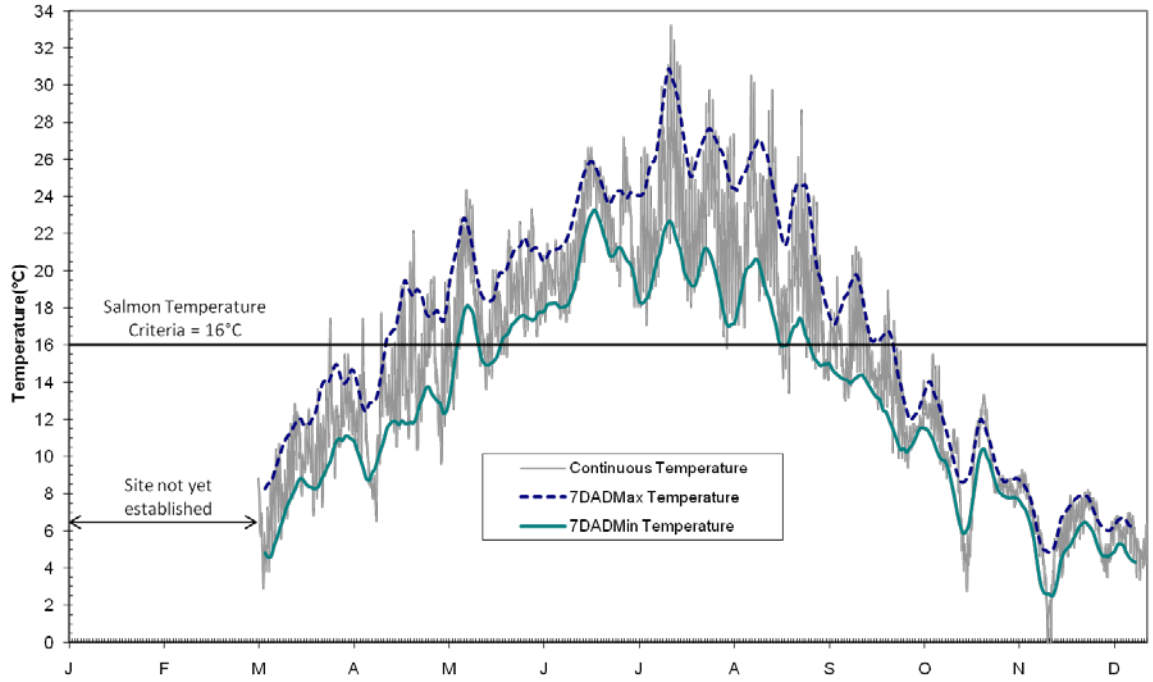

Figure J-5. 2006 continuous temperature profile for Brown Slough.

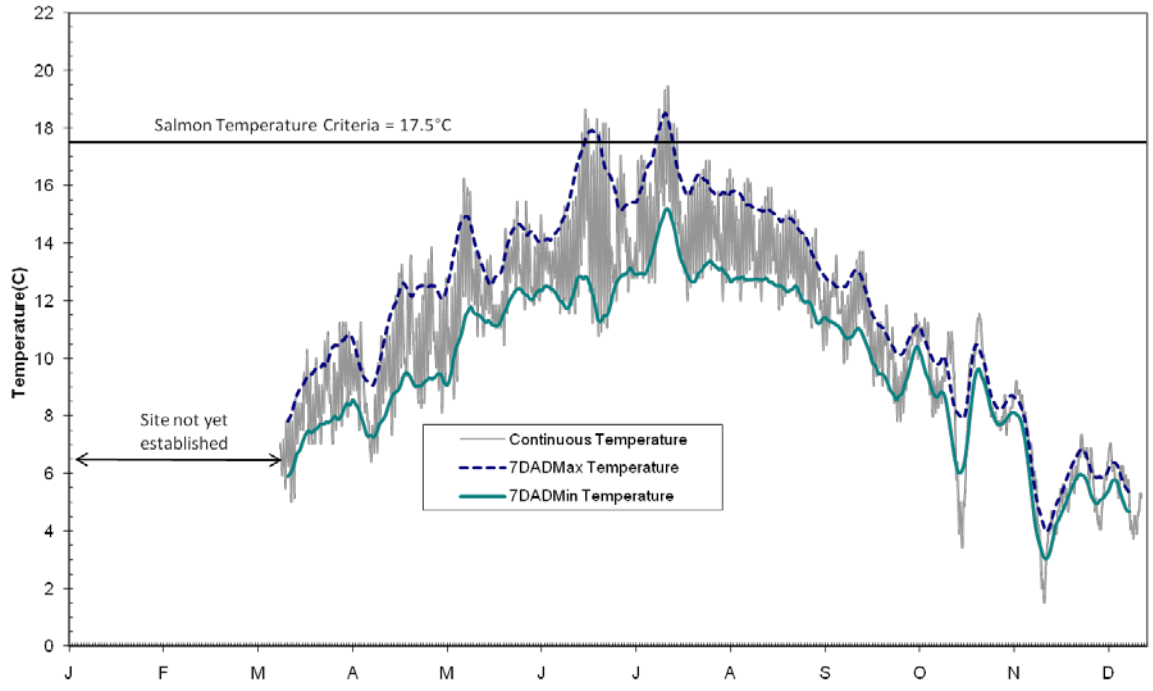

Figure J-6. 2006 continuous temperature profile for the upper Samish River.

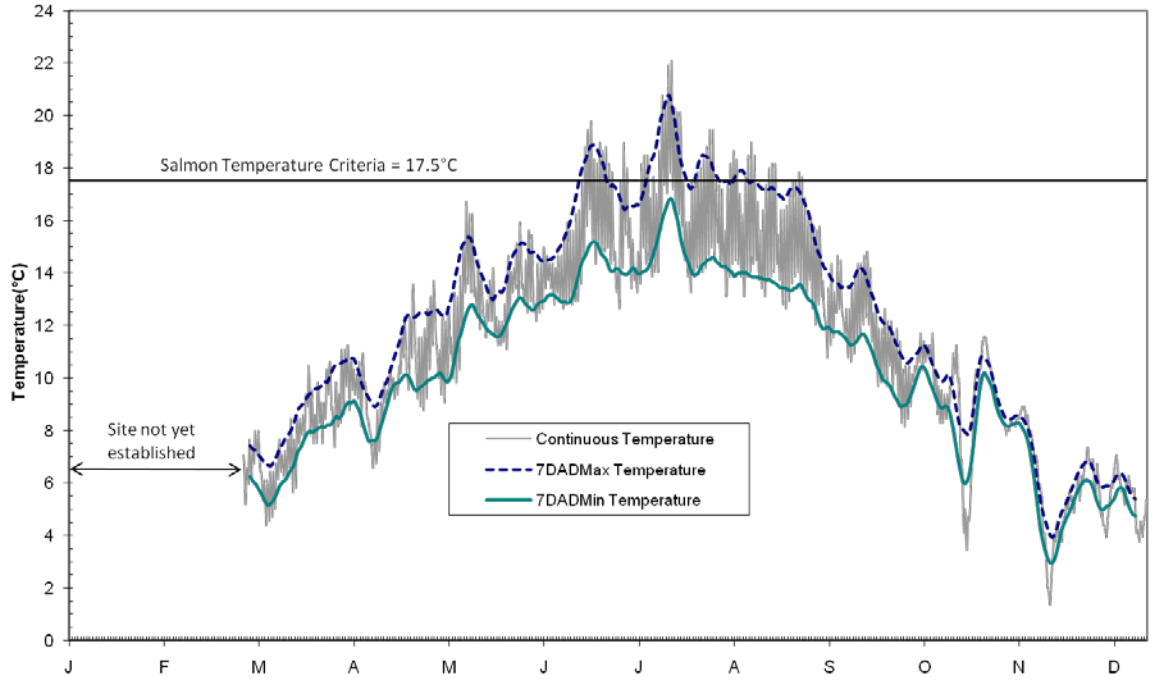

Figure J-7. 2006 continuous temperature profile for the lower Samish River.

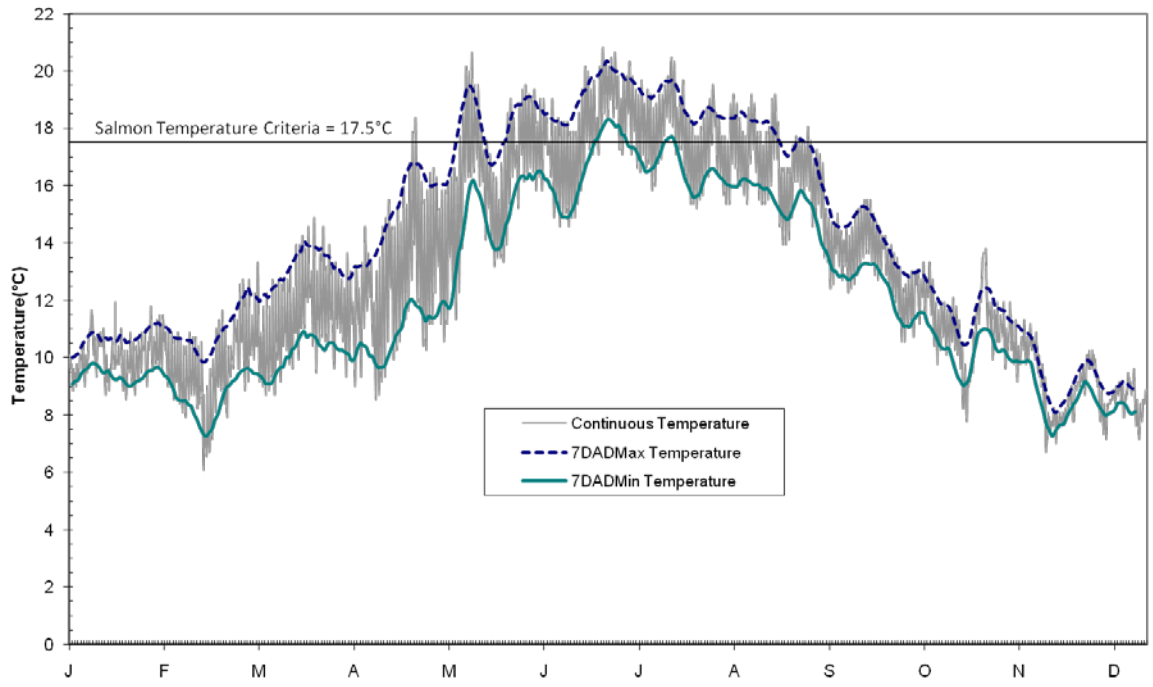

Figure J-8. 2006 continuous temperature profile for upper Spring Creek.

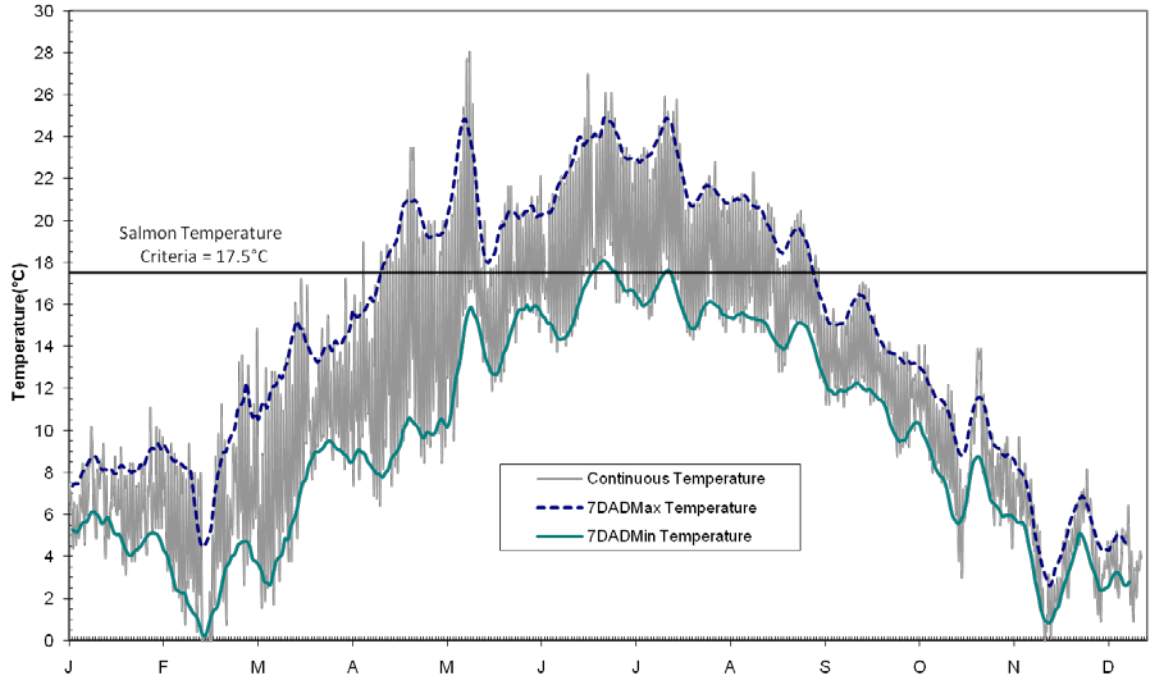

Figure J-9. 2006 continuous temperature profile for lower Spring Creek.

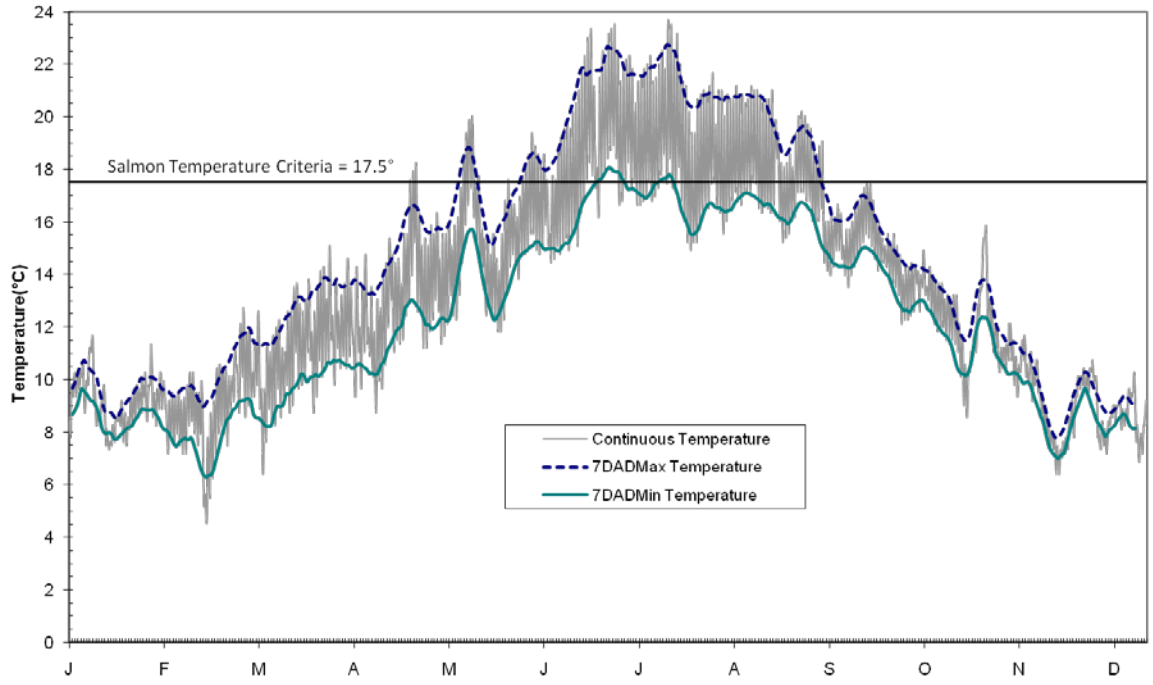

Figure J-10. 2006 continuous temperature profile for Marion Drain.

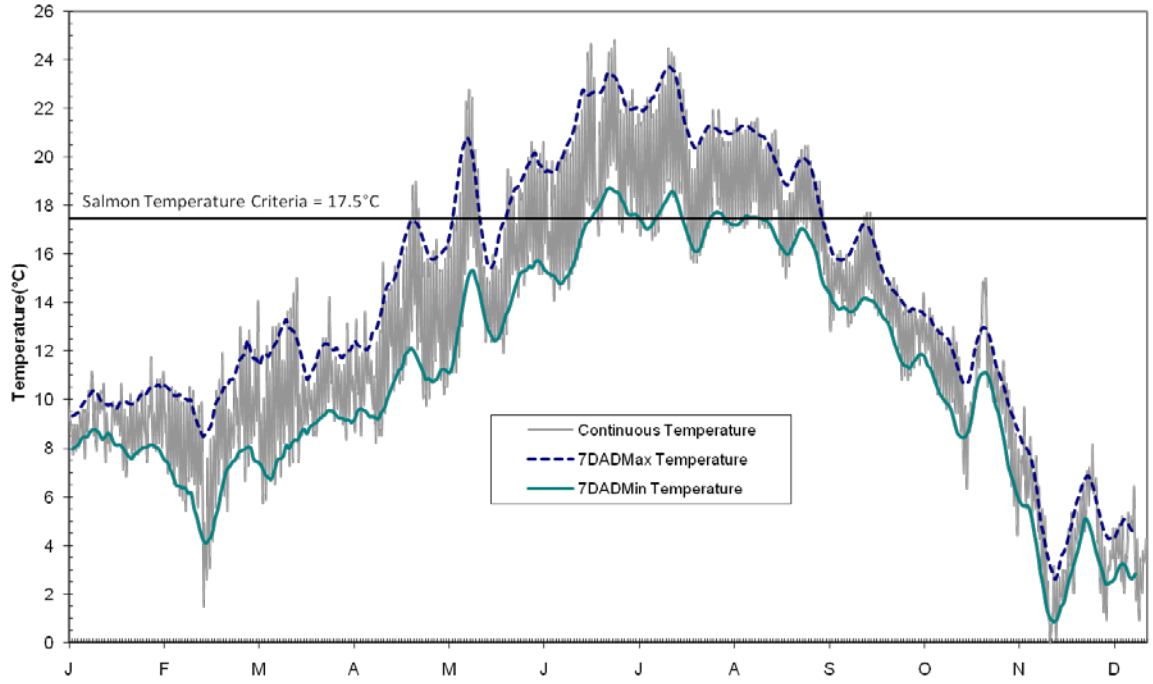

Figure J-11. 2006 continuous temperature profile for Sulphur Creek Wasteway.

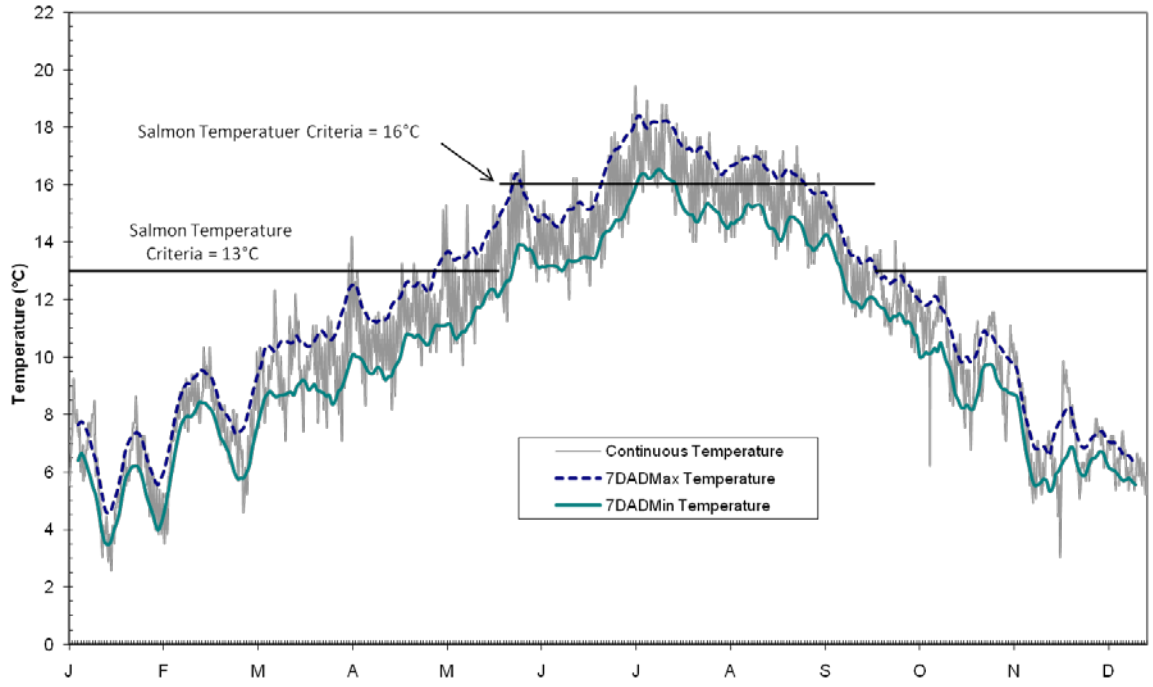

Figure J-12. 2007 continuous temperature profile for upstream Thornton Creek.

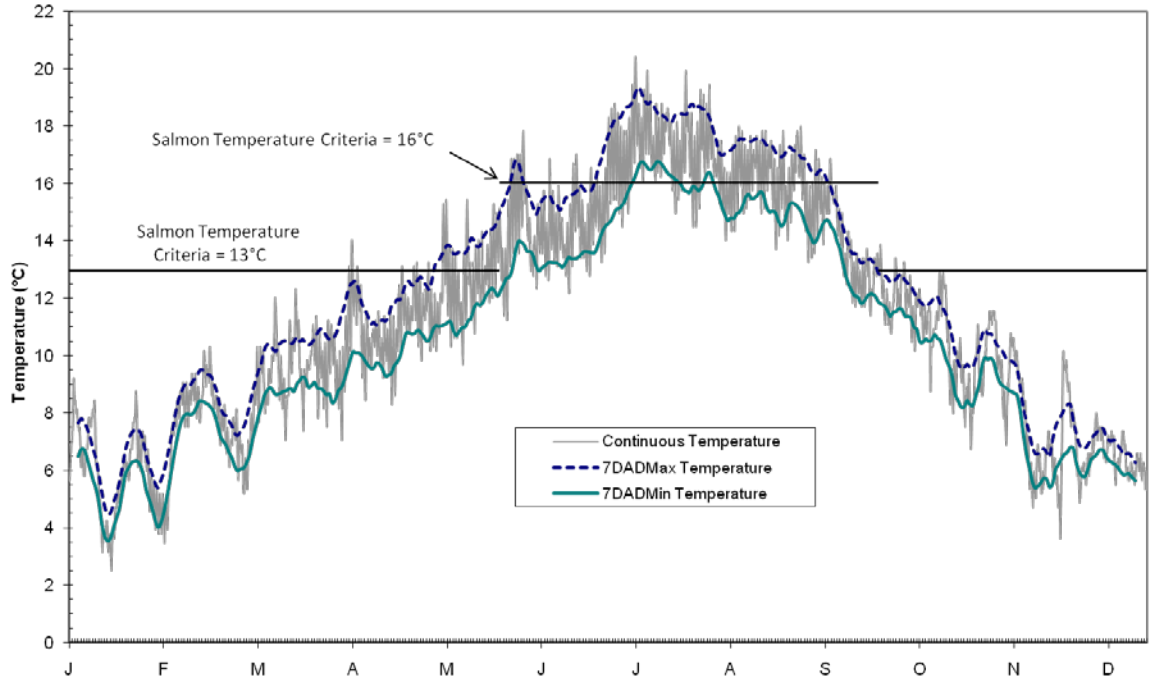

Figure J-13. 2007 continuous temperature profile for downstream Thornton Creek.

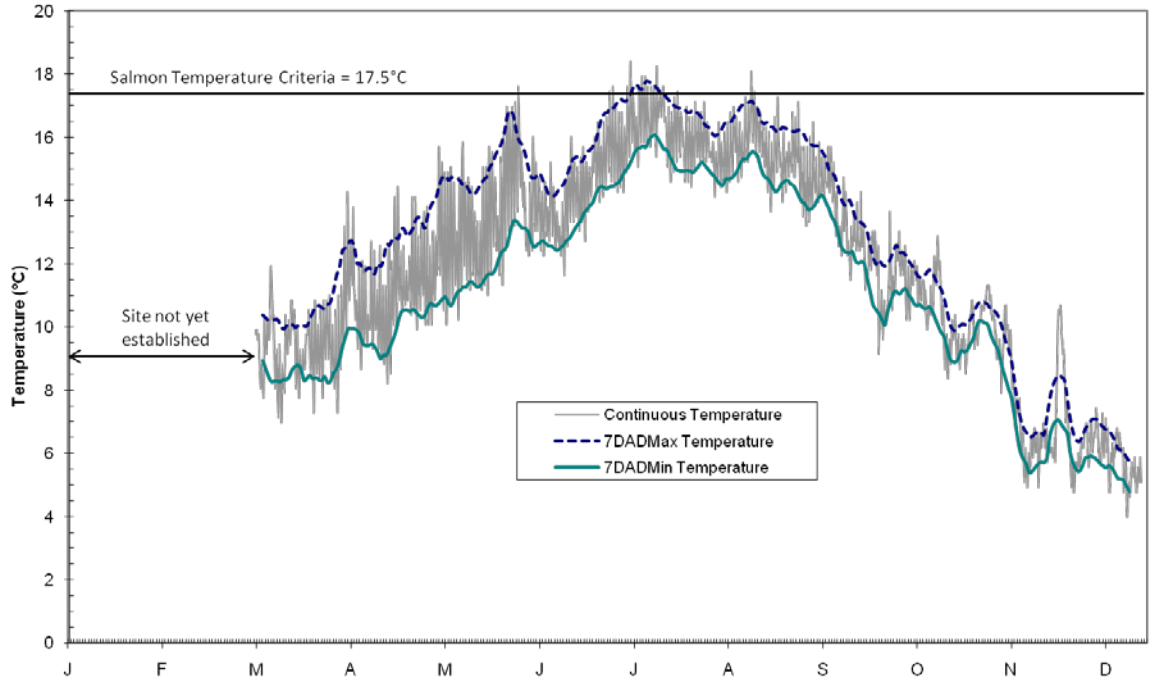

Figure J-14. 2007 continuous temperature profile for upper Big Ditch.

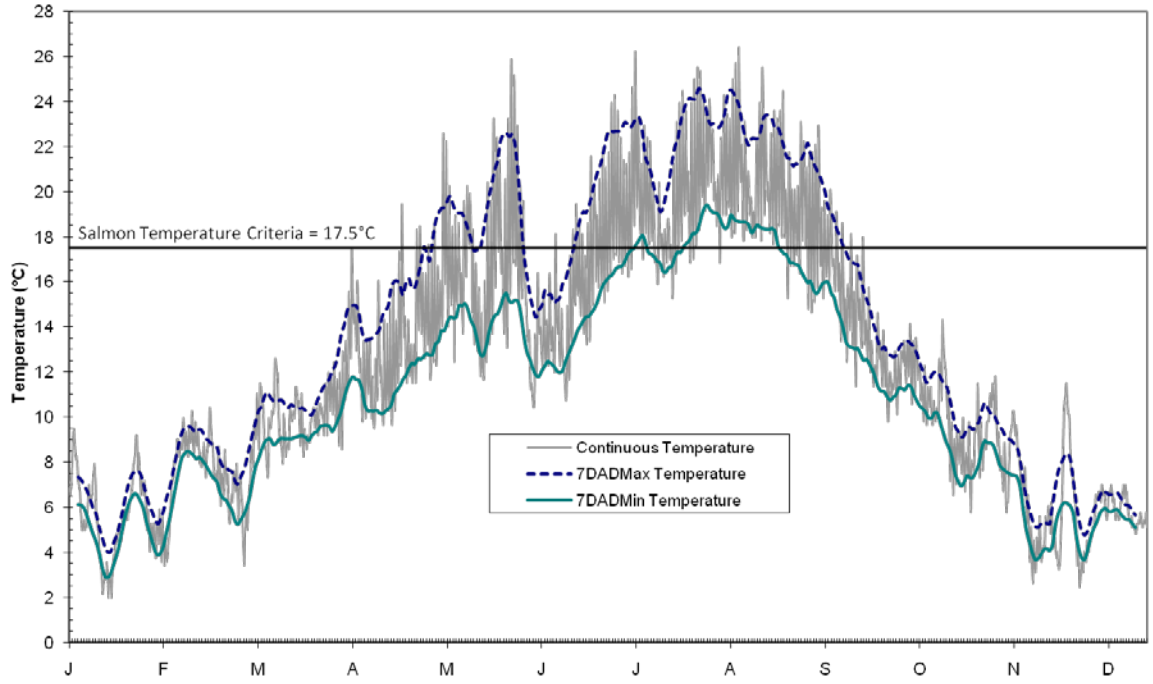

Figure J-15. 2007 continuous temperature profile for lower Big Ditch.

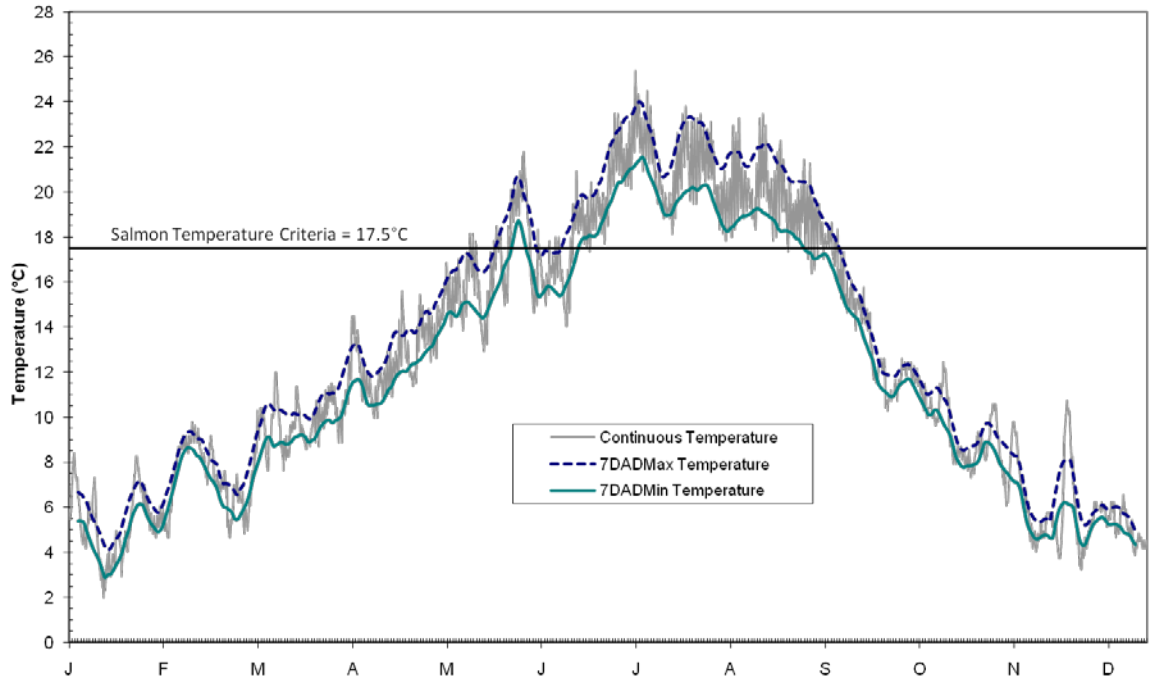

Figure J-16. 2007 continuous temperature profile for Indian Slough.

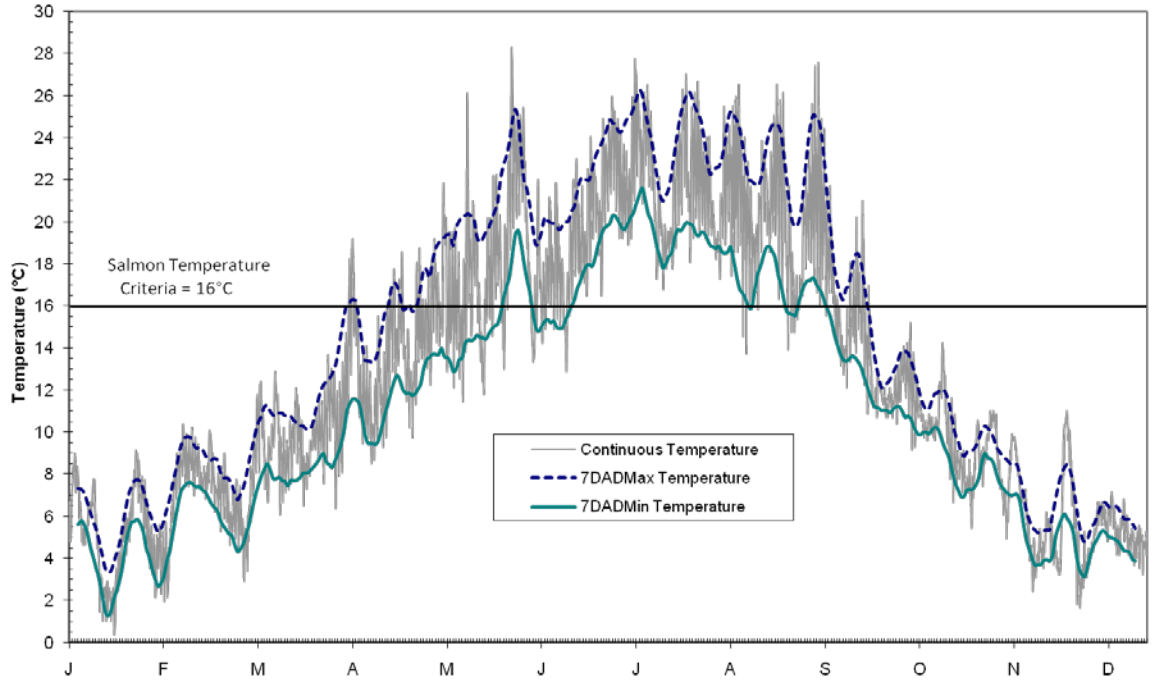

Figure J-17. 2007 continuous temperature profile for Brown Slough.

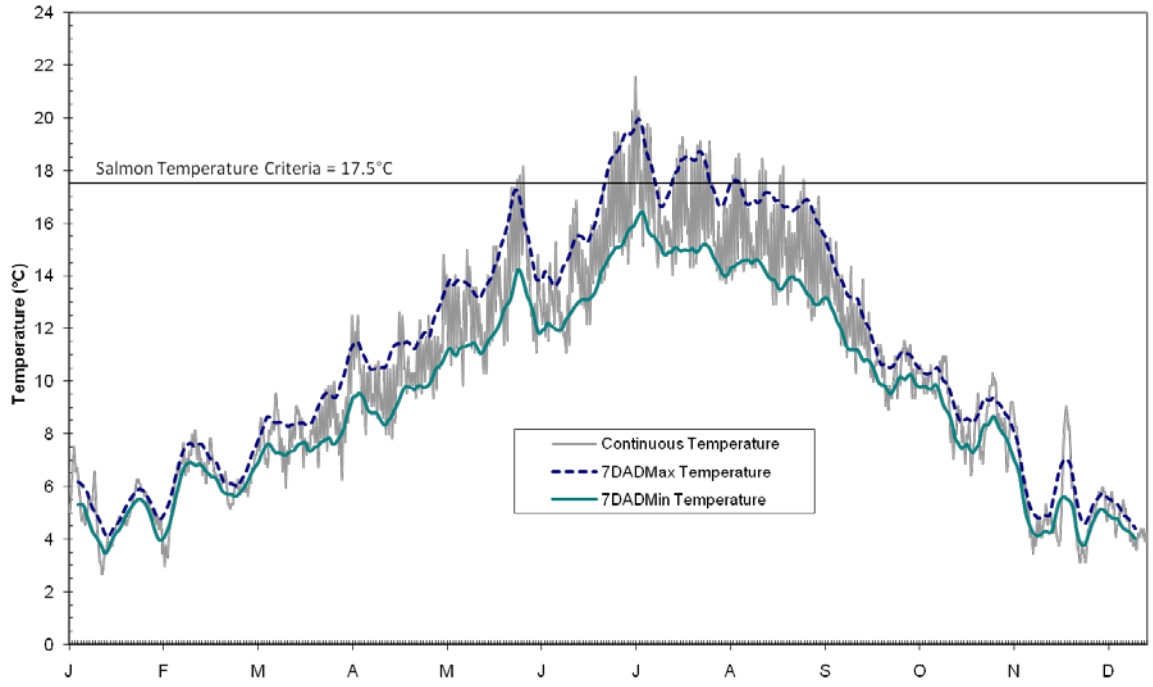

Figure J-18. 2007 continuous temperature profile for the Samish River.

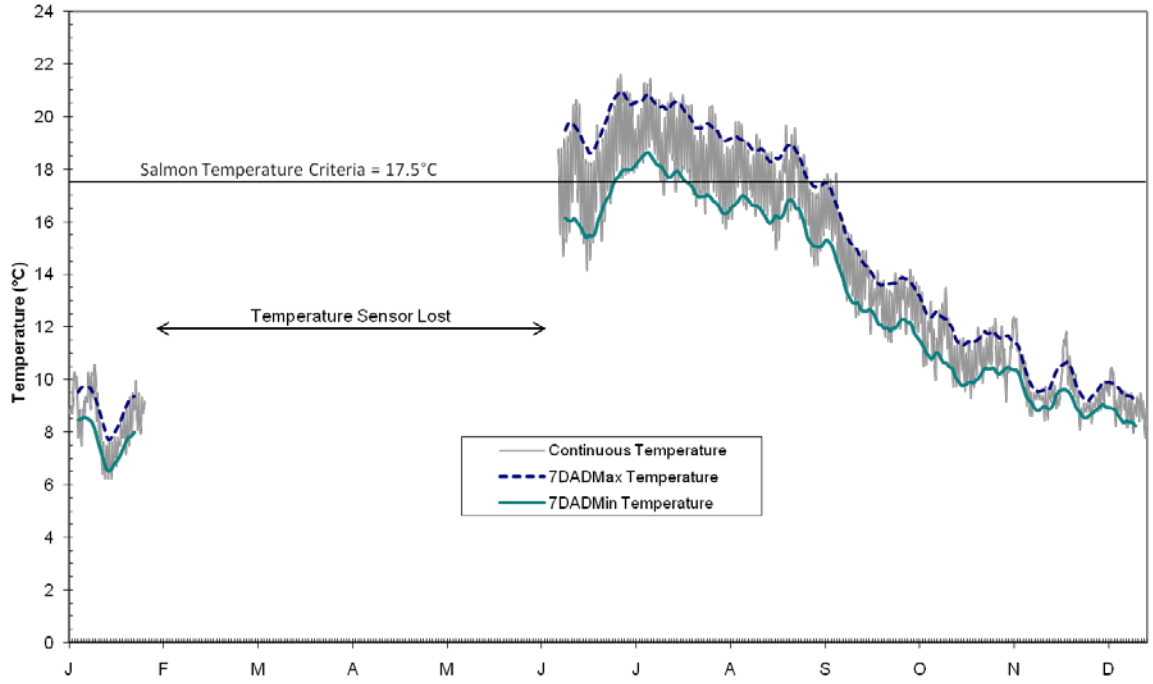

Figure J-19. 2007 continuous temperature profile for upper Spring Creek.

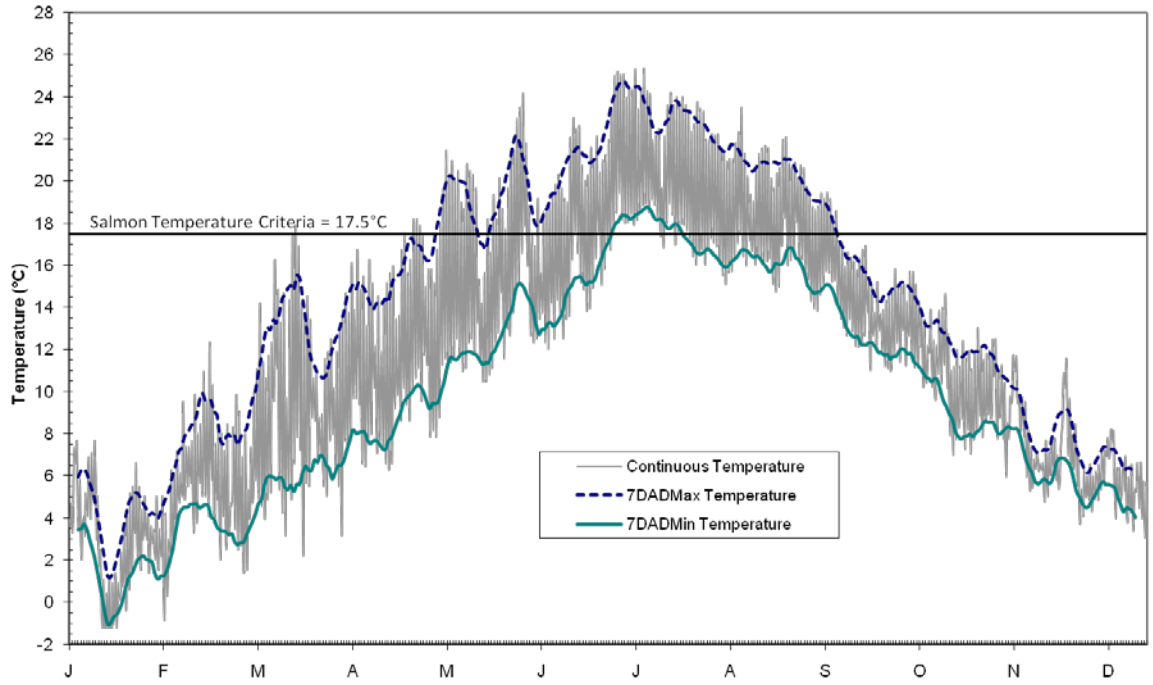

Figure J-20. 2007 continuous temperature profile for lower Spring Creek.

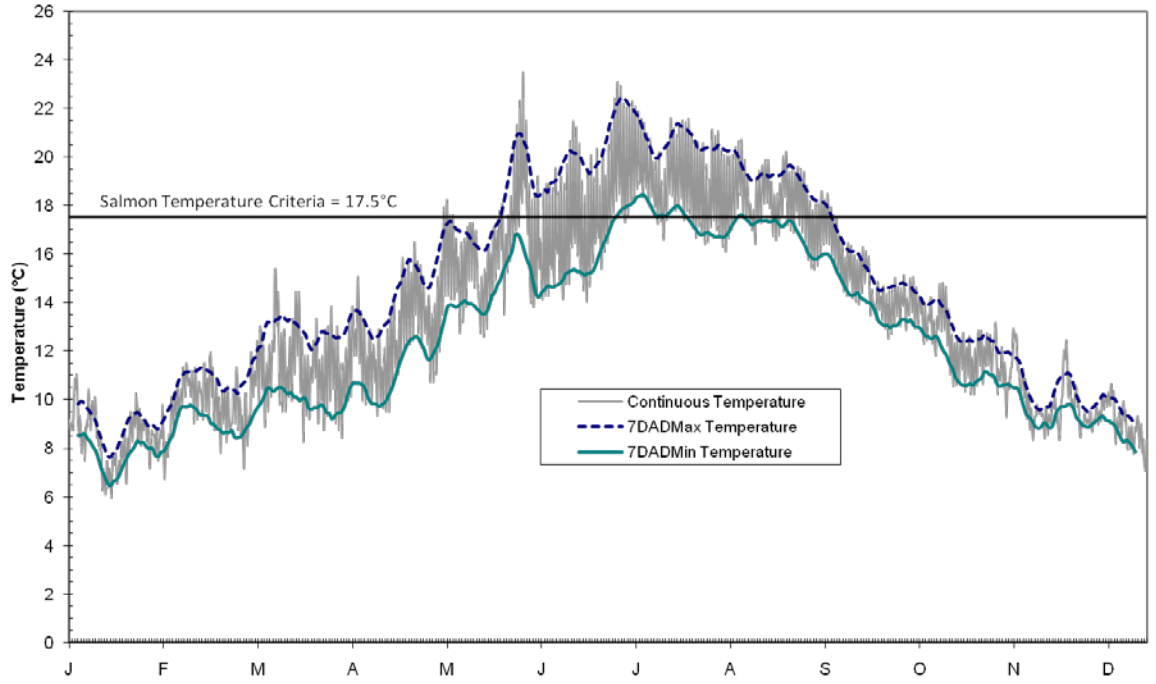

Figure J-21. 2007 continuous temperature profile for Marion Drain.

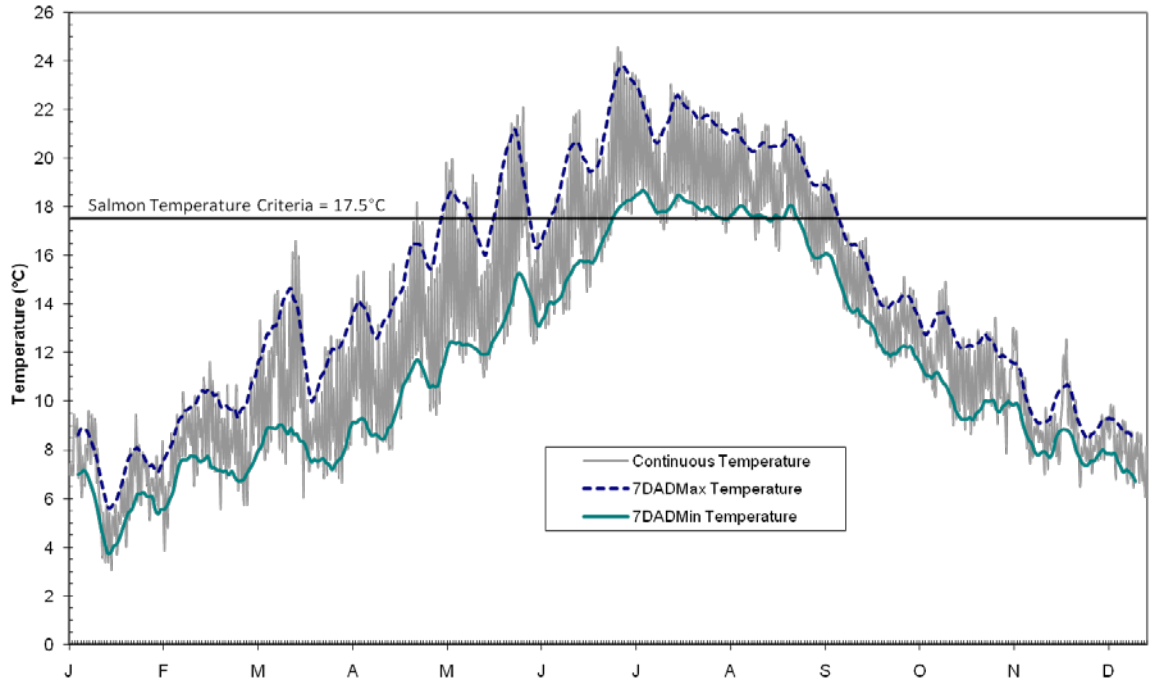

Figure J-22. 2007 continuous temperature profile for Sulphur Creek Wasteway.

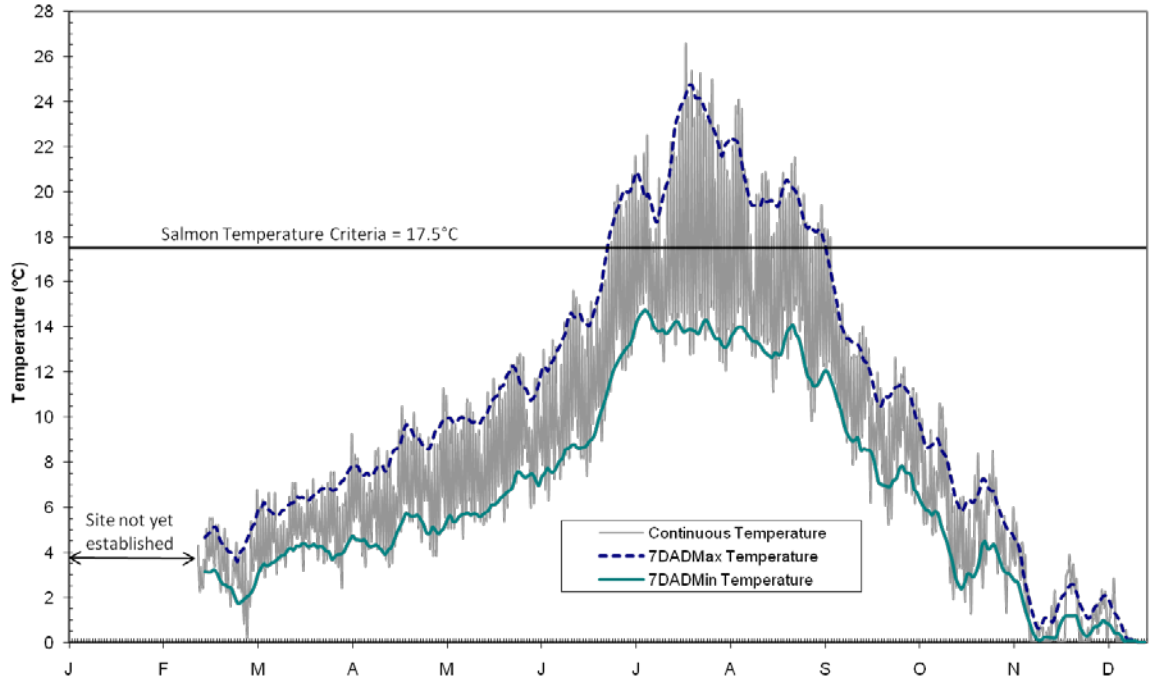

Figure J-23. 2007 continuous temperature profile for Peshastin Creek.

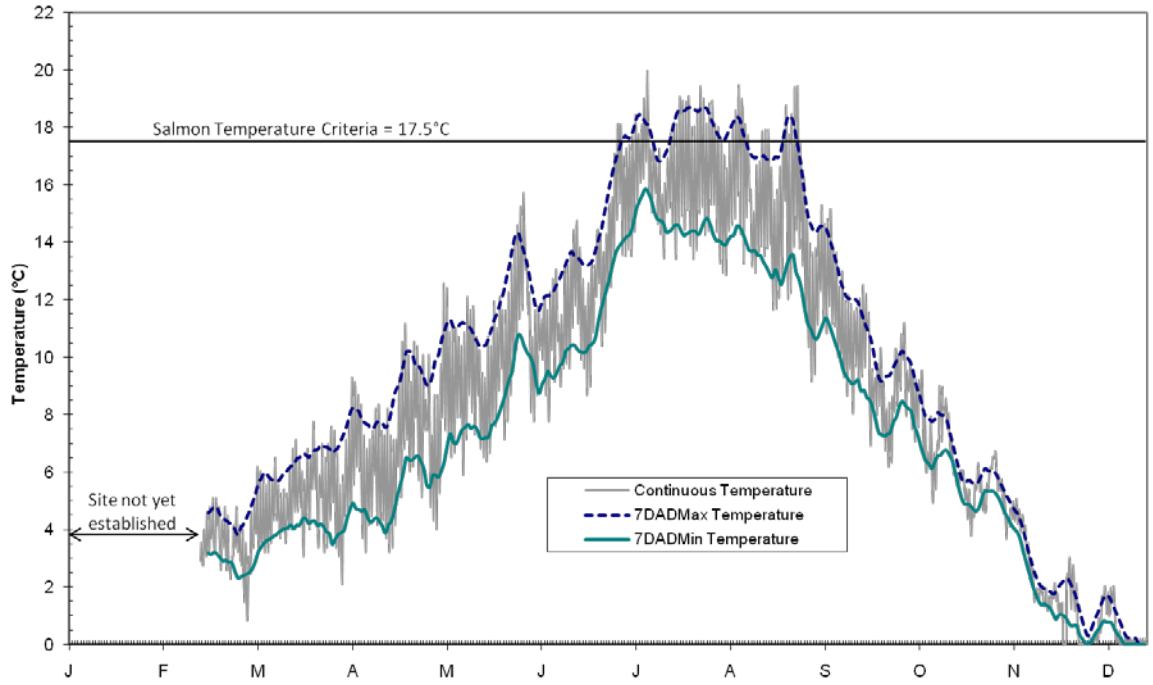

Figure J-24. 2007 continuous temperature profile for Mission Creek.

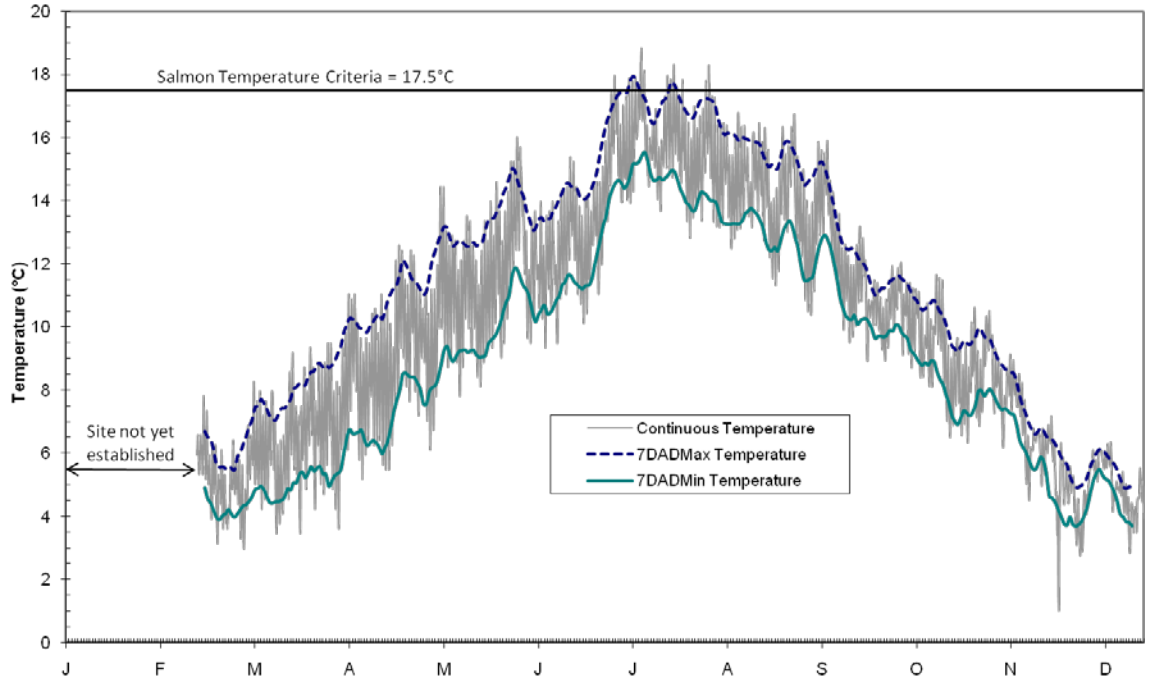

Figure J-25. 2007 continuous temperature profile for Brender Creek.

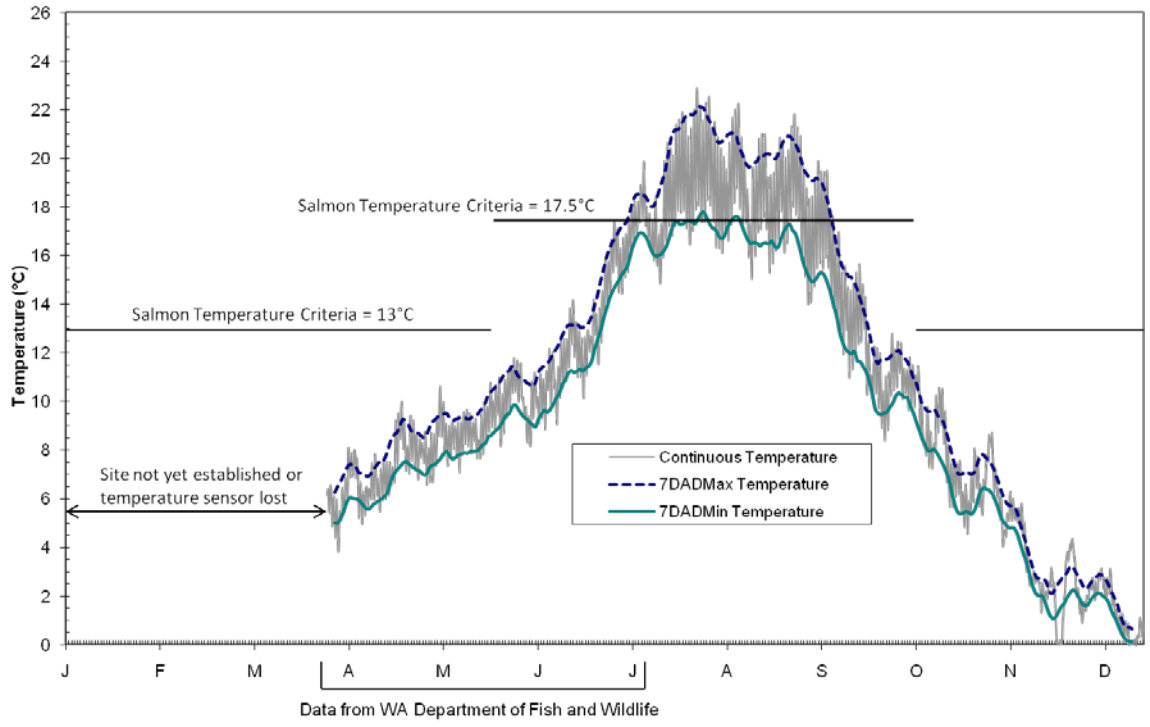

Figure J-26. 2007 continuous temperature profile for the Wenatchee River.

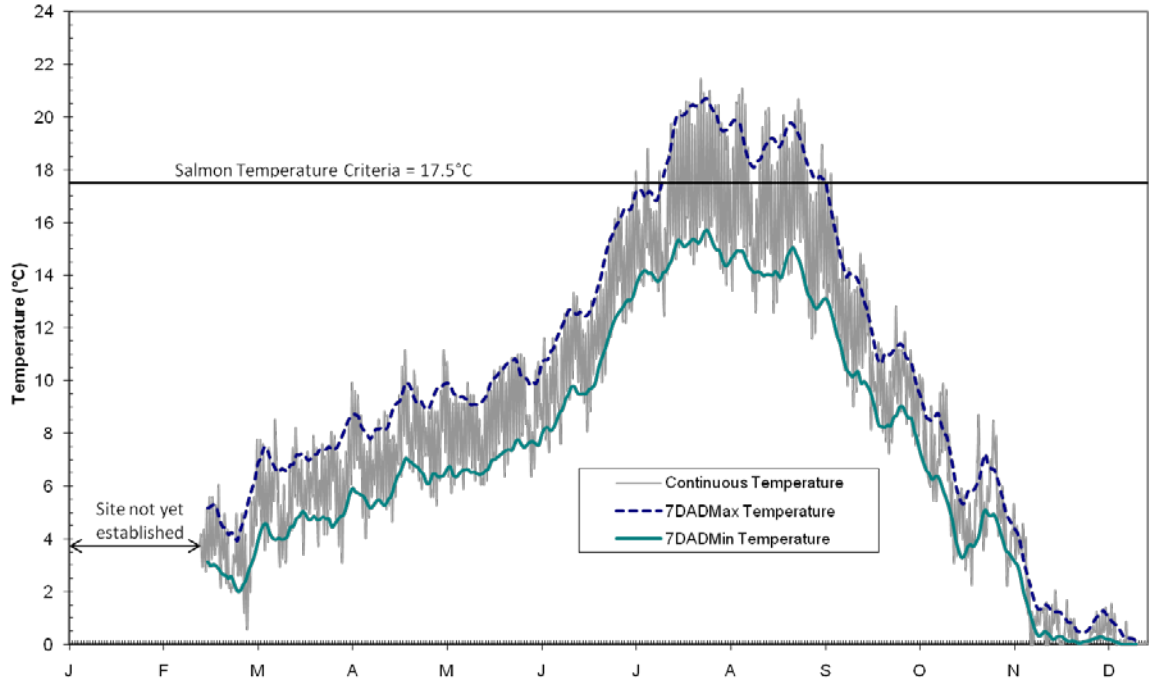

Figure J-27. 2007 continuous temperature profile for the Entiat River.

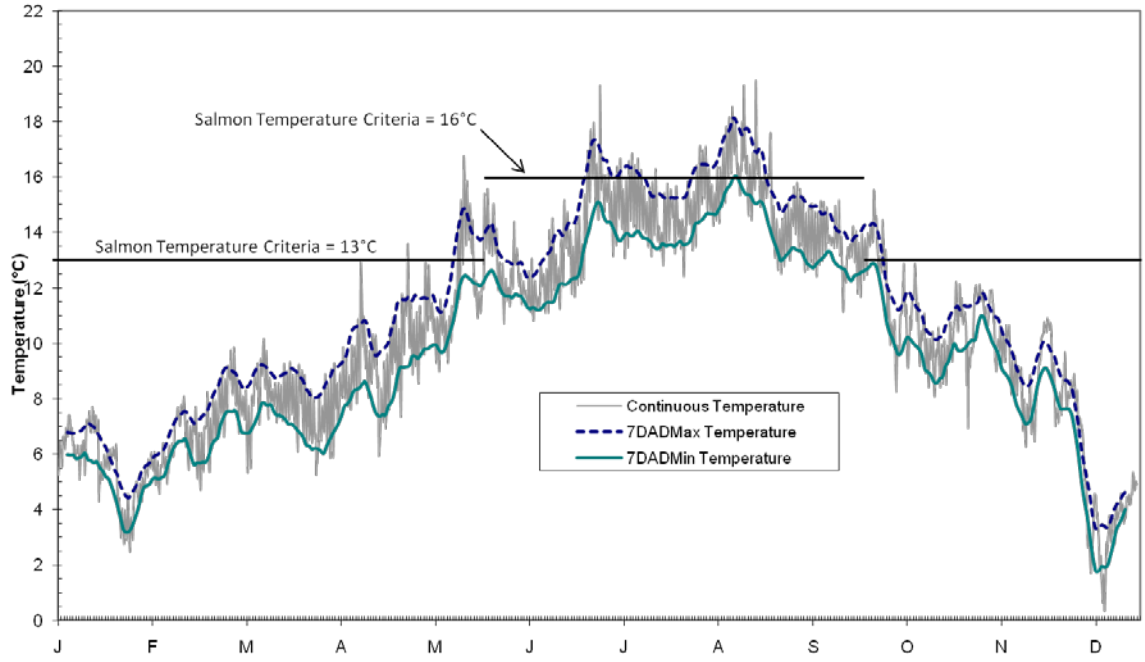

Figure J-28. 2008 continuous temperature profile for upstream Thornton Creek.

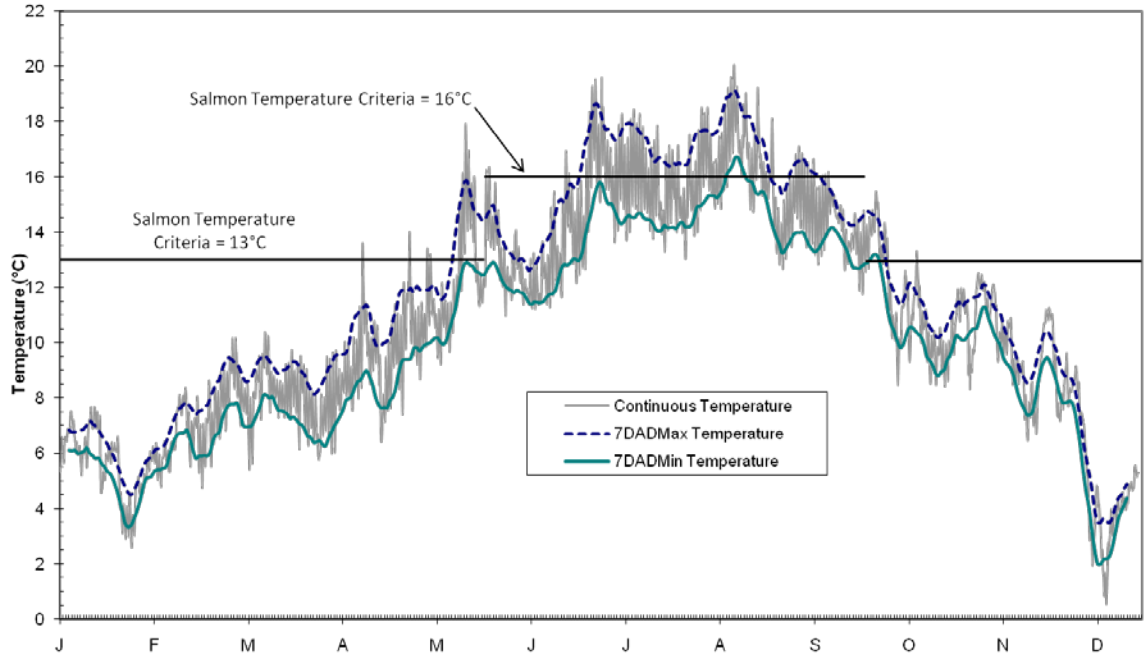

Figure J-29. 2008 continuous temperature profile for downstream Thornton Creek.

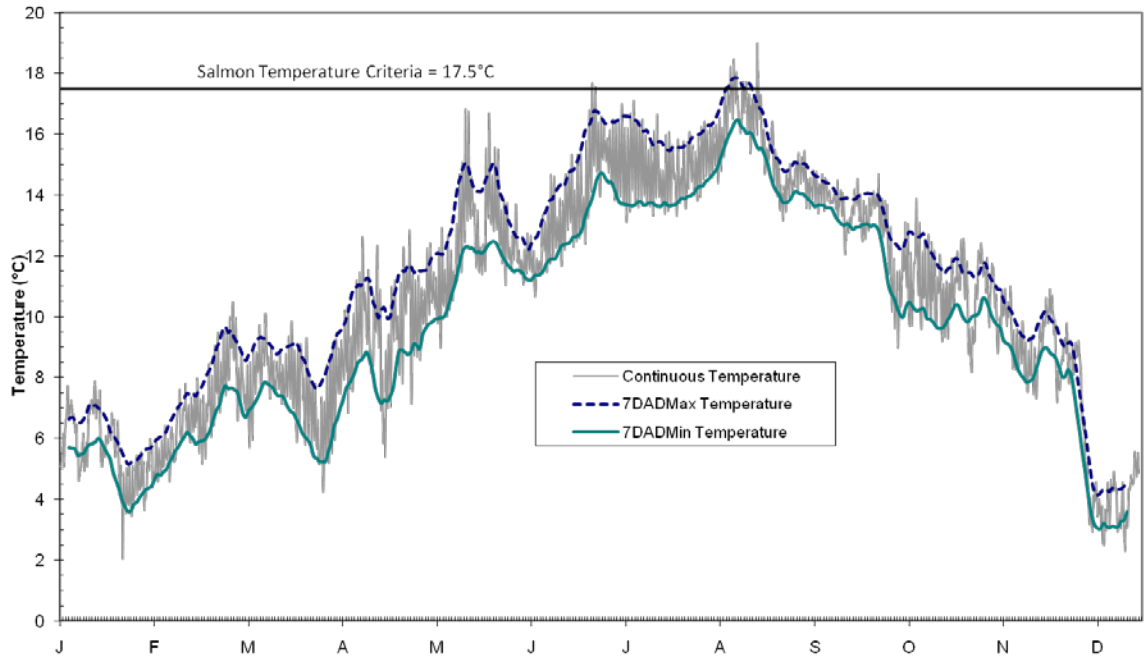

Figure J-30. 2008 continuous temperature profile for upper Big Ditch.

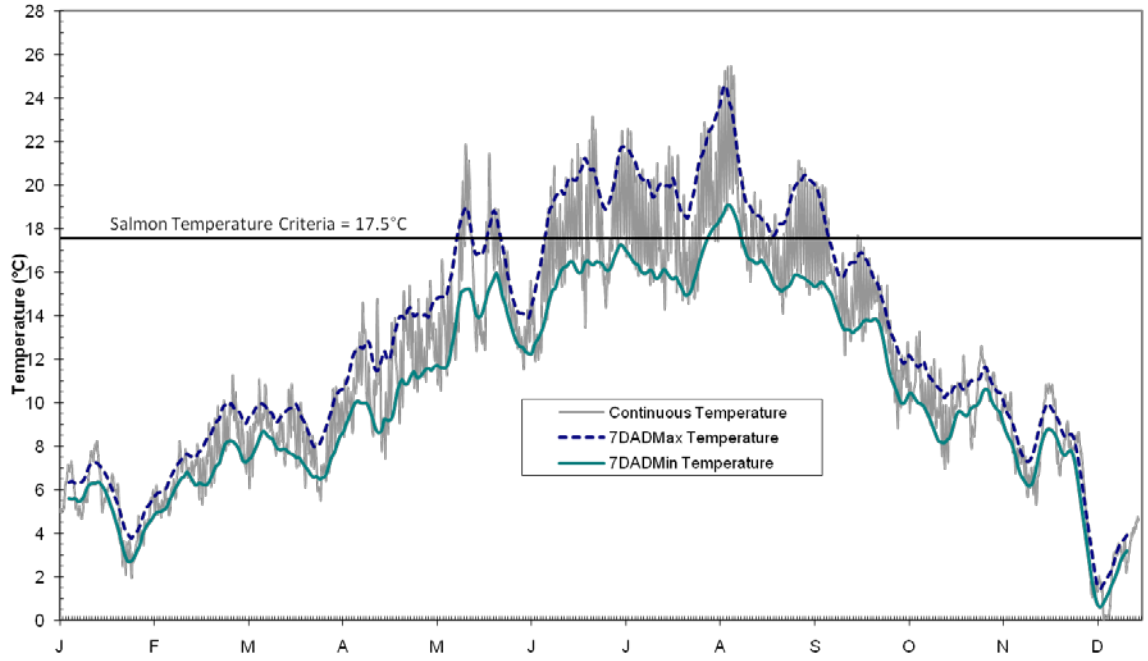

Figure J-31. 2008 continuous temperature profile for lower Big Ditch.

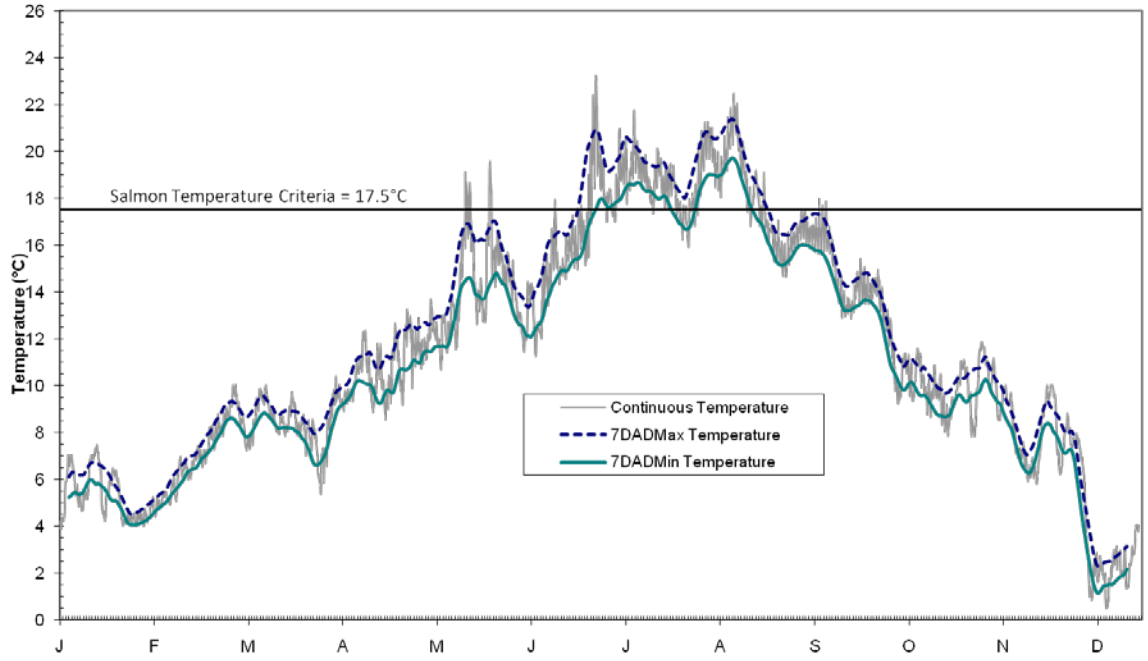

Figure J-32. 2008 continuous temperature profile for Indian Slough.

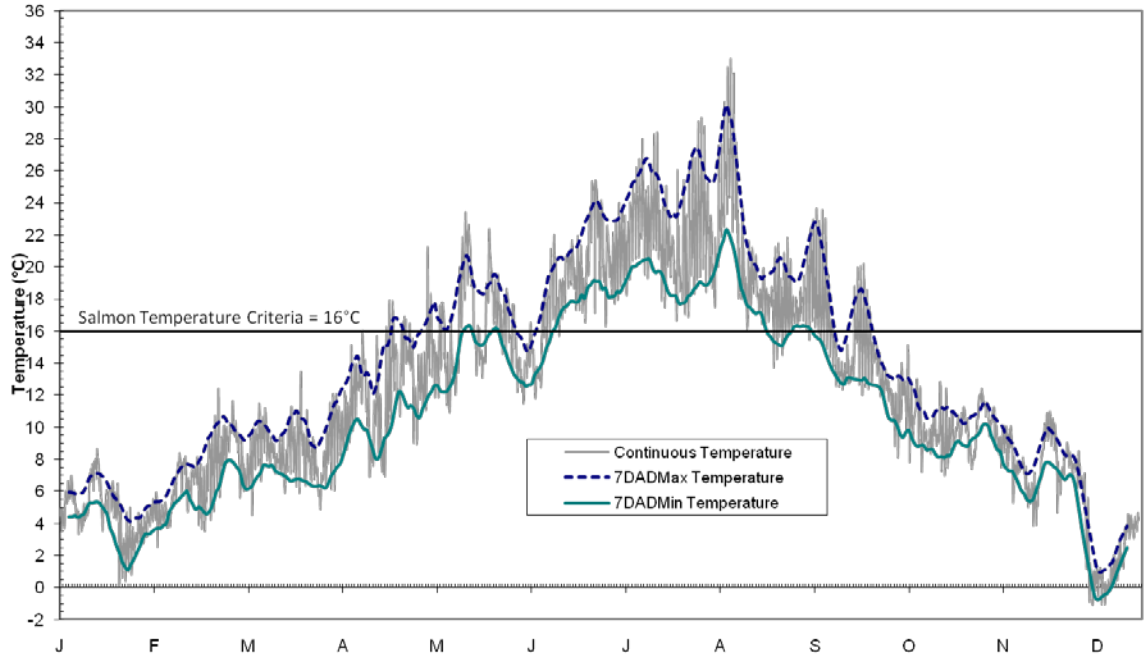

Figure J-33. 2008 continuous temperature profile for Brown Slough.

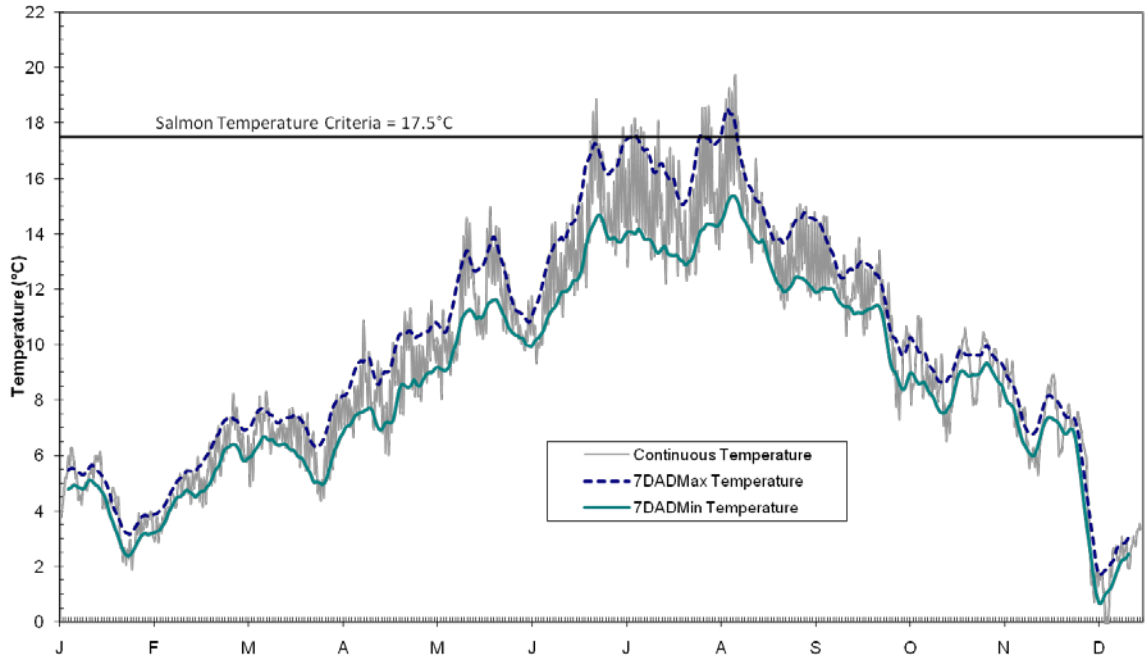

Figure J-34. 2008 continuous temperature profile for the Samish River.

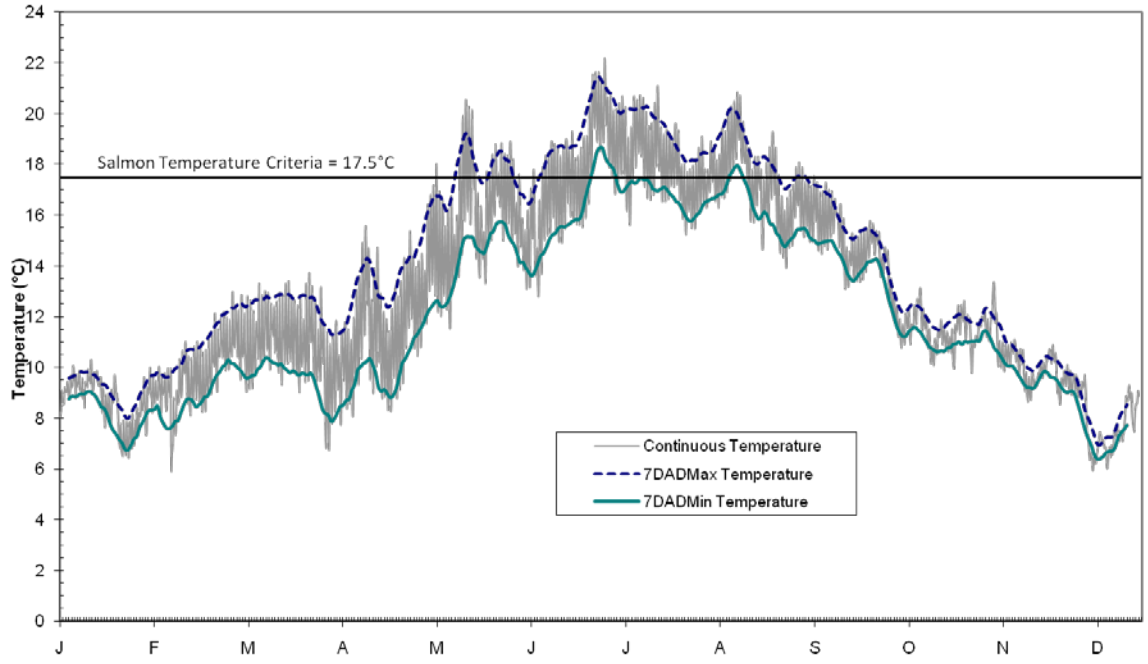

Figure J-35. 2008 continuous temperature profile for upper Spring Creek.

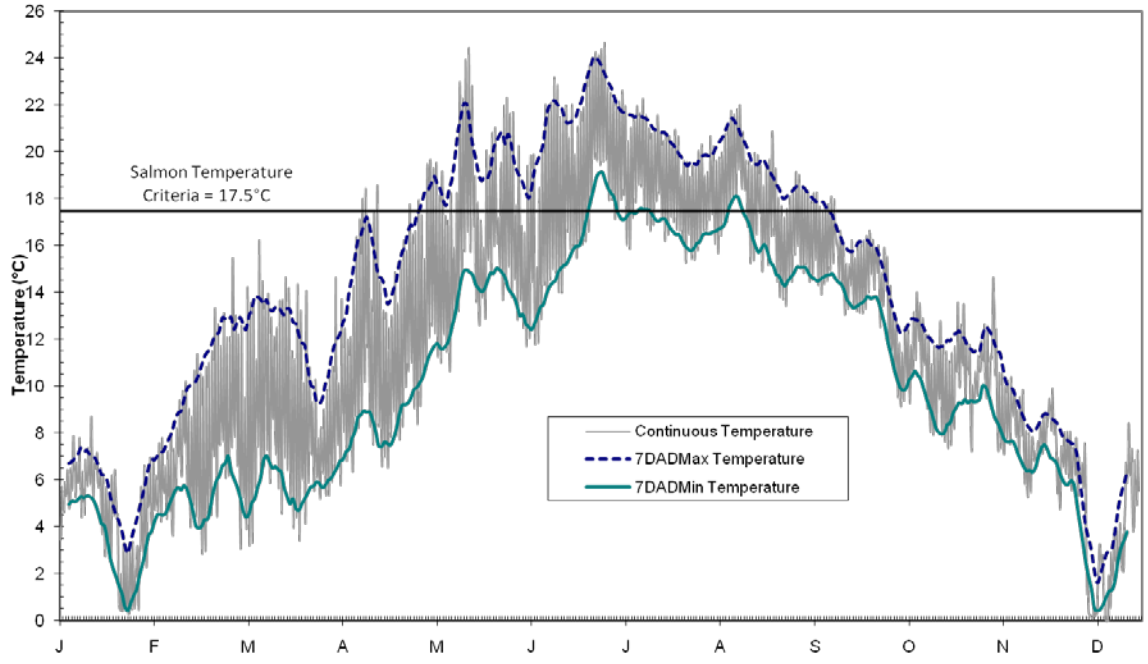

Figure J-36. 2008 continuous temperature profile for lower Spring Creek.

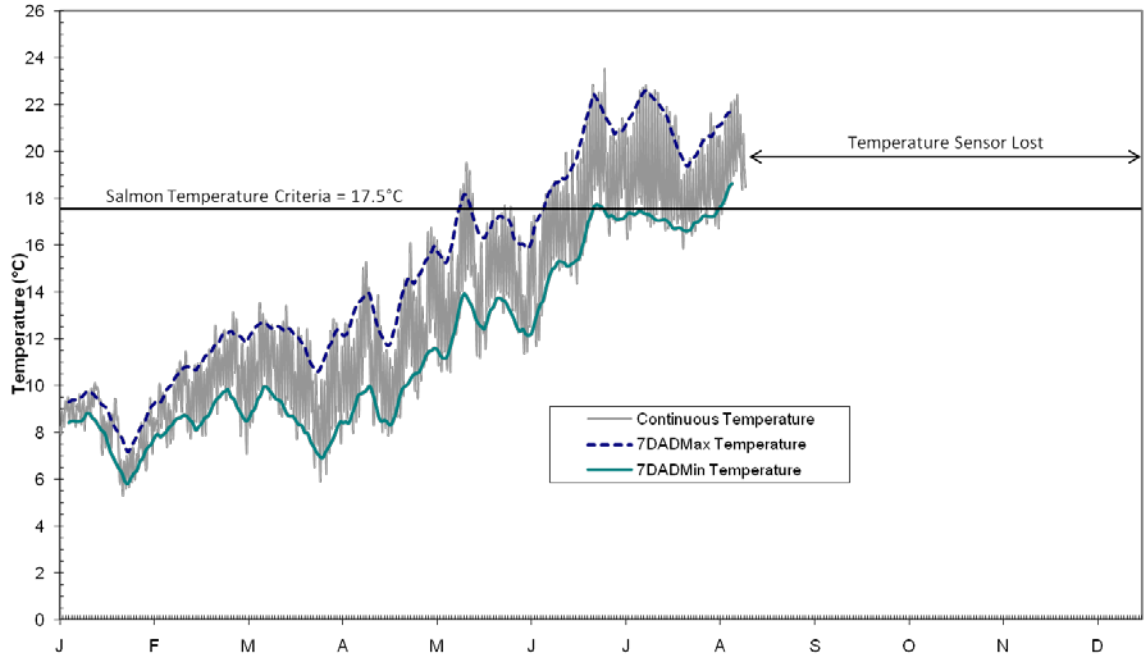

Figure J-37. 2008 continuous temperature profile for Marion Drain.

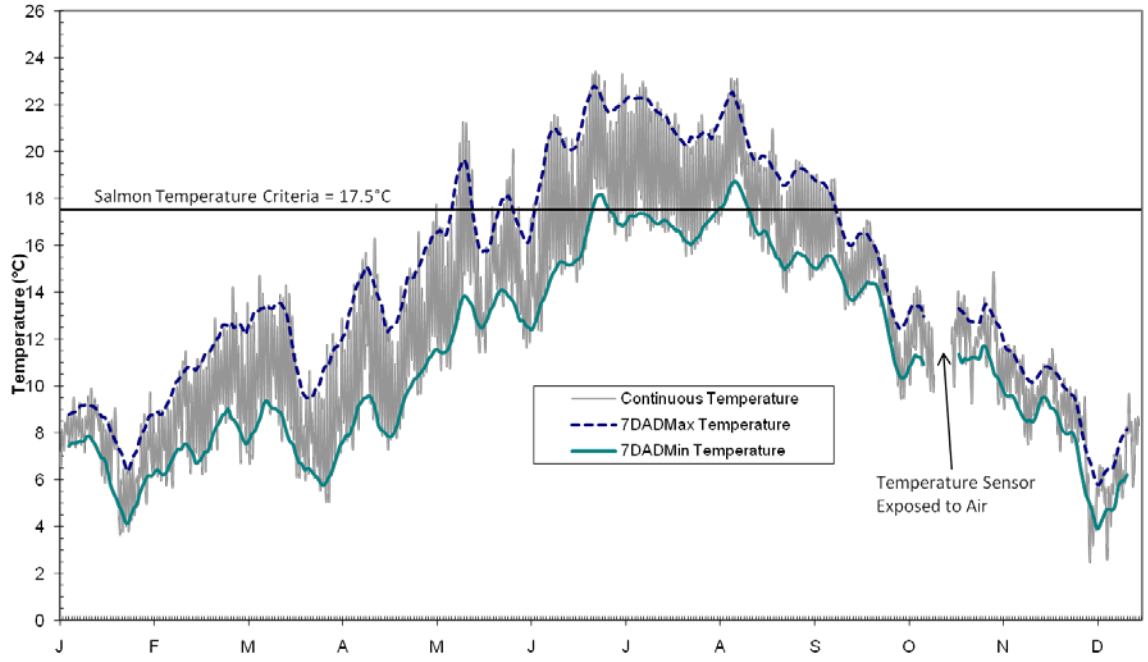

Figure J-38. 2008 continuous temperature profile for Sulphur Creek Wasteway.

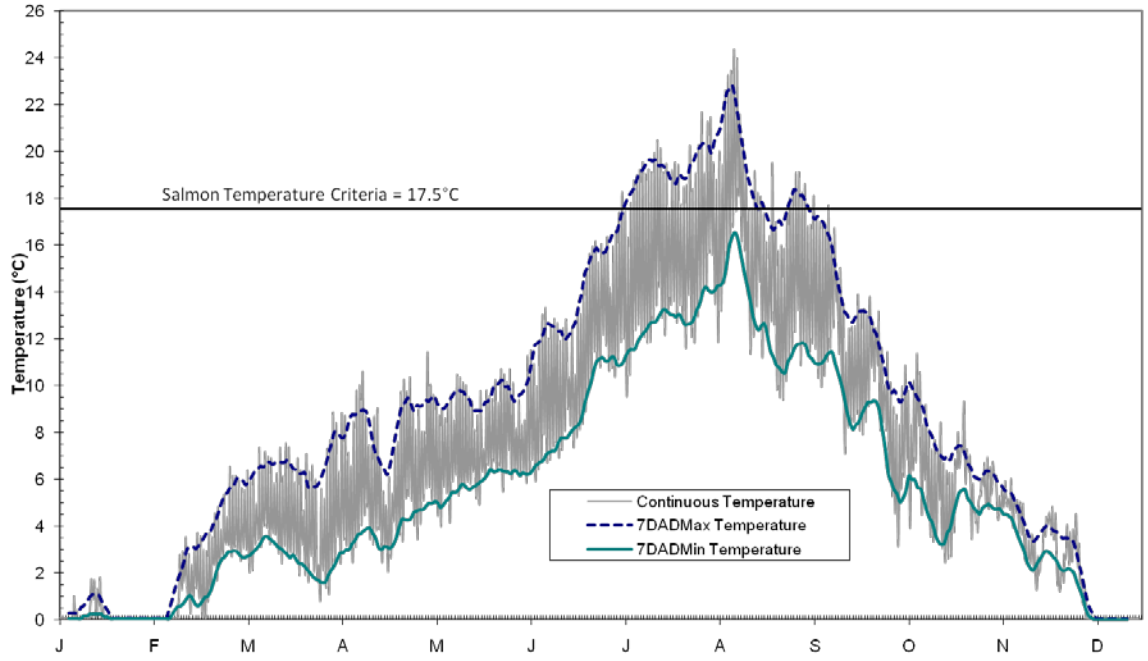

Figure J-39. 2008 continuous temperature profile for Peshastin Creek.

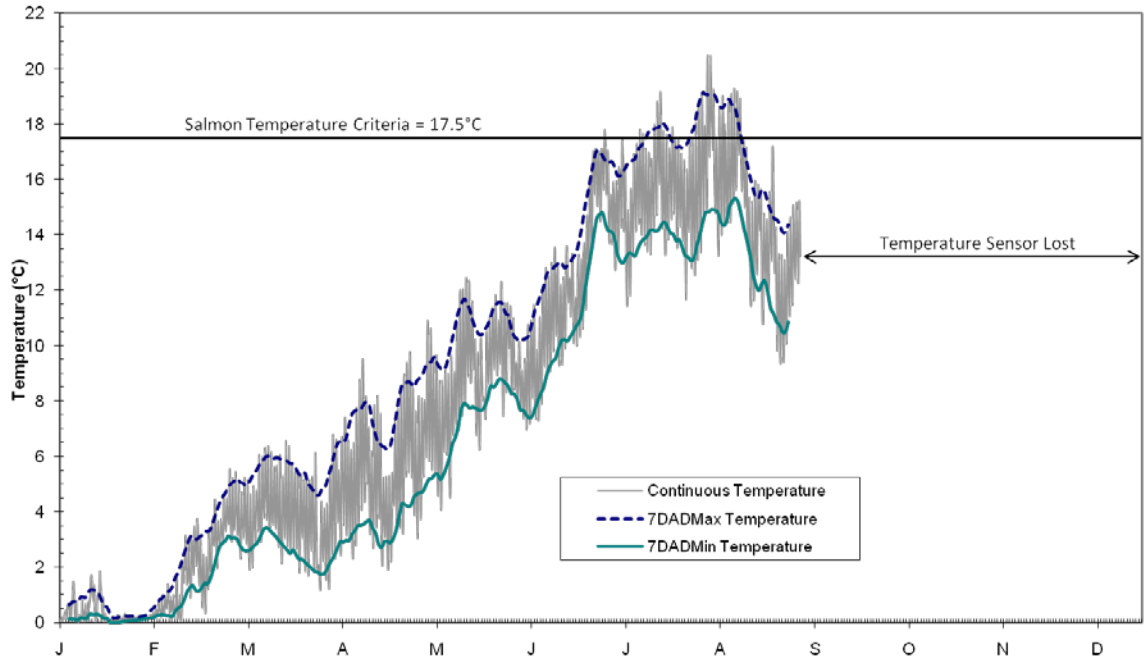

Figure J-40. 2008 continuous temperature profile for Mission Creek.

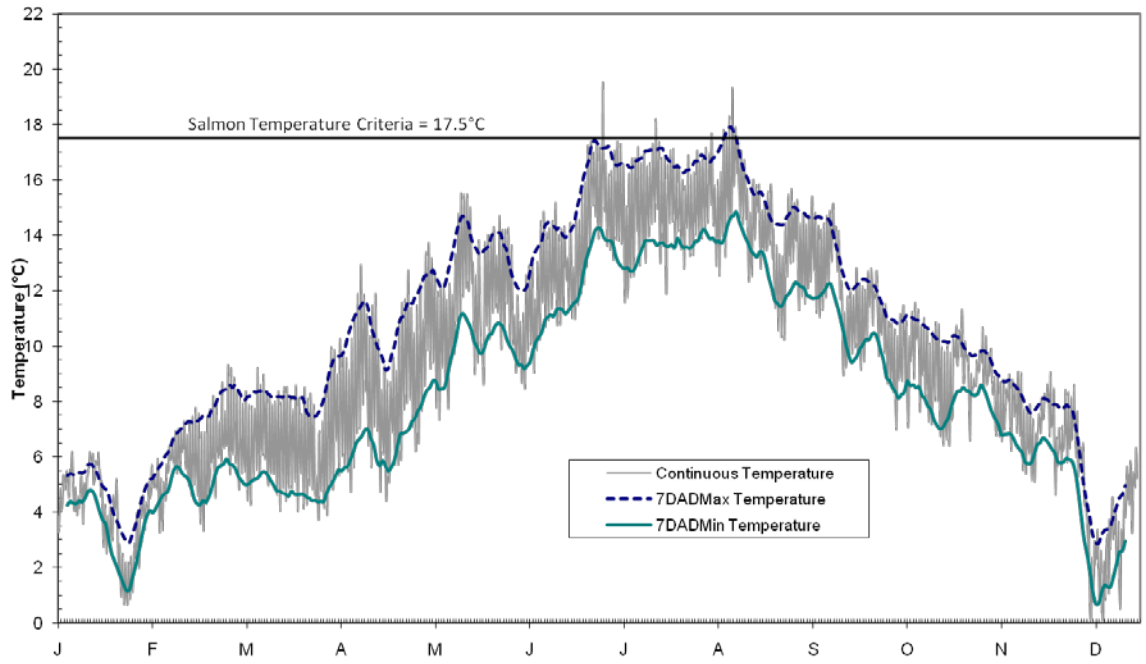

Figure J-41. 2008 continuous temperature profile for Brender Creek.

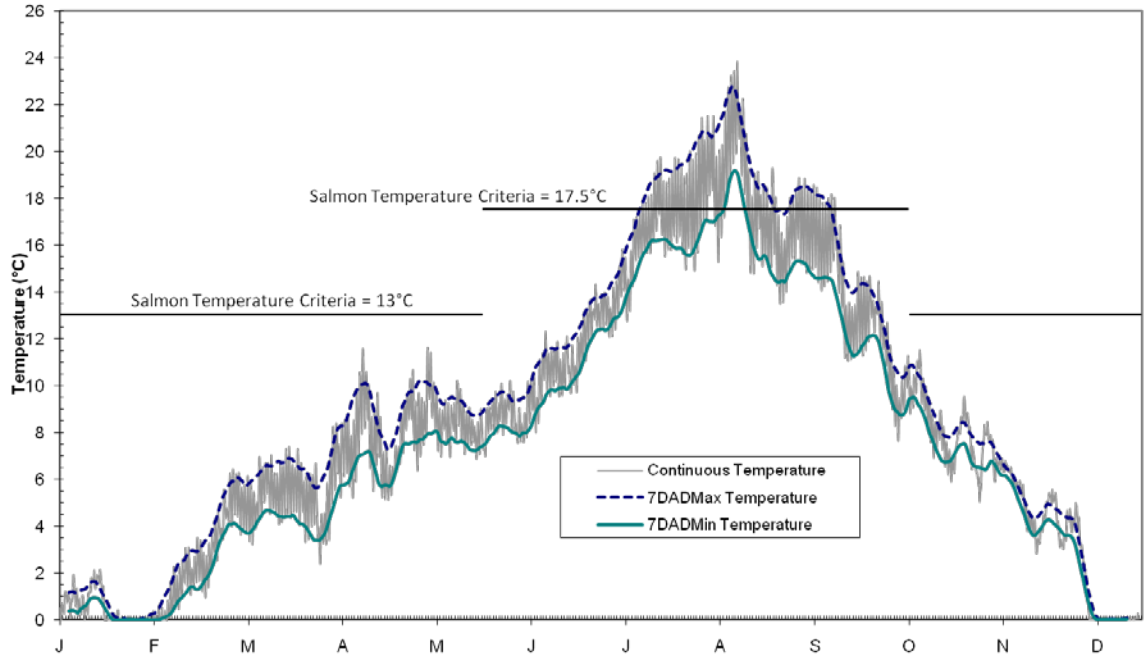

Figure J-42. 2008 continuous temperature profile for the Wenatchee River.

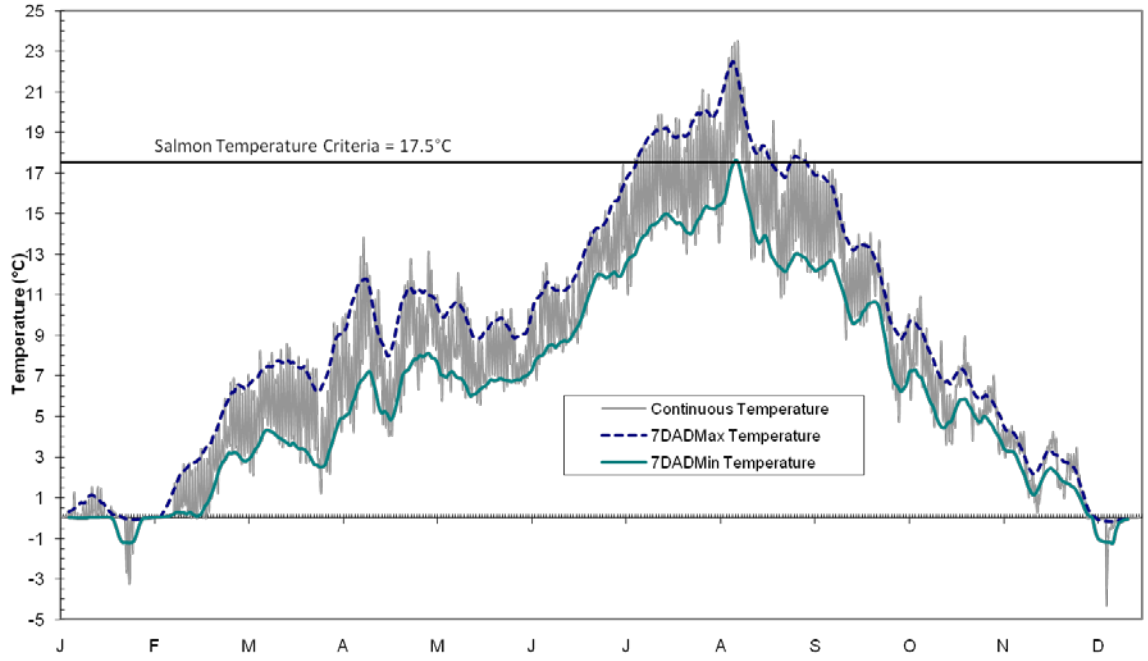

Figure J-43. 2008 continuous temperature profile for the Entiat River.