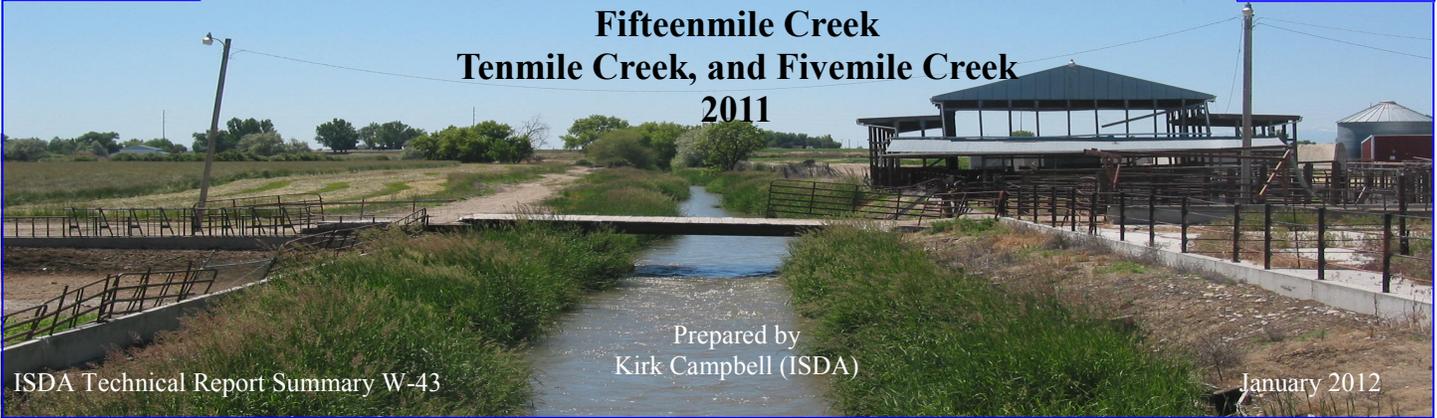




Pesticide Residue Evaluation for Fifteenmile Creek Tenmile Creek, and Fivemile Creek 2011



ISDA Technical Report Summary W-43

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Introduction

The Idaho State Department of Agriculture (ISDA) conducted pesticide residue monitoring in 2011 on Fifteenmile Creek and its two major tributaries Tenmile Creek and Fivemile Creek (Figure 1). Tenmile Creek (51,021 acres) and Fivemile Creek (62,214 acres) comprises the majority of the Fifteenmile Drainage. Fifteenmile is a short stream section that flows approximately 3.6 miles prior to entering the Lower Boise River just east of Middleton, Idaho. Fivemile and Tenmile Creeks supply the majority of water to Fifteenmile Creek.

Agricultural acreage in the Tenmile drainage is approximately 11,327 acres (22.2%) and agricultural acreage in the Fivemile Drainage is approximately 17,420 acres (27.7%) (USGS, StreamStat).

Monitoring conducted by ISDA in 2009, 2010, and 2011 indicates that pesticide residues are being transported by Fifteenmile Creek into the Lower Boise River (Table 1).

Table 1. Fifteenmile Creek pesticide detections for 2009, 2010, and 2011.

Year	Pesticides Identified	Total Detections	Herbicide Detections	Insecticide Detections
2009	17	60	50	10
2010	22	75	63	12
2011	21	62	52	10

Monitoring for this project was conducted on a bi-weekly schedule starting from April 5, 2011 through September 28, 2011. A total of 12 pesticide samples were collected from each monitoring site. Partial funding for this project was provided by the U.S. Environmental Agency (EPA) Region 10.

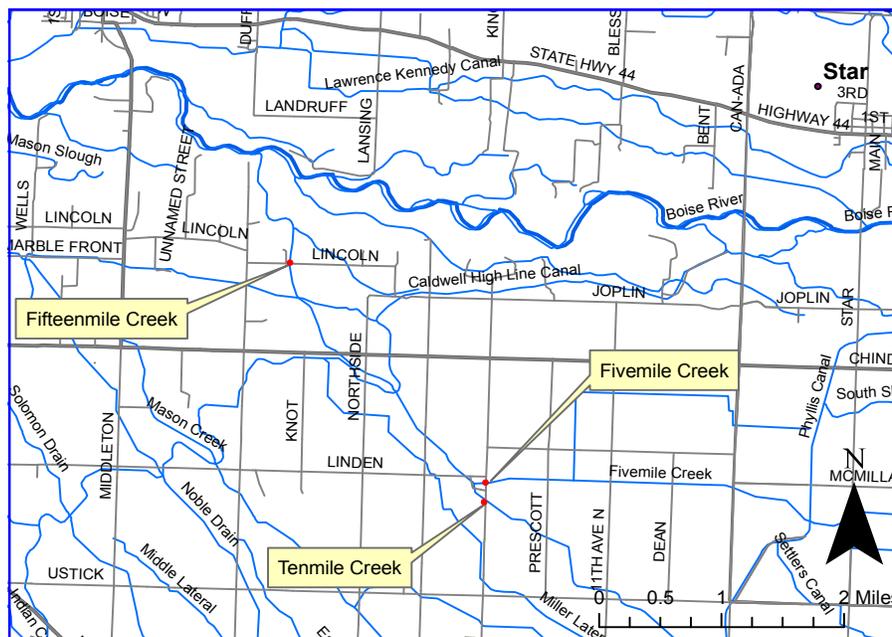


Figure 1. Fifteenmile, Tenmile, and Fivemile sampling sites.

Analytical Quality Assurance

All bottle blanks and equipment blanks submitted during this study resulted in non-detectable results indicating both field and laboratory activities were free from contamination. All analyte spikes and surrogate standard recoveries were within acceptable ranges (70-130%) indicating that pesticide residues were accurately recovered. Relative percent difference (RPD) calculated on field duplicate samples, submitted to UIASL, had a range of 0-27% an overall mean of 10% and a median of 8.0%.

Holding times between extraction and instrumental analysis were exceeded (samples collected on 8/19, 8/23, 9/6, and 9/20/2011) for the carbamate and phenylurea pesticide screens due to instrument failure following an electrical storm. Extraction solutions were frozen while the instrument was being replaced. All standard recoveries (spikes and surrogates) for the frozen extracts fell within an acceptable range.

Overall Results

For the 2011 assessment there were a total of 23 pesticide compounds identified with 17 herbicides, 5 insecticides and 1 degradate of atrazine (Table 1).

Table 1. Pesticides detected and trade names in 2011 for Fifteenmile, Tenmile, and Fivemile Creeks.

Detected Pesticides	Pesticide Type	Trade Name
2,4-D	Herbicide	Curtail
2,4-Dichlorbenzoic Acid	Herbicide	—
Acephate	Insecticide	Orthene
Atrazine	Herbicide	Aatrex
Bentazon	Herbicide	Basagran
Bromacil	Herbicide	Krovar
Bromoxynil	Herbicide	Buctril
Chlorpyrifos	Insecticide	Dursban/Lorsban
Desethyl Atrazine	¹ Degradate	—
Diazinon	Insecticide	Diazinon 50W
Dicamba	Herbicide	Brushmaster
Diuron	Herbicide	Karmex
EPTC	Herbicide	Eptam
Ethoprop	Insecticide	Mocap
Hexazinone	Herbicide	Velpar
Linuron	Herbicide	Lorox DF
MCPA	Herbicide	Banlene
Methomyl	Insecticide	Lannate
Metolachlor	Herbicide	Dual
Metribuzin	Herbicide	Sencore
Oxyfluorfen	Herbicide	Goal
Pendimethalin	Herbicide	Prowl
Terbacil	Herbicide	Sinbar
¹ Degradate of Atrazine		

There were a total of 172 pesticide detections for Fifteenmile, Tenmile, and Fivemile Creeks in 2011. There were 133 herbicide detections, 28 insecticides, and 11 desethyl atrazine detections (Figure 2). Terbacil (29), Diuron (28) and 2,4-D (20) lead the herbicide detections while chlorpyrifos (12), methomyl (7), and ethoprop (5) had the highest number of insecticide detections (Figure 2).

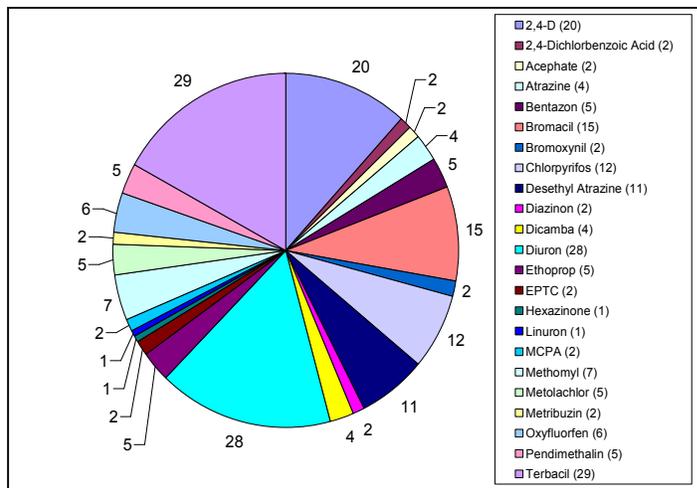


Figure 2. Total pesticide detections in 2011 for Fifteenmile, Tenmile, and Fivemile Creeks.

Monitoring Results

ISDA defines a pesticide of concern (POC) as any pesticide that is detected at a concentration that is greater than or equal to fifty percent ($\geq 50\%$) of an established Environmental Protection Agency (EPA) Aquatic Life Benchmark. These aquatic benchmarks are established for pesticide effects on fish and aquatic invertebrates at acute and chronic levels and non-vascular and vascular plants at acute levels. Acute toxicity of a pesticide refers to the effects from a single dose or repeated exposure over a short period of time, i.e. a few hours or a day. Chronic toxicity is the ability of a substance to cause adverse health effects resulting from long-term exposure or repeated low level exposures.

The Aquatic Life Benchmarks (for freshwater species) are based on toxicity values reviewed by EPA and used in the EPA's most recent pesticide registrations risk assessments. The Office of Pesticide Programs (OPP) within the EPA relies on studies required under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) as well as a wide range of environmental laboratory and field studies to assess environmental risk. Each Aquatic Benchmark is based on the most sensitive, scientifically acceptable toxicity endpoint available to EPA for a given taxon (EPA, OPP, 2011).

Fifteenmile Creek

There were a total of 21 pesticide compounds detected at Fifteenmile Creek with 16 herbicides, and five insecticides. In all there were a total of 62 pesticide detections with 52 herbicide and 10 insecticide detections (Table 2).

The pesticides of concern within Fifteenmile Creek that were $\geq 50\%$ of an EPA benchmark were the insecticide chlorpyrifos (two detections) for both acute and chronic invertebrates and the herbicide linuron (one detection) which exceeded the chronic invertebrate benchmark (Table 2). Four other insecticides acephate (1), diazinon (1), ethoprop (2), and methomyl (3) were detected at levels below any aquatic life benchmark.

Table 2. Fifteenmile Creek pesticide detections, POC in red.

Fifteenmile Creek				EPA Aquatic Life Benchmarks (ug/L)					
Pesticides Detected	Pesticide Type	Number of Detections	Highest Detection	Fish Acute	Fish Chronic	Inverts Acute	Inverts Chronic	NonVascular Acute	Vascular Acute
2,4-D	H	8	1.2	1,000	—	7,500	—	932	—
2,4-Dichlorobenzoic Acid	H	1	0.38	425	95	650	260	21	4,828
Acephate	I	2	5.5	416,000	5,760	550	150	—	—
Atrazine	H	1	0.025	2,650	65	360	60	1	37
Bentazon	H	2	0.24	>50,000	—	>50,000	—	>4,500	5,350
Bromacil	H	6	0.093	18,000	3,000	60,500	8,200	6.8	45
Chlorpyrifos	I	1	0.071	0.9	0.57	0.05	0.04	140	—
		1	0.047	0.9	0.57	0.05	0.04	140	—
Diazinon	I	1	0.077	45	<0.55	0.11	0.17	3,700	—
Dicamba	H	2	0.12	14,000	—	17,300	—	60	—
Diuron	H	10	0.38	200	26	80	200	2.4	15
Ethoprop	I	2	0.21	150	24	22	0.8	8,400	—
EPTC	H	1	0.3	7,000	—	3,245	810	1,400	5,600
Hexazinone	H	1	0.051	137,000	17,000	75,800	20,000	7	37.4
Linuron	H	1	0.095	1,500	5.58	60	0.09	13.7	2.5
MCPA	H	1	0.39	380	—	90	—	170	20
Methomyl	I	3	0.18	160	12	2.5	0.7	—	—
Metolachlor	H	2	0.11	1,600	1,000	550	1	8	21
Metribuzin	H	1	0.047	21,000	3,000	2,100	1,290	8.7	130
Oxyfluorfen	H	3	0.094	102	1.3	40	13	0.29	0.35
Pendimethalin	H	2	0.038	69	6.3	140	14.5	5.2	12.5
Terbacil	H	10	0.35	23,100	1,200	32,500	640	11	140

Tenmile Creek

Tenmile Creek had a total of 13 pesticide compounds identified with nine herbicides, three insecticides and one degradate (desethyl atrazine). There were a total of 49 pesticide detections with 31 herbicides, 12 insecticides and six degradates of atrazine (desethyl atrazine).

Chlorpyrifos is a POC within Tenmile Creek and had a total of six detections which were all $\geq 50\%$ of both the acute and chronic invertebrate benchmarks (Table 3). These six detections (50% of the samples) were spread out through May, June, July and August which may indicate a consistent chronic presents of the insecticide within Tenmile Creek.

The insecticide ethoprop had two detection with one detection at $\geq 50\%$ of the chronic invertebrate benchmark. There were also four detections of the insecticide methomyl which were all below any chronic or acute benchmark levels (Table 3).

Table 3. Tenmile Creek detections, POC in red.

Tenmile Creek				EPA Aquatic Life Benchmarks (ug/L)					
Pesticides Detected	Pesticide Type	Number of Detections	Highest Detection	Fish Acute	Fish Chronic	Inverts Acute	Inverts Chronic	NonVascular Acute	Vascular Acute
2,4-D	H	5	0.42	1,000	—	7,500	—	932	—
Atrazine	H	1	0.029	2,650	65	360	60	1	37
Bentazon	H	1	0.26	>50,000	—	>50,000	—	>4,500	5,350
Bromacil	H	1	0.062	18,000	3,000	60,500	8,200	6.8	45
Bromoxynil	H	1	0.1	26.5	18	48	3	51	—
Chlorpyrifos	I	1	0.028	0.9	0.57	0.05	0.04	140	—
		1	0.03	0.9	0.57	0.05	0.04	140	—
		1	0.03	0.9	0.57	0.05	0.04	140	—
		1	0.031	0.9	0.57	0.05	0.04	140	—
		1	0.047	0.9	0.57	0.05	0.04	140	—
		1	0.071	0.9	0.57	0.05	0.04	140	—
Desethyl Atrazine	D	6	0.055	2,650	65	360	60	1	37
Diuron	H	8	0.16	200	26	80	200	2.4	15
Ethoprop	I	2	0.47	150	24	22	0.8	8,400	—
Methomyl	I	4	0.13	160	12	2.5	0.7	—	—
Metribuzin	H	1	0.085	21,000	3,000	2,100	1,290	8.7	130
Oxyfluorfen	H	3	0.11	102	1.3	40	13	0.29	0.35
Terbacil	H	10	0.96	23,100	1,200	32,500	640	11	140

Fivemile Creek

Fivemile Creek had a total of 17 pesticides identified with 13 herbicides, three insecticides and one degradate of atrazine. Overall there were a total of 49 pesticide detections with 31 herbicides, 12 insecticides, and six degradates of atrazine (desethyl atrazine).

The two POC for Fivemile Creek was chlorpyrifos with four detections that all were $\geq 50\%$ of the acute and chronic benchmarks for invertebrates and one detection for the insecticide diazinon that was $\geq 50\%$ of both the acute and chronic levels for invertebrates (Table 4).

Table 4. Fivemile Creek pesticide detections, POC in red.

Fivemile Creek				EPA Aquatic Life Benchmarks (ug/L)					
Pesticides Detected	Pesticide Type	Number of Detections	Highest Detection	Fish Acute	Fish Chronic	Inverts Acute	Inverts Chronic	NonVascular Acute	Vascular Acute
2,4-D	H	7	0.76	1,000	—	7,500	—	932	—
2,4-Dichlorobenzoic Acid	H	1	0.36	425	95	650	260	21	4,828
Atrazine	H	2	0.029	2,650	65	360	60	1	37
Bentazon	H	2	0.29	>50,000	—	>50,000	—	>4,500	5,350
Bromacil	H	8	0.086	18,000	3,000	60,500	8,200	6.8	45
Bromoxynil	H	1	0.1	26.5	18	48	3	51	—
Chlorpyrifos	I	1	0.048	0.9	0.57	0.05	0.04	140	—
		1	0.068	0.9	0.57	0.05	0.04	140	—
		1	0.039	0.9	0.57	0.05	0.04	140	—
		1	0.028	0.9	0.57	0.05	0.04	140	—
Desethyl Atrazine	D	5	0.049	2,650	65	360	60	1	37
Diazinon	I	1	0.14	45	<0.55	0.11	0.17	3,700	—
Dicamba	H	2	0.29	14,000	—	17,300	—	60	—
Diuron	H	10	0.55	200	26	80	200	2.4	15
EPTC	H	1	0.1	7,000	—	3,245	810	1,400	5,600
Ethoprop	I	1	0.032	150	24	22	0.8	8,400	—
MCPA	H	1	0.62	380	—	90	—	170	20
Metolachlor	H	3	0.15	1,600	1,000	550	1	8	21
Pendimethalin	H	3	0.038	69	6.3	140	14.5	5.2	12.5
Terbacil	H	9	0.55	23,100	1,200	32,500	640	11	140

Observation/Conclusions

The POC identified for Tenmile, Fivemile and Fifteenmile were chlorpyrifos, diazinon, ethoprop, and the herbicide linuron. These pesticides of concern are consistent with other pesticide data collected within the Lower Boise River Watershed.

Chlorpyrifos, which is one of the more toxic insecticides at low concentrations for aquatic species, was detected in 50% of the samples from Tenmile Creek (6), four detections in Fivemile Creek, and only two detections in Fifteenmile Creek. The lower number of detection in Fifteenmile could be due to dilution factors or the diversion of water from Fifteenmile Creek for irrigation.

The overall breakdown of pesticide contributions to Fifteenmile Creek from Tenmile and Fivemile Creeks are presented in Figure 3.

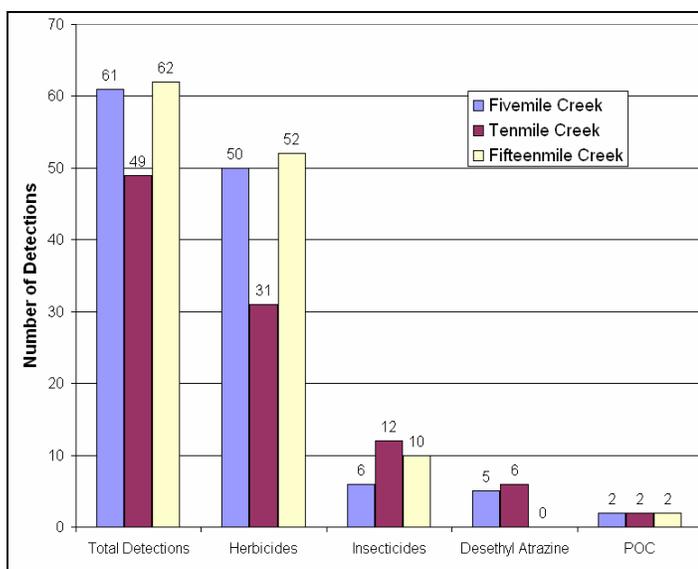


Figure 3. Overall pesticides detected in Fivemile, Tenmile and Fifteenmile Creeks.

The data indicates that both Tenmile Creek and Fivemile Creek contribute a significant number of pesticides into Fifteenmile Creek. Herbicides which tend to have higher concentration thresholds for any acute or chronic effects still dominate the overall detections. The continued presents of insecticides that have acute and chronic effects on invertebrates, at very low concentrations, should be of concern for the biotic structure of these waterways.

ISDA’s water group will continue to monitor and evaluate pesticides and their usage within the Lower Boise River Watershed. We will continue to work with applicators and cooperators on education and BMP practices. We will work with ISDA’s pesticide inspectors to evaluate the sales, handling and usage areas for pesticides of concern.

There are several steps that can be taken by applicators to reduce the availability of pesticides to surface or ground water.

- ◇ Read and follow pesticide labels, especially the precautionary statements, directions for use, storage, disposal, and environmental hazards.

- ◇ Incorporate pesticides to reduce the amount vulnerable to runoff.
- ◇ Delay application when the soil is saturated or wet weather is expected.
- ◇ Use band application on crops to reduce volume of pesticides applied.
- ◇ Use integrated pest management strategies.
- ◇ Establish buffers zones.
- ◇ Mix, load and dispose of pesticides properly.
- ◇ Establish water and sediment basins to reduce sediment movement.
- ◇ Avoid windy conditions to limit drift.

References

Environmental Protection Agency, 2011. Office of Pesticides Programs’ Aquatic Life Benchmarks.

Idaho State Department of Agriculture, 2010. Pesticide Residue Evaluation Second Year Lower Boise River and Tributaries.

United States Geological Survey, 2007. StreamStats. <http://streamstats.usgs.gov/>