2016 Pesticide Surface Water Monitoring Report

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ND Department of Health
ND Department of Parks and Recreation
ND Game and Fish Department
ND Geological Survey
ND State University Extension Service
ND State Water Commission
US Department of Agriculture-NRCS
US Fish and Wildlife Service
US Geological Survey

SUMMARY

The North Dakota Department of Agriculture, working in cooperation with the North Dakota Department of Health's Division of Water Quality and the U.S. Geological Survey, completed a surface water monitoring project in 2016 to assess levels of pesticides and pesticide degradates in North Dakota rivers and streams. Thirty sites were sampled approximately six times from April through October, and four additional sites were sampled either at random or as part of follow-up sampling, resulting in a total of 196 river and stream samples collected. Each sample was analyzed for 102 different pesticides and pesticide degradates. Sample analysis was performed by the Montana State University Agriculture Experiment Station's Analytical Laboratory. Of all the river and stream analyses, there were a total of 2,228 (11.14%) detections, of which 51 (0.26%) were notable and 1,338 (6.69%) instances when an analyte was deemed present, but below the laboratory detection limit. The most commonly detected pesticide was atrazine, which was detected in 98% of samples and was found present, but below the detection limit, in all of the remaining samples. Other commonly detected pesticides were 2,4-D, bentazon, and prometon.

Results indicate that pesticides in North Dakota's rivers and streams were present at levels posing minimal risk to human health or the environment. Because there were detections, the project supports the need for regular, comprehensive monitoring of pesticide levels in surface water, in order to assess risks of pesticides to human health and the environment and identify long term trends.

INTRODUCTION

The North Dakota Department of Agriculture (hereafter "Department") is the lead pesticide regulatory agency in the state through the authority provided in Chapters 4-35, 4-35.1, and 19-18 of the North Dakota Century Code. Under a cooperative agreement with the U.S. Environmental Protection Agency (EPA), the Department is charged with regulating pesticides in the public's interest to ensure that they do not pose a risk of unreasonable adverse effects to human health or the environment. Before 2007, the Department's Pesticide Water Quality Program (hereafter "Program") was focused on those pesticides that posed a risk of contaminating groundwater. The Department has had a committee in place for over a decade to advise them on groundwater issues and establish a groundwater monitoring program. Agencies represented on the committee include the ND Department of Health (NDDoH), US Department of Agriculture Natural Resource Conservation Service, ND State University Extension Service, US Geological Survey (USGS), ND Geological Survey, and the ND State Water Commission.

The Program has since expanded its water quality focus to include surface water. To reflect this expansion, the Groundwater Working Committee has been renamed the Water Quality Advisory Committee (WQAC) and now also includes representatives from the US Fish and Wildlife Service, ND Game and Fish Department, and the ND Parks and Recreation Department.

Identifying pesticide surface water issues is a priority for the Department and the WQAC. Before the first pilot monitoring project in 2006, no agency routinely monitored North Dakota's surface waters for pesticides. The pilot monitoring project coordinated between the Department and the NDDoH was conducted in 2006. Eleven sites were sampled twice from late June through August and tested for 63 different pesticides. Results showed one detection of picloram at a concentration of 0.23 parts per billion (ppb), which is below any level of concern established by the EPA for human health or aquatic life.

The Department, working in cooperation with the NDDoH's Division of Water Quality, resumed a surface water monitoring survey in 2008 for pesticides and pesticide degradates. Nine sites in three different North Dakota basins (Sheyenne, Souris, and Yellowstone Rivers) were sampled and tested for 184 different pesticides and pesticide degradates every three weeks from April through October. A total of nine pesticides and one pesticide degradate were detected. The most commonly detected pesticides in 2008 were the herbicides 2,4-D and diuron. For all but one pesticide, concentrations were below levels deemed harmful by the EPA. Diuron was found in the Souris River in 2008 at concentrations that could be harmful to aquatic life, specifically green algae (Orr and Gray, 2009).

The pesticide water quality monitoring program received an increase in funding in 2009. Because of this funding increase, a later start date, and a six week sampling schedule instead of a three week schedule, the program was able to dramatically expand the number of sites sampled and make the program truly state-wide, representing every major North Dakota river basin. The 2009 sampling program consisted of sampling and testing 29 sites every six weeks for 180 different pesticides and pesticide degradates. Because no detections were found during the 2008 monitoring project until June, the WQAC recommended 2009 sampling start in June and end in November. There were eleven detections of four different pesticides, including atrazine, bentazon, dimethenamid, and MCPA. The most commonly detected pesticides were the herbicides atrazine and bentazon, which were detected four and three times, respectively. MCPA and dimethenamid were each detected twice. Concentrations of all pesticides were below levels deemed harmful by the EPA (Johnson and Gray, 2010).

The funding increase continued into 2010, and sampling sites were chosen from the NDDoH's Ambient River and Stream Water Quality Monitoring Program sites to make the sampling most efficient. Thirty three sites were sampled every six weeks from April to October of 2010 and tested for 180 different pesticides and pesticide degradates. There were 43 detections of 9 different pesticides, including 2,4-D, atrazine, bentazon, bifenthrin, clopyralid, dicamba, diuron, MCPA, and metolachlor. The most commonly detected pesticide in 2010 was bentazon, which was detected 22 times. Metolachlor and 2,4-D were each detected four times. For all pesticides, concentrations were below levels deemed harmful by the EPA (Johnson and Gray, 2011).

In 2011, funding was directed to a wetland pesticide monitoring project. Due to staffing shortage, no monitoring was performed by the Department in 2012.

Monitoring of rivers and streams resumed in 2013. Sampling sites were once again chosen from the NDDoH's Ambient River and Stream Water Quality Monitoring Program. Thirty sites were sampled approximately seven times from April to October and tested for 99 pesticides and pesticide degradates. There were 30 notable detections of 6 different pesticides, including 2,4-D, acetochlor, atrazine, dimethenamid, diuron, and metolachlor. The most commonly detected pesticide was atrazine, followed by 2,4-D (Sauter and Gray, 2014).

In 2014, river and stream monitoring continued and was similar in design to 2013. In 2014, targeted sampling was also performed in addition to monthly sampling. Targeted sampling consisted of higher frequency sampling during heaviest times at select sites that had a history of high detections. Because of targeted sampling, there were more detections in 2014 than any previous year. There were 50 notable detections of 6 pesticides including acetochlor, atrazine, bromoxynil, chlorpyrifos, malathion, and metolachlor. The most commonly pesticide was atrazine followed by 2,4-D (Sauter and Gray, 2015).

Also in 2014, the NDDoH and USGS provided an opportunity to sample lakes throughout North Dakota for pesticides. This project consisted of collecting and analyzing samples from 27 lakes throughout the state once during mid to late summer. These samples were analyzed by Montana State University Agriculture Experiment Station's Analytical Laboratory for 96 pesticides and pesticide degradates. There were two notable detections of chlorpyrifos and one notable detection of atrazine. Similar to river and stream results, atrazine and 2,4-D were the most commonly detected pesticides (Sauter and Gray, 2015).

In 2015, river and stream monitoring continued and was similar in design to 2013 and 2014. Thirty sites were sampled approximately six times from April through October, resulting in a total of 178 river and stream samples collected. Each sample was analyzed for 101 different pesticides and pesticide degradates. The most commonly detected pesticides were atrazine, 2,4-D, bentazon, and metolachlor (Sauter, 2016).

2016 Project goals

The goals of the 2016 monitoring study were to:

- Determine the occurrence and concentration of pesticides in North Dakota rivers and streams.
- Identify trends in pesticide contamination to guide regulatory activities.
- Determine whether any pesticides may be present at concentrations that could adversely affect human health, aquatic life, or wildlife dependent on aquatic life.
- Evaluate levels of certain neonicotinoid insecticides in North Dakota Rivers and streams.

The Department will also use the monitoring data as part of its cooperative agreement with the EPA to evaluate a pre-defined list of national and local pesticides of interest that may pose a risk to water quality. Under that agreement, the Department is also required to demonstrate that risks are appropriately managed. Results may also be used by the Endangered Species Protection Program and evaluations for special pesticide registrations.

MATERIALS AND METHODS

Pesticide samples and associated field measurements were collected approximately six times in 2016 at 30 sites and randomly or as follow-up sampling at four sites from April through

November. Locations of the sampling sites, site IDs, and GPS coordinates can be found in Table 1 and Figure 1. Sample collection dates are shown in Table 2. Sample collection was scheduled for once a month in April, May, June, July, August, and October. Realistically, dates were variable and dependent on weather and staffing. The 2016 pesticide surface water sampling program featured good representation of North Dakota’s rivers and streams and correlated well with the heaviest pesticide use period.

Dissolved oxygen, temperature, pH, and specific conductivity were measured at the time of sampling using standardized, calibrated data loggers. Results were recorded in the field on a sample log form (Appendix A). River and stream samples for pesticide analysis were collected in the main current below the surface at a depth of approximately 60 percent of the total water depth. This depth was chosen for sample collection as it is assumed to be representative of the entire stream. Samples were collected using weighted bottle samplers (WBSs) or by wading the site. A WBS consists of a stainless steel or fiberglass tube that is approximately seven inches long and four inches inside diameter, which is connected to a rope. Each pesticide sample bottle was filled by placing the sample bottle in the WBS and lowering the WBS into the water from a bridge. The WBS was lowered into the stream at a point where the stream is approximately at its greatest depth in the cross section. The WBS was then lowered to a depth equal to approximately 60 percent of the total stream depth. For example, if the stream was five feet deep at its deepest point in the streams cross section, the sample would be collected at that point at a depth three feet off the bottom. When the bottle was completely filled (i.e., no bubbles observed) the WBS and bottle were retrieved. The bottle was capped, removed from the WBS, labeled, and placed in a cooler on ice until shipment. When necessary, wadeable grab samples were collected by wading into the stream. When the sample was collected by wading, the stream was entered slightly down current from the sampling point and then the sampler waded to the area with the greatest current. The sample bottle was then submerged to approximately 60 percent of the stream depth; the cap removed and the bottle was allowed to fill facing towards the current, allowing it to fill naturally. Once the bottle was filled, the cap was replaced prior to removing the bottle from the stream. The samples were carefully packed with bubble wrap and/or rubber mesh and put into a cooler with ice and more packing materials shortly after collection. Coolers containing samples and ice were shipped to the laboratory within seven days of collection using a next-day shipping service.

Each pesticide sample consisted of one, 1-L amber glass jar with caps featuring a 1/8” PTFE-faced silicone seal. Sample bottles arrived precleaned according to EPA procedure 1 methods for extractable organic, semivolatile, and pesticide analysis.

Selected field samples were collected in replicate to provide estimates of sample variability. The replicates consisted of one separate sample collected immediately after the original sample. Field blank samples were also collected by each sampling entity twice during the season. Field blanks consisted of blank water received from the NDDoH’s Laboratory Division. The blank water was received in 1-L amber glass bottles with Teflon lined lids. At the time of sampling, the blank water was poured into a sampling bottle, the lid was placed on the bottle, and the bottle was labeled and placed in a cooler with ice.

Each sample was analyzed for 102 different pesticides and pesticide degradates (Appendix B) by Montana State University's Agriculture Experiment Station Analytical Laboratory using a customized method titled the MTUniversal method. This method was initially developed to analyze samples for Montana's groundwater monitoring program, but it also fit this project. The method is modeled after the successful USDA PDP Water Survey Program, which uses the analytical approach to universalize one method to capture as many compounds as possible at the lowest possible levels with a broader range of acceptable performance. The method is validated according to the requirements of the MT 2008 EPA QAPP.

Table 1. 2016 North Dakota pesticide surface water monitoring project sites.

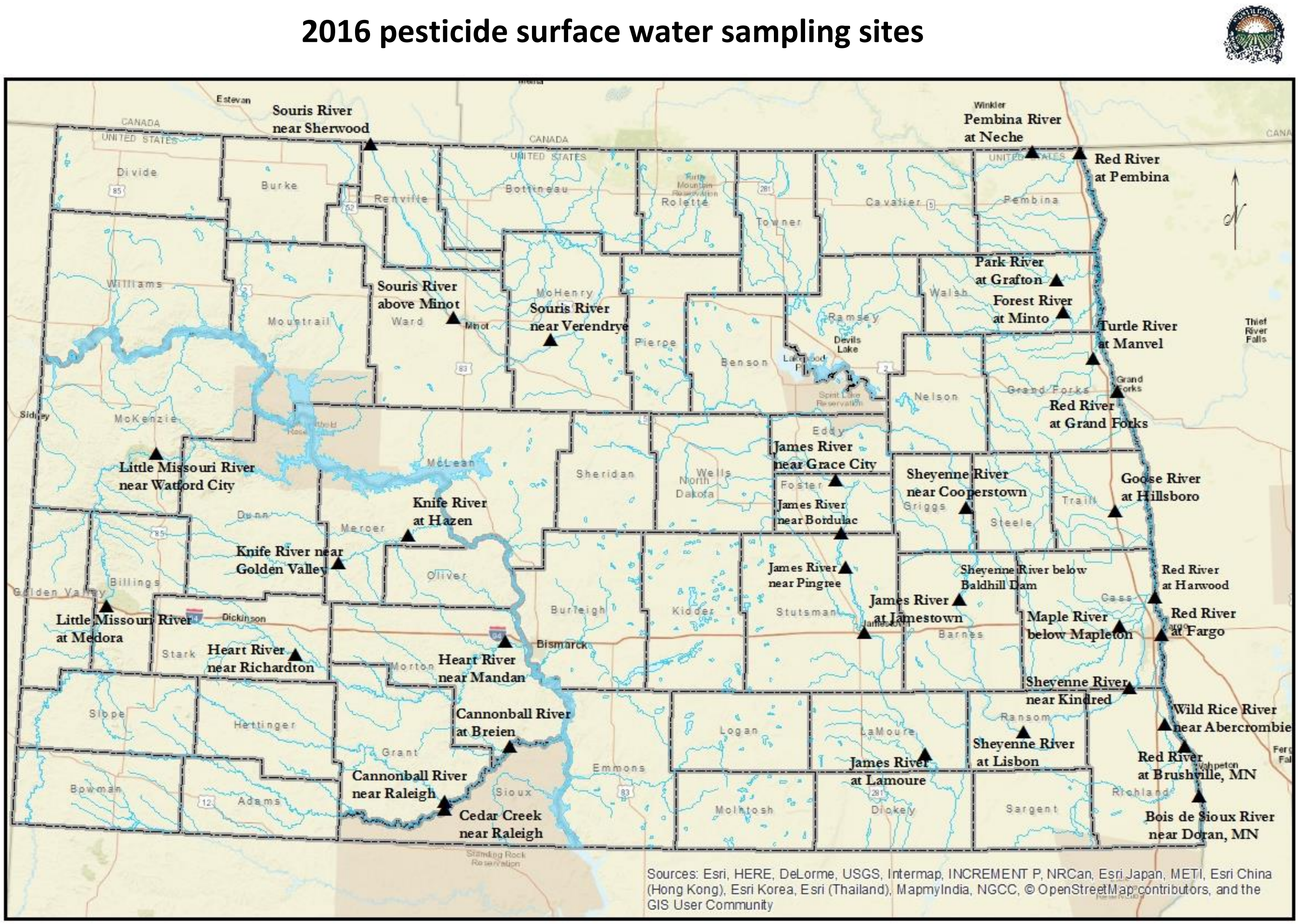
Site ID	Site Name	Latitude	Longitude
380009	Sheyenne River near Cooperstown, ND	47.4328	-98.0276
380012	James River at Lamoure, ND	46.3555	-98.3045
380013	James River at Jamestown, ND	46.8897	-98.6817
380022	Little Missouri River at Medora, ND	46.9195	-103.528
380031	Wild Rice River near Abercrombie, ND	46.4680	-96.7837
380037	Turtle River at Manvel, ND	48.0786	-97.1845
380039	Forest River at Minto, ND	48.2858	-97.3681
380059	Little Missouri River near Watford City, ND	47.5958	-103.263
380067	Cannonball River at Breien, ND	46.3761	-100.934
380077	Cedar Creek near Raleigh, ND	46.0917	-101.334
380083	Red River at Brushville, MN	46.3695	-96.6568
380087	Knife River at Hazen, ND	47.2853	-101.622
380091	Souris River near Sherwood	48.9900	-101.958
380095	Souris River near Verendrye, ND	48.1597	-100.73
380105	Cannonball River near Raleigh, ND	46.1269	-101.333
380151	Heart River near Mandan, ND	46.8339	-100.975
380153	Sheyenne River below Baldhill Dam, ND	47.0339	-98.0837
380156	Goose River at Hillsboro, ND	47.4094	-97.0612
380157	Park River at Grafton, ND	48.4247	-97.412
380158	Pembina River at Neche, ND	48.9897	-97.557
380160	Heart River near Richardton, ND	46.7456	-102.308
380161	Souris River above Minot, ND	48.2458	-101.371
384130	James River near Grace City, ND	47.5581	-98.8629
384131	Knife River near Golden Valley, ND	47.1545	-102.06
384155	Maple River below Mapleton, ND	46.9052	-97.0526
384156	Red River at Grand Forks, ND	47.9275	-97.0281
384157	Red River at Pembina, ND	48.9769	-97.2376
385001	Sheyenne River near Kindred, ND	46.6316	-97.0006
385055	Bois de Sioux River near Doran, MN	46.1522	-96.5789
385168	Sheyenne River at Lisbon, ND	46.4469	-97.6793
385414	Red River at Fargo, ND	46.8611	-96.7837
385040	Red River at Harwood, ND	46.9770	-96.8203
390001	James River near Pingree, ND	47.1611	-98.7900
390002	James River near Bordulac, ND	47.3269	-98.8319

Table 2. 2016 North Dakota pesticide river and stream monitoring sample collection dates.

Site ID	Sample Date					
380009	4/25/2016	5/23/2016	6/20/2016	7/18/2016	8/29/2016	10/18/2016
380012	4/26/2016	5/24/2016	6/20/2016	7/19/2016	8/30/2016	10/17/2016
380022	4/26/2016	5/17/2016	6/8/2016	7/25/2016	8/22/2016	10/10/2016
380031	4/12/2016	5/24/2016	6/22/2016	7/26/2016	8/30/2016	10/18/2016
380037	4/26/2016	5/23/2016	6/28/2016	7/13/2016	8/1/2016	10/16/2016
380039	4/26/2016	5/23/2016	6/28/2016	7/13/2016	8/1/2016	10/16/2016
380059	4/26/2016	5/17/2016	6/8/2016	7/25/2016	8/22/2016	10/10/2016
380067	4/29/2016	5/16/2016	6/9/2016	7/26/2016	8/23/2016	10/11/2016
380077	4/29/2016	5/16/2016	6/9/2016	7/26/2016	8/23/2016	10/11/2016
380083	4/13/2016	5/25/2016	6/20/2016		8/30/2016	10/19/2016
380087	4/26/2016	5/17/2016	6/8/2016	7/25/2016	8/22/2016	10/10/2016
380091	4/20/2016	5/11/2016	6/8/2016	7/13/2016	8/30/2016	10/18/2016
380095	4/18/2016	5/10/2016	6/7/2016	7/12/2016	8/31/2016	10/19/2016
380105	4/29/2016	5/16/2016	6/9/2016	7/26/2016	8/23/2016	10/11/2016
380151	4/29/2016	5/16/2016	6/8/2016	7/25/2016	8/22/2016	10/10/2016
380153						10/17/2016
380156	4/25/2016	5/25/2016	6/1/2016	7/12/2016	8/3/2016	11/3/2016
380157	4/26/2016	5/24/2016	6/28/2016	7/13/2016	8/1/2016	10/16/2016
380158	4/27/2016	5/24/2016	6/29/2016			10/30/2016
380160	4/26/2016	5/17/2016	6/8/2016	7/25/2016	8/22/2016	10/10/2016
380161	4/19/2016	5/10/2016	6/7/2016	7/13/2016	9/1/2016	10/18/2016
384131	4/26/2016	5/17/2016	6/8/2016	7/25/2016	8/22/2016	10/10/2016
384155	4/11/2016	5/23/2016	6/21/2016	7/26/2016	8/31/2016	10/19/2016
384156	4/20/2016	5/11/2016	6/15/2016	7/27/2016	8/9/2016	10/17/2016
384157	4/26/2016	5/24/2016	6/29/2016			10/30/2016
385001	4/12/2016	5/23/2016	6/22/2016	7/26/2016	8/31/2016	10/18/2016
385055	4/13/2016	5/24/2016	6/20/2016	7/27/2016	8/29/2016	10/18/2016
385168	4/26/2016	5/24/2016	6/20/2016	7/19/2016	8/30/2016	10/17/2016

385414	4/25/2016		5/25/2016			6/15/2016		7/12/2016			8/3/2016		10/29/2016		
385040	4/13/2016														
390001						7/21/2016		7/27/2016			8/3/2016		8/10/2016		
390002						7/21/2016		7/27/2016			8/3/2016		8/10/2016		
380013 2016	~~4/26~~	5/24	6/20	7/19	7/21	7/27	8/3	8/10	8/30	10/18					
384130 2016	~~4/25~~	5/23	6/20	7/18	7/21	7/27	8/3	8/10	8/29	10/18	11/1	11/17	11/22	11/25	11/29

Figure 1. 2016 pesticide surface water sampling sites.



RESULTS AND DISCUSSION

River and stream sites

A total of 196 samples were analyzed for 102 different pesticides. Of the 102 pesticides analyzed, 69 different pesticides were present in at least one of the samples. Several pesticides were present in a high percentage of the samples as indicated in Table 3. Atrazine, 2,4-D, bentazon, and prometon were present in over 70% of the samples collected. Although these pesticides were present in 70% or more of samples collected, a high percentage of the detections were well below levels that may negatively impact aquatic ecosystems or human health.

Table 3. Common pesticides detected in North Dakota surface waters in 2016.

Common pesticides detected in ND Rivers and Streams in 2016						
	Quantifiable detections		Qs (Present but below reporting limit)		Total samples with quantifiable detections and Qs	
Analyte	Number	Percent of all samples	Number	Percent of all samples	Number	Percent of all samples
Atrazine	193	98	3	2	196	100
Deethyl atrazine	187	95	9	5	196	100
2,4-D	167	85	28	14	195	99
Hydroxy atrazine	152	78	31	16	183	93
Bentazon	138	70	7	4	145	74
Prometon	101	52	43	22	144	73
Metolachlor ESA	114	58	24	12	138	70
Tebuconazole	35	18	87	44	122	62
Acetochlor ESA	95	48	23	12	118	60
Acetochlor OA	116	59	1	1	117	60
Propiconazole	37	19	69	35	106	54
IMAM	65	33	39	20	104	53
Imazethapyr	71	36	29	15	100	51
MCPA	49	25	49	25	98	50
Pyrasulfotole	26	13	60	31	86	44
Imazapyr	32	16	47	24	79	40
Imazapic	17	9	55	28	72	37
Tebuthiuron	29	15	38	19	67	34
Metolachlor OA	20	10	45	23	65	33
Metolachlor	33	17	28	14	61	31
Dimethenamid	38	19	19	10	57	29
Sulfentrazone	26	13	31	16	57	29
Deisopropyl atrazine	14	7	41	21	55	28
Saflufenacil	35	18	20	10	55	28
Diuron	33	17	20	10	53	27
Imazamox	27	14	25	13	52	27

Data were compared to EPA established aquatic life benchmark (ALB) values and human health maximum contaminant level (MCL) values. Detections at 20% or more of the lowest of either of these values were further reviewed. There were 51 detections of 7 pesticides at or above these levels as detailed in Table 4.

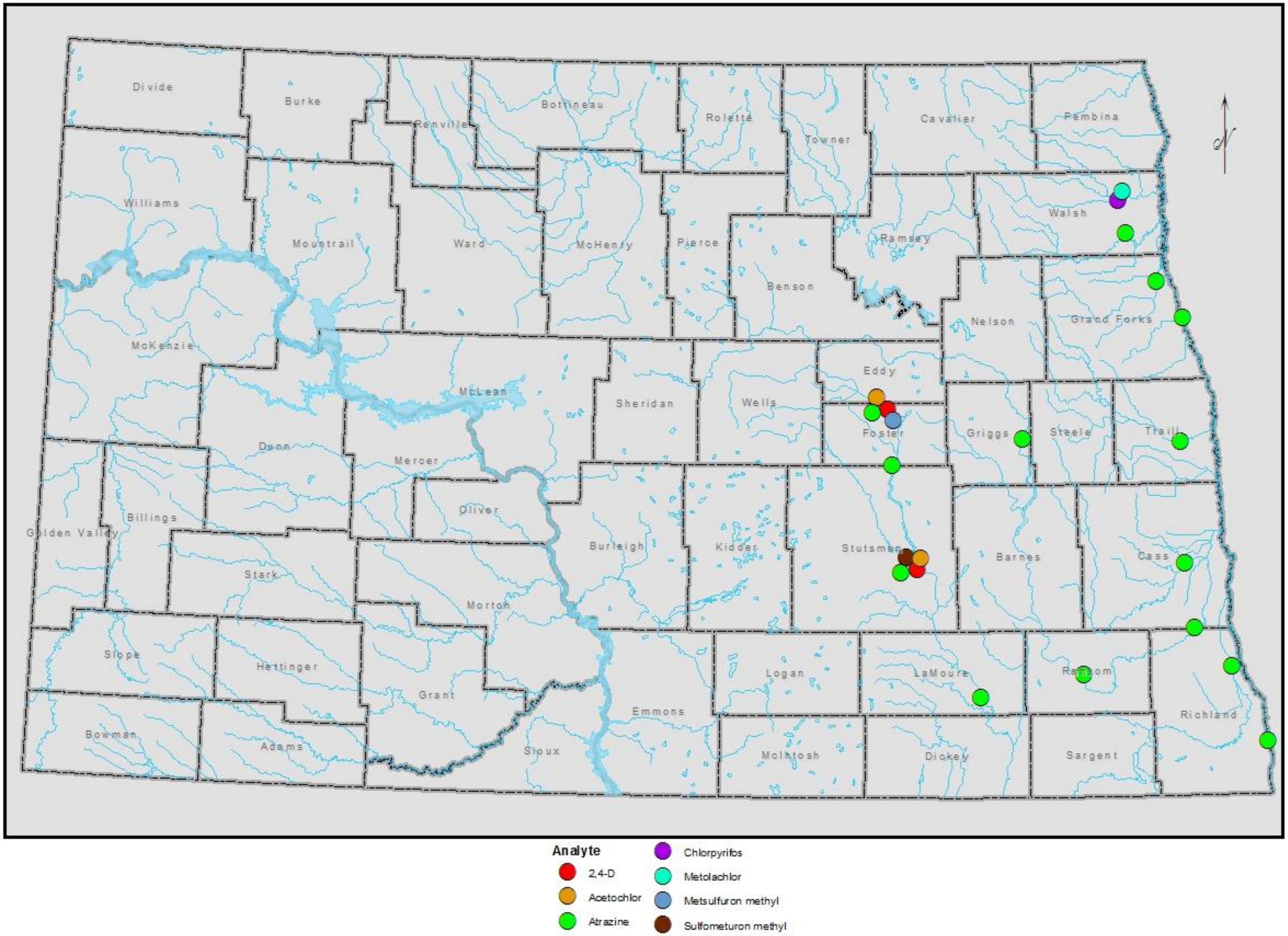
Table 4. Detections that were 20% or more of lowest ALB or MCL.

Detections that were 20% or more of lowest ALB or MCL			
Chemical	**Number of detections**	**Range of detections (PPB)**	**Lowest ALB or MCL (PPB)**
2,4-D	3	2.9-11	13.1
Acetochlor	2	2.4-3	1.43
Atrazine	37	0.2-5.3	1
Chlorpyrifos	1	0.1	0.04
Metolachlor	1	2.1	10
Metsulfuron methyl	6	0.097-4.7	0.36
Sulfometuron methyl	1	0.24	0.45

These chemicals were found at 20% or more of an ALB or MCL in 15 different sites (Figure 2). All of the 15 sites are in the eastern third of North Dakota, with the Red River basin containing most of the sites. Within the Red River basin, the Bois de Sioux River sampled near Doran, MN and the Wild Rice River sampled near Abercrombie, ND each had three atrazine detections. The Goose River sampled at Hillsboro, ND; the Maple River below Mapleton, ND; the Red River at Grand Forks, ND; the Sheyenne River near Kindred, ND; and the Sheyenne River at Lisbon, ND each had two atrazine detections. The Park River sampled at Grafton, ND had one detection of chlorpyrifos and one of metolachlor. The Sheyenne River near Cooperstown, ND and the Forest River at Minto, ND each had one atrazine detection.

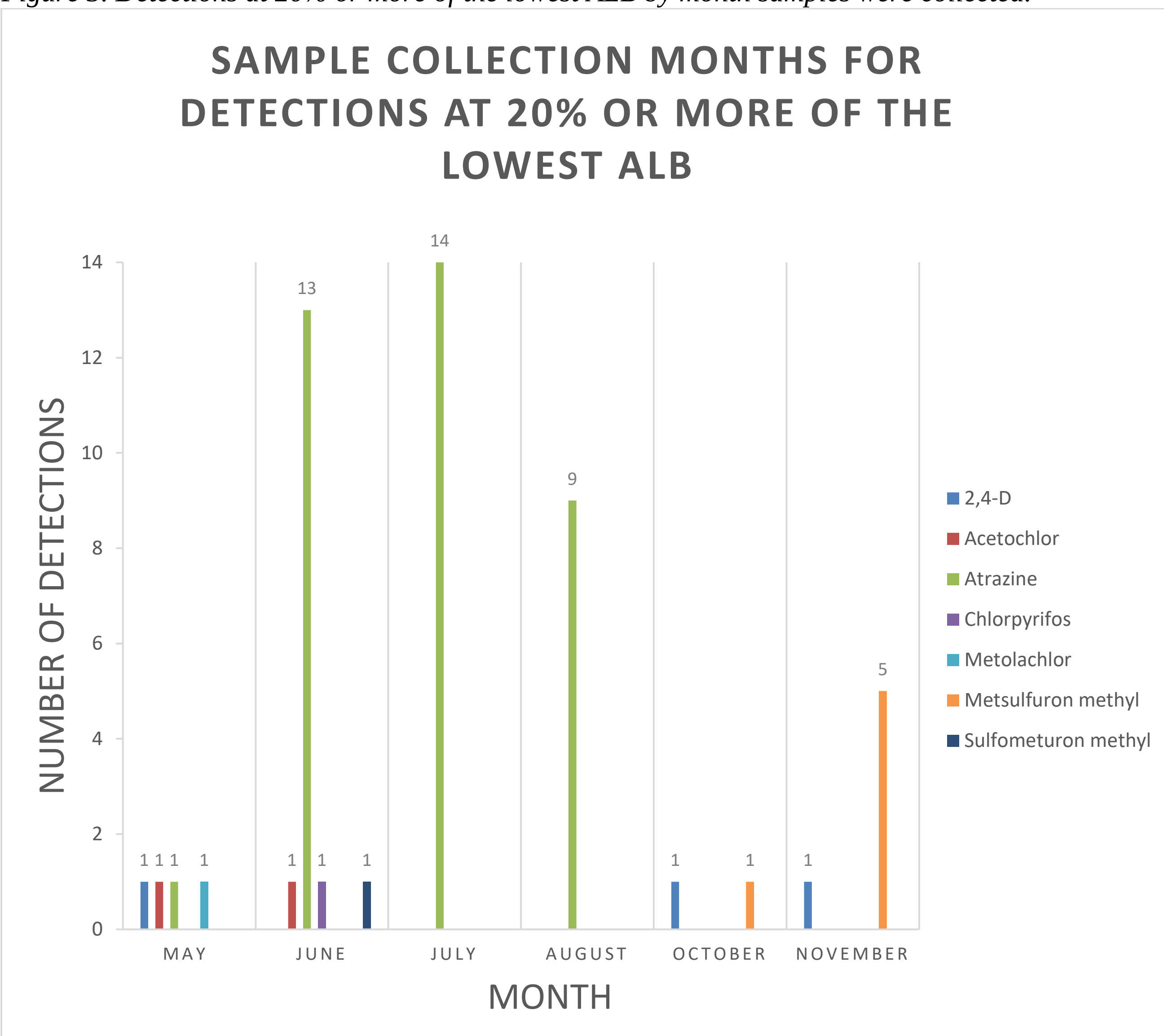
Outside of the Red River basin, the James River sampled near Grace City, ND had fifteen detections; the pesticides detected were 2,4-D (two detections), Acetochlor, atrazine (six detections), and metsulfuron methyl (six detections). The James River at Jamestown, ND had 11 detections; the pesticides detected were 2,4-D, acetochlor, atrazine (eight detections) and Sulfometuron methyl. The James River at Lamoure, ND had three atrazine detections. The James River near Bordulac, ND had one atrazine detection.

Figure 2. Sampling sites where pesticides were detected at 20% or more of lowest ALB.



The 51 pesticide detections at concentrations of 20% or more of the lowest ALB were spread throughout the growing season, with the most detections occurring in June in 2016 (Figure 3). There were no pesticide detections above 20% of an ALB or MCL in April. In May, 2,4-D, acetochlor, atrazine, and metolachlor were each detected once at levels 20% or more of the lowest ALB. June had the most detections, with acetochlor, chlorpyrifos, and sulfometuron methyl each detected once, and atrazine detected 11 times. In July, atrazine was detected 14 times. August saw nine atrazine detections. No pesticide samples were collected in September. In October, there was one 2,4-D detection and one metsulfuron methyl detection. November had one 2,4-D detection and five metsulfuron methyl detections. It is important to point out that targeted sampling occurred in July and November, leading to additional detections during these months.

Figure 3. Detections at 20% or more of the lowest ALB by month samples were collected.



Looking at values at or above 20% of an ALB is a very conservative means to filter data and does not automatically indicate significant risk to aquatic ecosystems or human health. In order to determine levels that may pose risk, results were further reviewed to identify instances in which an ALB or MCL had been exceeded (Tables 4 & 5). The most conservative ALBs and MCLs, which are displayed below, are based on long-term exposure to a pesticide and are discussed in detail below.

ALB discussion

The EPA has established ALBs for several chemicals, relying on studies required under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as well as a wide range of environmental, laboratory, and field studies, as well as modeling available in published scientific literature. ALBs, which are based on the most sensitive toxicity endpoint for a given taxon, are estimates of the concentrations below which pesticides are not expected to harm aquatic life. ALBs are typically based on continuous exposure over a window of time, such as 96 hours or more, depending on the study. EPA-established ALBs are intended for states to use as guidance, and are not regulatory thresholds. Because Department sampling consists of one grab sample, essentially it represents one point in time and is difficult to correlate with a true ALB. In most cases, the Department was able to compare the concentration detected in surface water to the EPA-established ALB as a reference. Any value that exceeded an ALB constitutes an indication of exceedance, but does not constitute a true exceedance as samples are not collected the same way as in the established ALB.

Table 4. Detections indicating an aquatic life benchmark (ALB) was met or exceeded.

Site Name	Date	Chemical	Detected level (ppb)	ALB (ppb)
James River at Jamestown, ND	5/24/2016	Acetochlor	2.4	1.43
James River at Jamestown, ND	5/24/2016	Atrazine	3	1
James River nr Grace City, ND	6/20/2016	Acetochlor	3	1.43
James River nr Grace City, ND	6/20/2016	Atrazine	5.3	1
James River nr Grace City, ND	7/18/2016	Atrazine	1.1	1
James River nr Grace City, ND	10/18/2016	Metsulfuron methyl	4.5	0.36
James River nr Grace City, ND	11/1/2016	Metsulfuron methyl	4.7	0.36
James River nr Grace City, ND	11/17/2016	Metsulfuron methyl	0.7	0.36
James River nr Grace City, ND	11/22/2016	Metsulfuron methyl	0.48	0.36
James River nr Grace City, ND	11/25/2016	Metsulfuron methyl	0.36	0.36
Maple River below Mapleton, ND	6/21/2016	Atrazine	1.5	1
Park River at Grafton, ND	6/28/2016	Chlorpyrifos	0.1	0.04

MCL discussion

The EPA sets a Maximum Contaminant Level (MCL) for many contaminants including some pesticides. The MCL is the maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, and which allows an adequate margin of safety. The MCL is a legal limit set by EPA and is based on a lifelong exposure to a contaminant. For known cancer-causing contaminants, the MCL is set at zero, because any chemical exposure could present a cancer risk.

Table 5. Detections indicating a Maximum Contaminant Level (MCL) was met or exceeded.

Site Name	Date	Chemical	Detected level (ppb)	MCL (ppb)
James River at Jamestown, ND	5/24/2016	Atrazine	3	3
James River nr Grace City, ND	6/20/2016	Atrazine	5.3	3

Targeted Sampling

In 2016, two detections met or exceeded an ALB or MCL, resulting in targeted sampling being performed. One MCL exceedance led to additional sample collection at that site, addition of sampling sites, and additional sample collection at a downstream site (Figure 4 and Table 6). Significant ALB exceedance and abnormal pesticide detections at the end of the season triggered additional sample collection at one site (Table 7).

Figure 4. Targeted sampling after atrazine MCL exceedance.

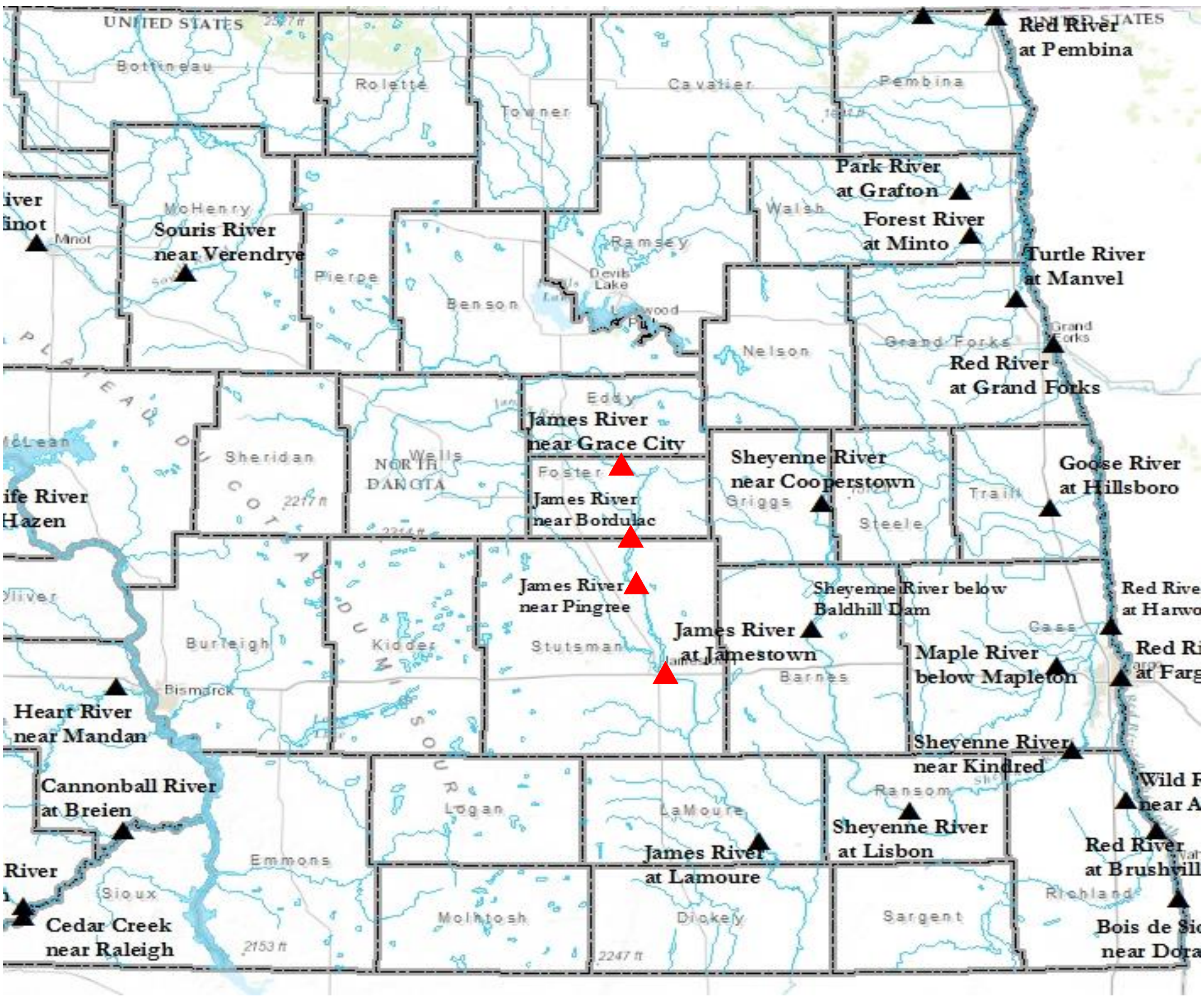


Table 6. Atrazine MCL exceedance and targeted sampling results.

Atrazine Results From James River Sites after MCL Exceedance, ND (ppb)								
Sampling Date	5/23	6/20	7/18	7/19	7/21	7/27	8/3	8/10
James River nr Grace City	0.037	5.3	1.1		0.99	0.34	0.28	0.19
James River nr Bordulac					0.065	0.069	0.1	0.24
James River nr Pingree					0.16	0.14	0.15	0.12
James River at Jamestown		0.91		0.4	0.27	0.33	0.34	0.25

Highlighted cell indicates MCL exceedance.

The EPA set the MCL value for atrazine at 3 ppb. A sample collected from the James River near Grace City on June 20, 2016 indicated an atrazine level of 5.3 ppb or 1.77 times higher than the MCL. As a result of this detection, targeted sampling was performed and revealed that although there a spike above an MCL, it was short in duration and decreased to a level well below the MCL in less than a month. Also, targeted sampling showed that concentrations remained localized, and a high level at one site did not indicate a high level at a downstream site. Risk from atrazine will be discussed further below.

Table 7. Metsulfuron methyl ALB exceedance and targeted sampling results.

James River near Grace City, ND							
Sampling Date	8/29	10/18	11/1	11/17	11/22	11/25	11/29
Metsulfuron methyl	ND	4.5	4.7	0.7	0.48	0.36	0.097

Highlighted cells indicate ALB exceedance.

A sample collected on October 18, 2016, indicated the herbicide metsulfuron methyl was present at a level of 4.5 ppb. The EPA established ALB for metsulfuron methyl is 0.36 ppb or 12.5 times lower than the level detected. Samples collected after the detection at various intervals at this site indicated that metsulfuron methyl spiked on or around November 1, 2016 and decreased to a level below the ALB after November 25, 2016. Risk from metsulfuron methyl will be discussed further below.

Risk from ALB and MCL Exceedance

Acetochlor

Acetochlor is an herbicide used on corn and soybeans in ND. Acetochlor was detected at 20% or more of an ALB two times in 2016. Acetochlor breakdown products were detected or present in about 60% of samples. The lowest EPA established ALB for acetochlor is 1.43 ppb for acute aquatic non-vascular plants. This value is based on the effective concentration (EC50) that affects 50% of the organisms in a static environment, exposed for 5 days. The species used in this test was *Selenastrum capricornutum* (EPA 2006). The two notable detections were 2.4 ppb and 3 ppb which are 1.7 and 2.1 times higher than the ALB. Targeted sampling and historical sampling results indicate that pesticide spikes are typically short in length in North Dakota in rivers and streams, thus it is unlikely that these two detections resulted in significant adverse effects. No negative aquatic impacts were reported to the Department at any point in 2016, which was a year of abnormally high precipitation for the state. In multiple instances, areas received three to four inches of rainfall in a very short timeframe, leading to excess runoff. These pesticide levels are cause for continued monitoring and should these levels be found more frequently, risk will be reevaluated. There is no EPA established drinking water standard for Acetochlor.

Atrazine

Atrazine, a broadleaf herbicide used primarily on corn, was detected in 98% of the samples collected in 2016 (*Table 3*). Of those detections, 37 were at 20% or more of an MCL or ALB. Atrazine detections indicated an MCL was met or exceeded two times with values of 3 ppb and 5.3 ppb. Atrazine detections indicated an ALB was met or exceeded four times with values ranging from 1.1-5.3 ppb.

The EPA established MCL for atrazine is 3 ppb, which is the regulatory level set by EPA. This level is based on risk assessment data, peer-reviewed research, and discussion with other agencies. High levels of safety factors are built in, which look at safe levels in drinking water exposure over a lifetime. Sampling showed that levels at or above an MCL were short in duration and did not pose risk from chronic exposure. It is important to note these detections and compare to past and future data.

Detections at or above an MCL have not been recorded by the Department in the past.

The Refined Ecological Risk Assessment for Atrazine (EPA 2016) discusses risk from atrazine to the environment. This document lists the most sensitive aquatic endpoint for atrazine at less than 1.0 ppb. This value is based on a study performed in 1976 that demonstrated a 67% reduction in chlorophyll production in green algae over a seven day exposure period (Torres and O'flaherty 1976). The EPA risk assessment states average atrazine concentrations in water at or above 5.0 ppb for several weeks are predicted to lead to reproductive effects in fish, while a 60 day average of 3.4 ppb has a high probability of impacting aquatic plant community primary productivity, structure, and function. In 2016, the highest concentration detected was 5.3 ppb. The sample collected before this detection indicated atrazine was at 0.037 ppb, and the sample collected less than one month later at this site indicated an atrazine level of 1.1 ppb. Without continuous monitoring, it was impossible to determine when the level rose above 3.4 ppb and when the level decreased below 3.4 ppb, but it is unlikely the level was above 3.4 ppb for 60 days. Assuming a worst case scenario, it is possible that algae populations were impacted at and near this site, however no aquatic impacts were noted by samplers or were reported to the Department by any other entities. Although the ALB was exceeded, it is important to note that out of 192 samples, atrazine was only found above an ALB four times. This shows that there was a small risk to aquatic ecosystems, but the risk was limited to a select number of sites, and was short in duration. These sites will continue to be monitored closely, and if atrazine detections continue to increase, risk will be reevaluated.

Chlorpyrifos

Chlorpyrifos is used to control insect pests on various crops grown in North Dakota. It was applied to approximately 934,000 acres as a stand-alone product and to an additional 9,800 acres in mixtures in 2012 (Zollinger et al. 2014) and likely comparable acreage in 2016. Chlorpyrifos was present in one sample at a level of 0.1 ppb. The lowest EPA ALB is the no observed adverse effect concentration (NOAEC) of 0.04 ppb for chronic freshwater invertebrates (EPA 2009). Further review indicates the lowest observed adverse effect concentration (LOAEC) is 0.08 ppb, which greatly reduces survival and offspring production in *Daphnia magna*. The highest concentration detected was 0.1 ppb which is 1.25 times higher than the LOAEC. Chlorpyrifos was not detected in samples collected before and after the detection. Since 2013, a very small percentage of samples indicate chlorpyrifos may pose a risk to one or two aquatic ecosystems in ND. Monitoring will continue in the future to further assess risk. There is no EPA established drinking water standard for chlorpyrifos.

Metsulfuron methyl

Metsulfuron methyl is an herbicide typically used on rangelands and CRP, but is also labeled for small grain production. Metsulfuron methyl was present in 23 samples, and found at levels at or above an ALB five times in 2016. The five detections at or above an ALB were at one site, the James River near Grace City and occurred in November. The lowest EPA ALB is 0.36 ppb, which is the EC50 value for aquatic vascular plants, with duckweed being the species tested. The highest detection was 4.7 ppb, which is 13 times higher than the ALB. The first sample that indicated an ALB exceedance at this site was collected on October 18, 2017. The site was sampled five additional times through 11/29/2017. On 11/25/2017, the level of metsulfuron methyl was 0.36 ppb, and on 11/29/2017, the level was measured at 0.097 ppb. Sampling indicated a level at or above an ALB was potentially present for a month or more. This finding is unusual, since sampling typically indicates levels dissipate quickly, and any potential ecosystem risk is short-term. The Department believes these levels are a result of applications to control leafy spurge or other noxious weeds in the area and will discuss the issue with applicators in the area. The Department did not receive any reports of impacts to aquatic ecosystems in the area, but will continue to monitor this site and will discuss the importance of label restrictions near water with producers in the area. There is no EPA established drinking water standard for metsulfuron methyl.

Neonicotinoid discussion

As neonicotinoid insecticides continue to gain attention, and discussions about prevalence in the environment become more common, it is important to discuss them as part of river and stream sampling. In 2008 and 2009 samples were analyzed for imidacloprid and in 2010 clothianidin was added. Since 2013, the neonicotinoid insecticides clothianidin, imidacloprid, and thiamethoxam have been analyzed for in ND river and stream sampling. Compared to herbicides such as atrazine and 2,4-D, the neonicotinoids are not frequently detected. When detections do occur, they are usually at very low levels. In 2016, clothianidin was detected 13 times and present but below the reporting limit in 22 samples. The highest detection was 0.065 ppb. Imidacloprid was detected in 34 samples and present below the reporting limit in 16 samples. The highest detection was 0.17 ppb. Thiamethoxam was detected eight times and present below the reporting limit 18 times, with the highest detection being 0.060 ppb. The detections are well below ALBs for any of the three chemicals, with the most sensitive ALB being 1.05 ppb for imidacloprid. River and stream sampling does not indicate neonicotinoid insecticides are prevalent at levels that pose risk to aquatic ecosystems in ND.

Conclusion

Results of the 2016 monitoring study indicate that pesticides were found at higher levels in 2016 than in previous years. This is not completely surprising, given the abnormal rain events experienced in 2016 and the high potential for runoff. Trends over the last few years show certain pesticides are consistently found in North Dakota rivers and streams. With the exception of 2016, detections did not indicate risk to human health and indicated minimal risk to the environment. In 2016, twelve detections indicated MCL and/or ALB had been exceeded, but this is still a very small percentage of samples. Overall, detections ranged widely in level and frequency based on the pesticide, with a very large percentage below the laboratory's reporting limits.

The need for continued sampling is of upmost importance not only to continue to ensure rivers and streams in ND are safe, but also to identify trends and build on the existing data set. Atrazine, 2,4-D, prometon, tebuconazole, and bentazon are present in a high percentage of samples and occasionally approach levels that may begin to impact aquatic ecosystems. It is imperative to continue monitoring levels of these pesticides, and if necessary, implement risk mitigation before significant impacts to human health or the environment happen. Mitigation measures could include increased use inspections focused on specific pesticides, increased user education and compliance assistance, and site-specific or chemical-specific use restrictions.

Comparisons of river and stream data from 2008, 2009, 2010, 2013, 2014, 2015, and 2016 showed a few potential trends. Atrazine continues to be found in a high percentage of samples, which isn't surprising given its large scale use and chemical properties. Atrazine is also the most common pesticide found at higher levels, especially in the eastern third of the state. This is also not surprising, since atrazine is predominantly used on corn, which is planted on a large portion of acres in the Red River Valley. In addition, use of atrazine and other herbicides has likely increased due to the expansion in acres infested with glyphosate-resistant weeds. Another trend across all years of data reveals the highest number of detections comes from samples collected in June through August. This is also not surprising, as the majority of pesticides detected are pre-emergence herbicides which are typically applied around planting and take several weeks to move into surface water.

This project is the only state-wide comprehensive surface water monitoring project for pesticides in North Dakota. Sampling in 2015 revealed more information as laboratory testing capabilities improved, and technology will continue to advance in the future. Resources permitting, the Department will continue to work with its state and federal partners to monitor surface water to ensure that pesticides do are not negatively impact water resources. These data demonstrate the effectiveness of current approaches and provide a valid argument against unnecessary use restrictions. If impairments of rivers are found, they can be addressed through education and, if necessary, regulation. This mix of compliance assistance and regulatory oversight has been shown to be highly effective, especially when supported by sound data.

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Appendix A. Sample identification record.

Preservation: Yes ☐	Temperature:
Initials:	

Sample Identification Record
North Dakota Department of Health .... Telephone: 701.328.6140
Division of Laboratory Services–Chemistry .... Fax: 701.328.6280

Sample Collection/Billing Information						
Account #	**Project Code:**		**Project Description:** Ambient Water Quality Monitoring			
Collected By:						
Analyte Groups:		**Collection Method:** Grab			**Matrix:** Water	
For Laboratory Use Only Lab ID:	Site ID:	Site Description:			**DO**	**pH**
	Date Collected:	Time Collected:	Depth (m): Surface	Comments:	**Temp.**	**SC**
	Site ID:	Site Description:			**DO**	**pH**
	Date Collected:	Time Collected:	Depth (m): Surface	Comments:	**Temp.**	**SC**
	Site ID:	Site Description:			**DO**	**pH**
	Date Collected:	Time Collected:	Depth (m): Surface	Comments:	**Temp.**	**SC**
	Site ID:	Site Description:			**DO**	**pH**
	Date Collected:	Time Collected:	Depth (m): Surface	Comments:	**Temp.**	**SC**
	Site ID:	Site Description:			**DO**	**pH**
	Date Collected:	Time Collected:	Depth (m): Surface	Comments:	**Temp.**	**SC**
	Site ID:	Site Description:			**DO**	**pH**
	Date Collected:	Time Collected:	Depth (m): Surface	Comments:	**Temp.**	**SC**
	Site ID:	Site Description:			**DO**	**pH**
	Date Collected:	Time Collected:	Depth (m): Surface	Comments:	**Temp.**	**SC**

Appendix B. List of analytes and reporting limits.

List of analytes and reporting limits in 2016			
Analyte	Common Trade Names*	Type	Reporting Limit (ppb)
2,4-D	2,4-D, Curtail	H	0.009
Acetochlor	Surpass, Harness	H	0.14
Acetochlor ESA	degradate	D	0.02
Acetochlor OA	degradate	D	0.0084
Alachlor	Intrro, Lariat, Lasso	H	0.11
Alachlor ESA	degradate	D	0.044
Alachlor OA	degradate	D	0.0068
AMBA (mesotrione metabolite)	degradate	D	0.021
Aminocyclopyrachlor	Method, Perspective	H	0.025
Aminopyralid	Cleanwave	H	0.03
Atrazine	Aatrex	H	0.0022
Azoxystrobin	Quadris	F	0.0052
Bentazon	Basagran	H	0.0022
Bromacil	Hyvar, Bromax	H	0.0041
Bromoxynil	Huskie, Buctril	H	0.012
Carbaryl	Sevin, Savit	I	0.014
Chlorpyrifos	Lorsban, Dursban	I	0.06
Chlorsulfuron	Finesse, Glean	H	0.0056
Clodinafop acid	Discover NG	H	0.013
Clopyralid	Stinger, Curtail	H	0.088
Clothiandin	Poncho	I	0.016
Deethyl atrazine	degradate	D	0.0017
Deethyl Deisopropyl Atrazine (DEDIA)	degradate	D	0.1
Deisopropyl atrazine	degradate	D	0.04
Dicamba	Banvel	H	0.88
Difenoconazole	CruiserMaxx, InspireF	H	0.011
Dimethenamid	Outlook	H	0.006
Dimethenamid OA	degradate	D	0.0072
Dimethoate	Cygon, Roxion	I	0.0022
Disulfoton sulfone	degradate	D	0.0066
Diuron	Direx, Karmex	H	0.0053
Fluoroethyldiaminotriazine (FDAT)	degradate	D	0.0051
Fipronil	Regent	I	0.0024
Fipronil desulfinyl	degradate	D	0.14
Fipronil sulfide	degradate	D	0.08
Fipronil sulfone	degradate	D	0.04
Flucarbazone	Everst, Prepare	H	0.0024
Flucarbazone sulfonamide (FSA)	degradate	D	0.0039
Flumetsulam	Python	H	0.029

Appendix B. List of analytes and reporting limits (continued).

List of analytes and reporting limits in 2016			
Analyte	Common Trade Names*	Type	Reporting Limit (ppb)
Flupyradifurone	Sivanto	I	0.045
Fluroxypyr	Starane	H	0.035
Glutaric Acid	degradate	D	0.03
Hydroxy atrazine	degradate	D	0.004
Halosulfuron methyl	Permit	H	0.01
Hexazinone	Velpar	H	0.0015
Imazamethabenz methyl acid metabolite (IMAM)	degradate	D	0.0025
Imazamethabenz methyl ester (IME)	degradate	D	0.001
Imazamox	Raptor, Beyond	H	0.0057
Imazapic	Plateau	H	0.003
Imazapyr	Imazapyr, Lineage	H	0.0035
Imazethapyr	Authority Assist, Pursuit	H	0.004
Imidacloprid	Touchstone PF	I	0.0018
Indaziflam	Alion, Specticle	H	0.002
Isoxaben	Gallery, Snapshot	H	0.003
Isoxaflutole	Corvus, Balance Flexx	H	0.13
Malathion	Malathion, Cythion	I	0.028
Malathion oxon	degradate	D	0.0024
MCPA	MCP	H	0.0046
MCPP	Encore, Trimec	H	0.0044
Metalaxyl	Hi-Yield, Ridomil	F	0.0035
Methomyl	Lannate	I	0.012
Methoxyfenozide	Intrepid	I	0.01
Metolachlor	Dual Magnum	H	0.024
Metolachlor ESA	degradate	D	0.005
Metolachlor OA	degradate	D	0.042
Metsulfuron methyl	Ally, Cimarron	H	0.01
Nicosulfuron	Accent, Steadfast	H	0.011
NOA 407854 (Pinoxaden metablolite)	degradate	D	0.0052
NOA 447204 (Pinoxaden metablolite)	degradate	D	0.02
Norflurazon	Solicam	H	0.02
Norflurazon desmethyl	degradate	D	0.02
Oxamyl	Vydate	I	0.01
Parathion methyl oxon	degradate	D	0.012
Phorate sulfone	degradate	D	0.024
Phorate sulfoxide	degradate	D	0.003
Picloram	Tordon	H	0.28
Picoxystrobin	Approach	F	0.0075
Prometon	Pramitol	H	0.001

Appendix B. List of analytes and reporting limits (continued).

List of analytes and reporting limits in 2016			
Analyte	Common Trade Names*	Type	Reporting Limit (ppb)
Propiconazole	Banner, Tilt, Radar	F	0.01
Prosulfuron	Peak, Spirit	H	0.005
Pyrasulfatole	Huskie, Wolverine	H	0.02
Pyroxsulam	GR1, Powerflex	H	0.013
Saflufenacil	Sharpen	H	0.01
Simazine	Princep	H	0.0026
Sulfentrazone	Spartan	H	0.035
Sulfometuron methyl	Lineage, Oust	H	0.0025
Sulfosulfuron	Maverick, Outrider	H	0.0054
Tebuconazole	Folicur	F	0.014
Tebuthiuron	Spike	H	0.0011
Tembotrione	Capreno, Laudis	H	0.073
Terbacil	Sinbar	H	0.0048
Terbufos sulfone	degradate	D	0.011
Tetraconazole	Domarck, Eminent	F	0.0039
Thiamethoxam	CruiserMaxx, Meridian	I	0.02
Thiencarbazone methyl	Corvus, Huskie Complete	H	0.04
Thifensulfuron	Supremacy Harmony	H	0.022
Tralkoxydim	Achieve	H	0.0051
Tralkoxydim acid	degradate	D	0.005
Triallate	Far-Go	H	0.3
Triasulfuron	Dally, Rave	H	0.0055
Tricolpyr	Garlon	H	0.022
Trifloxystrobin	Compass, Stratego	F	0.02

*Common trade names do not represent all trade names containing an active ingredient. Trade names chosen are for example purposes only and this list is not endorsing or making any recommendations.

H=Herbicide; I=Insecticide; F=Fungicide; D=Degradate (breakdown product)

Appendix C. List of detections that were 20% or more of an aquatic life benchmark.

Detections that were 20% or more of an aquatic life benchmark					
Site Name	Site ID	Sample Date	Analyte	Level (ppb)	ALB (ppb)
Sheyenne River near Cooperstown, ND	380009	6/20/2016	Atrazine	0.3	1
James River at Lamoure, ND	380012	6/20/2016	Atrazine	0.29	1
James River at Lamoure, ND	380012	7/19/2016	Atrazine	0.41	1
James River at Lamoure, ND	380012	8/30/2016	Atrazine	0.24	1
James River at Jamestown, ND	380013	5/24/2016	2,4-D	2.9	13.1
James River at Jamestown, ND	380013	5/24/2016	Acetochlor	2.4	1.43
James River at Jamestown, ND	380013	5/24/2016	Atrazine	3	1
James River at Jamestown, ND	380013	7/19/2016	Atrazine	0.4	1
James River at Jamestown, ND	380013	7/21/2016	Atrazine	0.27	1
James River at Jamestown, ND	380013	8/3/2016	Atrazine	0.33	1
James River at Jamestown, ND	380013	7/27/2016	Atrazine	0.34	1
James River at Jamestown, ND	380013	8/10/2016	Atrazine	0.25	1
James River at Jamestown, ND	380013	8/30/2016	Atrazine	0.37	1
James River at Jamestown, ND	380013	6/20/2016	Atrazine	0.91	1
James River at Jamestown, ND	380013	6/20/2016	Sulfometuron methyl	0.24	0.45
Wild Rice River near Abercrombie, ND	380031	6/22/2016	Atrazine	0.73	1
Wild Rice River near Abercrombie, ND	380031	7/26/2016	Atrazine	0.59	1
Wild Rice River near Abercrombie, ND	380031	8/30/2016	Atrazine	0.42	1
Turtle River at Manvel, ND	380037	6/28/2016	Atrazine	0.22	1
Forest River at Minto, ND	380039	6/28/2016	Atrazine	0.23	1
Goose River at Hillsboro, ND	380156	6/1/2016	Atrazine	0.7	1
Goose River at Hillsboro, ND	380156	7/12/2016	Atrazine	0.32	1
Park River at Grafton, ND	380157	6/28/2016	Chlorpyrifos	0.1	0.04
Park River at Grafton, ND	380157	5/24/2016	Metolachlor	2.1	10
James River near Grace City, ND	384130	10/18/2016	2,4-D	9.7	13.1
James River near Grace City, ND	384130	11/1/2016	2,4-D	11	13.1
James River near Grace City, ND	384130	6/20/2016	Acetochlor	3	1.43
James River near Grace City, ND	384130	6/20/2016	Atrazine	5.3	1
James River near Grace City, ND	384130	7/18/2016	Atrazine	1.1	1
James River near Grace City, ND	384130	7/21/2016	Atrazine	0.99	1
James River near Grace City, ND	384130	7/27/2016	Atrazine	0.34	1
James River near Grace City, ND	384130	8/3/2016	Atrazine	0.28	1
James River near Grace City, ND	384130	8/29/2016	Atrazine	0.2	1
James River near Grace City, ND	384130	10/18/2016	Metsulfuron methyl	4.5	0.36
James River near Grace City, ND	384130	11/1/2016	Metsulfuron methyl	4.7	0.36
James River near Grace City, ND	384130	11/17/2016	Metsulfuron methyl	0.7	0.36
James River near Grace City, ND	384130	11/22/2016	Metsulfuron methyl	0.48	0.36
James River near Grace City, ND	384130	11/25/2016	Metsulfuron methyl	0.36	0.36

Detections that were 20% or more of an aquatic life benchmark					
Site Name	Site ID	Sample Date	Analyte	Level (ppb)	ALB (ppb)
James River near Grace City, ND	384130	11/29/2016	Metsulfuron methyl	0.097	0.36
Maple River below Mapleton, ND	384155	6/21/2016	Atrazine	1.5	1
Maple River below Mapleton, ND	384155	7/26/2016	Atrazine	0.58	1
Red River at Grand Forks, ND	384156	6/15/2016	Atrazine	0.42	1
Red River at Grand Forks, ND	384156	7/27/2016	Atrazine	0.27	1
Sheyenne River near Kindred, ND	385001	6/22/2016	Atrazine	0.48	1
Sheyenne River near Kindred, ND	385001	7/26/2016	Atrazine	0.21	1
Bois de Sioux River near Doran, MN	385055	6/20/2016	Atrazine	0.37	1
Bois de Sioux River near Doran, MN	385055	7/27/2016	Atrazine	0.56	1
Bois de Sioux River near Doran, MN	385055	8/29/2016	Atrazine	0.27	1
Sheyenne at Lisbon	385169	6/20/2016	Atrazine	0.31	1
Sheyenne at Lisbon	385169	7/19/2016	Atrazine	0.2	1
James River near Bordulac, ND	390002	8/10/2016	Atrazine	0.24	1