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2022 Field-Edge Groundwater Monitoring Program

ANNUAL REPORT

Wisconsin Department of Agriculture, Trade and Consumer Protection
Agricultural Resource Management Division
Environmental Quality Unit
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Introduction

In 2022, the Wisconsin Department of Agriculture, Trade and Consumer Protection's (DATCP) Agrichemical Management (ACM) Bureau continued the Field-Edge Groundwater Monitoring Program to document the effect continual pesticide use is having on groundwater quality. Groundwater monitoring was performed by DATCP staff across a network of 57 monitoring wells and piezometers at 22 established locations. At each location, depth to groundwater is measured and groundwater samples are collected in the spring and fall to identify pesticide concentrations and evaluate seasonal variations. Collected samples are submitted to DATCP's Bureau of Laboratory Services (BLS) for chemical analysis. This report has been prepared to document 2022 program activities and includes a summary of groundwater level measurements and analytical data results. Recommendations for the 2023 Field-Edge Groundwater Monitoring Program plan based on historic trend results are also presented in this report.

A compilation of acronyms and definitions used throughout this document is provided in Appendix A – Acronyms and Definitions.

Purpose of Field-Edge Groundwater Monitoring

It is estimated that agriculture contributes $104.8 billion annually to Wisconsin's economy (Wisconsin Department of Agriculture, Trade and Consumer Protection, 2023a). Growers in Wisconsin use several million pounds of pesticides and tons of fertilizers annually to grow a wide variety of crops. DATCP's Field-Edge Groundwater Monitoring Program is one form of monitoring the agency performs to meet its statutory obligation to protect groundwater quality. Wisconsin's groundwater law, Chapter 160, Wis. Stats., requires agencies to sample and monitor groundwater for substances related to facilities, activities, and practices under their jurisdiction; that have a reasonable probability of entering the groundwater resources of the state; and to determine whether preventive action limits (PAL) or enforcement standards (ES) have been exceeded at points of standard application. The statute further specifies that agencies should develop monitoring plans that include provisions for conducting four types of monitoring (Wis. Stats., ch. §160.05 and §160.27):

1. Problem assessment monitoring, to detect substances in the groundwater and to assess the significance of the concentrations of the detected substances;
2. Regulatory monitoring, to determine if preventive action limits or enforcement standards are attained or exceeded and to obtain information necessary for the implementation of responses with respect to specific sites;
3. At-risk monitoring, to define and sample at-risk potable wells in areas where substances are detected in the groundwater or where preventive action limits or enforcement standards are attained or exceeded; and
4. Management practice monitoring, to assure practices are within compliance regulations.

The purpose of the Field-Edge Groundwater Monitoring Program (Program) is to evaluate agricultural practices and agrichemical uses on groundwater quality (problem assessment and regulatory monitoring). Depth to groundwater measurements and groundwater sample results are used to measure affects from agrichemical practices and use within and adjacent to agricultural fields. Affects to groundwater quality from agrichemical use is dependent on conditions at each location. Results are used to measure both localized and regional affects to aquifers over time at each field-edge sampling site. Historic and current goals of the Program include the following:

- Provide an early warning system to detect new agrichemical compounds in groundwater before widespread contamination can occur in underlying aquifers.
- Identify and measure pesticide concentrations that may have a potential to migrate to groundwater and exceed groundwater quality standards.
- Identify which environmental conditions (i.e. depth to groundwater, soil type, and geologic setting) are most vulnerable to conditions from routine agrichemical use.

- Gather and compile data regarding the occurrence and persistence of pesticide and metabolites in groundwater that may affect drinking water wells so that health-based groundwater quality standards can be established.
- Study the dissipation of restricted use pesticides (i.e. atrazine) in groundwater after prohibition areas are established or use is restricted, and the dissipation of pesticides no longer in use (i.e. aldicarb).
- Gather and compile long-term data on nitrate contamination in groundwater and its relationship to application practices.
- Evaluate affects to groundwater quality from various land uses and related pesticide use (i.e. tree nurseries, infiltration basins, golf courses).

Program Approach

DATCP and the property owner typically have access agreements allowing DATCP to install and access wells for sample collection. Typically, a monitoring well nest consists of a shallow well intersecting the water table and adjacent deeper wells (piezometers) installed with well screens placed at deeper depths within the underlying aquifer. These well nests are installed at the edge of an agricultural field to measure potential affects from routine agrichemical use. Well locations were carefully selected to avoid interference from other potential sources (i.e. septic systems or spills).

Over time, monitoring well nests have been installed within a variety of geologic settings, often in areas prone to groundwater contamination, such as areas with sandy soil, shallow depths to bedrock, or shallow groundwater. Nested well locations have two to five monitoring wells/piezometers. The shallowest well intersects the water table with piezometers installed at deeper intervals. Table B 1 in Appendix B provides construction specifications for each well in the Program's groundwater monitoring well network. Figure 1 (page 6) depicts the Program's monitoring locations relative to State of Wisconsin and county boundaries.

Program data collection and documentation are completed in accordance with established protocols and guidance (Wisconsin Department of Agriculture, Trade and Consumer Protection, 2021; Wisconsin Department of Natural Resources, 1996). Depth to water measurements and sample collection procedures are designed to collect reliable data consistently and in an unbiased fashion to ensure that localized conditions and regional impacts to aquifers over time can be evaluated. Field sampling observations and water level measurements are recorded in field notebooks. The compiled field information, along with laboratory results, are retained in databases maintained by DATCP.

Standard operating procedures for groundwater sampling include the following:

- After unlocking the protective casing, remove the well cap to allow the water level to equilibrate with atmospheric pressure before measuring and recording the water level at each well.
- Each well is then properly purged to remove a minimum of four well casing volumes. Purging is performed either by using dedicated bailers and rope, peristatic pumps (low flow) with dedicated tubing, or submersible electric pumps (i.e. whale or tornado pumps) with dedicated tubing. The volume of water removed is measured and recorded in the field logbook.
- Samples are then collected and placed in laboratory-provided containers using either sampling equipment dedicated to the well or with equipment that is decontaminated prior to use.
- Samples are placed into coolers and held on ice while in transport to the laboratory.
- Water purged from the wells and any rinse water used for cleaning is discarded on the ground surface.
- Field information is recorded in logbooks and maintained by ACM staff.

Groundwater samples are collected using the same equipment used for purging. Samples are collected in one-liter amber glass bottles provided by BLS. (Fifty-millimeter plastic containers were used for select glyphosate sampling.) Bottles and containers are then placed in a cooler and held on ice along with a properly completed sample collection record and hand delivered to BLS within 48 hours. During the 2022 Program, there were no issues with shipping or bottle breakage.

BLS performed all groundwater analytical testing using gas chromatography/mass spectroscopy (GC/MS/MS) and liquid chromatography/mass spectroscopy (LC/MS/MS) methods in accordance with ISO 17025 accreditation standards. All samples were tested for 106 pesticide analytes as well as nitrogen as nitrate plus nitrite. Pesticide analytes are listed in Table B 2 of Appendix B along with corresponding reporting limits. A summary of the 2022 program analytical data results is listed in Table B 3 of Appendix B. Individual monitoring well or piezometer analytical reports are available upon request.

DATCP provides annual program findings documentation for each site to the respective property owner or grower. The summary letters provide the year's water level data and analytical results and includes a brief discussion of data trends over time. As part of the letter, growers are asked to reply with information regarding crops grown, pesticide use, and the amount of nitrogen applied to the fields near monitoring wells.

Program Assets and Infrastructure

The groundwater-monitoring network for the 2022 Field Edge Monitoring Program included 57 groundwater monitoring wells (31 water table observation wells and 42 piezometers) at 22 locations/stations around the state. Table B 1 in Appendix B lists well construction specifications associated with these Program assets. Figure 1 (page 6) depicts the Program's monitoring sites relative to State of Wisconsin and county boundaries. Construction logs and well development forms (and abandonment forms) associated with the groundwater monitoring wells, and piezometers are available upon request. The following is a summary of the Program's well installation history.

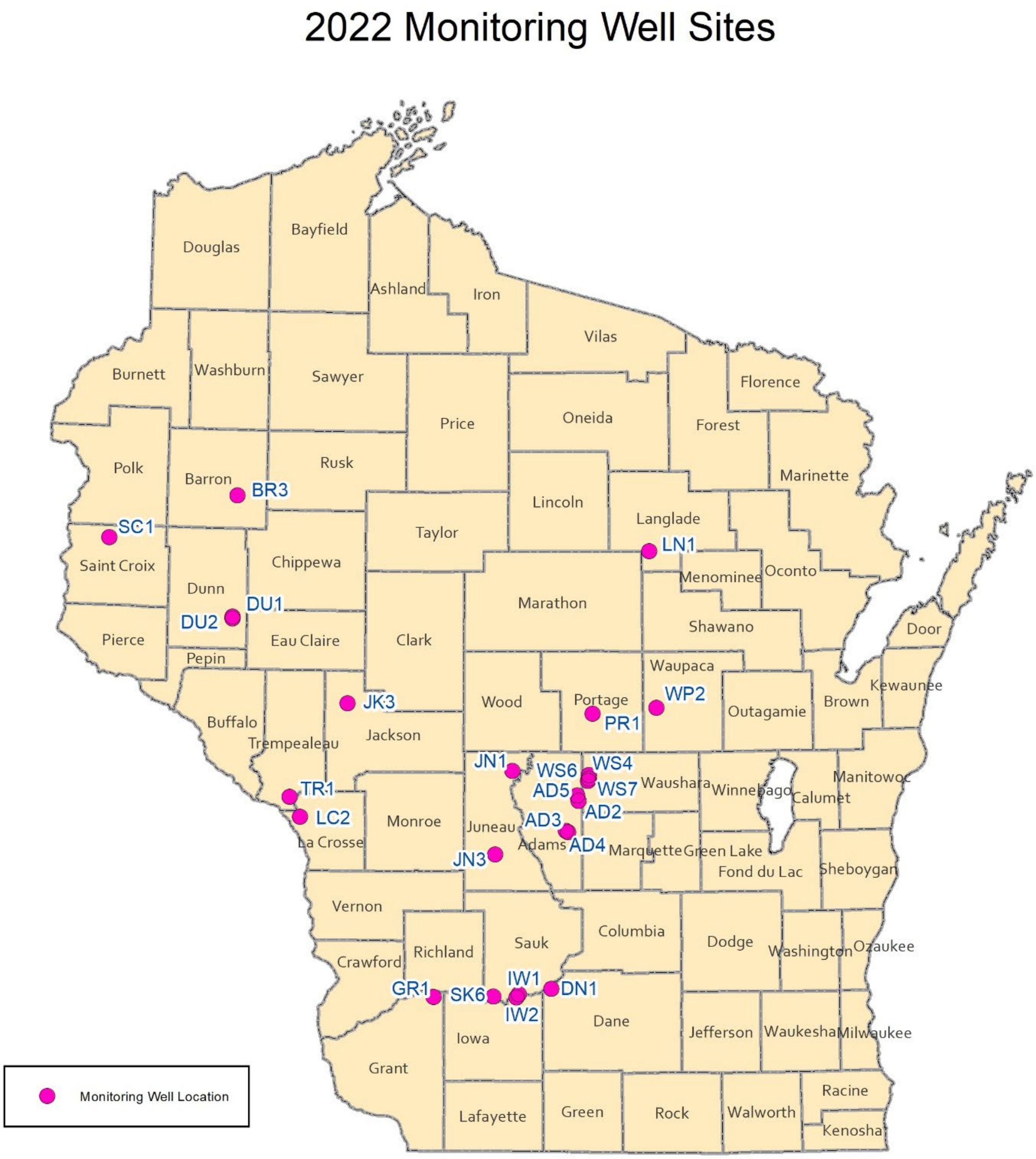


Figure 1: 2022 Monitoring Well Sites

1985-1989 ORIGINAL MONITORING WELLS AND PIEZOMETERS

The DATCP Field-Edge Groundwater Monitoring Program began in 1985. Initially, arrangements with growers and landowners at 50 sites were established in areas highly susceptible to groundwater contamination (i.e. coarse soil over sand, shallow depth to groundwater, and/or irrigated agricultural areas). Groundwater monitoring nests with three to four wells were installed at each site. Nested wells were constructed with well screens placed at various depths in the underlying aquifer. These wells were constructed adjacent to agricultural fields in the Central Sands region, Lower Wisconsin River Valley, and at other sandy soil areas throughout the state. The original Field-Edge Study was designed to collect groundwater samples from the uppermost shallow aquifer. Samples were tested for a limited number of agrichemicals and fertilizer to evaluate potential impacts to shallow groundwater from routine agricultural practices performed at nearby fields.

Data from the Program's initial years led to the establishment of statewide pesticide management plans for both atrazine and aldicarb. Over the years, many of the wells installed for the initial study have been abandoned due to changes in land ownership, urban encroachment, or damage. Of the original 50 sites, monitoring wells remain at 16 sites and were included in the 2022 monitoring program.

2005 MONITORING PROGRAM EXPANSION

In the fall of 2005, DATCP expanded its groundwater monitoring network with funding from a United States Environmental Protection Agency (US EPA) grant. New monitoring wells and piezometers were constructed at six sites based on local agricultural practices and susceptible to groundwater contamination (i.e. shallow groundwater with permeable subsurface soil units). Each of the six sites selected for program expansion were used for a prior DATCP groundwater monitoring study (Evaluation of Renewed Use of Atrazine in Atrazine Prohibition Areas), completed by DATCP in 2005. That study (also known as the Atrazine Reuse Study) was performed to gather information to evaluate the potential to repeal atrazine prohibition areas.

The groundwater flow direction was determined as part of the Atrazine Reuse Study. Using that information, two monitoring wells were installed hydraulically down gradient and adjacent to agricultural fields at the six new sites. All six of these sites still were included in the 2022 monitoring program.

2010 UNIVERSITY WISCONSIN–OSHKOSH WELLS

In the spring of 2010, DATCP became aware of a forthcoming study by a University of Wisconsin-Oshkosh graduate student and the Wisconsin Geological and Natural History Survey (WGNHS). The study included installation of shallow bedrock monitoring wells at the edge of agricultural fields in a karst geological setting. It used monitoring wells at sites in Brown, Calumet, Kewaunee, and Manitowoc counties. Bedrock fractures at each well were identified by the study team. Groundwater samples were collected by the study team and DATCP and tested annually as part of this Program between 2010 and 2014. The study was completed, and all monitoring wells were subsequently abandoned in 2014.

2011 MONITORING PROGRAM EXPANSION

In the summer and fall of 2011, DATCP expanded its groundwater monitoring network again with additional funding from a US EPA grant. Monitoring wells were constructed at two new stations in La Crosse and Trempealeau counties. These wells were installed along an elevated terrace adjacent to the Mississippi River. Since the groundwater flow direction was known at each site (both locations were part of the Atrazine Reuse Study), DATCP installed two groundwater monitoring wells at each site at the hydraulically down gradient edge of each agricultural field. Wells at both sites remain and were included in the 2022 monitoring program.

2017 MONITORING PROGRAM EXPANSION

In the summer and fall of 2017, DATCP further expanded the groundwater monitoring network with additional funding from a US EPA grant. Piezometers were constructed at three existing sites (two sites in Adams County [AD2 and AD5] and one in Portage County [PR1]) and at one new site, the Hancock Agricultural Research Station (HARS). At each of these sites, two piezometers were installed near the existing groundwater monitoring nest with five-foot screens located at depths greater than 50 feet and 80 feet. The purpose was to evaluate groundwater quality relative to agrichemical uses at deeper aquifer intervals and compare data to shallower aquifer depths. A water table observations well (well screen placed to intersect the water table) was also constructed at HARS. The HARS site and nested wells at the Adams and Portage County sites remain and were included in the 2022 Program.

2021 MONITORING PROGRAM EXPANSION/ABANDONMENT

In the summer and fall of 2021, DATCP obtained additional funding from a US EPA grant again to expand the groundwater monitoring network. Eleven monitoring wells/piezometers were installed at six existing nested monitoring well sites. New wells were installed at sites in Adams County (AD2 and AD5), Dane County (DN1), Sauk County (SK6), Waushara County (WS7), and at two sites in Iowa County (IW1 and IW2). A monitoring well was also installed at the Dane County site to replace a well that was damaged beyond repair and subsequently abandoned in 2018. This shallow well was installed with a well screen intersecting the water table. Wells installed at the other five sites were constructed as piezometers with well screens placed 30 to 40 feet further in depth below the deepest existing piezometer screen already on-site in the well nest. These new piezometers were constructed with five-foot long well screens. The purpose was to evaluate groundwater quality relative to agrichemical uses at deeper aquifer intervals and compare data across vertical aquifer horizons. All new wells were included in the 2022 fall sampling event.

Additionally, five wells at two monitoring locations were removed from the Program in 2021 in response to a change in property ownership. New owners for two Adams County sites (AD3 and AD4) did not want to continue to participate in the Program and requested removal of the wells. Two shallow water table observation monitoring wells and three piezometers were abandoned in December 2021.

2022 Results

A total of 144 water level measurements and 112 groundwater samples were collected as a part of DATCP’s 2022 Field-Edge Groundwater Monitoring Program. All groundwater samples were submitted to BLS for chemical analysis. Table B 3 in Appendix B summarizes 2022 Program analytical results and provides comparative risk values. The analytical data is compared to groundwater/drinking water standards to assess potential risk to human health and the environment. The risk values are sourced from the Wisc. Admin. Code ch. NR 140 for groundwater qualitative health standard limits and Wisconsin Department of Health Services (WDHS) drinking water health advisories.

Key findings for 2022 include the following.

- Information regarding field use of pesticides and fertilizer was requested from growers for 22 sites, but only four growers responded. This is less than usual.
- Water level measurements show an overall slight decline in water table elevations in 2022. In 2022, according to National Oceanic and Atmospheric Administration (NOAA), the state received on average 32.16 inches of precipitation compared to an average of 34.06 inches. This slight decline is likely related to the less than average of precipitation.
- Laboratory analysis include 106 pesticide analytes for the laboratory testing methods. During 2022, 32 pesticide analytes were detected in excess of reporting limits in numerous groundwater samples, which is similar to previous years.
- Pesticides detected in 2022 samples in excess of laboratory reporting limits include 12 herbicides, 13 herbicide metabolites, five insecticides, and two fungicides.
- It appears that pesticides were detected at slightly greater concentrations during the fall sampling event compared to spring results.
- Overall, analytical data collected at nested monitoring wells indicates that pesticide and nitrogen concentrations increase with depth. Greater concentrations at depth indicate that pesticides migrate vertically and laterally within the underlying aquifers. This trend is consistent with prior years’ findings.
- Metolachlor ethanesulfonic acid (ESA) was detected in excess of laboratory reporting limits in 99% of all samples collected and was the most frequently detected pesticide in 2022. Additionally, metolachlor ESA was detected at each groundwater monitoring site, which is the only compound detected at each monitoring well nest location. This is consistent with prior years’ findings.

- Clothianidin was the second most frequently detected compound. It was detected in excess of laboratory reporting limits in 78% of the samples collected, and at 19 of the 22 groundwater monitoring sites. These observations are consistent with findings from prior years.
- Alachlor ESA was the third most frequently detected compound. It was detected in excess of laboratory reporting limits in 69% of the samples collected. However, the number of sites where it was detected (17 sites) has been decreasing when compared to previous year's findings.
- Atrazine or one of its breakdown products (de-ethyl atrazine, de-isopropyl atrazine, and diamino atrazine) was detected in excess of laboratory reporting limits in 47% of the samples collected. At each site with nested wells, results were evaluated by well depth. The greatest concentrations were detected in groundwater samples collected from the deepest piezometers.
- Neonicotinoid compounds clothianidin, imidacloprid, and thiamethoxam were detected in excess of laboratory reporting limits in 78%, 46%, and 42%, respectively, of the samples collected in 2022. The frequency of detection is similar to observations from the previous year.
- There was only one Wisc. Admin. Code, ch. NR 140 ES exceedances of an established groundwater quality health standards. (Note; only 31 of the 106 pesticides tested for have established groundwater quality health standard levels). Alachlor ESA exceeded the ES in a November groundwater sample collected from a well nest located in Juneau County. Additionally, there were Wisc. Admin. Code, ch. NR 140 PAL exceedances for atrazine, de-ethyl atrazine, de-isopropyl atrazine, di-amino atrazine, and atrazine total chlorinated residuals (TCR) at multiple locations and monitoring wells.
- The WDHS has also established drinking water quality advisories for several pesticides. Imidacloprid was detected at 14 out of 24 sites, with 12 of the 14 detections exceeding the WDHS drinking water health advisory level of 0.2 micrograms per liter (µg/L) or parts per billion (ppb).

GROWER RESPONSES

DATCP obtained limited information for 2022 regarding crops grown, pesticide use, and the amount of nitrogen applied to the fields adjacent to monitoring wells. A request for this information was included with each 2021 summary letter sent to nearby property owners and growers. Responses to the information request is voluntary. DATCP received replies from only four of the 21 sites. No information was requested from HARS for site WS7. Table B 4 in Appendix B summarizes information provided by the growers along with available information from the previous six years. The following Table 1 is a summary of crops grown adjacent to the monitoring well nests and nitrogen use data for 2022 based on property owners and growers' responses.

Table 1: Crops Grown and Nitrogen Applied on Fields Adjacent to 2022 Field Edge Stations

Crop	Number of Sites with Crops	Percent of Sites (reported)	Range of Nitrogen Applied (lbs / acre)
Corn	2	50%	220 – 415
Soy Beans	1	25%	0
Alfalfa	1	25%	0

Irrigation systems are present at 19 of the 24 monitoring sites. Of the 19 sites with irrigation systems, four sites provided water usage data for 2022. Growers reported that the range of irrigation water applied to the fields in 2022 ranged from 2 to 5.25 inches per acre.

Growers were also asked if they have state-approved Nutrient Management Plans for the adjacent fields. Of the four respondents, three indicated they have an approved plan.

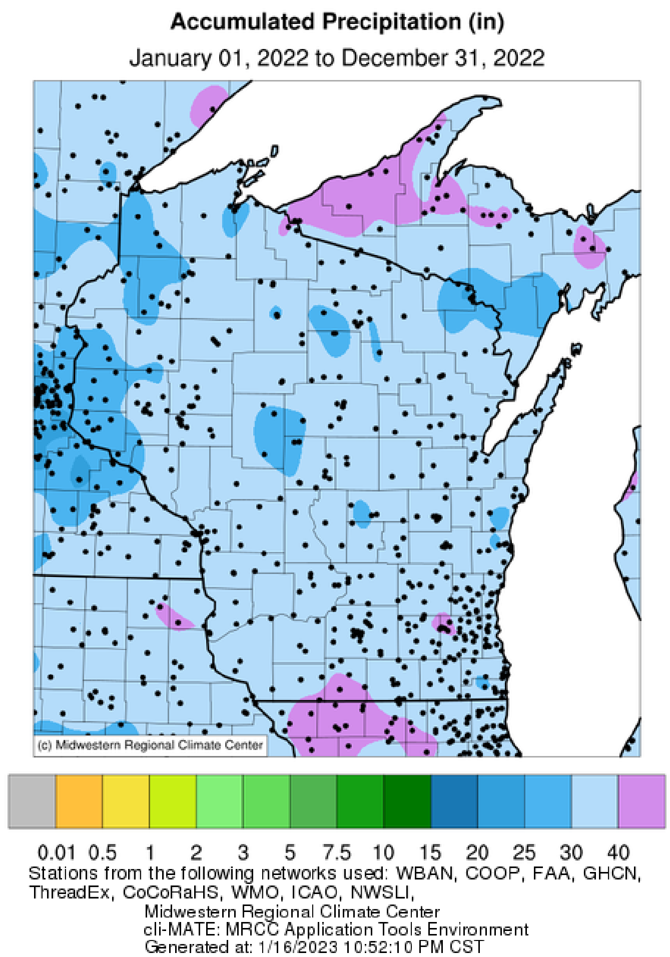
A wide variety of pesticides used on fields adjacent to field edge monitoring wells was reported by the growers. Metolachlor was the most widely used active ingredient pesticide followed by glyphosate. A total of six different active ingredients (pesticide compounds) were reported to be applied in 2022 to the four fields. Table B 4 in Appendix B identifies the complete list of pesticides used in 2022 as reported by the Growers.

WATER LEVEL MEASUREMENTS

Depth to water level is measured at each well prior to collection of groundwater samples for laboratory testing, and measurements are compared with past DATCP records to determine any historic trends. Water level measurements are typically taken in late spring and again in late fall. In 2022, this included April, May, early June, October, and November. Overall, measured water levels of sampled wells increased slightly during 2022 by an average of 0.89 inches. Additionally, well water levels were slightly higher on average than historic measurements made during the same months.

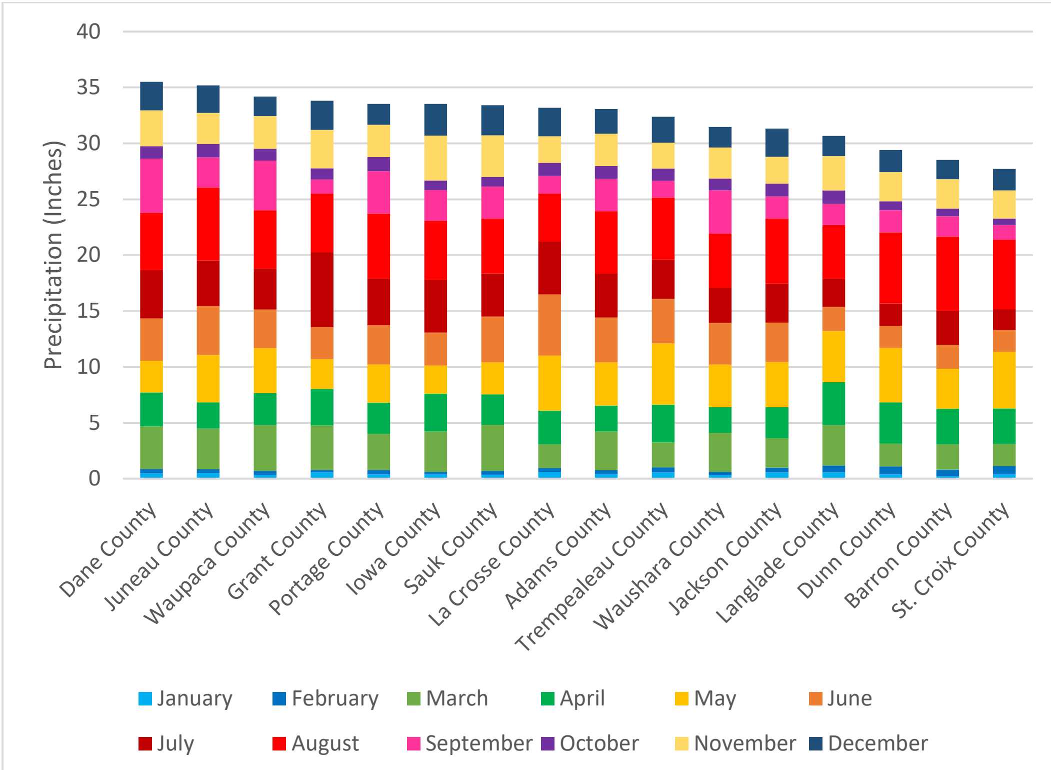
Wisconsin averages 34.06 inches of precipitation annually, according to the 1991-2020 historic climate normal (Midwestern Regional Climate Center, 2023). In 2022, the state was slightly drier than usual, receiving 32.16 inches of total precipitation (Midwestern Regional Climate Center, 2023). Figure 2 shows the total accumulated precipitation in Wisconsin over the course of 2022 (Wisconsin State Climatology Office, 2023). The map shows a relatively even distribution of total accumulated precipitation, with most of the state receiving between 30 and 40 inches. Several isolated spots received relatively less rain (between 25 and 30 inches), particularly in the northwestern region of the state.

Figure 2: Accumulated Precipitation from the Wisconsin Monthly Climate Watch Archive



The monthly total precipitation for each county with a Field-Edge Program monitoring well nest is shown in Figure 3 below. The figure was produced using data from the NOAA National Centers for Environmental Information (2023). Each color within a bar represents the amount of precipitation received during its corresponding month.

Figure 3: 2022 Monthly Precipitation Totals for Sampling-Site Counties from the NOAA Monthly Climate Watch Archive



Records of storm events provide specifics relating to precipitation patterns seen in sampled counties during 2022 (NOAA National Centers for Environmental Information, 2023). Between January and early April of 2022, heavy snowfall events occurred on eight occasions in 14 counties across northern and central latitudes of Wisconsin. Heavy rain events between March and July occurred on five days in six counties, primarily in the southern portion of the state. October through December saw heavy snow in 11 counties on seven separate days, again largely in the north. These snowfall events primarily occurred during the months of November and December.

Figure 4 depicts the monthly statewide precipitation departures from the historic 1991-2020 average (Wisconsin State Climatology Office, 2023). Positive precipitation departure values indicate more precipitation was received than average for that month, and negative means relatively less was received. In 2022, the months of January, February, May, June, July, September, and October had negative departures from the historic average. June and October had the biggest negative departures and were in excess of -1 inches. The values of negative precipitation departure ranged from nearly 0 to approximately -1.8 inches. March, April, August, November, and December all had positive precipitation departures, with March and August having departure values in excess of 1 inch. Positive precipitation departure values ranged from about 0.2 to 1.4 inches.

Figure 4: Wisconsin Monthly Precipitation Departures (from 1991-2020 Average) for 2022

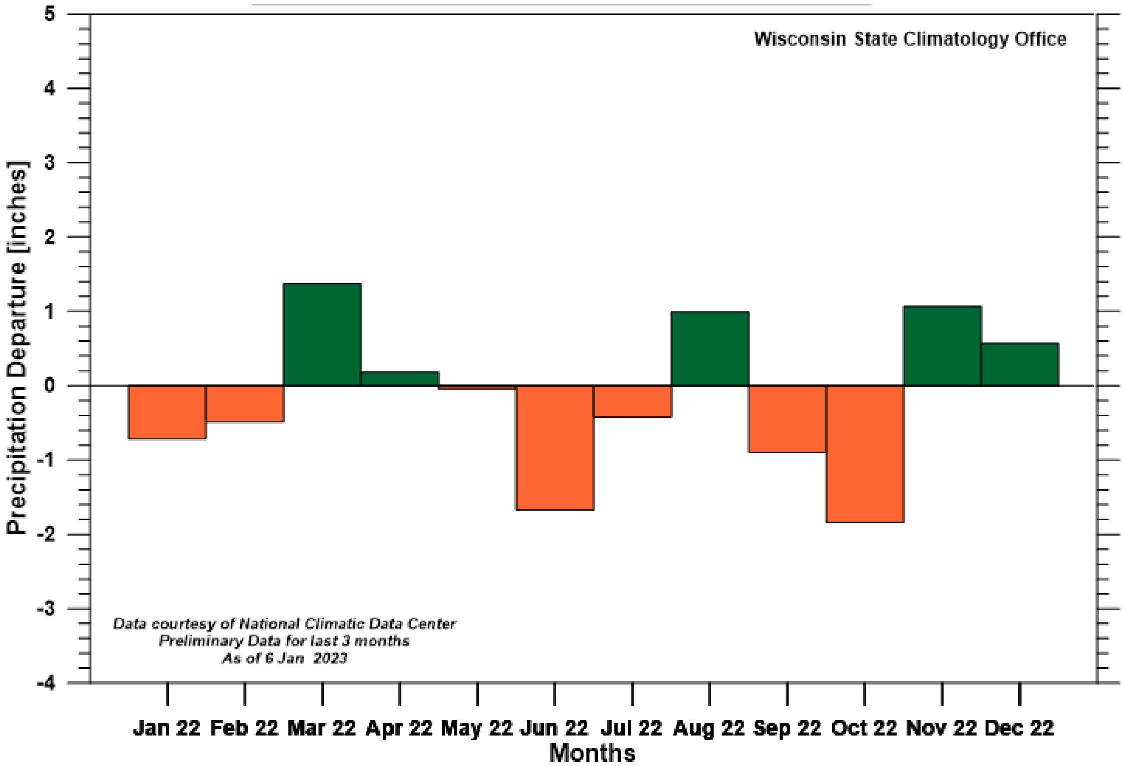
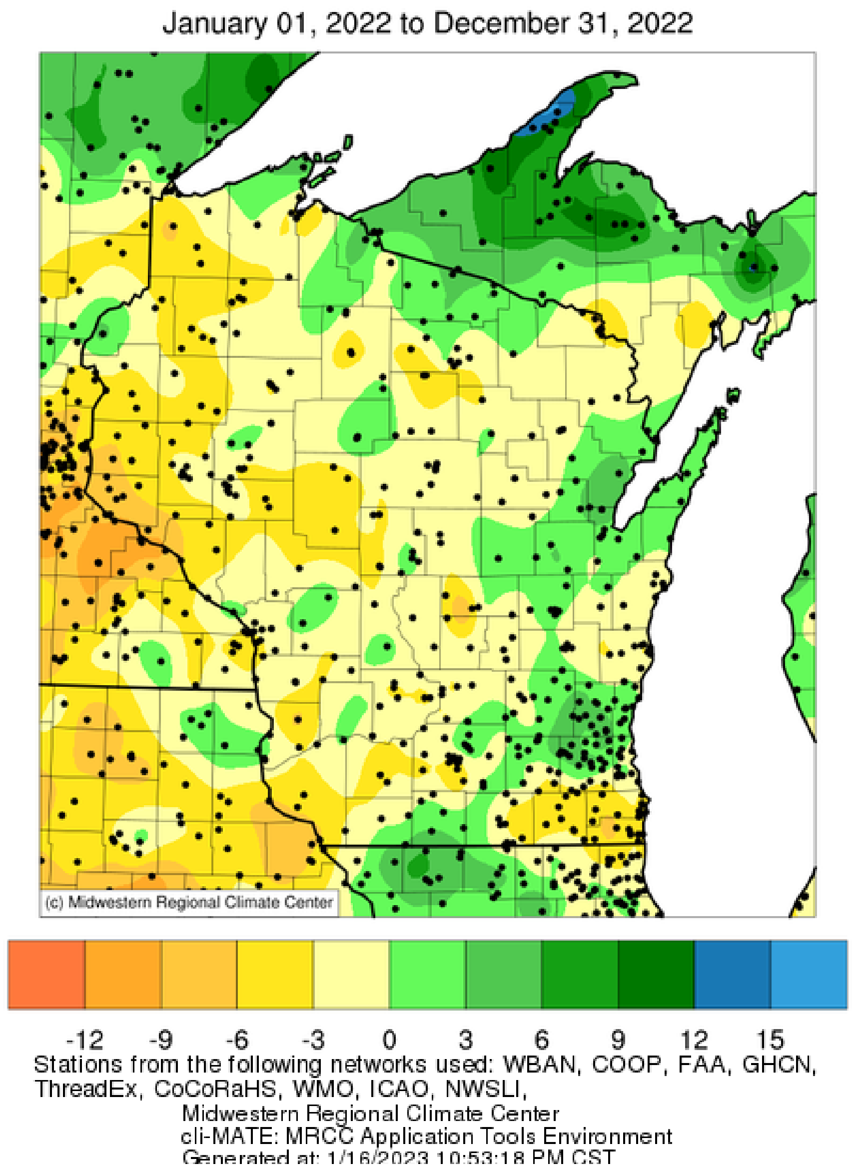


Figure 5 shows the accumulated precipitation departure in 2022 across Wisconsin as provided by the Wisconsin State Climatology Office (2023). The colors on the map show the difference between the amounts of precipitation received in 2022 compared to the 1991-2020 historic average. Green and blue indicate more precipitation accumulated than average, and yellow, orange, and red indicate less. Most of Wisconsin generally received slightly less total precipitation than usual, particularly in the northwestern region of the state where some regions received three to six inches less than normal. Several areas in the eastern region received greater than average precipitation, up to three to six inches. Overall, the total precipitation accumulated during 2022 was classified as “near average” relative to historic records (NOAA National Centers for Environmental Information, 2023).

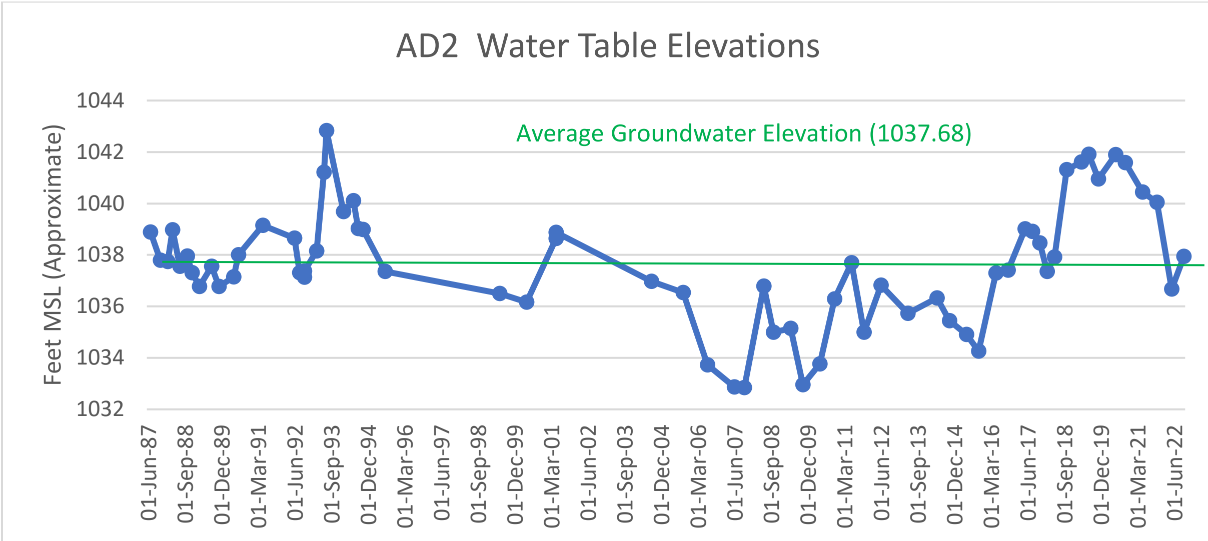
Figure 5: Wisconsin Accumulated Precipitation (in): Departure from 1991-2020 Average



The following Figures (6 to 8) provide examples of measured water level fluctuations over time for three wells in the groundwater monitoring network. These three wells are at sites with infrastructure for irrigation. Graphs showing water level measurement trends for all other wells in the groundwater monitoring network are available upon request.

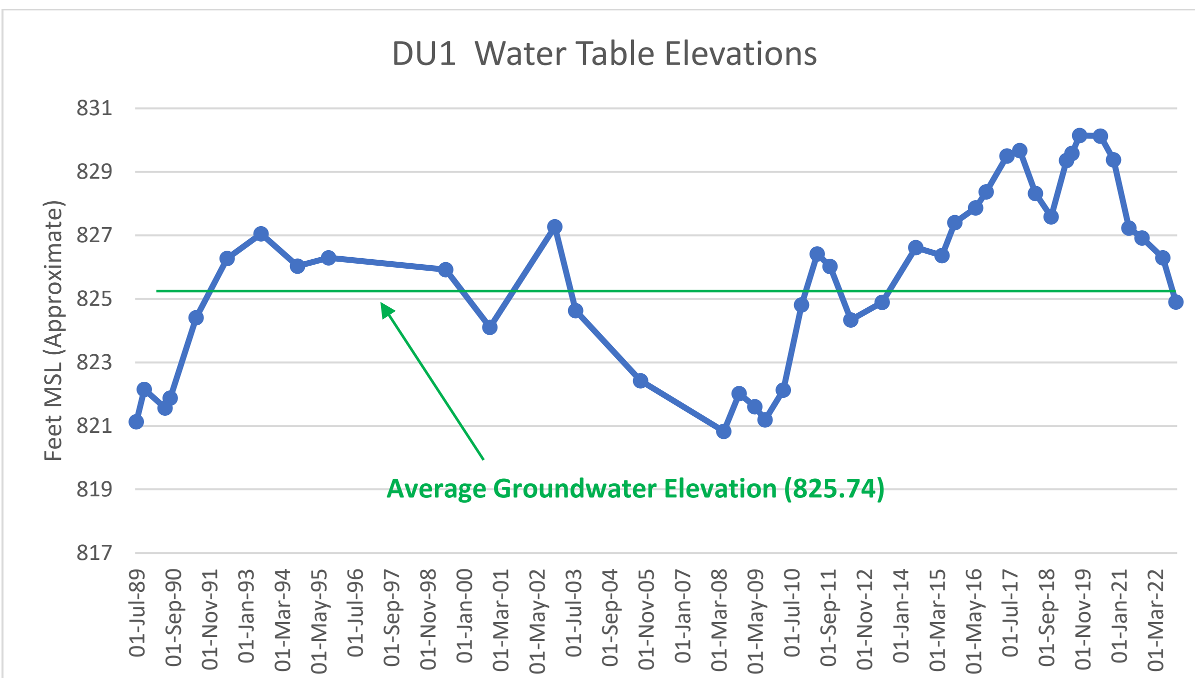
2022 water level data for Field-Edge Monitoring Program station AD2 indicate a lowering water level relative to the past several years (Figure 6). In 2022, water levels were statistically at the average for the duration of the monitoring program. According to NOAA, Adams County received only 30.09 inches of precipitation in 2022, which was notably less than the past nine years, compared to an average yearly precipitation of 34.24 inches. This precipitation decrease is likely the explanation for the decrease in 2022 water level observations compared to the previous years.

Figure 6: Historic Water Table Level Data for a Field-Edge Monitoring Station AD2 in Adams County



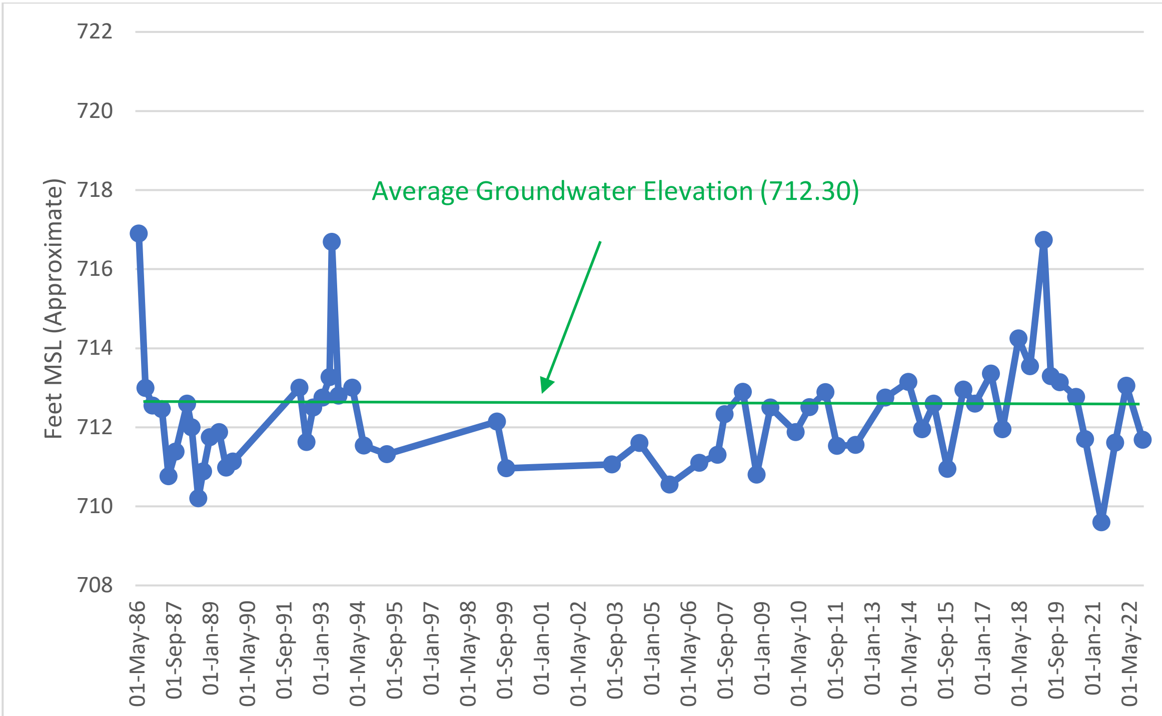
2022 water level data for Dunn County station DU1 also indicated a continued decrease compared to the previous year (Figure 7). In 2022, the water levels dropped slightly below its historic average. In Dunn County, NOAA has reported that precipitation levels over the past couple of years have been less than average. The receding water level recorded in the DU1 location wells likely reflect that decreasing precipitation.

Figure 7: Historic Water Table Level Data for a Field-Edge Monitoring Station DU1 in Dunn County



2022 water level data for Iowa County station IW1 indicates stable water table conditions (compared to the previous two reported locations), consistent with historical measurements (Figure 8). Because this site is near the Wisconsin River, it is likely influenced by river water levels and the dams that control water flow. High water table conditions in the spring have been observed several times at this location over the course of the monitoring program. The overall trend continues to indicate a stable trend over the past 20 years, which likely correlates to nearby river elevations. Precipitation amount have less of an effect.

Figure 8: Historic Water Table Level Data for a Field-Edge Monitoring Station IW1 in Iowa County



DATCP is planning to complete an additional evaluation of groundwater elevation data for each individual monitoring site as part of a detailed study. Historical water level monitoring data will be evaluated for each site and results will be documented in a separate report prepared for each site (*Historical Field-Edge Site Data Analysis*). This evaluation will include a comparison of water level trends to precipitation records. These reports are planned to be completed over a three-year period with the first group available in 2024.

PESTICIDE DETECTION FREQUENCY

Thirty-two of the 106 analytes tested in DATCP's 2022 Field-Edge Groundwater Monitoring Program were detected in excess of laboratory reporting limits. The number of compounds detected in 2022 were fairly consistent from 2021 when 33 analytes were detected and is consistent with historical detection numbers.

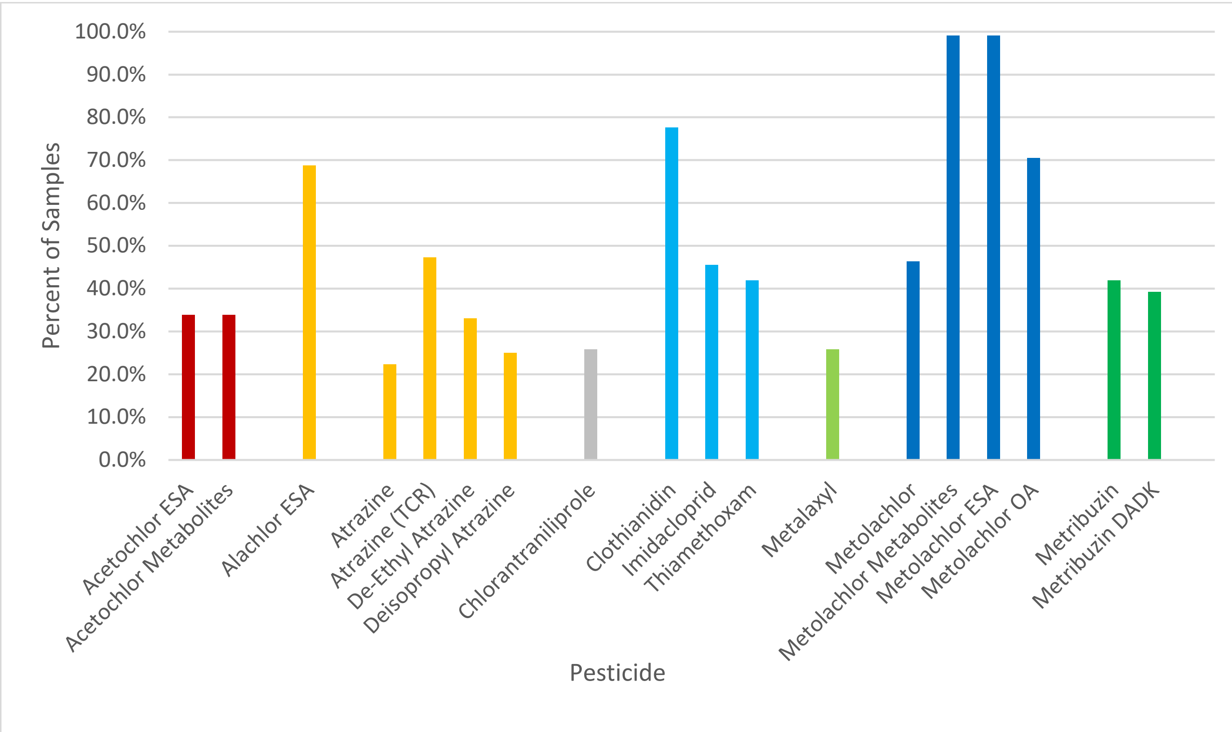
Chlorothalonil was detected for the first time in the field edge monitoring program in 2022. Chlorothalonil is a fungicide used to treat vegetables, ornamental, and orchard diseases. It was detected in a groundwater sample collected in the fall from a well located in Waushara County.

There were some recurrent trends regarding analyte detections. There continues to be an absence of bromacil and dicamba in groundwater samples. These two compounds were consistently detected in the prior years, but not in the last two. Clopyralid and dimethenamid (and its metabolities) have continued to be detected in field-edge groundwater well samples, which is a recent trend.

At least two pesticide analytes were detected in every groundwater sample collected in the 2022 Field Edge Program. Pesticides detected in excess of laboratory reporting limits in 2022 samples include 12 herbicides, 13 herbicide metabolites, five insecticides, and two fungicides.

The most frequently detected pesticide compounds in 2022 are listed in Figure 9. This figure includes all pesticide analytes detected at a concentration greater than the laboratory reporting limit at a frequency greater than 20%.

Figure 9: Percentage of 2022 Samples with Detectable Pesticide Concentrations (Includes all analytes detected in 20% or more of all samples collected)



Notes: *Atrazine TCR is total chlorinated residues of atrazine, which includes the sum of atrazine plus its metabolites de-ethyl atrazine, de-isopropyl atrazine, and di-amino atrazine.*

Metolachlor ESA was once again the most frequently detected analyte in excess of laboratory reporting limits. It is a breakdown product of metolachlor, which is an active ingredient in corn herbicides. Metolachlor ESA was detected at every site and in 99.1% of all samples collected in 2022.

Clothianidin was the second most frequently detected compound in 2022. Clothianidin is an insecticide that controls sucking and some chewing insects, such as aphids, thrips, and beetles. It is commonly used for seed treatment on corn. It was detected in excess of laboratory reporting limits at 19 of the 22 sites and in 77.7% of the samples collected. This rate of detection is 2.7% greater than in 2021, continuing the trend of increasing clothianidin detections since testing for the analyte began 15 years prior. In the past, clothianidin detections were largely common at sites within the Central Sands Agricultural Region, but now it is detected throughout the monitoring network. Clothianidin is now commonly detected at most field edge monitoring well sites within agricultural-intense areas.

The third most frequently detected analyte for the 2022 program was metolachlor OA, which is followed closely by alachlor ESA. Both analytes were detected in a similar percentage of samples collected in 2022, but with metolachlor OA having a slightly higher rate of detection than alachlor ESA. Metolachlor OA was detected in excess of laboratory reporting limits at 17 of 22 sites and in 70.5% of collected samples. Similarly, alachlor ESA was detected at 17 of 22 sites and in 68.8% of samples. Both of these percentages are slightly greater than in 2022, but results may have been influenced by the decrease in the number of sampled sites between 2021 and 2022.

COMPARISON TO STANDARDS

The Wisconsin Department of Natural Resources (WDNR) sets groundwater quality standards in Wisc. Admin. Code ch. NR 140, which includes substances of public health concern based on recommendations from WDHS. These standards have two parts, the ES and the PAL. The ES is a level that, if exceeded, requires intervention from the appropriate authority. In the case of pesticides in drinking water, DATCP is required to intervene if levels exceed the ES. The PAL is a percentage of the ES: 10% of the ES for carcinogenic, mutagenic, or teratogenic properties, and 20% of the ES for all other substances. The PAL is intended to act as a trigger for intervention by the appropriate authority before the pollutant becomes a risk to public health. These NR 140 standards have been established for 29 of the 106 analytes tested for in this program.

Additionally, WDHS has recently established drinking water health advisories for 16 pesticides parent materials and metabolites. Pesticide concentrations identified during DATCP's 2022 Program were compared to these WAC ch. NR 140 Groundwater Quality standards and WDHS drinking water health advisories. Table B 3 in Appendix B lists the existing standards alongside the range of concentrations for the pesticide compounds detected in 2022 groundwater samples.

In 2022, one groundwater sample contained an analyte that exceeded an established ES. An elevated concentration of alachlor ESA was detected in excess of the 20 micrograms per liter (µg/L or parts per billion [ppb]) ES. This herbicide metabolite was detected at 23.2 µg/L in a groundwater sample collected in the fall from well JN3-1 located in Juneau County. Additionally, imidacloprid was detected in 11 groundwater samples at concentrations greater than the WDHS drinking water health advisory of 0.2 µg/L. These groundwater samples were collected from monitoring wells located in Adams, Iowa, Sauk, and Waushara counties; six of the samples were collected from Adams County wells. All of the sites are located in the Lower Wisconsin River Valley or Central Sands Agricultural Region. Imidacloprid concentrations in these samples ranged from 0.207 to 1.52 µg/L. No other analytes were found at concentrations greater than their respective ES or WDHS drinking water health advisory.

As depicted in Table B 3 of Appendix B, concentrations of metolachlor, de-ethyl atrazine, de-isopropyl atrazine, di-amino atrazine, and atrazine TCR (total chlorinated residues, which is the sum of atrazine and its three analyzed metabolites) were detected in excess of their respective Wisc. Admin. Code ch. NR 140 PAL standards.

Table B 3 of Appendix B also includes results for pesticides and their metabolites with no established ES, PAL, or WDHS drinking water advisories. Sixty-one of 106 pesticides compounds tested have no established groundwater quality standard or level. A review of 2022 data indicates that 32 different pesticides compounds were detected in excess of laboratory reporting limits, and 17 of these 32 compounds have no Wisc. Admin. Code ch. NR 140 established standard. However, nine of the 17 analytes with no Wisc. Admin. Code ch. NR 140 standards have a WDHS drinking water health advisories (chlorantraniliprole, clothianidin, flumetsulam, fomesafen, imidacloprid, metalaxyl, saflufenacil, sulfentrazone, and thiamethoxam).

Four of the 17 compounds with no established standards or WDHS advisories are metabolites for compounds with standards (alachlor, dimethenamid, or metribuzin). The remaining three detected compounds with no existing standard or WDHS advisory are chlorothalonill, clopyralid, and cyantraniliprole. Table 2 includes a detection summary of these remaining three compounds that are not metabolites and have no standard or advisory.

Table 2: Detected Parent Compounds that have No Wisc. Admin. Code ch. NR 140 Standard or WDHS Drinking Water Health Advisory Levels

Analyte	Sites with Detects (out of 22)	Number of Detects (out of 112)	% of Samples Detected	Concentration Range (in µg/L)
Chlorothalonil	1	1	0.9%	0.123
Clopyralid	2	3	2.7%	0.131-0.232
Cyantraniliprole	3	5	4.5%	0.0509-0.0943

2022 is the first year chlorothalonil has been detected in a field-edge monitoring well groundwater sample, and it is the only new compound detected in excess of laboratory reporting limits. Chlorothalonil is a fungicide used to treat vegetables, ornamental, and orchard diseases. It was detected in a groundwater sample collected in the fall from a well located in Waushara County.

It is important to note that comparisons of detected pesticides and their metabolite concentrations to established groundwater quality standards and drinking water advisories are based on exposure to a single compound. These comparisons do not fully evaluate the risk to human health when two or more compounds are present. Currently, there are no calculations to predict potential risk when multiple compounds are present. Since the current approach does not account for potential cumulative risk, potential toxicity may be underestimated when two or more compounds are present.

OTHER NOTABLE OBSERVATIONS

Neonicotinoids:

Interest in the neonicotinoid class of insecticides has increased greatly in recent years due to concerns over possible effects on pollinators. DATCP began testing for these compounds in 2008 with thiamethoxam. BLS now analyzes for six neonicotinoid compounds. Three of these compounds - clothianidin, imidacloprid, and thiamethoxam (CIT) - were detected in field-edge groundwater samples collected in 2022. The other three neonicotinoid compounds - acetamiprid, dinotefuran, and thiacloprid - were not detected in excess of laboratory reporting limits in any groundwater samples. The presence of the three CIT compounds in groundwater is expected as these compounds are known to readily leach when applied to crops grown in sandy soils and are used in many insecticide products. CIT compounds are labeled for use on most crops grown in the state including corn, soybeans, potatoes, many other vegetables, fruit crops, and most small grains.

Historic field-edge monitoring results indicate that CIT compounds are becoming more prevalent in groundwater over time. CIT compounds were observed at 19 of the 22 locations in 2022, which is more compared to prior years. However, concentrations seem to be stable or slightly decreasing at areas with known impacts. Thiamethoxam and imidacloprid have been detected in field-edge samples since testing for neonicotinoid compounds began, primarily at sites within the Central Sands Agricultural Region and Lower Wisconsin River Valley.

No Wis. Admin. Code ch. NR 140 ES or PAL groundwater quality standards have been established for the CIT compounds. However, WDHS has identified drinking water health advisories for each CIT compounds

Clothianidin and thiamethoxam were detected in 78% and 42%, respectively, of all 2022 samples collected from Field-Edge monitoring wells. This is consistent with historical detection percentages. Clothianidin concentrations ranged from 0.0115 to 1.59 µg/L and thiamethoxam concentrations ranged from 0.0104 to 5.34 µg/L. These detections are again consistent with historical detection ranges. Additionally, these detected concentrations do not exceed any of the respective WDHS drinking water health advisories for clothianidin or thiamethoxam.

Imidacloprid concentrations exceeding laboratory reporting limits were detected in 46% of the 2022 groundwater samples collected. It was detected in samples collected from 11 of 22 sites at concentrations ranging from 0.0118 to 1.52 µg/L. These detection frequency and range are consistent with 2021 values but represents an overall increasing trend. Imidacloprid exceeded the WDHS drinking water health advisory of 0.2 µg/L in 11 groundwater samples. These groundwater samples were collected from sites within the Central Sands Agricultural Region and Lower Wisconsin River Valley (Adams, Iowa, Sauk and Waushara counties). The imidacloprid data relative to each monitoring location is summarized in Table B 5 in Appendix B.

One observation regarding the 2022 data suggests that the imidacloprid and thiamethoxam are migrating vertically and horizontally within Central Sands Agricultural Region aquifers. Concentrations appear not to fluctuate seasonally, but greater concentrations have been detected in the groundwater collected from deeper screened wells at sites AD2-5, AD3-3, AD5-5, and WS7-3 compared to adjacent shallow wells. Additionally, imidacloprid and thiamethoxam have also been detected in nearby surface water samples indicating that groundwater is discharging to surface water year-round as base flow (see DATCP's *2022*

Surface Water Sampling Report - Wisconsin Department of Agriculture, Trade and Consumer Protection, 2023b).

Results from DATCP's Field-Edge Groundwater Monitoring Program can also be compared to nearby historical Surface Water Sampling Program results. This data can then be used to further evaluate mobility, persistence, and discharge to surface water. DATCP intends to report findings of the evaluation along with an evaluation of historical results as part of DATCP's upcoming detailed comprehensive report for each field edge site.

Alachlor:

As noted previously, alachlor ESA was the third most frequently detected compound in 2022 samples. It was detected in excess of laboratory reporting limits in more than 69% of the samples collected and at 17 of the 22 field edge monitoring sites. The alachlor ESA data relative to each monitoring location is summarized in Table B 6 in Appendix B.

Alachlor ESA concentrations ranged from 0.0514 to 23.2 µg/L in 2022 samples. The greatest concentration of alachlor ESA was 23.2 µg/L in a groundwater sample collected from monitoring well JN3-1. This concentration exceeds the 20.0 µg/L Wis. Admin. Code ch. NR 140 ES. In 2021, an alachlor ESA was detected at a concentration of 15.5 µg/L in a groundwater sample collected from this same monitoring well.

As observed since 2017, groundwater samples collected from deeper wells AD5-5 and WS7-3 detected alachlor ESA at concentrations in excess of the Wis. Admin. Code ch. NR 140 PAL of 4.0 µg/L. Between 2018 and 2022, no PAL exceedances were observed in samples collected from wells screened at shallower depths at these same sites. Although alachlor ESA remains at concentrations in excess of the PAL, it cannot be attributed to current use at nearby fields. Alachlor ESA is a breakdown product of alachlor. Alachlor production ceased in December 2014 and could not be sold in Wisconsin after August 2018. The parent alachlor was not detected in excess of laboratory reporting limits in any samples collected in 2022. These results were also observed with samples collected between 2018 and 2020.

Alachlor ESA was also widely detected in surface water and groundwater samples collected throughout the state. Because alachlor is no longer sold in Wisconsin and field use has ceased, it is expected that metabolite concentrations will decline over time. However, the ES exceedance detection is of concern. Additional data collection and evaluation of data from multiple years is needed to validate these observations.

Atrazine:

There are currently 101 atrazine Prohibition Areas (PAs) covering approximately 1.2 million acres within Wisconsin. It is illegal to apply any pesticide containing the active ingredient atrazine within an atrazine PA. In non-PAs, atrazine use is restricted but not prohibited. Since PAs have been in place for 10 years or more, it is anticipated that atrazine and its metabolite concentrations in groundwater would be limited, or not present at all. Of the 24 field-edge sites in the Program, only 11 are located within a PA. No grower self-reported atrazine use on adjacent fields within the PAs.

Atrazine or one of its breakdown products (de-ethyl atrazine, de-isopropyl atrazine, and di-amino atrazine) were detected in excess of laboratory reporting limits in 47% of the groundwater samples collected in 2022. No atrazine parent material, atrazine metabolites, or atrazine TCR concentrations were detected exceeding the 3.0 µg/L Wis. Admin. Code ch. NR 140 ES. However, atrazine TCR was observed in 24 groundwater samples (21% of collected samples) at a concentration greater than the 0.3 µg/L Wisc. Admin. Code ch. NR 140 PAL. Concentrations for atrazine TCR ranged from 0.0505 to 1.22 µg/L. Parent material atrazine, metabolite, and atrazine TCR data for each monitoring site is presented in Table B 7 in Appendix B.

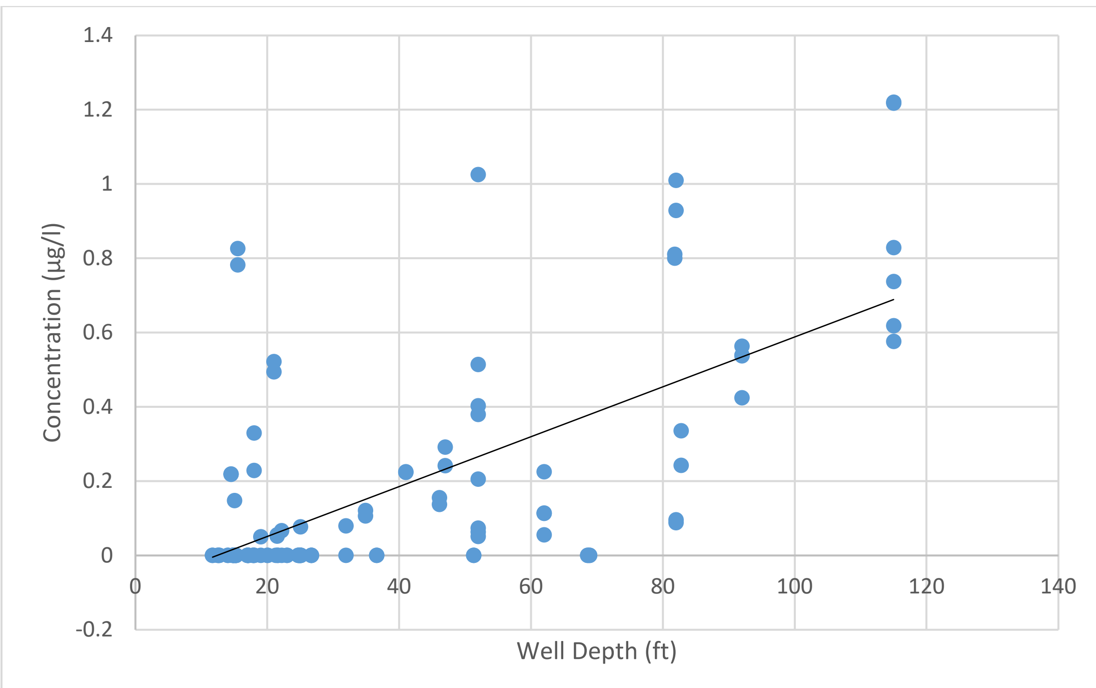
The 2022 groundwater results indicated atrazine or one of its metabolites was detected in samples collected from 16 of the 22 sites. Groundwater samples with detections in excess of the Wis. Admin. Code ch. NR 140 PAL for atrazine TCR were collected from monitoring well networks located at nine of the 22 sites as follows:

- At two locations in Adams, Iowa, and Waushara counties; and
- at one location in St. Croix, Sauk, and Waupaca counties.

Of those nine sites, five are located in a PA: Iowa County (IW1, IW2), St. Croix County (SC1), Sauk County (SK6), and Waushara County (WS4). Of the five locations within a PA, parent material atrazine was found in excess of detection limits at sites IW1, IW2, and SK6. All of these detections were identified in groundwater samples collected from the new piezometers constructed in 2022 at the deepest monitoring depths. This is consistent with previous year's results. Based on grower self-reporting, atrazine has not been used on the adjacent WS4 fields for over 20 years. These results indicate that the source for the parent material atrazine detections is not from adjacent fields. It is likely from a source beyond the immediate area, or it may be from historic use prior to establishment of the PA.

As observed during previous years, the greatest concentrations of atrazine TCR in 2022 samples, were typically detected in samples collected from deeper screened wells. Figure 10 depicts atrazine TCR concentrations relative to groundwater sample well depth. As indicated, elevated concentrations of atrazine TCR were detected in samples collected from monitoring wells screened between 50 and 60 feet below ground surface (bgs), and at deeper wells screened between 80 and 115 feet bgs. On average, shallow wells screened between 10 and 40 feet bgs detected atrazine TCR at lesser concentrations. Based on atrazine TCR concentrations observed across the aquifer depth, it is possible that atrazine is applied at nearby agricultural fields at rates that are not affecting shallow groundwater quality. The greater atrazine concentrations observed at depth likely indicate affects from historic use rather than an ongoing source from field use. A trend analysis is needed to show all historical groundwater data to determine if the atrazine TCR concentrations are decreasing within PAs as intended. DATCP intends to report these finding along with an evaluation of historical results as part of DATCP's detailed comprehensive report for each field-edge site.

Figure 10: 2022 Atrazine TCR Concentrations relative to Groundwater Sample Well Depth



Notes: *Line through data represents trend of concentrations relative to depth.*

Nitrogen:

DATCP's Field-Edge Groundwater Monitoring Program primary focus is on pesticide affects to groundwater quality. In addition to pesticides, BLS includes nitrogen as nitrate plus nitrite analyses. Nitrogen impacts in groundwater and drinking water are the responsibility of WDNR. However, BLS includes nitrogen as nitrate plus nitrite analyses as part of this program, and that data is shared with WDNR.

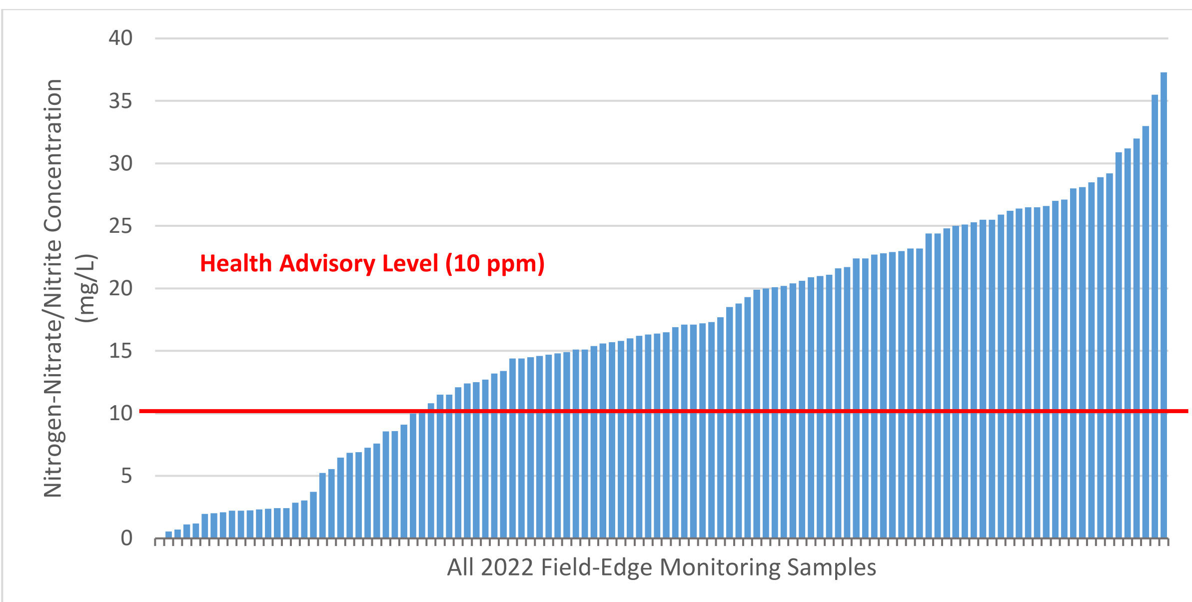
Nitrogen as nitrate plus nitrite was detected in excess of laboratory reporting limits in 111 of the 112 field edge groundwater samples collected in 2022. The average nitrogen concentration for all 2022 samples was 16.42 milligram per liter (mg/L or parts per million [ppm]), which is slightly greater than last year's (2021) average of concentration of 16.28 ppm. This is statistically in-line with the previous three years but continues the overall decreasing trend calculated over the past six years, which is summarized in Table 3.

Table 3: Average Nitrogen as Nitrate plus Nitrite Concentration over Previous Years

Year	Average Nitrogen-Nitrate/Nitrite Concentration (in parts per million)
2017	17.90
2018	17.72
2019	14.61
2020	16.89
2021	16.28
2022	16.42

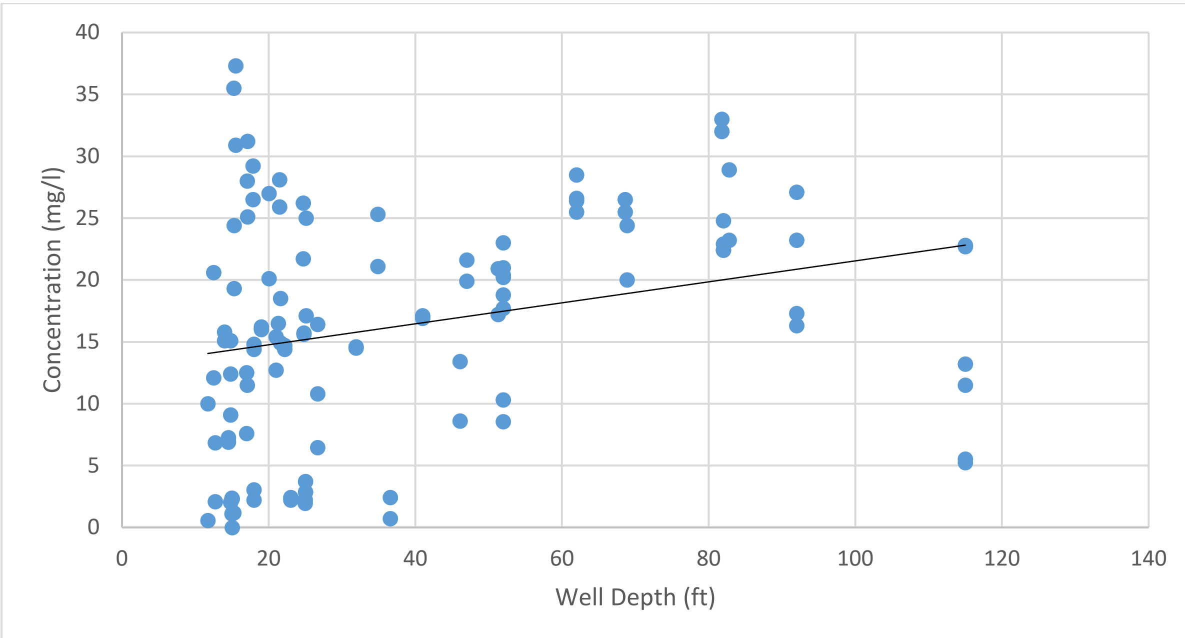
The Wis. Admin. Code ch. NR 140 ES of 10 mg/L for nitrogen as nitrate plus nitrite was exceeded in 83 of the 112 groundwater samples collected in 2022. Of the 29 that did not exceed the ES, 23 groundwater samples exceeded the Wis. Admin. Code ch. NR 140 PAL of 2.0 mg/L. The greatest concentration of nitrogen (37.3 mg/L) was detected in the WS6-2 groundwater sample collected in the fall at a Waushara County station. All nitrogen as nitrate plus nitrite data relative to each monitoring location is summarized in Table B 8 of Appendix B. Figure 11 shows the 2022 nitrogen concentration distribution.

Figure 11: Nitrogen as Nitrate plus Nitrite Results Distribution in Groundwater Samples from All-Wells



Nitrogen as nitrate plus nitrite concentrations were also compared to wells screened at different depths. Figure 12 depicts nitrogen concentrations for all wells by depth. As indicated, nitrogen as nitrate plus nitrite was detected over a wide range of concentrations in groundwater samples collected from wells screened at shallow depths (between 10 and 40 feet bgs) compared to deeper wells. Groundwater samples collected from deeper wells typically detected nitrogen as nitrate plus nitrite at greater concentrations compared to the shallower screened well nest. However, it does appear concentrations decrease below a depth of 80 feet. As indicted, nitrogen as nitrate plus nitrite exceeded the 10 mg/L ES in samples collected from nearly all the monitoring wells screened across the aquifer at a depth greater than 40 feet, and in more than half the wells less than 40 feet deep.

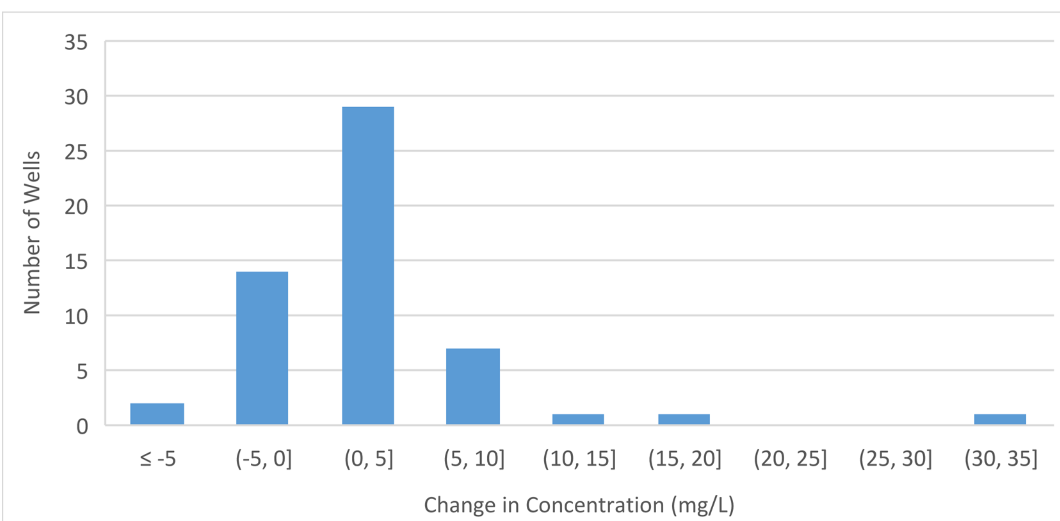
Figure 12: 2022 Nitrogen as Nitrate plus Nitrite Concentrations relative to Groundwater Sample Well Depth



Notes: *Line through data represents trend of concentrations relative to depth.*

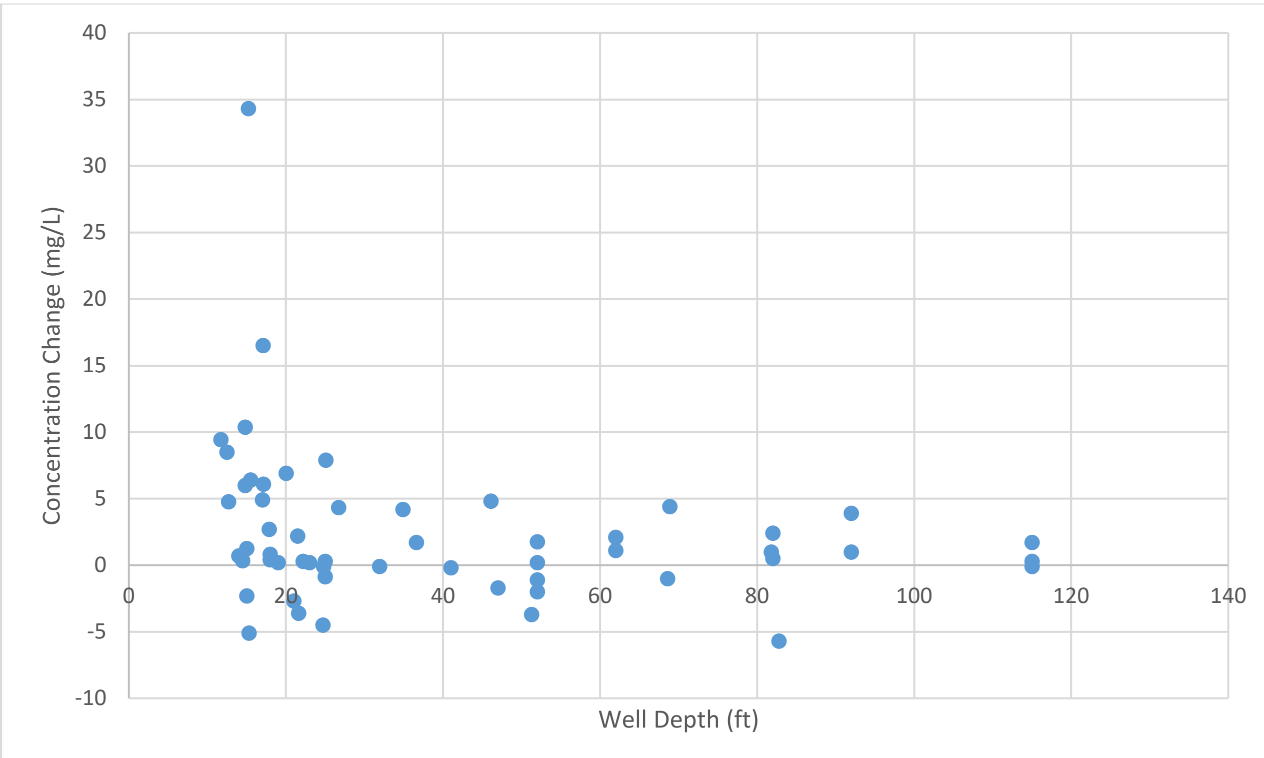
Groundwater samples collected from deeper screened wells also show less seasonal variation in nitrogen concentrations compared to shallow wells. As depicted on Figure 13 below, nitrogen as nitrate plus nitrite concentrations fluctuated between -5 mg/L to + 5 mg/L in samples collected between spring and fall 2022 at the majority of monitoring well locations. On average, nitrogen concentrations increased by 0.32 mg/L between spring and fall. Overall, this suggests that nitrogen as nitrate plus nitrite concentrations for the majority of wells indicate little seasonal variation.

Figure 13: 2022 Nitrogen as Nitrate plus Nitrite Concentrations Variability from Spring to Fall at Individual Wells



Seasonal data based on nitrogen as nitrate plus nitrite concentration variances relative to groundwater depths was evaluated. It appears that there is a limited seasonal variability with the depth. This likely indicates nitrogen applications at the surface influence groundwater quality seasonally. As depicted on the Figure 14 below, groundwater samples collected from shallower wells have a somewhat greater range of variability in nitrogen concentrations to deeper wells. Nitrogen as nitrate plus nitrite concentrations in samples collected from deeper screened wells are expected to show less variability and serve as a baseline, with little seasonal influence occurring. This has not been observed throughout all the years of monitoring. Additional years of monitoring are necessary to validate or refute this observation.

Figure 14: 2022 Nitrogen Concentrations Variability by Depth from Spring to Fall of Individual Wells



2023 Program Goals and Objectives

The Field-Edge Groundwater Monitoring Program mission is to monitor groundwater quality at strategic geographic locations within agricultural areas to characterize agrichemical migration to underlying aquifers, and act as an early warning signal for nearby drinking water wells. The program will continue in 2023.

Program goals for 2023 include:

- Collaborate with BLS and develop a 2023 Field-Edge Groundwater Monitoring Program Sampling Plan.
- Conduct a groundwater sampling event in the spring (limited) and fall from the Program's groundwater monitoring network. BLS capacity will be limited in late spring to early fall due to DATCP's Drinking Water Survey sampling and analyses during this timeframe. The Field-Edge sampling will be limited during the spring but will be fully sampled in the fall timeframe.
- Document annual activities completed and summarize results for each site in a letter sent to each grower.
- Document the annual activities completed and summarize results in a *2023 Field-Edge Groundwater Monitoring Program Summary Report*.

2023 data will be added to the existing database to ensure that long-term water level and groundwater monitoring data can be used to identify trends in groundwater quality over time. Long-term groundwater quality trends may be used to further evaluate the effectiveness of atrazine PAs. Long-term groundwater data will also be compared to surface water data from within the same watershed to identify potential relationships between surface water and groundwater quality. This evaluation may also be used to evaluate seasonal surface water flow variations and base flow groundwater discharge to surface water. DATCP intends to report finding along with an evaluation of historical results as part of DATCP's detailed comprehensive report for each field-edge site.

Acknowledgments

ACM's financial information includes the state fiscal year (FY) 2022 and 2023, from July 1, 2020 through June 30, 2022. Federal grants operate October 1 through September 30 (2022 and 2023). This report covers those portions of the federal grants that occurred during the state fiscal year. The primary sources of revenue for ACM are industry fees for licenses, permits, registrations, and tonnage under the feed, fertilizer, soil and plant additive, lime, and pesticide programs. In addition, a federal grant provides some funding to cover annual pesticide program expenses. ACM recognizes these important partnerships with industry and the federal government and works hard to maximize the use of this funding for the benefit of the industry, consumers, and the environment.

The raw data required to reproduce the above findings are available upon request. For any questions and clarifications, please do not hesitate to reach out to us at DATCPGW@wisconsin.gov or at (608) 224-4502.

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Appendix A

The acronyms and terminology included on this list are generic definitions intended to help understand the Field-Edge Monitoring Program. Some of these terms are more specifically defined in various regulations.

ACRONYMS

- µg/l ______ Micrograms per liter (a liquid equivalent of ppb)
- ACM ______ DATCP Bureau of Agrichemical Management
- AMPA ______ Aminomethylphosphonic acid
- Bgs ______ Below ground surface
- BLS ______ DATCP Bureau of Laboratory Services
- CAS ______ Chemical Abstract Service
- CIT ______ clothianidin, imidacloprid, and thiamethoxam
- DADK ______ Desaminodiketo
- DATCP ______ Wisconsin Department of Agriculture, Trade and Consumer Protection
- ES ______ Enforcement Standard
- ESA ______ Ethane Sulfonic Acid
- GC ______ Gas Chromatography
- GCC ______ Wisconsin Groundwater Coordinating Council
- HARS ______ Hancock Agricultural Research Station
- ISO ______ International Organization for Standardization
- LC ______ Liquid Chromatography
- mg/L ______ Milligrams per liter (a liquid equivalent of ppm)
- MS ______ Mass Spectroscopy
- msl ______ Mean sea level
- N ______ Nitrogen
- ND ______ No Detect – concentrations are less than laboratory reporting limits
- NOAA ______ National Oceanic and Atmospheric Administration
- OA ______ Oxanilic Acid
- PA ______ Prohibition Area
- PAL ______ Preventive Action Limit
- PPB ______ Parts per billion
- PPM ______ Parts per million
- TCR ______ Total chlorinated resides of atrazine
- TPVC ______ Top of well casing
- TSAMP ______ Targeted Sampling Program

USDA ______________ United States Department of Agriculture
US EPA ____________ United States - Environmental Protection Agency
WDHS _____________ Wisconsin Department of Health Services
WDNR _____________ Wisconsin Department of Natural Resources
WGNHS ____________ Wisconsin Geological and Natural History Survey
Wis. Admin. Code___ Wisconsin Administrative Code
WUWN_____________ Wisconsin Unique Well Number

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DEFINITIONS

Analyte - A chemical substance that has a defined Chemical Abstract Service (CAS) number

Atrazine Prohibition Area - An area where atrazine use is currently prohibited under Administrative Code ATCP 30

Chronic Exposure value - The highest concentration of a chemical to which the organism can be exposed without causing chronic toxicity to the organism in question

Compound - A substance formed by the chemical union of two or more ingredients

Detection - When an analyte has a concentration that can be quantified (i.e., a concentration greater than the Laboratory Reporting Limit)

Herbicide - A pesticide used to kill or inhibit the growth of plants, weeds, or grasses

Insecticide - A pesticide used to kill or inhibit the growth of insects

Metabolite or Residual compound or Breakdown product - A chemical substance left behind by a parent compound that has degraded through natural chemical breakdown and/or been metabolized by bacteria

Neonicotinoids- Insecticides that target the neurological systems of insects. The neonicotinoid family includes acetamiprid, clothianidin, dinotefuran, imidacloprid, nitenpyram, nithiazine, thiacloprid, and thiamethoxam

NR140 - Wisconsin Administrative Code which establishes groundwater quality standards and required responses when the standards are exceeded

Pesticide - Substance used to kill, repel, or control certain forms of plant or animal life that are considered to be pests. The pesticide category includes herbicides, insecticides, rodenticides, fungicides, and bactericides

Piezometer – Monitoring well with screened section in saturated conditions within the aquifer beneath the groundwater surface

Reporting limit - The minimum analyte concentration that can be reliably quantified and reported by the laboratory

Total chlorinated residues (TCR) of atrazine - Sum of atrazine and atrazine metabolites (de-ethyl atrazine, de-isopropyl atrazine, and diamino atrazine)

APPENDIX B

Table B 1: Field-Edge Groundwater Monitoring Program - Monitoring Wells and Piezometers Construction Specifications

County	Site (Grower)	Well Identification	WUWN	Year Constructed	Prohibition Area	Irrigation Available	Ground Elevation (MSL)	TPVC Elevation (MSL)	Well Depth (ft)	Bottom of Well (MSL)	Screen Length (ft)	Top of Screen (ft)	Sampling Method
Adams	AD2	AD2-1	BH954	1987	No	Yes	1,051.7	1,053.96	17.87	1,036.09	5	1,053.96	Peristolic Pump
		AD2-2	BH953	1987				1,054.14	22.83	1,031.31	5	1,054.14	
		AD2-3	BH952	1987				1,054.17	27.62	1,026.55	5	1,054.17	
		AD2-4	VR844	2017				1,054.44	54.70	999.74	5	1,054.44	Whale Pump and Dedicated Tubing
		AD2-5	VR845	2017				1,054.35	85.70	968.65	5	1,054.35	
		AD2-6	PT421	2021				--	116.40	--	5	--	
	AD3	AD3-1[4]	BH999	1987	No	Yes	1,008.0	1,010.48	14.93	995.55	5	1,010.48	
		AD3-2[4]	BI000	1987				1,010.34	19.64	990.70	5	1,010.34	
		AD3-3[4]	BI001	1987				1,010.44	24.69	985.75	5	1,010.44	
	AD4	AD4-1[4]	BH996	1987				1,017.38	24.71	992.67	5	1,017.38	
		AD4-2[4]	BH997	1987	No	Yes	1,013.9	1,017.26	29.69	987.57	5	1,017.26	
		AD4-3[4]	BH998	1987				1,016.56	34.57	981.99	5	1,016.56	
	AD5	AD5-1	CL461	1988	No	Yes	1,051.1	1,053.18	15.24	1,037.94	5	1,053.18	Peristolic Pump
		AD5-2	CL455	1988				1,053.31	19.91	1,033.40	5	1,053.31	
		AD5-3	CL456	1988				1,053.27	25.23	1,028.04	5	1,053.27	
		AD5-4	VR846	2017				1,053.63	53.20	1,000.43	5	1,053.63	Whale Pump and Dedicated Tubing
		AD5-5	VR847	2017				1,053.68	85.70	967.98	5	1,053.68	
		AD5-6	PT422	2021				--	117.50	--	5	--	
Barron	BR3	BR3-1	BR279	1987	No	Yes	1,052.7	1,055.79	15.03	1,040.76	5	1,055.79	Peristolic Pump
		BR3-2	BR280	1987				1,055.37	20.02	1,035.35	5	1,055.37	
		BR3-3	BR281	1987				1,054.93	25.02	1,029.91	5	1,054.93	
Dane	DN1	DN1-1[2]	BR250	1985				744.38	12.10	732.28	5	744.38	
		DN1-1	PT428	2021	93-57-04	Yes	743.7	745.32	14.90	730.42	5	745.32	Dedicated Bailer
		DN1-2	BR251	1985				745.87	17.40	728.47	5	745.87	Peristolic Pump
		DN1-3	BR252	1985				746.08	22.20	723.88	5	746.08	
Dunn	DU1	DU1-1	AO384	1989	No	Yes	852.5	853.92	34.90	819.02	5	853.92	Dedicated Bailer
		DU1-2	AO385	1989				854.87	40.80	814.07	5	854.87	
		DU1-3	AO386	1989				855.12	46.10	809.02	5	855.12	
	DU2	DU2-1	AO387	1989	No	Yes	856.2	858.05	26.70	831.35	5	858.05	Peristolic Pump
		DU2-2	AO388	1989				858.17	31.30	826.87	5	858.17	
		DU2-3	AO389	1989				858.48	36.60	821.88	5	858.48	
Grant	GR1	GR1-1	BR255	1985	93-57-04	No	683.8	686.32	12.50	673.82	5	686.32	Peristolic Pump
		GR1-2	BR256	1985				686.48	17.30	669.18	5	686.48	
		GR1-3	BR257	1985				686.12	21.60	664.52	5	686.12	
Iowa	IW1	IW1-1[3]	BH955	1986					14.90		5		
		IW1-2[3]	BH956	1986					19.90		5		
		IW1-3[3]	BH957	1986					24.90		5		
		IW1-4	BR259	1986	93-57-04	Yes	722.5	723.85	17.10	706.75	5	723.85	Peristolic Pump
		IW1-5	BR260	1986				723.84	21.30	702.54	5	723.84	
		IW1-6	BR261	1986				723.67	26.70	696.97	5	723.67	
		IW1-7	BH967	1987				723.67	61.99	661.68	5	723.67	Whale Pump and Dedicated Tubing
		IW1-8	PT425	2021				723.06	93.97	629.09	5	723.67	
	IW2	IW2-1	BR036	1986	93-57-04	Yes	723.8	726.76	14.80	711.96	5	726.76	Peristolic Pump
		IW2-2	BR037	1986				726.50	19.70	706.80	5	726.50	
		IW2-3	BR038	1986				726.40	24.70	701.70	5	726.40	
		IW2-4	PT426	2021				725.89	65.92	659.97	5	725.89	Whale Pump and Dedicated Tubing
		IW2-5	PT427	2021				726.24	94.81	631.43	5	726.24	
Jackson	JK3	JK3-1	JH991	2005	94-27-04	No	1,025.3	1,028.06	27.33	1,000.73	10	1,028.06	Peristolic Pump
		JK3-2	JH981	2005			1,023.7	1,026.44	25.77	1,000.67	10	1,026.44	
Juneau	JN1	JN1-1	BR046	1985	No	Yes	939.7	941.26	11.70	929.56	5	941.26	Peristolic Pump
		JN1-2	BR047	1985				941.21	16.70	924.51	5	941.21	
		JN1-3	BR048	1985				941.34	21.50	919.84	5	941.34	
	JN3	JN3-1	JH937	2005	94-29-01	No	901.5	903.84	20.42	883.42	10	903.84	Peristolic Pump
		JN3-2	JH936	2005			902.0	905.20	18.14	887.06	10	905.20	
La Crosse	LC2	LC2-1	VZ391	2011	No	Yes	684.1	686.40	49.22	637.18	10	686.40	Dedicated Bailer
		LC2-2	VZ392	2011			687.8	681.91	43.98	637.93	10	681.91	

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Langlade	LN1	LN1-1	BH964	1986	No	No	1,471.6	1,473.85	14.80	1,459.05	5	1,473.85	Peristolic Pump
		LN1-2	BH965	1986				1,474.44	19.70	1,454.74	5	1,474.44	
		LN1-3	BH966	1986				1,473.74	24.80	1,448.94	5	1,473.74	
Portage	PR1	PR1-1	BR207	1986	No	Yes	1,079.7	1,082.01	12.70	1,069.31	5	1,082.01	Peristolic Pump
		PR1-2	BR208	1988				1,081.94	17.60	1,064.34	5	1,081.94	
		PR1-3	BR209	1988				1,081.72	22.50	1,059.22	5	1,081.72	
		PR1-4	VR848	2017				1,082.83	55.30	1,027.53	5	1,082.83	Whale Pump and Dedicated Tubing
		PR1-5	VR849	2017				1,082.77	84.70	998.07	5	1,082.77	
St. Croix	SC1	SC1-1	JH938	2005	94-56-02	Yes	1,006.8	1,010.14	24.87	985.27	10	1,010.14	Peristolic Pump
		SC1-1 (D)	VZ390	2011				1,009.16	30.10	979.06	10	1,009.16	
		SC1-2	JH939	2005			1,003.9	1,006.63	21.87	984.76	10	1,006.63	
		SC1-2(D)	VZ393	2011				1,006.40	30.17	976.23	10	1,006.40	
Sauk	SK6	SK6-1	BB246	1988	93-57-04	Yes	711.8	713.68	14.92	698.76	5	713.68	Peristolic Pump
		SK6-2	BB247	1988				713.37	20.04	693.33	5	713.37	
		SK6-3	BB248	1988				713.55	25.10	688.45	5	713.55	
		SK6-4	PT424	2021			710.2	711.56	53.42	658.14	5	711.56	Whale Pump and Dedicated Tubing
Trempealeau	TR1	TR1-1	PX201	2005	No	Yes	730.4	733.29	75.55	657.74	10	733.29	Dedicated Bailer
		TR1-2	PX202	2005			731.1	733.83	75.20	658.63	10	733.83	
Waupaca	WP2	WP2-1	JH985	2005	94-69-01	No	908.4	911.03	20.45	890.58	10	911.03	Peristolic Pump
		WP2-2	JH984	2005			905.7	908.82	20.43	888.39	10	908.82	
Waushara	WS4	WS4-1	BB258	1988	93-70-01	Yes	1,082.4	1,084.97	17.13	1,067.84	5	1,084.97	Peristolic Pump
		WS4-2	BB259	1988				1,085.03	22.02	1,063.01	5	1,085.03	
		WS4-3	BB260	1988				1,084.98	27.16	1,057.82	5	1,084.98	
		WS4-4	BB261	1988				1,084.88	31.94	1,052.94	5	1,084.88	
	WS6	WS6-1	JH989	2005	93-70-01	Yes	1,076.8	1,080.90	18.27	1,062.63	10	1,080.90	Peristolic Pump
		WS6-2	JH990	2005				1,079.07	17.02	1,062.05	10	1,079.07	
	WS7	WS7-1	VR841	2017	No	Yes	1,075.7	1,078.65	18.40	1,060.25	10	1,078.65	Peristolic Pump
		WS7-2	VR842	2017				1,078.79	54.70	1,024.09	5	1,078.79	Whale Pump and Dedicated Tubing
		WS7-3	VR843	2017				1,078.78	84.80	993.98	5	1,078.78	
		WS7-4	PT423	2021				--	104.10	--	5	--	

Notes:

--	Elevation surveying in progress.
1	Monitoring well was abandoned on May 30, 2019 because integrity of protective casing was compromised during spring 2019 sampling.
2	Monitoring well was abandoned on December 13, 2018 because integrity of protective casing was compromised by a vehicle prior to fall 2018 sampling.
3	Monitoring wells were abandoned June 11, 1993 because they were no longer needed for the monitoring program.
4	Monitoring wells were abandoned December 1, 2021 because ownership no longer wished to participate in the monitoring program.
WUWN	Wisconsin Unique Well Number
MSL	Mean sea level
TPVC	Top of well casing (PVC)
	Monitoring Well/Piezometer abandoned.
	Monitoring Well/Piezometer construction was financed by a 2021 U.S. EPA grant.
	Monitoring Well/Piezometer construction was financed by a 2017 U.S. EPA grant.
	Monitoring Well/Piezometer construction was financed by a 2011 U.S. EPA grant.
	Monitoring Well/Piezometer construction was financed by a 2005 U.S. EPA grant.
	Monitoring Wells/Piezometers assocaited with initial program activities and financed by State.

Table B 2: 2022 Sample Analytes, Applicable Wis. Admin. Code ch. NR 140 PALs & ESs, Drinking Water Health Advisories, and Reporting Limits

Analyte Description	Prentive Action Limit	Enforcement Standard	Advisory*	Reporting Limit (µg/l)
2,4-D (dichlorophenoxyacetic acid)	7	70		0.050
2,4-DB				1.00
2,4-DP				0.050
2,4,5-T				0.050
2,4,5-TP (trichlorophenoxy-prop. acid)	5	50		0.050
ACETAMIPRID				0.010
ACETOCHLOR	0.7	7		0.050
ACETOCHLOR ESA	46 [1]	230 [1]		0.050
ACETOCHLOR OA	46 [1]	230 [1]		0.30
ACIFLUORFEN				0.050
ALACHLOR	0.2	2		0.050
ALACHLOR ESA	4	20		0.050
ALACHLOR OA				0.25
ALDICARB SULFONE				0.050
ALDICARB SULFOXIDE				0.071
AMINOPYRALID				0.150
ATRAZINE	0.3	3		0.050
DE-ETHYL ATRAZINE	0.3	3		0.050
DEISOPROPYL ATRAZINE	0.3	3		0.050
DIAMINO ATRAZINE	0.3	3		0.150
ATRAZINE TCR (calculated)	0.3 [3]	3 [3]		0.050
AZOXYSTROBIN				0.050
BENFLURALIN				0.050
BENTAZON	60	300		0.050
BICYCLOPYRONE				0.050
BROMACIL				0.050
BIFENTHRIN				0.005
CARBARYL	4	40		0.050
CARBOFURAN	8	40		0.050
CHLORAMBEN	30	150		0.32
CHLORANTRANILIPROLE			16,000	0.050
CHLOROTHALONIL				0.10
CHLORPYRIFOS	0.4	2		0.050
CHLORPYRIFOS OXYGEN ANALOG				0.050
CLOMAZONE				0.050
CLOPYRALID				0.050
CLOTHIANIDIN			1,000	0.010
CYANTRANILIPROLE				0.050
CYCLANILIPROLE				0.20
CYFLUTHRIN				0.050
CYPERMETHRIN				0.10
CYPROSULFAMIDE				0.050
DACTHAL	14	70		0.050
DACTHAL DI-ACID			70 [2]	0.050
DACTHAL MONO-ACID			70 [2]	0.050
DIAZINON				0.050
DIAZINON OXYGEN ANALOG				0.050
DICAMBA	60	300		0.200
DICHLOBENIL				0.050
DIMETHENAMID	5	50		0.050
DIMETHENAMID ESA				0.050
DIMETHENAMID OA				0.050
DIMETHOATE	0.4	2		0.050
DINOTEFURAN				0.010
DIURON				0.050

Analyte Description	Prentive Action Limit	Enforcement Standard	Advisory*	Reporting Limit
EPTC	50	250		0.050
ESFENVALERATE				0.025
ETHALFLURALIN				0.050
ETHOFUMESATE				0.050
FLUMETSULAM			10,000	0.050
FLUPYRADIFURONE				0.050
FLUROXYPYR				0.050
FOMESAFEN			25	0.050
GLYPHOSATE			10,000	0.50
GLYPHOSATE AMMONIUM				0.50
AMPA			10,000	0.50
HALOSULFURON METHYL				0.050
HEXAZINONE			400	0.050
IMAZAPYR				0.050
IMAZETHAPYR				0.050
IMIDACLOPRID			0.2	0.010
ISOXAFLUTOLE			3 [4]	0.050
ISOXAFLUTOLE DKN			3 [4]	0.050
LAMBDA-CYHALOTHRIN				0.020
LINURON				0.050
MALATHION				0.050
MCPA				0.050
MCPB				0.10
MCPP				0.050
MESOTRIONE				0.10
METALAXYL			800	0.050
METHYL PARATHION				0.050
METOLACHLOR	10	100		0.050
METOLACHLOR ESA	260 [5]	1300 [5]		0.050
METOLACHLOR OA	260 [5]	1300 [5]		0.27
METRIBUZIN	14	70		0.050
METRIBUZIN DA				0.10
METRIBUZIN DADK				0.12
METSULFURON-METHYL				0.050
NICOSULFURON				0.050
NORFLURAZON				0.050
OXADIAZON				0.050
PENDIMETHALIN				0.050
PERMETHRIN				0.030
PICLORAM	100	500		0.050
PROMETONE	20	100		0.050
PROMETRYN				0.050
PROPICONAZOLE				0.050
PROTHIOCONAZOLE-DESTHIO				0.050
SAFLUFENACIL			460	0.050
SIMAZINE	0.4	4		0.050
SULFENTRAZONE			1,000	0.050
SULFOMETURON-METHYL				0.050
TEBUPIRIMPHOS				0.050
TEMBOTRIONE				0.10
THIACLOPRID				0.010
THIAMETHOXAM			120	0.010
THIENCARBAZONE-METHYL			800	0.050
TRICLOPYR				0.050
TRIFLURALIN	0.75	7.5		0.050
NITROGEN-NITRATE/NITRITE (mg/L)	2	10		0.5

All concentrations are presented as micrograms per liter (µg/L) or parts per billion, excpet for Nitrogen.

* Wisconsin Department of Health Services Drinking Water Health Advisory (June 2019, November 2020, Revised February 2022).

1 Combined sum of acetochlor metabolites ESA and OA.

2 Combined sum of metabolites (di- and mono-acid) and parent material dacthal.

3 Total Chlorinated Residue for Atrazine. Combined sum of metabolites (de-ethyl, de-isopropyl and di-amino) and parent material atrazine.

4 Combined sum of metabolite (DKN) and parent material isoxaflutole.

5 Combined sum of metolachlor metabolites ESA and OA.

mg/L - milligrams per liter or parts per million.

DA - desamino

DADK - desaminodiketo

DKN - diketonitrile

ESA - ethane sulfonic acid.

OA - oxanilic acid, can also be identified as OXA.

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Table B 3: Field-Edge Groundwater Monitoring Program - 2022 Groundwater Analytical Results

2022 Ground Water Project Results (all concentrations in ug/L)							Wisconsin Department of Health Services	Wisconsin Admin. Code Chapter NR 140	
Pesticide Name	Pesticide Class	Reporting Limit	Number of Sites with Detects[1]	Number of Total Detects[2]	Percent of Samples with Detects	Concentration Range	Drinking Water Health Advisory[3]	Enforcement Standard	Preventive Action Limit
2,4-D (dichlorophenoxyacetic acid)	Herbicide	0.05	--	--	--	--	--	70	7
2,4-DB	Herbicide	1.00	--	--	--	--	--	--	--
2,4-DP	Herbicide	0.05	--	--	--	--	--	--	--
2,4,5-T	Herbicide	0.05	--	--	--	--	--	--	--
2,4,5-TP (trichlorophenoxy-propionic acid)	Herbicide	0.05	--	--	--	--	--	50	5
Acetamiprid	Insecticide	0.010	--	--	--	--	--	--	--
Acetochlor	Herbicide	0.05	--	--	--	--	--	7	0.7
Acetochlor ESA	Metabolite	0.05	11	38	33.9%	0.0507 - 2.23	--	230	46
Acetochlor OA	Metabolite	0.3	1	2	1.8%	0.351 - 0.793	--	230	46
Acetochlor Combination[4]	Summation	N/A	11	38	33.9%	0.0507 - 2.23	--	230[4]	46[4]
Acifluorfen	Herbicide	0.05	--	--	--	--	--	--	--
Alachlor	Herbicide	0.05	--	--	--	--	--	2	0.2
Alachlor ESA	Metabolite	0.05	17	77	68.8%	0.0514 - 23.2	--	20	4
Alachlor OA	Metabolite	0.25	3	9	8.0%	0.262 - 2.63	--	--	--
Aldicarb Sulfone	Insecticide	0.05	--	--	--	--	--	--	--
Aldicarb Sulfoxide	Insecticide	0.071	--	--	--	--	--	--	--
Aminopyralid	Herbicide	0.15	--	--	--	--	--	--	--
Atrazine	Herbicide	0.05	7	25	22.3%	0.051 - 0.246	--	3	0.3
De-ethyl atrazine	Metabolite	0.05	11	37	33.0%	0.0505 - 0.787	--	3	0.3
De-isopropyl atrazine	Metabolite	0.05	12	28	25.0%	0.0504 - 0.488	--	3	0.3
Di-amino atrazine	Metabolite	0.15	9	20	17.9%	0.151 - 0.377	--	3	0.3
Atrazine (TCR)	Summation	0.05	16	53	47.3%	0.0505 - 1.22	--	3	0.3
Azoxystrobin	Fungicide	0.05	--	--	--	--	--	--	--
Benfluralin	Herbicide	0.05	--	--	--	--	--	--	--
Bentazon	Herbicide	0.05	4	15	13.4%	0.0501 - 6.09	--	300	60
Bicyclopyrone	Herbicide	0.05	--	--	--	--	--	--	--
Bifentrin	Insecticide	0.0050	--	--	--	--	--	--	--
Bromacil	Herbicide	0.05	--	--	--	--	--	--	--
Carbaryl	Insecticide	0.05	--	--	--	--	--	40	4
Carbofuran	Insecticide	0.05	--	--	--	--	--	40	8

Chloramben	Herbicide	0.32	--	--	--	--	--	150	30
Chlorantraniliprole	Insecticide	0.050	7	29	25.9%	0.051 - 1.09	16,000	--	--
Chlorothalonil	Fungicide	0.10	1	1	0.9%	0.123	--	--	--
Chlorpyrifos	Insecticide	0.05	--	--	--	--	--	2	0.4
Chlorpyrifos Oxon	Metabolite	0.05	--	--	--	--	--	--	--
Clomazone	Herbicide	0.05	--	--	--	--	--	--	--
Clopyralid	Herbicide	0.05	2	3	2.7%	0.131 - 0.232	--	--	--
Clothianidin	Insecticide	0.010	19	87	77.7%	0.0115 - 1.59	1,000	--	--
Cyantraniliprole	Insecticide	0.050	3	5	4.5%	0.0509 - 0.0943	--	--	--
Cyclaniliprole	Insecticide	0.2	--	--	--	--	--	--	--
Cyfluthrin	Insecticide	0.050	--	--	--	--	--	--	--
lambda- Cyhalothrin	Insecticide	0.020	--	--	--	--	--	--	--
Cypermethrin	Insecticide	0.1	--	--	--	--	--	--	--
Cyprosulfamide	Safener	0.05	--	--	--	--	--	--	--
Dacthal	Herbicide	0.05	--	--	--	--	--	70	14
Dacthal Di-acid	Metabolite	0.05	--	--	--	--	70	--	--
Dacthal Mono-acid	Metabolite	0.05	--	--	--	--	70	--	--
Dacthal Combination[5]	Summation	N/A	--	--	--	--	70[5]	--	--
Diazinon	Insecticide	0.05	--	--	--	--	--	--	--
Diazinon oxon	Metabolite	0.05	--	--	--	--	--	--	--
Dicamba	Herbicide	0.20	--	--	--	--	--	300	60
Dichlobenil	Herbicide	0.05	--	--	--	--	--	--	--
Dimethenamid	Herbicide	0.05	1	2	1.8%	0.112 - 0.153	--	50	5
Dimethenamid ESA	Metabolite	0.05	4	12	10.7%	0.0842 - 10.1	--	--	--
Dimethenamid OA	Metabolite	0.05	2	4	3.6%	0.067 - 1.34	--	--	--
Dimethoate	Insecticide	0.050	--	--	--	--	--	2	0.4
Dinotefuran	Insecticide	0.010	--	--	--	--	--	--	--
Diuron	Herbicide	0.05	--	--	--	--	--	--	--
EPTC	Herbicide	0.05	--	--	--	--	--	250	50
Esfenvalerate	Insecticide	0.025	--	--	--	--	--	--	--
Ethalfluralin	Herbicide	0.05	--	--	--	--	--	--	--
Ethofumesate	Herbicide	0.05	--	--	--	--	--	--	--
Flumetsulam	Herbicide	0.05	3	3	2.7%	0.0506 - 0.0764	10,000	--	--
Flupyradifurone	Insecticide	0.05	--	--	--	--	--	--	--
Fluroxypyr	Insecticide	0.050	--	--	--	--	--	--	--
Fomesafen	Herbicide	0.05	3	6	5.4%	0.0563 - 0.425	25	--	--

Halosulfuron methyl	Herbicide	0.05	--	--	--	--	--	--	--
Hexazinone	Herbicide	0.05	--	--	--	--	400	--	--
Imazapyr	Herbicide	0.05	--	--	--	--	--	--	--
Imazethapyr	Herbicide	0.05	--	--	--	--	--	--	--
Imidacloprid	Insecticide	0.010	11	51	45.5%	0.0118 - 1.52	0.2	--	--
Isoxaflutole	Herbicide	0.05	--	--	--	--	3	--	--
Isoxaflutole DKN	Metabolite	0.05	--	--	--	--	3	--	--
Isoxaflutole Combination[6]	Summation	N/A	--	--	--	--	3[6]	--	--
Linuron	Herbicide	0.05	--	--	--	--	--	--	--
MCPA	Herbicide	0.05	--	--	--	--	--	--	--
MCPB	Herbicide	0.1	--	--	--	--	--	--	--
MCPP	Herbicide	0.05	--	--	--	--	--	--	--
Malathion	Insecticide	0.05	--	--	--	--	--	--	--
Mesotrione	Herbicide	0.1	--	--	--	--	--	--	--
Metalaxyl	Fungicide	0.05	9	29	25.9%	0.0517 - 0.499	800	--	--
Methyl Parathion	Insecticide	0.05	--	--	--	--	--	--	--
Metolachlor	Herbicide	0.05	12	52	46.4%	0.0505 - 11.2	--	100	10
Metolachlor ESA	Metabolite	0.05	22	111	99.1%	0.068 - 43.9	--	1,300	260
Metolachlor OA	Metabolite	0.27	17	79	70.5%	0.299 - 21.3	--	1,300	260
Metochlor Combination[7]	Summation	N/A	22	111	99.1%	0.068 - 80.3	--	1,300[7]	260[7]
Metribuzin	Herbicide	0.05	9	47	42.0%	0.0575 - 6.47	--	70	14
Metribuzin DA	Metabolite	0.1	6	18	16.1%	0.143 - 1.17	--	--	--
Metribuzin DADK	Metabolite	0.12	9	44	39.3%	0.124 - 3.51	--	--	--
Metsulfuron methyl	Herbicide	0.05	--	--	--	--	--	--	--
Nicosulfuron	Herbicide	0.05	--	--	--	--	--	--	--
Norflurazon	Herbicide	0.05	--	--	--	--	--	--	--
Oxadiazon	Herbicide	0.05	--	--	--	--	--	--	--
Pendimethalin	Herbicide	0.05	--	--	--	--	--	--	--
Permethrin	Insecticide	0.030	--	--	--	--	--	--	--
Picloram	Herbicide	0.05	--	--	--	--	--	500	100
Prometone	Herbicide	0.05	1	2	1.8%	0.0697 - 0.0885	--	100	20
Prometryn	Herbicide	0.05	--	--	--	--	--	--	--
Propiconazole	Fungicide	0.05	--	--	--	--	--	--	--
Prothioconazole-desthio	Metabolite	0.050	--	--	--	--	--	--	--
Saflufenacil	Herbicide	0.05	2	5	4.5%	0.794 - 1.05	460	--	--
Simazine	Herbicide	0.05	2	6	5.4%	0.0744 - 0.273	--	4	0.4

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Sulfentrazone	Herbicide	0.05	3	6	5.4%	0.0585 - 0.141	1,000	--	--
Sulfometuron methyl	Herbicide	0.05	--	--	--	--	--	--	--
Tebupirimphos	Insecticide	0.05	--	--	--	--	--	--	--
Tembotrione	Herbicide	0.10	--	--	--	--	--	--	--
Thiacloprid	Insecticide	0.010	--	--	--	--	--	--	--
Thiamethoxam	Insecticide	0.010	14	47	42.0%	0.0104 - 5.34	120	--	--
Thiencarbazone methyl	Herbicide	0.05	--	--	--	--	800	--	--
Triclopyr	Herbicide	0.05	--	--	--	--	--	--	--
Trifluralin	Herbicide	0.05	--	--	--	--	--	7.5	0.75

Notes:

1 Total number of sites in 2022 were 22.
2 Total number of samples collected in 2022 were 112.
3 Wisconsin Department of Health Services(DHS) Drinking Water Health Advisory (June 2019, November 2020, revised February 2022).
4 Combined sum of acetochlor metabolites ESA and OA.
5 Combined sum of metabolites (di- and mono-acid) and parent material dacthal.
6 Combined sum of metabolite DKN and parent material isoxaflutole.
7 Combined sum of metolachlor metabolites ESA and OA.
-- Indicates that Health Advisory Level value in Wisconsin not established.
DKN diketonitrile
ESA ethane sulfonic acid
OA oxanilic acid; can also be identified as OXA.
µg/L micrograms per liter or parts per billion
TCR Total Chlorinated Residue for Atrazine. Reflects an additive quantity of atrazine (parent material) and its three metabolites (de-ethyl, de-isopropyl and di-amino atrazine).

(white)	Indicates no detects in excess of laboratory reporting limits.
(light yellow)	Indicates detects in excess of laboratory reporting limits.
(light orange)	Indicates detects in excess of laboratory reporting limits and Wis. Admin. Code ch. NR 140 Preventive Action Limit.
(red)	Indicates detects in excess of laboratory reporting limits and either Wis. Admin. Code ch. NR 140 Enforcement Standard or DHS Drinking Water Health Advisory.

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Table B 4: Field-Edge Groundwater Monitoring Program - 2022 Land Pesticide/Nitrogen- and Irrigation-Use (as Provided by Growers)

COUNTY	SITE (Grower)	YEAR	CROP	NUTRIENT MANAGEMENT PLAN	IRRIGATION APPLIED (in inches)	NITROGEN APPLIED (in lbs/acre)	PESTICIDE PRODUCT APPLIED
Adams	AD2	2016	corn silage	---	6.45	374.8	glyphosate
							atrazine
							dicamba
		2017 [1]	---	---	---	---	---
		2018 [1]	---	---	---	---	---
		2019 [1]	---	---	---	---	---
		2020 [1]	---	---	---	---	---
		2021 [1]	---	---	---	---	---
		2022 [1]	---	---	---	---	---
	AD5	2016 [1]	---	---	---	---	---
		2017 [1]	---	---	---	---	---
		2018 [1]	---	---	---	---	---
		2019 [1]	---	---	---	---	---
		2020 [1]	---	---	---	---	---
		2021 [1]	---	---	---	---	---
		2022 [1]	---	---	---	---	---
Barron	BR3	2016 [1]	---	---	---	---	---
		2017 [1]	---	---	---	---	---
		2018 [1]	---	---	---	---	---
		2019	corn	no	2.24	300	glyphosate
							topramezone, dimethenamid
							acetochlor, flumetsulam, clopyralid
		2020 [1]	---	---	---	---	---
		2021 [1]	---	---	---	---	---
		2022 [1]	---	---	---	---	---
Dane	DN1	2016	seed corn	---	3	216.7	simazine
							metolachlor
							mesotrione
							topramezone
							bifenthrin
							pyraclastrobin, metconazole
							2,4-D
							glyphosate
							sodium chlorate
		2017	soybeans	---	2	6.0	glyphosate
							clethodim
							lambda-cyhalothrin
							glufosinate
		2018 [1]	---	---	---	---	---
		2019	soybeans	yes	2	1.7	glyphosate
							metribuzin
							dimethenamid
							glufosinate
							clethodim
							lambda-cyhalothrin
		2020	seed corn	yes	4	201.95	metolachlor
							glycine
							mesotrione
							simazine
							topramezone
							acetochlor
							simazine
							azoxystrobin, cyproconazole
							bifenthrin
							metaconazole, pyraclostrobin
		2021 [1]	---	---	---	---	---
		2022	corn	yes	5	415	simazine
							bifenthrin
							pydiflumatafen
							metolachlor
							glyphosate
							mesotrione
							acetochlor
							azoxystrobin

Dunn	DU1	2016	soybeans	---	3.43	100.0	dimethenamid
							flumioxazin
							clethodim
							benzoic acid
		2017	horseradish	---	0.8	140.5	peroxyacetic acid, hydrogen peroxide
							oxyfluorfen
							sulfentrazone
							glyphosate
							clethodim
							boscolid
							chlorothalonil
		2018	corn (grain)	no	3.97	193.3	glyphosate
							dicamba
							dimethenamid, saflufenacil
		2019 [1]	---	---	---	---	---
		2020	kidney beans	no	2.5	91.98	pendimethalin
							metolachlor
							imazamox
							sodium bentazon
							clethodim
							beta-cyfluthrin, imidacloprid
							saflufenacil
		2021	corn	no	15.6	1076.9	dicamba
							dimethenamide
							glyphosate
							saflufenacil
		2022 [1]	---	---	---	---	---
	DU2	2016	corn	---	8	241.0	glyphosate
							dimethenamid, saflufenacil
		2017	kidney beans	---	4	85.0	pendimethalin
							metolachlor
							bentazon
							fomesafen
							imazamox
							clethodim
							saflufenacil
							thiamethoxam, fludioxonil
		2018	corn	---	5	66.2	dimethenamid, saflufenacil
							glyphosate
							atrazine
		2019	kidney beans	yes	3.25	72.5	pendimethalin
							glyphosate
							metolachlor
							imazamox
							bentazon
							fomesafen
							clethodim
							imidacloprid
							saflufenacil
		2020	kidney beans	no	2.5	91.98	pendimethalin
							metolachlor
							imazamox
							sodium bentazon
							clethodim
							beta-cyfluthrin, imidacloprid
							saflufenacil
		2021	corn	no	4.2	85	clothianidin
							glyphosate
							dicamba
							dimethenamide
							pyroxasulfone
							saflufenacil
		2022	soybeans	no	4	0	metolachlor
							metribuzin
							glufosinate
							glyphosate
Grant	GR1	2016 [1]	---	---	na	---	---
		2017 [1]	---	---	na	---	---
		2018 [1]	---	---	na	---	---
		2019 [1]	---	---	na	---	---
		2020 [1]	---	---	na	---	---
		2021 [1]	---	---	na	---	---
		2022 [1]	---	---	na	---	---

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Iowa	IW1	2016	potatoes	---	18.4	374.4	metam sodium azoxystrobib, difenoconazole metalaxyl imidacloprid azoxystrobin metribuzin novaluron spinosad beta-cyfluthrin rimsulfuron chlorothalonil pyraclostrobin boscolid abamectin pyrimethanil mancozeb diquat bromide
		2017	seed corn	---	8.9	198.5	glyphosate bifenthrin glufosinate MCPA, bromoxynil pendimethalin pyraclostrobin, metconazole propiconazole, azoxystrobin
		2018	snap beans	no	5.7	77.0	thiamethoxam halosulfuron-methyl s-metolachlor imazamox, bentazon sethoxydim
		2019[1]	---	---	---	---	---
		2020	potatoes	no	21	225.93	bifenthrin, pyraclostrobin metribuzin metolachlor indoxacarb acetamiprid chlorothalonil spinosad lambda-cyhalothrin mefentrifluconazole abamectin zoxamide pyrimethanil mancozeb fentin hydroxide diquat dibromide
		2021	seed corn	no	9.4	199	abamectin azoxystrobin bifenthrin bromoxynil fludioxonil tembotrione glyphosate mefanoxam pendimethalin propiconazole pydiflumetofen thiabendazole thiamethoxam
		2021[1]	---	---	---	---	---
	IW2	2016	seed corn	---	12.8	195.5	glyphosate bifenthrin metolachlor pendimethalin tembotrione bromoxynil azoxystrobin
		2017	snap beans	---	6.6	72.2	glyphosate EPTC thiamethoxam bifenthrin imazamox, bentazon
		2018	seed corn	no	12.1	256.0	bifenthrin bicyclopyrone, metolachlor, mesotrione pendimethalin thiamethoxam azoxystrobin
		2019[1]	---	---	---	---	---
		2020	seed corn	no	10.6	223.2	bifenthrin glufosinate metolachlor nicosulfuron pyroxasulfone pendimethalin azoxystrobin, propiconazole, pydiflumetofen
		2021	snap beans	no	5.2	65	bifenthrin captan glyphosate imazomox, bentazon halosulfuron-methyl matalaxyl sethoxydim metolachlor thiophanate-methyl thiram thiamethmoxam
		2021[1]	---	---	---	---	---

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Jackson	JK3	2016 [1]	---	---	na	---	---
		2017 [1]	---	---	na	---	---
		2018 [1]	---	---	na	---	---
		2019 [1]	---	---	na	---	---
		2020 [1]	---	---	na	---	---
		2021 [1]	---	---	na	---	---
		2022 [1]	---	---	na	---	---
Juneau	JN1	2016	sweet corn	---	8	211.0	atrazine
							metolachlor
		2017	snap beans	---	2.9	122.0	metolachlor
							halosulfuron-methyl
		2018	sweet corn	no	8	228.6	atrazine
							metolachlor
		2019	potatoes	no	12.5	65.05	azoxystrobin
							chlorothalonil
							esfenvalerate
							spinosad
							thiamethoxam
							diquat dibromide
							boscalid
							metribuzin
							cyantraniliprole, abamectin
							metam sodium
							metalaxyl
		2020	sweet corn	no	9.5	212.37	atrazine
							metolachlor
		2021	snap beans	no	5	152.6	halosulfuron-methyl
							metolachlor
		2021 [1]	---	---	---	---	---
	JN3	2016 [1]	---	---	na	---	---
		2017 [1]	---	---	na	---	---
		2018 [1]	---	---	na	---	---
		2019 [1]	---	---	na	---	---
		2020 [1]	---	---	na	---	---
		2021 [1]	---	---	na	---	---
		2022 [1]	---	---	na	---	---
La Crosse	LC2	2016	corn silage	---	---	179.5	glyphosate
							lorsban
							acetochlor
							dicamba
		2017	soybeans	---	---	0.0	glyphosate
							2,4-D
							imazethapyr
		2018	corn	yes	2.5	705.7	glyphosate
							atrazine, acetochlor
							mesotrione
		2019	beans	---	---	0.0	glyphosate
							methansulfonamide
							metribuzin
							metolachlor
							glyphosate, imazethapyr
		2020 [1]	---	---	---	---	---
		2021 [1]	---	---	---	---	---
		2022	alfalfa	yes	5.25	0	none
Langlade	LN1	2016 [1]	---	---	---	---	---
		2017 [1]	---	---	---	---	---
		2018 [1]	---	---	---	---	---
		2019 [1]	---	---	---	---	---
		2020 [1]	---	---	---	---	---
		2021 [1]	---	---	---	---	---
		2022	sweet corn	yes	2	220	nicosulfuron
Portage	PR1	2016 [1]	---	---	---	---	---
		2017 [1]	---	---	---	---	---
		2018	sweet corn	yes	4.6	164.0	metolachlor
							atrazine
		2019	potatoes	yes	6.7	159	chlorothalonil
							azoxystrobin
							spinetram
							abamectin, cyantraniliprole
							imidacloprid
							novaluron
							diqust
		2020 [1]	field corn	---	7.2	167.17	glyphosate
		2021 [1]	---	---	---	---	---
		2022 [1]	---	---	---	---	---
St. Croix	SC1	2016	soybeans	---	na	---	glyphosate
		2017	corn	---	na	250.0	glyphosate
							tembotrione
							acetochlor
		2018	soybeans	no	na	0.0	glyphosate
		2019 [1]	---	---	na	---	---
		2020 [1]	---	---	na	---	---
		2021 [1]	---	---	na	---	---
		2022 [1]	---	---	na	---	---
Sauk	SK6	2016 [1]	---	---	na	---	---
		2017 [1]	---	---	na	---	---
		2018 [1]	---	---	na	---	---
		2019 [1]	---	---	---	---	---
		2020 [1]	---	---	---	---	---
		2021 [1]	---	---	---	---	---
		2022 [1]	---	---	---	---	---

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Trempealeau	TR1	2016 [1]	---	---	---	---	---
		2017 [1]	---	---	---	---	---
		2018 [1]	---	---	---	---	---
		2019 [1]	---	---	---	---	---
		2020 [1]	---	---	---	---	---
		2021 [1]	---	---	---	---	---
		2022 [1]	---	---	---	---	---
Waupaca	WP2	2016	corn	---	na	132.0	acetochlor
							clopyralid
							flumetsulam
		2017	soybeans	---	na	0.0	glyphosate
		2018	soybeans	yes	na	0.0	glyphosate
		2019	corn	yes	na	122.0	acetochlor, clopyralid, flumetsulam
							glyphosate
		2020	corn	yes	na	97.9	acetochlor, clopyralid, flumetsulam
		2021	soybeans	yes	na	0	glyphosate
		2022 [1]	---	---	---	---	---
Waushara	WS4	2016	carrots	---	9.08	176.0	glyphosate
							pendimethalin
							chlorothalonil
							esfenvalerate
							clethodim
							azoxystrobin
		2017	potatoes	---	13.62	115.1	glyphosate
							thiamethoxam, fludioxonil
							mancozeb
							azoxystrobin
							pentachloronitrobenzene
							metolachlor
							metribuzin
							rimsulfuron
							chlorothalonil
							novaluron
							metalaxyl
							spinosad
							boscolid
							cyantraniliprole, abamectin
							pyraclostrobin
							oxathiapiprolin
							fentin hydroxide
							diquat bromide
		2018	corn	no	9.1	70.6	metolachlor
							simazine
							glyphosate
							ammonium sulfamate
		2019	beans	no	2.42	24.96	metolachlor
							halosulfuron-methyl
		2020	carrots	no	12.12	241.3	pendimethalin
							clethodim
							prometryn
							carfentrazone-ethyl
							esfenvalerate
							chlorothalonil
							azoxystrobin
							boscalid
		2021	potatoes	no	12.71	292.3	abamectin
							cyantraniliprole
							esfenvalerate
							metolachlor
							novaluron
							pendimethalin
							phosmet
							spinetoram
		2022 [1]	---	---	---	---	---
	WS6	2016	corn	---	8.35	70.4	glyphosate
							simazine
							metolachlor
		2017	beans	---	6	105.6	glyphosate
							metolachlor
							halosulfuron-methyl
		2018	carrots	no	12.76	254.1	clethodim
							carfentrazone-ethyl
							cypermethrin
							azoxystrobin
		2019	potatoes	no	10.9	200.16	pendimethalin
							metribuzin
							novaluron
							phosmet
							chlorothalonil
							boscolid
							cyantraniliprole, abamectin
							metalaxyl
							fentin hydroxide
							diquat dibromide
		2020	corn	no	7.93	70.78	glyphosate
							metolachlor
							simazine
							tembotrione
		2021	corn	no	14.6	133	metolachlor
							simazine
							topramezone
		2022 [1]	---	---	---	---	---

Waushara	WS7	2016					
		2017					
		2018					
		2019					
		2020					
		2021					
		2022					

Notes:

1 Grower did not provide information in Annual Reporting Form.

Site is located within an atrazine Prohibition Area.

--- Information not provided by Grower.

na Fields are not equipped to irrigate.

Site is a research location with multiple crops and herbicide types and application rates. Information not available for publication.

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Table B 5: Field-Edge Groundwater Monitoring Program - 2022 Imidacloprid Concentrations in Groundwater Samples

County	Site (Grower)	Well Name	WUWN	Sample Date	Imidacloprid
Adams	AD2	AD2-1	BH954	5/17/2022	0.0275
				10/18/2022	0
		AD2-4	VR844	5/17/2022	1.52
				10/18/2022	0.231
		AD2-5	VR845	5/17/2022	0.309
				10/18/2022	0.309
		AD2-6	PT421	5/17/2022	0
				10/18/2022	0
	AD5	AD5-1	CL461	5/17/2022	0
				10/18/2022	0
		AD5-4	VR846	5/17/2022	0.102
				10/18/2022	0.0855
		AD5-5	VR847	5/17/2022	0.241
				10/18/2022	0.234
		AD5-6	PT422	5/17/2022	0
				10/18/2022	0
Barron	BR3	BR3-1	BR279	6/1/2022	0
				11/29/2022	0
		BR3-3	BR281	6/1/2022	0
				11/29/2022	0
Dane	DN1	DN1-1	PT428	4/19/2022	0
				10/27/2022	0
		DN1-3	BR252	4/19/2022	0.0185
				10/27/2022	0
Dunn	DU1	DU1-1	AO384	6/1/2022	0
				11/29/2022	0
		DU1-3	AO386	6/1/2022	0
				11/29/2022	0
	DU2	DU2-1	AO387	6/1/2022	0
				11/29/2022	0
		DU2-3	AO389	6/1/2022	0
				11/29/2022	0
Grant	GR1	GR1-1	BR255	4/19/2022	0
				10/27/2022	0
		GR1-3	BR257	4/19/2022	0
				10/27/2022	0
Iowa	IW1	IW1-4	BR259	4/27/2022	0.0789
				11/10/2022	0.0371
		IW1-5	BR260	4/27/2022	0.0495
		IW1-6	BR261	11/10/2022	0.0346
		IW1-7	BH967	4/27/2022	0.0245
				11/10/2022	0.0198
		IW1-8	PT425	4/27/2022	0.146
				11/10/2022	0.153
	IW2	IW2-1	BR036	4/27/2022	0.122
				11/10/2022	0.0349
		IW2-3	BR038	4/27/2022	0.207
				11/10/2022	0.264
		IW2-4	PT426	4/27/2022	0.0286
				11/10/2022	0.0304
		IW2-5	PT427	4/27/2022	0.0146
				11/10/2022	0
Jackson	JK3	JK3-1	JH982	5/11/2022	0
				11/17/2022	0
		JK3-2	JH981	5/11/2022	0
				11/17/2022	0
Juneau	JN1	JN1-1	BR046	5/11/2022	0
				12/6/2022	0
		JN1-3	BR048	5/11/2022	0.0516
				12/6/2022	0.0216
	JN3	JN3-1	JH937	5/17/2022	0
				11/17/2022	0
		JN3-2	JH936	5/17/2022	0
				11/17/2022	0
La Crosse	LC2	LC2-1	VZ391	6/2/2022	0
				11/28/2022	0
		LC2-2	VZ392	6/2/2022	0
				11/28/2022	0
Langlade	LN1	LN1-1	BH964	5/3/2022	0
				10/11/2022	0
		LN1-3	BH966	5/3/2022	0
				10/11/2022	0

Portage	PR1	PR1-1	BR207	5/3/2022	0
				10/11/2022	0
		PR1-4	VR848	5/3/2022	0.0266
				10/11/2022	0.0206
		PR1-5	VR849	5/3/2022	0.0285
				10/11/2022	0.0226
St. Croix	SC1	SC1-1	JH938	6/2/2022	0
				11/28/2022	0
		SC1-2	JH939	6/2/2022	0
				11/28/2022	0
Sauk	SK6	SK6-2	BB247	4/19/2022	0.351
				10/27/2022	0.217
		SK6-3	BB248	4/19/2022	0.0783
				10/27/2022	0.114
		SK6-4	PT424	4/19/2022	0
				10/27/2022	0
Trempealeau	TR1	TR1-1	PX201	6/2/2022	0
				11/28/2022	0
		TR1-2	PX202	6/2/2022	0
				11/28/2022	0
Waupaca	WP2	WP2-1	JH985	5/3/2022	0
				10/11/2022	0
		WP2-2	JH984	5/3/2022	0
				10/11/2022	0
Waushara	WS4	WS4-1	BB258	5/4/2022	0.149
				11/3/2022	0.779
		WS4-4	BB261	5/4/2022	0.0304
				11/3/2022	0.0225
	WS6	WS6-1	JH989	5/4/2022	0.0229
				11/3/2022	0.0144
		WS6-2	JH990	5/4/2022	0.0249
				11/3/2022	0.0235
	WS7	WS7-1	VR841	5/4/2022	0.0493
				11/3/2022	0.0336
		WS7-2	VR842	5/4/2022	0.167
				11/3/2022	0.0183
		WS7-3	VR843	5/4/2022	0.0345
				11/3/2022	0.0118
		WS7-4	PT423	5/4/2022	0.0702
				11/3/2022	0.0319

Notes:

WUWN	Wisconsin Unique Well Number
µg/L	Micrograms per liter or parts per billion
0	Concentration does not exceed laboratory reporting limit of 0.01 µg/L.
(yellow highlight)	Exceeds Wisconsin Department of Health Services Drinking Water Health Advisory of 0.2 µg/L (June 2019, November 2020, revised February 2022).

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Table B 6: Field-Edge Groundwater Monitoring Program - 2022 Alachlor ESA Concentrations in Groundwater Samples

County	Site (Grower)	Well Name	WUWN	Sample Date	Alachlor ESA
Adams	AD2	AD2-1	BH954	5/17/2022	0.191
				10/18/2022	0.194
		AD2-4	VR844	5/17/2022	0.347
				10/18/2022	0.28
		AD2-5	VR845	5/17/2022	0.514
				10/18/2022	0.605
		AD2-6	PT421	5/17/2022	3.27
				10/18/2022	2.97
	AD5	AD5-1	CL461	5/17/2022	0
				10/18/2022	0.816
		AD5-4	VR846	5/17/2022	1.23
				10/18/2022	1.11
		AD5-5	VR847	5/17/2022	9.7
				10/18/2022	9.61
		AD5-6	PT422	5/17/2022	1.03
				10/18/2022	1.19
Barron	BR3	BR3-1	BR279	6/1/2022	0
				11/29/2022	0
		BR3-3	BR281	6/1/2022	0
				11/29/2022	0
Dane	DN1	DN1-1	PT428	4/19/2022	0
				10/27/2022	0
		DN1-3	BR252	4/19/2022	0
				10/27/2022	0.0514
Dunn	DU1	DU1-1	AO384	6/1/2022	0.257
				11/29/2022	0.417
		DU1-3	AO386	6/1/2022	0.15
				11/29/2022	0.156
	DU2	DU2-1	AO387	6/1/2022	0.118
				11/29/2022	0.135
		DU2-3	AO389	6/1/2022	0.0876
				11/29/2022	0.107
Grant	GR1	GR1-1	BR255	4/19/2022	0
				10/27/2022	0
		GR1-3	BR257	4/19/2022	0.0516
				10/27/2022	0.0591
Iowa	IW1	IW1-4	BR259	4/27/2022	0.757
				11/10/2022	0.859
		IW1-5	BR260	4/27/2022	0.713
		IW1-6	BR261	11/10/2022	1.33
		IW1-7	BH967	4/27/2022	1.5
				11/10/2022	1.69
		IW1-8	PT425	4/27/2022	1.55
				11/10/2022	1.7
	IW2	IW2-1	BR036	4/27/2022	0.313
				11/10/2022	0.579
		IW2-3	BR038	4/27/2022	0.336
				11/10/2022	0.307
		IW2-4	PT426	4/27/2022	0.484
				11/10/2022	0.612
		IW2-5	PT427	4/27/2022	0.312
				11/10/2022	0.356
Jackson	JK3	JK3-1	JH982	5/11/2022	0
				11/17/2022	0
		JK3-2	JH981	5/11/2022	0
				11/17/2022	0
Juneau	JN1	JN1-1	BR046	5/11/2022	0
				12/6/2022	0
		JN1-3	BR048	5/11/2022	0.925
				12/6/2022	0.97
	JN3	JN3-1	JH937	5/17/2022	1.24
				11/17/2022	23.2
		JN3-2	JH936	5/17/2022	0
				11/17/2022	0

La Crosse	LC2	LC2-1	VZ391	6/2/2022	0
				11/28/2022	0
		LC2-2	VZ392	6/2/2022	0
				11/28/2022	0
Langlade	LN1	LN1-1	BH964	5/3/2022	0
				10/11/2022	0
		LN1-3	BH966	5/3/2022	0
				10/11/2022	0
Portage	PR1	PR1-1	BR207	5/3/2022	0
				10/11/2022	0
		PR1-4	VR848	5/3/2022	0.472
				10/11/2022	0.545
		PR1-5	VR849	5/3/2022	0.586
				10/11/2022	0.673
St. Croix	SC1	SC1-1	JH938	6/2/2022	0.163
				11/28/2022	0.24
		SC1-2	JH939	6/2/2022	0.139
				11/28/2022	0.103
Sauk	SK6	SK6-2	BB247	4/19/2022	0.478
				10/27/2022	0.699
		SK6-3	BB248	4/19/2022	0.232
				10/27/2022	0.448
		SK6-4	PT424	4/19/2022	1.15
				10/27/2022	0.326
Trempealeau	TR1	TR1-1	PX201	6/2/2022	0
				11/28/2022	0
		TR1-2	PX202	6/2/2022	0
				11/28/2022	0
Waupaca	WP2	WP2-1	JH985	5/3/2022	0.0519
				10/11/2022	0.0567
		WP2-2	JH984	5/3/2022	0
				10/11/2022	0.0588
Waushara	WS4	WS4-1	BB258	5/4/2022	0.326
				11/3/2022	0.699
		WS4-4	BB261	5/4/2022	0.158
				11/3/2022	0.307
	WS6	WS6-1	JH989	5/4/2022	0.194
				11/3/2022	0.251
		WS6-2	JH990	5/4/2022	0
				11/3/2022	0
	WS7	WS7-1	VR841	5/4/2022	0.332
				11/3/2022	0.217
		WS7-2	VR842	5/4/2022	0.564
				11/3/2022	0.393
		WS7-3	VR843	5/4/2022	3.08
				11/3/2022	3.31
		WS7-4	PT423	5/4/2022	4.88
				11/3/2022	4.85

Notes:

WUWN	Wisconsin Unique Well Number
µg/L	Micrograms per liter or parts per billion
0	Concentration does not exceed laboratory reporting limit of 0.05 µg/L.
(yellow)	Detected concentration exceeds the Wisconsin Administrative Code ch. NR 140 Preventive Action Limit of 4.0 µg/L.
(orange)	Detected concentration exceeds the Wisconsin Administrative Code ch. NR 140 Enforcement Standard of 20.0 µg/L.

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Table B 7: Field-Edge Groundwater Monitoring Program - 2022 Atrazine and Metabolite Concentrations in Groundwater Samples

County	Site (Grower)	Well Name	WUWN	Sample Date	Atrazine	De-ethyl Atrazine	De-isopropyl Atrazine	Di-amino Atrazine	Atrazine TCR
Adams	AD2	AD2-1	BH954	5/17/2022	0	0	0	0	0
				10/18/2022	0	0	0	0	0
		AD2-4	VR844	5/17/2022	0.157	0.357	0	0	0.514
				10/18/2022	0.149	0.231	0	0	0.38
		AD2-5	VR845	5/17/2022	0.0839	0.252	0	0	0.3359
				10/18/2022	0.0818	0.161	0	0	0.2428
		AD2-6	PT421	5/17/2022	0.246	0.784	0	0.188	1.218
				10/18/2022	0.244	0.787	0	0.189	1.22
	AD5	AD5-1	CL461	5/17/2022	0	0	0	0	0
				10/18/2022	0	0	0	0	0
		AD5-4	VR846	5/17/2022	0.051	0	0	0	0.051
				10/18/2022	0.0803	0.0591	0.066	0	0.2054
		AD5-5	VR847	5/17/2022	0.113	0.663	0	0.234	1.01
				10/18/2022	0.114	0.587	0	0.228	0.929
		AD5-6	PT422	5/17/2022	0	0.576	0	0	0.576
				10/18/2022	0	0.618	0	0	0.618
Barron	BR3	BR3-1	BR279	6/1/2022	0.0942	0.0537	0	0	0.1479
				11/29/2022	0	0	0	0	0
		BR3-3	BR281	6/1/2022	0	0	0	0	0
				11/29/2022	0.0772	0	0	0	0.0772
Dane	DN1	DN1-1	PT428	4/19/2022	0	0	0	0	0
				10/27/2022	0	0	0	0	0
		DN1-3	BR252	4/19/2022	0	0	0	0	0
				10/27/2022	0	0	0.0668	0	0.0668
Dunn	DU1	DU1-1	AO384	6/1/2022	0	0	0.106	0	0.106
				11/29/2022	0	0	0.121	0	0.121
		DU1-3	AO386	6/1/2022	0	0	0.137	0	0.137
				11/29/2022	0	0	0.155	0	0.155
	DU2	DU2-1	AO387	6/1/2022	0	0	0	0	0
				11/29/2022	0	0	0	0	0
		DU2-3	AO389	6/1/2022	0	0	0	0	0
				11/29/2022	0	0	0	0	0
Grant	GR1	GR1-1	BR255	4/19/2022	0	0	0	0	0
				10/27/2022	0	0	0	0	0
		GR1-3	BR257	4/19/2022	0	0	0	0	0
				10/27/2022	0	0	0	0	0
Iowa	IW1	IW1-4	BR259	4/27/2022	0	0	0	0	0
				11/10/2022	0	0	0	0	0
		IW1-5	BR260	4/27/2022	0	0	0	0	0
		IW1-6	BR261	11/10/2022	0	0	0	0	0
		IW1-7	BH967	4/27/2022	0	0.0567	0.0571	0	0.1138
				11/10/2022	0	0.0591	0.0544	0	0.1135
		IW1-8	PT425	4/27/2022	0.067	0.0901	0.142	0.24	0.5391
				11/10/2022	0	0.07	0.119	0.235	0.424
	IW2	IW2-1	BR036	4/27/2022	0	0	0	0	0
				11/10/2022	0	0	0	0	0
		IW2-3	BR038	4/27/2022	0	0	0	0	0
				11/10/2022	0	0	0	0	0
		IW2-4	PT426	4/27/2022	0	0	0.0695	0.156	0.2255
				11/10/2022	0	0	0.0554	0	0.0554
		IW2-5	PT427	4/27/2022	0.162	0.139	0.0853	0.151	0.5373
				11/10/2022	0.161	0.137	0.101	0.164	0.563
Jackson	JK3	JK3-1	JH982	5/11/2022	0	0	0	0	0
				11/17/2022	0	0	0	0	0
		JK3-2	JH981	5/11/2022	0	0	0	0	0
				11/17/2022	0	0	0	0	0
Juneau	JN1	JN1-1	BR046	5/11/2022	0	0	0	0	0
				12/6/2022	0	0	0	0	0
		JN1-3	BR048	5/11/2022	0	0.052	0	0	0.052
				12/6/2022	0	0.0552	0	0	0.0552
	JN3	JN3-1	JH937	5/17/2022	0	0	0	0	0
				11/17/2022	0	0	0	0	0
		JN3-2	JH936	5/17/2022	0	0	0	0	0
				11/17/2022	0	0	0	0	0
La Crosse	LC2	LC2-1	VZ391	6/2/2022	0.0609	0.181	0	0	0.2419
				11/28/2022	0.0714	0.17	0.0504	0	0.2918
		LC2-2	VZ392	6/2/2022	0.0518	0.172	0	0	0.2238
				11/28/2022	0.0564	0.169	0	0	0.2254
Langlade	LN1	LN1-1	BH964	5/3/2022	0	0	0	0	0
				10/11/2022	0	0	0	0	0
		LN1-3	BH966	5/3/2022	0	0	0	0	0
				10/11/2022	0	0	0	0	0

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Portage	PR1	PR1-1	BR207	5/3/2022	0	0	0	0	0
				10/11/2022	0	0	0	0	0
		PR1-4	VR848	5/3/2022	0	0.0734	0	0	0.0734
				10/11/2022	0	0.063	0	0	0.063
		PR1-5	VR849	5/3/2022	0	0.0878	0	0	0.0878
				10/11/2022	0	0.0962	0	0	0.0962
St. Croix	SC1	SC1-1	JH938	6/2/2022	0	0.0691	0.0885	0.337	0.4946
				11/28/2022	0	0.0733	0.0943	0.354	0.5216
		SC1-2	JH939	6/2/2022	0	0	0	0	0
				11/28/2022	0	0.0505	0	0	0.0505
Sauk	SK6	SK6-2	BB247	4/19/2022	0	0	0	0	0
				10/27/2022	0	0	0	0	0
		SK6-3	BB248	4/19/2022	0	0	0	0	0
				10/27/2022	0	0	0	0	0
		SK6-4	PT424	4/19/2022	0.127	0.307	0.283	0.308	1.025
				10/27/2022	0.0972	0.151	0.155	0	0.4032
Trempealeau	TR1	TR1-1	PX201	6/2/2022	0	0	0	0	0
				11/28/2022	0	0	0	0	0
		TR1-2	PX202	6/2/2022	0	0	0	0	0
				11/28/2022	0	0	0	0	0
Waupaca	WP2	WP2-1	JH985	5/3/2022	0	0	0.0544	0.174	0.2284
				10/11/2022	0	0	0.0813	0.248	0.3293
		WP2-2	JH984	5/3/2022	0	0	0	0	0
				10/11/2022	0	0	0	0	0
Waushara	WS4	WS4-1	BB258	5/4/2022	0	0	0	0	0
				11/3/2022	0	0	0	0	0
		WS4-4	BB261	5/4/2022	0	0	0.0793	0	0.0793
				11/3/2022	0	0	0	0	0
	WS6	WS6-1	JH989	5/4/2022	0	0	0.449	0.377	0.826
				11/3/2022	0	0	0.488	0.294	0.782
		WS6-2	JH990	5/4/2022	0	0	0.218	0	0.218
				11/3/2022	0	0	0.219	0	0.219
	WS7	WS7-1	VR841	5/4/2022	0	0	0	0	0
				11/3/2022	0	0	0	0	0
		WS7-2	VR842	5/4/2022	0	0	0	0	0
				11/3/2022	0	0	0	0	0
		WS7-3	VR843	5/4/2022	0.0803	0.402	0.167	0.161	0.8103
				11/3/2022	0.0985	0.415	0.123	0.164	0.8005
		WS7-4	PT423	5/4/2022	0.1	0.57	0	0.159	0.829
				11/3/2022	0.0865	0.492	0	0.159	0.7375

Concentrations identified as micrograms per liter or parts per billion.
TCR Total Chlorinated Residue for Atrazine. Reflects an additive quantity of atrazine and its three metabolites (de-ethyl, de-isopropyl and di-amino atrazine).
WUWN Wisconsin Unique Well Number
µg/L Micrograms per liter or parts per billion.
0 Concentration does not exceed laboratory reporting limit of 0.05 µg/L.
[green] Site is located within an atrazine Prohibition Area.
[yellow] Detected concentration exceeds the Wisconsin Administrative Code ch. NR 140 Preventive Action Limit of 0.3 µg/L.

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Table B 8: Field-Edge Groundwater Monitoring Program - 2022 Nitrogen-Nitrate/Nitrite Concentrations in Groundwater Samples

County	Site (Grower)	Well Name	WUWN	Sample Date	Nitrogen-Nitrate/Nitrite
Adams	AD2	AD2-1	BH954	5/17/2022	26.5
				10/18/2022	29.2
		AD2-4	VR844	5/17/2022	18.8
				10/18/2022	17.7
		AD2-5	VR845	5/17/2022	28.9
				10/18/2022	23.2
		AD2-6	PT421	5/17/2022	11.5
				10/18/2022	13.2
	AD5	AD5-1	CL461	5/17/2022	1.18
				10/18/2022	35.5
		AD5-4	VR846	5/17/2022	23
				10/18/2022	21
		AD5-5	VR847	5/17/2022	22.4
				10/18/2022	24.8
		AD5-6	PT422	5/17/2022	5.23
				10/18/2022	5.53
Barron	BR3	BR3-1	BR279	6/1/2022	2.31
				11/29/2022	0
		BR3-3	BR281	6/1/2022	3.72
				11/29/2022	2.86
Dane	DN1	DN1-1	PT428	4/19/2022	15.1
				10/27/2022	15.8
		DN1-3	BR252	4/19/2022	14.4
				10/27/2022	14.7
Dunn	DU1	DU1-1	AO384	6/1/2022	21.1
				11/29/2022	25.3
		DU1-3	AO386	6/1/2022	8.59
				11/29/2022	13.4
	DU2	DU2-1	AO387	6/1/2022	6.46
				11/29/2022	10.8
		DU2-3	AO389	6/1/2022	0.717
				11/29/2022	2.42
Grant	GR1	GR1-1	BR255	4/19/2022	12.1
				10/27/2022	20.6
		GR1-3	BR257	4/19/2022	18.5
				10/27/2022	14.9
Iowa	IW1	IW1-4	BR259	4/27/2022	11.5
				11/10/2022	28
		IW1-5	BR260	4/27/2022	16.5
		IW1-6	BR261	11/10/2022	16.4
		IW1-7	BH967	4/27/2022	25.5
				11/10/2022	26.6
		IW1-8	PT425	4/27/2022	23.2
				11/10/2022	27.1
	IW2	IW2-1	BR036	4/27/2022	9.1
				11/10/2022	15.1
		IW2-3	BR038	4/27/2022	26.2
				11/10/2022	21.7
		IW2-4	PT426	4/27/2022	26.4
				11/10/2022	28.5
		IW2-5	PT427	4/27/2022	16.3
				11/10/2022	17.3
Jackson	JK3	JK3-1	JH982	5/11/2022	1.95
				11/17/2022	2.23
		JK3-2	JH981	5/11/2022	2.22
				11/17/2022	2.42
Juneau	JN1	JN1-1	BR046	5/11/2022	0.564
				12/6/2022	9.99
		JN1-3	BR048	5/11/2022	25.9
				12/6/2022	28.1
	JN3	JN3-1	JH937	5/17/2022	1.11
				11/17/2022	2.36
		JN3-2	JH936	5/17/2022	2.21
				11/17/2022	3.03

La Crosse	LC2	LC2-1	VZ391	6/2/2022	21.6
				11/28/2022	19.9
		LC2-2	VZ392	6/2/2022	17.1
				11/28/2022	16.9
Langlade	LN1	LN1-1	BH964	5/3/2022	2.02
				10/11/2022	12.4
		LN1-3	BH966	5/3/2022	15.7
				10/11/2022	15.6
Portage	PR1	PR1-1	BR207	5/3/2022	2.08
				10/11/2022	6.85
		PR1-4	VR848	5/3/2022	20.2
				10/11/2022	20.4
		PR1-5	VR849	5/3/2022	22.4
				10/11/2022	22.9
St. Croix	SC1	SC1-1	JH938	6/2/2022	15.4
				11/28/2022	12.7
		SC1-2	JH939	6/2/2022	16
				11/28/2022	16.2
Sauk	SK6	SK6-2	BB247	4/19/2022	20.1
				10/27/2022	27
		SK6-3	BB248	4/19/2022	17.1
				10/27/2022	25
		SK6-4	PT424	4/19/2022	8.55
				10/27/2022	10.3
Trempealeau	TR1	TR1-1	PX201	6/2/2022	26.5
				11/28/2022	25.5
		TR1-2	PX202	6/2/2022	20
				11/28/2022	24.4
Waupaca	WP2	WP2-1	JH985	5/3/2022	14.4
				10/11/2022	14.8
		WP2-2	JH984	5/3/2022	7.59
				10/11/2022	12.5
Waushara	WS4	WS4-1	BB258	5/4/2022	25.1
				11/3/2022	31.2
		WS4-4	BB261	5/4/2022	14.6
				11/3/2022	14.5
	WS6	WS6-1	JH989	5/4/2022	30.9
				11/3/2022	37.3
		WS6-2	JH990	5/4/2022	6.9
				11/3/2022	7.25
	WS7	WS7-1	VR841	5/4/2022	24.4
				11/3/2022	19.3
		WS7-2	VR842	5/4/2022	20.9
				11/3/2022	17.2
		WS7-3	VR843	5/4/2022	32
				11/3/2022	33
		WS7-4	PT423	5/4/2022	22.8
				11/3/2022	22.7

Notes:

WUWN	Wisconsin Unique Well Number
mg/L	Milligrams per liter or parts per million
0	Concentration does not exceed laboratory reporting limit of 0.5 mg/L.
(yellow)	Detected concentration exceeds the Wisconsin Administrative Code ch. NR 140 Preventive Action Limit of 2.0 mg/L.
(orange)	Detected concentration exceeds the Wisconsin Administrative Code ch. NR 140 Enforcement Standard of 10.0 mg/L.