DEPARTMENT OF AGRICULTURE

Pesticide Management Plan Status Report

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Executive Summary

The Minnesota Department of Agriculture (MDA) submits a biennial Pesticide Management Plan Status Report to the Environmental Quality Board and to the House of Representatives and Senate committees with jurisdiction over the environment, natural resources, and agriculture.

The Pesticide Management Plan (PMP) is a guidance document for the prevention, evaluation, and mitigation of occurrences of pesticides or their breakdown products in Minnesota groundwater and surface water due to non-point source pollution from the legal use of pesticide products.

In the 2019-2020 biennium, prevention activities, including education and outreach activities coordinated through the PMP's Education and Promotion Team, continued efforts to inform pesticide applicators and others about the importance of minimizing pesticide impacts to water quality to the extent practicable.

The MDA's water quality Monitoring and Assessment Program continued to be the foundation of 2019-2020 evaluation activities. It is further supported by data collected from the pesticide applicator use survey, the Pesticide Management Plan Committee's review of data, and consultation with risk assessors and water quality program staff at the Minnesota Department of Health (MDH) and the Minnesota Pollution Control Agency (MPCA).

Mitigation activities in 2019-2020 included ongoing education and outreach specific to groundwater and surface water pesticides of concern, analysis of Best Management Practices (BMP) adoption and effectiveness data, and the promotion and distribution of BMPs. This also involved the development of new BMPs addressing neonicotinoid insecticide use. In addition, three updated BMPs addressing agricultural herbicide use were published.

There continues to be a great deal of activity at the MDA in support of the PMP, with coordinated implementation of prevention, evaluation, and mitigation efforts within the MDA and in cooperation with other state agencies, the University of Minnesota (UMN), industry groups, and other stakeholders.

In 2019-2020, the Office of the Legislative Auditor (OLA) evaluated pesticide regulation activities at the MDA. The OLA report concluded that the MDA has implemented most of the recommendations from a previous OLA program audit in 2006 and noted several areas of improvement such as dramatically expanding its water-quality monitoring program over the last decade Several recommendations for improvements were also noted.

I. Introduction

The following biennial status report provides background and outlines major activities conducted during 2019 and 2020 in support of the Pesticide Management Plan: A Plan for the Protection of Groundwater and Surface Water (PMP).

The PMP is a guidance document for the prevention, evaluation, and mitigation of occurrences of pesticides or pesticide breakdown products in Minnesota groundwaters and surface waters due to non-point source pollution from the legal use of pesticide products.

Three sections on Prevention, Evaluation, and Mitigation coincide with the three statutorily required components of the PMP. It also includes information on other pesticide-related environmental activities.

The PMP is available on the MDA website at www.mda.state.mn.us/protecting/waterprotection/pmp.aspx. Additional information on many of the activities discussed in this report, as well as others undertaken by the MDA are available through the MDA general website, www.mda.state.mn.us, and the pesticide management programs web page, www.mda.state.mn.us/pesticide-management.

While the PMP is required by statute, it is a guidance document and has no inherent enforceable or regulatory requirements.

II. Background

The Pesticide Control Law (Minn. Stat. §18B.045) directs the MDA to submit a biennial PMP status report to the Environmental Quality Board (EQB) and to the House of Representatives and Senate committees with jurisdiction over the environment, natural resources, and agriculture.[1]

The statutory requirements and purpose for the PMP are outlined in the enabling legislation (18B.045):

> "The commissioner shall develop a pesticide management plan for the prevention, evaluation, and mitigation of occurrences of pesticides or pesticide breakdown products in groundwaters and surface waters of the state. The pesticide management plan must include components promoting prevention, developing appropriate responses to the detection of pesticides or pesticide breakdown products in groundwater and surface waters, and providing responses to reduce or eliminate continued pesticide movement to groundwater and surface water."

[1] The statutory requirement for this report is found in the Pesticide Control Law, Minn. Stat. § 18B.045 subd. 1: "Beginning September 1, 1994, and biennially thereafter, the commissioner must submit a status report on the plan to the environmental quality board for review and then to the legislative water commission." An electronic version of this report is available at: www.mda.state.mn.us/protecting/waterprotection/pmp.

The PMP includes components promoting prevention, developing appropriate responses to the detection of pesticides or pesticide breakdown products in groundwater and surface waters, and providing recommendations to reduce or eliminate pesticide movement to groundwater and surface water. The PMP is to be coordinated with other state agency plans and with other state agencies through the EQB. Development of the PMP included input from the UMN Extension, farm organizations, farmers, environmental organizations, and industry.

Development of the PMP began in 1990, with a final draft published in 1996. Minor revisions were made in 1998. The United States Environmental Protection Agency (EPA) provided a formal concurrence with the original 1996 version and with the revised 1998 version. The MDA again revised the PMP in June 2005 after conducting an issues forum and several public meetings. Additional revisions were incorporated in November 2007 based on recommendations made the previous year by the Office of the Legislative Auditor (OLA)'s review of MDA's pesticide programs. In 2019-2020, the OLA followed up on the review and evaluated pesticide regulation activities at the MDA. The OLA report was released in April 2020. On Dec. 30, 2019, a notice was published in the State Register announcing the MDA's intention to revise the Pesticide Management Plan. This included the acceptance of public comments concerning the plan. The comment period closed on March 13, 2020. Currently, the MDA is reviewing the public comments and will revise the PMP based on public input.

III. Prevention Activities

Water quality problems due to pesticide pollution are best addressed by first focusing on prevention. The MDA has developed 21 BMPs for Pesticide Management and Handling. These include BMPs for general pesticide distribution, storage, handling, use, and disposal. These BMPs continue to be promoted by the MDA and cooperators, through pesticide applicator training programs, seasonal updates, and other distribution and outreach mechanisms, such as the MDA Update newsletter, which is sent to private and commercial pesticide applicators. The BMPs for Pesticide Management and Handling are available at www.mda.state.mn.us/pesticide-fertilizer/pesticide-best-management-practices.

The MDA has developed voluntary BMPs that focus on the general use of agricultural herbicides, fungicides, and insecticides, as well as BMPs for specific pesticides of concern for water resources. These BMPs were developed, in part, in direct response to MDA's mandates under the state Groundwater Protection Act (Minn. Stat. chapter 103H) and are designed to minimize pesticide detections in groundwater and prevent concentrations from exceeding drinking water standards. The BMPs also address surface water concerns in an effort to minimize losses of pesticides to lakes, rivers, and streams, and to avoid possible impairment declarations for specific water bodies under the Clean Water Act.

The pesticide specific BMPs, along with the BMPs for general pesticide management and handling, form the foundation of MDA's prevention efforts. This also involves the MDA's product registration reviews, use inspections and enforcement, applicator training, incident response program, waste pesticide product disposal, and certification and licensure efforts.

In 2019, the MDA updated three herbicide water quality BMPs and released an herbicide drift management cue card:

Water Quality Best Management Practices for Atrazine
Water Quality Best Management Practices for Metolachlor
Water Quality Best Management Practices for Metribuzin
Herbicide Drift Management cue card.

The MDA also released three new pesticide BMPs addressing neonicotinoid insecticide use in 2019. These documents refer to a number of pesticide use and application practices which protect water quality:

Stewardship guidelines and Best Management Practices for Soil and Foliar-applied Neonicotinoid Insecticides
Stewardship guidelines and Best Management Practices for Neonicotinoid Insecticide-Treated Seeds
Stewardship Guidelines and Best Management Practices for Home and Residential Use of Neonicotinoid Insecticides

The OLA report concluded that the MDA has fully implemented a plan for evaluating the adoption and effectiveness of its BMPs. The evaluation has resulted in changes to recommended practices such as applying pesticides at the "right rate" rather than at a "reduced rate". Also, "rotating" herbicides with different "sites-of-action" was changed to "combining and rotating".

In 2019-2020, examples of efforts to promote BMPs and the responsible, safe use of pesticides are summarized as follows:

Education and Outreach

During the 2019 and 2020 growing seasons, the MDA, along with the UMN Extension, commodity groups, registrants, and others, provided informational documents, presentations, and video for use by pesticide applicators, retailers, educators and other interested parties.

Information about statewide and regional impacts of pesticides on water quality, along with information about preventing such impacts, was prepared for and coordinated with MDA and UMN Extension staff engaged in multi-regional pesticide applicator training and is available at: www.extension.umn.edu/agriculture/pesticide-safety/.

Announcements about BMPs and other concerns are communicated to pesticide dealers and commercial applicators by mail and on the MDA and UMN websites. Related articles and information are distributed through the MDA Update, Agri News, Minnesota Irrigator, newsletters, press releases, and other conventional and social media outlets.

Education and outreach activities also included presentations to a diverse set of stakeholders through multiple venues. Posters on PMP implementation and the BMPs were included as part of several of these presentations:

- Minnesota Crop Protection Retailers Short Course.
- Turf and landscape industry at the Minnesota Nursery and Landscape Association meetings and the Minnesota Green Expo.
- MDA private and commercial pesticide applicator training and recertification workshops held annually across the state for those working with agriculture, turf, and landscape pest control.
- MN PIE (Minnesota Pesticide Information and Education) workshops held annually across the state for roadside, utility and forestry pesticide applicators.
- Farmfest education forum.
- Training sessions given by pesticide dealers for their technical and sales staff.
- Metropolitan Mosquito Control District applicator training.
- Chlorpyrifos use in Minnesota Webinar.

The MDA worked with the Department of Natural Resources (DNR) to implement Source Water Protection Programs and the accompanying education and outreach needed to protect public drinking water supplies from the impacts of agricultural crop production in Wellhead Protection areas. The MDA also worked in cooperation with the DNR regarding their aquatic pesticide program to ensure the proper use of pesticide products.

BMP Education & Promotion Team

The BMP Education and Promotion Team (EPT) is a component of the PMP. Membership and purpose are designed to:

1. Assist with the review and design of educational and promotional activities.
2. Promote BMPs and provide education about how the use of BMPs will prevent, minimize, reduce, and eliminate sources of water resource degradation, including through demonstration projects.
3. Identify opportunities for cooperation among state agencies, representative EPT organizations, pesticide registrants and other interested parties, including opportunities for joint grant-writing.

The EPT is comprised of a core team drawn from those agencies and organizations directed in Minn. Stat. chapter 103H to participate in BMP promotion and demonstration. The core team establishes the agenda for subsequent meetings of the full team, which is designed to engage participation of additional members from a variety of stakeholder groups. The core team then evaluates the activities of the full team to establish goals and agendas for subsequent meetings of the full team. The core and full membership of the EPT met four times (twice each year) in 2019 and 2020 to coordinate BMP messaging and awareness of emerging pesticide water quality issues. EPT recommendations for the MDA to exploit social media as a means of outreach resulted in various projects and

increased efforts to use such tools. The EPT also focused on education of its members. At the 2019 EPT, presentations included:

- Chlorpyrifos update, Trisha Leaf (MDA)
- Rural neonicotinoid detections, seed treatments, and BMPs, Raj Mann (MDA)
- Urban neonicotinoid detections, BMPs, Kate Hall (MDA)
- Discussion and recommendations for promoting educations materials, Trisha Leaf (MDA)
- Water quality report update, Bill VanRyswyk (MDA)

The MDA also conducted special registration reviews of new active ingredients and new uses of currently registered pesticides to gain a better understanding of label, compliance, enforcement, and non-target exposure issues associated with a product's registration or anticipated with its potential use.

Integrated Pest Management (IPM) and National Pollutant Discharge and Elimination System (NPDES) Permits

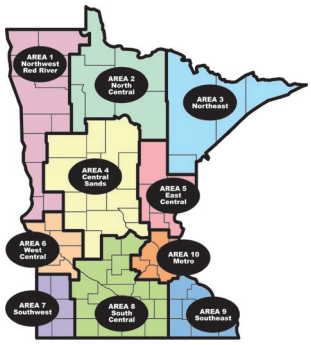
The MDA continues to provide leadership in developing and promoting the IPM use for the control of insect, disease, and weed pests through implementation of several programs. IPM is a decision-making process that utilizes all available pest management strategies, including cultural, physical, biological, and chemical control to prevent economically damaging pest outbreaks. These programs are coordinated and prioritized based on the current state of science and an understanding of where integrated management is currently feasible. The MDA has established a webpage to promote and provide IPM information.

Several water quality concerns related to pesticide use can be mitigated through implementation of IPM principles, which are incorporated into pesticide BMPs, and are a component of NPDES permits for several pesticide use patterns involving direct or indirect applications to water. Permit coverage from the MPCA for such use patterns became a requirement in April 2012. Implementation of the PMP is easily adaptable to and will account for the new NPDES pesticide permit requirements.

In addition, the MDA received an EPA grant "Protecting Pollinators with IPM in Minnesota" which will fund education and outreach efforts concerning protecting pollinators. This includes producing videos, conducting field days, creating online content, and distributing educational material. These efforts will also help in protecting water quality.

Pesticide Management Areas and Pesticide Monitoring Regions

Pesticide Management Areas (PMAs) are areas of similar characteristics in which BMPs may be promoted and evaluated. Boundaries of the PMAs also define the MDA's Pesticide Monitoring Regions (PMRs). The PMAs and PMRs continued to be used in 2019-2020 planning to establish goals, objectives, and priorities for BMP promotion and evaluation, water resource monitoring (as described in the *Evaluation Activities* section of this report), pesticide usage and use practices surveys, and in computer modeling exercises to predict potential leaching and runoff potential.



IV. Evaluation Activities

The foundation of the MDA's evaluation efforts for pesticides and water quality is an annual Water Quality Monitoring report. The MDA has a statutory requirement to "determine the impact of pesticides on the environment, including the impacts on surface and groundwater" (MN Chap 18B.04). Additionally, the review of non-MDA monitoring data, and BMP evaluation efforts contribute to the MDA's understanding of how best to prevent water quality impacts from pesticides. The Pesticide Management Plan Committee (PMPC) which helps the MDA make informed decisions regarding commonly detected pesticides in groundwater and pesticides of concern in surface water, provides diverse input on the implementation of the PMP and in assessing the appropriateness of evaluation activities. Other efforts – like identification of health and environmental toxicity reference values, development of laboratory methods, and pesticide use surveys – contribute to the MDA's PMP evaluation activities.

MDA Monitoring Program and Annual Water Quality Monitoring Report

As in previous years, in 2019-2020 the MDA monitoring program collected groundwater and surface water samples from sites throughout the state. The complete data report and related information, including annual groundwater and surface water monitoring design and work plan documents, are available online at www.mda.state.mn.us/monitoring.

Groundwater sampling is generally conducted in shallow monitoring wells where vulnerable soils serve as an indicator for potential losses of pesticides through leaching to groundwater. In southeast Minnesota, groundwater springs and private wells are sampled in lieu of direct groundwater sampling given the difficulty of installing and effectively sampling groundwater monitoring wells in karst geology. Annually, the MDA samples approximately 140 monitoring wells, 13 springs, and 12 domestic wells for its ambient ground monitoring. Since 2104, the MDA has also collected pesticide samples from domestic wells in areas of the state where groundwater is vulnerable to impacts from pesticides. The program, when it ends in 2021, will have sampled approximately 7,500 domestic drinking water wells across the state. Surface water sampling continues to benefit from the tiered monitoring approach begun in 2007, combining a mixture of periodic grab sampling throughout the state and automated sampling in specific,

representative watersheds. In 2019, 56 locations were sampled and approximately 700 samples were collected. The overall approach for groundwater and surface water monitoring in the 2019-2020 biennium is described in program work plans, including special projects that focus on issues such as the quality of lake water, analytical methods, private drinking water wells, and precipitation. The OLA report concluded that the MDA selects its monitoring locations based on a reasonable assessment of region's vulnerability to pesticide contamination.

In 2019, the MDA analyzed for cyanazine degradates in ambient surface water and groundwater samples. The Private Well Pesticide Sampling (PWPS) Project also provided cyanazine data from monitoring locations throughout the state. In response to the 2017 detections in Dakota County private wells, the MDA collected samples from 84 additional private well locations that had previously indicated the presence of cyanazine-related compounds. The MDA also evaluated the effectiveness of existing in-home point-of-use water treatment systems (primarily reverse osmosis) for removing pesticides (including the cyanazine degradates). The complete cyanazine data report and related water monitoring information is available online at www.mda.state.mn.us/monitoring. The MDA continues to report monitoring results on an annual basis to facilitate review by all stakeholders, and to inform refinement and implementation of MDA programs. In addition, results are submitted to the MDH and MPCA for comparisons to drinking water and surface water health and environmental standards and guidance. Results are also shared with the EPA. The report is also the focus of data review by the Pesticide Management Plan Committee

Additionally, the Groundwater Protection Act directs the MDA to review relevant pesticide-related water quality monitoring data in Minnesota. The MDA routinely obtains water quality pesticide data from the National Water Quality Monitoring Council (NWQMC) Water Quality Portal. The Water Quality Portal is a cooperative service sponsored by U.S. Geological Survey (USGS), the EPA, and the NWQMC. It serves data collected by over 400 state, federal, tribal, and local agencies. The MDA's ambient pesticide monitoring data is also publicly available through the Water Quality Portal.

Interagency Collaboration in Water Quality Data Collection and Analysis

Memoranda of agreement between state agencies continue to be implemented for both groundwater and surface water monitoring. These agreements establish the cooperative basis for sharing monitoring location infrastructure, access, and sample collection and processing. Monitoring cooperative projects in 2019-2020 included lake sampling, groundwater monitoring, and additional surface water sampling in cooperation with MPCA assessments. All water quality data is shared with the MDH and the MPCA and is evaluated in the context of drinking water and surface water body assessment activities. This information is routinely reviewed in the evaluation of pesticide impacts to state water resources.

Due to repeated detections of chlorpyrifos in Minnesota surface waters, the MDA developed a Chlorpyrifos Response Plan which collects information on chlorpyrifos use

and detections to determine the sources of contamination and whether existing label requirements are adequate to protect water quality. It also calls for the development of outreach materials for applicators and growers, such as newsletter articles, mailings, meeting displays, BMPs, concerning methods to reduce chlorpyrifos movement.

BMP Evaluation

There are a range of options available to evaluate the adoption and effectiveness of pesticide BMPs. Rates of BMP adoption can be measured through surveys and other means such as field audits, mail surveys, applicator and dealer surveys, direct interviews (including FANMAP), and focus groups. BMP effectiveness can be measured through plot and small watershed scale projects where specific pesticide use practices can be correlated with water monitoring and pest control data. Many of these options carry a relatively high cost if they are to be conducted in a meaningful manner. The actual implementation of options has been tied directly to the availability of funding and other resources. At a minimum, a sufficient level of groundwater and surface water monitoring is conducted at key locations in Minnesota to determine concentration trends over time sufficiently to evaluate, at a broad level, the need for additional protective actions.

Results of the biennial surveys (see the *Pesticide Use Information* section of this report) of pesticide usage (odd years) and use practices (even years) were reviewed in conjunction with the 2019 PMPC meeting. After a general trend of declining concentrations of pesticides of concern in critical groundwater and surface water, increases of acetochlor and atrazine concentrations were detected in surface water in some regions. Minnesota pesticide sales data show increased sales of these two herbicides in recent years. These results suggest that although adoption of pesticide BMPs can result in reductions in use of certain pesticide and decreased movement to Minnesota groundwater and surface water, other factors, such as weather, cropping patterns, weed resistance, and use of alternative pesticides also play a role in overall water quality changes of specific pesticides.

BMP evaluation is also an outcome of the MDA surveys conducted in cooperation with the National Agricultural Statistics Service (NASS) and its Minnesota field office (MASS). Every two years, a statewide survey is conducted to capture information about corn, soybean, wheat, and hay pesticide use practices. The survey is further described in the *"Pesticide Use Information"* section of this report. Field studies were also designed and conducted in order to evaluate the chlorpyrifos and neonicotinoid seed treatment BMPs. These studies are on-going.

Pesticide Management Plan Committee

The Pesticide Management Plan Committee (PMPC) provides informed diverse comment to the Commissioner of Agriculture on significant water quality evaluation activities and decisions, such as whether to determine that a pesticide meets the statutory definition of

"common detection" for groundwater, or the PMP's definition of a "surface water pesticide of concern." The committee's structure and process preserve the commissioner's statutory authority to make such determinations while engaging important stakeholders in the process of reviewing and commenting on water quality, pesticide use, climatic and other data. The PMPC membership includes the MPCA, the DNR, the MDH along with a representative from industry, farmers and farm organizations, environmental groups, UMN Extension personnel, and other technical experts. The PMPC meets at least one time per calendar year.

The PMPC met in June 2019 and 2020 to discuss recent and historical MDA pesticide water quality monitoring data for groundwater, surface water, and private wells, in addition to other elements of MDA's pesticide management activities related to water quality (see www.mda.state.mn.us/pmpc-members-meeting-information)**.** Topics at the 2019 meeting included discussion of water monitoring data, chlorpyrifos outreach and compliance, and information about neonicotinoid insecticide use and movement in the environment. The 2020 meeting included discussions on water monitoring data, general information about neonicotinoid insecticides, cyanazine in groundwater, and prioritization of chemicals for monitoring.

According to the statutory authority under which the PMPC was created and is convened (Minn. Stat. § 15.0597), the PMPC expires every two years and must be re-established. Therefore, in 2020, the MDA will seek applications for the PMPC for the 2021-2022 biennium.

Standards Development

The MDH is responsible for developing or reviewing health risk standards or guidance for pesticides (and other contaminants) in groundwater and the MPCA is responsible for developing or reviewing regulatory standards or other risk guidance (e.g., benchmarks) for pesticides and other contaminants in surface waters. Both agencies are active participants in PMP implementation and are members of the PMPC. Both are fully informed regarding MDA monitoring efforts and results. The OLA report concluded that the MDA's analysis of pesticide detections is appropriately conservative.

Human Health – In 2019-2020, the MDA consulted with the MDH on the review and prioritization of drinking water guidance for a limited number of pesticides to be addressed under the MDH's Health Risk Limits program for fiscal years 2019 and 2020. Additionally, the MDA has been consulting with the MDH regarding pesticide drinking water risk assessments under the MDH's Contaminants of Emerging Concern. The MDA also consulted with the MDH to develop rapid assessment values for new analytes added to the monitoring list.

Aquatic Life – In 2019-2020, the MDA and the MPCA shared information regarding the occurrence and concentration of surface water pesticide contaminants. The concentrations are compared to the EPA aquatic life benchmarks and the MPCA surface water standards. The MDA sent requests to the EPA in both 2019 and 2020 seeking additional aquatic life benchmarks for new laboratory analytes and newly detected pesticides.

MDA Laboratory Analyses for Pesticides and Pesticide Breakdown Products

The Groundwater Protection Act and the Pesticide Control Law contain references to the need for evaluation of groundwater or surface water for pesticide breakdown products, and the PMP acknowledges this need. During 2019-2020, MDA analytical methods have continued to improve providing the MDA with the ability to analyze water samples for approximately 175 pesticides and degradates in 2020 (Figure IV-1). The OLA report concluded that the MDA has dramatically expanded its water-quality monitoring program over the last decade. Limitations to the MDA's current laboratory methods prevents it from analyzing certain pesticides, including three commonly sold pesticide active ingredients or breakdown products (the mancozeb breakdown product ethylenethiourea, triphenyltin hydroxide, and glufosinate ammonium) with medium-to-high toxicity.

New analytes were added to both the GC MS/MS and LC MS/MS methods in 2019 and 2020.

Three pesticide compounds, dithiopyr, piperonyl butoxide, and trifloxystrobin were added to the GC MS/MS method in 2019 and 2020.

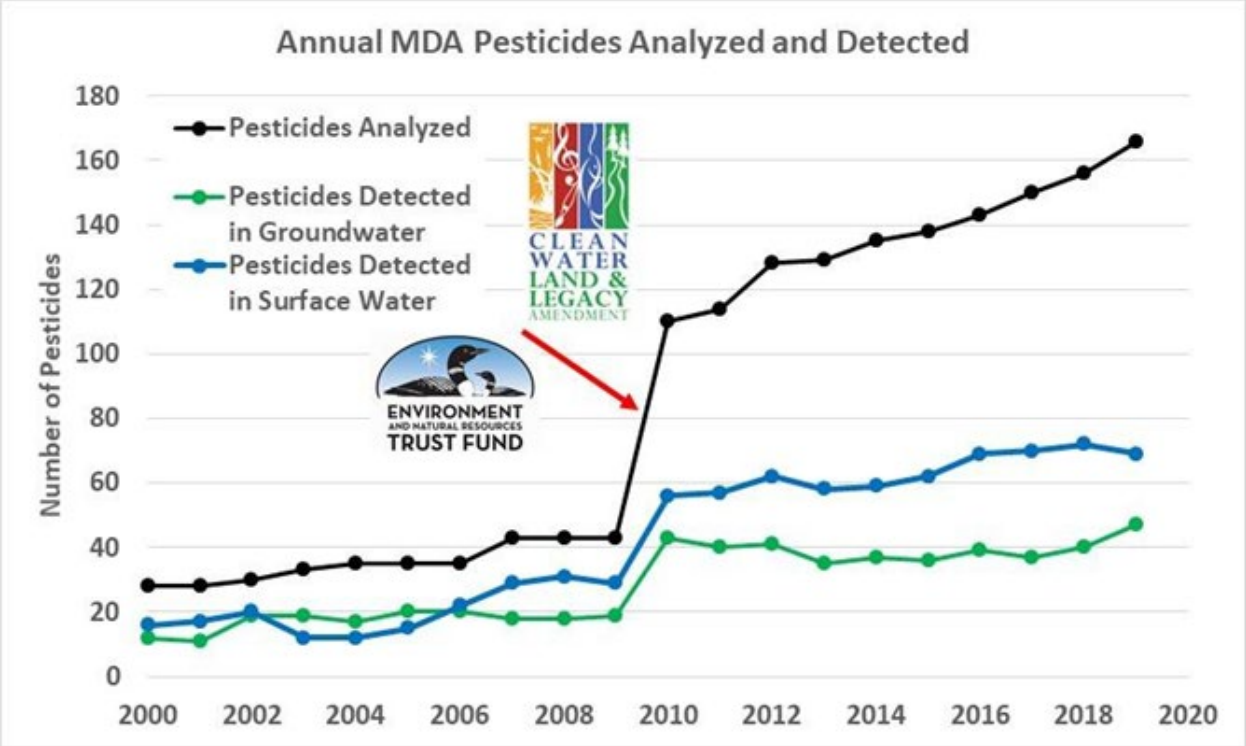
Twenty pesticide compounds were added to the LC MS/MS method in 2019 and 2020: 4-hydroxychlorothalonil, acifluorfen, afidopyropen, bentazon AIBA, bixafen, clorannsulam-methyl, cyanazine acid, cyanazine amide, deethylcyanazine acid, deethylcyanazine amide, deethylcyanazine, fipronil, flutianil, flutianil OC 56574, flutianil OC 56635, mefentrifluconazole, metconazole, pydiflumetofen,, pyrimsulfan, and topramezone. These upgrades were made possible due to improvements in analytical methods on laboratory instruments funded by a grant from the Legislative Citizens Commission on Minnesota Resources (LCCMR) together with Clean Water Land and Legacy funding.

The MDA Laboratory utilized a contract Laboratory to synthesize five cyanazine degradates in early 2019. Using these chemicals as standards, the MDA and contract laboratories developed methods for the analysis of cyanazine degradates in water. The MDA Laboratory utilized a solid phase extraction (SPE) LC-MS/MS method, while the contract laboratory utilized direct aqueous injection (DAI) LC-MS/MS method. Both the MDA Laboratory and the contract laboratory have been conducting analyses for cyanazine degradates in water samples since March 2019. To MDA's knowledge no other lab in the nation other than the MDA lab and the MDA contract lab is currently able to analyze for these cyanazine degradates. A USGS research lab was previously able to analyze for these degradates but was unable to analyze recent samples for them.

The MDA will continue to assess available data and move forward with the OLA recommendation by developing pilot scale studies for groundwater and surface water monitoring in areas where mancozeb, triphenyltin hydroxide and glufosinate ammonium are used. The MDA will work with the MDA Laboratory to secure additional resources

that would allow for special studies without compromising existing monitoring analysis capacity. The MDA has already applied for an LCCMR grant to upgrade equipment in the MDA Laboratory to facilitate analysis of these three pesticides. If successful MDA's anticipates developing new methods by spring of 2023. The MDA will continue to seek additional resource to update existing laboratory equipment including possible Clean Water Land and Legacy Funding.

Figure IV-1. Pesticides analyzed and detected by MDA in groundwater and surface water.



Pesticide Use Information

For the MDA and its stakeholders to evaluate the source of pesticide detections and concentrations in water resources, information on pesticide use is frequently needed or requested.

To better document relationships between water quality and overall pesticide use and use rates and BMP adoption, the MDA continues to work with the USDA, NASS and its Minnesota field office to collect basic pesticide use and use rate information via phone surveys. Pesticide rate and use information is gathered on the four major crops in Minnesota of corn, soybeans, wheat, and hay. Thousands of farmers are surveyed each year to obtain information on active ingredients used, acres treated, and application rates. Pesticide use surveys have been conducted since 2003, www.mda.state.mn.us/chemicals/pesticides/pesticideuse.aspx. NASS also currently surveys these crops through the Agricultural Resource Management Survey and those can be found at:

https://www.nass.usda.gov/Surveys/Guide_to_NASS_Surveys/Chemical_Use/index.php In years that NASS surveys one of the four crops, the MDA forgoes its survey of that crop.

A variety of sources publish information related to pesticide use in Minnesota. Each source has a specific reason for collecting information and a set of assumptions underlying its collection and reporting methods. In 2019-2020, data from some of these sources were available through the MDA's website. Examples of sources and related information include:

1. The MDA's pesticide sales data was added for pesticide active ingredients based on pesticide registrant reporting requirements.

2. The MDA occasionally surveys farms in localized areas (several hundred acres) where community water supplies exhibit vulnerability to land use impacts or where other water quality concerns exist. Survey results are published by the MDA or other cooperators.

3. The MDA cooperates with the DNR on aquatic pesticide permitting and practices; the DNR publishes an annual report on the use of aquatic pesticides permitted under its authority. See www.dnr.state.mn.us/eco/apm/index.html.

4. The MDA also uses U.S. Geological Survey Estimated Annual Agricultural Pesticide Use data, https://water.usgs.gov/nawqa/pnsp/usage/maps/compound_listing.php.

V. Mitigation Activities

Education and Awareness

Educating and raising a pesticide user's awareness of environmental concerns is one of the most important activities necessary to protect the state's water resources from the potential for leaching and runoff of pesticides, and to mitigating observed impacts (regardless of the known or suspected impacts resulting from those impacts). For this reason, there is considerable overlap between prevention and mitigation activities. Those activities listed under *Prevention Activities*, although not repeated in this section, may be considered important components of mitigation activities under the PMP. For additional information, see the MDA website.

Pesticide Best Management Practices Development, Education/Outreach, and Evaluation

The development and promotion of pesticide BMPs is both a prevention activity (see above) and a mitigation activity. See the *Prevention Activities* section of this status report for background information on MDA BMPs. BMP evaluation activities also contribute to mitigating the impact of pesticides to water resources and are described the *Evaluation Activities* section of this report. For additional information, see the MDA website: https://www.mda.state.mn.us/pesticide-fertilizer/pesticide-best-management-practices

Registration Authority to Prevent Unreasonable Adverse Effects

As an outcome of an evaluation report on pesticide regulation conducted by the Office of the Legislative Auditor (March 2006), the MDA has increased its review of pesticide registrations. These reviews are an assessment of the status or potential impacts of a pesticide active ingredient or product that could lead to mitigation activities. The MDA conducted 42 special registration reviews since 2012. More information about special reviews can be found at https://www.mda.state.mn.us/pesticide-special-registration-reviews . To prevent adverse effects of pesticides, the MDA investigated an average of 109 pesticide-misuse complaints per year from 2012 to 2018. The OLA report concluded that the MDA is meeting most of its goals concerning water quality monitoring, investigating pesticide misuse complaints, pesticide BMP development and evaluation, special registration reviews, and waste pesticide collection.

Response to Water Quality Pesticide Impairments

There are 14 waterbodies in Minnesota that are either designated, or proposed to be designated, by the MPCA as impaired on the USEPA 303(d) Impaired Waters List for currently registered pesticides (Table V-1). These listings are a result of the MPCA's assessment of MDA collected surface water pesticide data. The 2019 and 2020 MDA pesticide water quality data will be reviewed by the MPCA as part of the 2022 USEPA 303(d) Impaired Waters List assessment process.

Table V-1. Minnesota pesticide Impairments for currently registered pesticides.

Pesticide	Impaired Waters List Year	Stream	County	Violation that Resulted in Impairment
Acetochlor	2016	Silver Creek	Carver	chronic (3,600 ng/L) Minnesota water quality standard
Chlorpyrifos	2018	Beauford Ditch	Blue Earth	maximum (83 ng/L) Minnesota water quality standard
Chlorpyrifos	2018	Beaver Creek	Murray	maximum (83 ng/L) Minnesota water quality standard
Chlorpyrifos	2018	Chetomba Creek	Renville	maximum (83 ng/L) Minnesota water quality standard
Chlorpyrifos	2020	Double Lake	Cottonwood	chronic (41 ng/L) Minnesota water quality standard
Chlorpyrifos	2016	Dry Weather Creek	Chippewa	maximum (83 ng/L) Minnesota water quality standard
Chlorpyrifos	2020	Dutch Creek	Martin	maximum (83 ng/L) Minnesota water quality standard
Chlorpyrifos	2014/2016	Grand Marais Creek	Polk	maximum (83 ng/L) Minnesota water quality standard
Chlorpyrifos	2018	Jack Creek	Jackson	maximum (83 ng/L) Minnesota water quality standard
Chlorpyrifos	2018	Lac qui Parle River	Lac qui Parle	maximum (83 ng/L) Minnesota water quality standard
Chlorpyrifos	2018	Sleepy Eye Creek	Redwood	maximum (83 ng/L) Minnesota water quality standard
Chlorpyrifos	2014	Tamarac River	Marshall	maximum (83 ng/L) Minnesota water quality standard
Chlorpyrifos	2020	Three Mile Creek	Lyon	maximum (83 ng/L) Minnesota water quality standard
Chlorpyrifos	2020	Yellow Medicine River	Yellow Medicine	maximum (83 ng/L) Minnesota water quality standard

Three waterbodies have been removed from the USEPA 303(d) Impaired Waters List for currently registered pesticides. The Le Sueur River and Beauford Ditch were designated as impaired for acetochlor in 2008 and were removed from the USEPA 303(d) Impaired Waters List in 2014. Seven Mile Creek was designated as impaired on the 2012 Impaired Waters List for chlorpyrifos and was removed from the USEPA 303(d) Impaired Waters

List in 2018. Removal from the USEPA 303(d) Impaired Waters List followed several years of water quality monitoring without elevated pesticide detections.

VI. Other Pesticide-Related Environmental Activities

EPA Office of Pesticide Programs

In 2019-2020, MDA staff held membership on the State-FIFRA Issues Research and Evaluation Group, the Pesticide Operations and Management Working Committee, and the Environmental Quality Imitative (EQI) group of Association of American Pesticide Control Officials (AAPCO). These groups address issues concerning pesticide regulations, registration, and label language.

Other MDA Pesticide Programs

The MDA has several pesticide-related programs designed to ensure the safe and proper use of pesticides and to reduce the risk from pesticides to human health and the environment. These programs address virtually every aspect of pesticide use and management in Minnesota. These include the following:

- Waste pesticide collection and empty pesticide container collection
- Pesticide applicator licensing and certification
- Permitting and inspection of pesticide storage and chemigation activities
- 24-hour emergency response to pesticide spills
- Environmental cleanup of contaminated pesticide sites and facilities
- Rapid cleanups to facilitate property transfers and development of rural brownfields through the Agricultural Voluntary Investigation and Cleanup (AgVIC) program
- Partial reimbursement of costs for environmental cleanup of pesticide releases through the Agricultural Chemical Response and Reimbursement Account (ACRRA)
- Pesticide use inspection to ensure compliance with pesticide labeling
- Pesticide misuse investigations
- Pesticide use data collection
- Enforcement of violations of pesticide law
- Pesticide related bee kill investigations

Activities Coordinated with Other State Agencies

Other state agencies have statutory responsibilities related to the protection of Minnesota's water resources. These inter-agency activities provide a forum for the discussion and coordination of many PMP-related issues. Some of these activities are mentioned elsewhere in this report and are included in the summary below. During 2019-2020:

- The MDA worked closely with other state commissioners and their staff through the Clean Water Council and other interagency workgroups on the quality and monitoring of groundwater and surface water.
- The MDA, MPCA, and MDH continued to cooperate on the implementation of agreements on groundwater and surface water monitoring. These agreements have been published as the *Integrated Ground Water Quality Monitoring Strategy* and the *Cooperative Surface Water Quality Monitoring System* signed by the commissioners of applicable agencies. The agreements represent the agencies' joint plan for conducting water quality monitoring on a statewide basis in Minnesota.
- The MDA continued to facilitate communications between the EPA's Office of Pesticide Programs and MDH toxicologists in order to obtain necessary data for establishment of drinking water and ecological guidance for assessment of pesticide impacts.
- The MDA continued to work with the MPCA on issues related to the development of surface water standards, and on improving coordination between surface water monitoring methods and MPCA's data needs for making surface water impairment decisions and implementation of its Total Maximum Daily Load initiatives.
- The MDA participated in technical workgroups and science advisory panels convened by the MDH to address Environmental Public Health Tracking (EPHT) Program and related biomonitoring concerns. The biomonitoring component of the EPHT seeks to evaluate the feasibility of measuring contaminants, including pesticides, in human body fluids and tissues as an indicator of potential health impacts. The health tracking component explores the feasibility of establishing indicators of health outcomes by linking the presence of environmental chemicals, including pesticides, with chronic or acute health issues.
- The MDA participated in the Interagency Pollinator Protection Team which advises the governor and other agencies on pollinator policy and programs.

VII. Conclusion

The MDA fully supports the PMP through these activities:

- Prevention of water resource contamination with pesticide continues to be the focus of PMP implementation.
- The MDA continues to expand groundwater and surface water monitoring and surveying continues and has been expanded in critical areas.
- Groundwater samples continue to be analyzed for additional pesticides and degradation products. Limitations to MDA's laboratory methods prevent it from analyzing a handful of high use pesticides and their breakdown products.
- MDA monitoring data is being managed, reported and shared efficiently and effectively.
- The MDA has developed 21 Best Management Practices (BMPs) and evaluation of BMPs has resulted in changes to recommended practices.

- The MDA actively promotes and evaluates BMPs for all herbicide use in the state, and for six herbicides that have been determined to be a concern for groundwater or surface water.
- The MDA has developed BMPs for additional water quality pesticide issues of concern.
- Where specific water quality pesticide concerns require enhanced attention (e.g., in watersheds with impairments due to pesticides), the MDA has cooperated with other state agencies to mitigate impacts while enhancing prevention and evaluation efforts.

This report fulfills the MDA's statutory requirement to provide a PMP biennial status report for 2019 and 2020.