Minnesota Department of Agriculture

Groundwater Quality Monitoring

2017 Annual Work Plan

March 2017

MONITORING and ASSESSMENT UNIT
ENVIRONMENTAL SECTION
PESTICIDE & FERTILIZER MANAGEMENT DIVISION

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1. INTRODUCTION

The purpose of this document is to describe planned groundwater monitoring activities of the Minnesota Department of Agriculture (MDA) Monitoring and Assessment Unit (MAU) for 2017. Direction for groundwater monitoring by MDA is derived from the Minnesota Pesticide Control Law (M.S. 18B) and the Minnesota Groundwater Protection Act (M.S. 103H). Specific information describing goals, objectives and practices pursued in implementing the charge to monitor groundwater by the MAU are described in the MAU's Groundwater Monitoring Design Document and its supporting material (QAPP, SOPs, etc.). Planning and prioritization are essential to the practical implementation of monitoring to meet MDA goals and objectives related to groundwater. Projects implemented by the MAU are pursued to optimize outcomes from limited resources, thus the MAU is constantly evaluating projects and procedures to try to maximize benefits and minimize costs.

2. LABORATORY ANALYTICAL METHODS

During 2017 the MDA laboratory will utilize a variety of methods for analyzing water samples collected by the monitoring program. The methods for the pesticide analysis are: GC-MS/MS - gas chromatography with tandem mass spectrometry; LC-MS/MS - liquid chromatography with tandem mass spectrometry; and glyphosate. Nitrate-nitrogen will also be analyzed. The list of chemical analytes and associated methodology for 2017 is located in Appendix A.

Samples from all sites (monitoring wells, springs and domestic wells) unless specifically stated in the sections below, will be analyzed by GC-MS/MS, LC-MS/MS, glyphosate and nitrate-nitrogen methods by the MDA laboratory.

All sites will be sampled once for glyphosate in 2017. The glyphosate samples will be collected at the first sampling event at the sample location. This means that, for locations with two scheduled sampling events, glyphosate will only be collected in the April/May sampling round.

3. GROUNDWATER MONITORING FRAMEWORK

The MAU has divided the state into ten Pesticide Monitoring Regions (PMRs), as shown in Figure 1. PMRs are based on areas with similar cropping practices, soil characteristics, hydrogeologic conditions, climate, and agro-ecosystem classifications. PMRs are delineated on county lines to facilitate the evaluation of the results by farmers, the general public and others. Table 1 provides detailed descriptions and characteristics of each PMR.

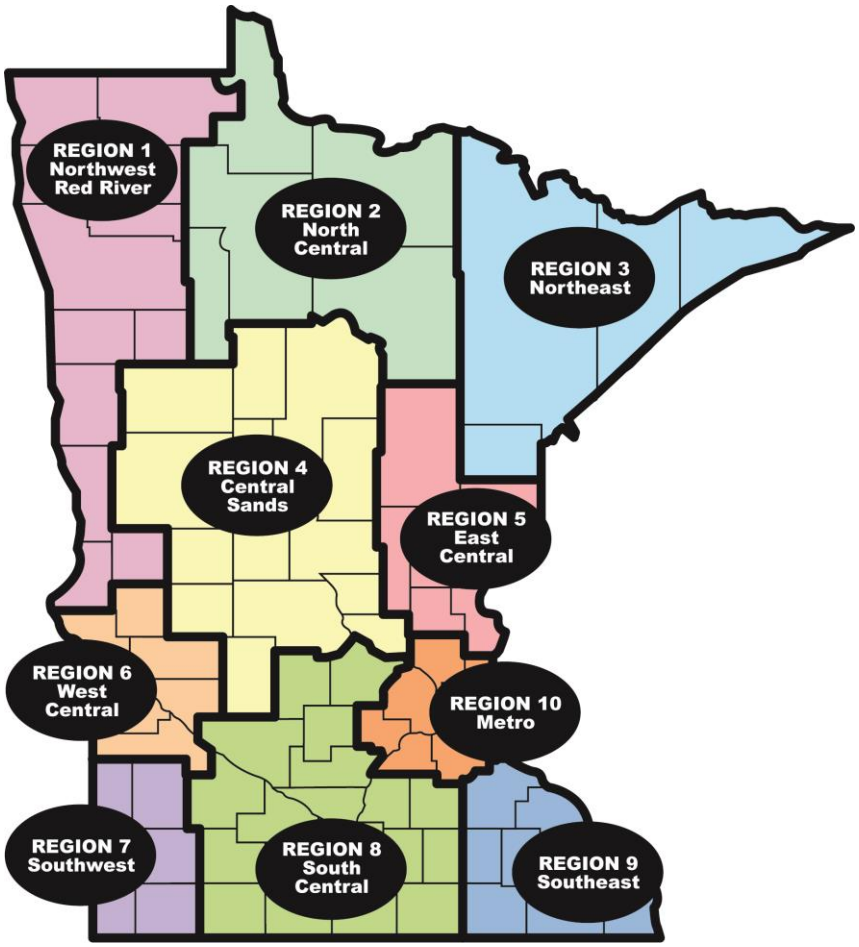

Figure 1. Pesticide Monitoring Regions (PMRs).

Table 1. MDA's Pesticide Monitoring Regions (PMRs) descriptions and characteristics.

PMR	Region	Counties Included	Physical Characteristics
1	Northwest Red River	Kittson, Roseau, Marshall, Pennington, Red Lake, Polk, Norman, Mahnomen, Clay, Wilkin, Traverse, Grant	Glacial lake bed w/ high clay content soils 150 to 250 ft thick; gravel aquifers buried under clay; beach ridge deposits of sand and gravel; high value agriculture of sugar beets and small grains
2	North Central	Lake of the Woods, Koochiching, Beltrami, Clearwater, Itasca	Mostly forested and bog; little agriculture in discontinuous areas; groundwater resources quite variable
3	Northeast	St. Louis, Lake, Cook, Carlton	Forested with shallow bedrock; agriculture nearly nonexistent
4	Central Sands	Becker, Hubbard, Cass, Crow Wing, Morrison, Wadena, Otter Tail, Todd, Douglas, Pope, Stearns, Benton, Sherburne, Kandiyohi	Large glacial outwash sand plains that are highly sensitive to surface activities; high value potatoes and other crops; irrigated fields are common
5	East Central	Aitkin, Pine, Mille Lacs, Kanabec, Chisago, Isanti	Glacial outwash and lacustrine sands; low pH soils; generally poor cropping conditions; some irrigation; some potato production
6	West Central	Stevens, Big Stone, Swift, Chippewa, Lac Qui Parle, Yellow Medicine	Some areas of glacial outwash sand; thin and narrow alluvial aquifers; many buried sand aquifers; mix of corn and soybeans; thick glacial tills in some areas
7	Southwest	Lincoln, Lyon, Pipestone, Murray, Rock, Nobles	Aquifers consist of highly sensitive alluvial river valley deposits; fractured quartzite formations and well protected deep cretaceous sediments; sufficient water supply is hard to come by; rural water systems are large and growing
8	South Central	Wright, Meeker, Renville, McLeod, Sibley, Nicollet, Le Sueur, Rice, Steele, Waseca, Blue Earth, Brown, Redwood, Cottonwood, Watonwan, Jackson, Martin, Faribault, Freeborn	A mix of glacial outwash sands; deep glacial tills, glacial lacustrine deposits; windblown silts, river valley deposits; and deep bedrock aquifers; sensitivity varies accordingly; corn and soybeans; intensive ag production; most productive land in the state
9	Southeast Karst	Goodhue, Wabasha, Winona, Olmsted, Dodge, Mower, Fillmore, Houston	Karst geology that is highly sensitive to surface activities; shallow windblown silt and glacial till soils; springs, sinkholes and disappearing streams; high value trout streams; extremely shallow to very deep bedrock aquifers; some river valley alluvial deposits
10	Metro	Anoka, Ramsey, Washington, Dakota, Scott, Carver, Hennepin	Urban, suburban and transitional areas; some irrigated farming; hobby farms; much farming conducted on leased land by relatively large farm operations; outwash sand and gravel to deep bedrock aquifers

Specific monitoring designs for each region are based on the characteristics of the specific region. Water quality samples are collected and analyzed to facilitate evaluation of conditions within, and between, each region. Five PMRs (1, 5, 6, 7, and 8) are included in a common design. Two PMRs (4 and 9) have unique monitoring designs based on their distinctive land use, hydrogeology, or other important characteristics. PMR 10 is monitoring urban land use settings. PMRs 2 and 3 are not included in the monitoring program due to very small amounts of agricultural production in these heavily forested areas.

Figure 2 presents the location of the 2017 proposed sampling locations, except for the urban wells. The locations of the urban wells are determined in collaboration with the MPCA (see Section 3.1.4), and the exact locations will be presented in the annual report after sampling has been completed.

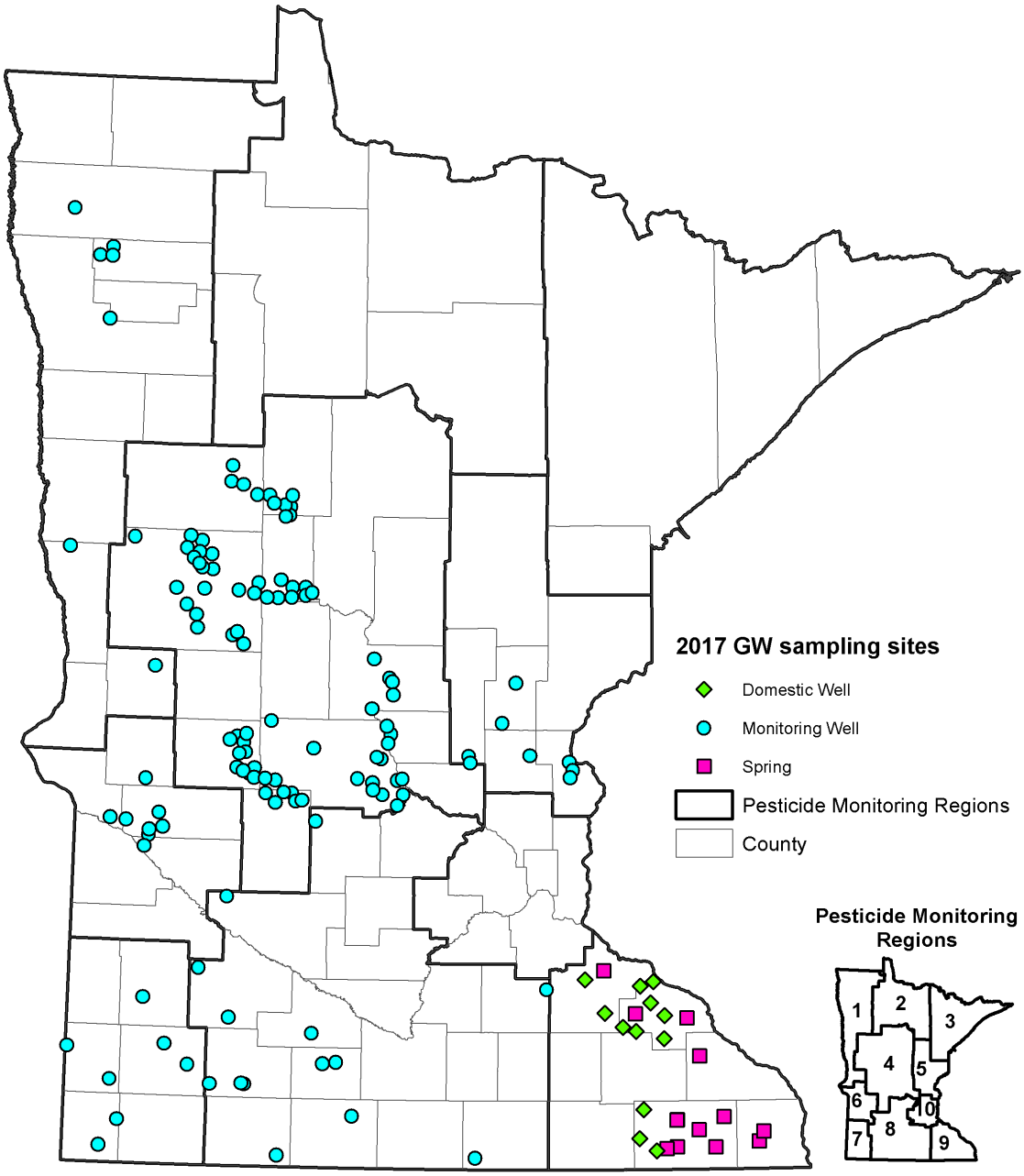

Figure 2 Groundwater Sampling Sites for 2017.

3.1. PMR Monitoring

The wells and springs to be sampled are detailed in tables in Appendix B. The number of expected samples by analytical method and PMR is presented in Appendix C. Under certain circumstances not all locations can be sampled during the season. This could be due to: well condition, low water in the wells due to drought, weather, or access limitations among other things. MDA will attempt to sample all of the locations specified in this workplan during the sampling season.

3.1.1. PMRs 1, 5, 6, 7 and 8

The 2017 sampling plan for PMRs 1, 5, 6, 7 and 8 consists of seven to fourteen wells per PMR. Each well is sampled twice a year, once during the spring (April or May) and once during the fall (October or November). Well locations are presented in Figure 2.

3.1.2. PMR 4

The 2017 sampling plan for PMR 4 consists of 79 locations containing nested wells and one location with a single well. The majority of samples in PMR 4 will be collected from the shallowest well in the nest that intersects the water table and is able to produce enough water for a sample. Each locations will be sampled once during 2017, either in the spring (April or May) or in the fall (October or November).

There are eight locations with a co-located deep well and these locations will have samples collected from the shallow well and from the deep well twice during 2017, once in the spring and once in the fall. Automated water level monitoring will continue at the eight deep well locations within PMR 4 during 2017.

With exception of the deep well locations, all wells are distributed to each sampling period by a randomization procedure. Well locations are presented in Figure 2.

3.1.3. PMR 9

The 2017 sampling plan for PMR 9 includes 13 springs and 12 domestic wells.

3.1.3.1. Springs

Each spring will be sampled two times during the year. The Minnesota Department of Natural Resources (DNR) fish hatchery springs will be sampled in February and in August; the remaining ten springs will be sampled in June and September. The sampling of springs is intended to target base flow (groundwater) periods instead of storm flow (rain event) periods. Spring locations are presented in Figure 2.

MDA staff will collect samples from the DNR hatcheries per the MDA Pesticide and Fertilizer Management Division - DNR Division of Fish and Wildlife, Section of Fisheries Spring Sampling Agreement. MDA staff will notify DNR hatchery staff with regards to when they will be on site to sample the springs so that DNR staff can observe/assist, if necessary.

3.1.3.2. Domestic Wells

The domestic wells will be sampled in September to coincide with the September sampling from the springs.

3.1.4. Urban

Wells in urban settings are sampled to evaluate for the presence of pesticides, some of which may be different than those used in agricultural areas. In addition, some of the urban areas sampled contain significant amounts of agricultural land that are in the process of conversion to suburban development. Samples are typically collected from urban areas within PMRs 2, 4, 9 and 10. In 2017, 20 wells are planned to be sampled.

The wells in the MDA's urban region are sampled by the Minnesota Pollution Control Agency (MPCA) as part of their groundwater monitoring program. Based on MDA established criteria, the MPCA selects a subset of the wells (in collaboration with MDA staff) that the MPCA is sampling for their program. These selected wells are also sampled for pesticides. The pesticide samples are collected by MPCA staff at the same time as their regular samples and submitted to the MDA laboratory for pesticide analysis. The samples will be collected during the summer months of July and August, if possible, but may be collected as late as October. The samples will be analyzed using GC-MS/MS, LC-MS/MS, and glyphosate methods. Nitrate-nitrogen will not be analyzed by the MDA laboratory for these samples because the MPCA includes it in their analytical suite.

These sample locations are best considered mixed-use, although summary statistics will be prepared for all urban sites together. All sampling work by the MPCA is conducted as outlined in the MDA/ MPCA groundwater monitoring Memorandum of Agreement (MOA) (see MDA website).

4. MAINTENANCE OF NETWORK WELLS AND SITES

4.1. Changes to the Groundwater Monitoring Well Network in 2016

Work is ongoing in evaluating, updating, and improving the MDA monitoring well network. New wells are added in locations where there has been little or no monitoring in the past, or when wells are damaged or removed by the landowner/well owner. Where possible, the damaged or removed wells are replaced in the same or nearby locations.

In 2016, two wells were added to the network. One was a new location in Sherburne County (in PMR 4). The second well was a replacement of a well in Rock County (PMR 7) that was damaged. The original well was sealed, and a new well was installed close to the same location.

Table 2 lists the wells that were installed or replaced in 2016 and the reason that the work was conducted. The well installation work was conducted in partnership with the DNR, whose licensed well driller conducted the work under the direction of a MDA hydrologist.

Table 2. Changes to the MDA network wells in 2016.

Well Unique Number	County	Activity	Reason for work	Date completed
816908	Sherburne	Installed	New well in an area for increasing the robustness of PMR 4.	6/17/2016
483549	Rock	Sealed	Well replaced because it was damaged by a tractor.	8/18/2016
816916	Rock	Installed	Replacement for 483549	8/18/2016

4.2. Replacement wells

Occasionally, wells in the network may need to be replaced, closed or discontinued, for various reasons. When necessary, replacement wells will be located as close to the existing well as possible. If a replacement well cannot be installed near the existing well, a new location, based on site selection criteria in the program design document, will be selected. Wells will also need major maintenance or repair on an unknown frequency. In 2015, the MDA contracted with the DNR to provide well drilling, sealing, and maintenance services. This agreement extends into 2017 and is expected to be continued into 2018. Currently, 45 well or well nests have been identified as possible candidates for replacement within the existing MDA network. The exact number of wells to be replaced in 2017 is uncertain at this time and is dependent upon funding and the driller's schedule.

4.3. Installation of wells at new locations

Additional wells at previously unmonitored locations may be installed as resources allow. At the time of the publication of this document, potential new sites in PMRs 1, 4, and 9 are being investigated. The installation of any new wells in 2017 will depend upon the availability of funds, well siting, cooperation with landowners, and personnel scheduling.

4.4. Evaluation of existing wells

Existing monitoring wells installed by other state or federal agencies remain the most cost effective means of collecting groundwater samples. The program will continue to assess existing wells of which it becomes aware. When a suitable, functioning well is discovered, it may or may not be immediately added to the program based on the Monitoring Unit resources or laboratory sample load constraints. All such wells will be added to a list the program will maintain for future reference when expansion of the network becomes possible or necessary.

5. SPECIAL PROJECTS FOR 2017

5.1. Private Well Pesticide Sampling Project

At the direction of the Minnesota Legislature (HF1183 Article 2, Sec. 2), the MDA will continue evaluating pesticide presence and magnitude in select private residential drinking water wells for the Private Well Pesticide Sampling (PWPS) project. Selections will come from a population of wells in sensitive geologic areas that were previously sampled by homeowners for nitrate-

nitrogen as part of the MDA groundwater nitrate-nitrogen Township Testing Program in coordination with the Nitrogen Fertilizer Management Plan.

The primary goal of the PWPS project is to provide information to homeowners and the general public on the presence of pesticides in private drinking water wells in geologically sensitive areas of Minnesota. This will be achieved by use of a contract laboratory to analyze water samples at low-level concentrations for a wide suite of pesticides and pesticide degradates. Nitrate-nitrogen samples will also be collected and analyzed.

The MDA plans to sample approximately 1,300 wells in Becker, Benton, Dodge, Douglas, Hubbard, Kandiyohi, Nobles, Todd, Rock, and Winona Counties during the 2017 sampling season. Further, approximately 120 wells in Washington County that were sampled previously and analyzed by a different laboratory, are planned to be resampled.

5.2. Coordination with DNR, MPCA and MDH

It is anticipated that coordination on projects with the DNR, MPCA, and MDH will occur in 2017. Projects with the DNR relate to installing new wells or sharing existing monitoring wells around the state. Cooperative sampling projects with the MPCA and the MDH occur on an as-needed basis, which is anticipated to continue in 2017.

5.2.1. Establishing a Permanent Well Network in PMR 10

The MDA is evaluating the benefit of establishing a permanent network of monitoring wells using the MPCA's well network in PMR 10. The selected wells would be the only ones within the MPCA's network that would be sampled for the MDA's urban sampling. This is a change from the current sampling practices, which are detailed in Section 3.1.4.

The benefits of establishing a permanent network is that the data collected would allow for consistent statistical evaluation, including trends over time. It would also be reflective of the networks established in other PMRs. The urban network would continue to use 20 wells.

Design criteria for determining which wells would be selected for the network are being developed. Some of the factors that need to be addressed are:

- Land use around the well locations, both current and future
- Review of the historical detections of all compounds and possible relationship to land use
- Review of detection frequency of all detected compounds
- Geology at each well site

If this design can be developed and approved by MDA, sampling from the permanent network may begin in 2017.

5.3. Coordination with Bayer Crop Science

Bayer Crop Science (BCS) has registered isoxaflutole for use in Minnesota. As part of the Commissioner's Order related to the registration of isoxaflutole, BCS is continuing to install and sample monitoring wells in areas of the state where isoxaflutole could be used. The MDA is

coordinating with BCS on the location and installation of these wells for compliance with the specifications set forth in the Commissioner's Order.

To date, BCS has installed only three monitoring wells and began sampling them for isoxaflutole and isoxaflutole DKN in 2016. The MDA collected and analyzed replicate samples along with Bayer. Results thus far indicate that neither isoxaflutole, nor it's degrade isoxaflutole DKN, was detected in these wells.

BCS will continue to install and sample new and existing wells in 2017. The MDA will continue to collect and analyze split samples to validate the BCS results with the MDA laboratory.

6. DATA ANALYSIS AND REPORT

During 2017, analysis of data for the 2016 annual MAU monitoring report began in January, with a report completion goal of April 30, 2017. Goals and objectives of the annual report are largely established by the information needs of the MDA pesticide management programs.

Additional reports covering specific components of the groundwater program may be completed during the year. Although no specific reports have yet been established, the program is considering detailed reports on various aspects of the monitoring program.

7. QUALITY ASSURANCE SAMPLING

The groundwater monitoring program collects additional samples used to ensure the quality of the program's results. Samples to be collected in 2017 include field blanks, replicates, field equipment blanks, and field equipment post-lab cleaning blanks, all of which are submitted to the laboratory as regular samples. Replicates will be collected at a rate of 1 in 20 regular samples (5%), while field blanks will be collected at a rate of 1 in 40 regular samples (2.5%). Field equipment blanks (collected in the field between sites) and field equipment lab cleaning blanks (collected in the lab following cleaning of the equipment and prior to sampling occurs) are collected by field staff that utilize equipment (such as peristaltic pumps) and will each be collected at a rate of 1 in 80 regular samples (1.25%). Approximately 12 sets of replicates, 6 sets of field blanks, 3 sets of field equipment blanks, and 3 sets of field equipment post-lab cleaning blanks will be collected during 2017. Data from the quality assurance samples will be checked against regular sample results as they become available. Results will additionally be shared with the analytical laboratory for the purposes of their internal quality control process.

Appendices

Appendix A
Laboratory Analysis

List of 2017 target pesticide and pesticide degradates for analysis in groundwater, with associated method reporting limits (MRLs).

*** New analyte for 2017.**
**** Analytical method changes from GC to LC in 2017. The MRL is the same or lower with the LC method.**

Common Name	Type	GC-MS/MS MRL (ng/L)	LC-MS/MS MRL (ng/L)
2,4,5-T	Herbicide		50
2,4,5-TP	Herbicide		50
2,4-D	Herbicide		8.3
2,4-DB	Herbicide		20
Acetamiprid	Insecticide		25
Acetochlor	Herbicide	30	
Acetochlor ESA	Herbicide Degradate		30
Acetochlor OXA	Herbicide Degradate		33.3
Alachlor	Herbicide	30	
Alachlor ESA	Herbicide Degradate		41.6
Alachlor OXA	Herbicide Degradate		33.3
Aldicarb Sulfone	Insecticide Degradate		15
Aldicarb Sulfoxide	Insecticide Degradate		50
Aminopyralid	Herbicide		25
Atrazine	Herbicide	30	
DEDI Atrazine	Herbicide Degradate		50
Deisopropylatrazine**	Herbicide Degradate		25
Desethylatrazine	Herbicide Degradate	50	
Hydroxyatrazine	Herbicide Degradate		6.7
Azoxystrobin	Fungicide		10
Benfluralin	Herbicide	25	
Bensulfuron-methyl	Herbicide		16.7
Bensulide	Herbicide		250
Bentazon	Herbicide		5
Benzovindiflupyr	Fungicide		50
Bicyclopyrone	Herbicide		10
Bicyclopyrone SYN503870	Herbicide Degradate		100
Bifenthrin	Insecticide	20	
Boscalid	Fungicide		50
Bromacil	Herbicide		30
Bromoxynil	Herbicide		25
Carbaryl	Insecticide		25
Carbendazim	Fungicide		10

Common Name	Type	GC-MS/MS MRL (ng/L)	LC-MS/MS MRL (ng/L)
Carbofuran	Insecticide		13.3
Chlorantraniliprole	Insecticide		50
Chlorimuron-ethyl	Herbicide		20
Chlorothalonil	Fungicide	50	
Chlorpyrifos	Insecticide	40	
Chlorpyrifos Oxon	Insecticide Degradate		40
Clomazone	Herbicide	15	
Clopyralid	Herbicide		41.6
Clothianidin	Insecticide		25
Cyanazine	Herbicide		25
Cyantraniliprole	Insecticide		100
Cyfluthrin	Insecticide	100	
Diazinon	Insecticide	30	
Diazinon Oxon	Insecticide Degradate	75	
Dicamba	Herbicide		50
Dichlobenil	Herbicide	5	
Dichlorprop	Herbicide		50
Dichlorvos	Insecticide	15	
Dicrotophos	Insecticide		25
Difenoconazole	Fungicide		25
Dimethenamid	Herbicide	15	
Dimethenamid ESA	Herbicide Degradate		6.7
Dimethenamid OXA	Herbicide Degradate		10
Dimethoate**	Insecticide		50
Dinotefuran	Insecticide		25
Disulfoton	Insecticide	60	
Disulfoton Sulfone	Insecticide		20
Diuron	Herbicide		13.3
EPTC	Herbicide	10	
Esfenvalerate	Insecticide	150	
Ethalfluralin	Herbicide	50	
Ethofumesate	Herbicide	50	
Flufenacet OXA	Herbicide Degradate		8.3
Flumetsulam	Herbicide		50
Flupyradifurone	Insecticide		10
Flutriafol	Fungicide		10
Fluxapyroxad	Fungicide		10 (estimated)
Fonofos	Insecticide	15	

Common Name	Type	GC-MS/MS MRL (ng/L)	LC-MS/MS MRL (ng/L)
Glyphosate	Herbicide		1,020
AMPA	Herbicide Degradate		5,090
Halauxifen Methyl*	Herbicide		10 (estimated)
Halauxifen Methyl Metabolite*	Herbicide Degradate		25
Halosulfuron-methyl	Herbicide		30
Hexazinone	Herbicide		10
Imazamethabenz-methyl	Herbicide		5
Imazamethabenz Acid	Herbicide Degradate		10
Imazamox	Herbicide		13.3
Imazapic	Herbicide		10
Imazapyr	Herbicide		8.3
Imazaquin	Herbicide		16.7
Imazethapyr	Herbicide		6.7
Imidacloprid	Insecticide		20
Imidacloprid Olefin*	Insecticide Degradate		50
Imidacloprid Urea*	Insecticide Degradate		50
Isoxaflutole	Herbicide		40
Isoxaflutole DKN	Herbicide Degradate		50
lambda-Cyhalothrin	Insecticide	75	
Linuron	Herbicide		20
Malathion	Insecticide	50	
Mandestrobin*	Fungicide		25
MCPA	Herbicide		5
MCPB	Herbicide		20
MCPP	Herbicide		50
Mesotrione	Herbicide		50
Metalaxyl	Fungicide		8.3
Methoxychlor	Insecticide	50	
Metolachlor	Herbicide	25	
Metolachlor ESA	Herbicide Degradate		10
Metolachlor OXA	Herbicide Degradate		10
Metribuzin	Herbicide	75	
Metribuzin DA**	Herbicide Degradate		25
Metribuzin DADK**	Herbicide Degradate		500
Metribuzin DK**	Herbicide Degradate		500
Metsulfuron-methyl	Herbicide		23.3
Momfluorothrin*	Insecticide		50
Myclobutanil	Fungicide		10

Common Name	Type	GC-MS/MS MRL (ng/L)	LC-MS/MS MRL (ng/L)
Nicosulfuron	Herbicide		26.6
Norflurazon	Herbicide		20
Norflurazon-desmethyl	Herbicide Degradate		50
Oxadiazon	Herbicide	75	
Oxathiapiprolin*	Fungicide		100
Oxydemeton-methyl	Insecticide		20
Parathion-methyl	Insecticide	100	
Parathion-methyl Oxon	Insecticide Degradate		25
Pendimethalin	Herbicide	75	
Phorate	Insecticide	25	
Picloram	Herbicide		41.6
Picoxystrobin	Fungicide		50
Prometon	Herbicide	100	
Prometryn	Herbicide		3.3
Propachlor	Herbicide	30	
Propachlor ESA	Herbicide Degradate		30
Propachlor OXA	Herbicide Degradate		10
Propazine	Herbicide	25	
Propiconazole	Fungicide		10
Pyraclostrobin	Fungicide		25
Pyroxasulfone	Herbicide		50
Saflufenacil	Herbicide		15
Sedaxane	Fungicide		75
Siduron	Herbicide		6.7
Simazine	Herbicide	75	
Sulfometuron-methyl	Herbicide		8.3
Tebuconazole	Fungicide		10
Tebupirimiphos	Fungicide	30	
Tembotrione	Herbicide		50
Terbufos	Insecticide	30	
Tetraconazole	Fungicide		10
Thiacloprid	Insecticide		50
Thiamethoxam	Insecticide		25
Thifensulfuron-methyl	Herbicide		16.7
Thiobencarb	Herbicide		8.3
Tolfenpyrad	Insecticide	100	
Triallate	Herbicide	50	
Triasulfuron	Herbicide		23.3

Common Name	Type	GC-MS/MS MRL (ng/L)	LC-MS/MS MRL (ng/L)
Triclopyr	Herbicide		50
Trifluralin	Herbicide	50	
zeta-Cypermethrin	Insecticide	500	

Nutrient target analyte list.

Compound	Method	MRL (mg/L)
Nitrate/Nitrite-Nitrogen	LAB-MTH-0041	0.40

Appendix B
Sampling Locations

Wells scheduled for sampling in PMRs 1, 5, 6, 7 and 8 during spring and fall 2017.

PMR	MDA#	Unique Well #
1	26101	747018
1	45006	249811
1	57003	244122
1	57005	244119
1	57008	244120
1	60201	267838
1	84101	747019
5	13101	747014
5	13102	747015
5	13103	747016
5	30014	689971
5	33102	792531
5	33101	747017
5	48101	747012
5	48102	747011
6	6101	733732
6	12101	733730
6	75002	244492
6	76047	708365
6	76045	244529
6	76101	733729
6	76102	733731
6	76104	733727
7	42101	733723
7	51008	623070
7	51101	733717
7	59101	733721
7	59102	733722
7	67102	733718
7	67010	816916
8	8101	733710
8	17007	492127
8	17101	733715
8	17102	733714
8	24101	792530
8	32101	733713
8	46101	733712
8	47101	733736
8	64103	733725
8	64016	689980
8	65101	747010
8	66101	747009
8	83102	792534
8	83103	809300

Wells scheduled for sampling in PMR 4 during spring and fall 2017.

*= sites with deep wells

2nd quarter (spring 2017)	2nd quarter (spring 2017)	4th quarter (fall 2017)	4th quarter (fall 2017)
03-I2	56-F8	03-I3	61-F3
03-J3	56-F9	03-K4*	61-G2*
03-K4*	56-I6	05-B2	61-G3
29-A8*	56-J10*	29-A8*	61-H6
05-C3	56-K5	29-C7	73-A1
29-A7	56-K6	29-C9	73-A6*
29-B8	61-F4	34-D2	73-B6
29-C8	61-F5	34-E1	73-E3
34-C1	61-G2*	49-D5	73-J6
34-D1	61-G4	49-D9*	73-J7
34-E2	61-G5	49-F6	73-K3
34-F2	61-G6	56-A1	73-L6
49-D9*	61-H5	56-D6	73-L8
49-F7	73-A6*	56-F2	73-M7
49-F8	73-I6	56-F3-3	80-A8
56-E1	73-J4	56-G3	80-B1*
56-E2	73-K4	56-G4	80-B7
56-E3	73-K7	56-I9	80-B8
56-E7	80-B1*	56-I10	80-C7
56-F1	80-C8	56-J10*	80-D7
56-F4	80-D8	61-F2	80-E8*
56-F6	80-E8*		
	71101		

Springs scheduled for sampling in PMR 9 during spring and fall 2017.

Spring Name	County	Schedule
Big BCVSP	Houston	June & September
Canfield	Wabasha	June & September
Cold South	Wabasha	June & September
Fountain E	Fillmore	June & September
Fountain W	Fillmore	June & September
Burr Oak	Fillmore	June & September
Rainy	Fillmore	June & September
Spring Creek	Goodhue	June & September
Hvoslef	Fillmore	June & September
Highway 76	Houston	June & September
Crystal Springs	Winona	Winter (February) & summer (August) quarters
Lanesboro	Fillmore	Winter (February) & summer (August) quarters
Peterson	Fillmore	Winter (February) & summer (August) quarters

Appendix C
Analysis Goals by PMR

2017 Analysis Goals by PMR.

Setting	PMR #	GC-MS/MS	LC-MS/MS	Nitrate-N	Glyphosate
Ag	1	14	14	14	7
Ag	2	0	0	0	0
Ag	3	0	0	0	0
Ag	4	103	103	103	98
Ag	5	16	16	16	8
Ag	6	16	16	16	8
Ag	7	14	14	14	7
Ag	8	28	28	28	14
Ag	9	38	38	38	25
Urban	Urban (multiple PMRs)	20	20	0	20
Total	**All**	**249**	**249**	**229**	**187**