Monitoring, Prevention & Mitigation of Agricultural Contaminant Sources

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MDA Statutory Responsibilities

- Lead agency for pesticide and inorganic fertilizer regulation in Minnesota
- Primary legislative authority:
  - MN Pesticide Control Law (18B)
  - MN Ground Water Protection Act (103H)
  - Delegated lead state agency for enforcing FIFRA (Federal Insecticide, Fungicide, Rodenticide Act)
  - MN Fertilizer, Soil Amendment & Plant Amendment Law (18C)

Statutory Authority

- **Under the *Pesticide Control Law (18B)***
  - Pesticides may not be used in a way that will cause "unreasonable adverse effects on the environment" (same language as in FIFRA)
  - Unreasonable adverse effects " – means unreasonable risk to humans or the environment, taking into effect the economic, social, and environmental costs and benefits
  - Pesticides are intended to be used in the environment, and some residual contamination is expected

Statutory Authority

- Under the ***Groundwater Protection Act (103H)***
  - MDA is lead agency for pesticides and inorganic fertilizer
  - MDA must
    - Determine if a contaminant is commonly detected
    - Develop voluntary BMPs to prevent or minimize contamination
    - Promote BMPs via education and demonstration projects
    - Evaluate BMP adoption and effectiveness
    - Consider regulation if BMPs are proven ineffective

Pesticide Management Plan

- **MDA is responsible for development of a Pesticide Management Plan (PMP)**
  - ***"to prevent, evaluate, and mitigate occurrences of pesticides or pesticide breakdown products in groundwaters and surface waters of the state"***

- **The PMP includes requirements from both 18B and 103H**

Minnesota Pesticide Management Plan Process

Prevention (primary goal of PMP)	Evaluation	Mitigation
Voluntary Best Management Practices	Water Quality Monitoring & BMP Evaluation	Water Resource Protection Requirements
Integrated Pest Management (IPM)		Cancellation or Restrictions of Registration

Statutory Authority

- Under the ***<u>Fertilizer, Soil Amendment, and Plant Amendment Law (18C)</u>***
  - MDA is the lead state agency for regulating fertilizer other than manure
  - A person may not store, handle, distribute, or dispose of a fertilizer in a manner will cause unreasonable adverse effects on the environment
  - Note that this does not include “use” of a fertilizer

Other Agencies

- **MPCA:**
  - surface water standards
  - impaired waters
- **MDH:**
  - potable wells
  - source water protection
  - drinking water standards (HRLs)
- **BWSR, SWCDs, MPCA, Minnesota Extension Service**:
  - promoting BMPs

Monitoring

- Minnesota Statutes 18B.04 PESTICIDE IMPACT ON THE ENVIRONMENT
- "The commissioner shall:
  - (1) determine the impact of pesticides on the environment, including the impacts on surface water and groundwater in the state"

What MDA Monitors for

- Herbicides, Insecticides, Fungicides
- Herbicide degradates (LC/MS/MS)
- Nutrients
- Analyte list based on volume of use, previous detections, environmental risk and suitable lab methods
- Pesticide analysis is expensive and a limiting factor for monitoring efforts

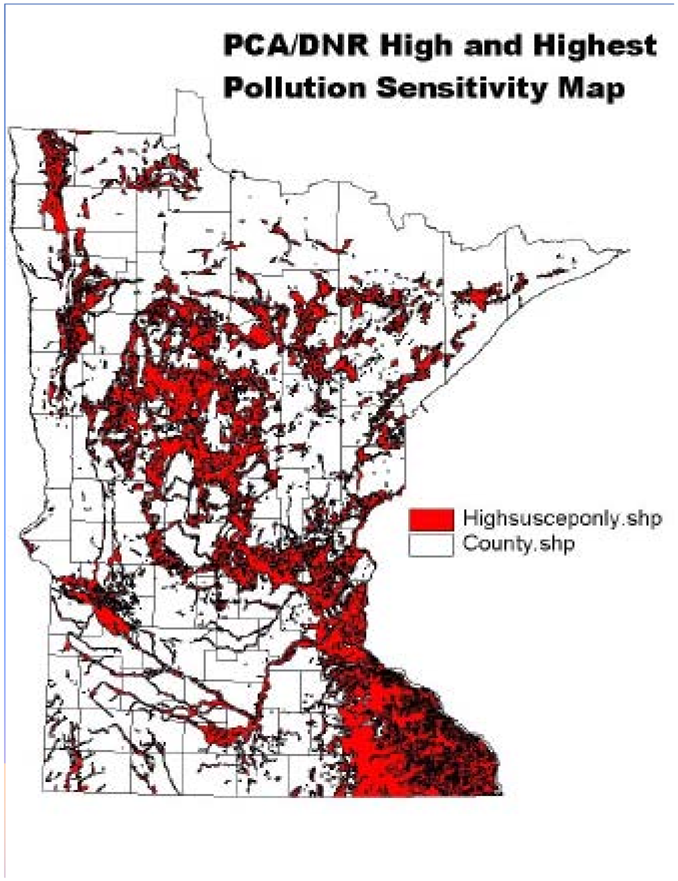
Monitoring Cooperation

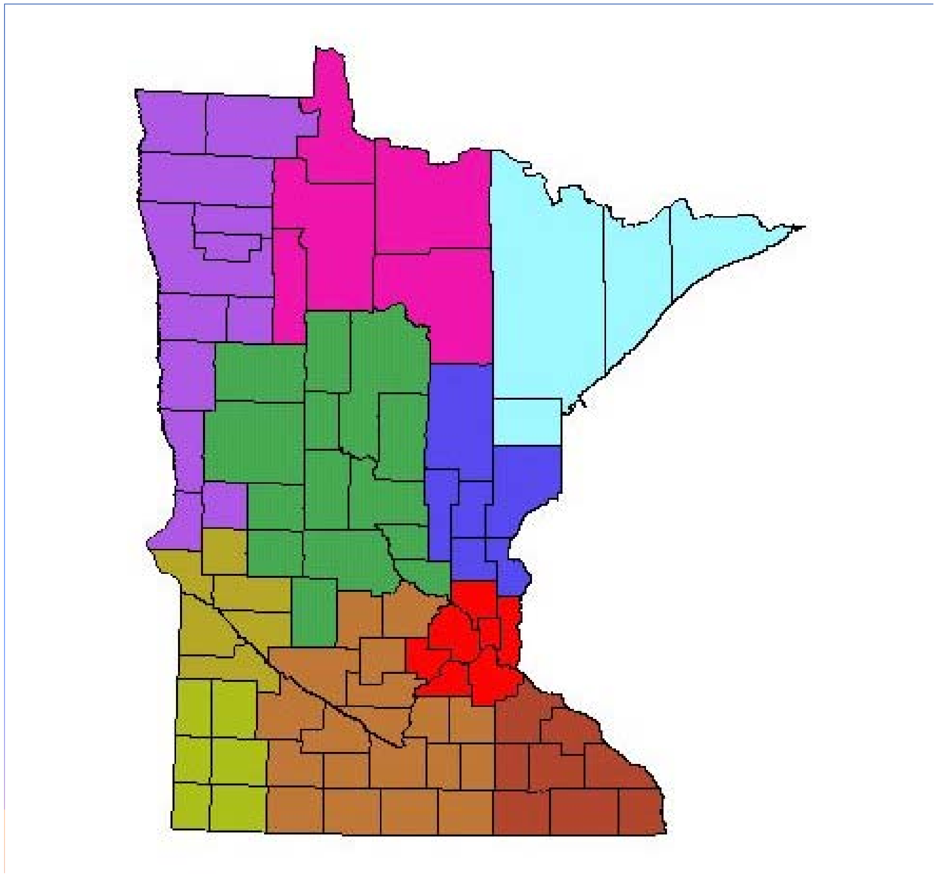
- Monitoring MOAs
  – Agriculture, Health, Pollution Control ? Groundwater
  – Agriculture, Pollution Control ? Surface water
- Cooperators
  – Farmers who allow us free access to install wells or sample springs on their land
  -- Counties, local government, Met Council, DNR and others
- Other Efforts
  – USGS, Dakota County

Monitoring Locations

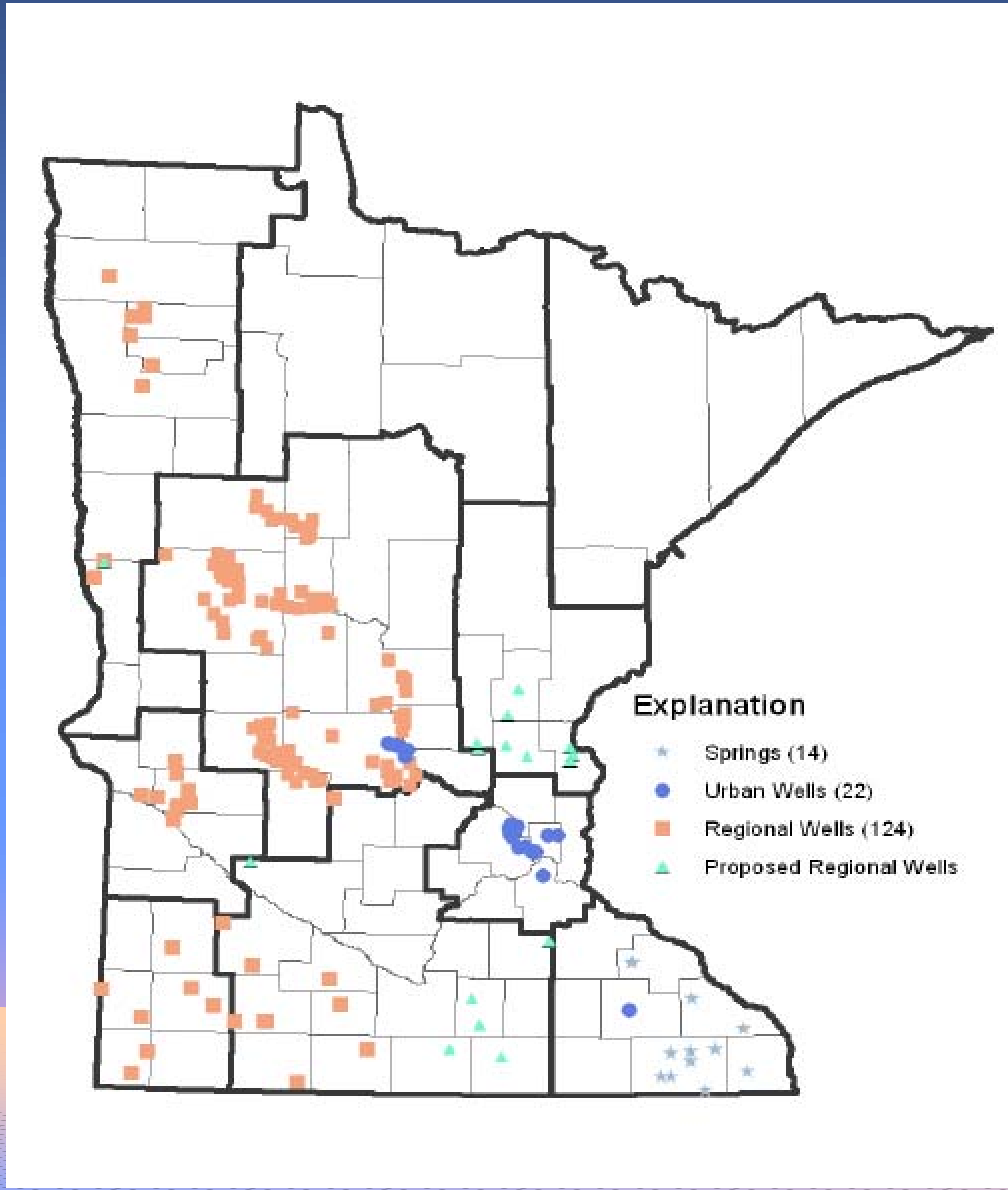
GW priority in sensitive areas

10 Pesticide Monitoring regions based on similar hydrogeology and agricultural practices

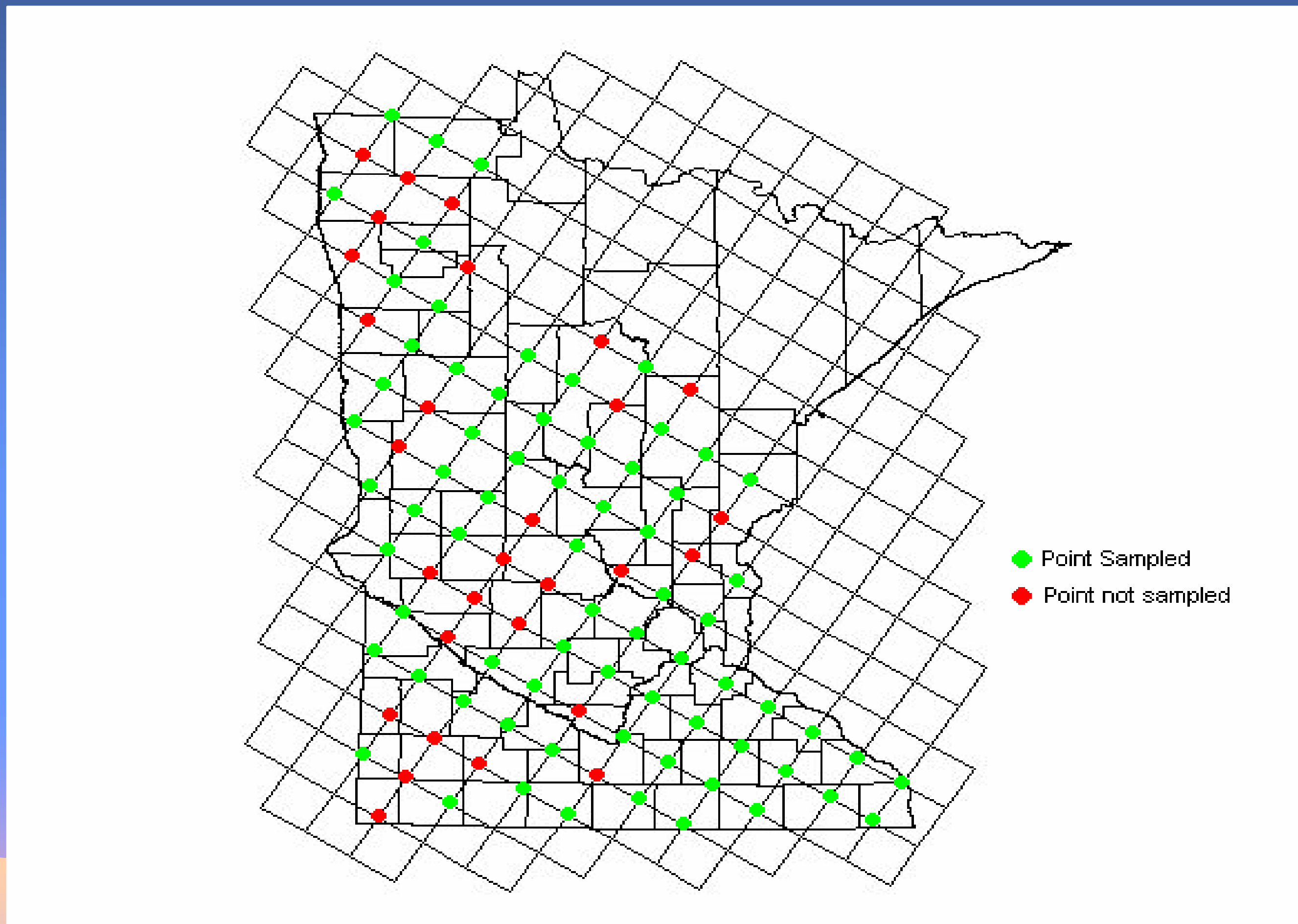




2006 Groundwater and Spring Monitoring



2004 Drinking Water Well Survey



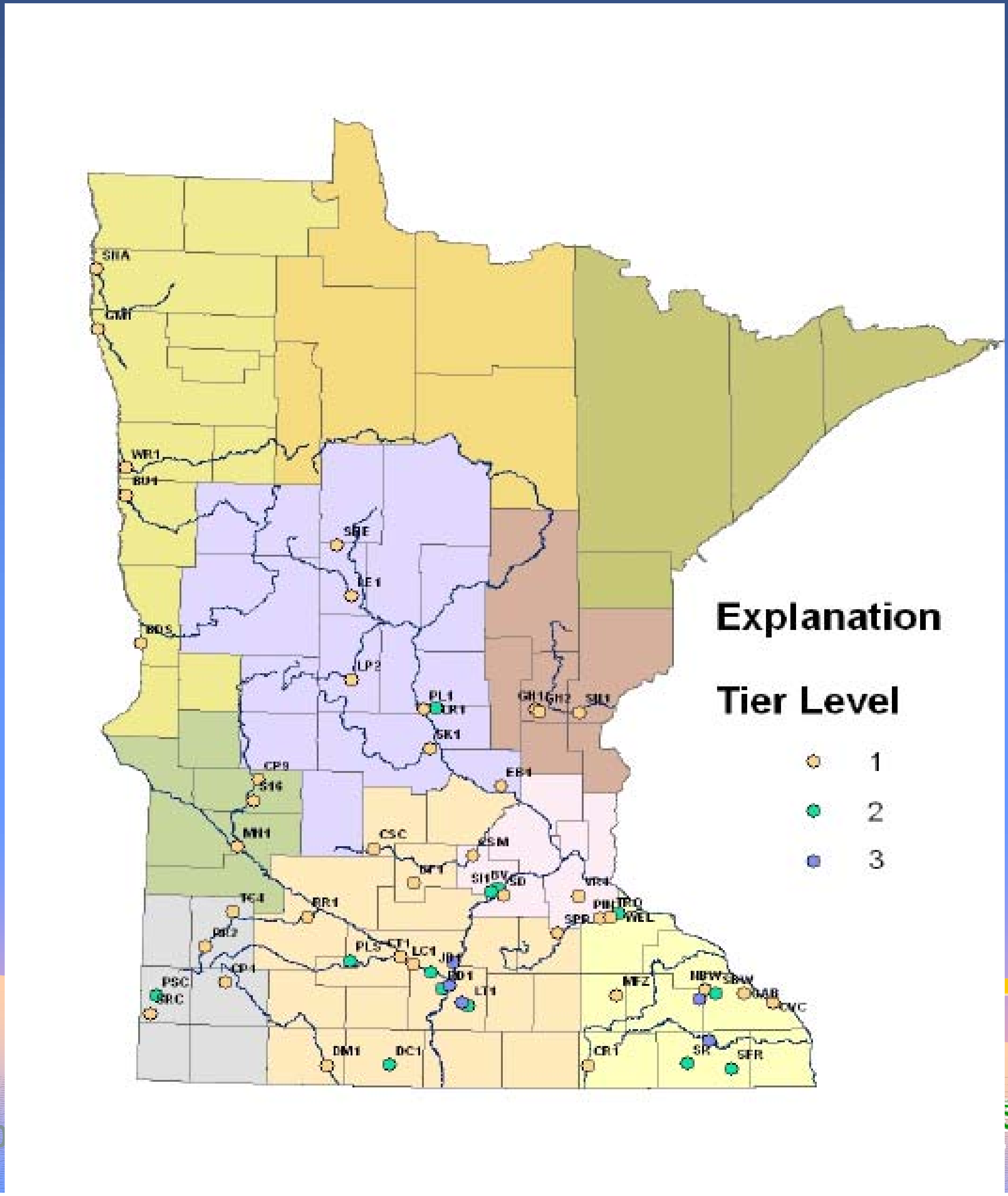
Surface Water Tiered Structure Monitoring Design

- **Tier 1** – Survey sites throughout agricultural areas sampled during May-July (4 samples, 1 every 2 weeks targeting storm flow)

- **Tier 2** – Survey sites with expanded sample collection (8 samples) due to detections at levels of concern

- **Tier 3** – Intensively monitored with grab and automated time-based composite samples

2006 Tier 1, 2 and 3 Surface Water Quality Monitoring



Monitoring Results

- Annual MDA monitoring report
- Available on the MDA web site

MINNESOTA DEPARTMENT OF AGRICULTURE
FROM THE FARM TO YOUR FAMILY

WATER QUALITY MONITORING PROGRAM

PESTICIDE MONITORING IN WATER RESOURCES:

ANNUAL DATA REPORT

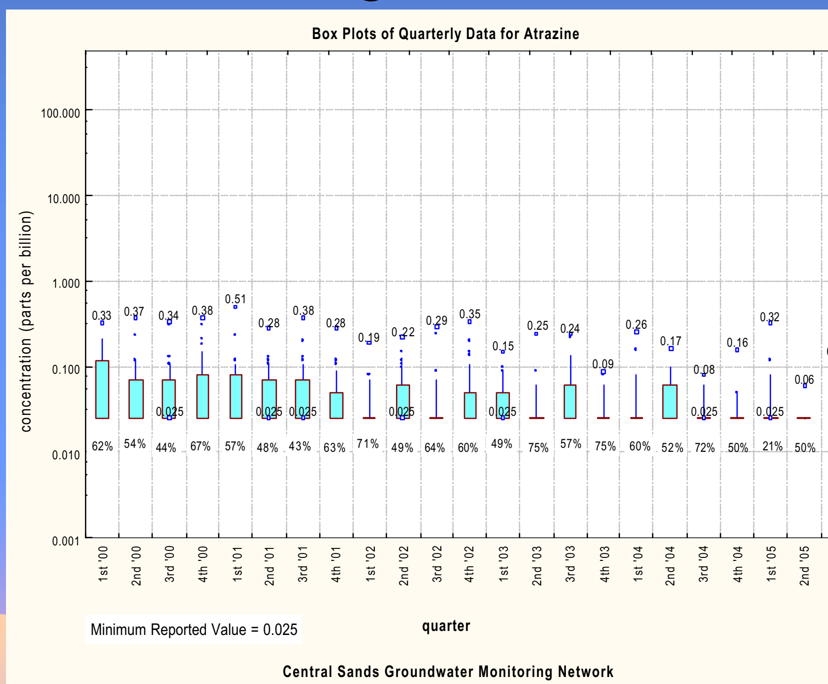
PUBLICATION DATE: May 13, 2004

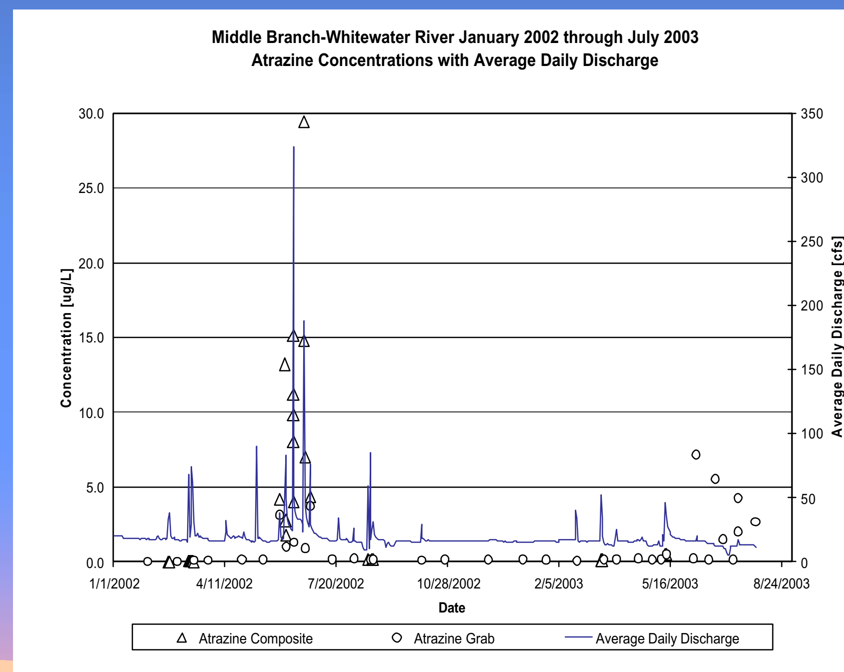
MINNESOTA DEPARTMENT OF AGRICULTURE

MONITORING AND ASSESSMENT UNIT
AGRICULTURAL CHEMICAL ENVIRONMENTAL SECTION
AGRONOMY & PLANT PROTECTION DIVISION

Monitoring Data is Compared to Standards

- Analyzed for long term trends for dedicated monitoring wells
- Evaluated under storm and base flow for surface water sites





Summary of pesticide and pesticide degradate concentrations in the Central Sands Groundwater Monitoring Network, 2005.

Pesticide	Detections	Concentration values of samples[1]; all values in ug/L (nd = non detect)			
	Frequency	Median (50th Percentile)	75th Percentile	90th Percentile	Maximum[2]
		2005	2005	2005	2005
Acetochlor	0%	nd	nd	nd	nd
Acetochlor + degradates	30%	nd	0.10	0.57	24.29
Alachlor	0%	nd	nd	nd	nd
Alachlor + degradates	44%	nd	0.31	1.26	4.26
Atrazine	51%	0.025	0.025	0.05	0.32
Atrazine + degradates	85%	0.085	0.185	0.275	1.17
Metolachlor	8%	nd	nd	nd	1.87
Metolachlor + degradates	65%	0.23	1.47	3.78	17.02
Metribuzin	12%	nd	nd	0.05	1.24
Metribuzin + degradates	22%	nd	nd	1.35	7.84

[1] Percentiles and Maximums are calculated using all sample results.

[2] The Maximum of parent plus degradate observed in a single well.

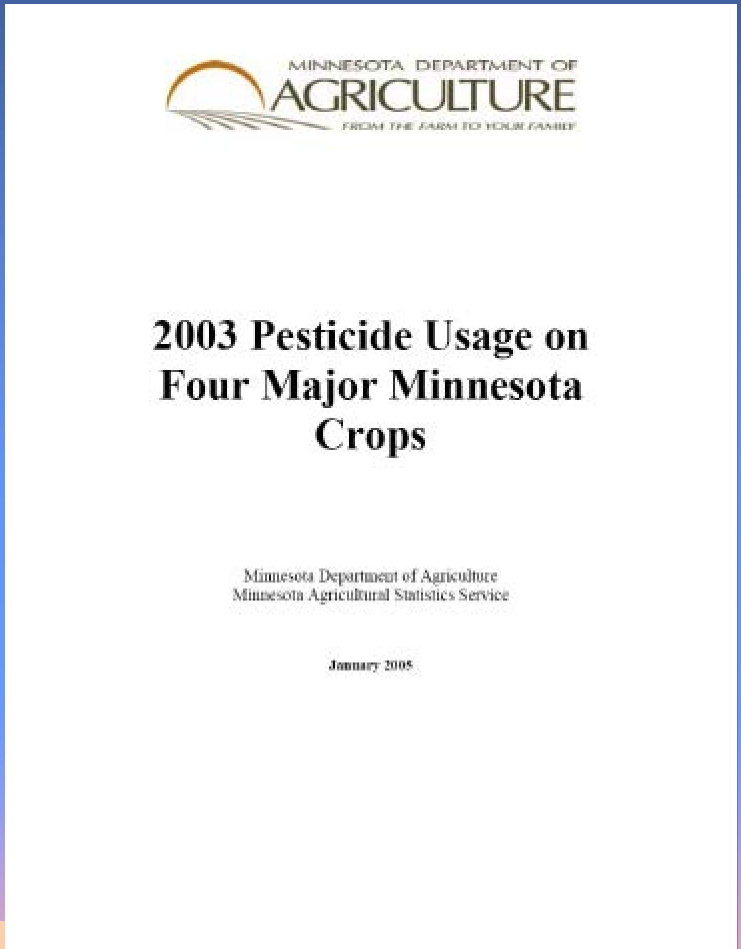
Monitoring Summary

- Atrazine, acetochlor, alachlor, metribuzin and metolachlor or their degradates are frequently detected at low levels in GW
- Degradates frequently exceed their parent and can be hard to analyze for (cyanazine)
- Atrazine parent appears to be declining
- Atrazine and acetochlor are detected at levels of concern in some surface waters

MDA Pesticide Use and BMP Adoption Surveys

- Pesticide use and BMP adoption are surveyed in agricultural areas in alternating years through a contract with the National Agricultural Statistics Service (NASS)

- Use data provided for each county and monitoring region


MINNESOTA DEPARTMENT OF AGRICULTURE
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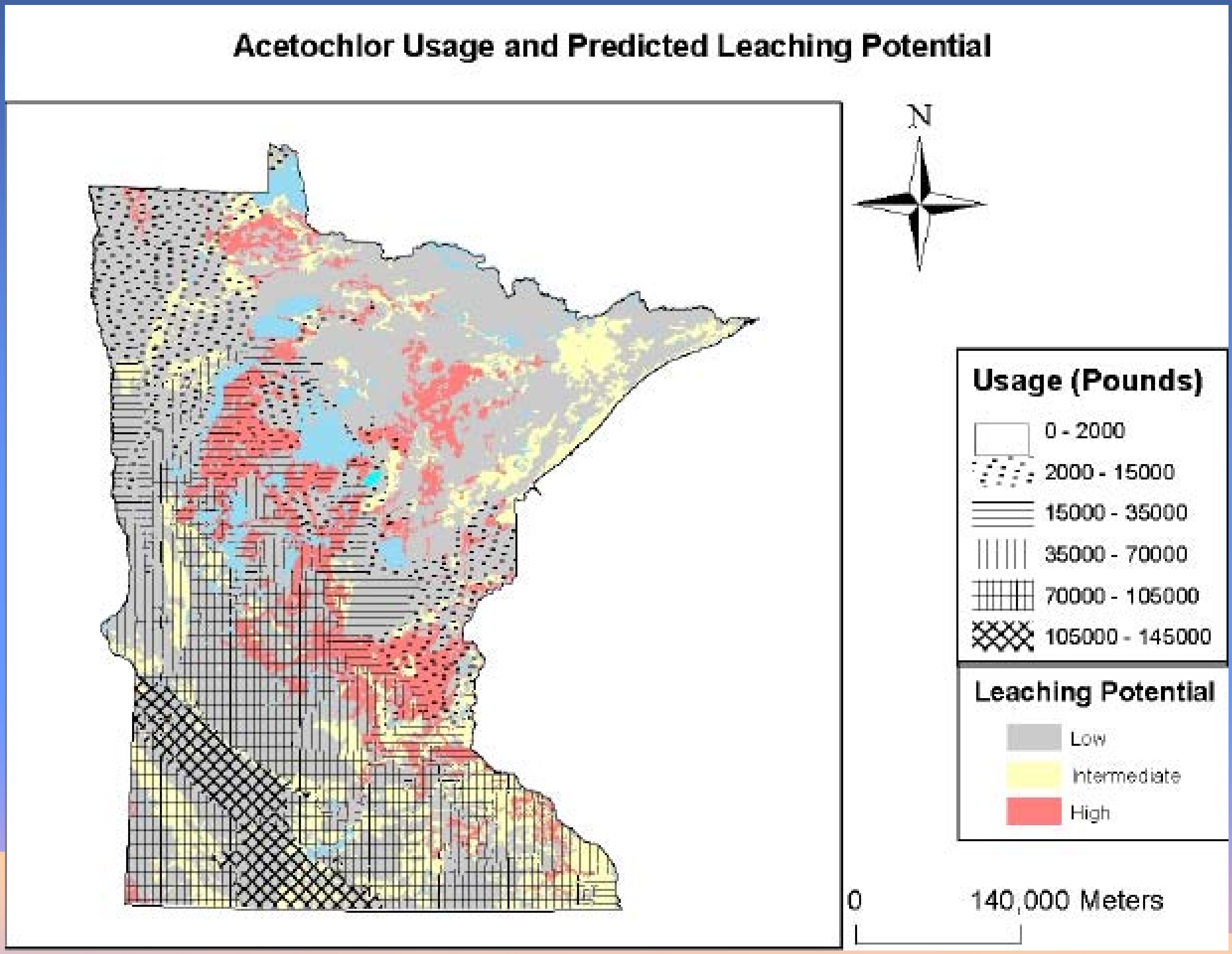
2003 Pesticide Usage on Four Major Minnesota Crops

Minnesota Department of Agriculture
Minnesota Agricultural Statistics Service

January 2005

Model of Leaching Risk Based on Vulnerability + Use Using WIN-PST



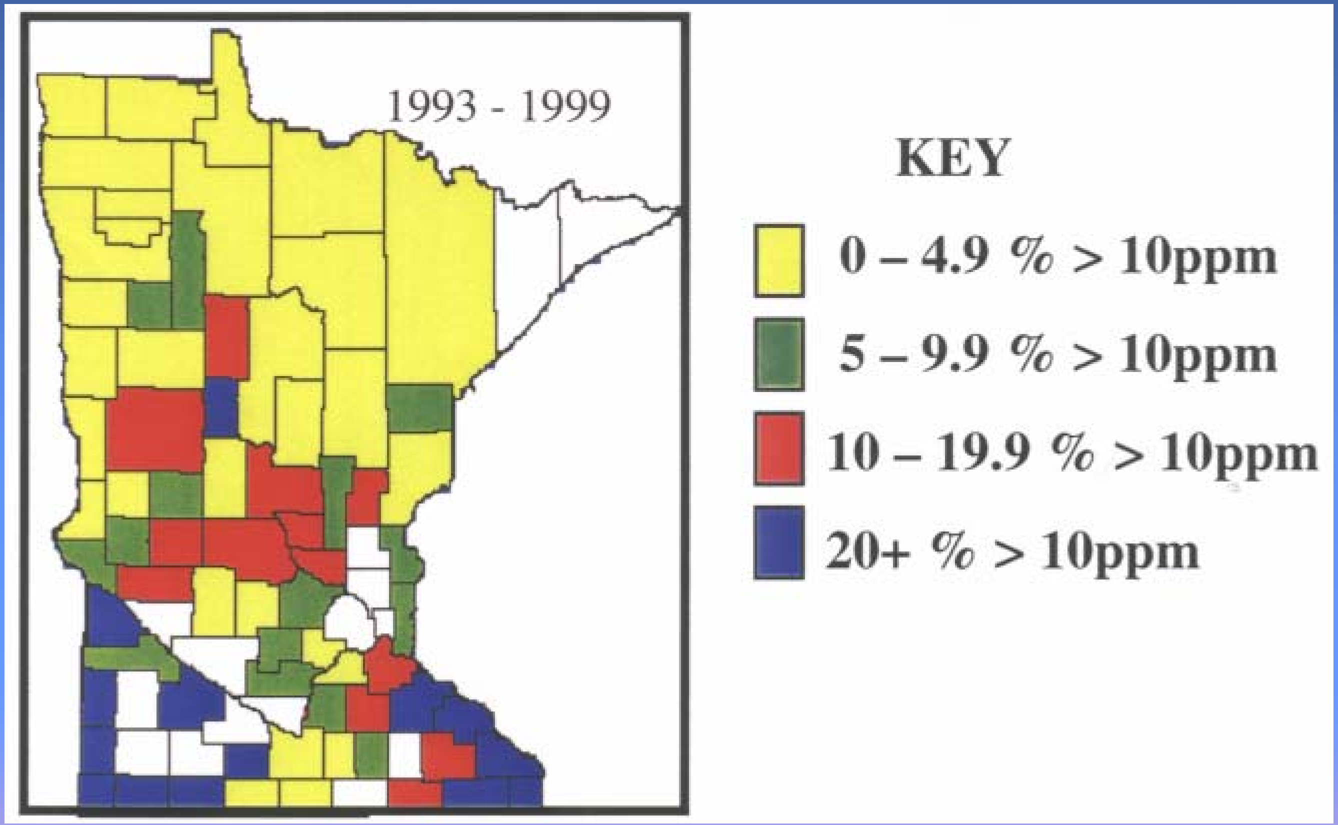
Risk Level	Area (ha)	Area (%)
High	2,984,953	13.6
Intermed.	3,830,632	17.5
Low	1,3948,754	63.8
Water	1,109,188	5.1
Total	2,1873,527	100.00

MN Nitrate Testing Clinic Data

- 1993 – MDA develops “walk-in” style testing clinic
- Goal = increase public awareness of nitrates in rural drinking and livestock water supplies
- ID occurrence of nitrate ‘hotspots’
- To date: 30,000 tests with educational outreach

Percentage of Private Wells Above the Nitrate-N Health Standard

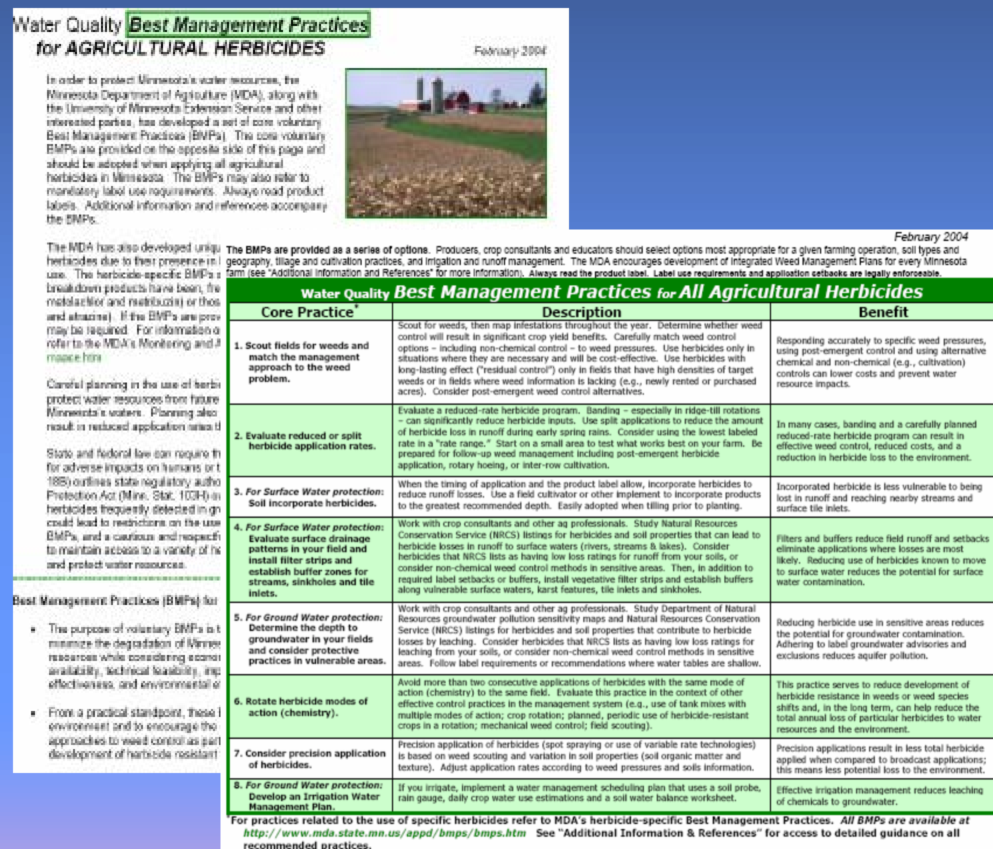
MDA clinic conclusions: private well NO_3-N results indicate that 12 to 15% exceed 10 mg/L



21,000 Wells Tested in 1993-99

Prevention

- **Core Herbicide BMPs**
  - BMPs for all Ag Herbicides
  - Broad-based stakeholder input
  - Provided as a series of options



Water Quality *Best Management Practices* *for AGRICULTURAL HERBICIDES*

February 2004

In order to protect Minnesota's water resources, the Minnesota Department of Agriculture (MDA), along with the University of Minnesota Extension Service and other interested parties, has developed a set of core voluntary Best Management Practices (BMPs). The core voluntary BMPs are provided on the opposite side of this page and should be adopted when applying all agricultural herbicides in Minnesota. The BMPs may also refer to mandatory label use requirements. Always read product labels. Additional information and references accompany the BMPs.

February 2004

The BMPs are provided as a series of options. Producers, crop consultants and educators should select options most appropriate for a given farming operation, soil types and geography, tillage and cultivation practices, and irrigation and runoff management. The MDA encourages development of Integrated Weed Management Plans for every Minnesota farm (see "Additional Information and References" for more information). **Always read the product label. Label use requirements and application setbacks are legally enforceable.**

Water Quality *Best Management Practices for All Agricultural Herbicides*

Core Practice*	Description	Benefit
1. Scout fields for weeds and match the management approach to the weed problem.	Scout for weeds, then map infestations throughout the year. Determine whether weed control will result in significant crop yield benefits. Carefully match weed control options – including non-chemical control – to weed pressures. Use herbicides only in situations where they are necessary and will be cost-effective. Use herbicides with long-lasting effect ("residual control") only in fields that have high densities of target weeds or in fields where weed information is lacking (e.g., newly rented or purchased acres). Consider post-emergent weed control alternatives.	Responding accurately to specific weed pressures, using post-emergent control and using alternative chemical and non-chemical (e.g., cultivation) controls can lower costs and prevent water resource impacts.
2. Evaluate reduced or split herbicide application rates.	Evaluate a reduced-rate herbicide program. Banding – especially in ridge-till rotations – can significantly reduce herbicide inputs. Use split applications to reduce the amount of herbicide loss in runoff during early spring rains. Consider using the lowest labeled rate in a "rate range." Start on a small area to test what works best on your farm. Be prepared for follow-up weed management including post-emergent herbicide application, rotary hoeing, or inter-row cultivation.	In many cases, banding and a carefully planned reduced-rate herbicide program can result in effective weed control, reduced costs, and a reduction in herbicide loss to the environment.
3. *For Surface Water protection:* Soil incorporate herbicides.	When the timing of application and the product label allow, incorporate herbicides to reduce runoff losses. Use a field cultivator or other implement to incorporate products to the greatest recommended depth. Easily adopted when tilling prior to planting.	Incorporated herbicide is less vulnerable to being lost in runoff and reaching nearby streams and surface tile inlets.
4. *For Surface Water protection:* Evaluate surface drainage patterns in your field and install filter strips and establish buffer zones for streams, sinkholes and tile inlets.	Work with crop consultants and other ag professionals. Study Natural Resources Conservation Service (NRCS) listings for herbicides and soil properties that can lead to herbicide losses in runoff to surface waters (rivers, streams & lakes). Consider herbicides that NRCS lists as having low loss ratings for runoff from your soils, or consider non-chemical weed control methods in sensitive areas. Then, in addition to required label setbacks or buffers, install vegetative filter strips and establish buffers along vulnerable surface waters, karst features, tile inlets and sinkholes.	Filters and buffers reduce field runoff and setbacks eliminate applications where losses are most likely. Reducing use of herbicides known to move to surface water reduces the potential for surface water contamination.
5. *For Ground Water protection:* Determine the depth to groundwater in your fields and consider protective practices in vulnerable areas.	Work with crop consultants and other ag professionals. Study Department of Natural Resources groundwater pollution sensitivity maps and Natural Resources Conservation Service (NRCS) listings for herbicides and soil properties that contribute to herbicide losses by leaching. Consider herbicides that NRCS lists as having low loss ratings for leaching from your soils, or consider non-chemical weed control methods in sensitive areas. Follow label requirements or recommendations where water tables are shallow.	Reducing herbicide use in sensitive areas reduces the potential for groundwater contamination. Adhering to label groundwater advisories and exclusions reduces aquifer pollution.
6. Rotate herbicide modes of action (chemistry).	Avoid more than two consecutive applications of herbicides with the same mode of action (chemistry) to the same field. Evaluate this practice in the context of other effective control practices in the management system (e.g., use of tank mixes with multiple modes of action; crop rotation; planned, periodic use of herbicide-resistant crops in a rotation; mechanical weed control; field scouting).	This practice serves to reduce development of herbicide resistance in weeds or weed species shifts and, in the long term, can help reduce the total annual loss of particular herbicides to water resources and the environment.
7. Consider precision application of herbicides.	Precision application of herbicides (spot spraying or use of variable rate technologies) is based on weed scouting and variation in soil properties (soil organic matter and texture). Adjust application rates according to weed pressures and soils information.	Precision applications result in less total herbicide applied when compared to broadcast applications; this means less potential loss to the environment.
8. *For Ground Water protection:* Develop an Irrigation Water Management Plan.	If you irrigate, implement a water management scheduling plan that uses a soil probe, rain gauge, daily crop water use estimations and a soil water balance worksheet.	Effective irrigation management reduces leaching of chemicals to groundwater.

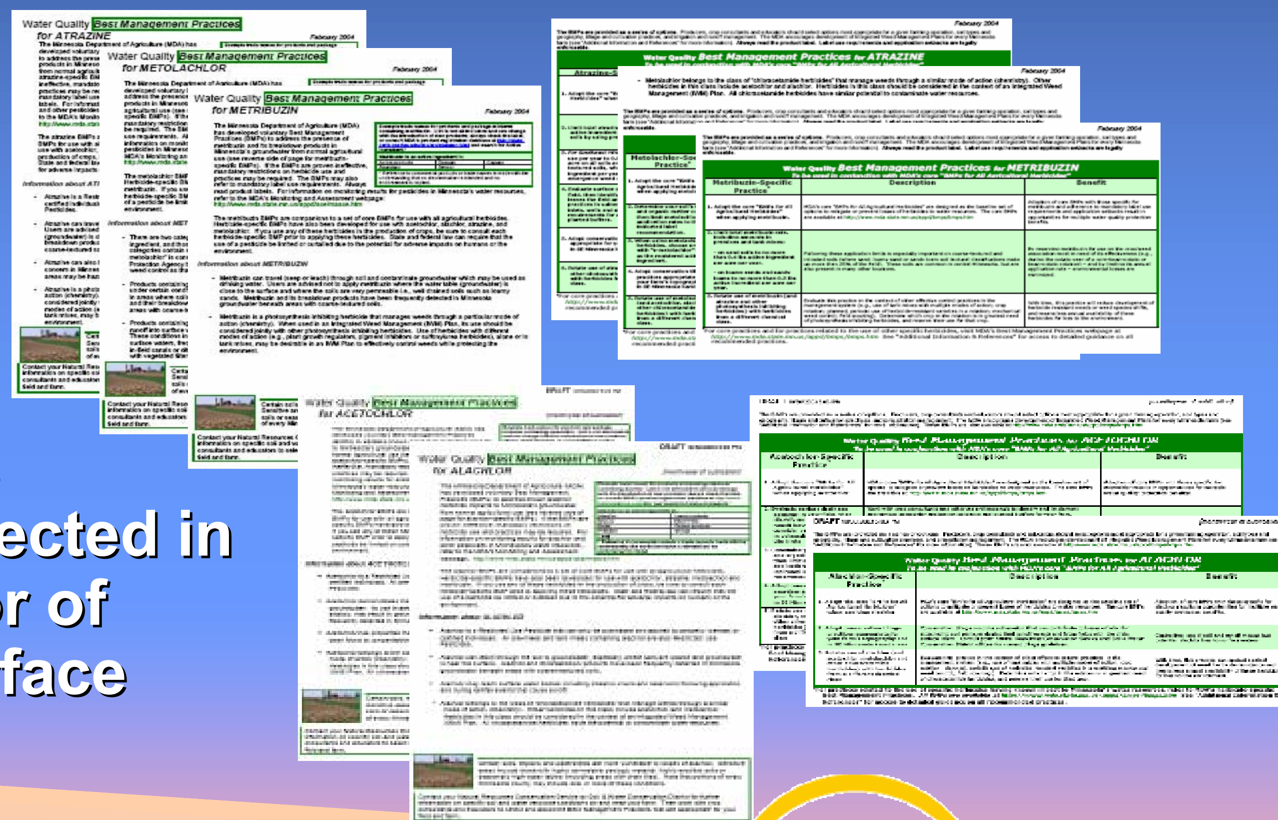
***For practices related to the use of specific herbicides refer to MDA's herbicide-specific Best Management Practices. *All BMPs are available at* *http://www.mda.state.mn.us/appd/bmps/bmps.htm* See "Additional Information & References" for access to detailed guidance on all recommended practices.**

Examples of Core BMPs for all Agricultural Herbicides

- Scout fields for weeds and match the management approach to the weed problem
- Evaluate reduced or split applications
- For Surface Water protection: Soil incorporate herbicides
- For Ground Water protection: Determine the depth to groundwater and consider protective practices in vulnerable areas
  - Consider herbicides with low loss ratings for leaching or consider non-chemical weed control

Best Management Practices

- Herbicide-specific BMPs for
  - Acetochlor
  - Alachlor
  - Atrazine
  - Metolachlor
  - Metribuzin



- For herbicides commonly detected in groundwater or of concern in surface water

Example Herbicide Specific BMPs

- Atrazine BMPs
  - Limit total atrazine use per year to 0.8 lbs a.i. per acre on coarse-textured soils and in SE MN Karst areas
  - SE MN medium and fine textured soils: 1.0 lb a.i. per year can be used pre-emergence
  - Adopt conservation tillage practices appropriate for your farm's topography and in SE Minnesota karst areas
  - Rotate use of atrazine with herbicides from a different chemical class

Evaluation

- MDA must evaluate BMP effectiveness and adoption
- For BMP effectiveness:
  - Primary means is water monitoring data
  - Decreasing trends suggest the BMPs are working
  - Plot scale and field scale research
  - Modeling
- May be a long lag time between BMP adoption and observed effects in GW

BMP Adoption

- Evaluated through phone surveys, local surveys and audits by MDA inspectors

Mitigation

- MDA may develop rules, called “water resource protection requirements” (WRPRs), if the implementation of BMPs has proven to be ineffective
- If adoption is high but effectiveness is in doubt, then the BMPs should be revised before considering a rule
  - rules will be based on the BMPs, if the BMPs are not effective then the rules also will not be effective

Water Resource Protection Requirements

- **WRPRs must be designed to "prevent and minimize pollution to the extent practicable," prevent pollution from exceeding HRLs, and must be based on:**
  - **The use and effectiveness of BMPs**
  - **Product use and practices causing pollution**
  - **Economic factors**
  - **Availability, technical feasibility, implementability and effectiveness**

Restrictions on Product Registration

- The commissioner may impose state use and distribution restrictions on a pesticide as part of the registration to *prevent* unreasonable adverse effects on the environment.

Nitrate Contamination Issues

- Under the Groundwater Protection Act (103H)
  - MDA lead for inorganic N fertilizer
  - MPCA lead for manure and septics
- 1989 Chap. 326, Art. 6, Sec. 33, Sub. 2b (Session Law)
  - Created a Task Force to develop a Nitrogen Fertilizer Management Plan (NFMP)

The NFMP

- The Nitrogen Fertilizer Management Plan, for the prevention, evaluation & mitigation of nonpoint source nitrogen fertilizer, was completed in 1990

Recommendations
Of The
Nitrogen Fertilizer Task Force
On

THE NITROGEN FERTILIZER
MANAGEMENT PLAN

To The
Minnesota
Commissioner of Agriculture

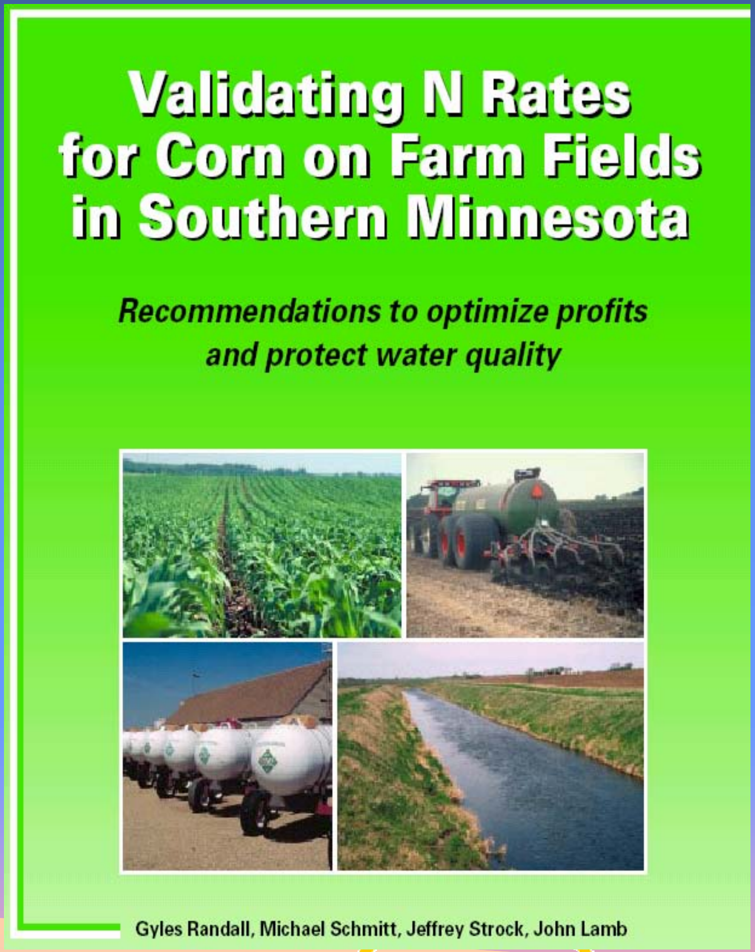
August 1990

Overall Response Phase

- <u>Similar Process as for Pesticides</u>
  - Greater emphasis on a local approach by designating a “Special BMP Promotion Area”
  - Voluntary BMPs already developed and would be promoted and evaluated in each area
  - If BMPs are proven ineffective, the MDA may implement “Water Resource Protection Requirements (WRPRs)”

Nitrogen Fertilizer BMPs

- Fertilizer BMPs by crop and region were developed by the University of Minnesota and widely promoted



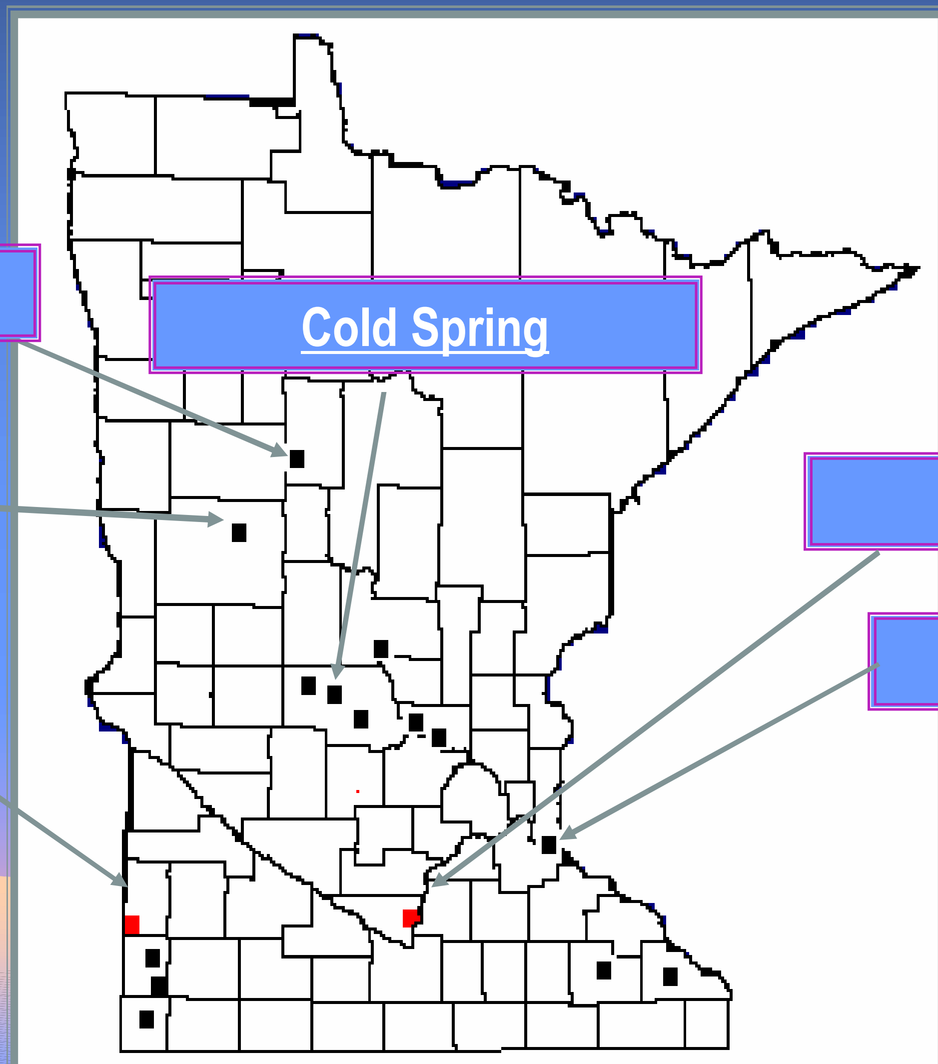
Demonstration and Validation of BMPs

- Much on-going work by University of Minnesota, MDA and cooperators, examples include:
  - Plot work and field days at Extension research and outreach centers
  - On Farm demonstration projects through Nutrient Management Initiative with NRCS
  - Tiled and instrumented demonstration sites at Red Top, Highway 90 and a third location under development,

Fertilizer Program Funding

- Never well funded
- Cuts in supplemental general funds and layoffs in 2003
- New fees were passed in 2005, but for multiple uses
- Currently five MDA non-point field staff

Focus on Community Water Suppliers With Nitrate Problems (a joint effort with MDH)



Park Rapids

Cold Spring

Perham

St. Peter

Lincoln Pipestone Rural Water System

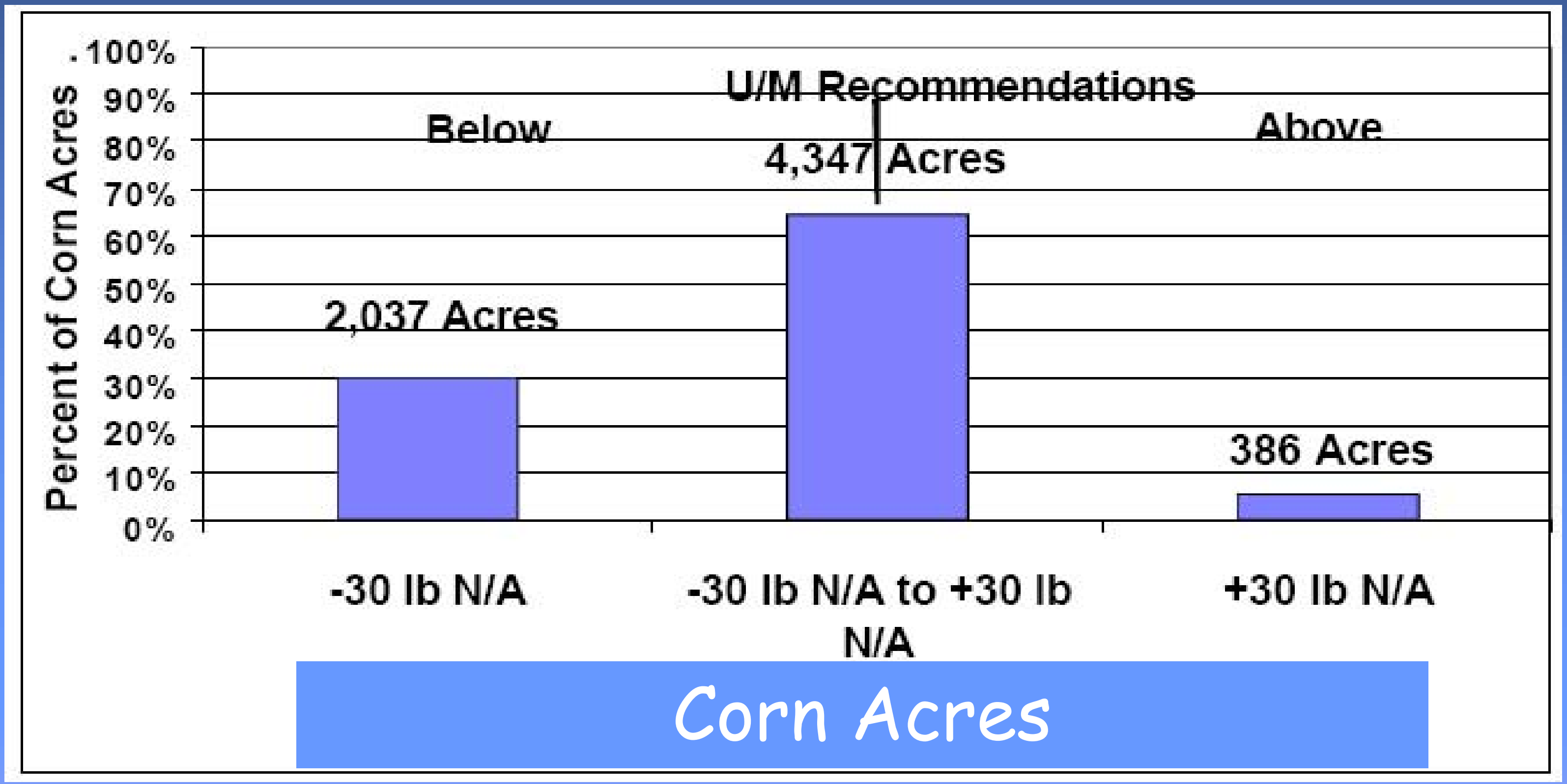
Hastings

Edgerton, Luverne, Adrian, Fulda

Local N Response

- Each situation is complex and unique, requiring a separate study
  - Detailed FANMAP survey to determine actual practices
  - Form a local team involving all stakeholders, especially local farmers
  - Use FANMAP and sensitivity data to target key practices on sensitive lands and to help obtain implementation funding

Farm Nutrient Management Assessment



FANMAP assists in understanding how much farmland is receiving nutrient inputs that are under, over and comparable to UM Recs……

Producers May be Using Recommended Nitrogen Inputs – and still have problems!

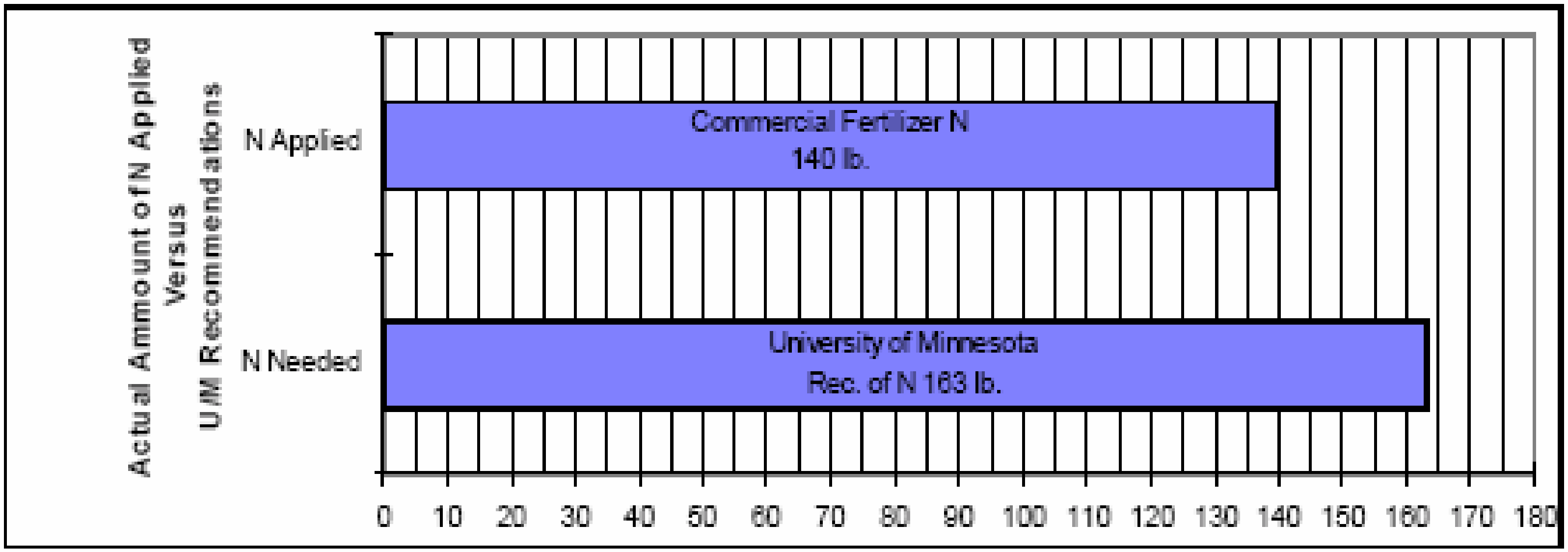


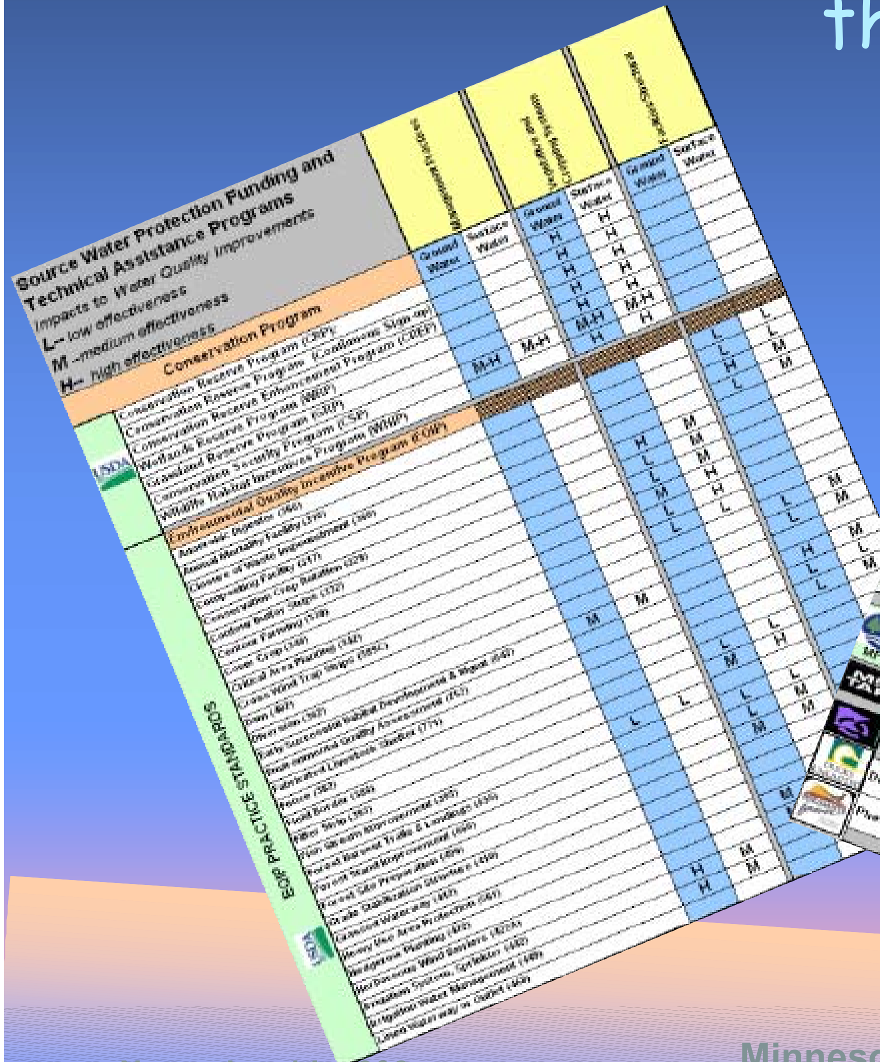
Figure 8. 1999 crop N requirements based on University of Minnesota N recommendations in comparison to actual N inputs (fertilizer and manure) for irrigated corn acres in the inventory area.

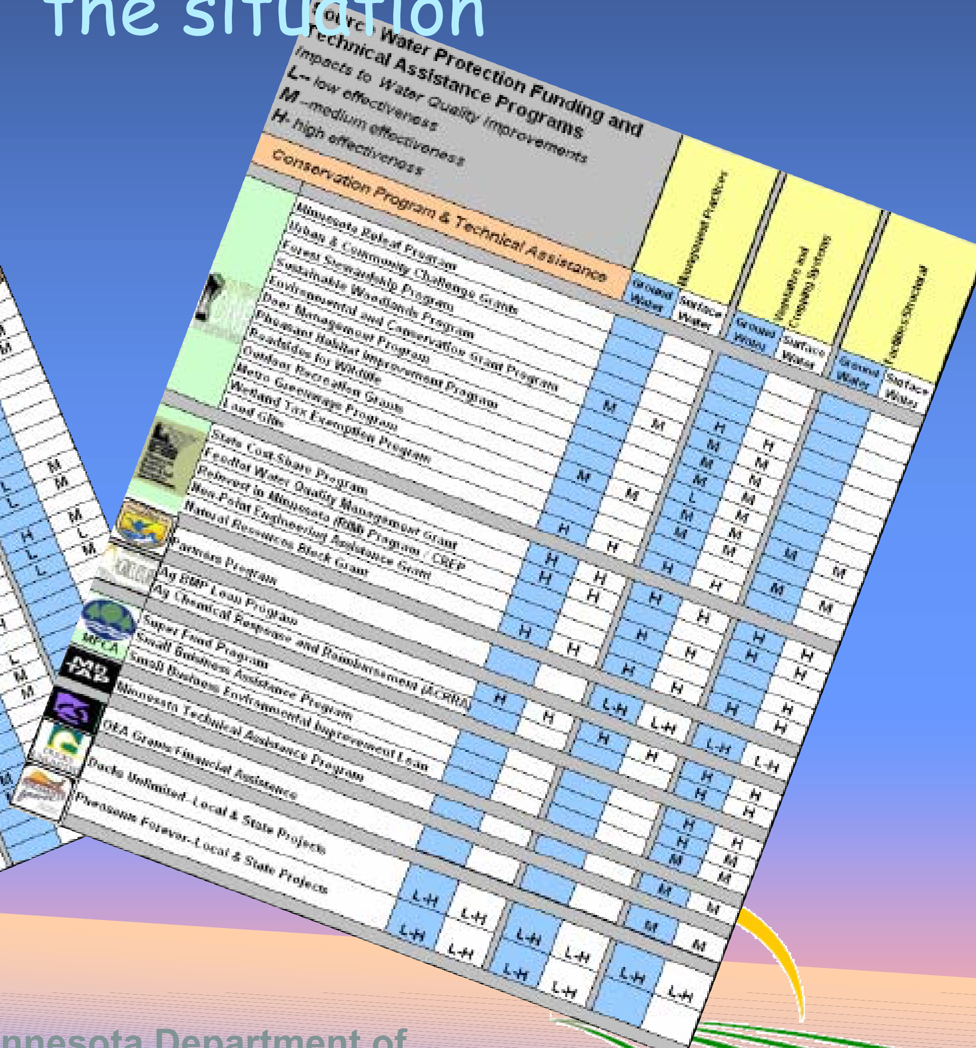
Source: 1999 FANMAP of Perham Producers-MDA

Example Nitrate Response Options

- Take highly vulnerable land out of production (CRP)
- Reduce fertilizer inputs
- Change crop types or rotation (esp alfalfa)
- Change timing or method of fertilization to match crop uptake
- Change variety (Altura potato)
- Nitrification inhibitors (ESN)
- Irrigation management

Matrix of Federal and State Cost Share for implementing the needed practice for the situation





"Case Studies" Available on Web

Legislative Audit

- Legislative audit of pesticide programs completed in February 2006
- Generally good review but some recommendations noted:
  - Urban water monitoring
  - Need to revise PMP to better address registration, urban and aquatic pesticides
  - Need a BMP evaluation plan

Key Issues

- Impaired waters – a huge effort and the focus of current funding and resources
- Nitrates in groundwater
- Possible surface water impairments for acetochlor and atrazine
- Evaluating pesticide BMP effectiveness
- Pesticide degradates – cyanazine
- Changing health and environmental standards

MDA Future Efforts

- Focus on impaired waters
  - Research using SWAT model to quantify BMP benefits
  - Using LIDAR to target high risk locations for BMP implementation
  - More involved in impairment process
- Continued pesticide and nutrient BMP promotion, demonstration and evaluation
- Implementation of the NFMP in problem areas
- Increased statewide water monitoring
- Environmental reviews in registration process
- Use of pesticide immunoassays

Questions?

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- Or Visit the MDA Web site at:
  - http://www.mda.state.mn.us
  - go to “Water and Land”