

# **Improvements to the MPCA Ambient Groundwater Quality Monitoring Network**

**December 2nd, 2009**





# Ambient Groundwater Quality Monitoring



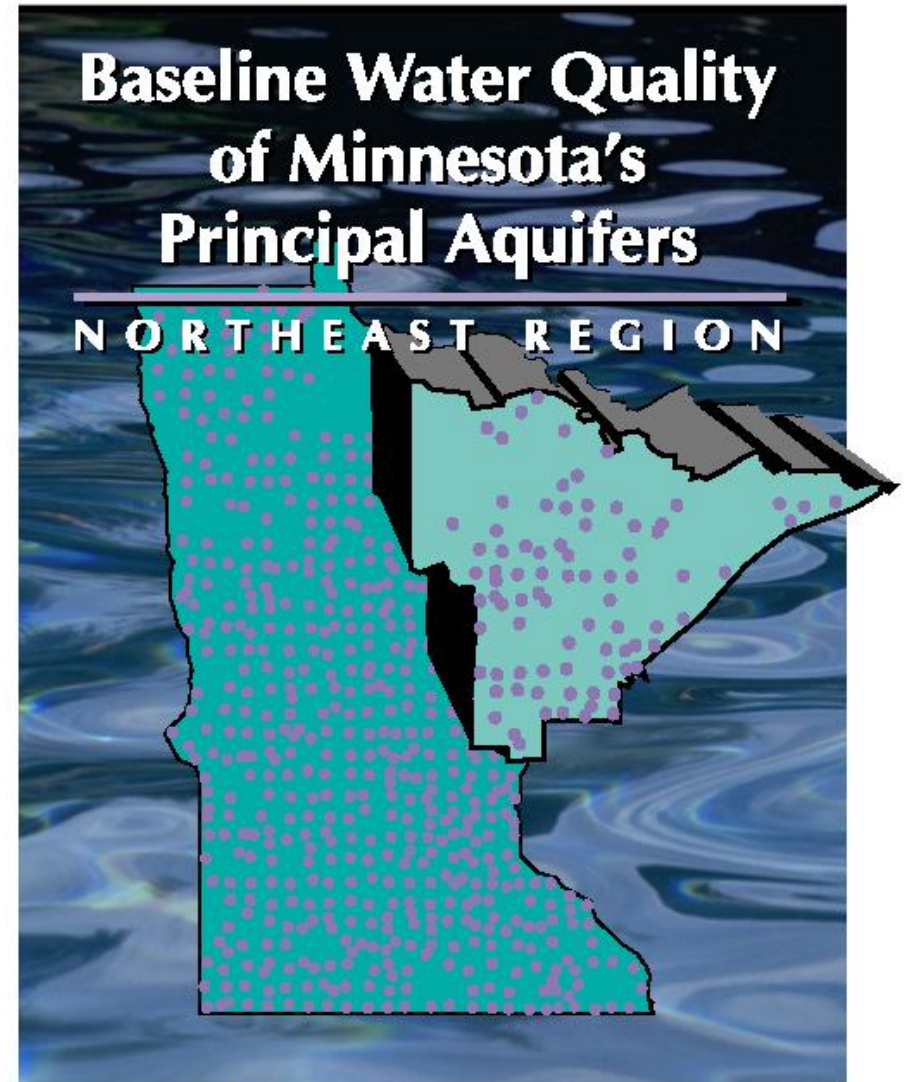
# Minnesota's

Ground Water Condition: A Statewide View

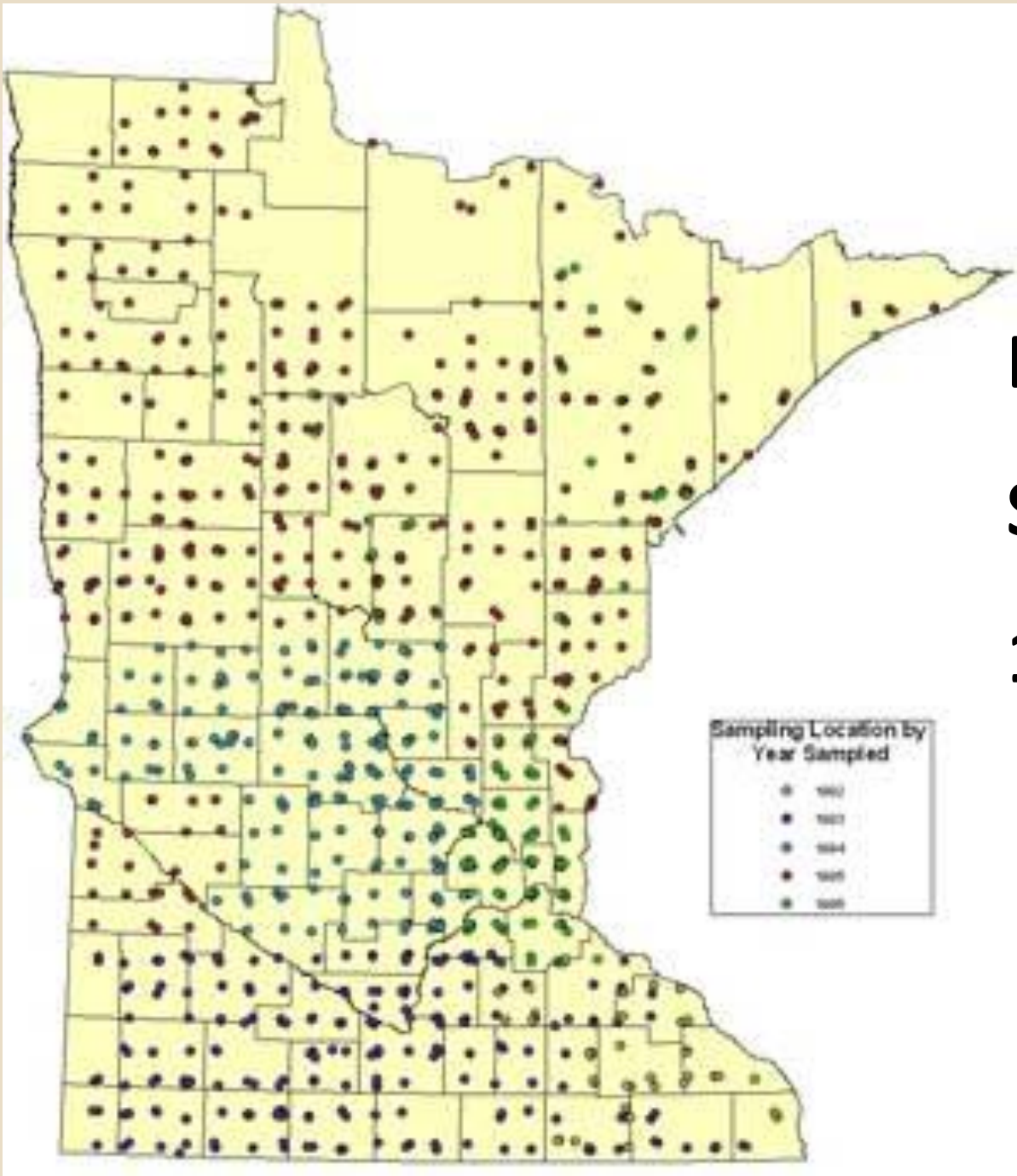
September 2007



Minnesota Pollution Control Agency



Minnesota Pollution Control Agency



**BASELINE**

**STUDY**

**1993-1996**

# Formalized Ground Water Quality Monitoring System

## AGREEMENT TO OPERATE AN INTEGRATED GROUND WATER QUALITY MONITORING SYSTEM FOR THE STATE OF MINNESOTA

The Minnesota Department of Agriculture, Minnesota Pollution Control Agency and Minnesota Department of Health (Agencies) agree that the attached document *Integrated Ground Water Quality Monitoring Strategy*, dated February 11, 2004, represents the Agencies' joint plan for conducting ground water quality monitoring on a statewide basis in Minnesota.

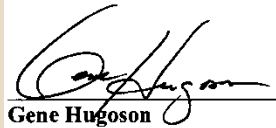
The plan outlines the Agencies' different purposes, goals and roles in ground water quality monitoring based on their individual state and federal authorities and requirements.

The plan identifies how the monitoring conducted by the Agencies will be conducted in an integrated fashion providing a comprehensive, statewide assessment of ground water quality resources for the future. The plan also establishes inter-agency cooperation in shared monitoring design, sample collection, sampling location selection, evaluation of sensitive areas, and data management to ensure efficiencies in the system.

The plan provides for an annual review of the ground water quality monitoring system to allow for modifications, along with a five-year evaluation, at which time this agreement will be updated.

By signing this agreement, the Agencies commit to fulfilling the monitoring activities outlined in this plan in cooperation with the other agencies. An individual agency may choose to terminate its participation in this agreement with 30 day notice to the other Agencies.

Signed,



Gene Hugoson  
Commissioner  
Department of Agriculture

2-18-04  
Date



Sheryl A. Corrigan  
Commissioner  
Pollution Control Agency

2/18/04  
Date



Dianne M. Mandernach  
Commissioner  
Department of Health

2/18/04  
Date

# NON-AGRICULTURAL CONTAMINATION



Monitored by the Minnesota  
Pollution Control Agency





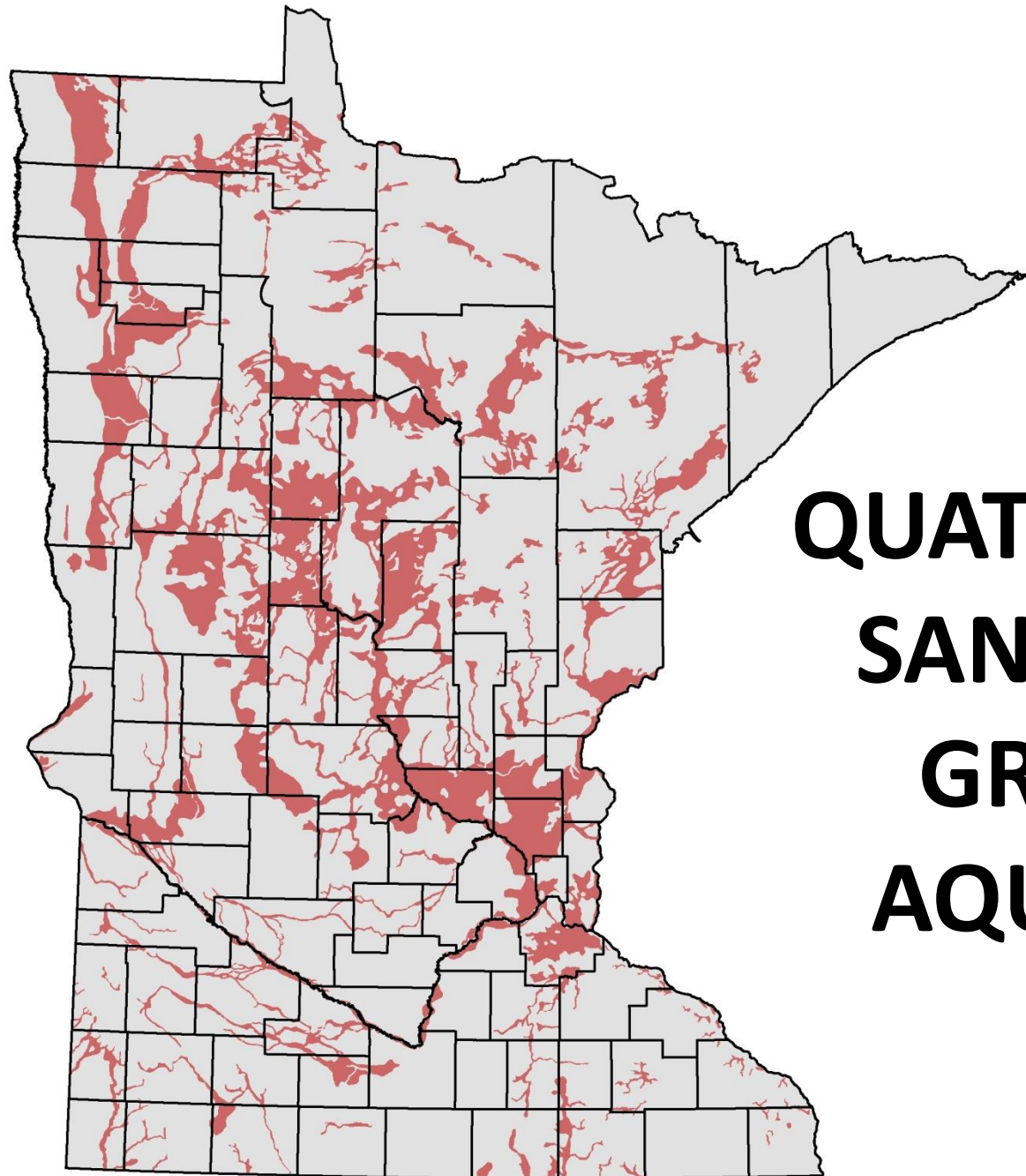
# **Agricultural Contamination**

**Monitored by the Minnesota  
Department of Agriculture**

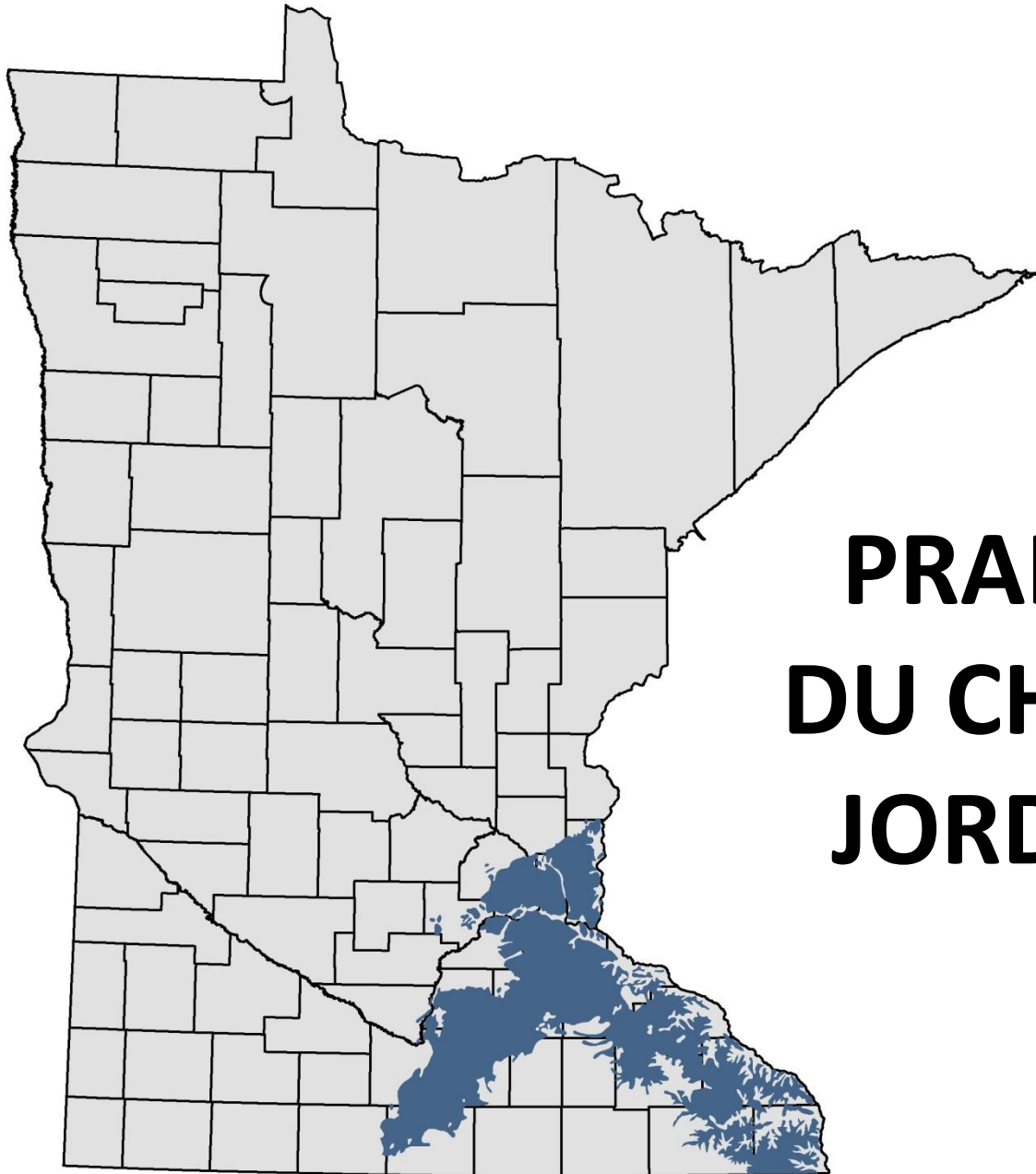
# Drinking Water



Monitored by the Minnesota Department of Health

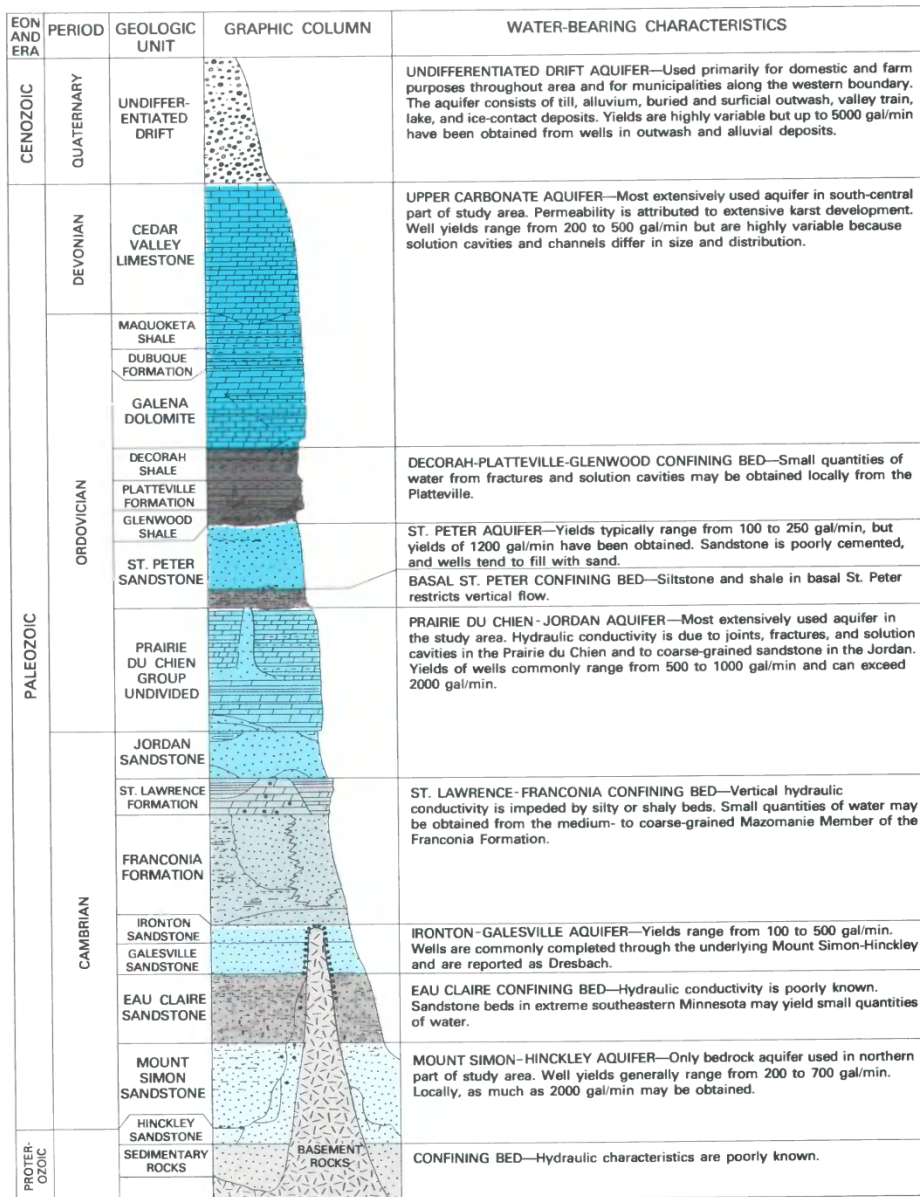


**QUATERNARY  
SAND AND  
GRAVEL  
AQUIFERS**



**PRAIRIE  
DU CHIEN-  
JORDAN**

# Generalized Geologic Units In Minnesota



### EXPLANATION



Figure 2.2-1. Generalized hydrogeologic column showing regional aquifers and confining beds in southeastern Minnesota (modified from Austin, 1969)



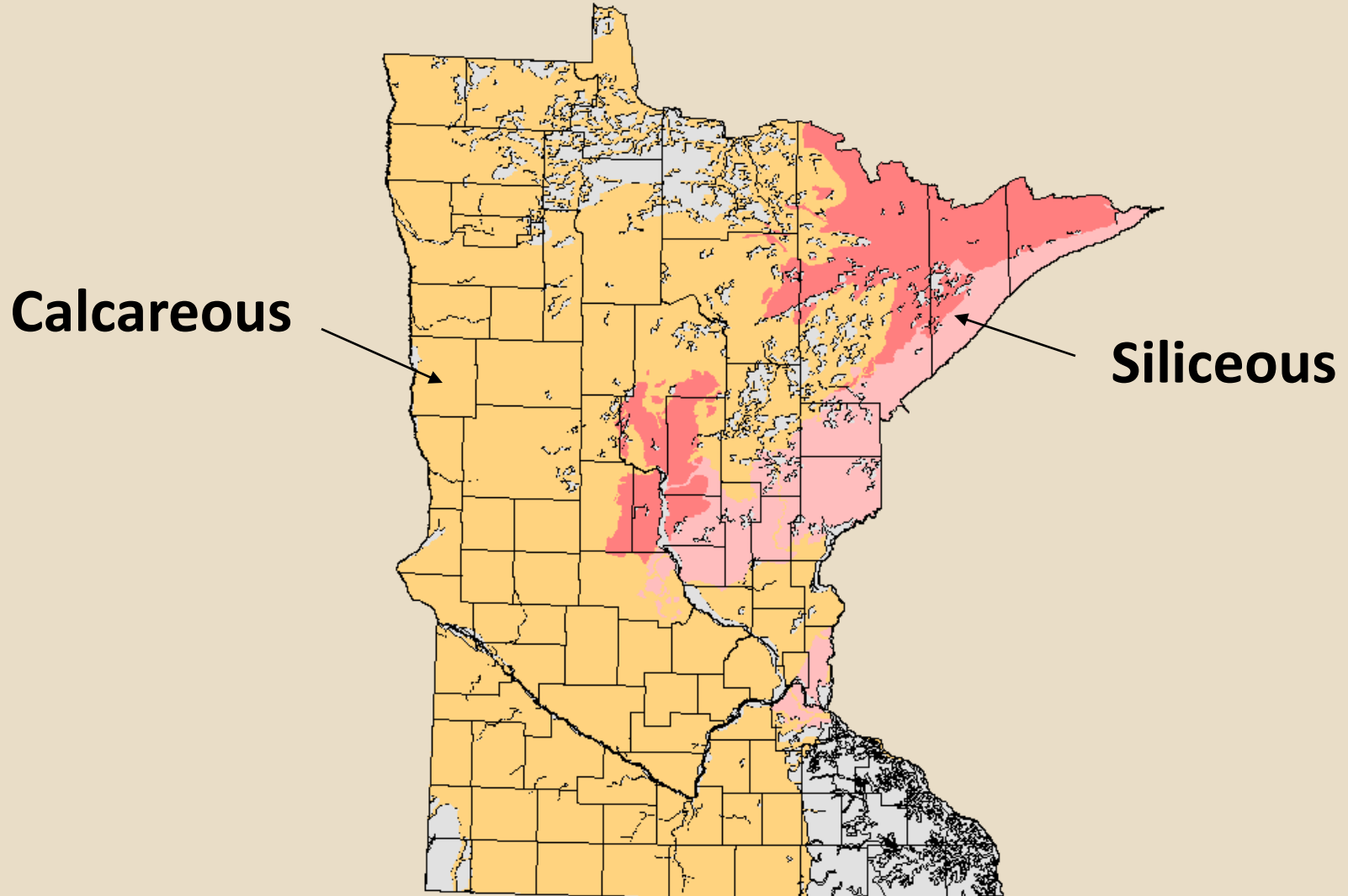
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# **Improvements to the MPCA Ambient Monitoring Network**

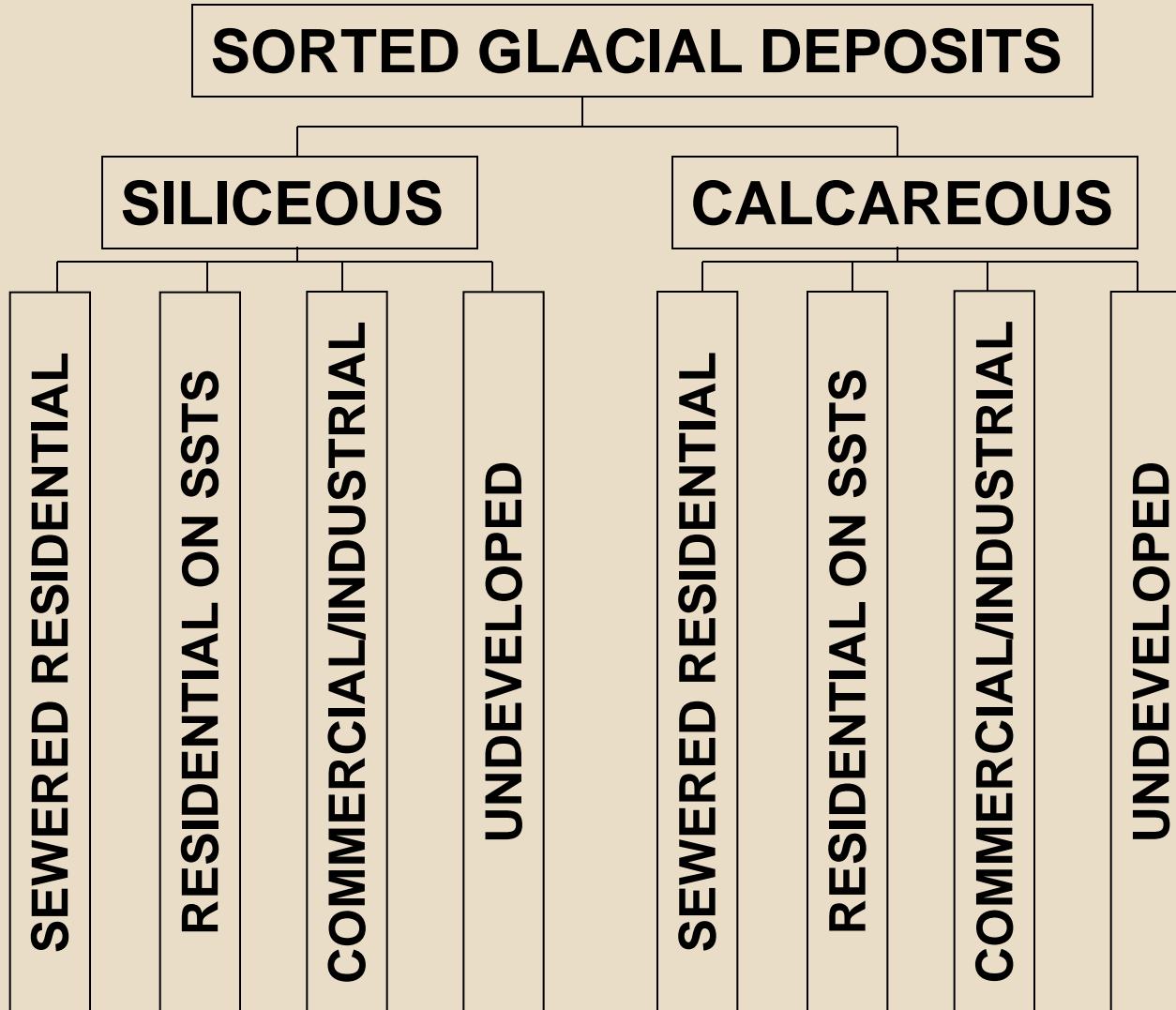




# Surficial Aquifer Composition



# NETWORK DESIGN

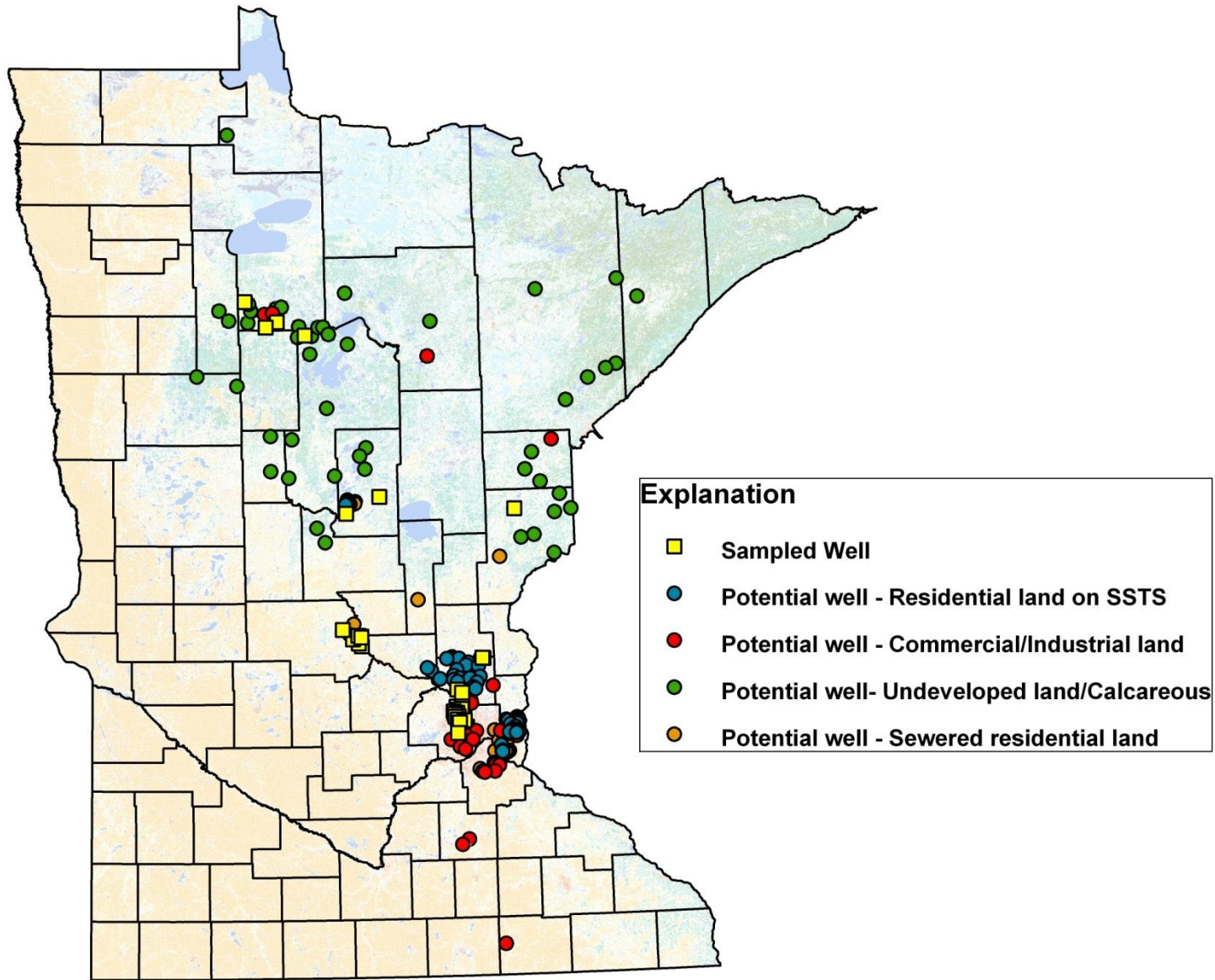


# CLEAN WATER FUND

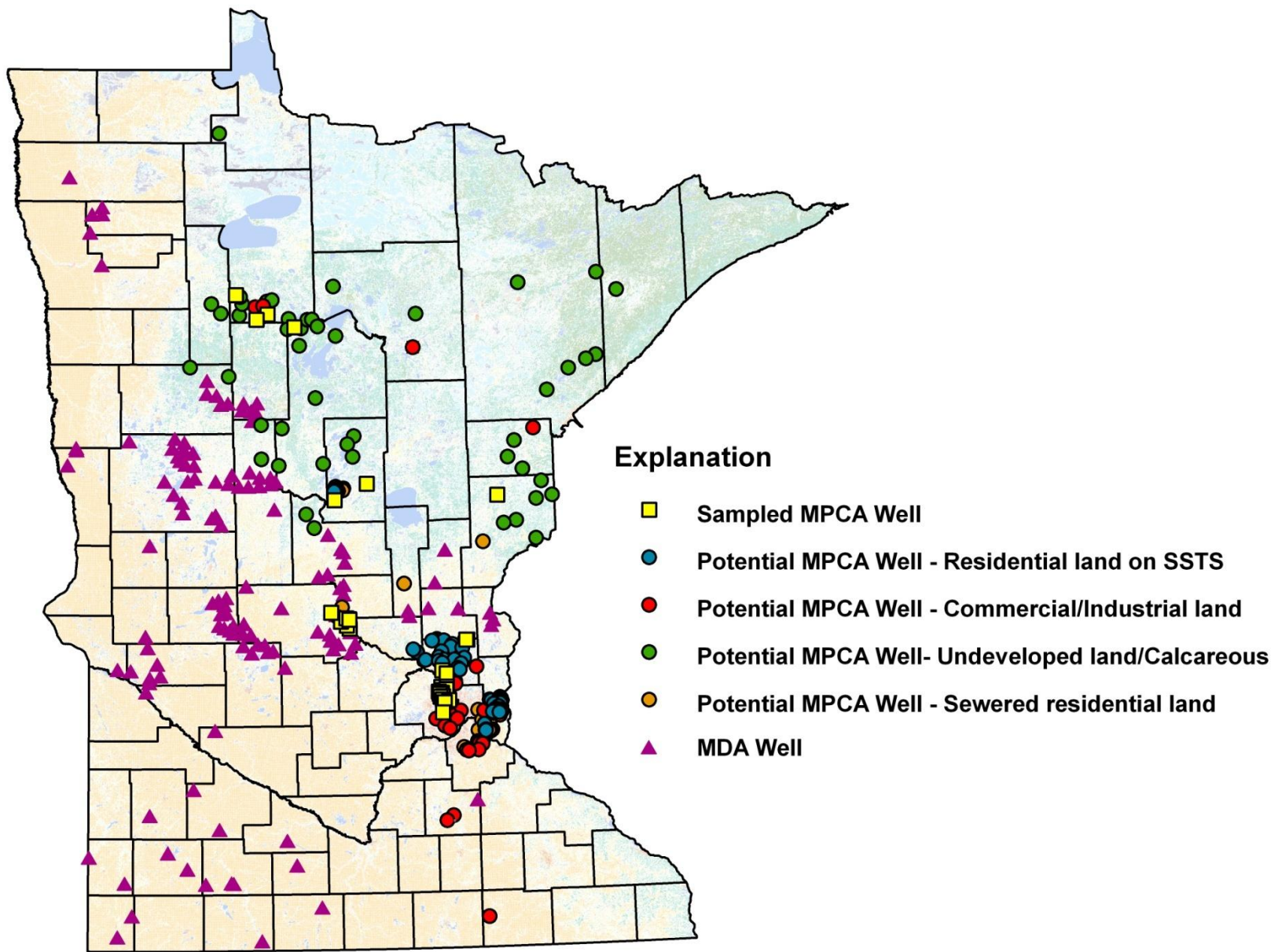
<b>Water Quality Monitoring and Assessment</b>	<b>\$16.74 million</b>
<b>TMDLs</b>	<b>\$18.5 million</b>
<b>Protection and Restoration</b>	<b>\$8.67 million</b>
<b>Groundwater assessment and drinking water protection</b>	<b>\$7.25 million</b>

# **SITE SELECTION/EVALUATION**

- **Homogeneous areas within each setting**
- **Defined by 500 meter circular buffer**
- **Surficial Geology – MGS**
- **Land Use**
  - **2001 NLCD**
  - **2005 Metropolitan Council**
  - **Areal photography**
  - **Maps published by municipalities**



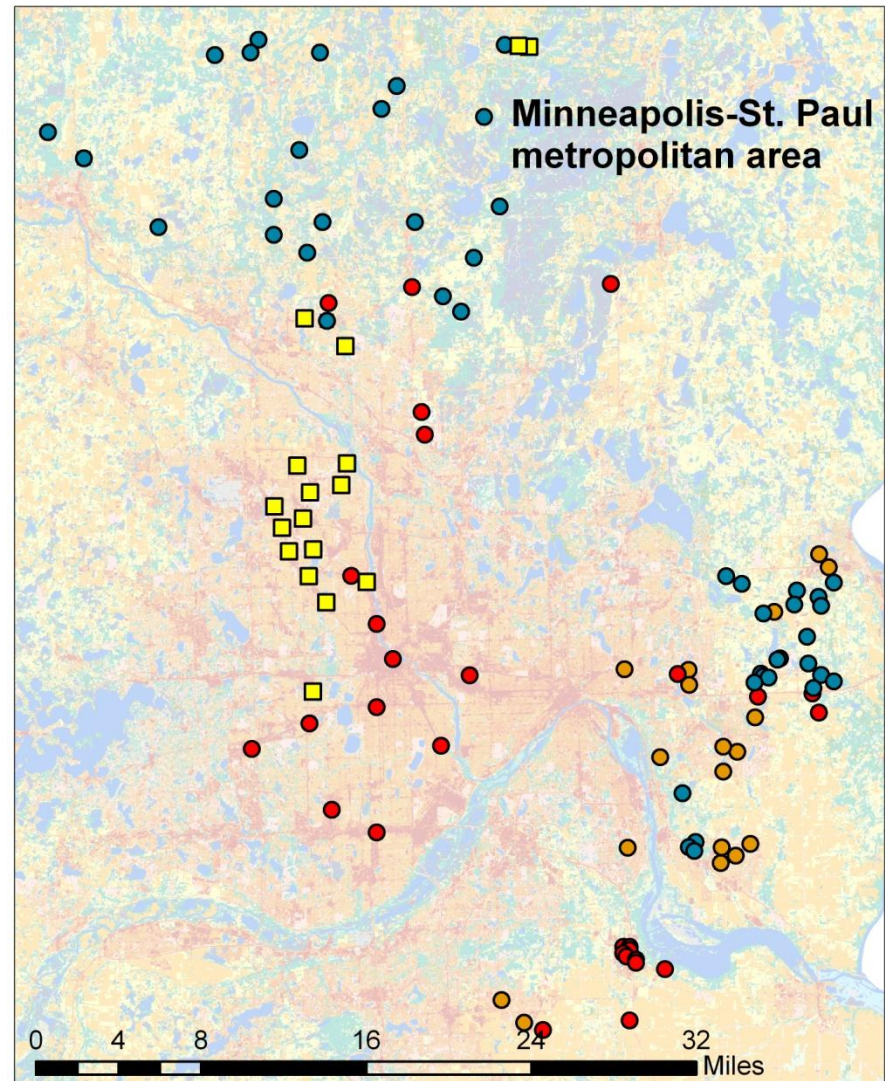
**Figure 3.** Proposed new and existing well locations for the MPCA ambient shallow surficial groundwater quality monitoring network.



**Figure 8.** Wells sampled by the MPCA and MDA in the quaternary sand and gravel aquifer and proposed monitoring sites for the MPCA ambient network [MPCA, Minnesota Pollution Control Agency; MDA, Minnesota Department of Agriculture].

## Explanation

- Sampled Well
- Potential well - Residential land on SSTS
- Potential well - Commercial/Industrial land
- Potential well - Sewered residential land

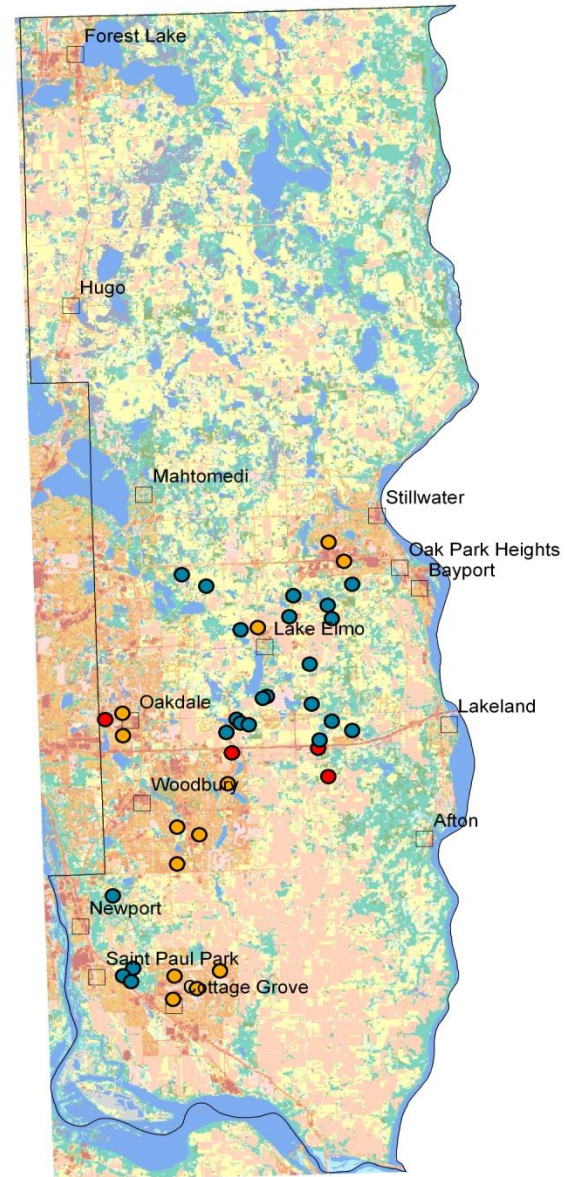


**Figure 7.** Proposed new and existing well locations for the MPCA ambient shallow surficial groundwater quality monitoring network in the Twin Cities metropolitan area.

# Proposed Well Locations in Washington Co.

## Proposed Locations for New Wells

- Commercial/Industrial
- Residential\_SSTS
- Sewered Residential





# Implementation of Network Enhancements

- Environmental Consultants
  - Obtain site access
  - Oversee drilling operations
  - Log boreholes
  - Well development
- Contract Well Drillers
  - Install monitoring wells

# ANALYTE LIST

- Nitrogen
  - Nitrate N
  - Ammonia N
  - Organic plus ammonia N
- Phosphorus
- Chloride
- Bromide
- Sulfate
- Calcium
- Magnesium
- Sodium
- Potassium
- Boron
- Iron
- Manganese
- Organic carbon
- Volatile organic compounds (68)

# ANALYTE LIST

- Trace elements
  - Al, As, Ba, Be, B, Cd Cr, Co, Cu, Pb, Li, Mn, Mo, Ni, Ag, Sr, Ti, V, and Zn
- Field measurements
  - Water temperature
  - Specific conductance
  - Dissolved oxygen
  - pH
  - Alkalinity

# EMERGING CONTAMINANTS



Fire testing in AFFF in a confined space.

# EMERGING CONTAMINANTS

- Acetophenone
- Acetyl-hexamethyl-tetrahydro-naphthalene (AHTN)
- 3-*tert*-Butyl-4-hydroxyanisole (BHA)
- Anthracene
- Anthraquinone
- Benzo[*a*]pyrene
- Benzophenone
- Hexahydrohexamethyl cyclopentabenzopyran (HHCB)
- 5-Methyl-1H-benzotriazole
- 1,4-Dichlorobenzene
- Bisphenol A
- Bromacil
- Bromoform
- Caffeine
- Camphor
- Carbaryl
- Carbazole
- Chlorpyrifos
- Cholesterol
- Triethyl citrate (ethyl citrate)
- Cotinine
- 3 Beta-coprostanol
- *para*-Cresol
- Diazinon
- Fluoranthene
- Indole
- 3-Methyl-1H-indole (skatol)
- Isoborneol
- Isopropylbenzene (cumene)
- Isoquinoline

# EMERGING CONTAMINANTS

- *d*-Limonene
- Menthol
- Metalaxyl
- Methyl salicylate
- Metolachlor
- Naphthalene
- 2,6-Dimethylnaphthalene
- 1-Methylnaphthalene
- 2-Methylnaphthalene
- 4-Cumylphenol
- para-Nonylphenol (total) (branched)
- 4-Nonylphenol diethoxylate, sum of all isomers (NP2EO)
- 4-*n*-Octylphenol
- 4-*tert*-Octylphenol
- 4-*tert*-octylphenol diethoxylate (OP2EO)
- 4-*tert*-octylphenol monoethoxylate (OP1EO)
- Pentachlorophenol
- Phenanthrene
- Phenol
- Tributyl phosphate
- Triphenyl phosphate
- Tris(2-butoxyethyl) phosphate
- Tris(2-chloroethyl) phosphate
- Tris(dichloroisopropyl) phosphate
- Prometon
- Pyrene
- *beta*-Sitosterol
- *beta*-Stigmastanol
- N,N-diethyl-*meta*-toluamide (DEET)
- Tetrachloroethylene

# EMERGING CONTAMINANTS

- Triclosan
- Carbamazepine
- Ibuprofen
- Azithromycin
- Erythromycin
- Erythromycin-H<sub>2</sub>O
- Roxithromycin
- Tylosin
- Virginiamycin
- Ciprofloxacin
- Lomefloxacin
- Norfloxacin
- Ofloxacin
- Sarafloxacin
- Enrofloxacin
- Sulfachloropyridazine
- Sulfadiazine
- Sulfadimethoxine
- Sulfamethazine
- Sulfamethoxazole
- Sulfathiazole
- Chlorotetracycline
- Epi-chlorotetracycline
- Iso-chlorotetracycline
- Epi-iso-chlorotetracycline
- Doxycycline
- Oxytetracycline
- Epi-oxytetracycline
- Tetracycline
- Epi-tetracycline
- Lincomycin
- Trimethoprim

# EMERGING CONTAMINANTS

- Chloramphenicol
- Ormetoprim
- 1,7-dimethylxanthine
- Codeine
- Thiabendazole
- Albuterol (Salbutamol)
- Acetaminophen
- Cotinine
- Dehydronifedipine
- Warfarin
- Diphenhydramine
- Diltiazem
- *cis*-Androsterone
- 4-Androsten-3,17-dione
- Diethylstilbestrol
- Epitestosterone
- Equilenin
- Equilin
- 17-*alpha*-Estradiol
- 17-*beta*-Estradiol
- Estriol
- Estrone
- 17-*alpha*-Ethinylestradiol
- 11-Ketotestosterone
- Mestranol
- Norethindrone (19-Noresthisterone)
- Progesterone
- Dihydrotestosterone
- Testosterone

**QUESTIONS?**