

# COUNTY OF MCHENRY



## WINTER SNOW AND ICE OPERATIONS



## ROADS, PARKING LOTS AND SIDEWALKS



## DIVISION OF WATER RESOURCES

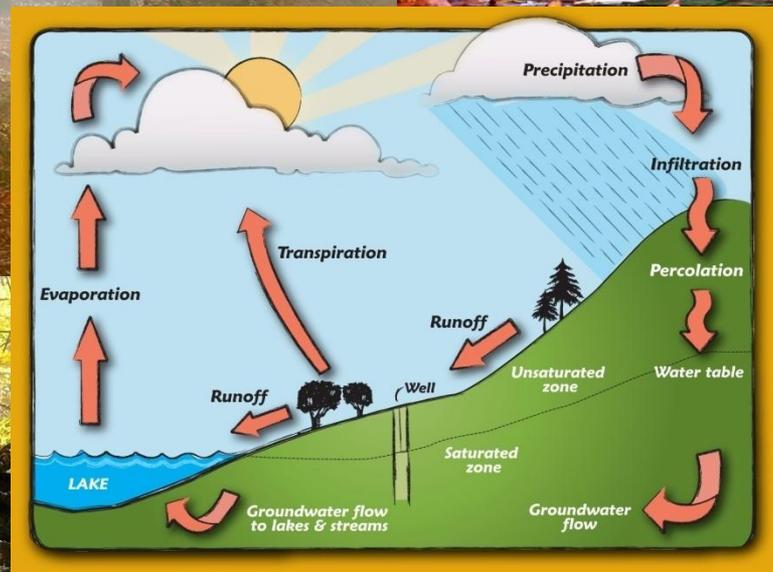
# Consider this...



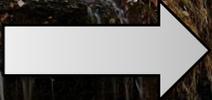
**CONDENSATION  
PRECIPITATION**



**EVAPORATION  
TRANSPIRATION**



**RUNOFF  
INFILTRATION**

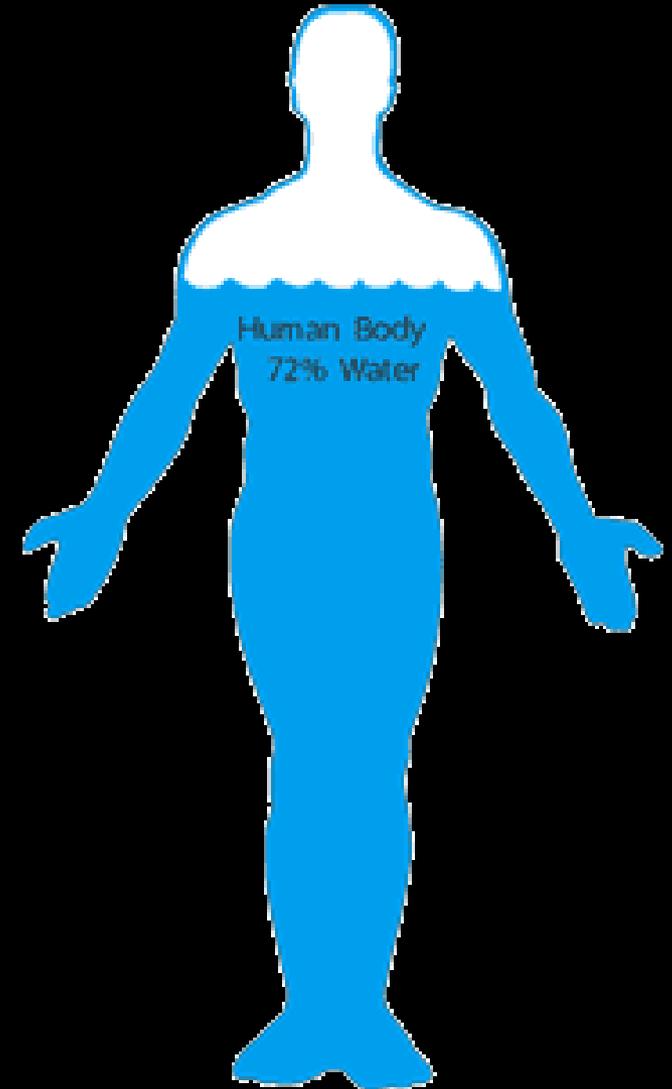


**GROUNDWATER  
SURFACE WATER  
WETLANDS/FENS**



Providing habitat for all living things

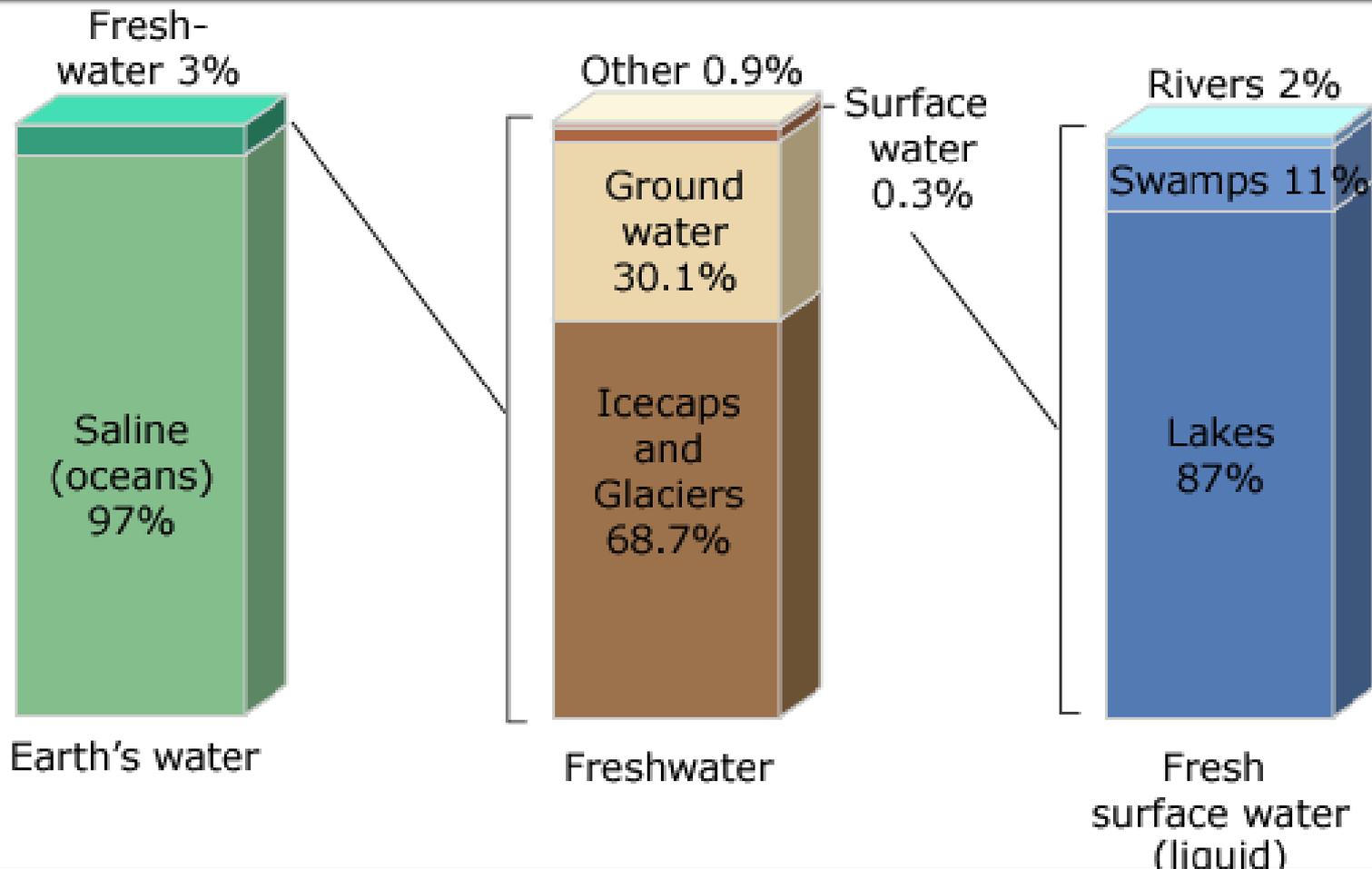
The average human requires  
10.5 cups of water per day!



# Water is a Finite Resource

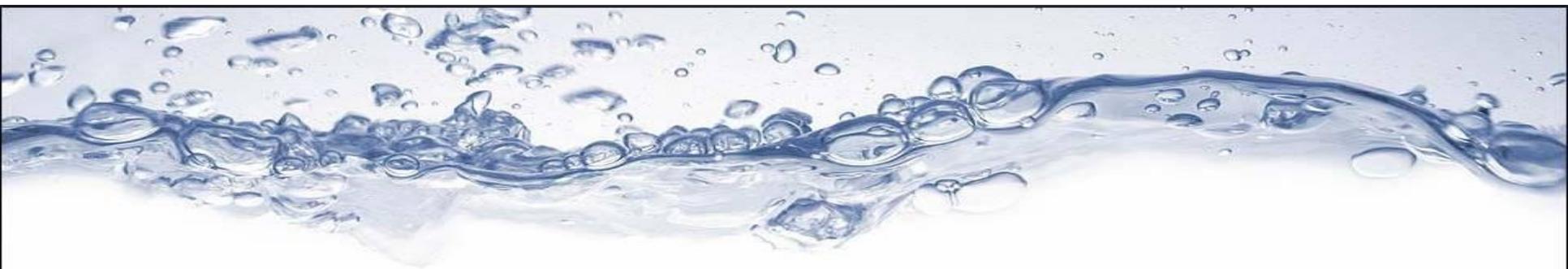


# Only a tiny fraction of the earth's water is fresh



70% of the earth's surface is covered by water  
**Of all the water on earth, less than 3% is fresh water**

**Water is Vulnerable...**



# Drought...



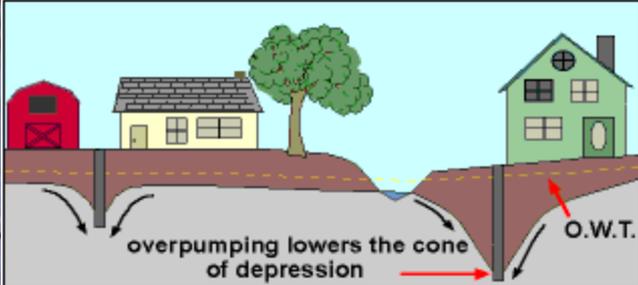
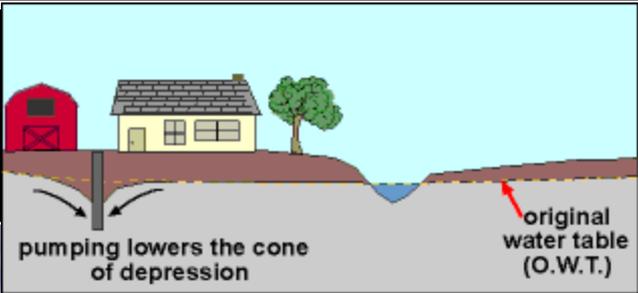
# Pollution...

THE DRAIN IS JUST FOR RAIN



# Mismanagement

## Impervious Surfaces, Overuse & Irrigation, Sprawl



**OVERPUMPING**  
- lowers the cone of depression  
- dries up the stream  
- original home owner must spend  
\$\$\$ to drill a deeper well



**Vulnerabilities lead to...**

Contamination  
&  
Water Shortages



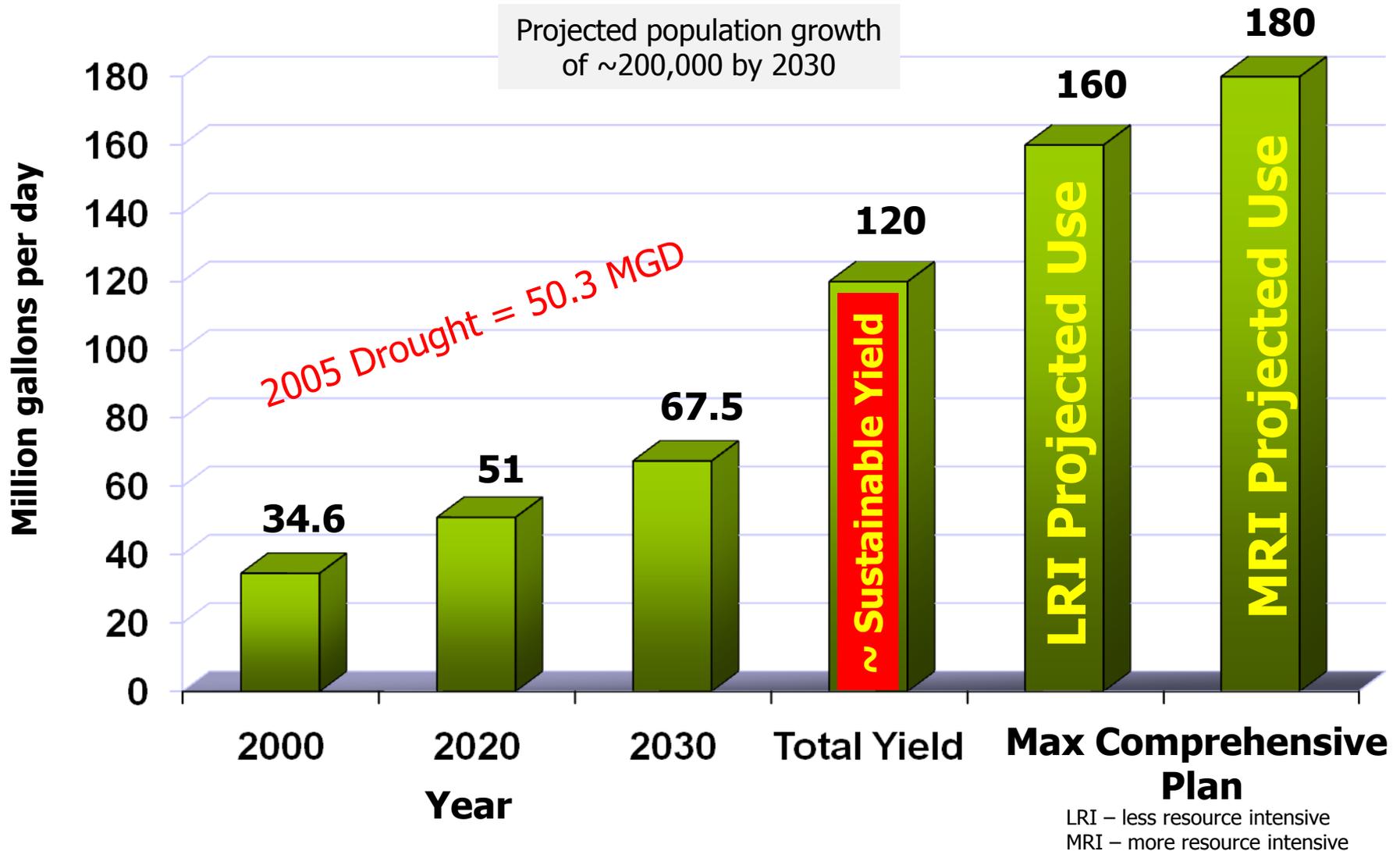


# The State of Water in McHenry County, Illinois

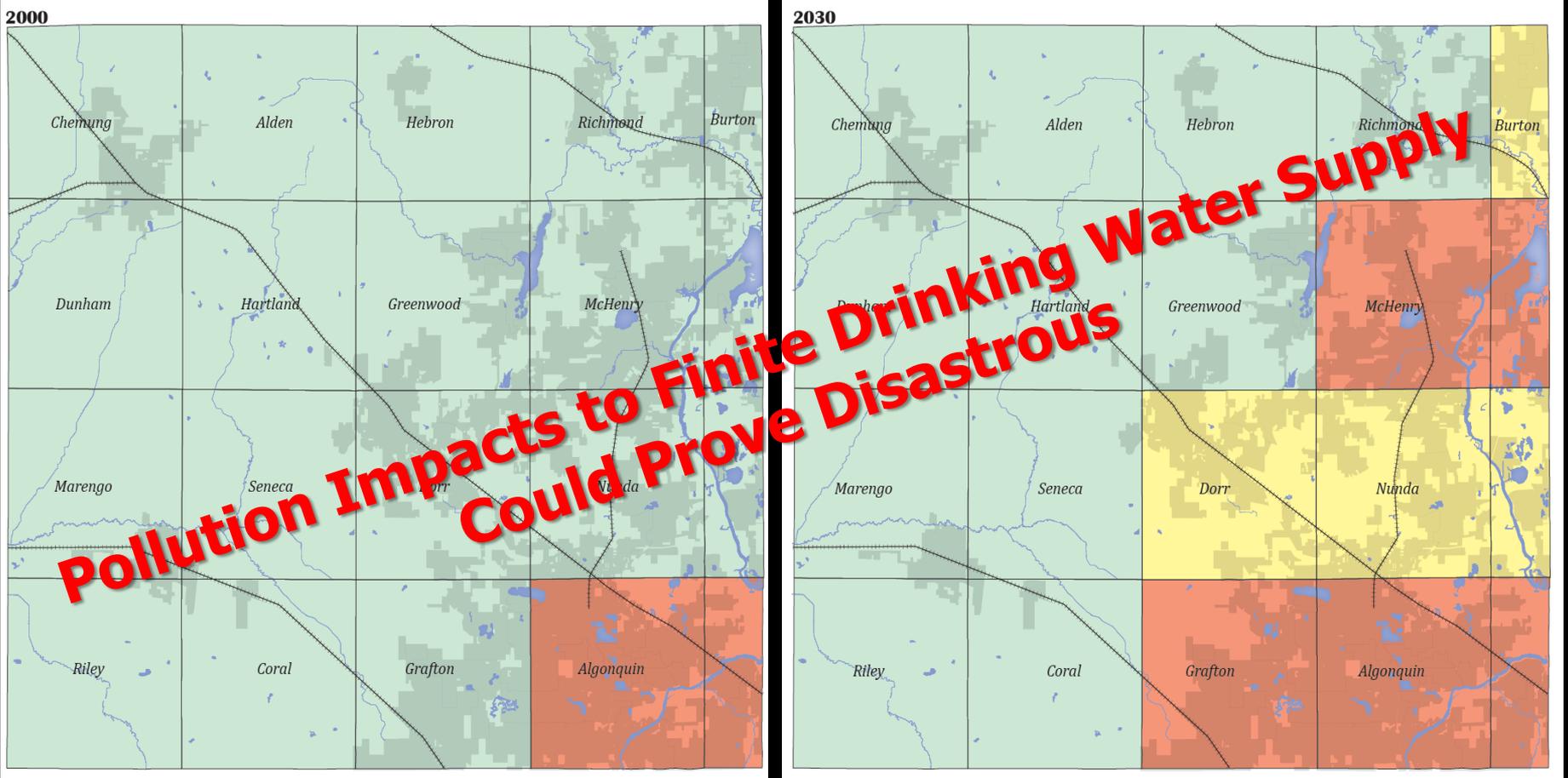
# McHenry County Challenge

- McHenry County is solely dependant on groundwater for all of its potable water needs
- Water supply is vulnerable to contamination -**INCLUDING SALT**
  - *Geology of County has significant sand and gravel at surface.*
  - *¾ of counties water supply comes from shallow aquifers within 100 feet of the surface of the ground*
- County is projected to grow by 190,000 people by 2030
- Groundwater shortages are predicted to occur as soon as 2020 in some of these areas

# How Much Water Do We Use in McHenry County?



# McHenry County Water Supply Projections



## Map Legend

-  Townships/Areas with Surplus Groundwater Capacity (Ratio 0.0 - 0.6)
-  Townships/Areas of Groundwater Concern (Ratio 0.6 - 0.8)
-  Townships/Areas with Potential for Groundwater Shortage (Ratio > 0.8)
-  Water Features
-  Railroads
-  Incorporated Municipality

# The Future of a Community

## Water Supply Planning

- Sound & Healthy Economy
  - Healthy Environment, Open Space & Agriculture
- High Quality of Life
- Sustainable & Safe Water Supply

**Smart Growth**



**Public Safety  
and Fire Protection?**

## Lack of Water Supply Planning

- Loss of Jobs, Retail & Industry
  - Degraded Environment, Loss of Open Space & Agriculture
- Decreased Quality of Life & Property Values
  - Unfit Water Supply?

**Sprawl**

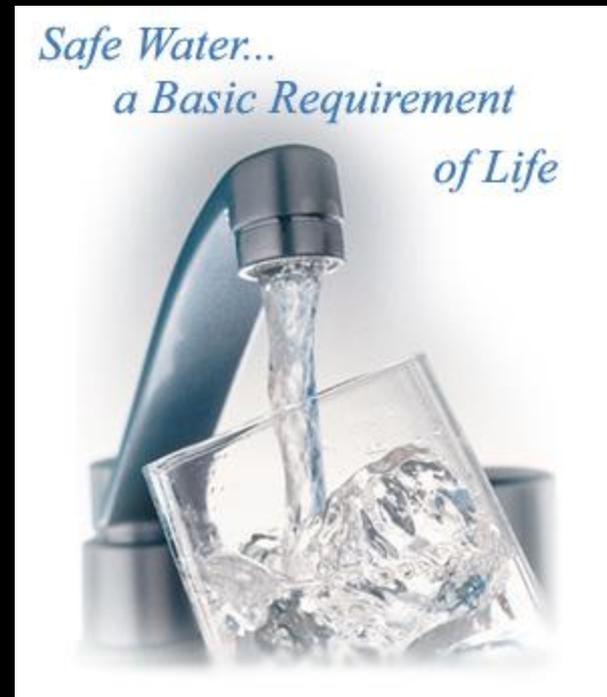
Why is it that water takes up  
70% of the earth's surface and 60% of our bodies, yet  
so little of our thinking?



Imagine turning water problems into  
**opportunities!**

# Opportunity:

- To rethink the way we treat and value water in Illinois!



## Create a Program to:

Protect and preserve the

***quantity and quality***

of water resources for current and  
future generations,  
including the built and natural  
environment.

# Water Resources Action Plan:

## Quality

- Pollution Prevention
- Winter Snow and Ice

## Education

## Quantity

- Water Conservation
- Conservation Design

## Quantity & Quality

- Groundwater Recharge
- Protection of Water Dependent Ecosystems
- Wastewater
- Water Supply Planning
  - Drought Preparedness
  - Contingency Planning

COUNTY OF MCHENRY

DIVISION OF WATER RESOURCES

# Winter Snow and Ice Operations



WINTER SNOW AND ICE OPERATIONS



### Sources of Chloride

- Natural sources
- Point source discharges – e.g., wastewater treatment plants
- Non-point runoff sources – e.g., deicing operations
  - Determined to be major source



### Impacts of Chloride

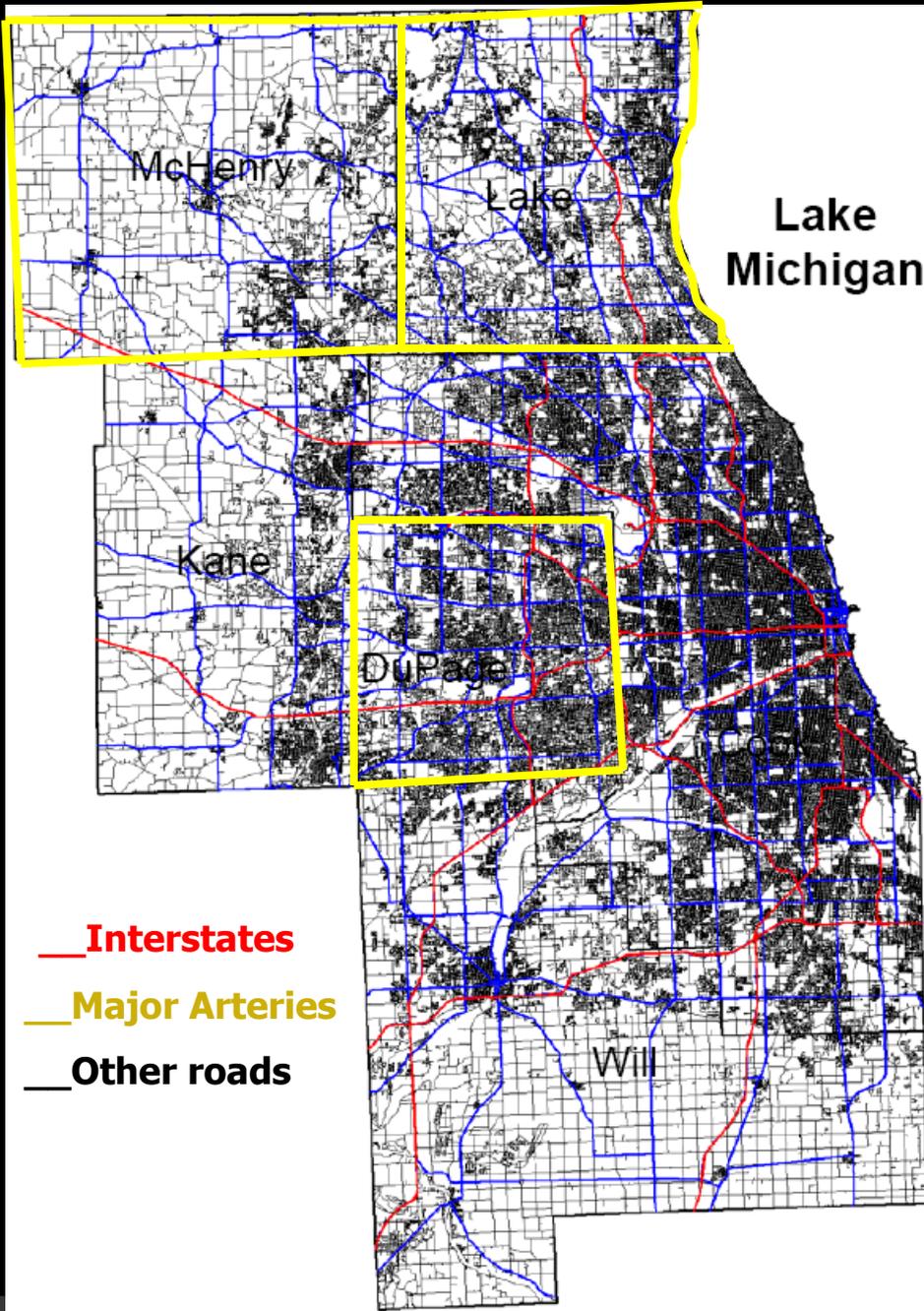
- On snow and ice: melting
- On infrastructure and vehicles: corrosion
- On vegetation: adverse growth effects
- On aquatic life: impairment
- On drinking water: salty taste
- Chloride does not biodegrade





Photo courtesy of Walt Kelly

**Chicago annual average snow cover: 38 inches (97 cm)**



## Chicago Metropolitan Area Roads:

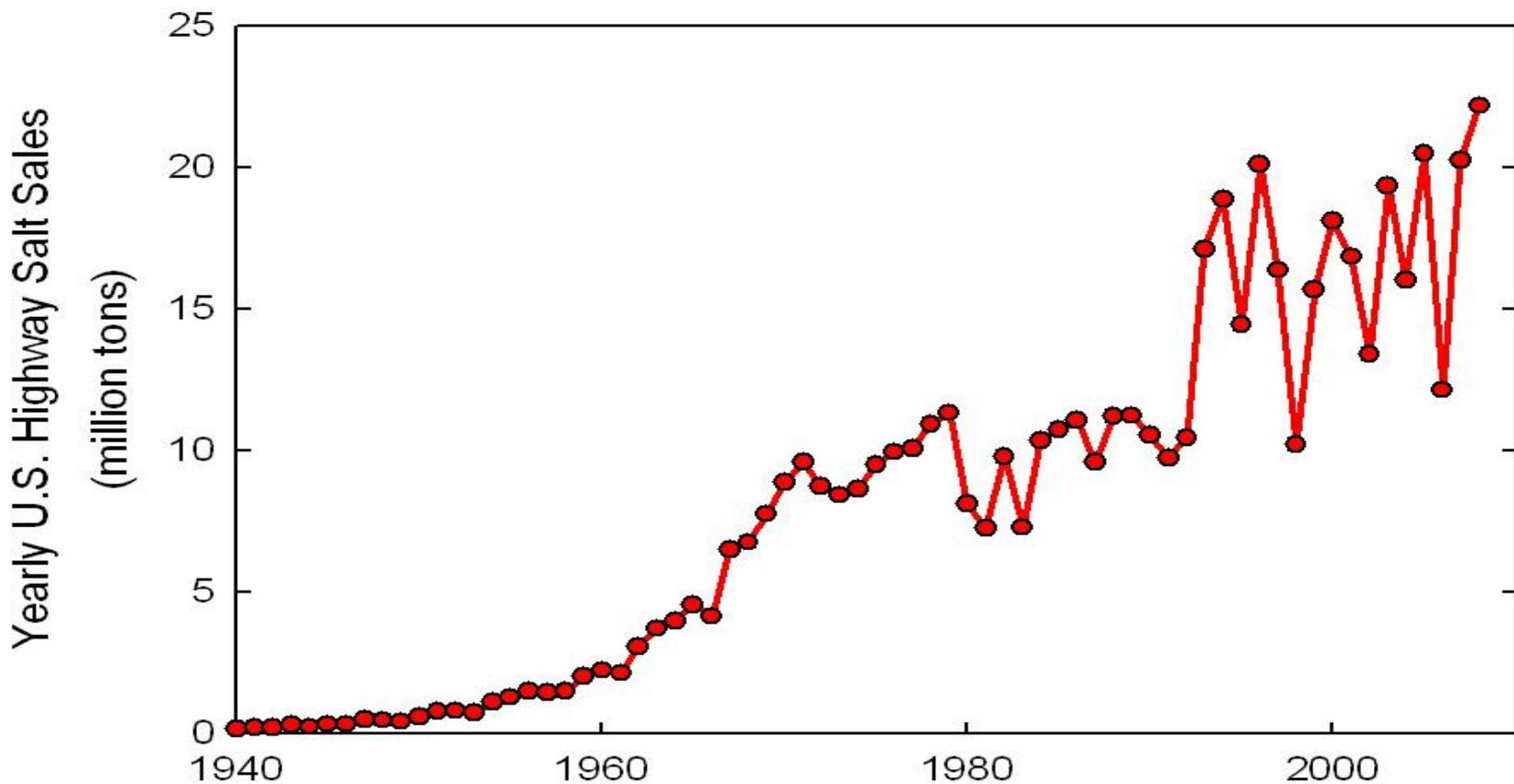
**In just 3 Counties,  
55,000 lane miles  
(2x around the world!!)**

**IT'S NOT JUST ROADS WE SALT!**



### Road Salt in U.S.

First applied in earnest around 1960



Graph courtesy of Walt Kelly

# Record highway salt sales

## ➤ United States Record salt sales

- 2005 – **20.5** million tons of road salt
- 2006 – 12.1 million tons
- 2007 – **20.3** million tons
- 2008 – **22.2** million ton

## ➤ What About McHenry County?

- In 2010:
  - 60,000 tons ordered on the State Bid
  - Of that, County of McHenry DOT received 12,000 tons
    - Use an annual average of 9,000 tons



- Chicago's annual average road salt application: >270,000 tons (~155,000 MgCl<sub>2</sub>/yr)
- State of Illinois Average Annual Salt Bid ~1.4 million tons
- This doesn't include private applicators, private bids, or other purchases.



**Chicagoland Region Used 1.8 million tons of salt...  
How much is 1.8 million tons of salt?**

**What if we stored it in solder field?**















### **SALT & WATER**

**THE ENVIRONMENTAL IMPACTS OF TREATING ROADS**



**Once in solution, always in solution**

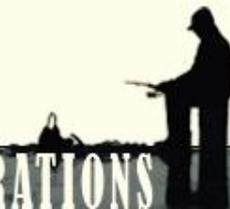


COUNTY OF MCHENRY

DIVISION OF WATER RESOURCES

# Infrastructure

WINTER SNOW AND ICE OPERATIONS



## Chloride and Corrosion

- Chloride ions are the major cause for the corrosion of steel reinforcement in concrete and can accelerate corrosion of metallic pipes and structures
- Deicing salts result in **annual** repair/maintenance costs estimated at \$200 to \$450 million
  - Primarily for bridge decks
    - 1991 Transportation Research Board Report
- \$50 of rock salt cause \$1450 in damage to roads and bridges



COUNTY OF MCHENRY

DIVISION OF WATER RESOURCES

# Natural Resources

WINTER SNOW AND ICE OPERATIONS



### Road Salt: Ecological Effects



**Road Salts Can Damage Plants**

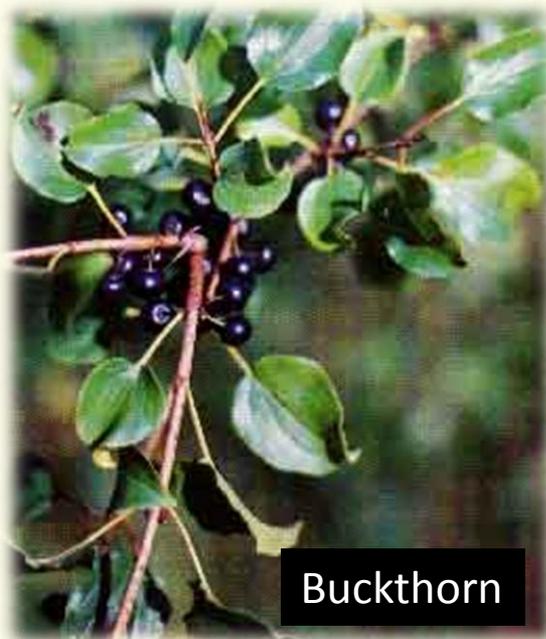


### Road Salt: Ecological Effects

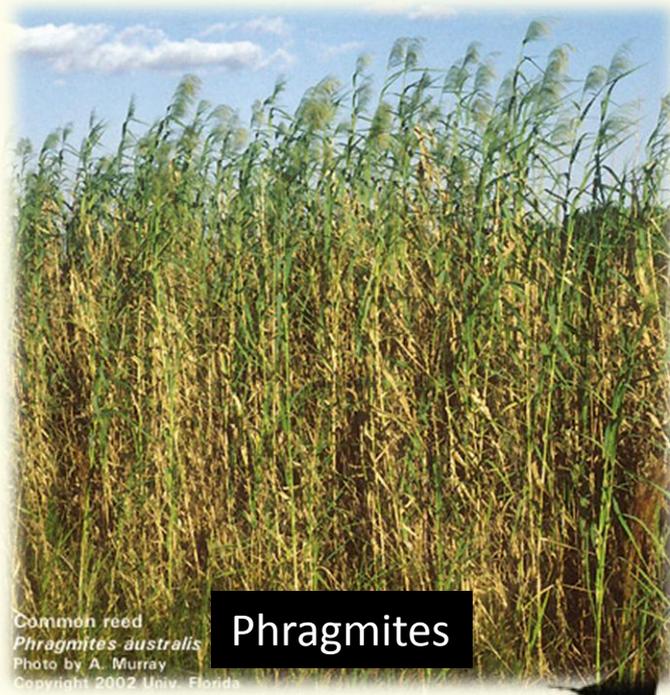
Salt tolerant species may outcompete native species, decrease biodiversity



Cattails



Buckthorn



Common reed  
*Phragmites australis*  
Photo by A. Murray  
Copyright 2002 Univ. Florida

Phragmites

## Road Salt: Ecological Effects

- Aquatic fauna negatively impacted by high salt concentrations
  - Wood frogs
  - Salamanders
  - Caddisflies
  - Amphipods
  - Trout, minnows ( $\text{Cl}^-$  as low as 210 mg/L)
- Some birds may also be affected by salt consumption



### Road Salt: Ecological Effects

- High chloride levels may augment concentrations of toxic metals in pond sediments
- Salt concentrations in lakes may be high enough to stop spring turnover, preventing oxygen from reaching benthic sediments





How many of you went fishing this year?

### What do we know about Illinois streams and lakes?

Assessed waters:

~15,569 stream miles  
(22%)

~147,361 lake acres or  
366 lakes (46%)



# COUNTY OF MCHENRY

## DIVISION OF WATER RESOURCES

### Percent of Illinois Stream Miles Assessed as Good, Fair and Poor in 2008

Designated Use	Miles Assessed	Percent Assessed	Percent Fully Supporting (Good) <sup>(2)</sup>	Percent Not Supporting (Fair) <sup>(2)</sup>	Percent Not Supporting (Poor) <sup>(2)</sup>	Percent Not Assessed
Aquatic Life	15,314	21.5	61.1	34.8	4.1	78.5
Fish Consumption	3,827	5.4	0.0	91.9	8.1	94.6
Indigenous Aquatic Life	85	100.0	38.2	55.1	6.7	0.0
Primary Contact	3,915	5.5	18.9	36.2	44.9	94.5
Public and Food Processing Water Supply	1,108	100.0	9.0	91.0	0.0	0.0
Secondary Contact <sup>(1)</sup>	740	1.0	100.0 <sup>(3)</sup>	---	---	99.0
Aesthetic Quality <sup>(1)</sup>	0	0.0	---	---	---	100.0

Note: Numbers and percentages may not add up due to slight rounding errors.

1. Assessment guidelines are not yet fully developed; see section C-2 Assessment Methodology.
2. Percentages of Good, Fair and Poor indicate the percent of miles assessed.
3. By definition, Secondary Contact Use is "Fully Supporting" in all waters in which Primary Contact Use is "Fully Supporting"; otherwise, assessment guidelines are not yet developed for determining the level of use attainment.

**100% of streams tested do not fully support fish consumption**

# 98% of lakes tested do not support fish consumption

Designated Use	Number of Lakes Assessed	Percent of All Lakes Assessed <sup>(2)</sup>	Percent of Lakes Fully Supporting (Good) <sup>(1)</sup>	Percent of Lakes Not Supporting (Fair) <sup>(1)</sup>	Percent of Lakes Not Supporting (Poor) <sup>(1)</sup>	Percent of All Lakes Not Assessed <sup>(2)</sup>	Percent of Lakes as Insufficient Information
Aesthetic Quality	345	0.4	13.3	72.5	14.2	99.5	0.1
Aquatic Life	345	0.4	89.0	10.7	0.3	99.5	0.1
Fish Consumption	95	0.1	2.1	96.8	1.1	99.9	0.0
Indigenous Aquatic Life	1	100.0	100.0	0.0	0.0	0.0	0.0
Primary Contact	15	0.02	46.7	53.3	0.0	99.98	0.0
Public and Food Processing Water Supply	76	95.0	23.7	76.3	0.0	5.0	0
Secondary Contact <sup>(3)</sup>	7	0.01	---	---	---	99.99	0

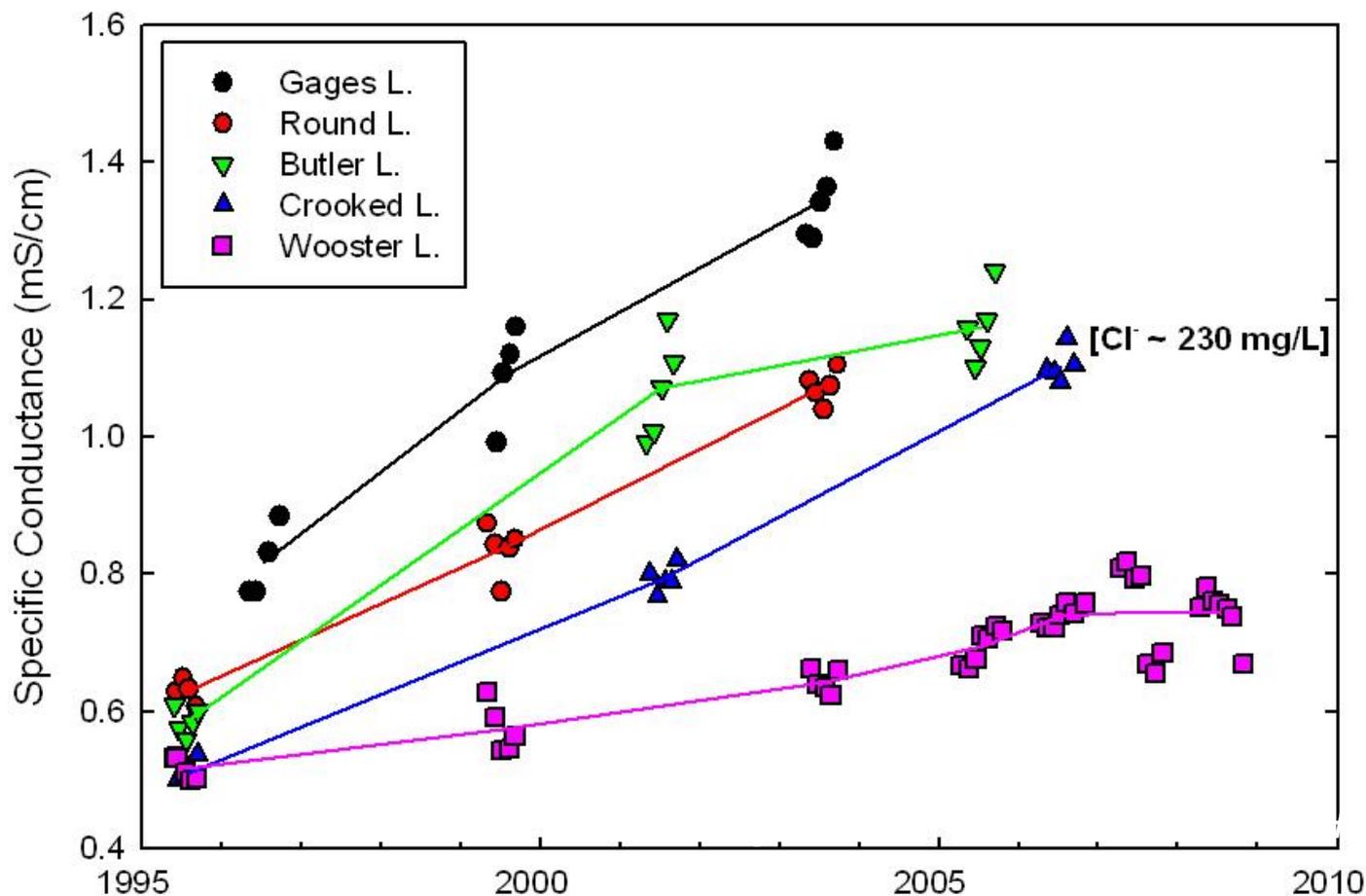
1. The percentages of Good, Fair and Poor indicate the percent of lake acres (or lake numbers) assessed.
2. The percent of all lakes assessed is based on a statewide total of 91,456 lakes and ponds, except for Indigenous Aquatic Life (which applies to only one lake) and Public and Food Processing Water Supply (which applies to only 80 lakes in Illinois).
3. By definition, Secondary Contact Use is "Fully Supporting" in all waters in which Primary Contact Use is "Fully Supporting"; otherwise, assessment guidelines are not yet developed for determining the level of use attainment.

Crystal Lake Outlet, Des Plaines River, DuPage River, Hickory Creek, Higgens Creek, Huntley Ditch, Little Vermilion River, Middle Fork North Branch Chicago River, North Branch Chicago River, Poplar Creek, Prairie Creek, Saline River, Sugar Creek, Thorn Creek, West Branch DuPage River, West Fork North Branch Chicago River, West Fork Spoon River



**2008 Illinois Chloride impaired waters in Northeastern IL**

### Lakes in Lake Co., IL



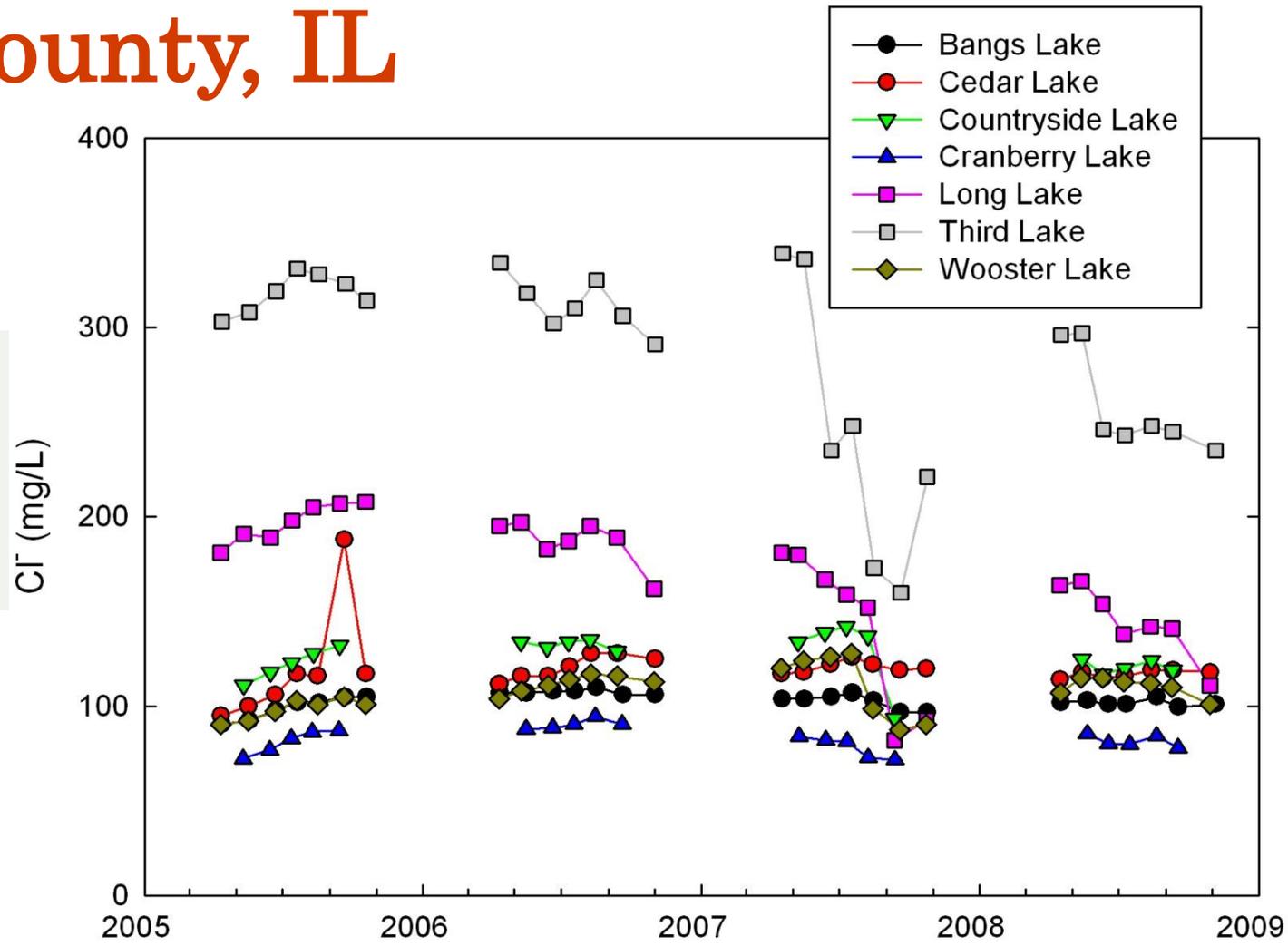
*Samples collected between Apr. – Oct.*

*th Dept*



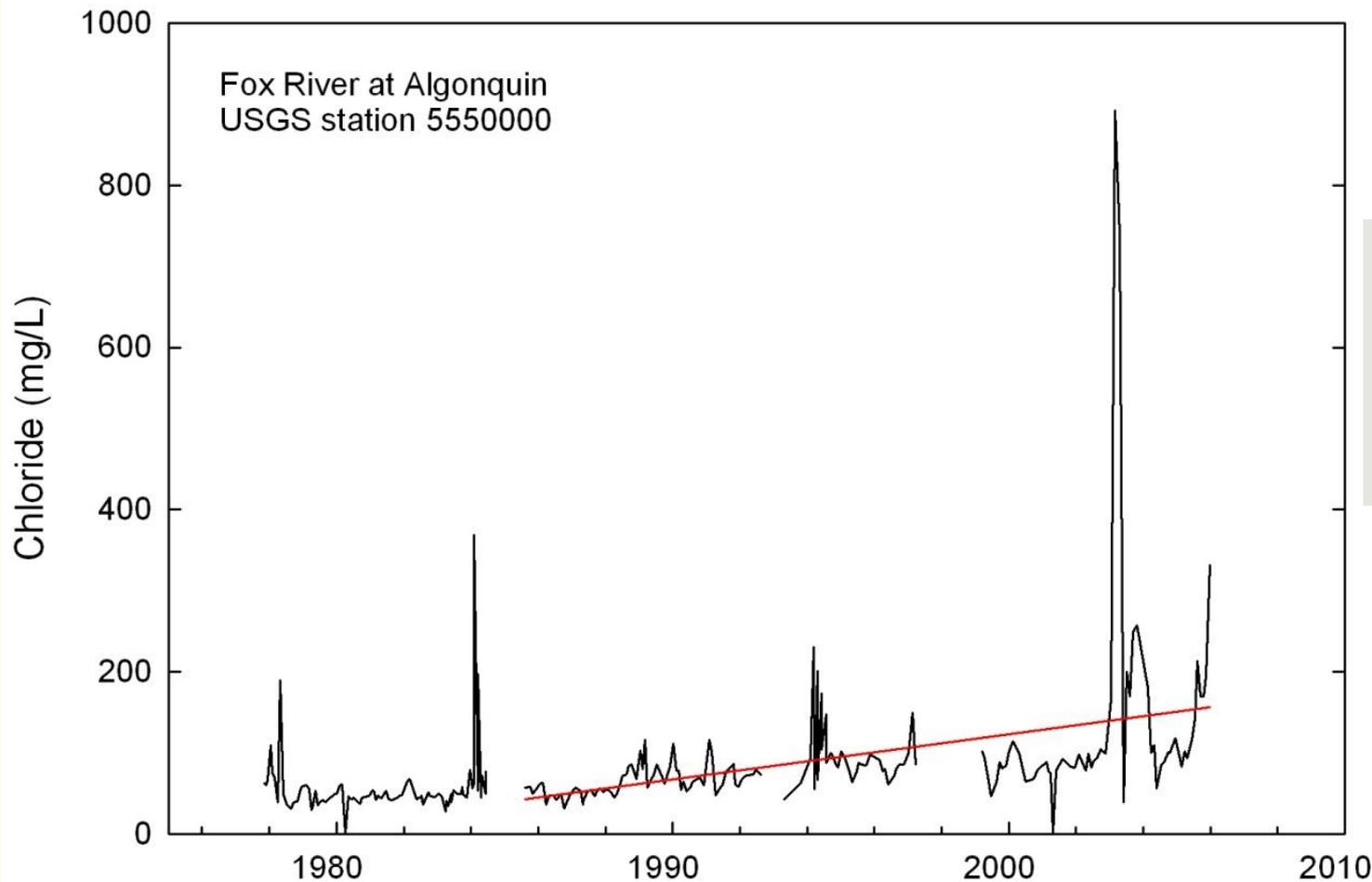
### Lake County, IL

**Note high chlorides:**  
Some golf courses used to irrigate with lake water but have since had to drill wells



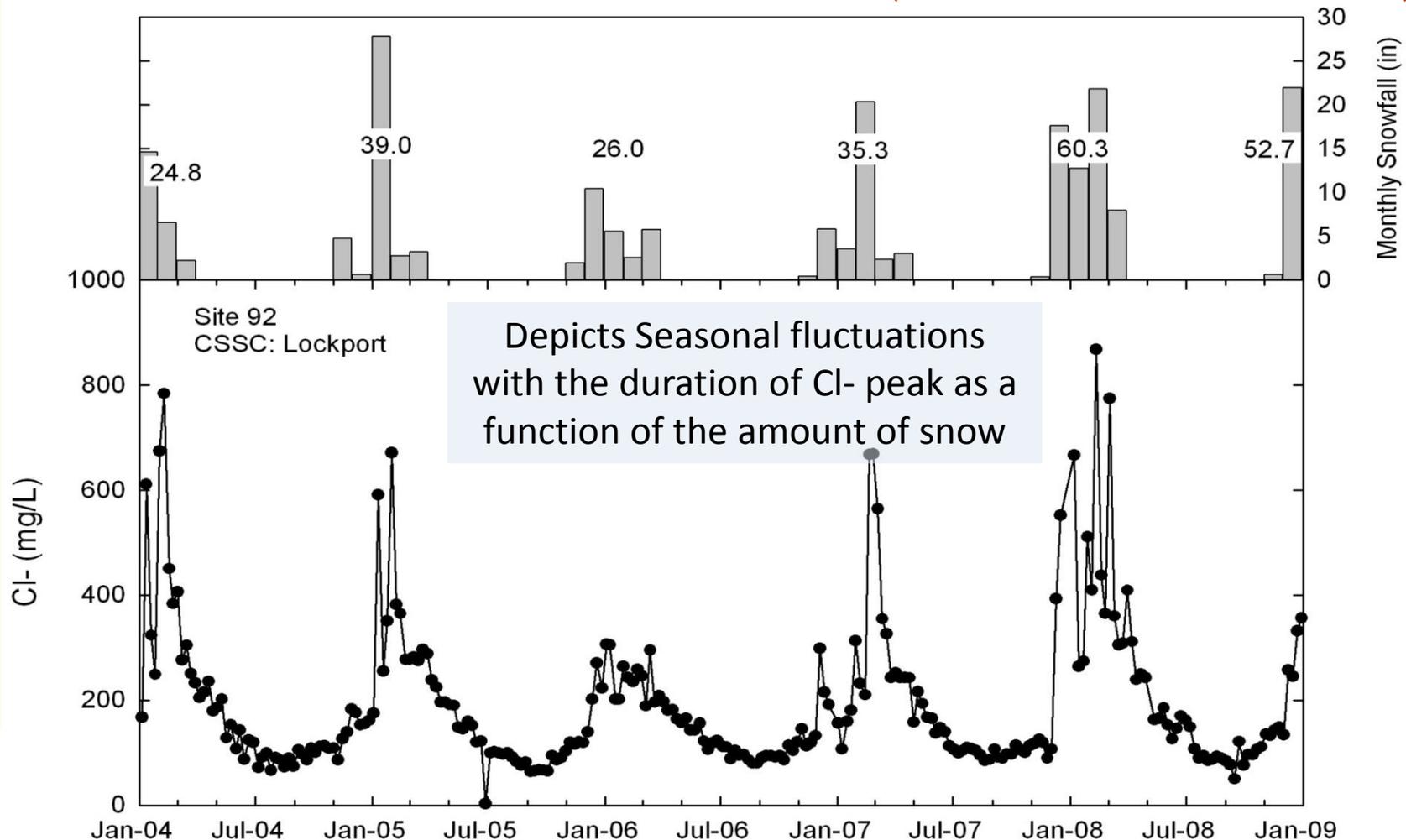
# COUNTY OF MCHENRY

## DIVISION OF WATER RESOURCES

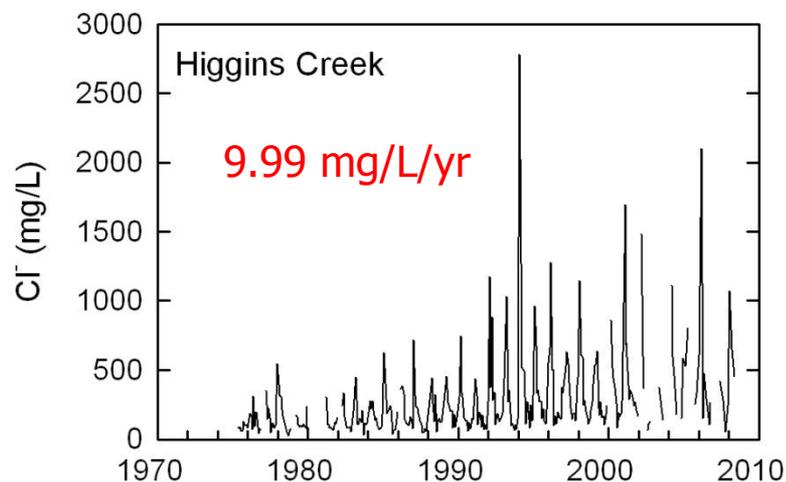
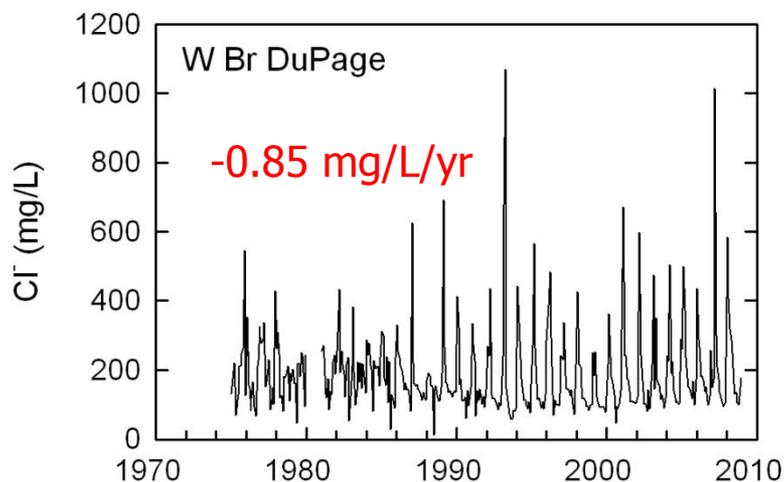
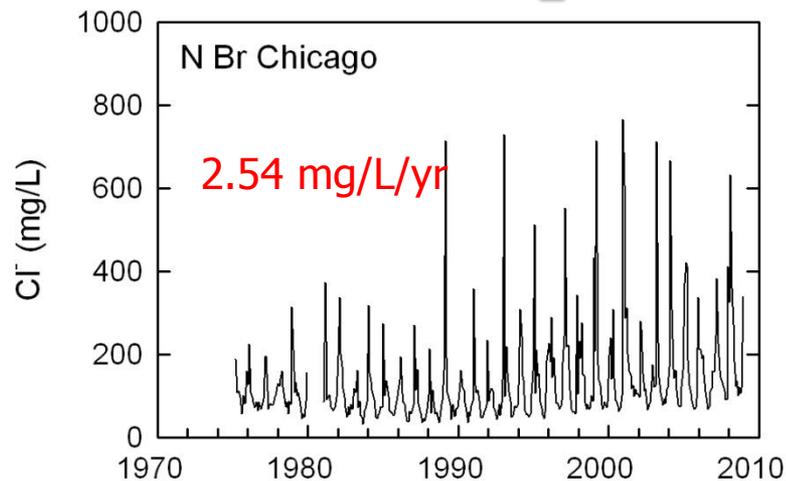
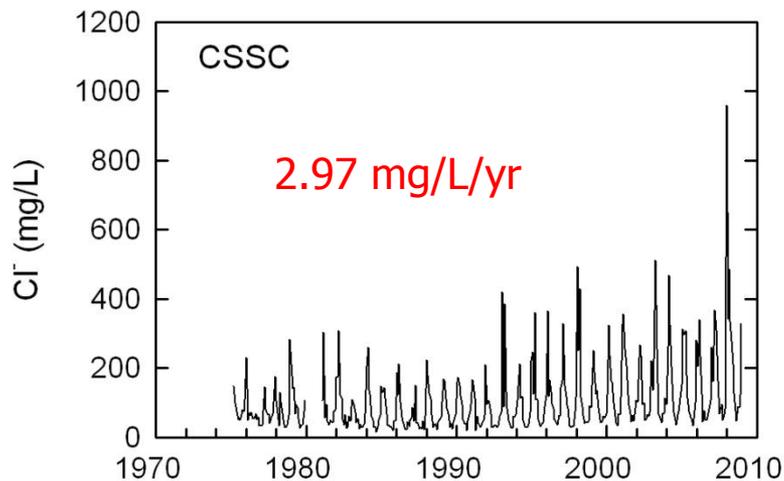


Increase in Chloride Concentrations of about 5 mg/L per year

### Seasonal Cl<sup>-</sup> concentrations (MWRDGC Data)



# MWRDGC Stations: Examples



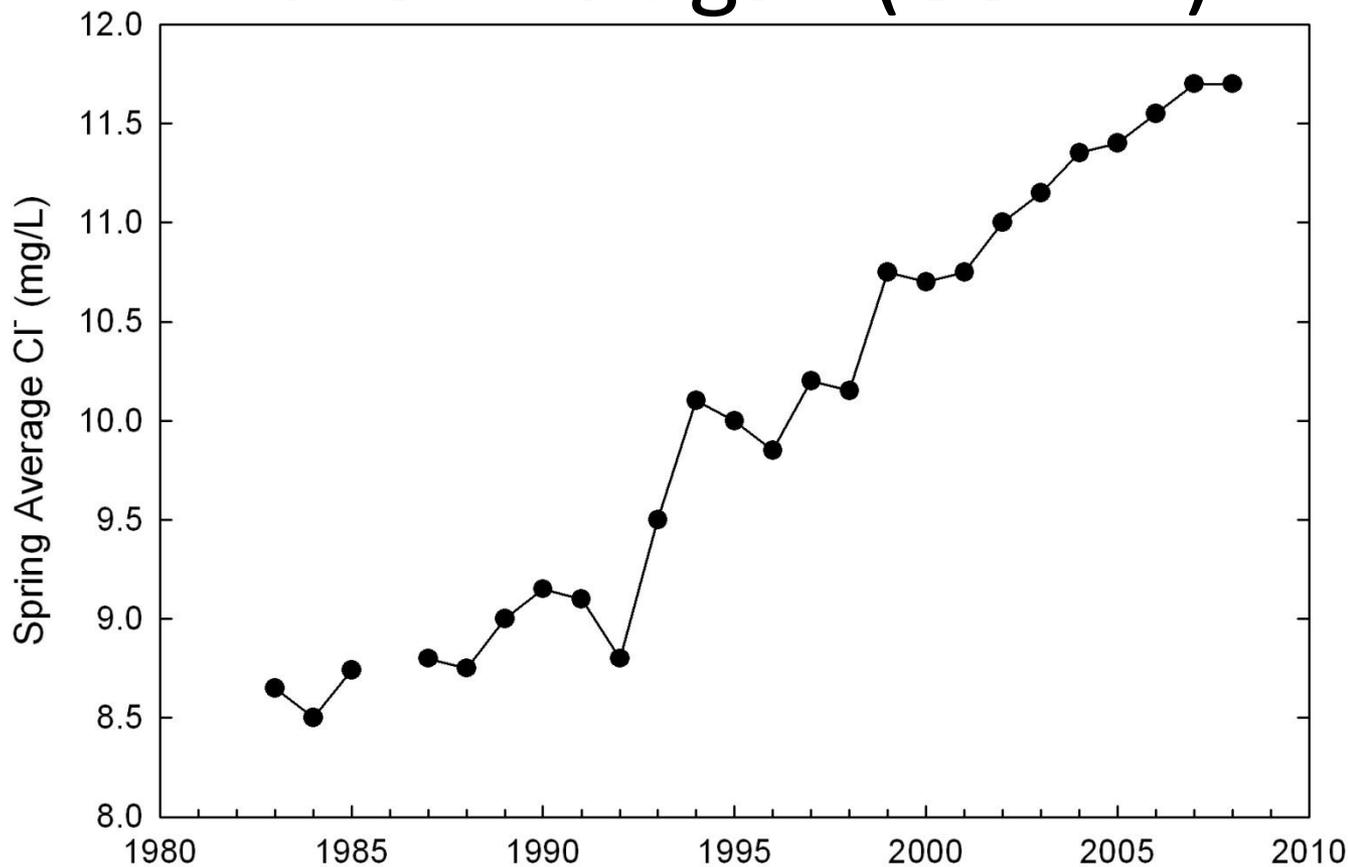
85% have increasing trends since 1975

Note concentrations in Higgins Creek, a relatively small stream, have been measured > 2000 mg/L.

The State of Illinois has jurisdiction over ~1,526 square miles of open water and 63 shoreline miles of Lake Michigan bordering Cook and Lake counties.

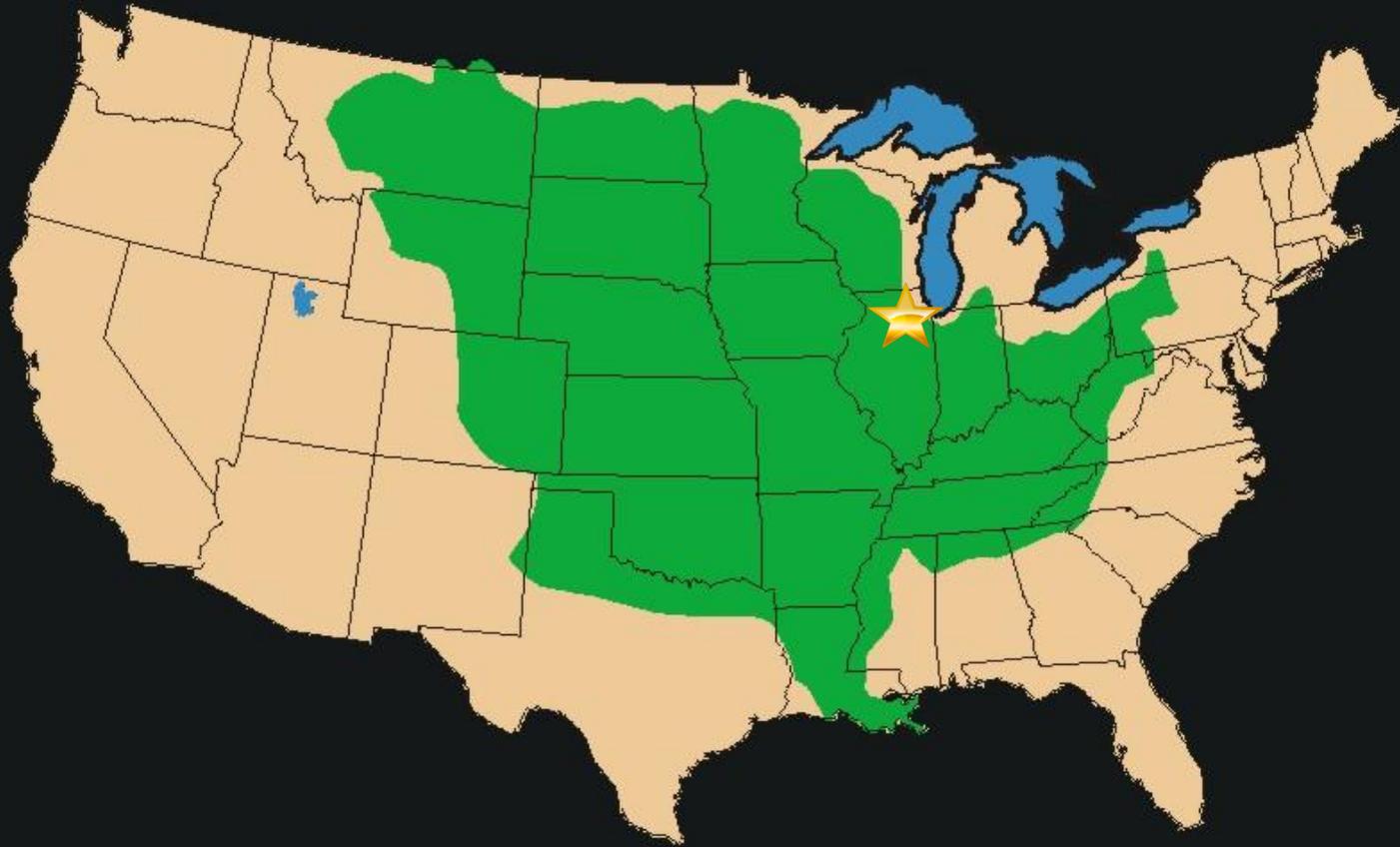
The Illinois portion of Lake Michigan does not support fish consumption.

### Lake Michigan (USEPA)



Spring average concentration – sample collected by USEPA somewhere near Chicago

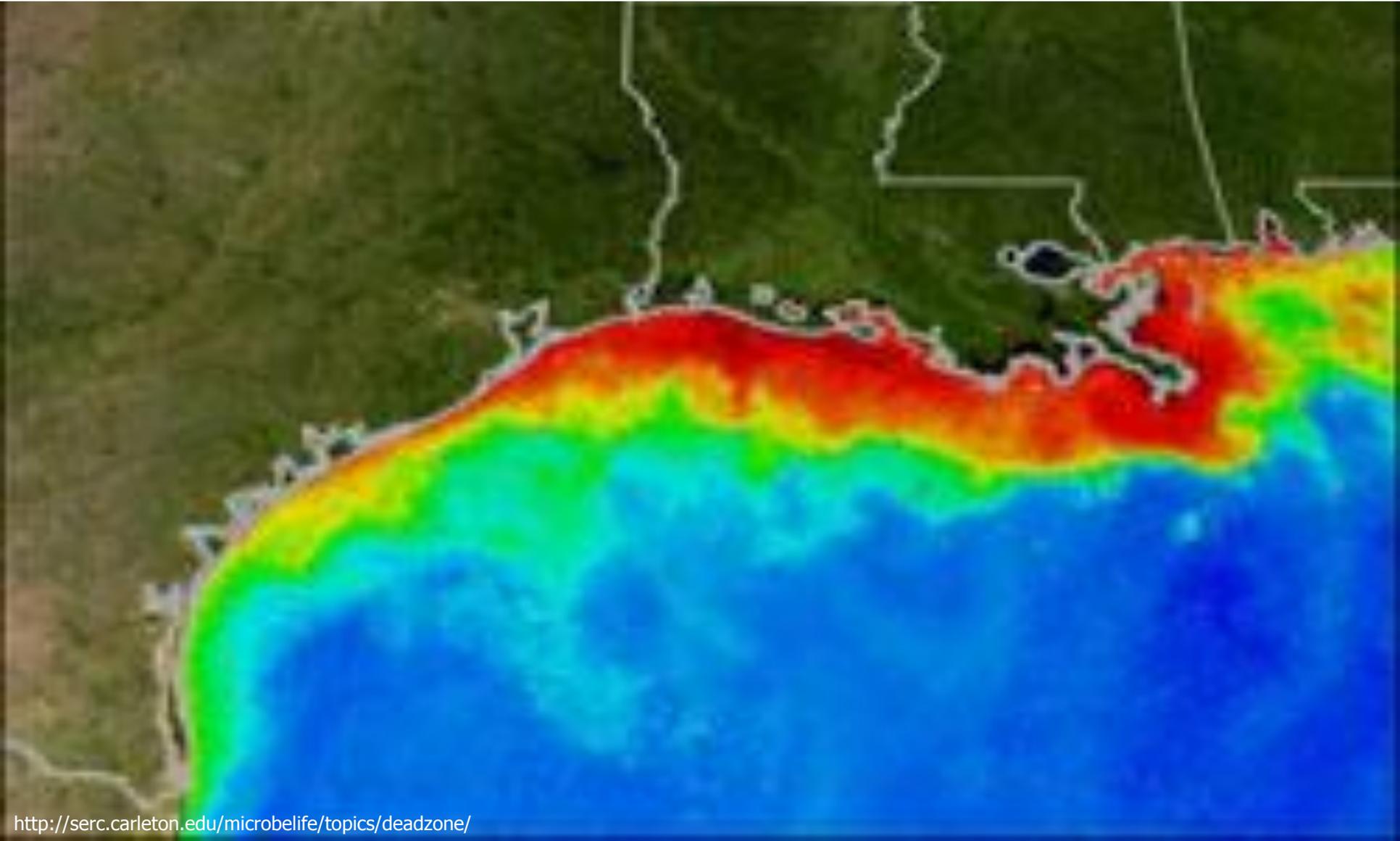




Mississippi River Basin

# Dead Zone

6,000 – 7,000 miles<sup>2</sup> of the Gulf of Mexico (size of New Jersey)



### Measure Impacts of Urbanization – Fish Shocking



**High Quality Stream has  
25 Fish Species,**

**Urban Streams  
0 to 8 Species**



### Chloride Concentration Guidelines: Fish

Concentrations (mg/l)

Emerging fry		
Channel catfish	14,000	Upper tolerance limit
Black bullhead	8,000 10,000	Median toxicity threshold in NaCl Probable lethal limit
Yellow perch	11,500	No adverse effects
Fathead minnow	6,000-7,000 5,300-5,900	Acutely lethal 96-hr LC50
Green Sunfish	10,700 20,000	Median toxicity threshold in NaCl Lethal
Bluegill	11,900	Lethal limit
Golden Shiner	5,600	Upper tolerance limit
Common Carp	12,000 18,500-19,000	No observed effect Upper tolerance limit
D. ...	10,000	...

### Chloride Concentration Guidelines

- Increases in salinity up to 1,000 mg/liter can have lethal and sub-lethal effects on aquatic plants and invertebrates
- Concentrations of chloride as low as 250 mg/liter have been recognized as harmful to freshwater life
- DRSCW data suggest summer concentrations in the 120 mg/l range can have negative effects

*Environment Canada (2001) Priority Substances List Assessment Report for Road Salts.  
ISBN 0-662-31018-7; Cat. No. En40-215/63E.*

*Hart, B. T., Bailey, P., Edwards, R., Hortle, K., James, K., McMahon, A., Meredith, C. & Swadling, K. (1991) Hydrobiologia 210, 105-144.*



# COUNTY OF MCHENRY

## DIVISION OF WATER RESOURCES

### SALT'S EFFECT ON OUR AQUATIC LIFE



Bluegills die @ concentrations  
2,500-8,600mg/l

about 1/2 cup salt in 5 gallons of water



Chronic standard for Chlorides:  
230 mg/l  
= 1 teaspoon salt in 5gallons water

Acute standard:  
860mg/l  
about 1 Tablespoon of salt in 5 gallons of water

**High Quality Streams**  
**~25 Fish Species,**

**Urban Streams**  
**0 to 8 Species**

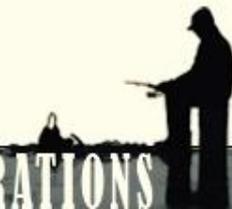


COUNTY OF MCHENRY

DIVISION OF WATER RESOURCES

# Potable Water Supply

WINTER SNOW AND ICE OPERATIONS



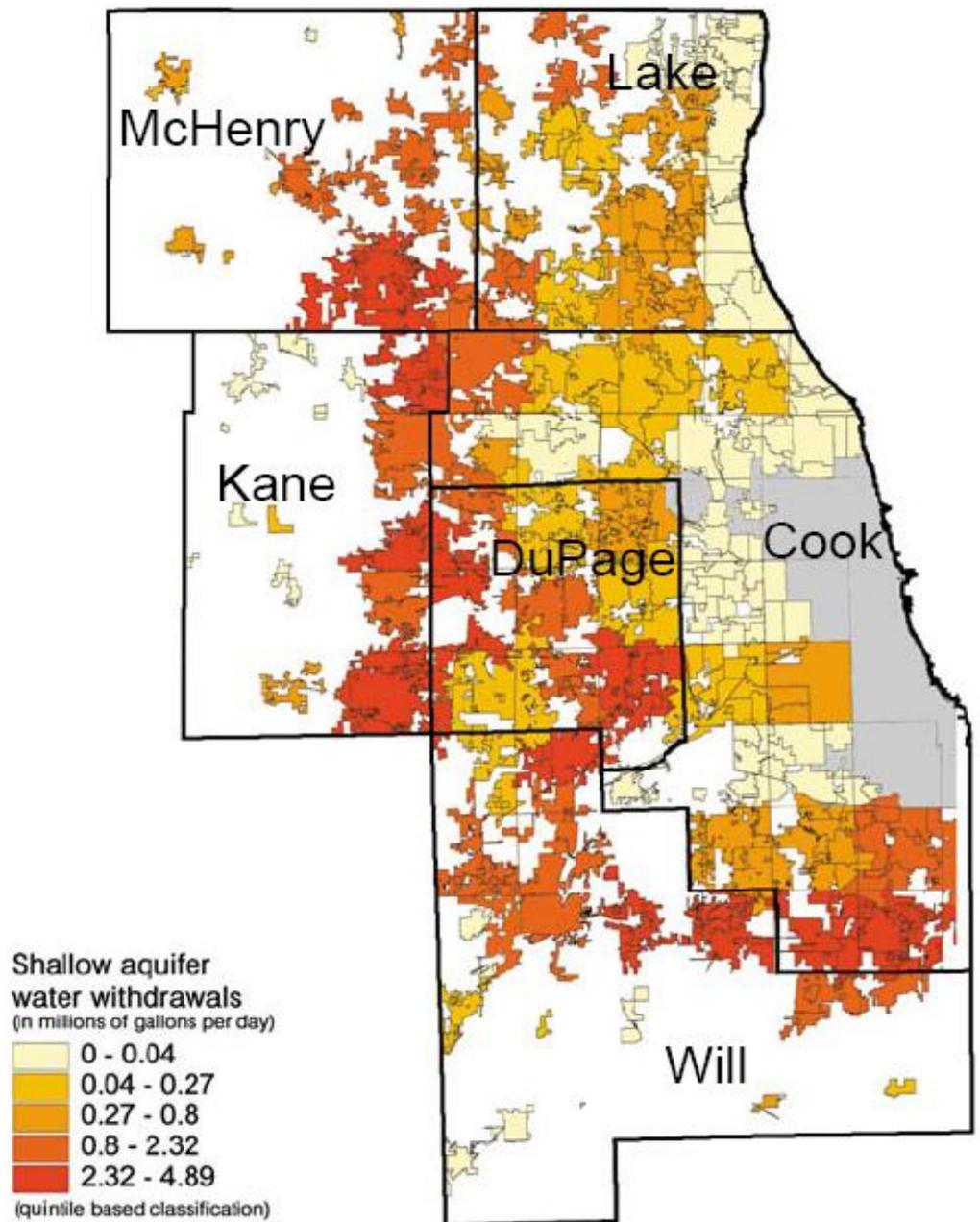
# Water Contamination in Chicago Region: Road Salt Epidemic



- Chlorides increasing in shallow wells
- Increasing chloride concentrations in inland lakes, rivers, streams, and canals
- High chloride readings are seasonal with increasing trends

# Increasing Water Demand In Chicagoland Region:

- As population grows, so do water needs.
- Deep aquifers are stressed.
- Growing demand on the Shallow Groundwater
- Shallow groundwater is vulnerable to contamination and climate change.



*Courtesy of Martin Jaffe (U. Illinois-Chicago)*

### Chloride Standards

- Illinois Environmental Protection Agency standard for Class I Potable Groundwater Resource: **200 mg/L**
- Elevated levels of Chlorides make water non-potable, Secondary Drinking Water Standard: **250 mg/L**
- ILEPA guidelines for Aquatic Life Impairment: **500 mg/L** = acute criteria for chlorides



Groundwater data shows an increasing trend of groundwater degradation.

- Prior to 1970: 80% of wells had chlorides less than 15 mg/L (maximum natural concentration)
- After 1990 (wells <200 feet)
  - 37% exceeded 50 mg/L and
  - 14% exceeded 100 mg/L.
- After 1990 (wells <100 feet):
  - 66% exceeded 50 mg/L and
  - 34% exceeded 100 mg/L

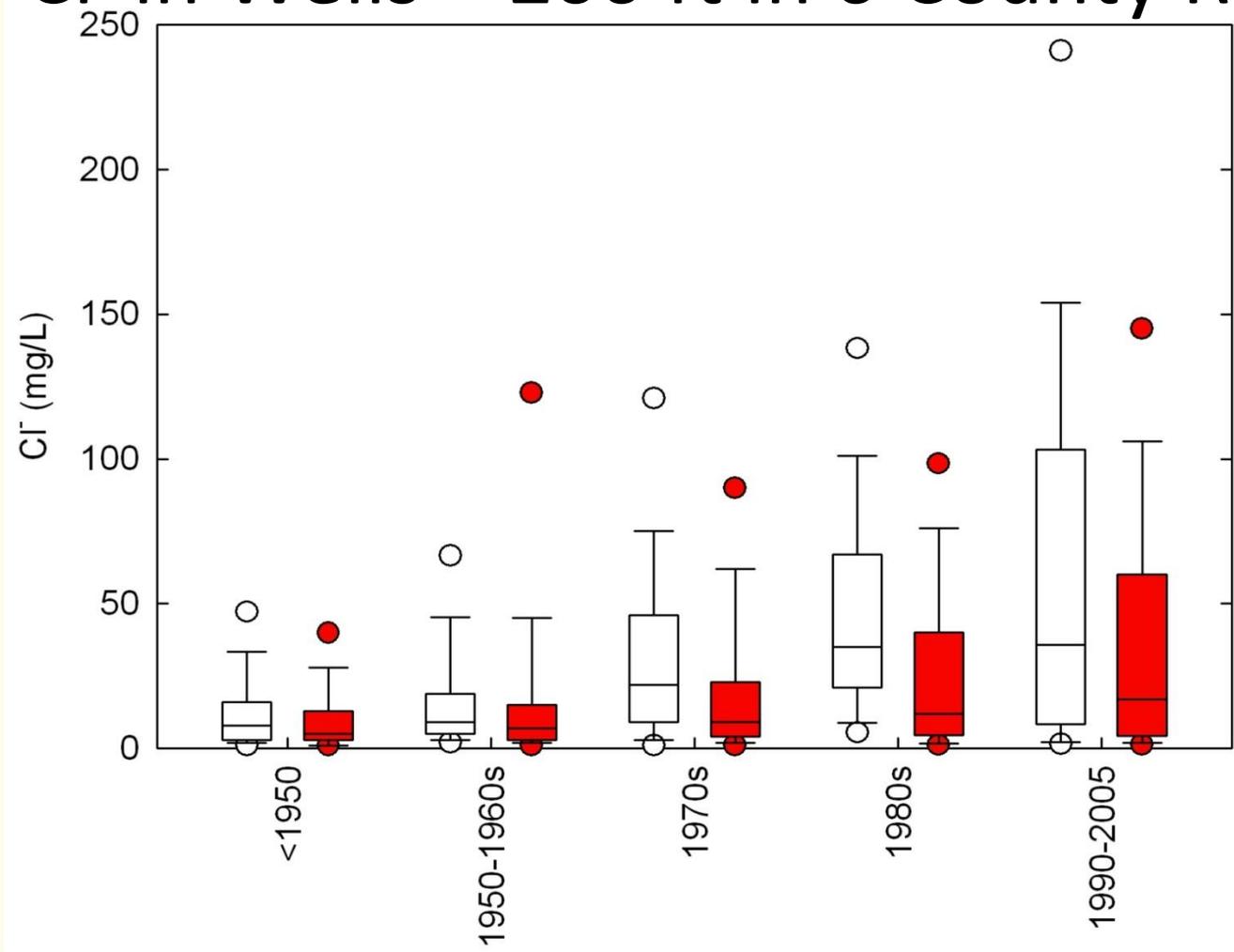


### Chloride rate increases:

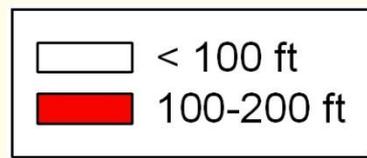
- More than half of the wells in DuPage, Kane, McHenry, and Will counties have Chlorides rising more than 1 mg/l/yr
  - 13% have increases greater than 4 mg/l/yr.
- Chloride concentrations have been recorded in excess of 1000-3500 mg/L in several shallow monitoring wells along major roadways.
  - Similar results have been found near improperly stored salts



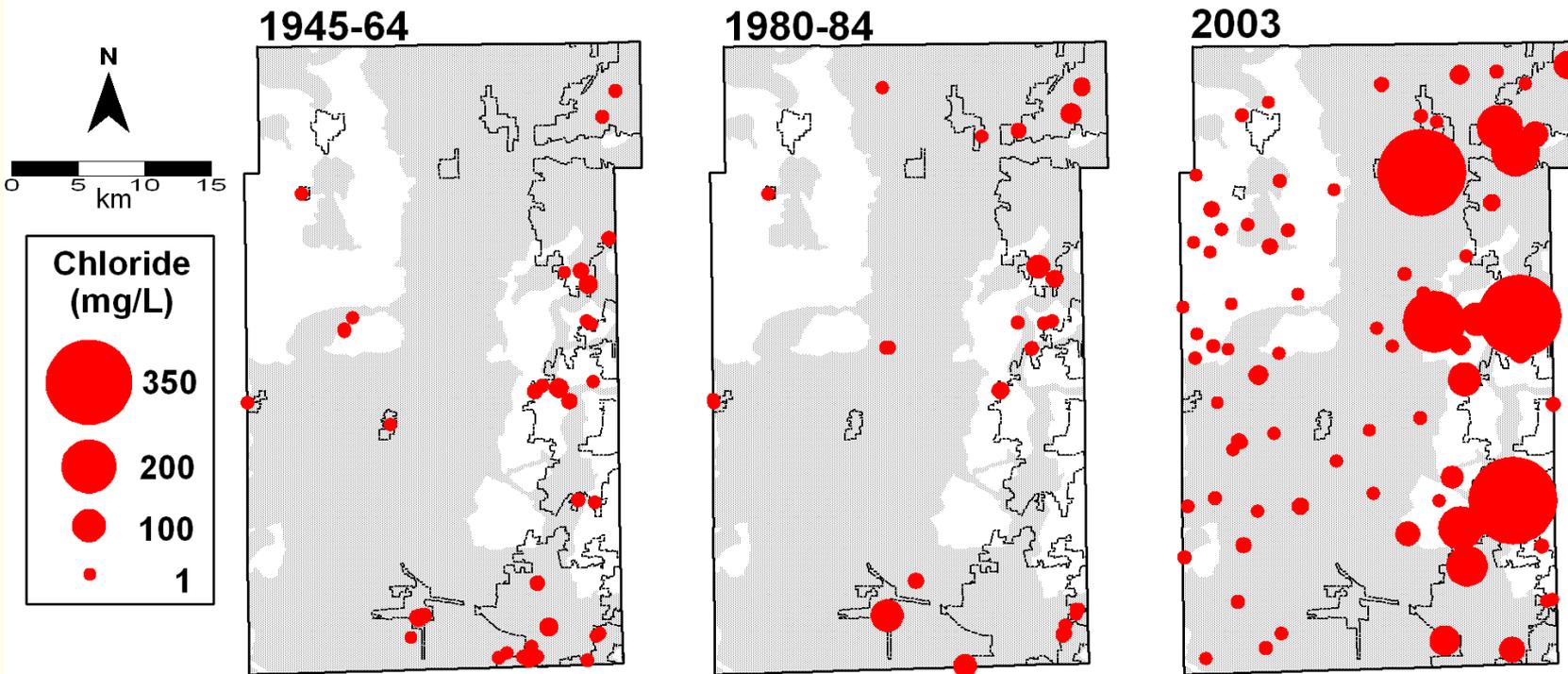
### Cl<sup>-</sup> in Wells < 200 ft in 6 County Region



~4600 samples



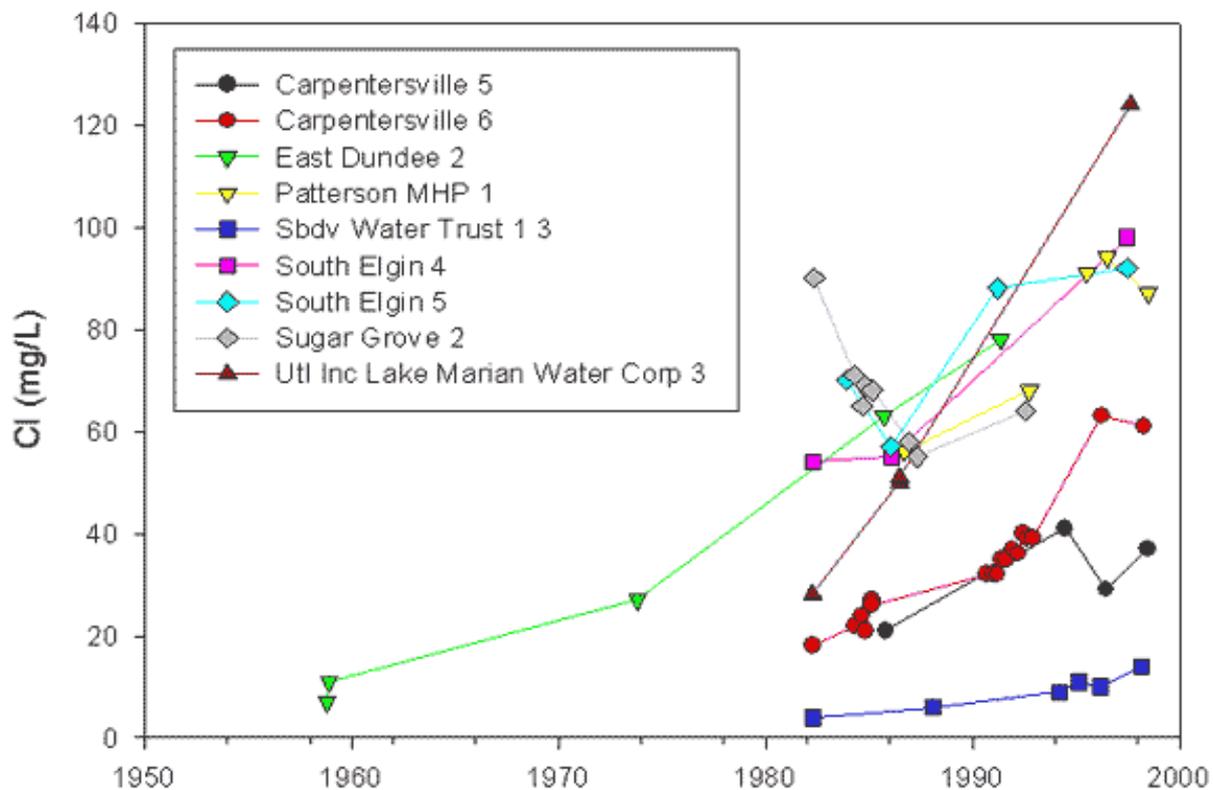
### Kane County Shallow Aquifers: Chlorides



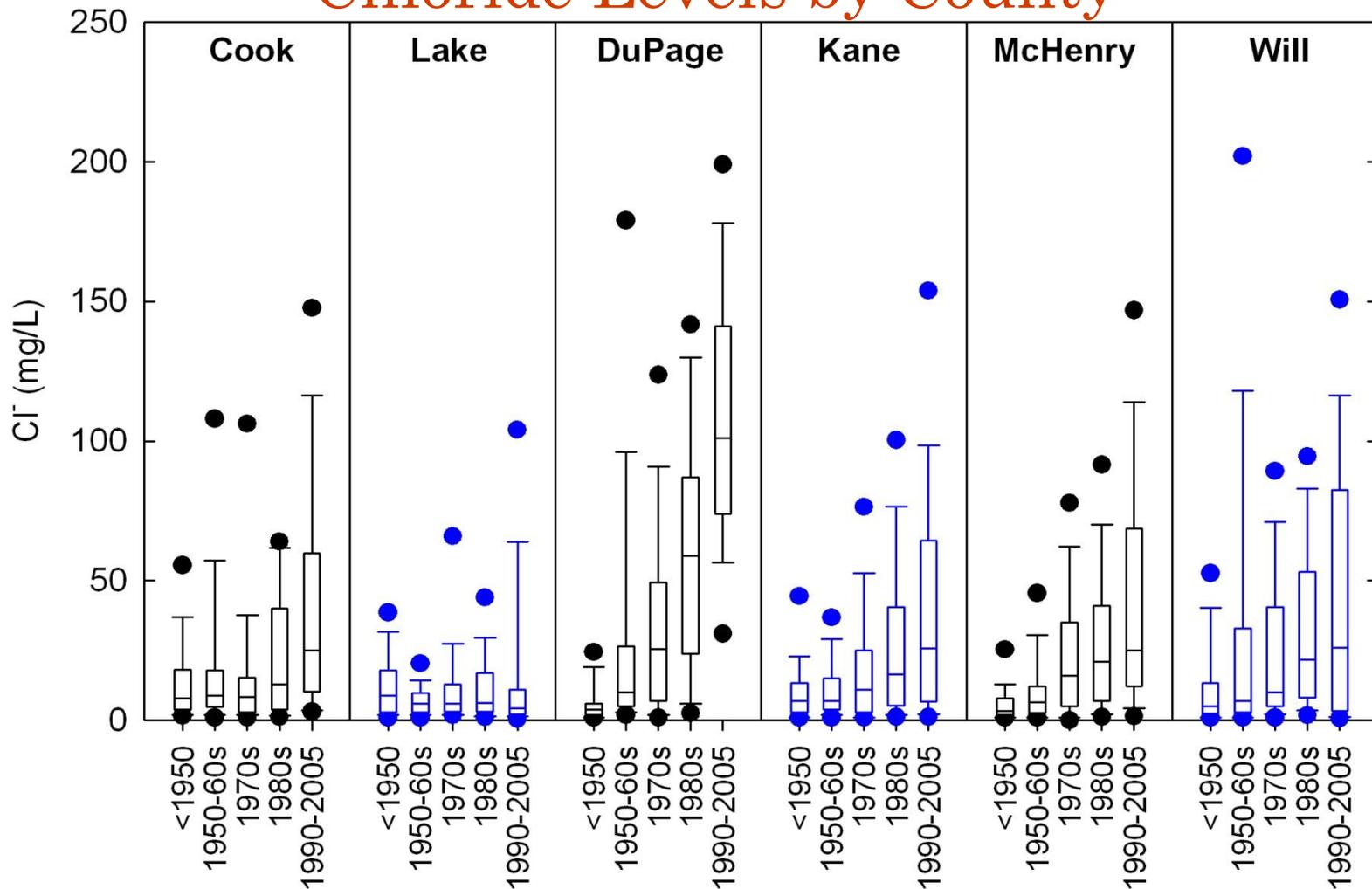
Gray areas: aquifer material within 50 ft of land surface



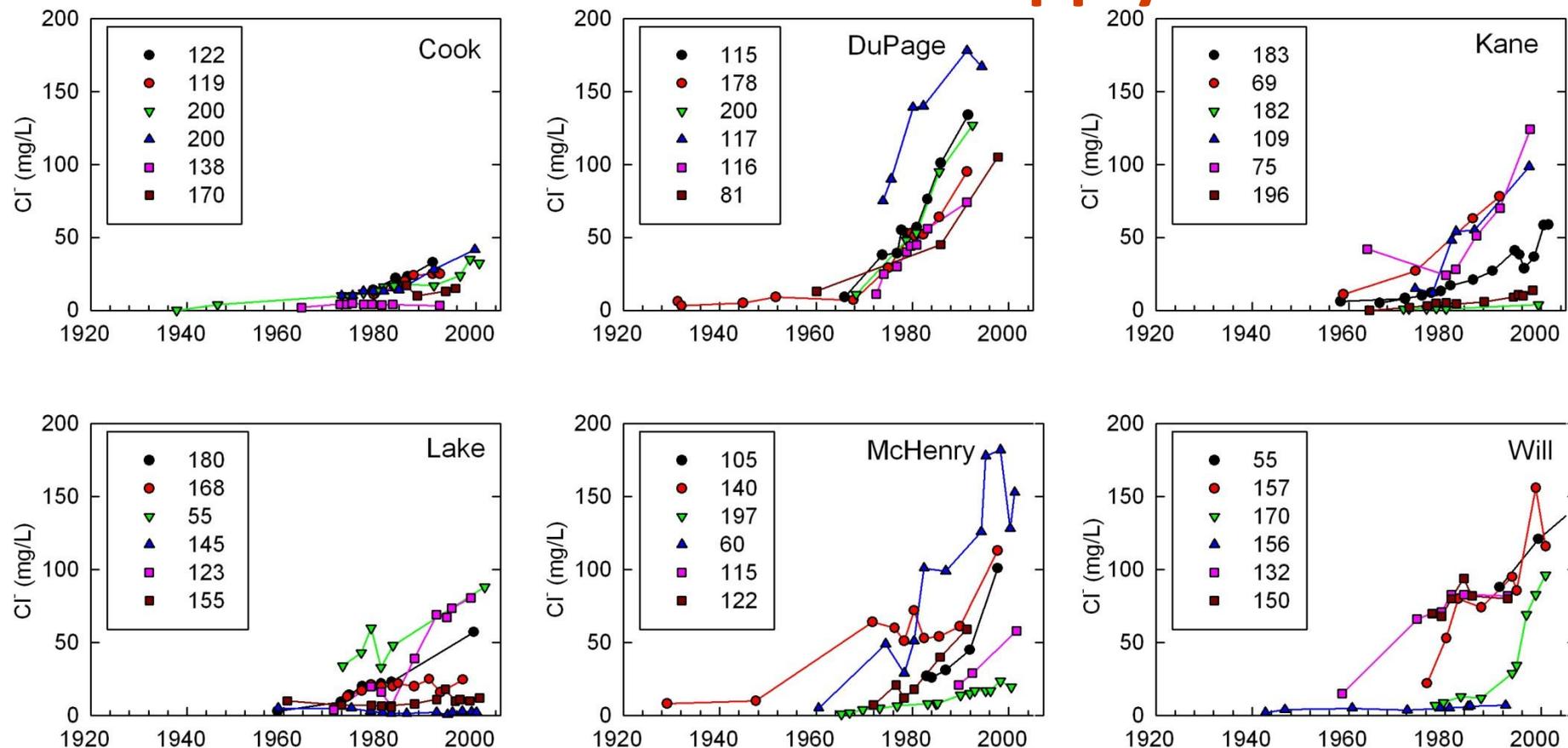
### Water Quality Changes in Shallow Kane County Public Water System Wells



### Chloride Levels by County



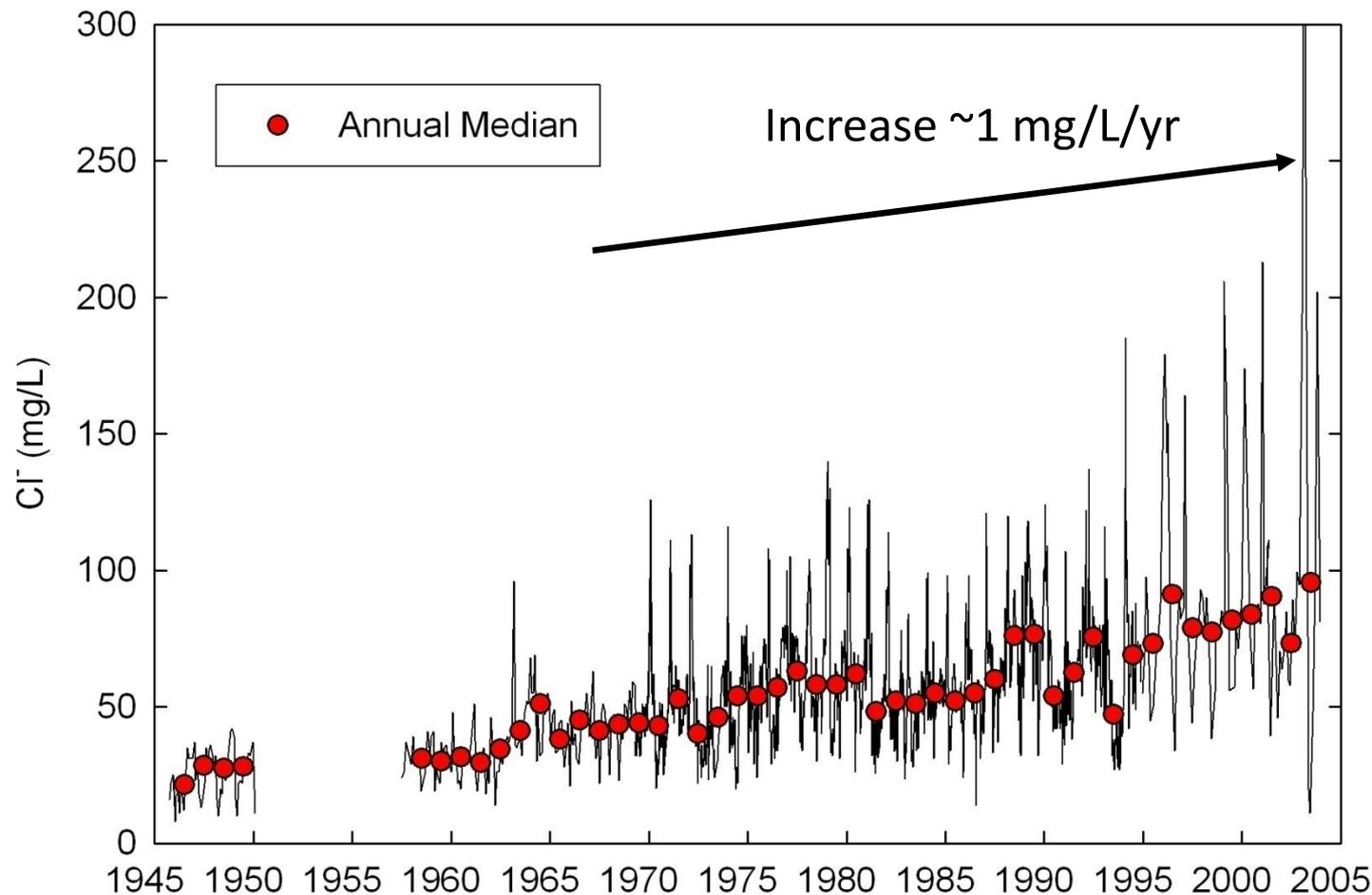
### Cl<sup>-</sup>: Individual Public Supply Wells



55% have positive trends; >60% in DuPage, Will, Kane

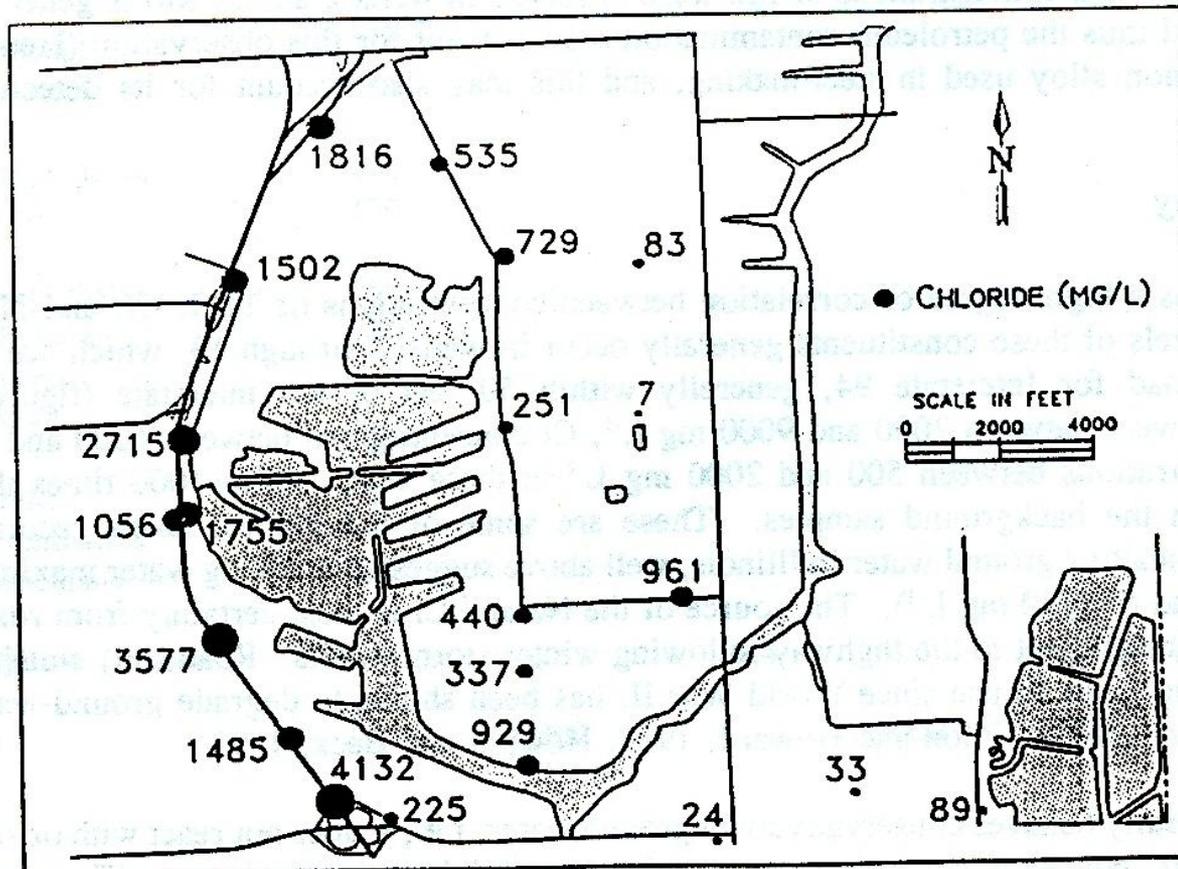
37% > 1 mg/L/yr; 12% > 4 mg/L/yr

### Chloride: Illinois River at Peoria



**\*Drinking water\***

### Lake Calumet (south Chicago): Cl<sup>-</sup> in shallow monitoring wells



**Recap... What does this look  
like in real life?**

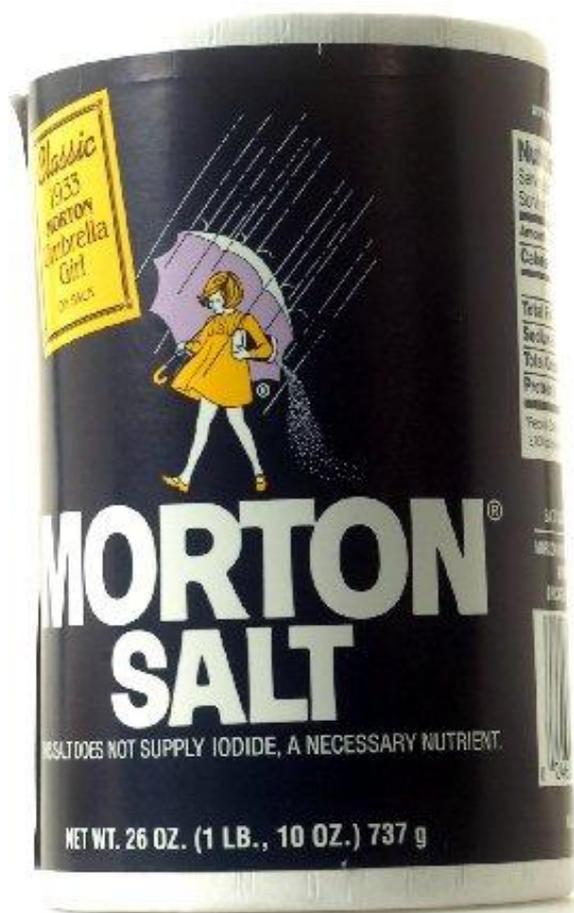


EPA: Drinking water < 1ts of salt  
in 5 gallons of water.

Bluegills die @ concentrations  $\frac{1}{2}$   
cup or 25 ts of salt to 5 gallons of  
water.

Once in solution always in  
solution





About 1.5pounds = 3cups = 150  
teaspoons

750gallons above EPA drinkable limit

You should drink  $\frac{1}{2}$  gallon a day  
1500days or **4years** of drinking  
water

**30 gallons** unlivable to fish



# COUNTY OF MCHENRY

## DIVISION OF WATER RESOURCES



300pounds = 600cups = 28,800  
teaspoons

144,000gallons above EPA drinkable  
limit

You should drink  $\frac{1}{2}$  gallon a day  
288,000days or **800**years of drinking  
water

**6,000**gallons unlivable to fish



# COUNTY OF MCHENRY

## DIVISION OF WATER RESOURCES



24,000pounds = 48,000cups = 2,400,000 teaspoons

12,000,000gallons above EPA drinkable limit

You should drink  $\frac{1}{2}$  gallon a day  
24,000,000days or **65,000years** of drinking water

**500,000gallons** unlivable to fish



# COUNTY OF MCHENRY

## DIVISION OF WATER RESOURCES

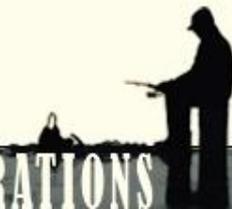


X 20  
Trucks  
Per Storm



Think of  
your  
summer  
this winter

# What Are Our Options?



# Regulatory Control

- Federal Clean Water Act - USEPA
  - Waters shall be “fishable” and “swimmable”
- IEPA
  - Administers programs and NPDES permits
  - Develops TMDLs for impaired waters
- Counties / Communities
  - NPDES Phase II permit holders
  - Implementation guidance / ordinance,
  - Best Management Practices - BMPs



# NPDES General Permit ILR40

- Within six minimum control measures required:
  - Pollution prevention for municipal operations
    - Prevent and reduce the discharge of pollutants to the maximum extent practicable
    - Training
    - BMPs for deicing / snow removal
  - Ensure the reduction of all pollutants of concern to the maximum extent practicable
- Additional requirements for TMDL waters



### Locally: Develop An Action Plan

- County of McHenry – Division of Water Resources: **Water Resources Action Plan**
  - Section II: Local Water Quantity and Quality
    - Subsection B6 Winter Snow and Ice Operations
      - Storage and Handling
      - Application
      - Training and Certification



# Implement Action Plan

- Encourage/require all operators to become **certified**
- Encourage/require all facilities or operators to have an approved **Salt Storage and Handling Plan**
- **Permit** all salt storage facilities, large or small



### McHenry County's Program: Training and Certification...

- Public and Private Sector
  - Municipalities and Townships
  - Commercial Applicators
  - Mom and Pop's
- Who:
  - Operators, Supervisors, Schools, Commercial and Industrial Facilities, Contracting Person, and more



### Training and Certification...

- Currently a Voluntary Certification Program
- 6 PDH's are offered
- Working towards requiring:
  - certification for all operators
  - permitting for all storage



### Goals:

#### ➤ Teach:

- Sensible salting
  - Application Rates
  - Pavement Temps
  - Treatment Options
  - Calibration
  - And more...
- Proper storage and handling
- Levels of service

#### ➤ Reduce:

- Environmental Impacts

#### ➤ Protect:

- Water Supply



### Fall 2009

- McHenry County held three six hour classes
- 200 people Trained and Certified
  - Municipalities
  - Townships
  - Private Operators
  - County Operators
  - Schools
  - Companies that sell salt



### Closing Thought:

Consider the water supply implications  
of your decisions

- ✓ Good business starts with resource protection, make water supply planning part of your business plan
- ✓ Value Water in all of its forms as a resource
- ✓ Safe water is a basic requirement of life
- ✓ ***Be a part of the solution, every drop counts!***





# QUESTIONS?

*"We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect."*

Aldo Leopold, A Sand County Almanac





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