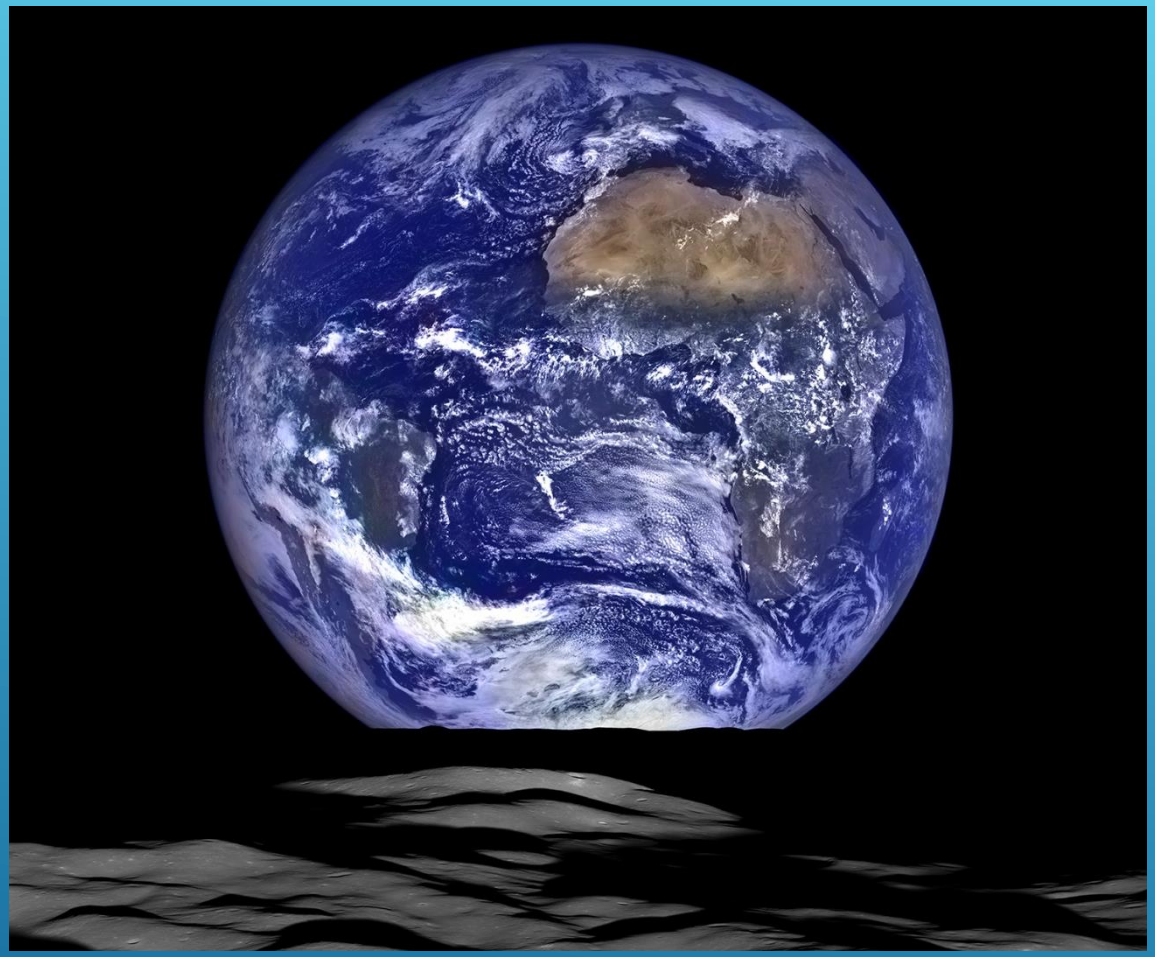
WINTER SNOW AND ICE WORKSHOP NOVEMBER 2017

Scott Kuykendall
Water Resources Specialist
McHenry County
Department of Planning and Development

WHY ARE WE HERE TODAY?

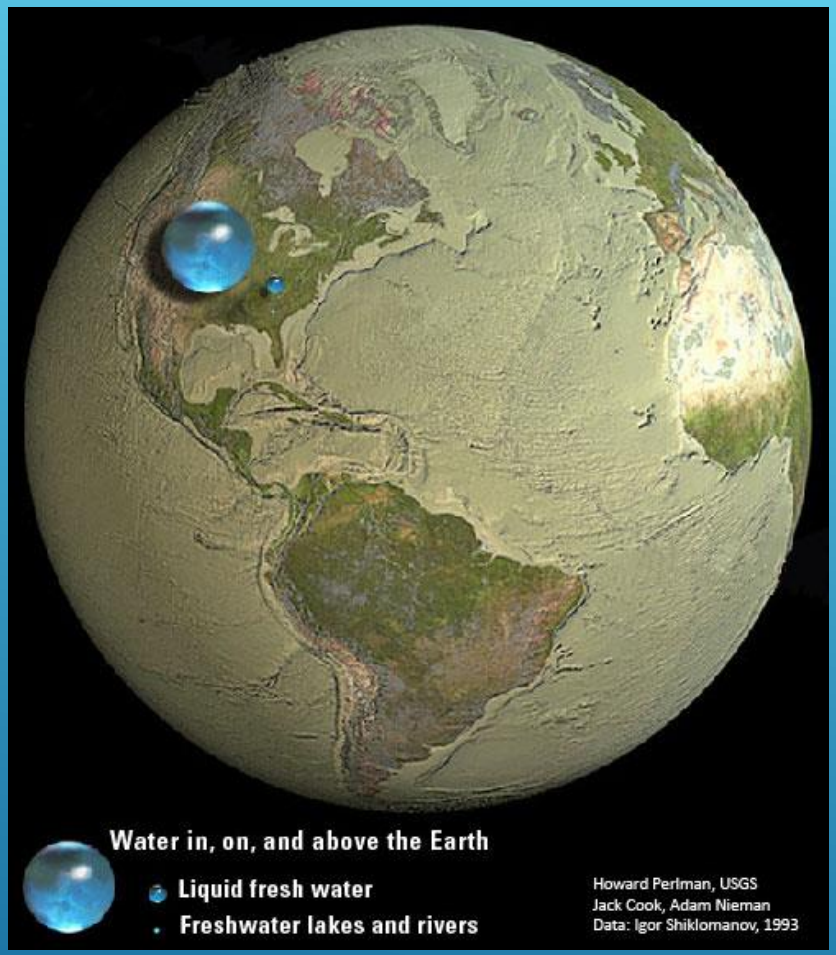
To understand the connection between your job and our water supply!

CONSIDER THIS…



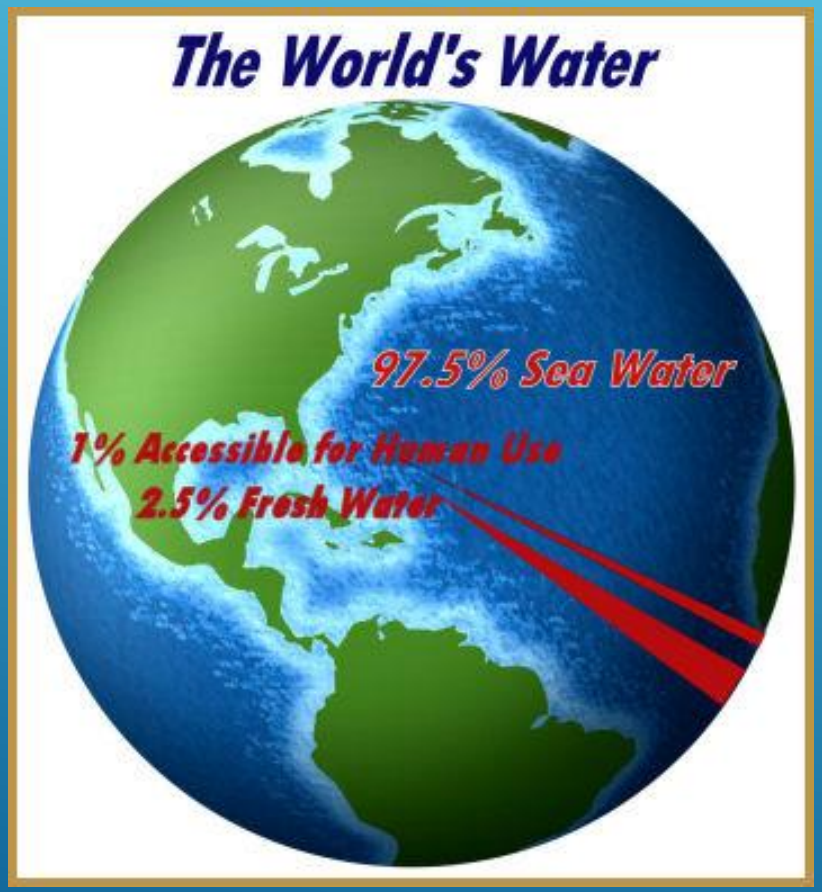
We live on a blue planet where about 75% of the Earth's surface is covered with water…

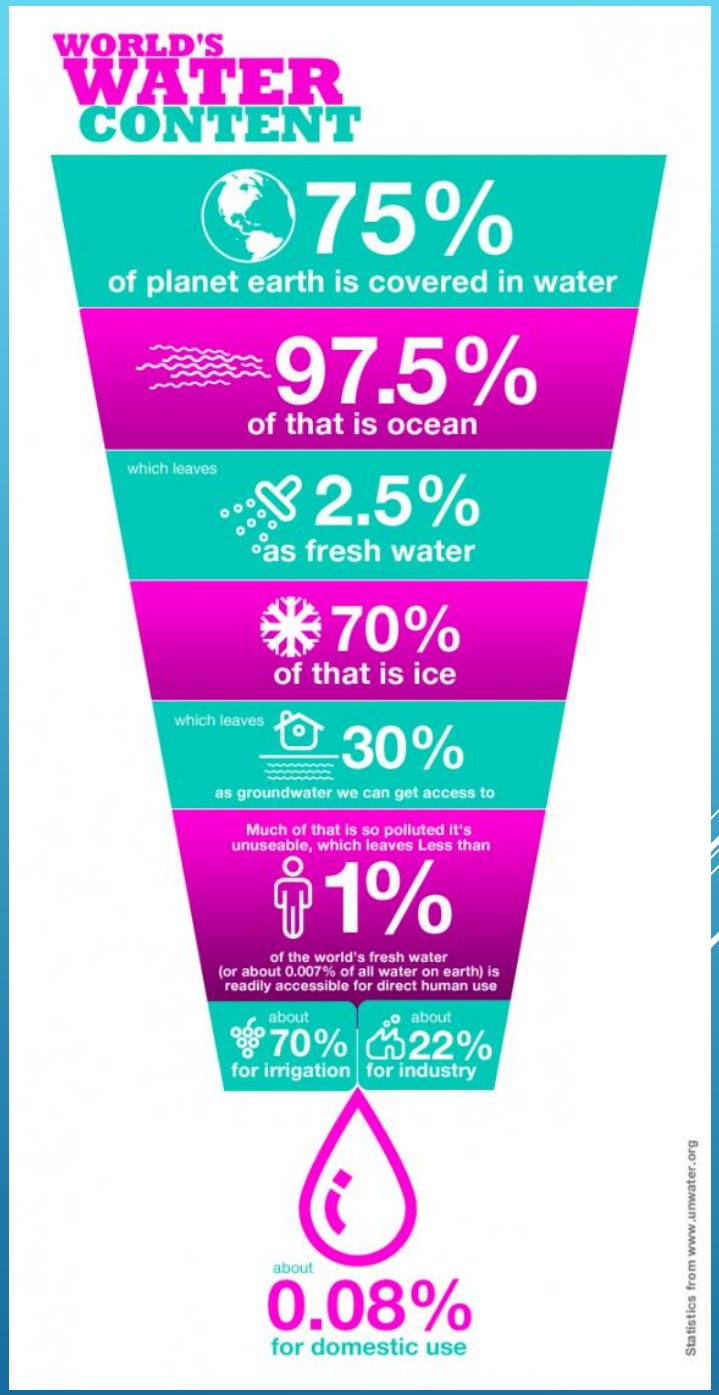
CONSIDER THIS…



…But only 2.5% is fresh water and
only a small percentage of that is available for human use

ONLY A TINY FRACTION OF THE EARTH'S WATER IS FRESH



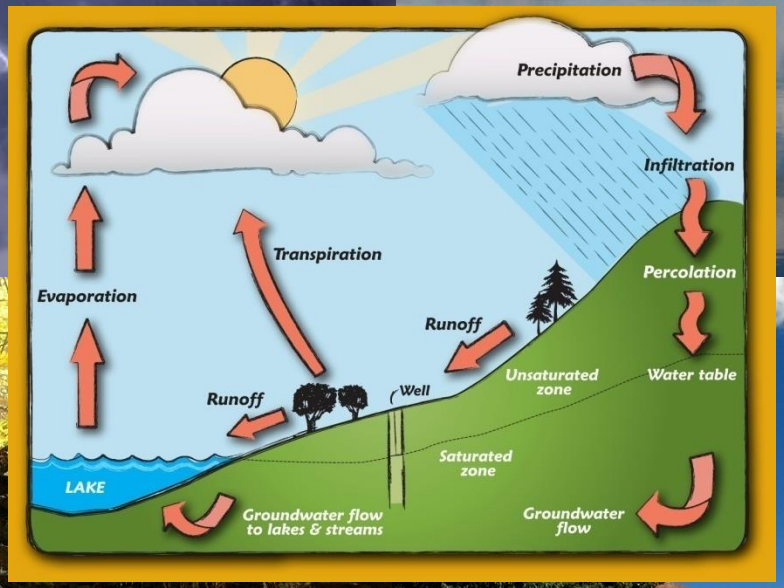


OUR ACTIONS ARE DAMAGING THE REMAINING 0.08%

THAT DAMAGE INCLUDES OUR USE OF ROAD SALT

CONDENSATION
PRECIPITATION

EVAPORATION
TRANSPIRATION



RUNOFF
INFILTRATION

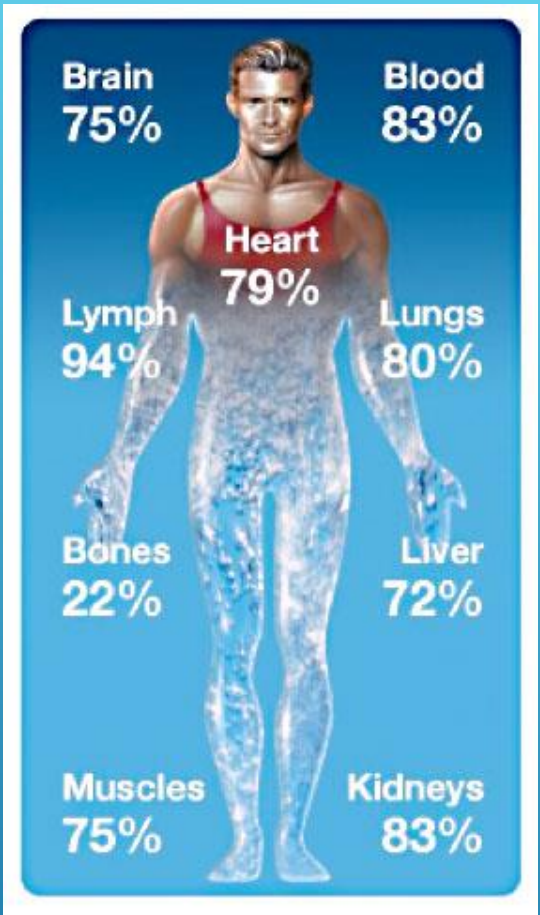
GROUNDWATER
SURFACE WATER
WETLANDS/FENS





WATER IS NECESSARY FOR ALL LIVING THINGS

WATER IS NECESSARY FOR ECONOMIC DEVELOPMENT



- Most of the human body consists of water
- We need to drink water to maintain healthy body and mind
- Average person should drink at least 8 cups of water per day
- Can survive month without food, only a week without water

- Water is scarce in much of the world
- By 2025: 1.8 billion people in absolute water scarcity
  2/3 of worlds population under water stress
- McHenry County has safe, sustainable water…

if we protect it!

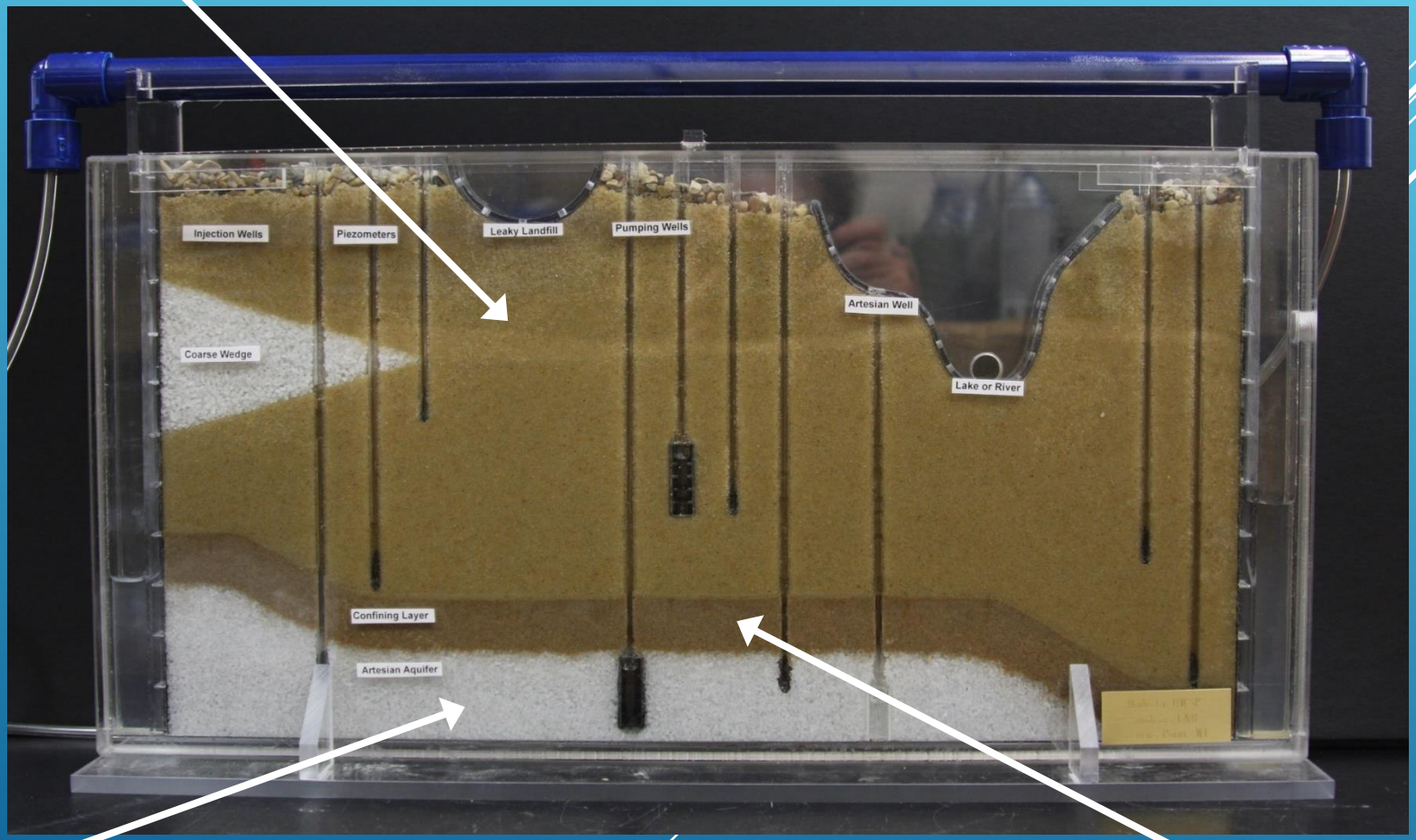
WHERE DOES MCHENRY COUNTY'S DRINKING WATER COME FROM?

MCHENRY COUNTY GROUNDWATER SUMMARY

- 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 the surface.*
- County had been projected to grow by 190,000 people by 2030
- Groundwater shortages are predicted to occur as soon as 2025 in some areas McHenry County

GROUNDWATER

SAND AND GRAVEL AQUIFERS (75% of water supply)

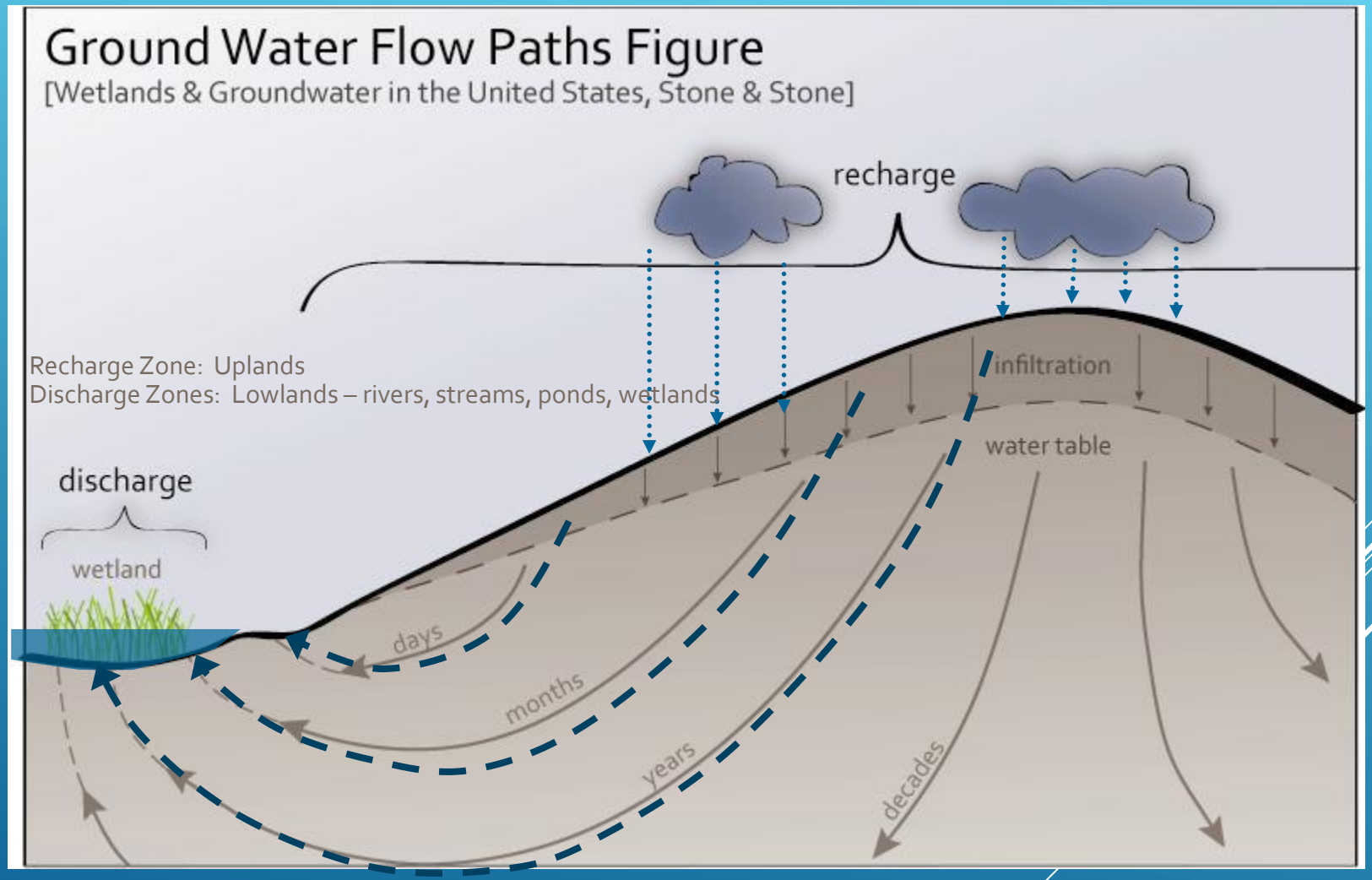


BEDROCK AQUIFERS (25% of water supply)

CONFINING LAYER

Natural Hydrology

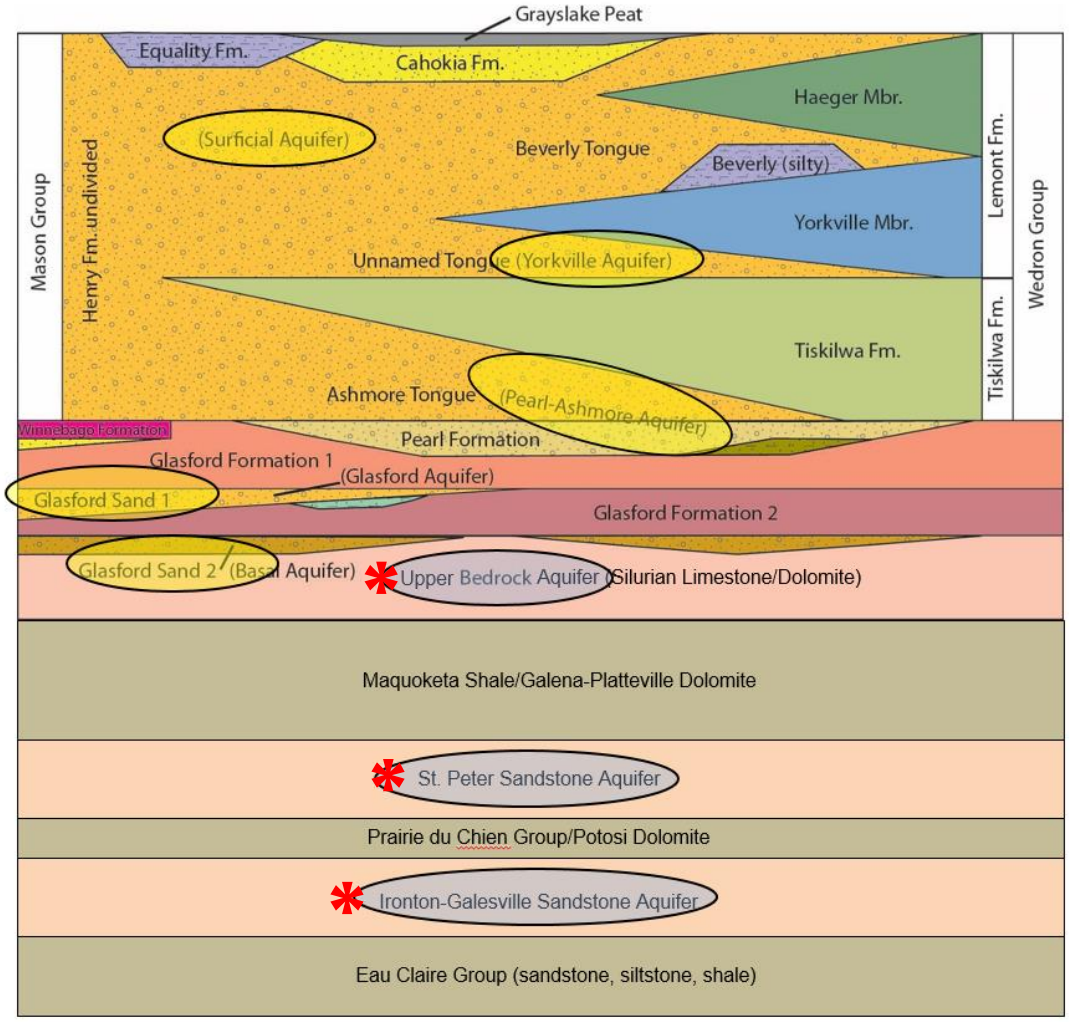
Slide courtesy of James Patchett and Conservation Design Forum



Constant, clean discharge flows, year round to sustain stable surface water hydrology with constant water temperature and chemistry

GROUNDWATER

Cross Section-McHenry Co. Geology & Groundwater Aquifers



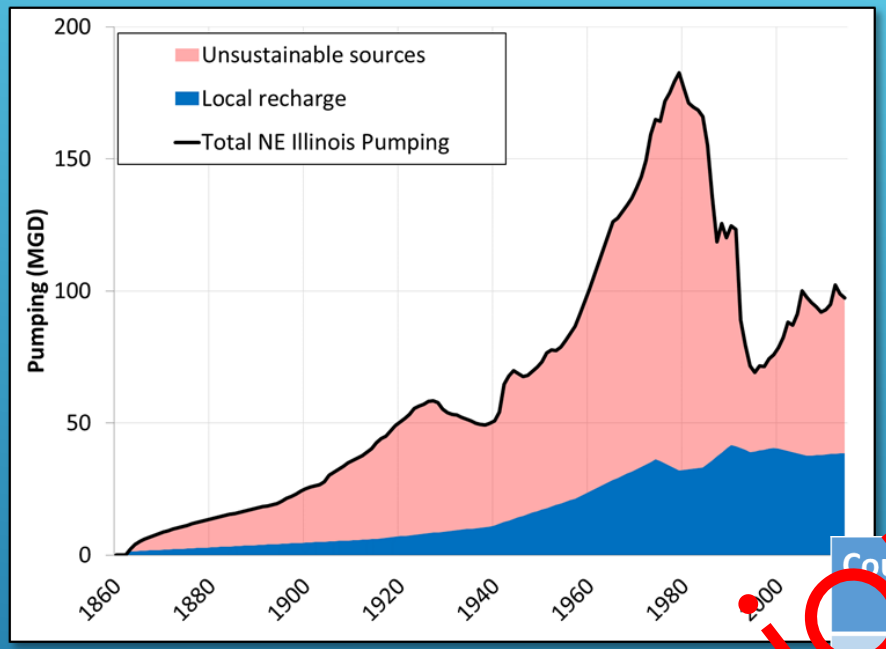
Shallow Sand and Gravel Aquifers 0-300 ft deep

*Bedrock Aquifers 100-1200 ft deep

OUR GROUNDWATER IS VULNERABLE…

OVER CONSUMPTION…

G-Water Demand vs. Recharge NE Illinois



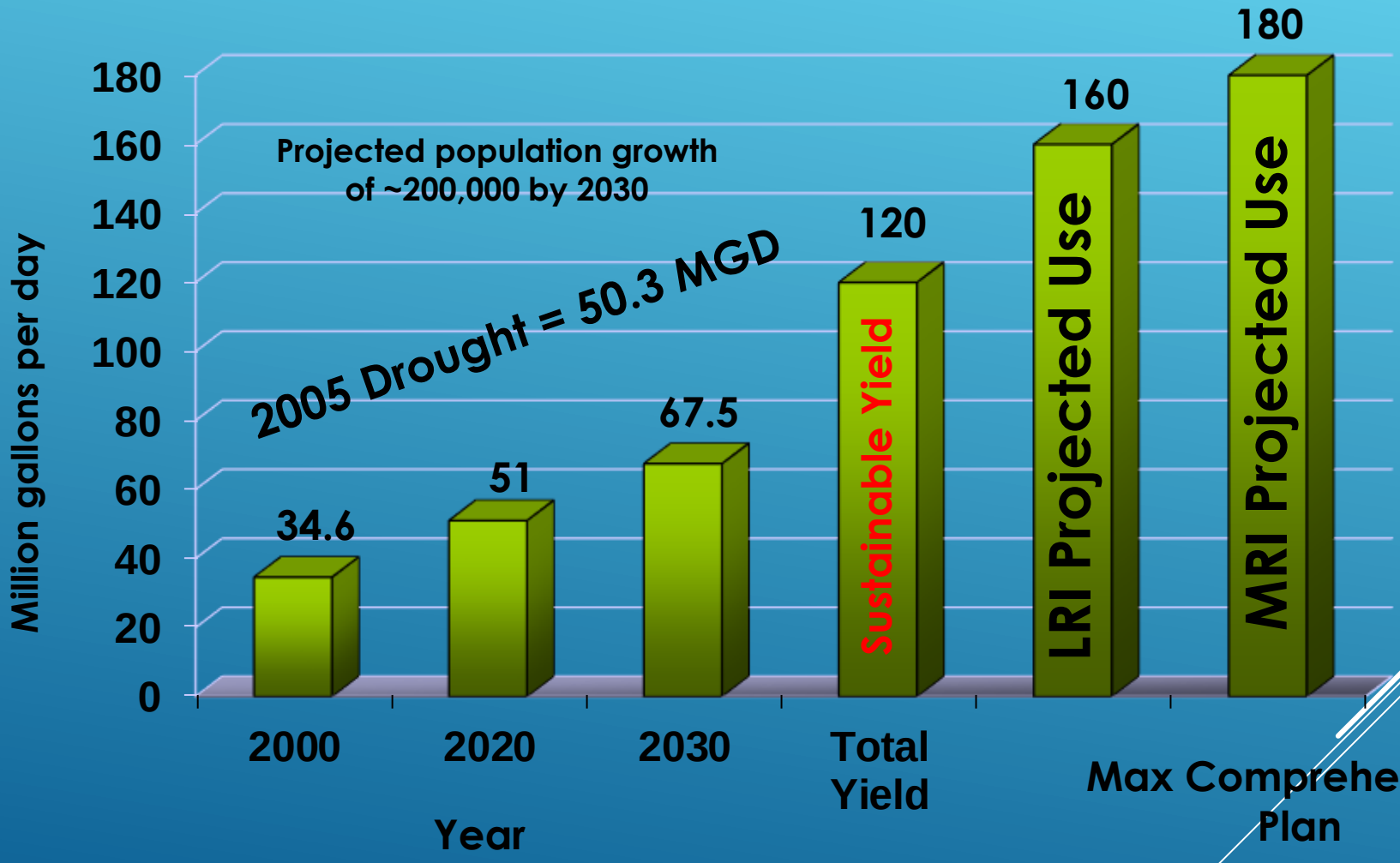
Provisional results

Deep Bedrock Aquifers NE Illinois

County	Sustainable Yield*	Current Demands	Percent Sustainable
Cook and DuPage	8	11	72%
Grundy	7	8	88%
Kane	17	27	63%
Kendall	2	9	22%
Lake	5	5	100%
McHenry	8	8	100%
Will	12	30	40%

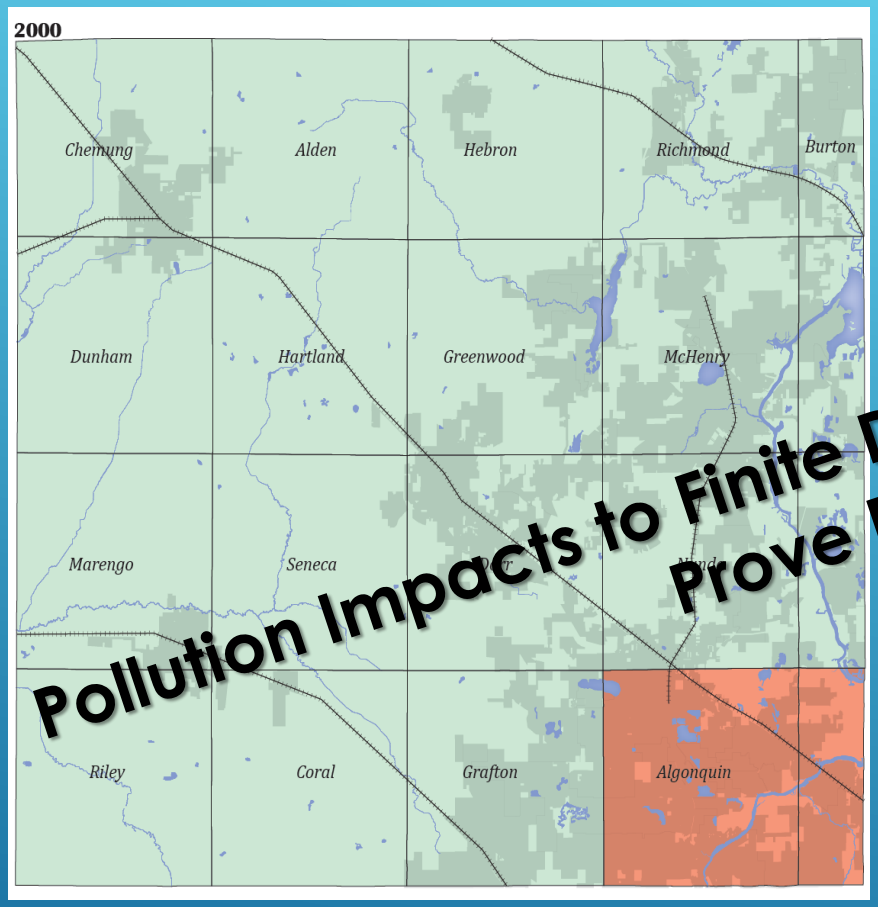
MGD

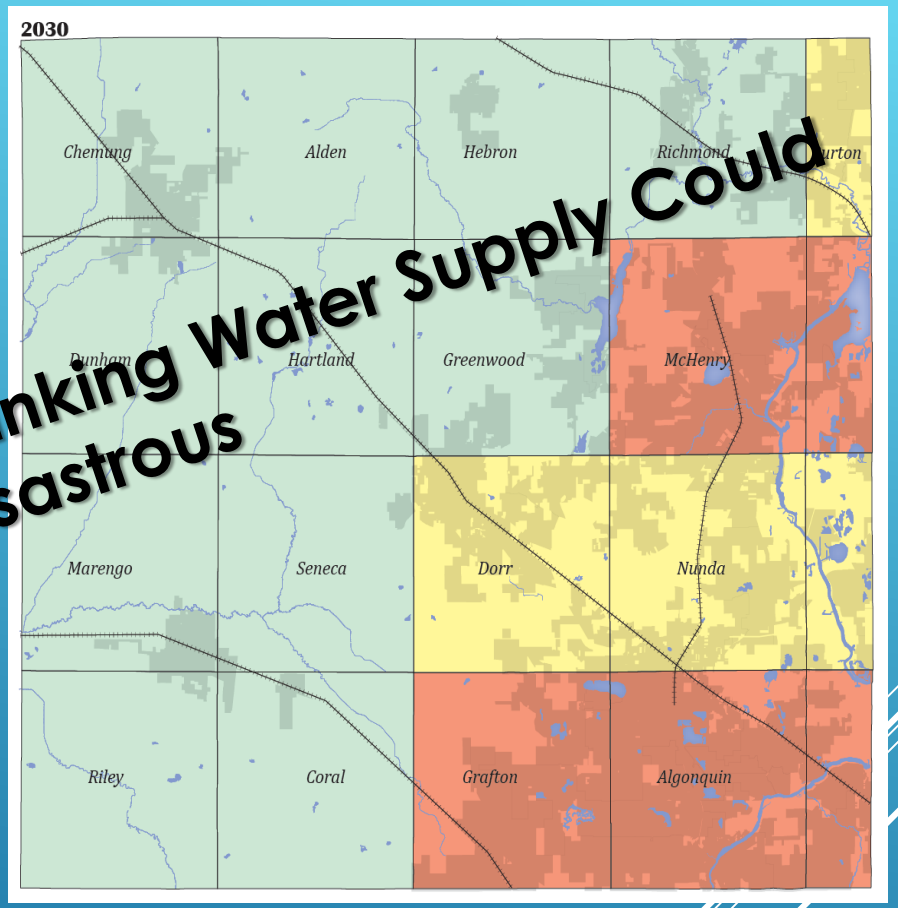
HOW MUCH WATER DO WE USE IN MCHENRY COUNTY?



LRI – less resource intensive
MRI – more resource intensive

McHenry County Water Supply Projections



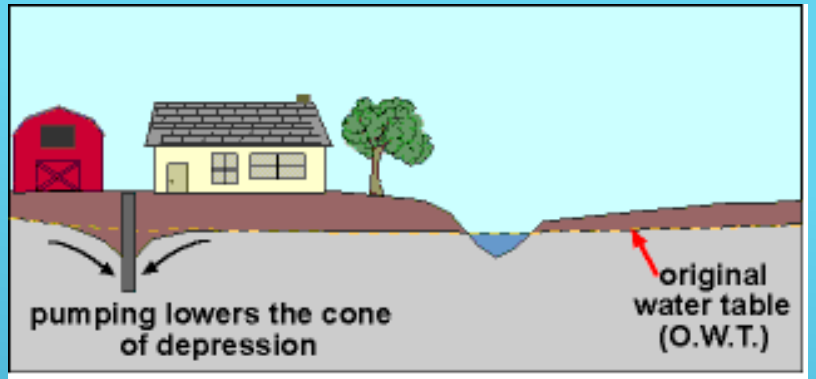


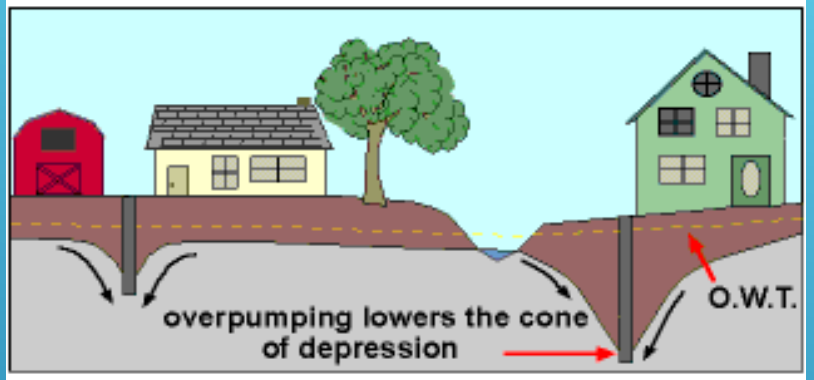
Pollution Impacts to Finite Drinking Water Supply Could Prove Disastrous

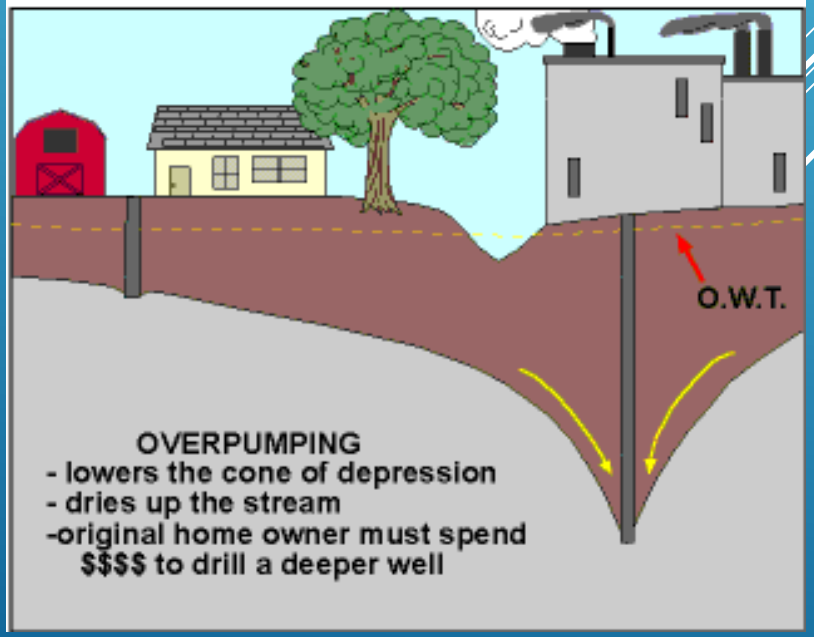
Map Legend

- 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

OVERUSE AND MISMANAGEMENT







DROUGHT…

"Period of unusually persistent dry weather that continues long enough to cause serious problems such as crop damage and/or water supply shortages"

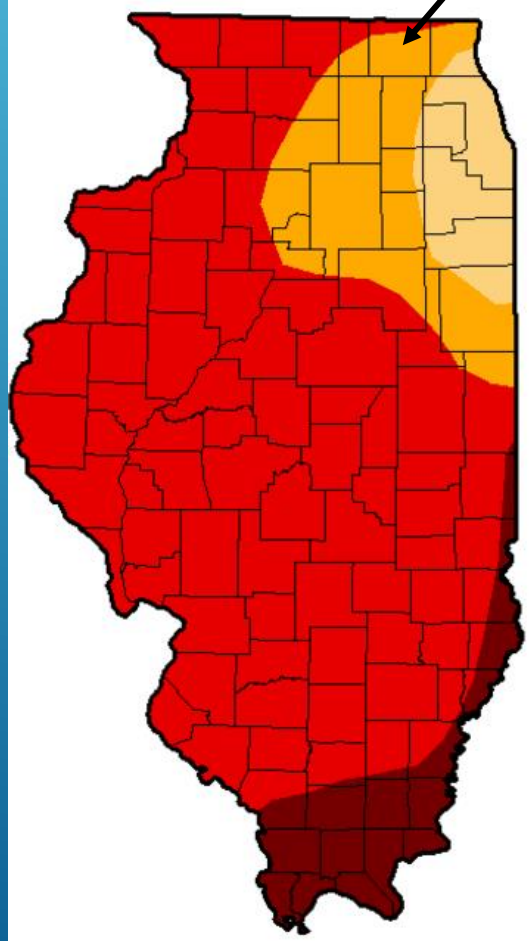
During periods of drought:

- Groundwater recharge decreases
- Water use increases across all sectors (SIUC):
  - Public-supply withdrawals increase by 5%
  - Commercial and Industrial withdrawals increase by 5.5-5.6%
  - Irrigation and Agricultural withdrawals increase by 50%

DROUGHT CONDITIONS IN 2012

U.S. Drought Monitor

Illinois



August 7, 2012

(Released Thursday, Aug. 9, 2012)

Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	100.00	94.10	81.18	8.38
Last Week 7/31/2012	0.00	100.00	100.00	93.93	71.29	8.39
3 Months Ago 5/8/2012	81.77	18.23	0.99	0.00	0.00	0.00
Start of Calendar Year 1/3/2012	100.00	0.00	0.00	0.00	0.00	0.00
Start of Water Year 9/27/2011	45.76	54.24	30.76	14.68	0.00	0.00
One Year Ago 8/9/2011	39.45	60.55	30.12	0.00	0.00	0.00

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Mark Svoboda
National Drought Mitigation Center

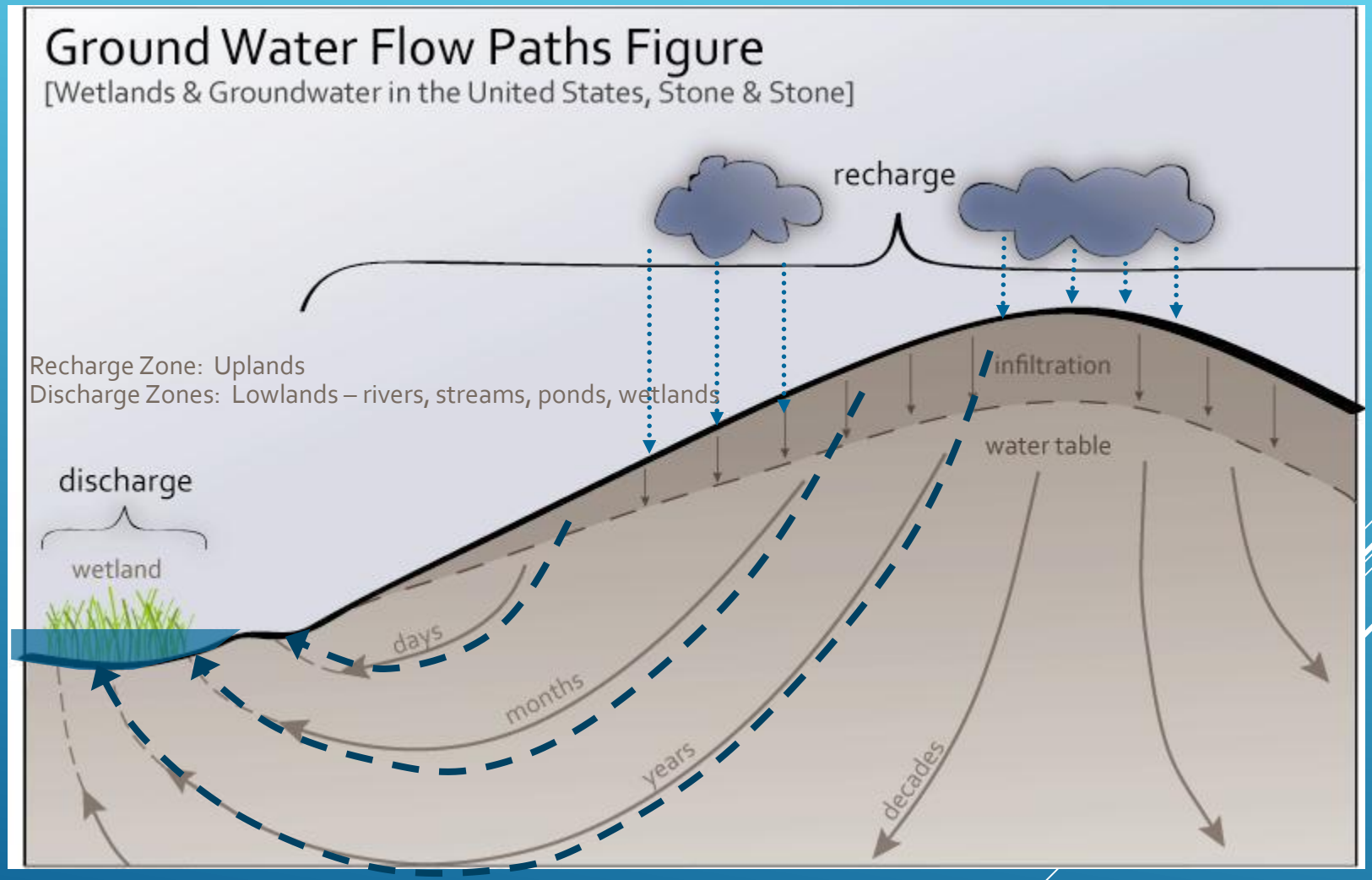
http://droughtmonitor.unl.edu/

2012 Drought
Major Drop in Water Levels

LOSS OF GROUNDWATER RECHARGE/ INCREASED IMPERVIOUS AREA

Natural Hydrology

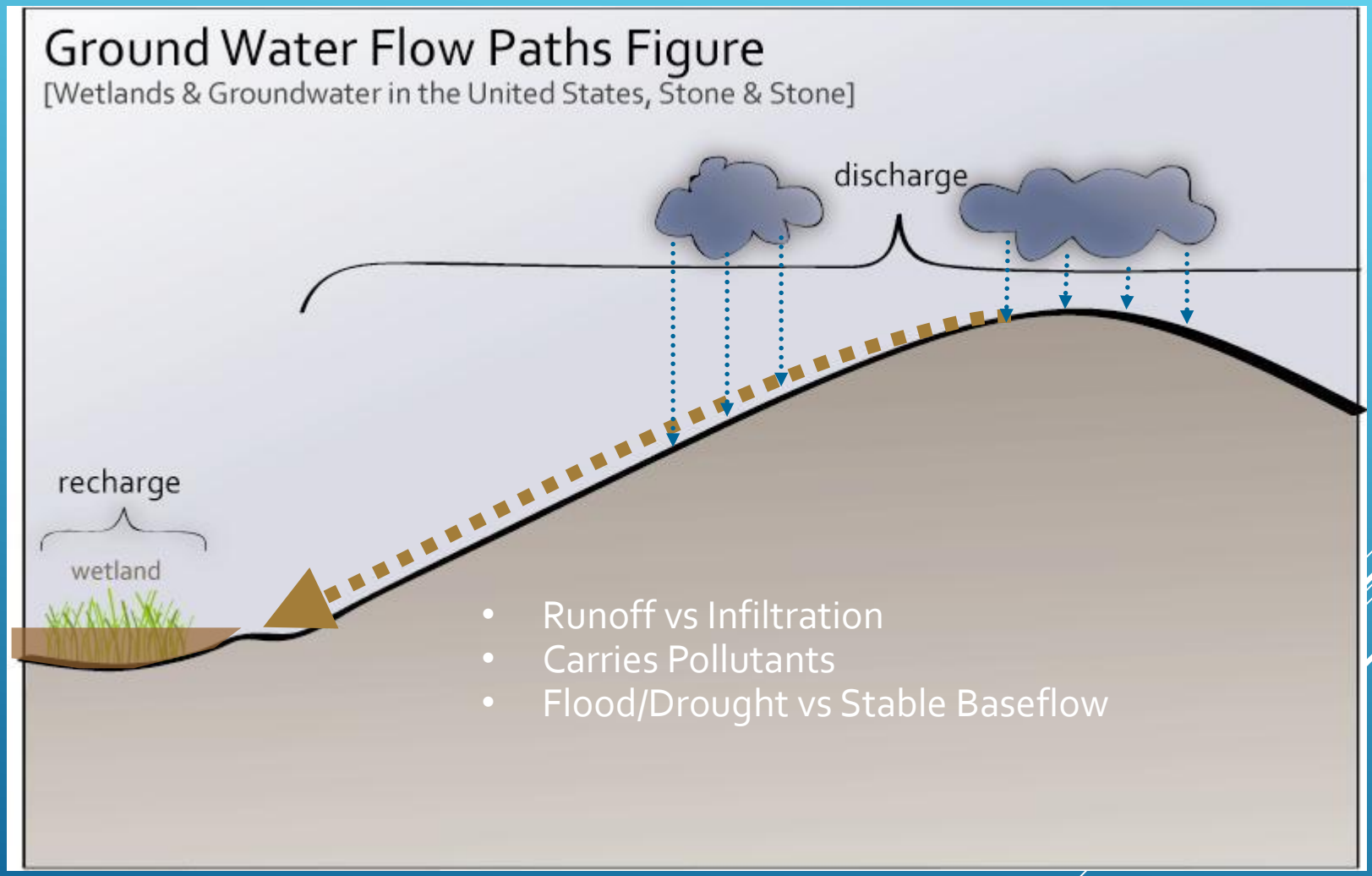
Slide courtesy of James Patchett and Conservation Design Forum



Constant, clean discharge flows, year round to sustain stable surface water hydrology with constant water temperature and chemistry

Urban Hydrology

Slide courtesy of James Patchett and Conservation Design Forum

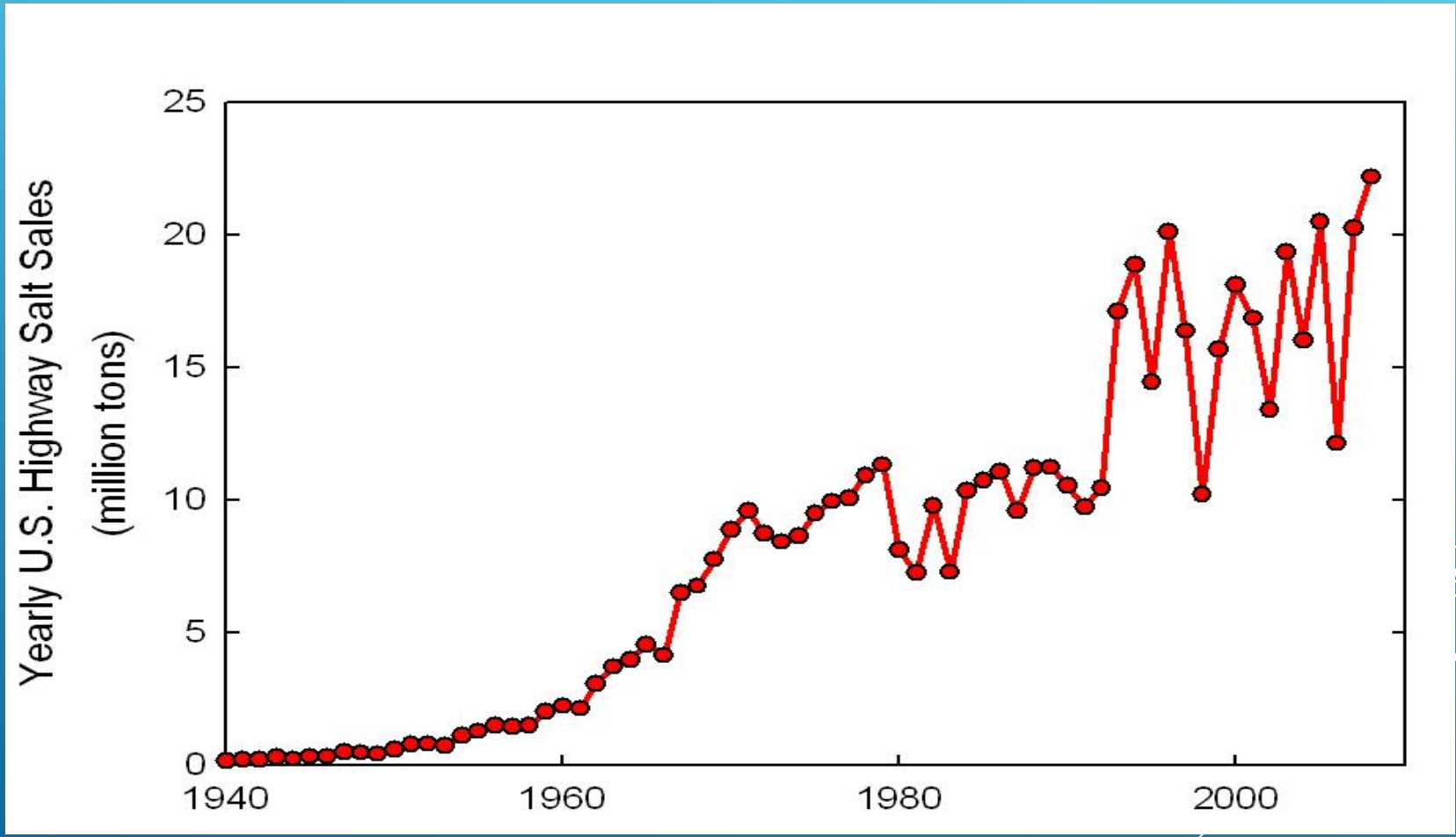


Reversed hydrological pattern results in runoff containing sediments, oils, greases, salts, fertilizers, pesticides, and higher water temperatures that inundate historical systems adapted to completely different hydrological and water quality conditions

CONTAMINATION…

WINTER SNOW AND ICE OPERATIONS AND THE CONNECTION TO WATER:

Road Salt in U.S.
First applied in earnest around 1960



Graph courtesy of Walt Kelly

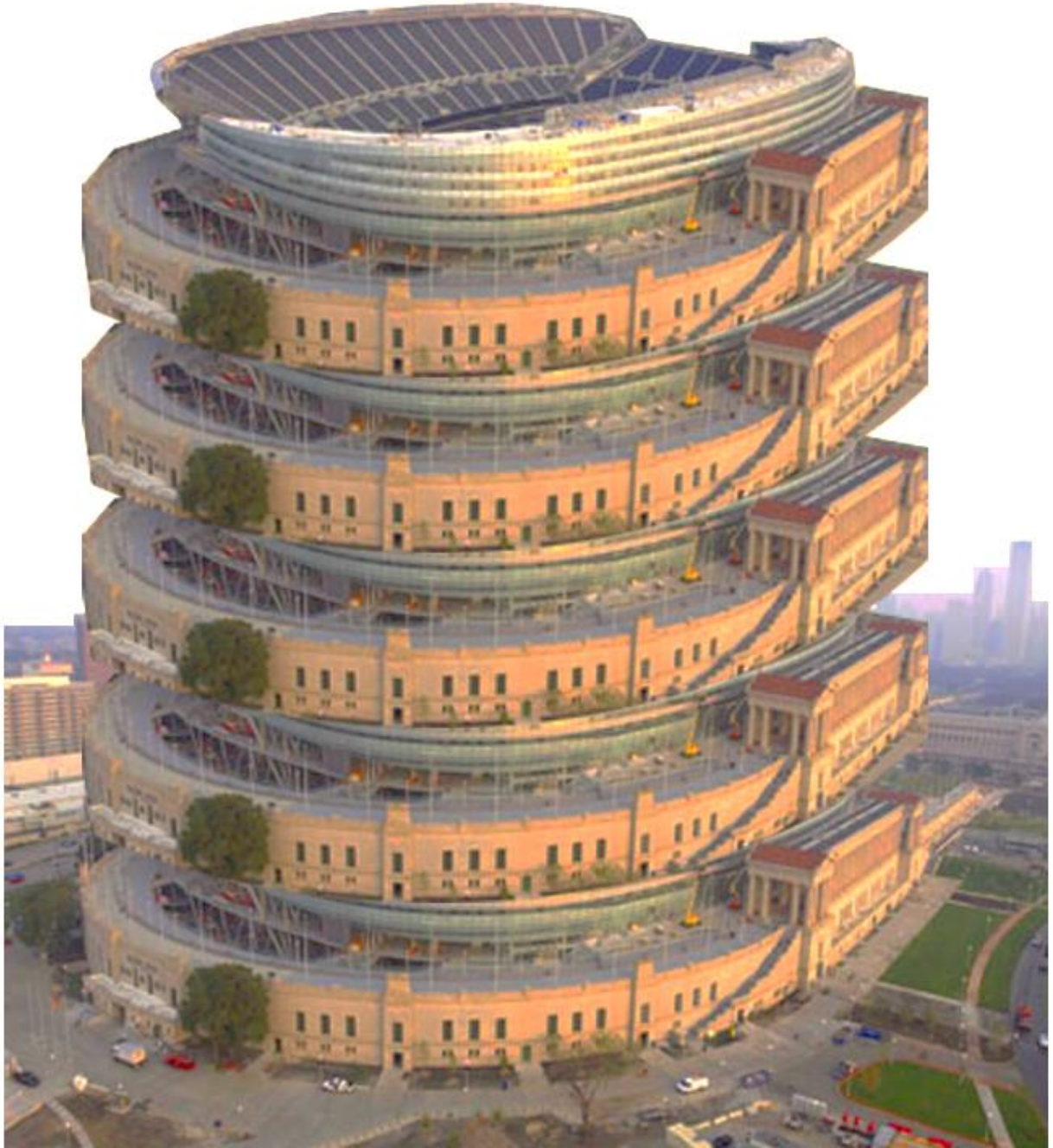
Photo courtesy of Walt Kelly

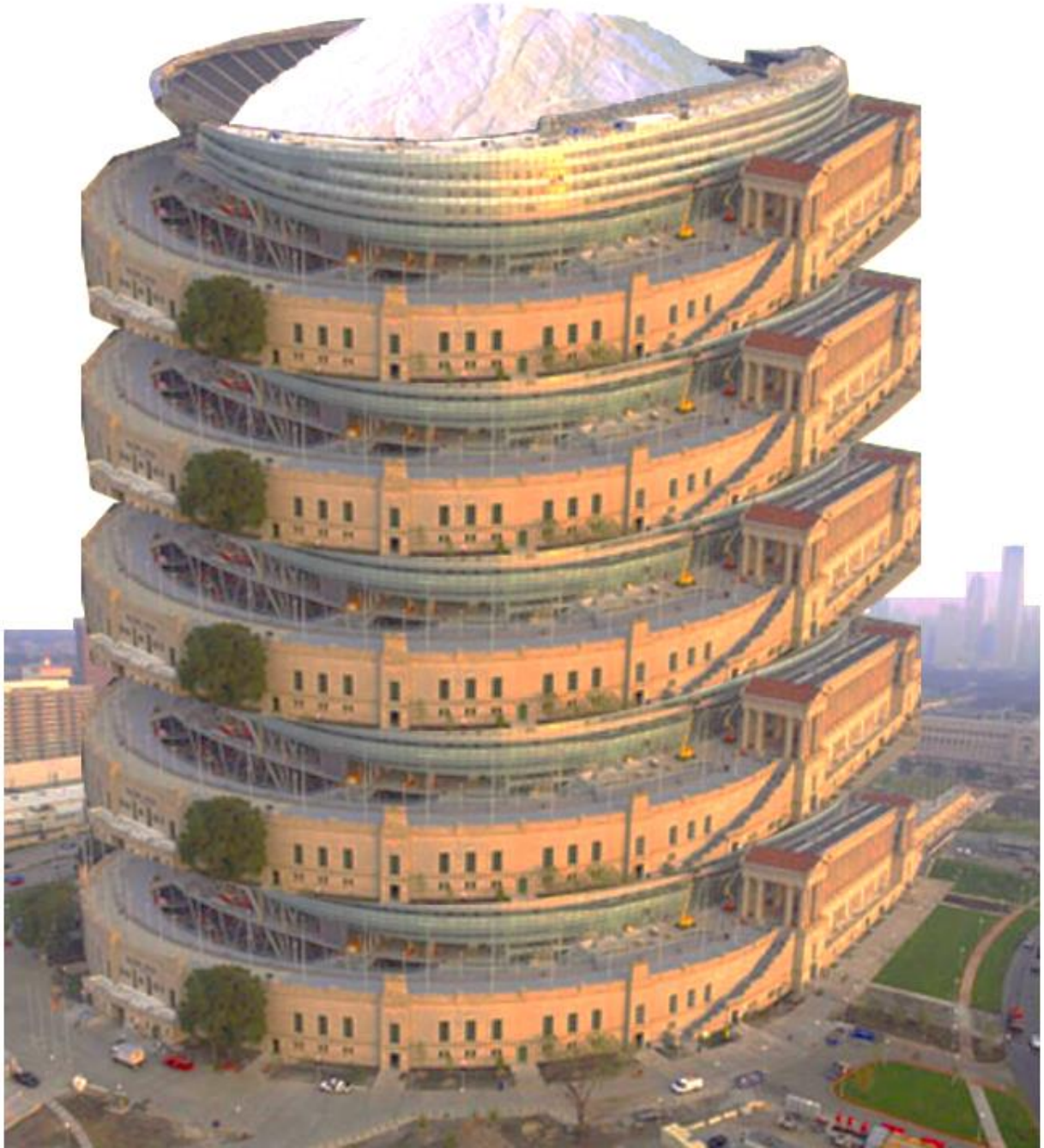
Chicagoland annual average snow cover: 36 inches (91 cm)

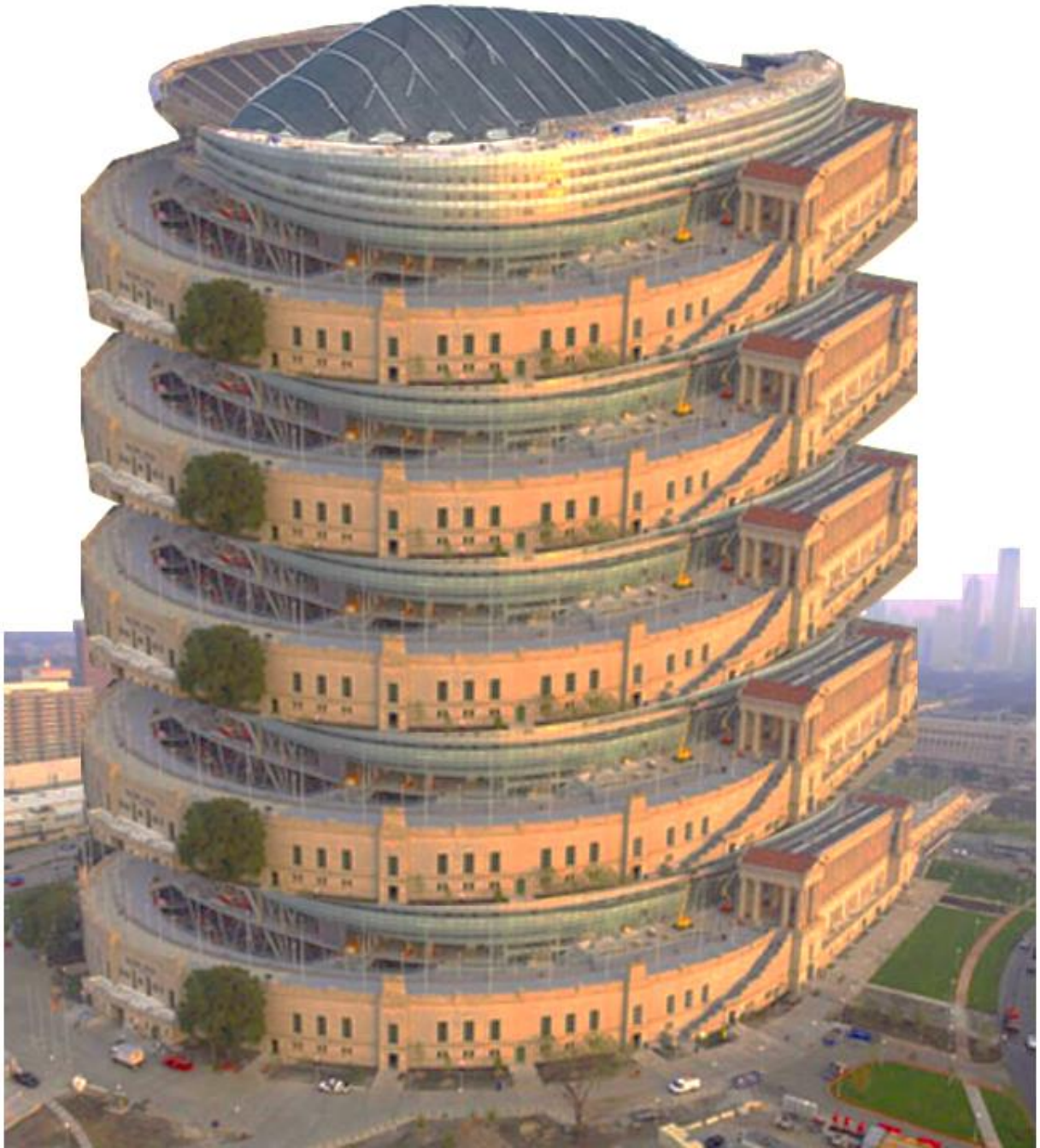
"Chicago's Seasonal Snowfall Amounts", National Weather Service. Chicago, IL

Chicagoland Region Historically Used 1.8 million tons of salt…
How much is 1.8 million tons of salt?

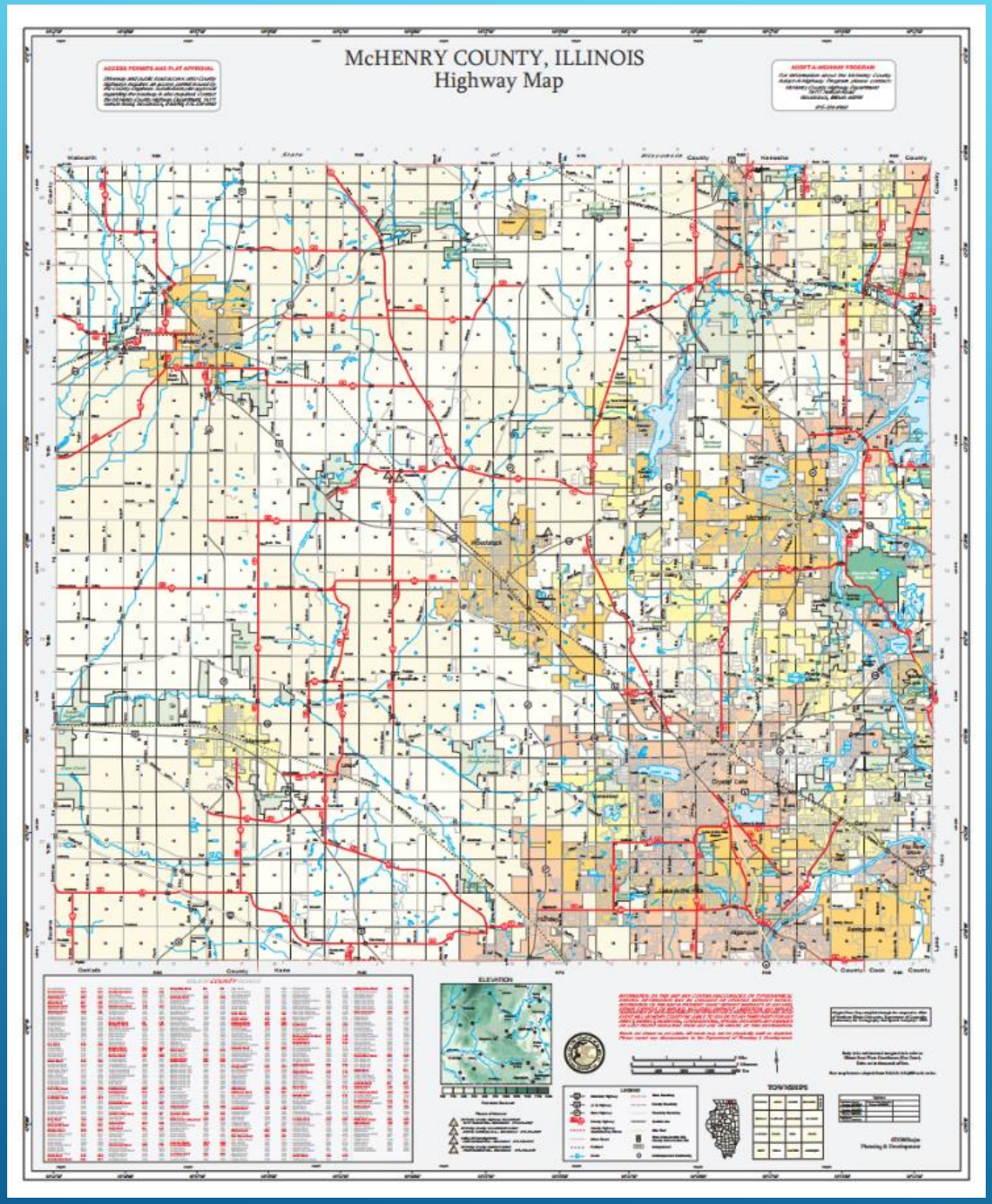
What if we stored it in soldier field?







WE USE SALT - LOTS OF SALT!



McHenry County has approximately 2,450 miles of roadway


IT'S NOT JUST ROADS WE SALT!

Photo courtesy of Walt Kelly

Estimated annual average road salt application in McHenry County:

35,000 tons - Public Roads
8,000 tons - Private Road and Parking Lot Application

(2006 B+W Groundwater Resources Management Plan)

WINTER SNOW AND ICE OPERATIONS: WHAT ARE THE IMPACTS???

INFRASTRUCTURE

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

CHLORIDE AND CORROSION

- Deicing salts result in **annual** repair/maintenance costs estimated at $200 to $450 million
  - Primarily for bridge decks
    - 1991 Transportation Research Board Report

Minneapolis I-35 Bridge Collapse

- 13 People Killed
- 145 People Injured
- Approximate Cost $459,600,00

Step 1. Outline the Problem

What	Problem(s)	Bridge collapse, Bridge overloaded, Design flaw, Loss of life	
When	Date	August 1, 2007	
	Time	6:05 p.m.	
	Differences	Evening rush hour, roadwork underway	
Where	Geographical location	Minneapolis, Minnesota	
	Unit	Bridge 9340	
	Process	Crossing Mississippi River	
Impact to the Goals			
	Safety	13 people killed	
		145 people injured	
	Environmental	?	
	Cust. Service	Loss of major transportation route (for	
	Production-Schedule	>140,000 vehicles/day)	
	Material, Labor Cost	Increased commuting expenses ($400,000/day for 414 days)	$ 165,600,000
		Loss to economy (estimated)	$ 60,000,000
		Replacement of bridge	$234,000,000
			This incident $ 459,600,000.00
	Frequency	Infrequent	
			Annual Total

Case study using State figures: www.thinkreliably.com

NATURAL RESOURCES

Road Salt: Ecological Effects

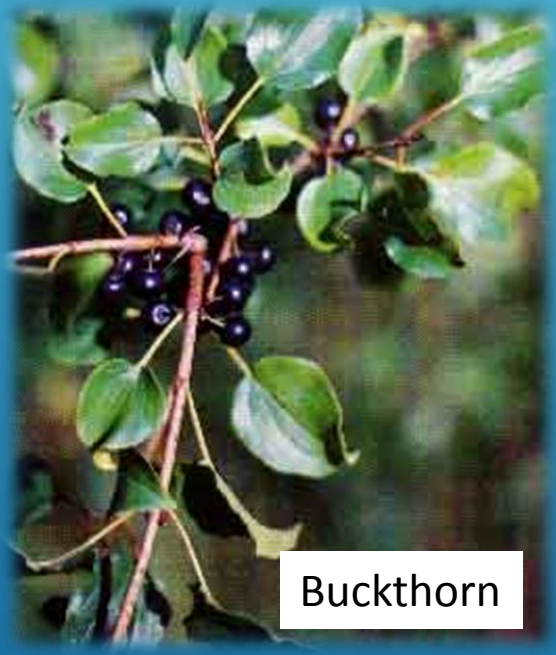
Photos Courtesy of Michael Adam, Lake County Health Dept.

Road Salts Damage Plants

Road Salt: Ecological Effects

- Salt tolerant species may outcompete native species, decrease biodiversity


Cattails


Buckthorn

Phragmites

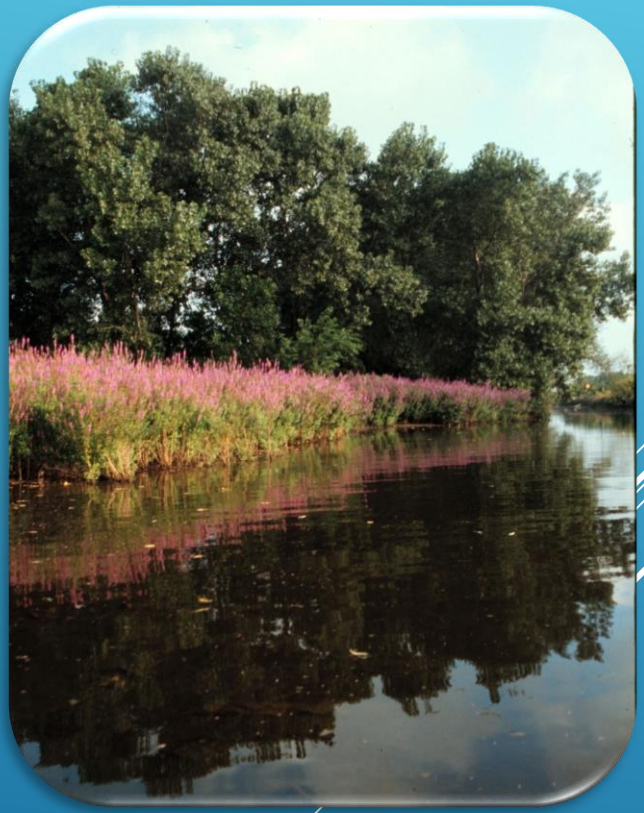
Photos Courtesy of Michael Adam, Lake County Health Dept.

Road Salt: Ecological Effects

- Aquatic fauna negatively impacted by high salt concentrations
  - Frogs
  - Salamanders
  - Fish, minnows (Cl^- as low as 210 mg/L)
- Some birds may also be affected by salt consumption

ROAD SALT: ECOLOGICAL EFFECTS

- Salt concentrations in lakes can be high enough to alter turnover that can lead to fish kills



Do you or someone you know like to fish?

SALT'S EFFECT ON OUR AQUATIC LIFE

Acute standard: 500 mg/l
about 2 Teaspoons of salt in 5 gallons of water

Bluegills die @ concentrations

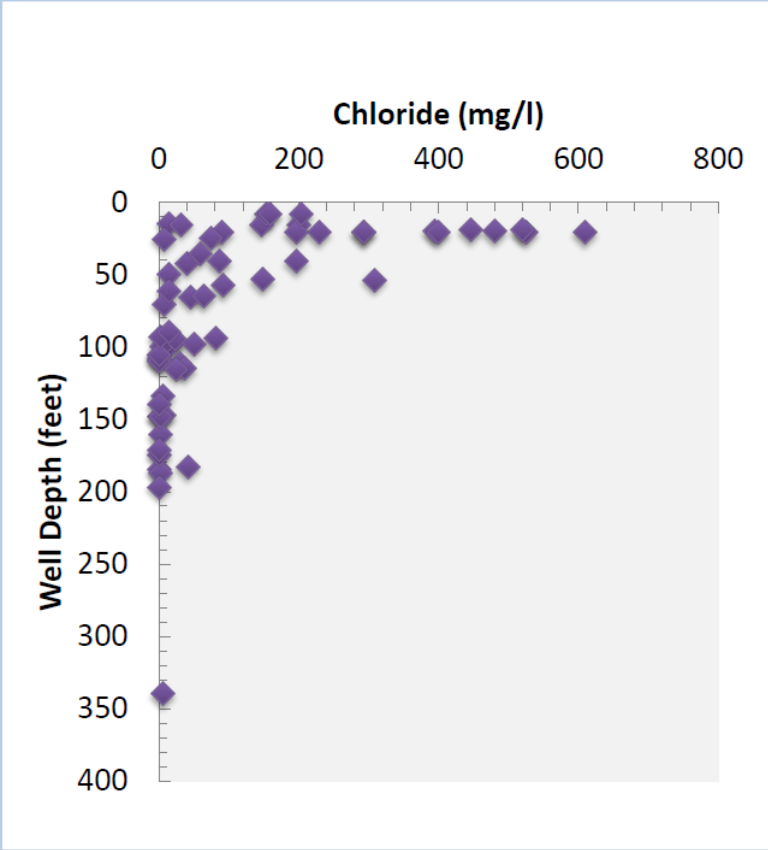
2,500-8,600mg/l

about 1/2 cup salt in 5 gallons of water

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

Chlorides Concentrations

- Chloride concentrations ranged from 0.49 to 521 mg/L in the 2010 sampling event.
  - Greater than 250 mg/L imparts a salty taste
- Highest concentrations detected at:
  - Urban wells (NAQWA wells)
  - Wells near heavy traffic roads or highways



USGS
science for a changing world

- Chlorides have been found in most wells monitored by the USGS
- 5 wells exceeded the SMCL of 250 mg/L

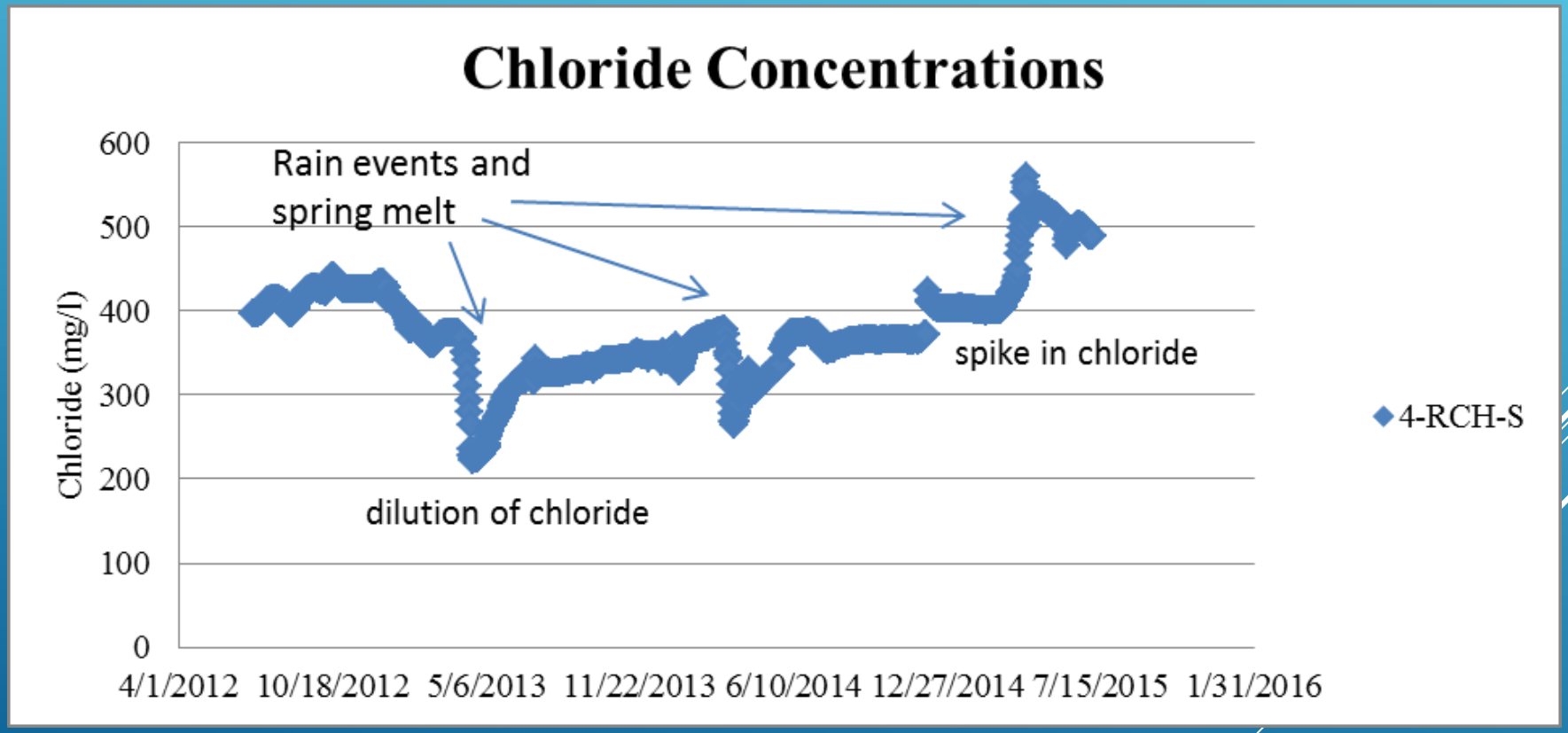
Sources of Chloride through Chloride-Bromide Analysis

- The ratio of chloride concentrations to bromide concentrations can be used to determine the source of the chloride.
  - Road salt
  - Road salt + water softener
  - Sewage + road salt
  - Sewage
  - Fertilizer (potassium chloride)

USGS
science for a changing world

- Analysis can distinguish between different sources of Chloride
- Road salt is the source for most of the Chloride observed in groundwater

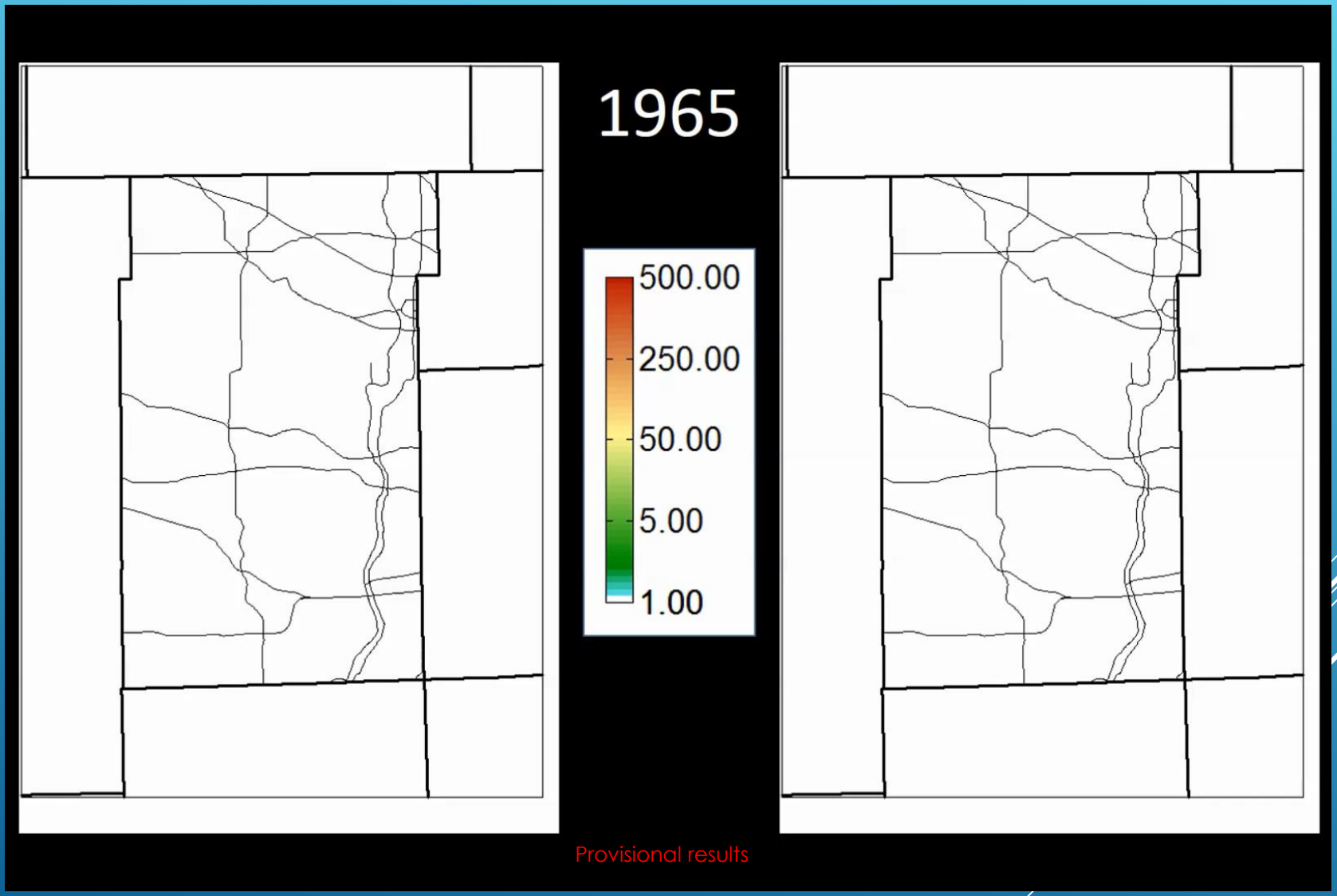
RELATION OF SPECIFIC CONDUCTANCE TO CHLORIDE CONCENTRATIONS



Increase of Chloride in Groundwater: 1965 - 2015

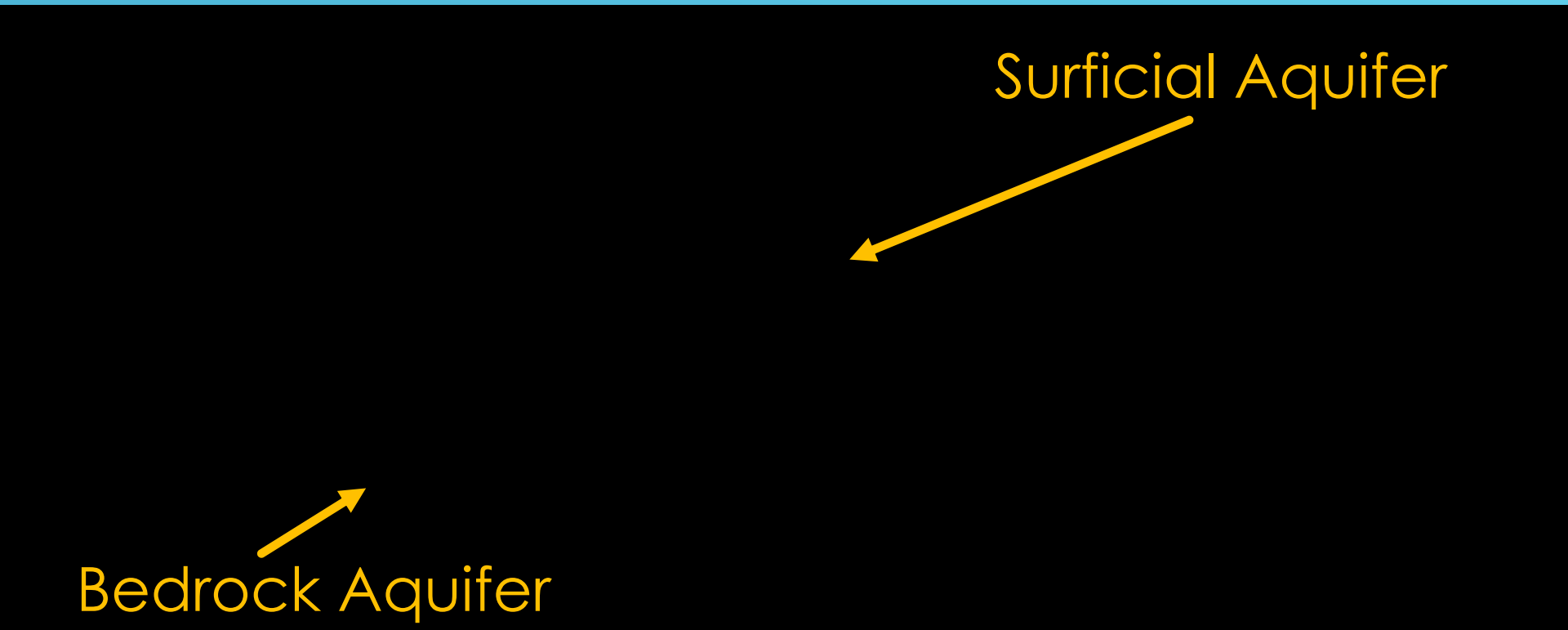
Shallow glacial material

Shallow bedrock



Cross-sectional view - Crystal Lake Chloride Plume

Chloride Increases in shallow & deep aquifers from 1965 to 2015



Importance of mapping local scale geology!

Provisional results

DRINKING WATER SUPPLY

Chloride Standards

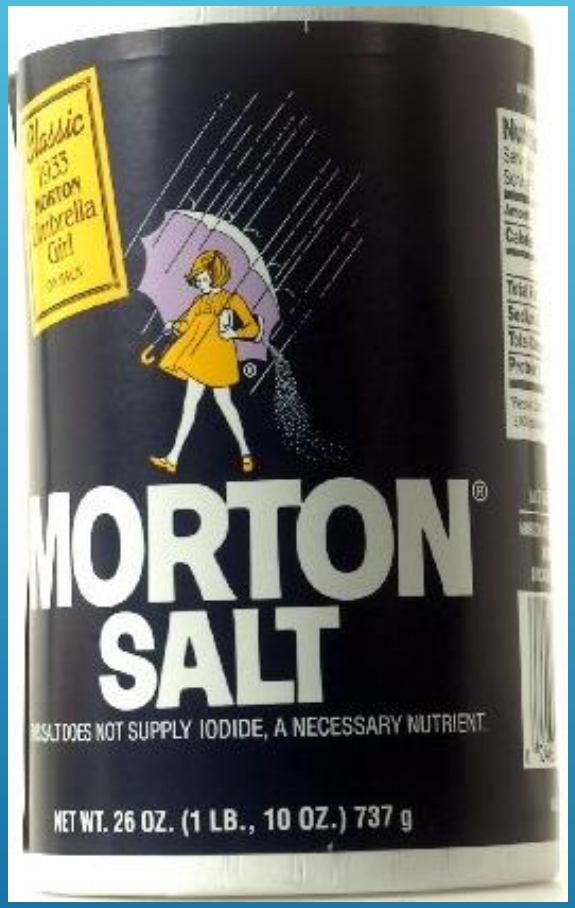
1 tsp. salt in 5 gal. of water =230 mg/L

- 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**

Source: 2008 IL EPA Bureau of Water Integrated Water Quality Report

RECAP… WHAT DOES THIS LOOK LIKE IN REAL LIFE?



About 1.5pounds = 3cups = 150 teaspoons

750gallons above EPA drinkable limit

You should drink ½ gallon a day 1500days or **4years** of drinking water

30 gallons unlivable to fish

300pounds = 600cups = 28,800 teaspoons

144,000gallons above EPA drinkable limit

You should drink ½ gallon a day
288,000days or **800years** of drinking water

6,000gallons unlivable to fish

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

12,000,000 gallons above EPA drinking water standard

You should drink ½ gallon a day
24,000,000 days worth of drinking water
Which is enough drinking water for **65,000 people for an entire year**

500,000 gallons unlivable to fish

WHAT WILL BE HAPPENING IN THE FUTURE?

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 MS4 permit holders
  - Implementation guidance / ordinances
  - Best Management Practices - BMPs

NPDES GENERAL PERMIT

- Has six minimum control measures, including:
  - 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: COUNTY OF MCHENRY

- Department of Planning and Development :

  Unified Development Ordinance

  - Section 14.5.E: De-Icing Agent Storage
    - Regulates the storage of de-icing agents for unincorporated areas of McHenry County regardless of the amount.

LOCALLY: 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

Workshops

- This is the 9th Year the McHenry County has held Snow and Ice Workshops.

- ~ *Trained and Certified (over 600)*
  - Municipalities
  - Townships
  - Private Operators
  - County Operators
  - Schools
  - Distributors
  - Facility Managers
  - Business Owners

NEW DE-ICING TECHNOLOGIES?

- Solar Roads?
- Geo-Thermal Roads?
- New Chloride Free De-Icing Chemicals?

Any new technology must be proven safe for drivers and will be slow to come to market.

Although they may be free of chlorides, alternative chemicals may have environmental consequences of their own.

For the moment, **Sensible Salting is our best option**.

CLOSING THOUGHTS

Remember:

- ✓ Water is a finite resource
- ✓ Residents of McHenry County are extremely fortunate to have safe, reliable water resources
- ✓ Those water resources will only be available if we take care for them

CONSIDER HOW YOUR ACTIONS CAN IMPACT OUR WATER & ENVIRONMENT!

Scott Kuykendall
Water Resources Specialist
Department of Planning and Development
McHenry County Government
2200 N. Seminary Avenue
Woodstock, IL 60098-2637

Phone: (815) 334-4560, Fax: (815) 337-3720

SHKuykendall@co.mchenry.il.us

www.mchenryh2o.com