

WINTER SNOW AND ICE WORKSHOP NOVEMBER 2017



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McHenry County
Department of Planning and Development

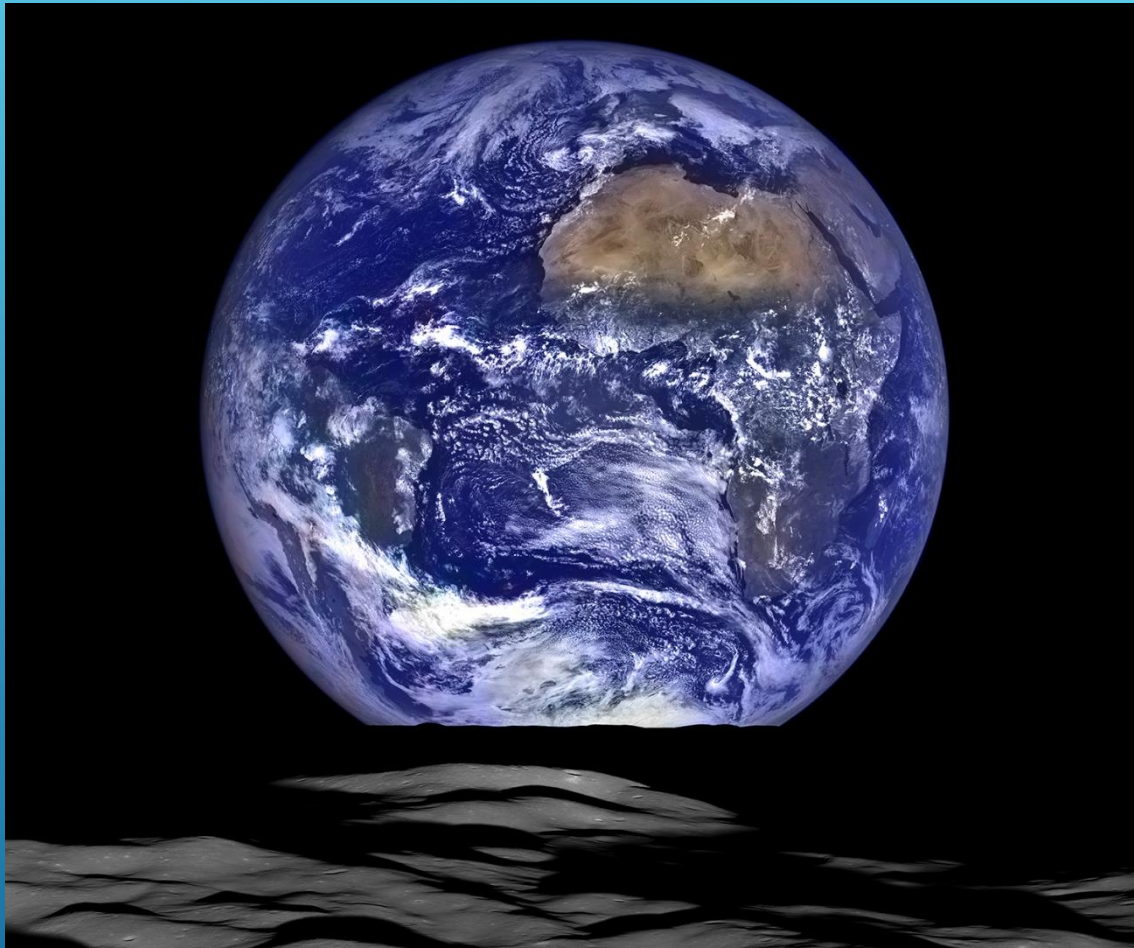
WHY ARE WE HERE TODAY?



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

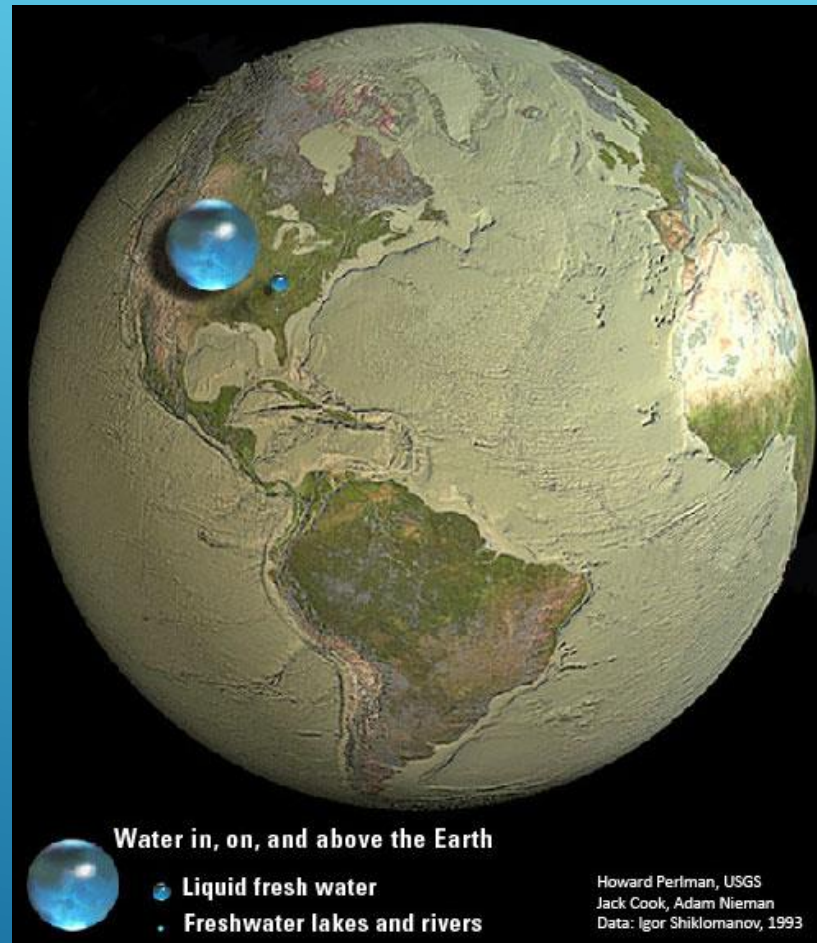


CONSIDER THIS...



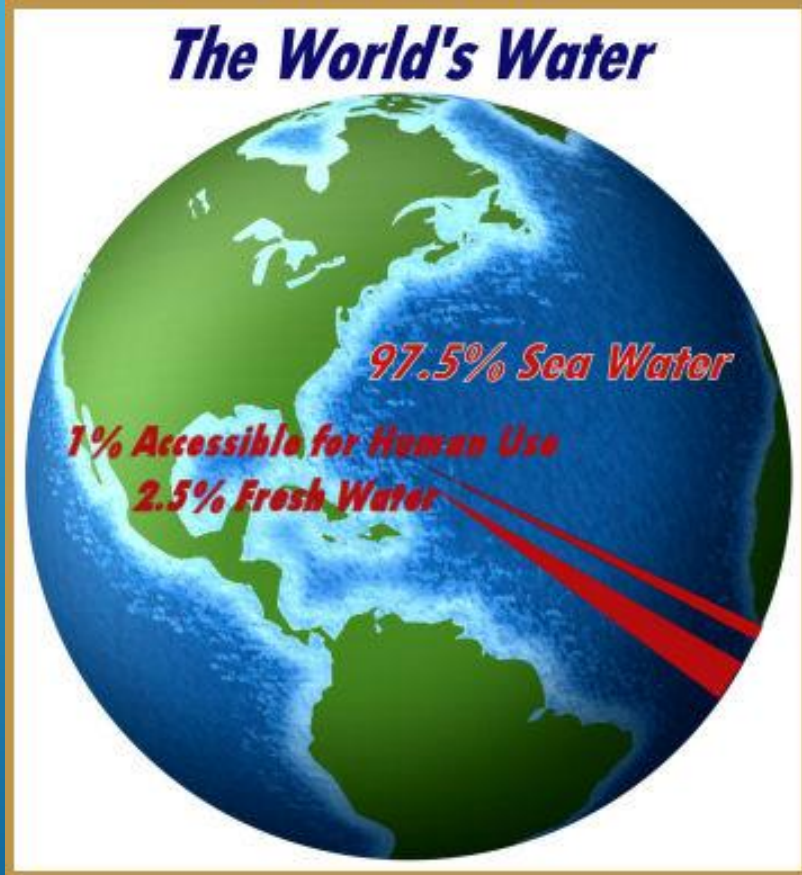
We live on a blue planet where about 75% of the Earth's surface is covered with water...

CONSIDER THIS...

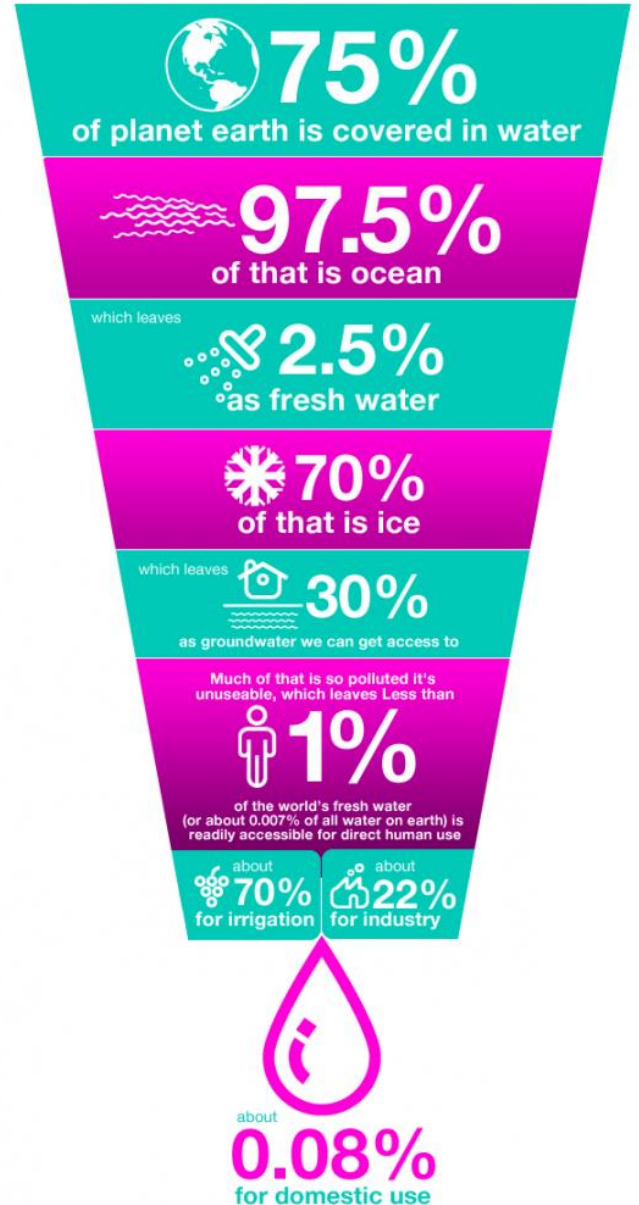


...But only 2.5% is fresh water and only a small percentage of that is available for human use

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



WORLD'S WATER CONTENT



OUR ACTIONS ARE DAMAGING THE REMAINING 0.08%



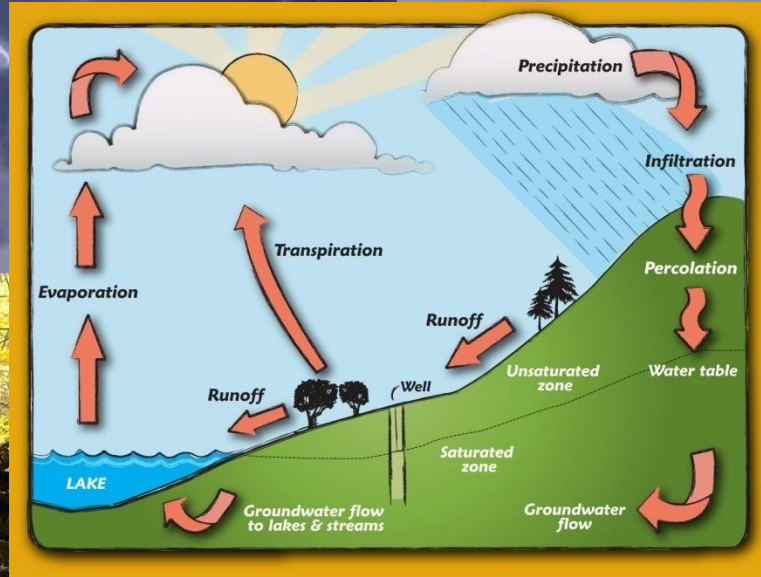
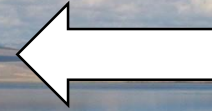
THAT DAMAGE INCLUDES OUR USE OF ROAD SALT



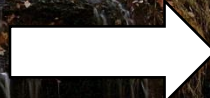
**CONDENSATION
PRECIPITATION**



**EVAPORATION
TRANSPIRATION**



**RUNOFF
INFILTRATION**



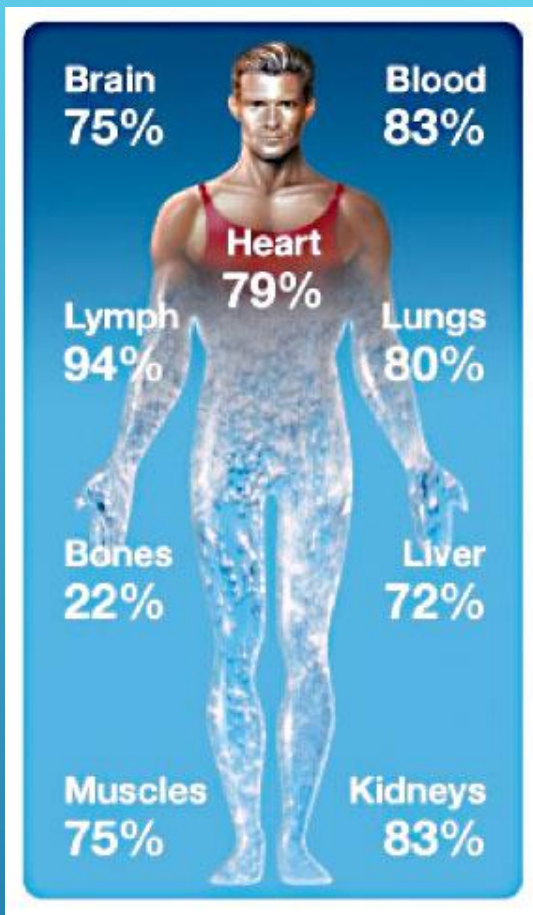
**GROUNDWATER
SURFACE WATER
WETLANDS/FENS**



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?

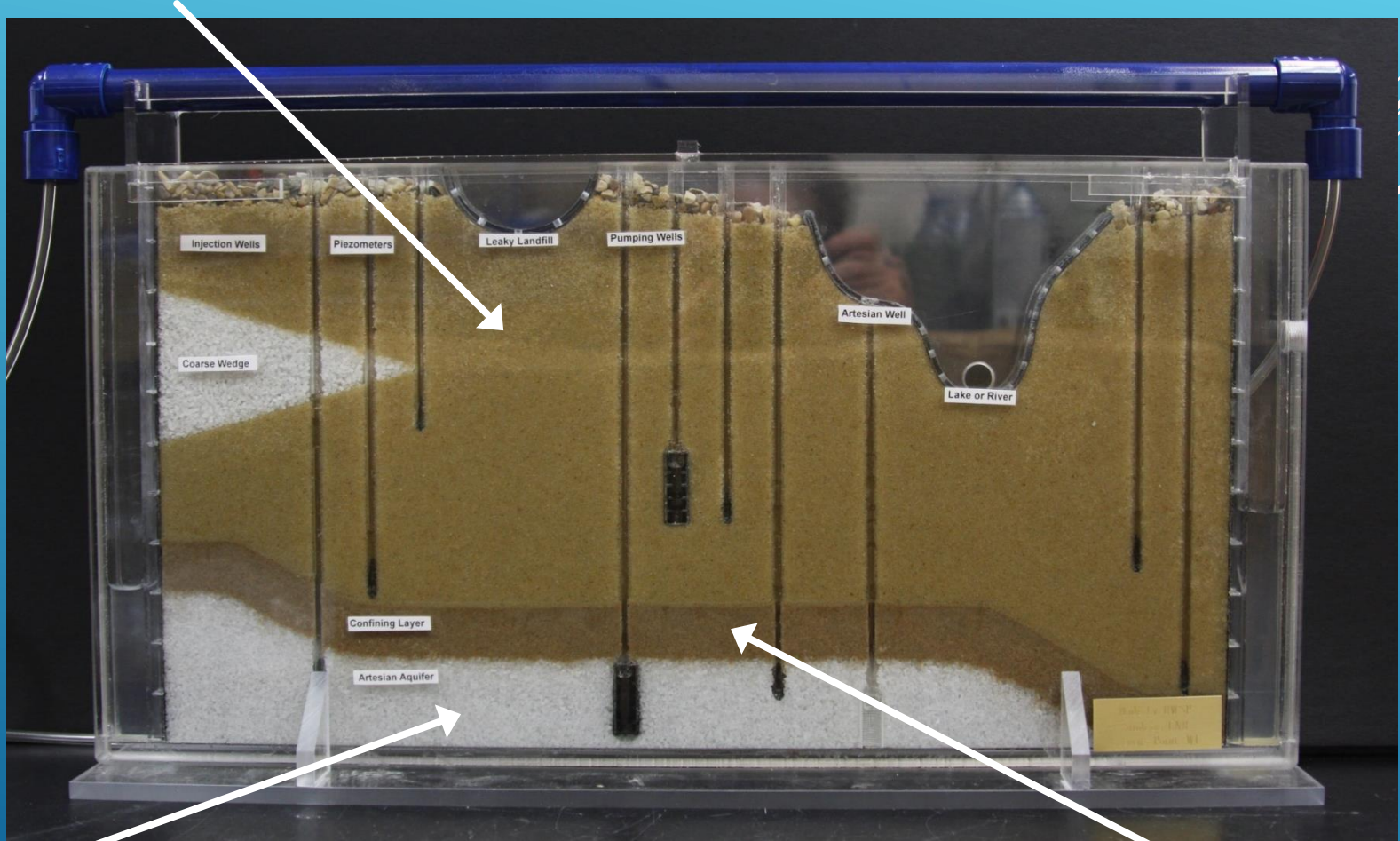


MCHENRY COUNTY GROUNDWATER SUMMARY

- ▶ 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)

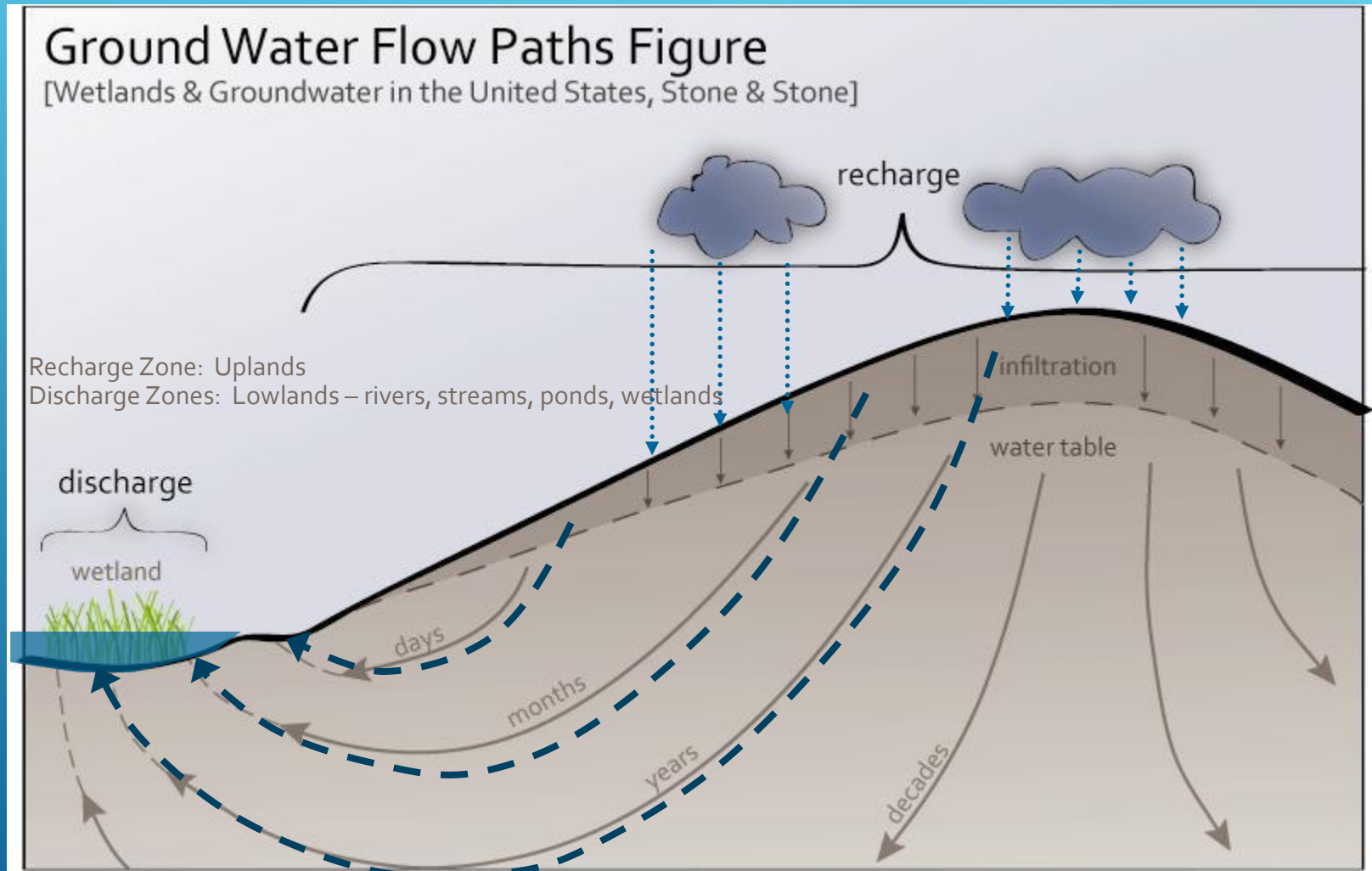


BEDROCK AQUIFERS (25% of water supply)

CONFINING LAYER

Natural Hydrology

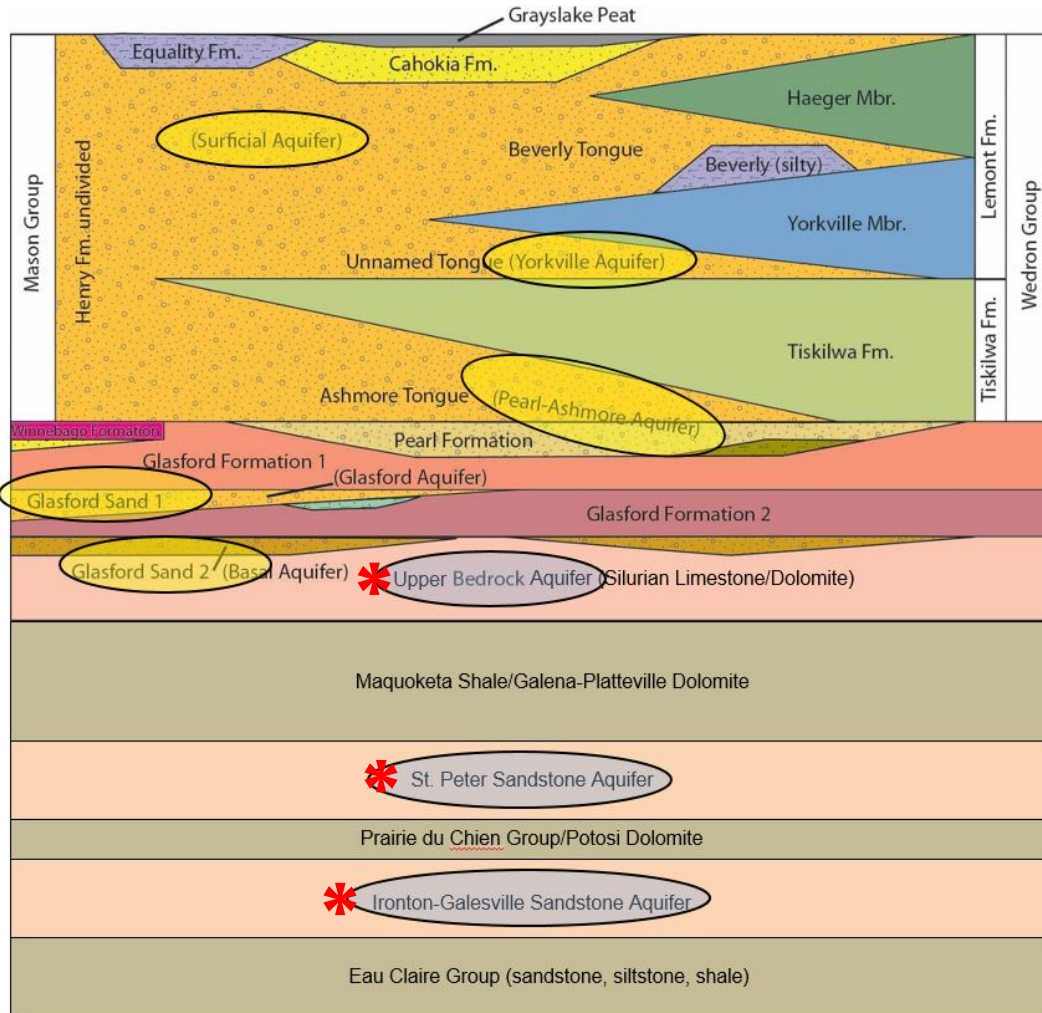
Slide courtesy of James Patchett and Conservation Design Forum



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

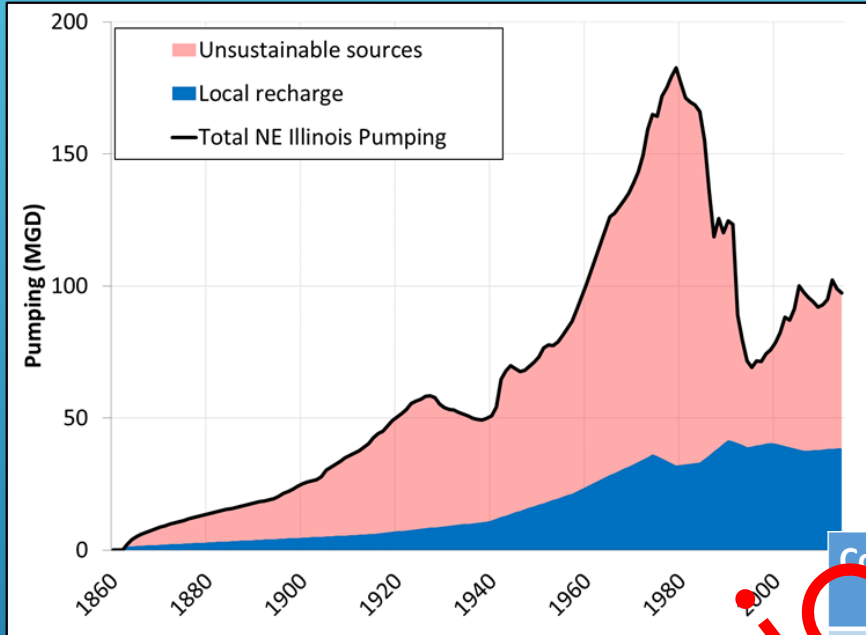
*Bedrock Aquifers
100-1200 ft deep

OUR GROUNDWATER
IS VULNERABLE...



OVER CONSUMPTION...

G-Water Demand vs. Recharge NE Illinois



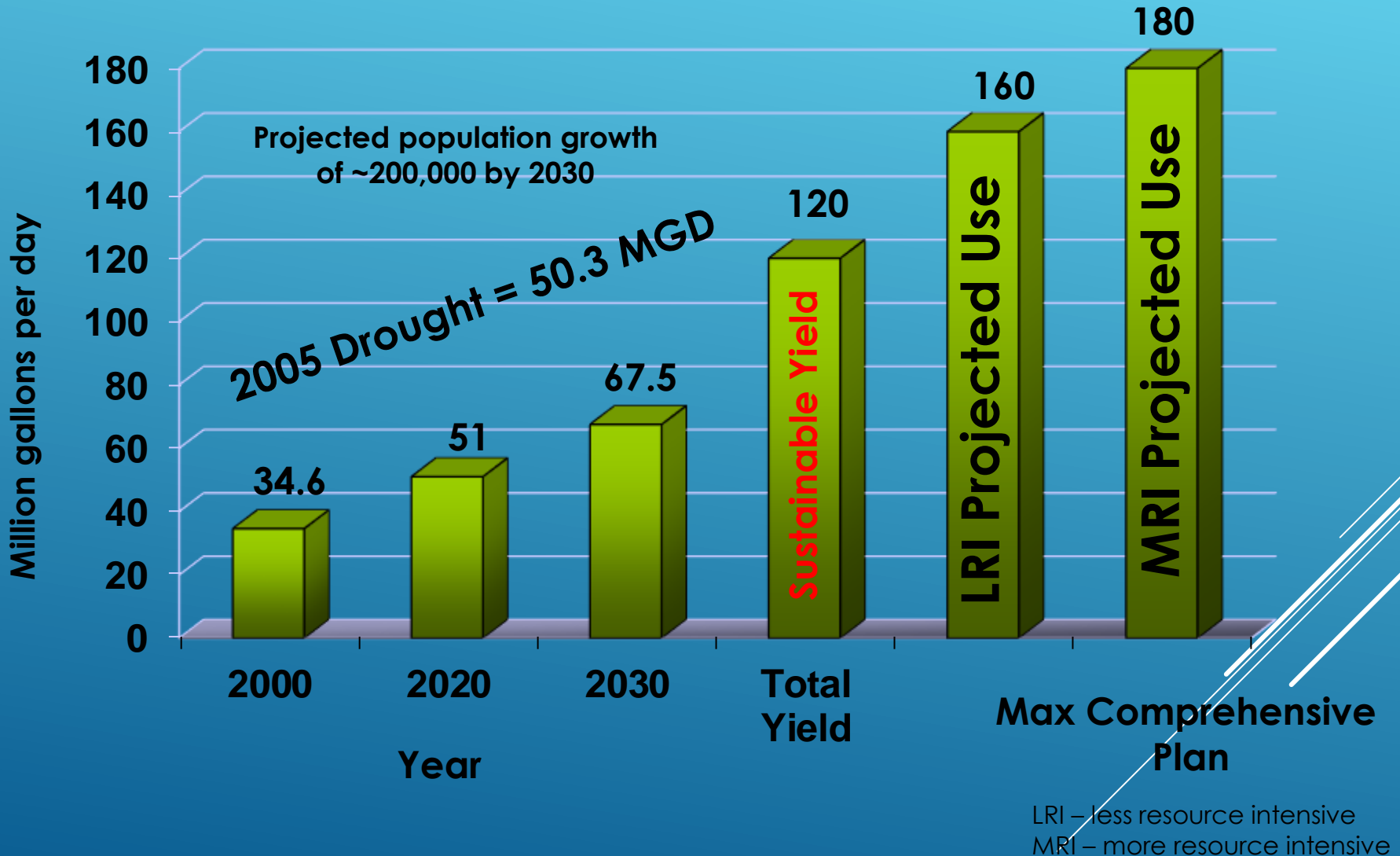
Deep Bedrock Aquifers NE Illinois

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%

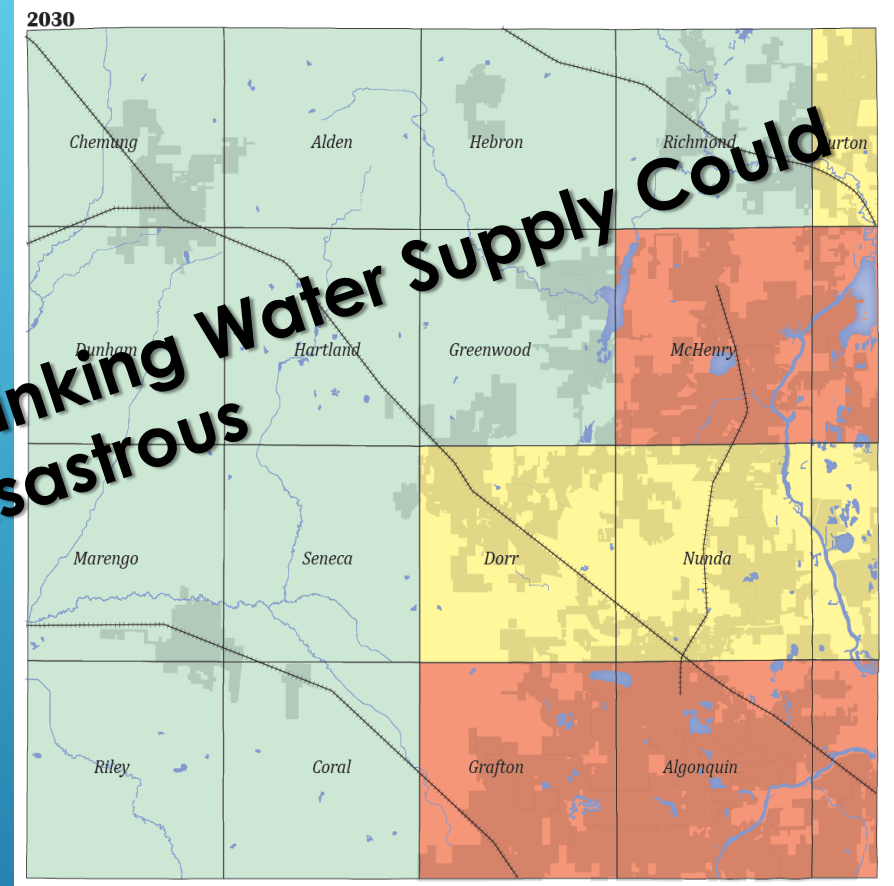
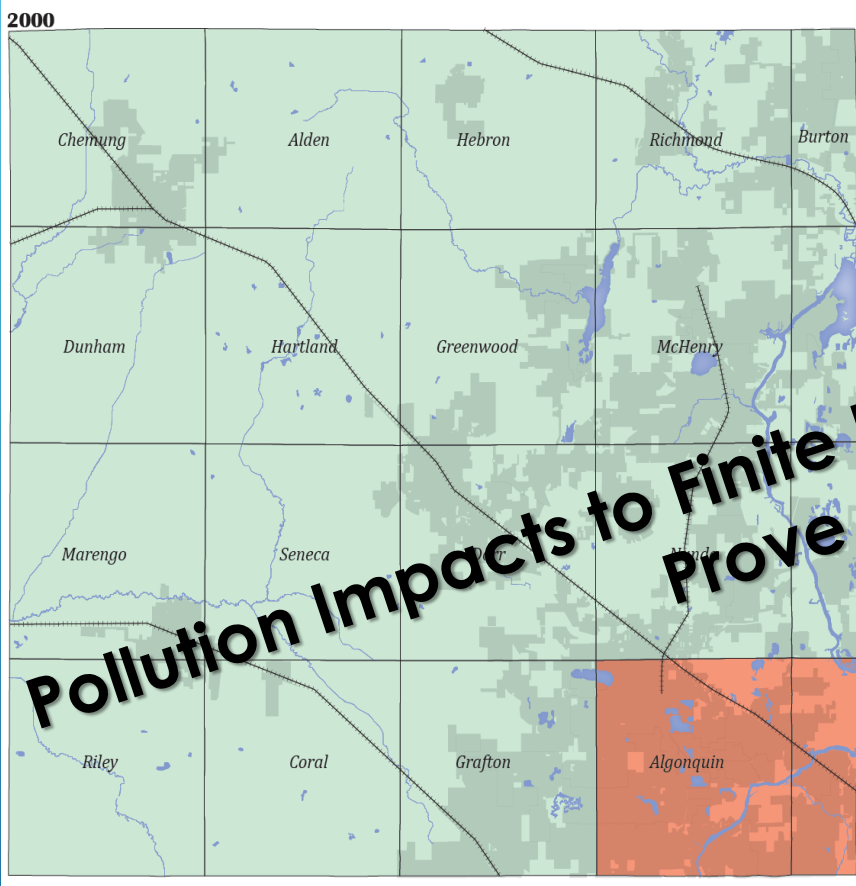
MGD

Provisional results

HOW MUCH WATER DO WE USE IN MCHENRY COUNTY?



McHenry County Water Supply Projections

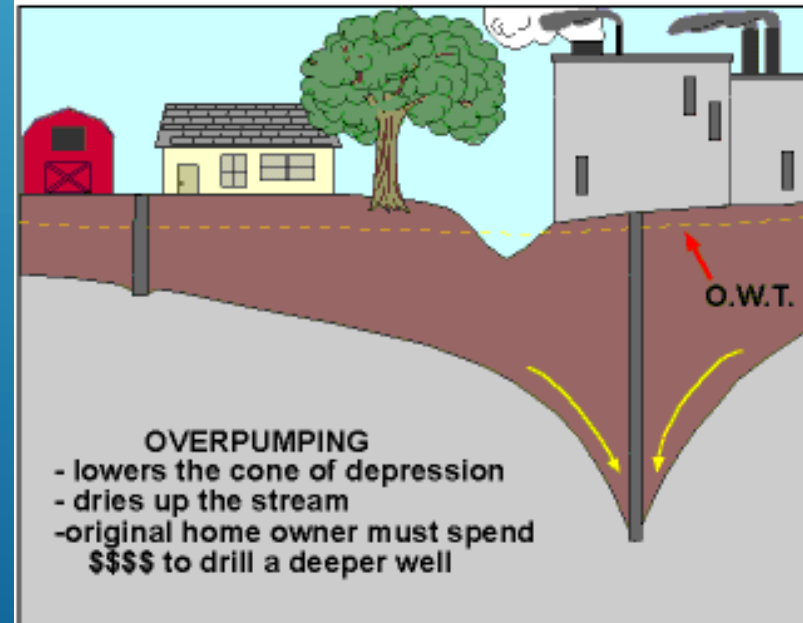
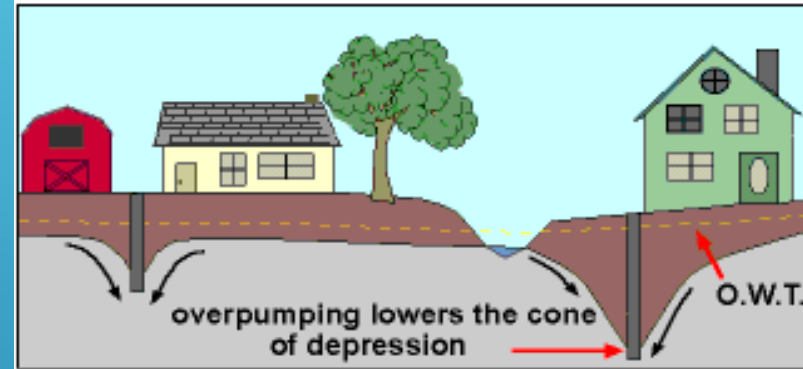
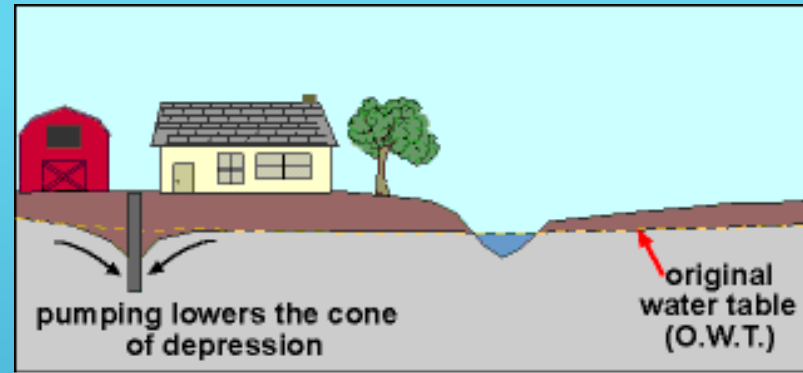


Map Legend

- 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



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:

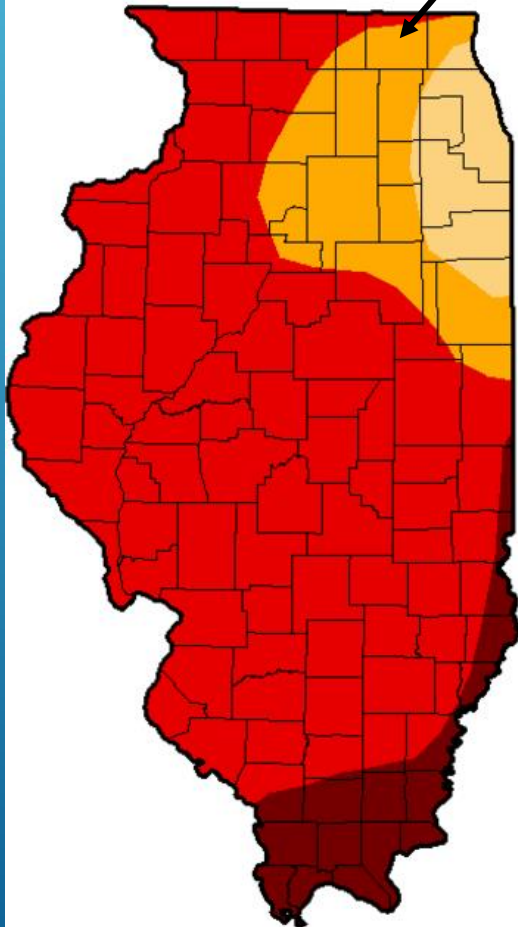
- Groundwater recharge decreases
- Water use increases across all sectors (SIUC):
 - Public-supply withdrawals increase by 5%
 - Commercial and Industrial withdrawals increase by 5.5-5.6%
 - Irrigation and Agricultural withdrawals increase by 50%

DROUGHT CONDITIONS IN 2012

U.S. Drought Monitor

Illinois

McHenry County



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 5/6/2012	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 8/8/2011	39.45	60.55	30.12	0.00	0.00	0.00

Intensity:

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



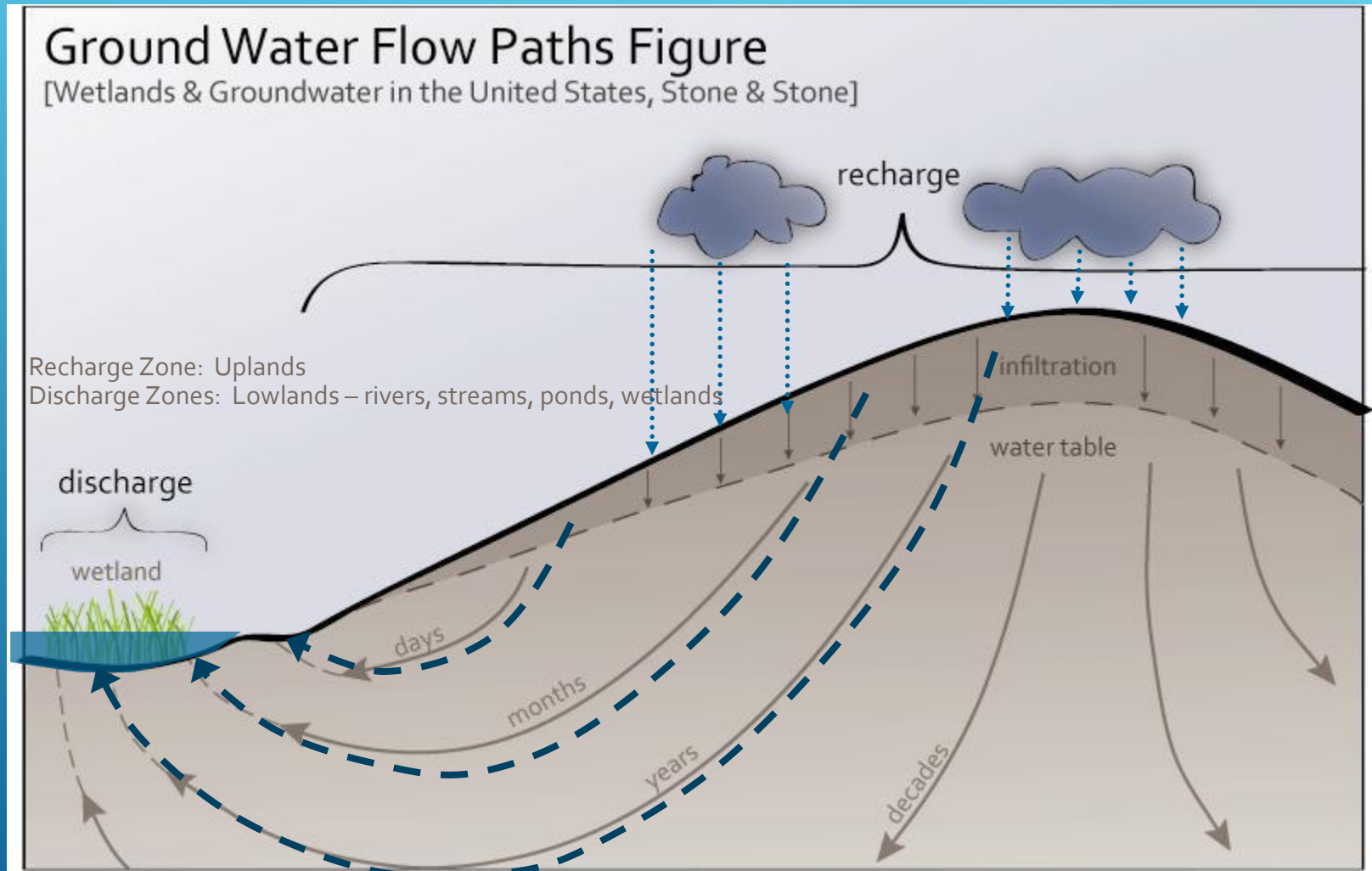
2012 Drought
Major Drop in
Water Levels

LOSS OF GROUNDWATER RECHARGE/ INCREASED IMPERVIOUS AREA



Natural Hydrology

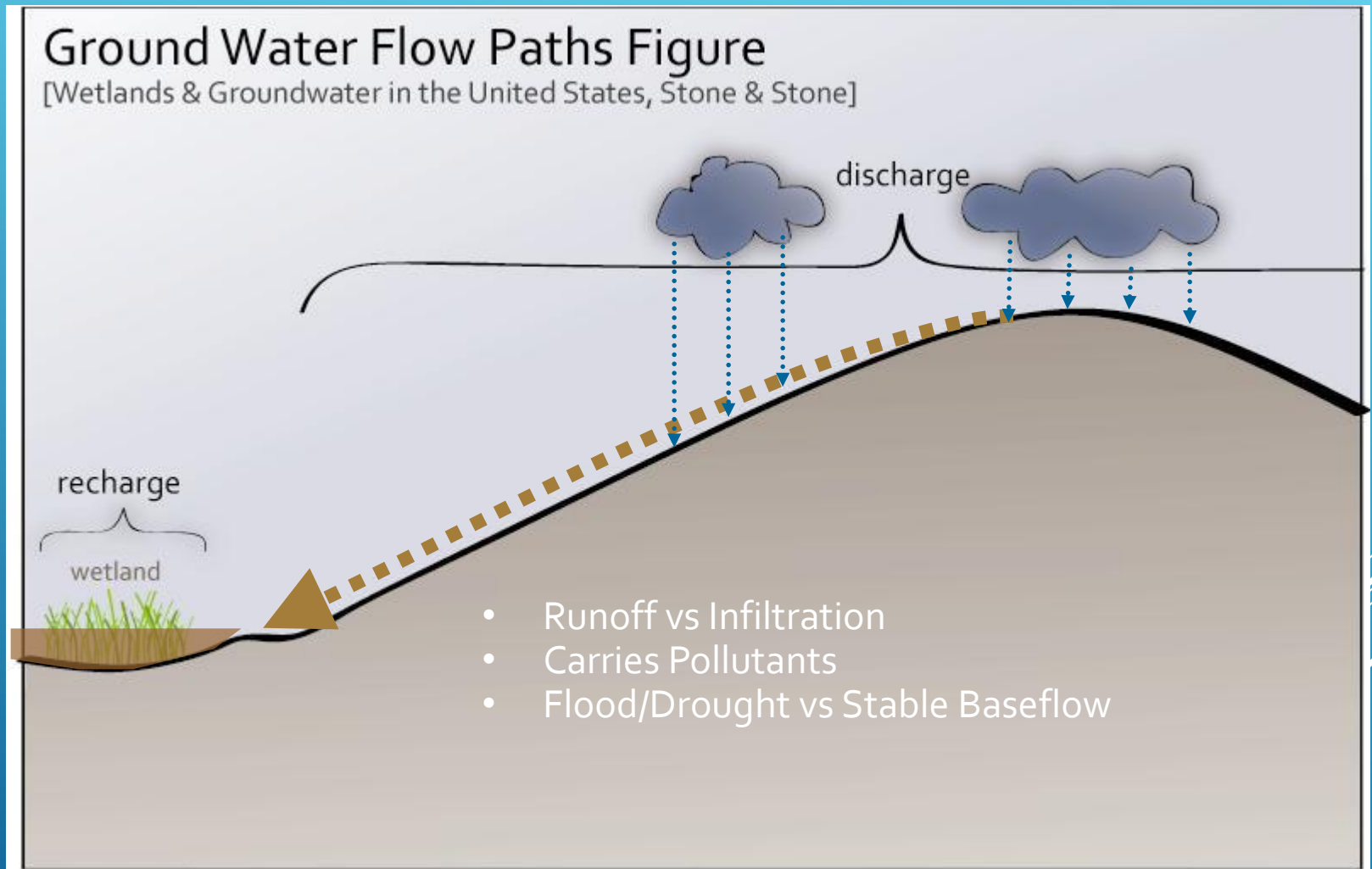
Slide courtesy of James Patchett and Conservation Design Forum



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

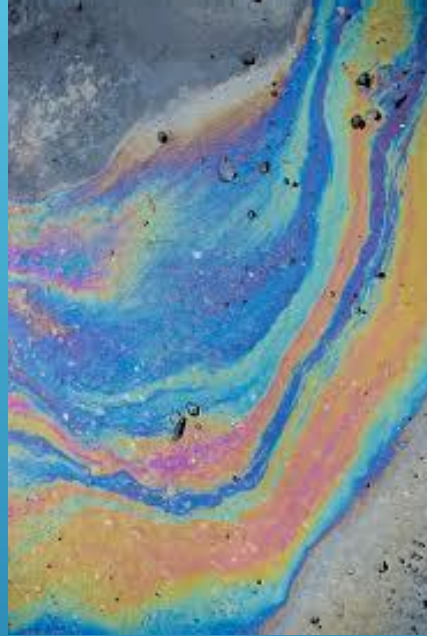
Urban Hydrology

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

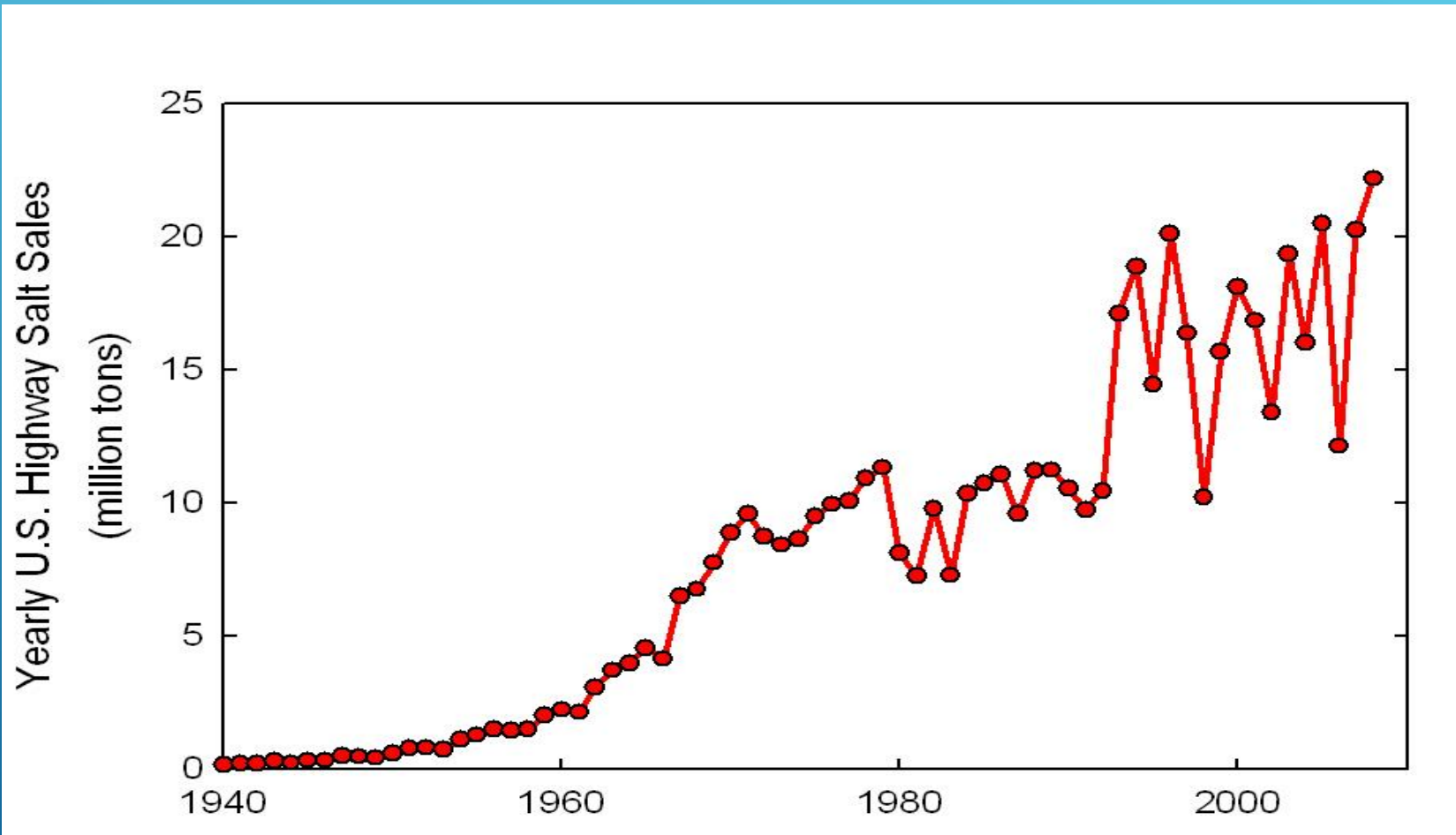




Photo courtesy of Walt Kelly

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?**

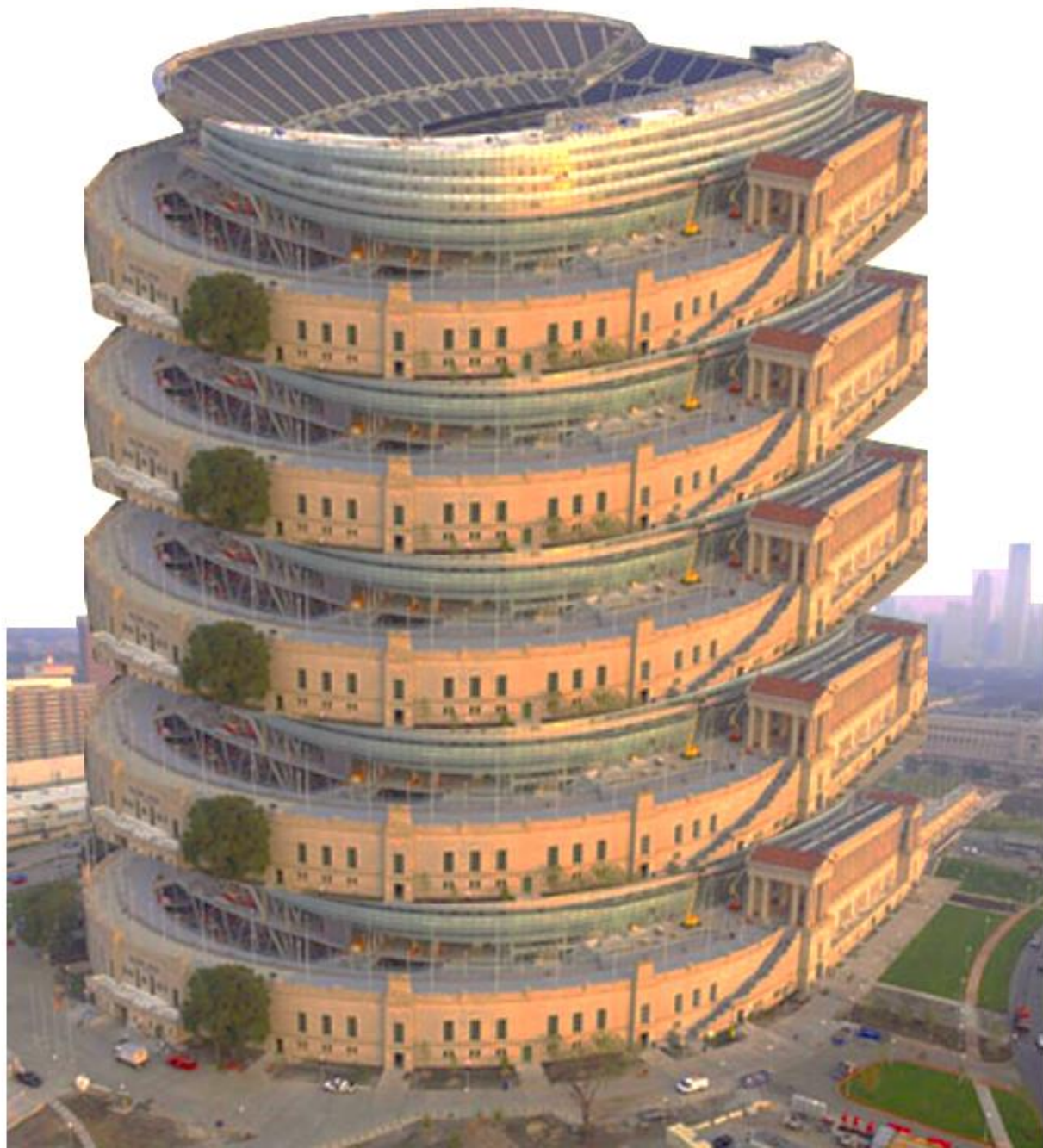
What if we stored it in soldier field?

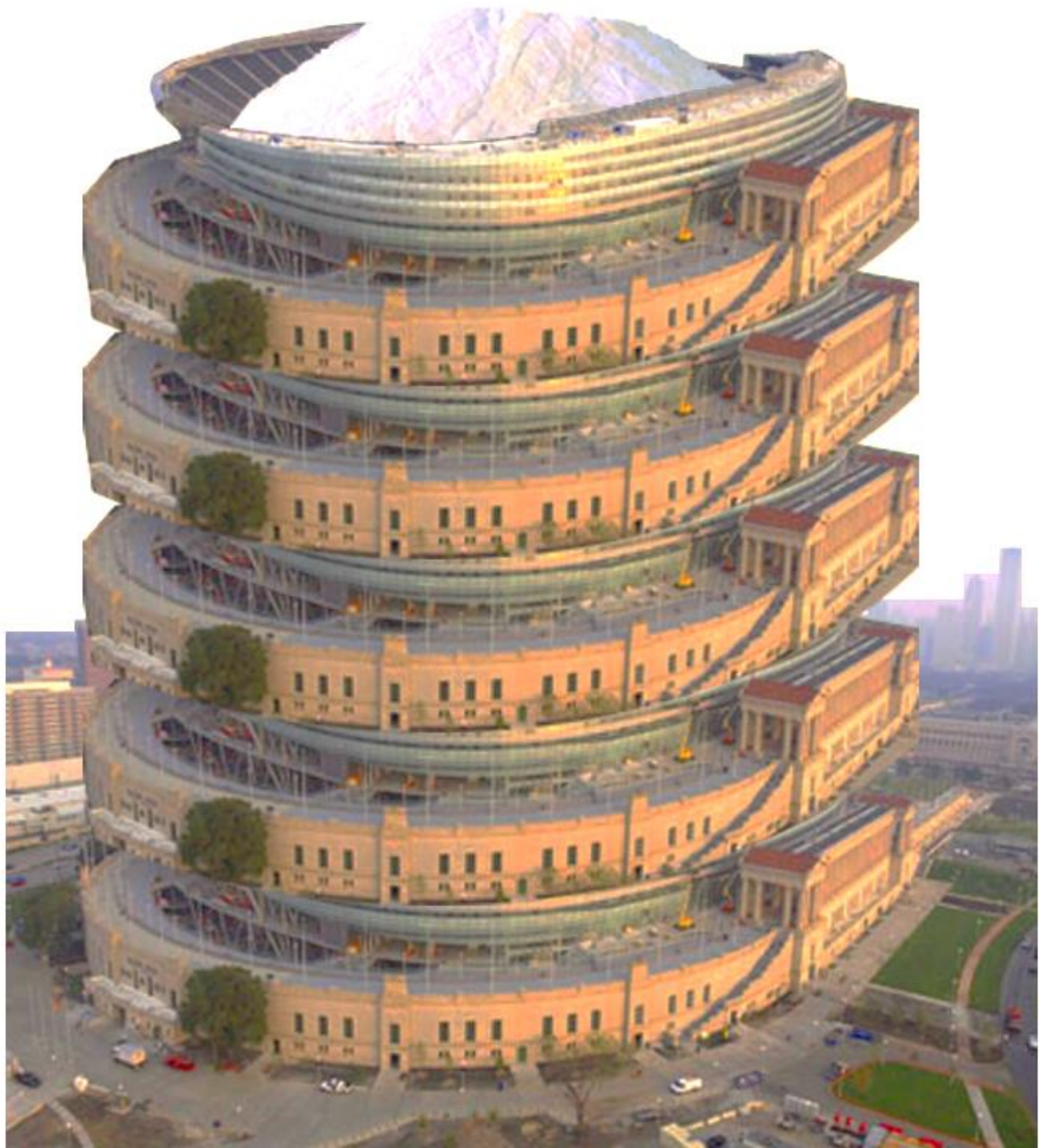


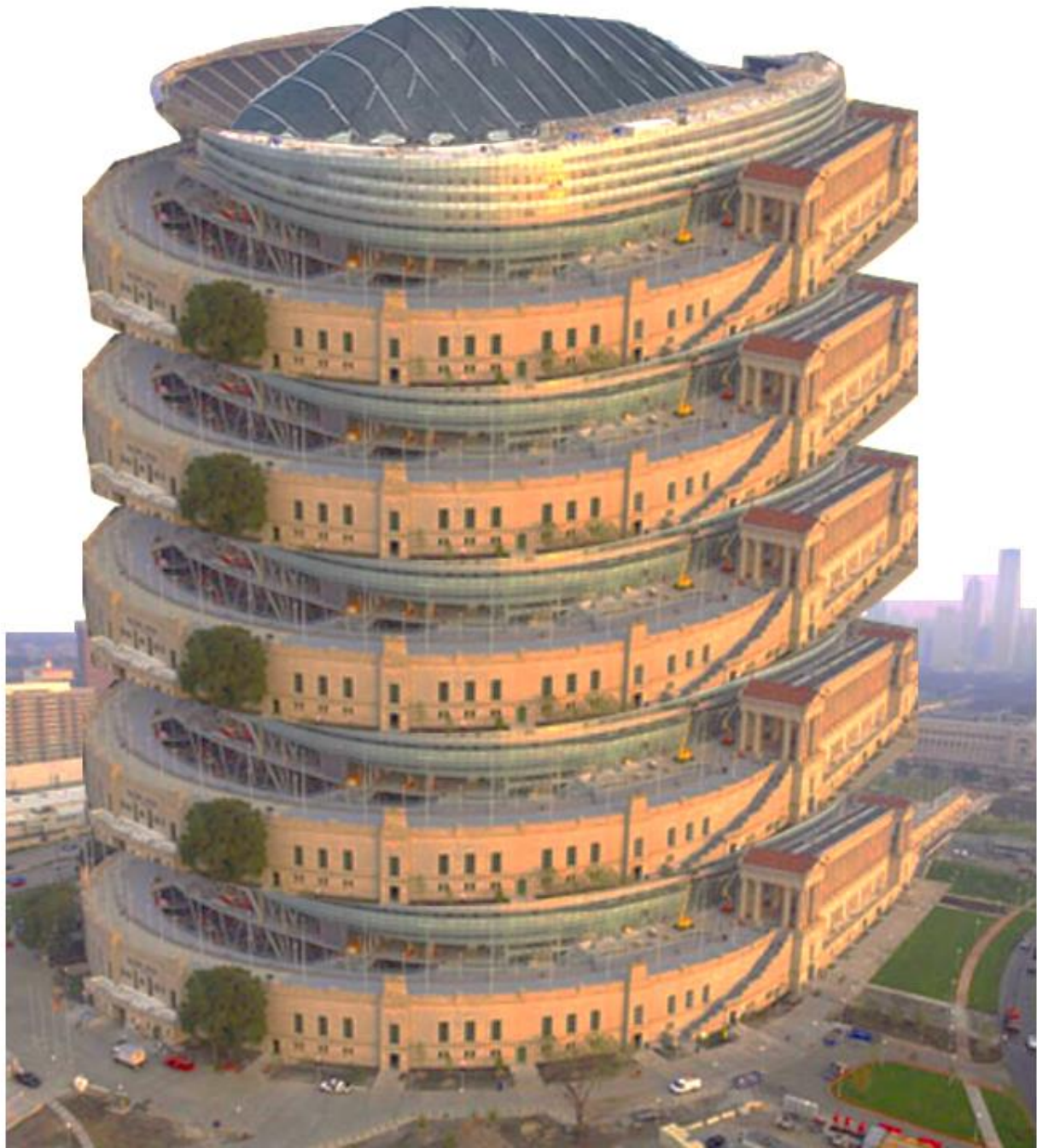












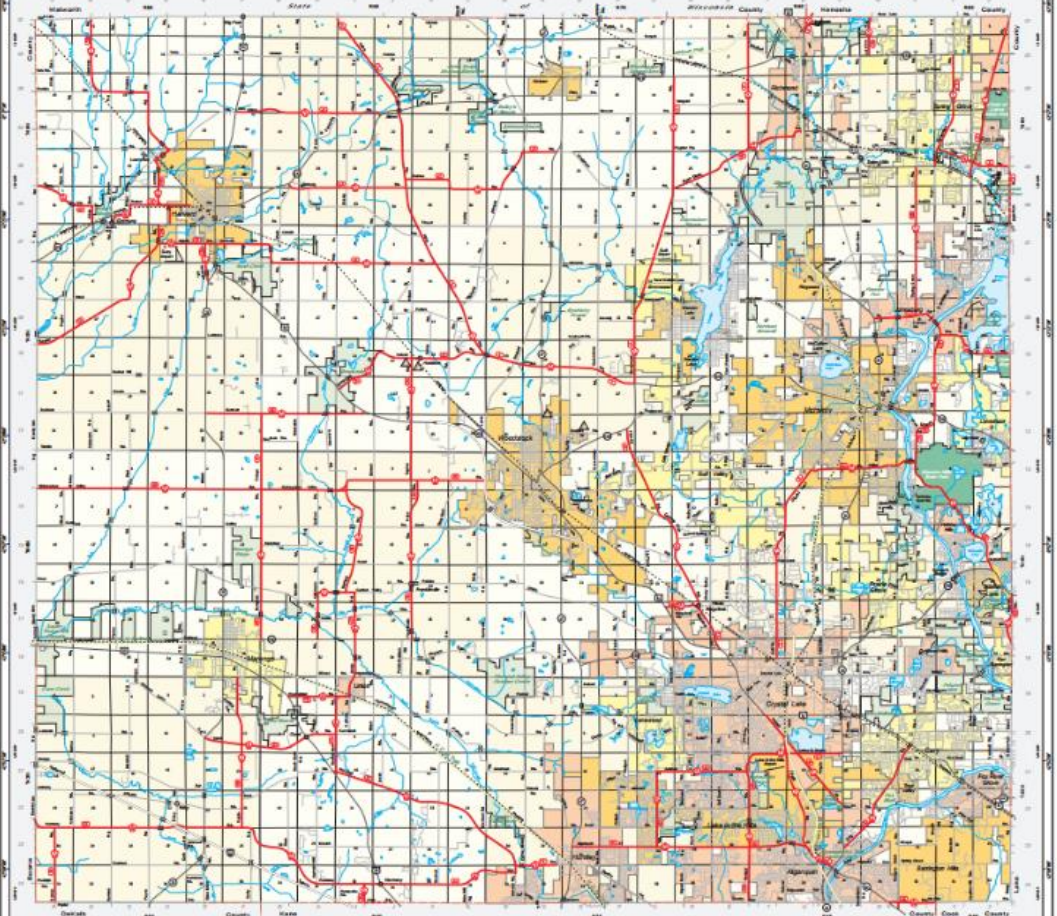
WE USE SALT - LOTS OF SALT!



McHENRY COUNTY, ILLINOIS
Highway Map

ACCESS PERMITS AND PLAT APPROVAL
All projects which require access permits or plat approval should be filed with the County Planning & Development Department. A fee is required for each plat approval. For more information, contact the County Planning & Development Department.

ADULT AGENCY PROGRAM
For information about the Adult Agency Program, please contact the County Planning & Development Department. A fee is required for each plat approval.



Highway	Route	Length (Miles)
1	1	1.0
2	2	1.0
3	3	1.0
4	4	1.0
5	5	1.0
6	6	1.0
7	7	1.0
8	8	1.0
9	9	1.0
10	10	1.0
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32	32	1.0
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35	35	1.0
36	36	1.0
37	37	1.0
38	38	1.0
39	39	1.0
40	40	1.0
41	41	1.0
42	42	1.0
43	43	1.0
44	44	1.0
45	45	1.0
46	46	1.0
47	47	1.0
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96	96	1.0
97	97	1.0
98	98	1.0
99	99	1.0
100	100	1.0



LEGEND

- 1 - Interstate
- 2 - U.S. Highway
- 3 - State Highway
- 4 - County Highway
- 5 - Local Road
- 6 - Unimproved Road
- 7 - Railroad
- 8 - Airway
- 9 - Canal
- 10 - Waterway
- 11 - Lake
- 12 - Pond
- 13 - Stream
- 14 - River
- 15 - Bay
- 16 - Sound
- 17 - Harbor
- 18 - Strait
- 19 - Inlet
- 20 - Spit
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- 489 - Stream
- 490 - River
- 491 - Bay
- 492 - Sound
- 493 - Harbor
- 494 - Strait
- 495 - Inlet
- 496 - Spit
- 497 - Point
- 498 - Headland
- 499 - Peninsula
- 500 - Island

TOWNSHIPS

Township	Area (Square Miles)
1	36.0
2	36.0
3	36.0
4	36.0
5	36.0
6	36.0
7	36.0
8	36.0
9	36.0
10	36.0
11	36.0
12	36.0
13	36.0
14	36.0
15	36.0
16	36.0
17	36.0
18	36.0
19	36.0
20	36.0
21	36.0
22	36.0
23	36.0
24	36.0
25	36.0
26	36.0
27	36.0
28	36.0
29	36.0
30	36.0
31	36.0
32	36.0
33	36.0
34	36.0
35	36.0
36	36.0
37	36.0
38	36.0
39	36.0
40	36.0
41	36.0
42	36.0
43	36.0
44	36.0
45	36.0
46	36.0
47	36.0
48	36.0
49	36.0
50	36.0

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

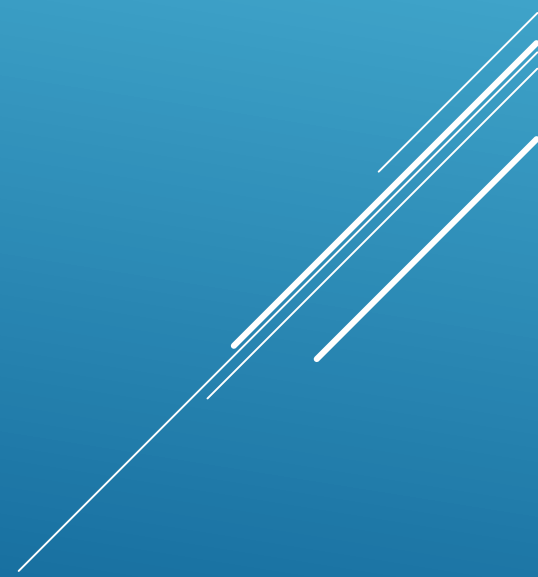
8,000 tons - Private Road and Parking Lot Application

(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



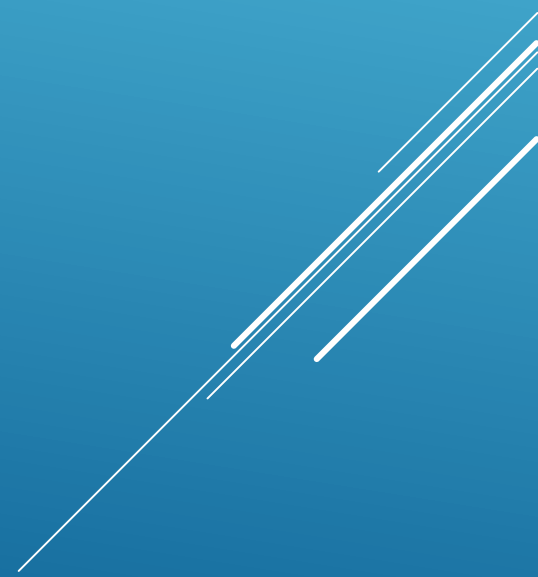
- 13 People Killed
- 145 People Injured
- Approximate Cost \$459,600,00



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.	
Where	Differences	Evening rush hour, roadwork underway	
	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 >140,000 vehicles/day)	
	Production-Schedule	Increased commuting expenses (\$400,000/day for 414 days)	\$ 165,600,000
	Material, Labor Cost	Loss to economy (estimated)	\$ 60,000,000
		Replacement of bridge	\$234,000,000
	This incident	\$ 459,600,000.00	
Frequency	Infrequent		
	Annual Total		

NATURAL RESOURCES



Road Salt: Ecological Effects

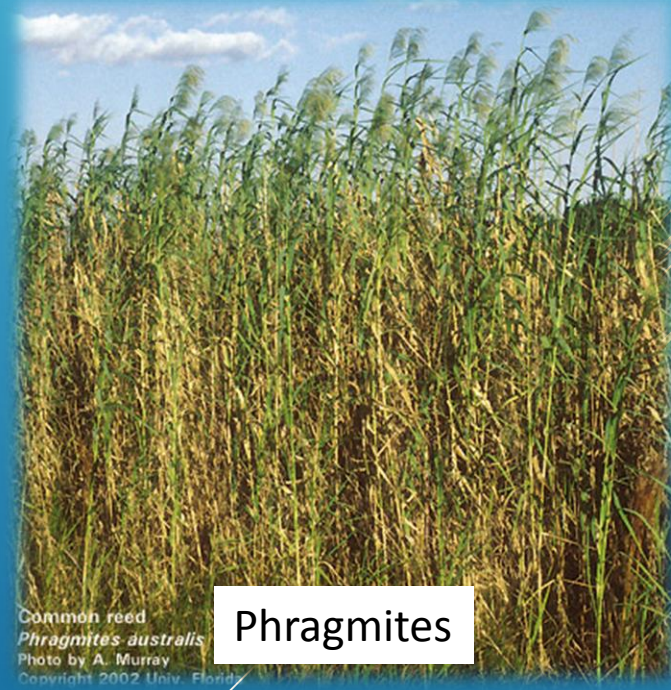


Photos Courtesy of Michael Adam, Lake County Health Dept.

Road Salts Damage Plants

Road Salt: Ecological Effects

- Salt tolerant species may outcompete native species, decrease biodiversity



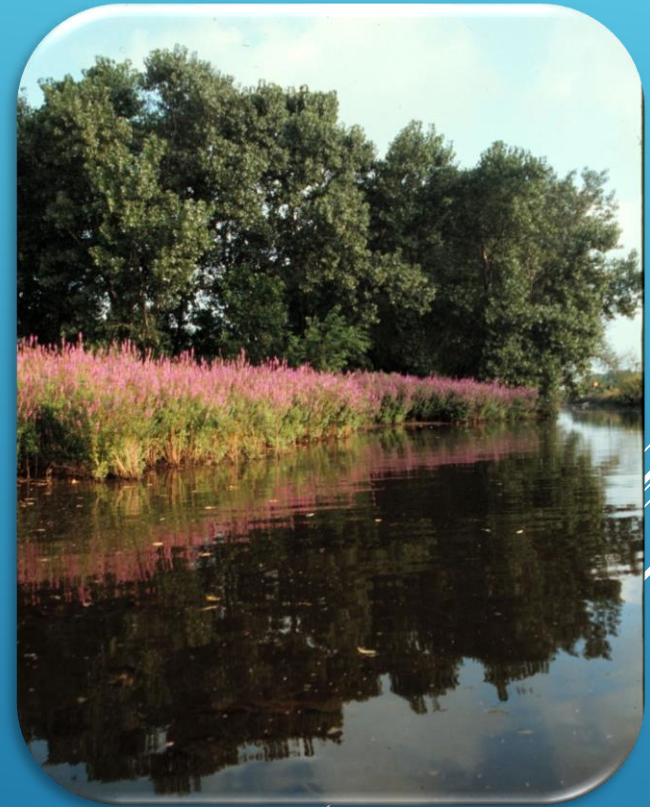
Road Salt: Ecological Effects

- 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



Bluegills die @ concentrations
2,500-8,600mg/l
about 1/2 cup salt in 5 gallons of
water

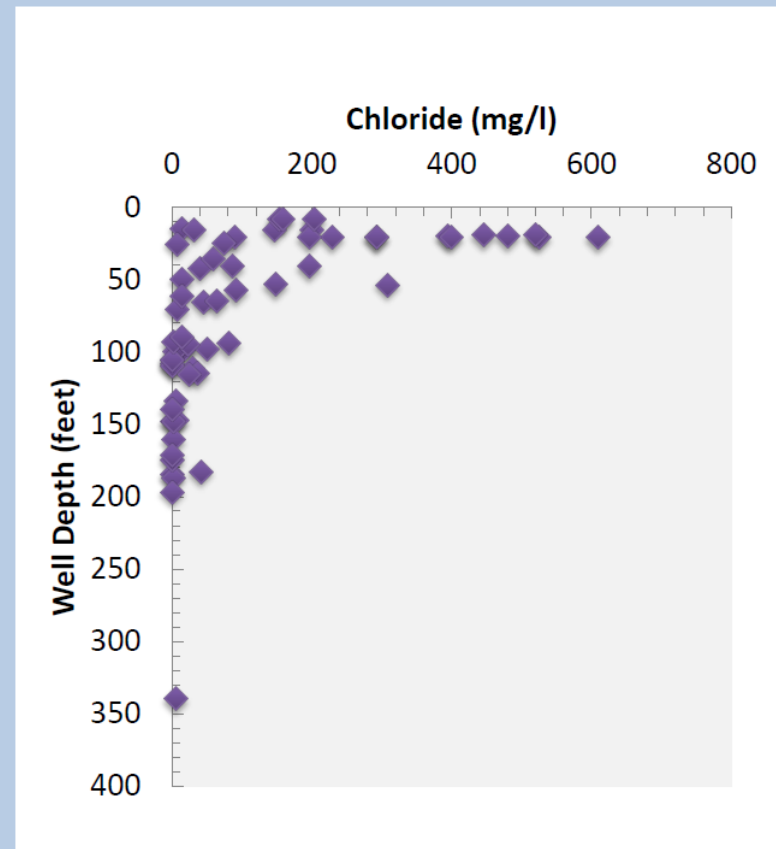


Acute standard: 500 mg/l
about 2 Teaspoons of salt in 5 gallons
of water

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



- 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

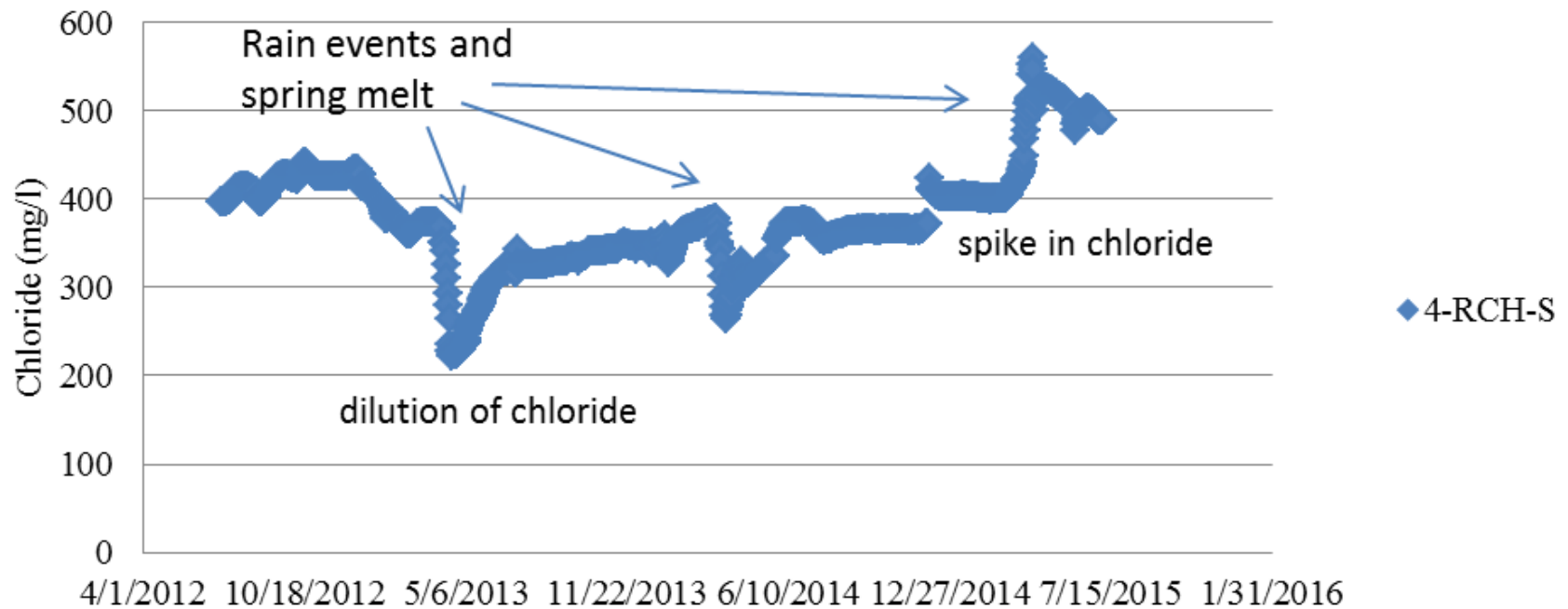
- The ratio of chloride concentrations to bromide concentrations can be used to determine the source of the chloride.
 - Road salt
 - Road salt + water softener
 - Sewage + road salt
 - Sewage
 - Fertilizer (potassium chloride)



- 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

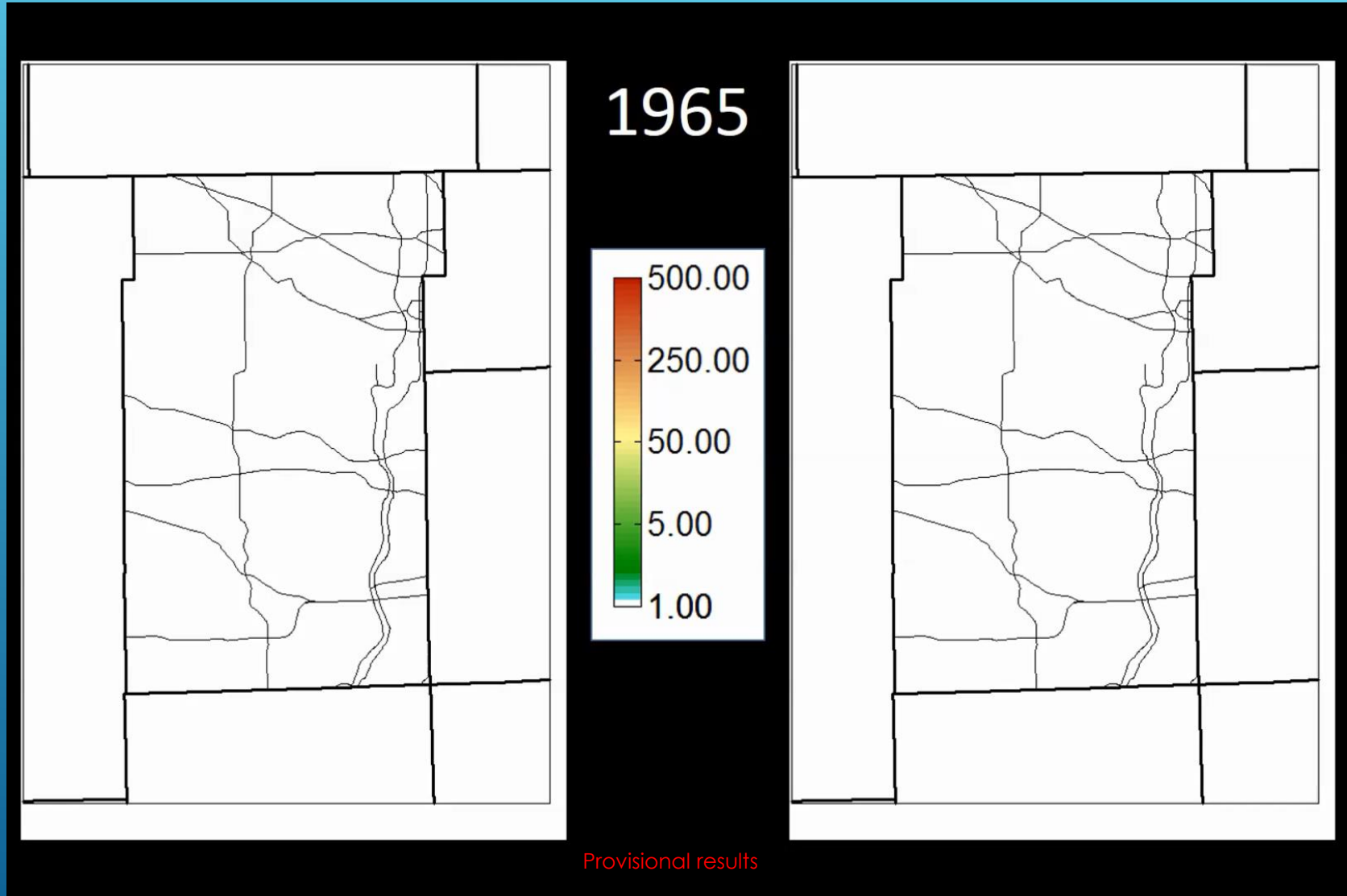
Chloride Concentrations



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

Surficial Aquifer



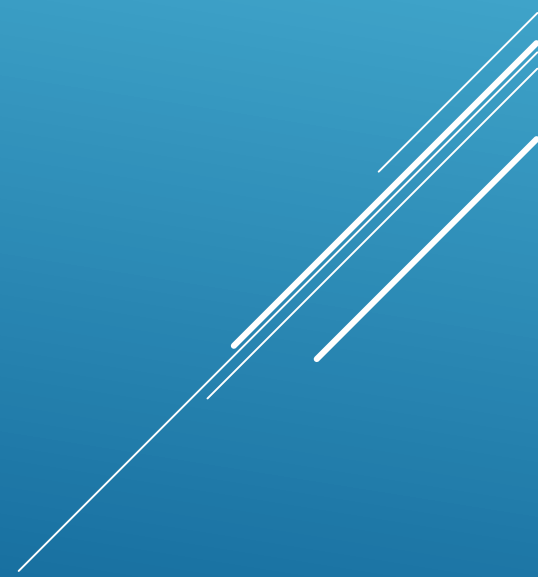
Bedrock Aquifer



Importance of mapping local scale geology!

Provisional results

DRINKING WATER SUPPLY



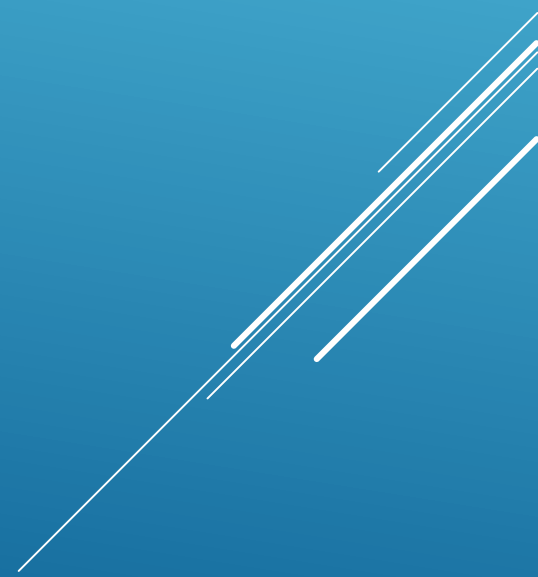
Chloride Standards

- 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**

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



RECAP... WHAT DOES THIS
LOOK LIKE IN REAL LIFE?





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



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

6,000gallons 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 $\frac{1}{2}$ 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

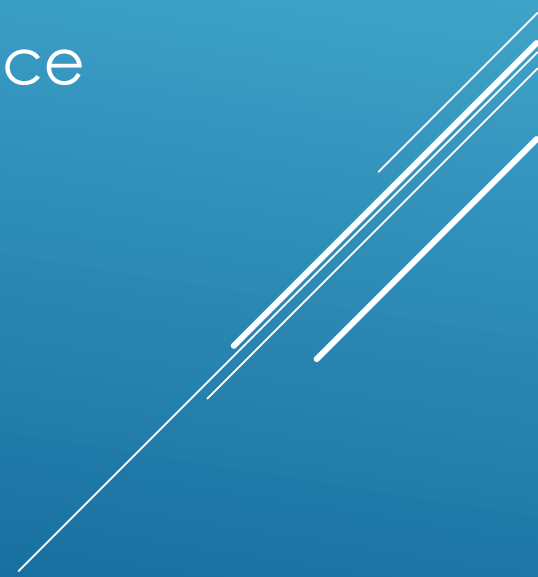


- ▶ Department of Planning and Development :
Unified Development Ordinance
 - ▶ Section 14.5.E: De-Icing Agent Storage
 - ▶ Regulates the storage of de-icing agents for unincorporated areas of McHenry County regardless of the amount.

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!**



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