Minewater Management

2013 Annual Meeting

Marion, Illinois

August 13, 2013

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Coal Mine Water Sources

Water Sources

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Typical Surface Control Pond

Typical Sand Pit

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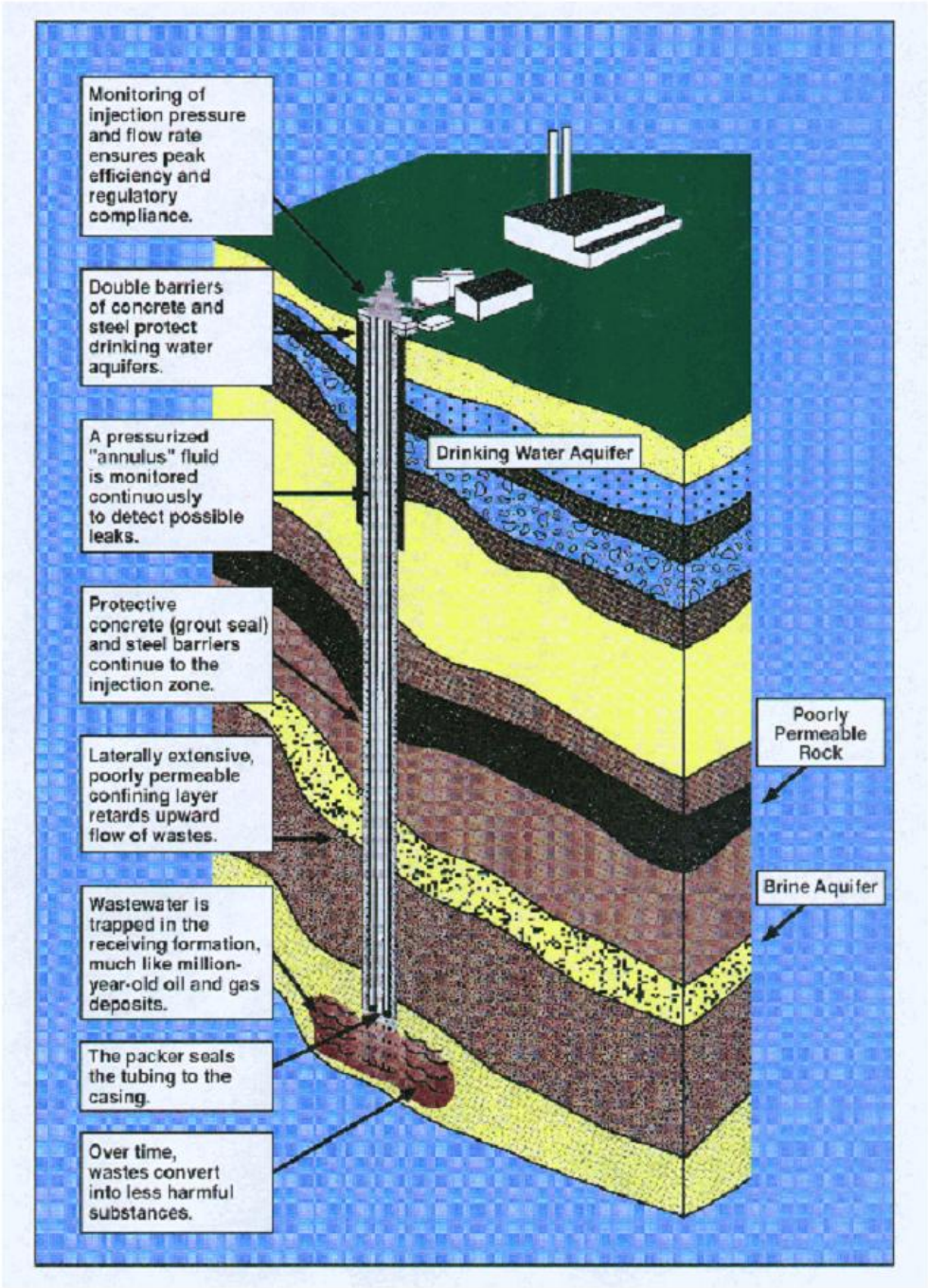
Surface Sand Pit Control Ponds

Public Review

Sierra Club Members Collecting water samples downstream of an Illinois coal mine.
http://sierraclub.typepad.com/scrapbook/2011/08/illinois-coal-water-sentinels.html

Other Water Management Options

- Manage water on site
- No off site disposal
- No public hearing for permitting
- No changing discharge limits
- No reduction in discharge volume
- No degradation of receiving water
- Environmentally acceptable



Class I Injection Well

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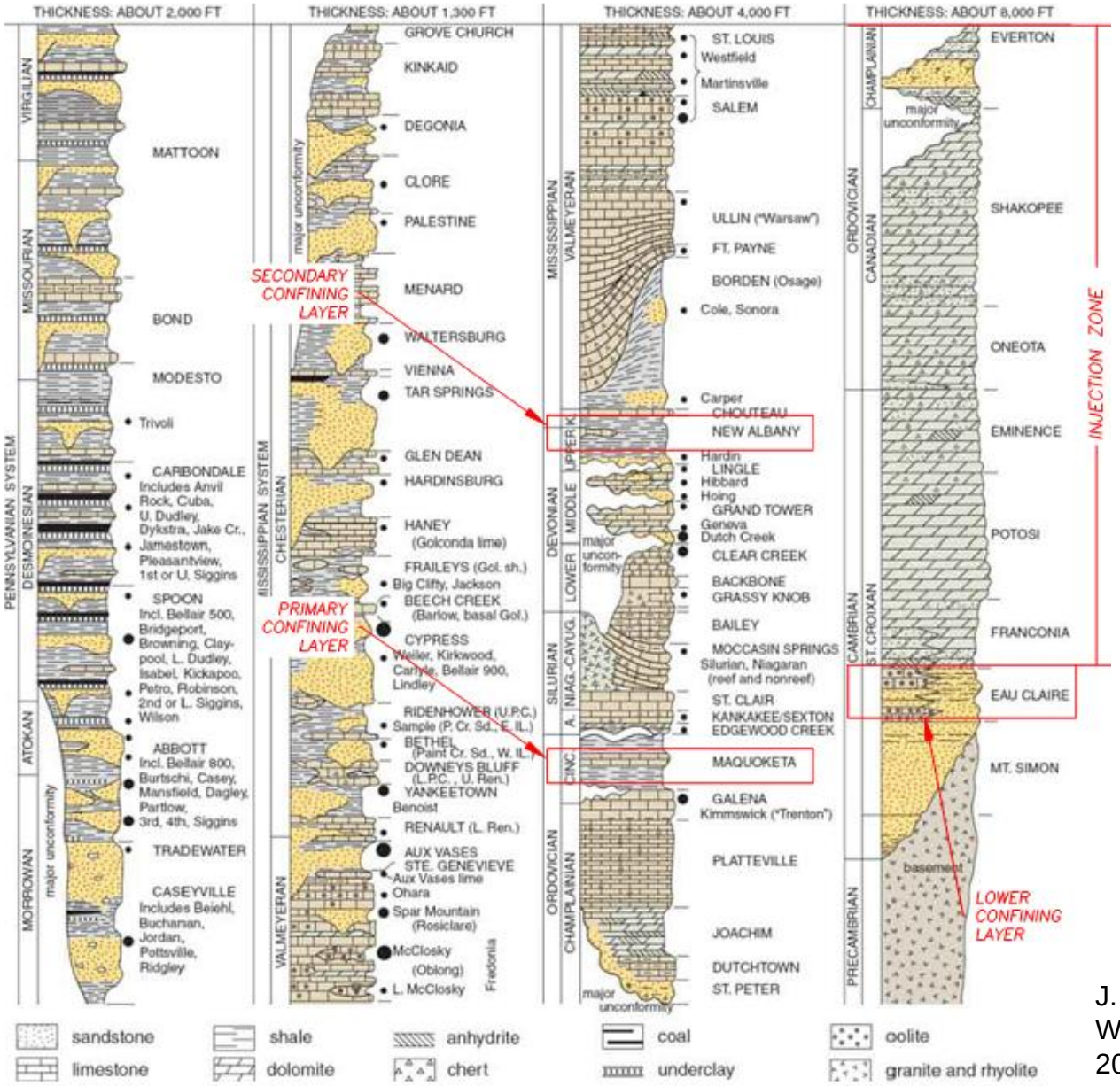
Class I Injection Well Summary

Class I UIC Inventory List - EPA Region V[1]

	Active/Plugged	Facility	County	Haz/NonHaz (H/NH)	Depth (ft)	Year Drilled	Year Plugged	Injection Formation
ILLINOIS								
	Active	ArcelorMittal Hennepin (formerly LTV Steel Co.)	Putnam	H	4868	1967		Mt. Simon
	Active	Archer Daniels Midland	Macon	NH	7236	2010		Mt. Simon
	Active	Cabot Corp.	Douglas	H	5318	1966		Potosi, Eminence
	Active	Cabot Corp.	Douglas	H	5300	1975		Potosi, Eminence
	Active	Equistar Chemicals	Douglas	NH	5524	1970		Oneota, Eminence, Potosi, Franconia
	Plugged	Allied Chemical Co.	Vermillion	H	4000	1973		Potosi
	Plugged	Cabot Corp.	Douglas	H	5318	1966	1995	Potosi, Eminence
	Plugged	Velsicol Corp.	Clark	NH	2634	1972	1972	Salem
	Plugged	Velsicol Corp.	Clark	NH	6000	1971		Salem
INDIANA								
	Active	ArcelorMittal Burns Harbor, LLC	Porter	H	4048	1963		Mt. Simon
	Active	ArcelorMittal Burns Harbor, LLC	Porter	H	4298	1968		Mt. Simon
	Active	ArcelorMittal Burns Harbor, LLC	Porter	H	4301	1968		Mt. Simon
	Active	ArcelorMittal Burns Harbor, LLC	Porter	H	4400			Mt. Simon
	Active	Criterion Catalyst	LaPorte	NH	4300	1991		Mt. Simon
	Active	Criterion Catalyst	LaPorte	NH	4200	1991		Mt. Simon
	Active	Criterion Catalyst[2]	LaPorte	NH	4550			Mt. Simon
	Active	Cathay Deep Well Disposal, LLC (formerly ISK Magnetics Indiana General; Pfizer, Inc.; Harcros Pigments)	Porter	NH	4538	1969		Mt. Simon
	Active	Cathay Deep Well Disposal, LLC (formerly ISK Magnetics Indiana General; Pfizer, Inc.; Harcros Pigments)	Porter	NH	4526	1981		Mt. Simon
	Active	Duke Energy Indiana, Inc.	Gibson	NH	8480	2006		Trenton Limestone, Black River Group, Ancell Group, Knox Group, Eau Claire Formation, Mt. Simon
	Active	Duke Energy Indiana, Inc.	Gibson	NH	11734	2007		Trenton Limestone, Black River Group, Ancell Group, Knox Group, Eau Claire Formation, Mt. Simon
	Active	Duke Energy Indiana, Inc.	Gibson	NH	8501	2008		Trenton Limestone, Black River Group, Ancell Group, Knox Group, Eau Claire Formation, Mt. Simon
	Active (5 wells pending)	Duke Energy Indiana, Inc.[2]	Gibson	NH	8500			Trenton Limestone, Black River Group, Ancell Group, Knox Group, Eau Claire Formation, Mt. Simon
	Active	Duke Energy Indiana, Inc.	Knox	NH	9480	2009		St. Peter Sandstone, Eau Claire Formation, Trenton Limestone, Plattin Formation, Pecatonica Formation, Joachim Dolomite, Dutchtown Formation, Oneota Dolomite, Potosi Dolomite, Mt Simon
	Active (5 wells)	Duke Energy Indiana, Inc.	Knox	NH	10000 (approx)			St. Peter Sandstone, Eau Claire Formation, Trenton Limestone, Plattin Formation, Pecatonica Formation, Joachim Dolomite, Dutchtown Formation, Oneota Dolomite, Potosi Dolomite, Mt Simon

Southern Illinois Geology



J. Crockett PTTC Workshop, March 6, 2013

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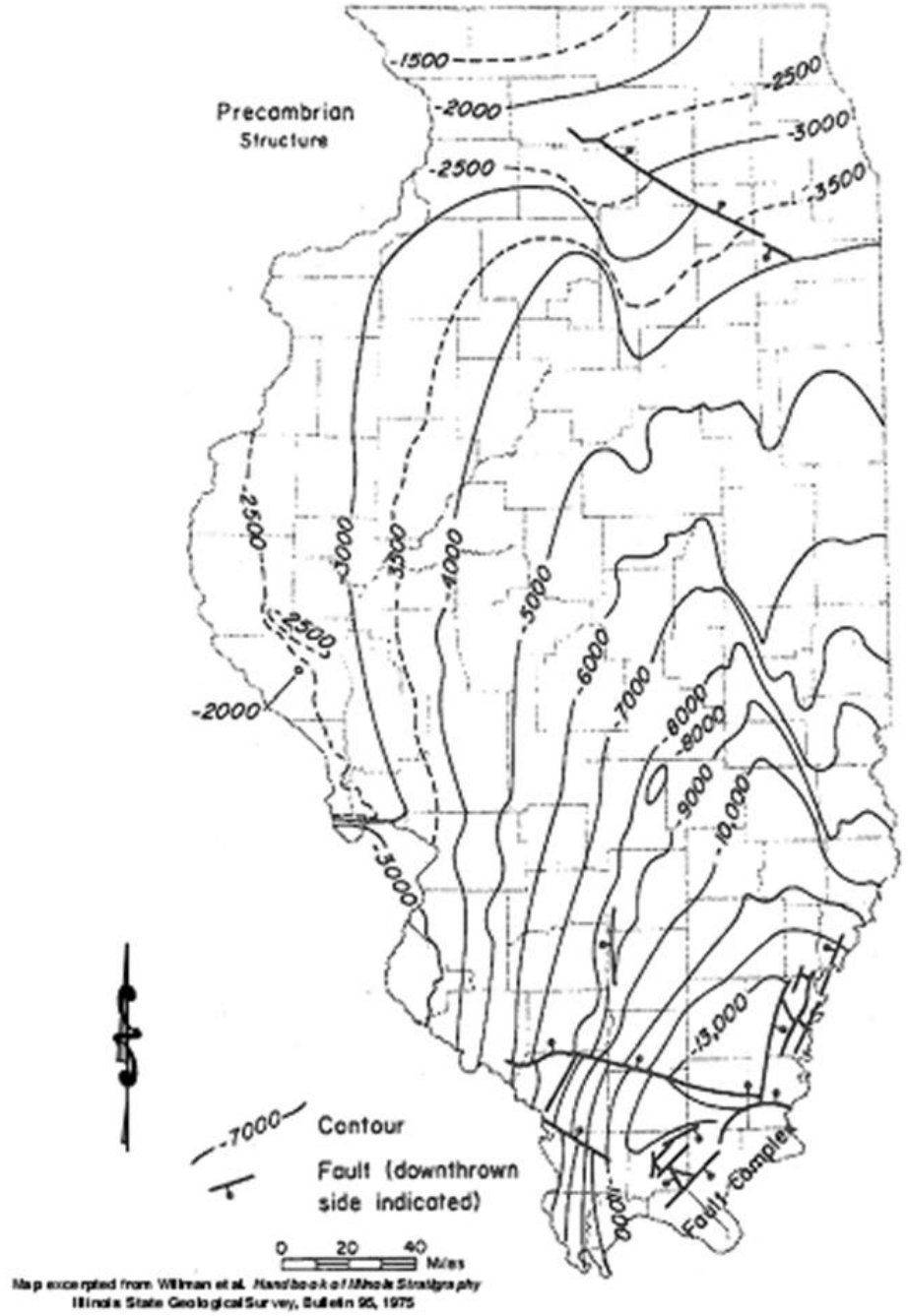
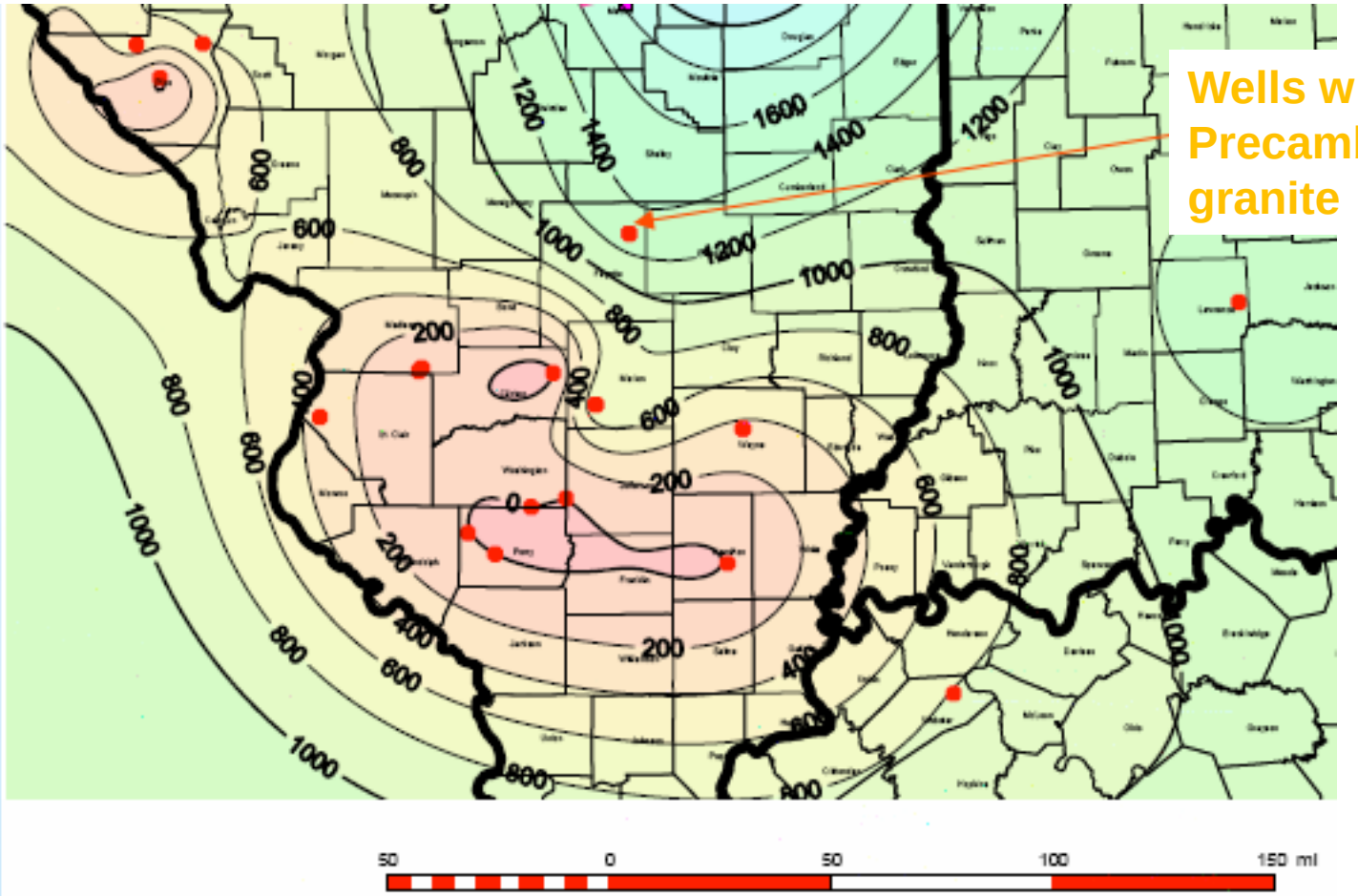
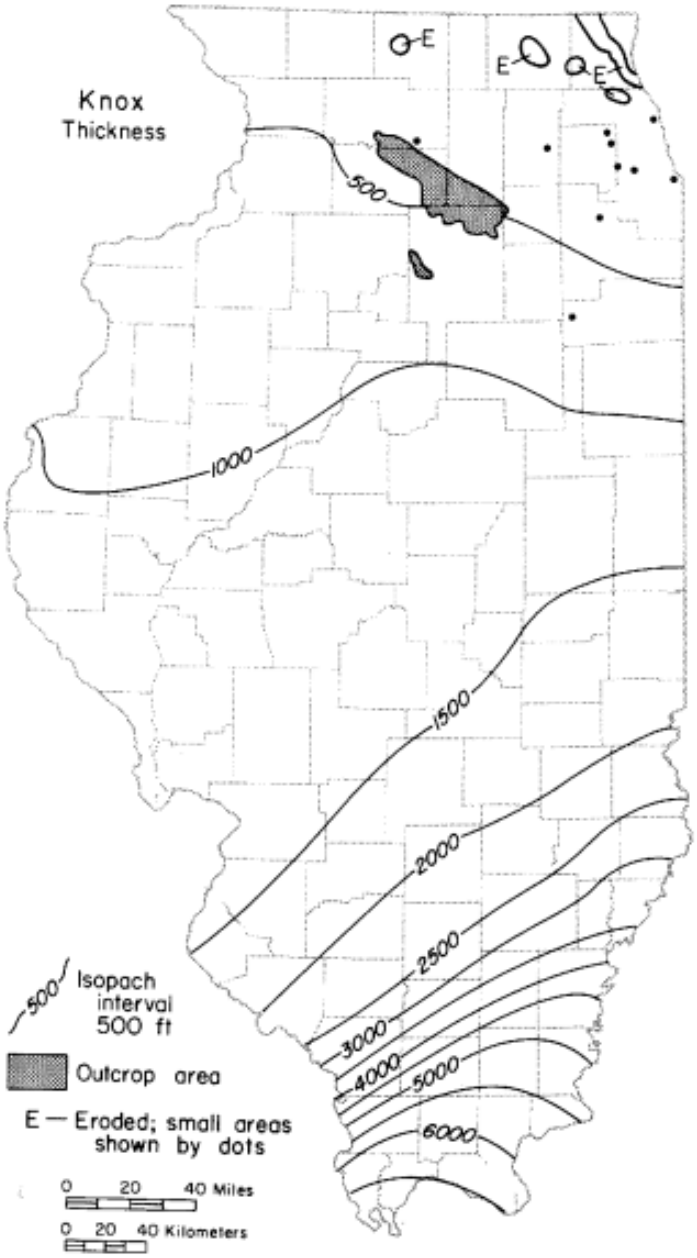
Basement Structure



Map excerpted from Willman et al. *Handbook of Illinois Stratigraphy* Illinois State Geological Survey, Bulletin 95, 1975

Mt. Simon Thickness





Knox Dolomite Megagroup Thickness

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Cambro-Ordovician Bedrock Aquifers

ISWS B-74

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Shallow Bedrock Aquifers (Silurian – Pennsylvanian)

ISWS B-74

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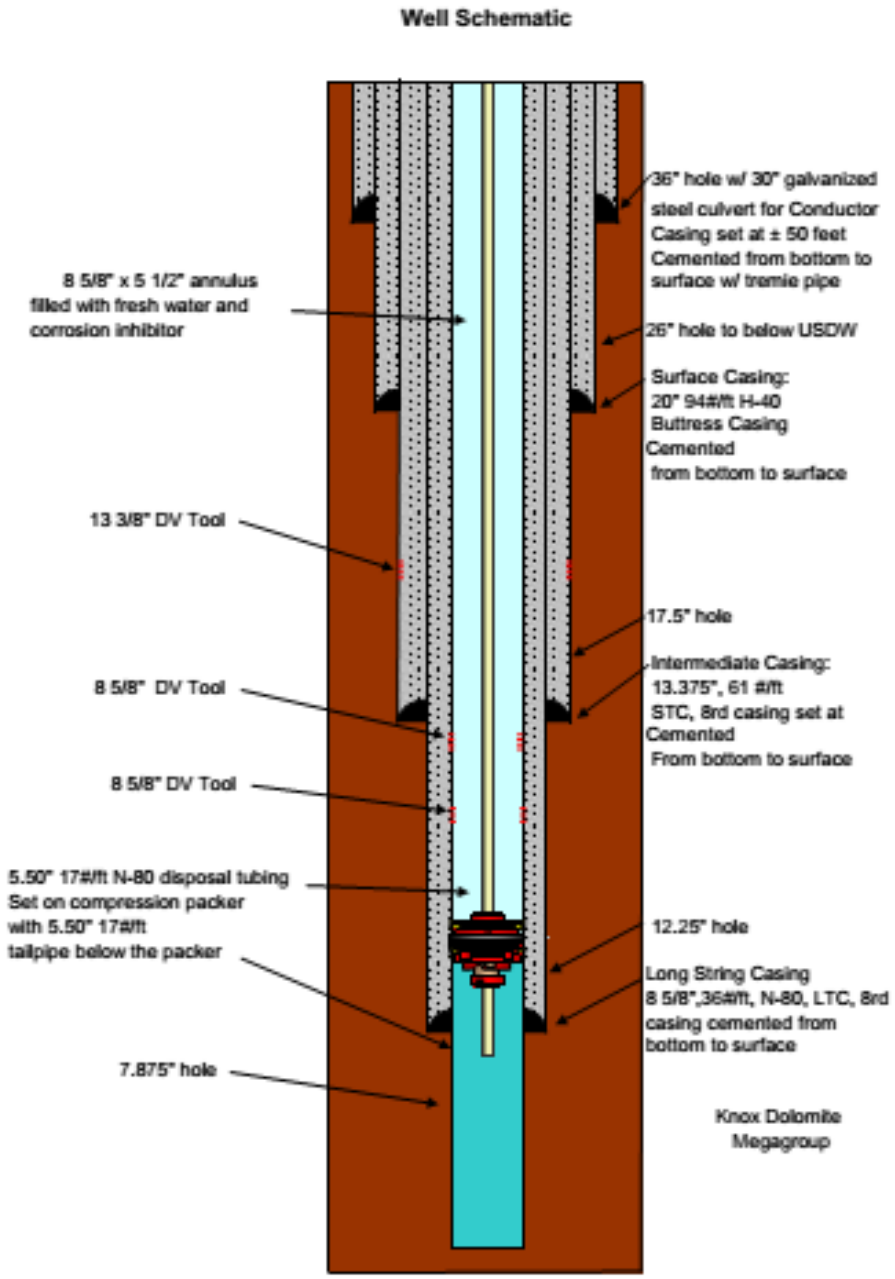
Class I Operating Requirements

Conditions for Operation

- All new injection wells require a Permit prior to construction.
- Area of review for non-hazardous injection wells is a minimum of 1/4 mile, except for some Indian Country.
- Area of review for hazardous waste injection wells is a minimum of 2 miles.
- Injection between the outermost casing and the wellbore is prohibited.
- All injection wells must be tested for mechanical integrity prior to operation. This includes both a pressure test to demonstrate the absence of casing, tubing, or packer leaks and a valid temperature, oxygen activation or noise log or approved alternative log to demonstrate the absence of vertical fluid movement.
- Hazardous waste injection wells must have surface casing set through all USDWs. This casing must be cemented to the surface.
- Permit issued for up to ten years.
- Injection pressure must be limited such that no fracturing of the injection zone occurs during operation.

Class I UIC Casing Plan



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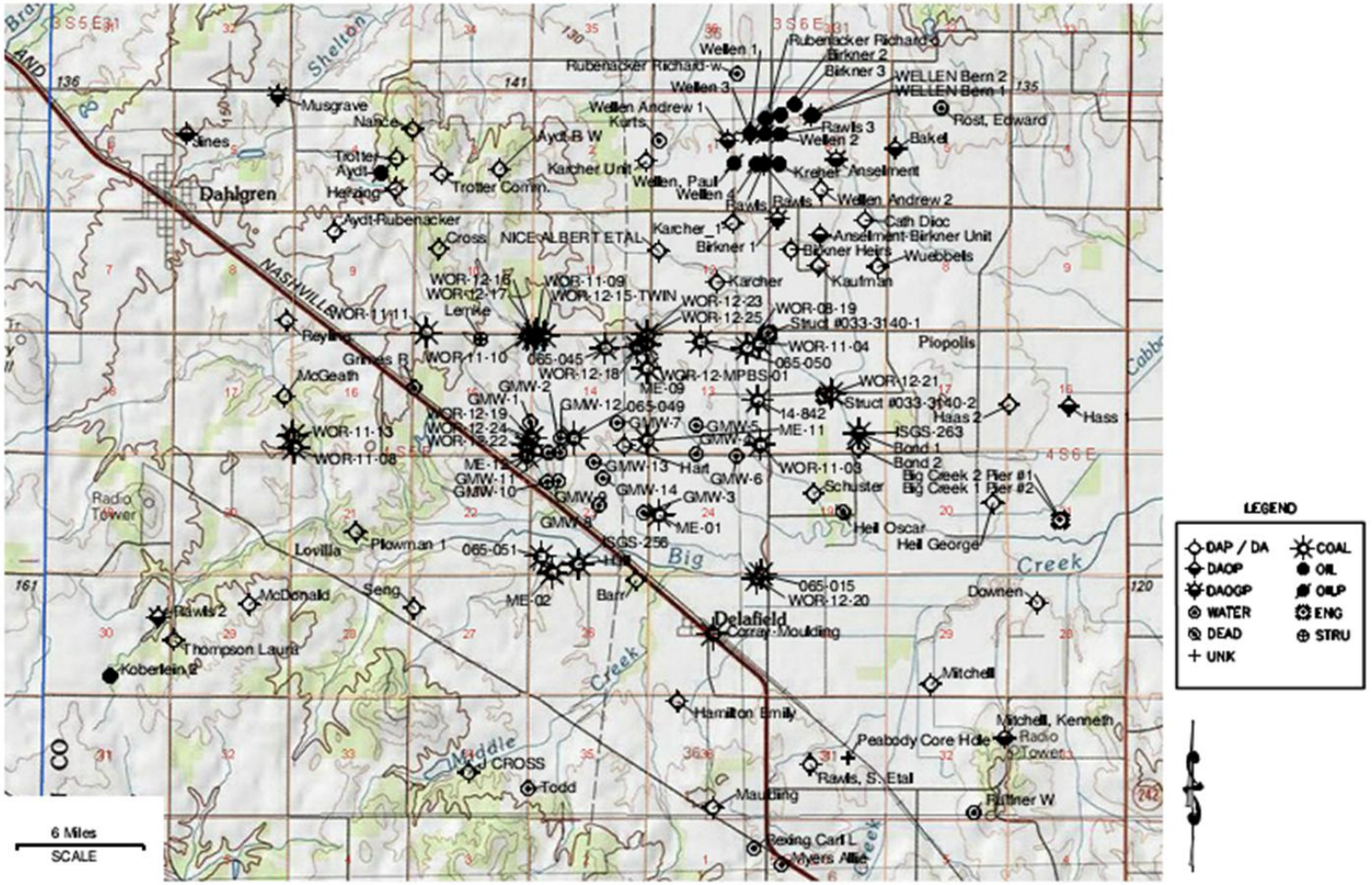
Packer Assembly

AOR



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Zone of Endangerment

$$r = \left(\frac{2.25\,KHt}{S10^{x}}\right)^{1/2}$$

where:

$$X = \frac{4\pi KH\left(h_w - h_{bo} \times S_p G_b\right)}{2.3Q}$$

r=Radius of endangering influence from injection well (length)
k=Hydraulic conductivity of the injection zone (length/time)
H=Thickness of the injection zone (length)
t=Time of injection (time)
S=Storage coefficient (dimensionless)
Q=Injection rate (volume/time)
h_{bo}=Observed original hydrostatic head of injection zone (length) measured from the base of the lowermost underground source of drinking water
h_w=Hydrostatic head of underground source of drinking water (length) measured from the base of the lowest underground source of drinking water

Allowable Disposal Well Injection Pressure

Except during stimulation, the owner or operator shall assure that injection pressure at the wellhead does not exceed a maximum which shall be calculated so as to assure that the pressure in the injection zone during injection does not initiate new fractures or propagate existing fractures in the injection zone

Current Regulatory Background

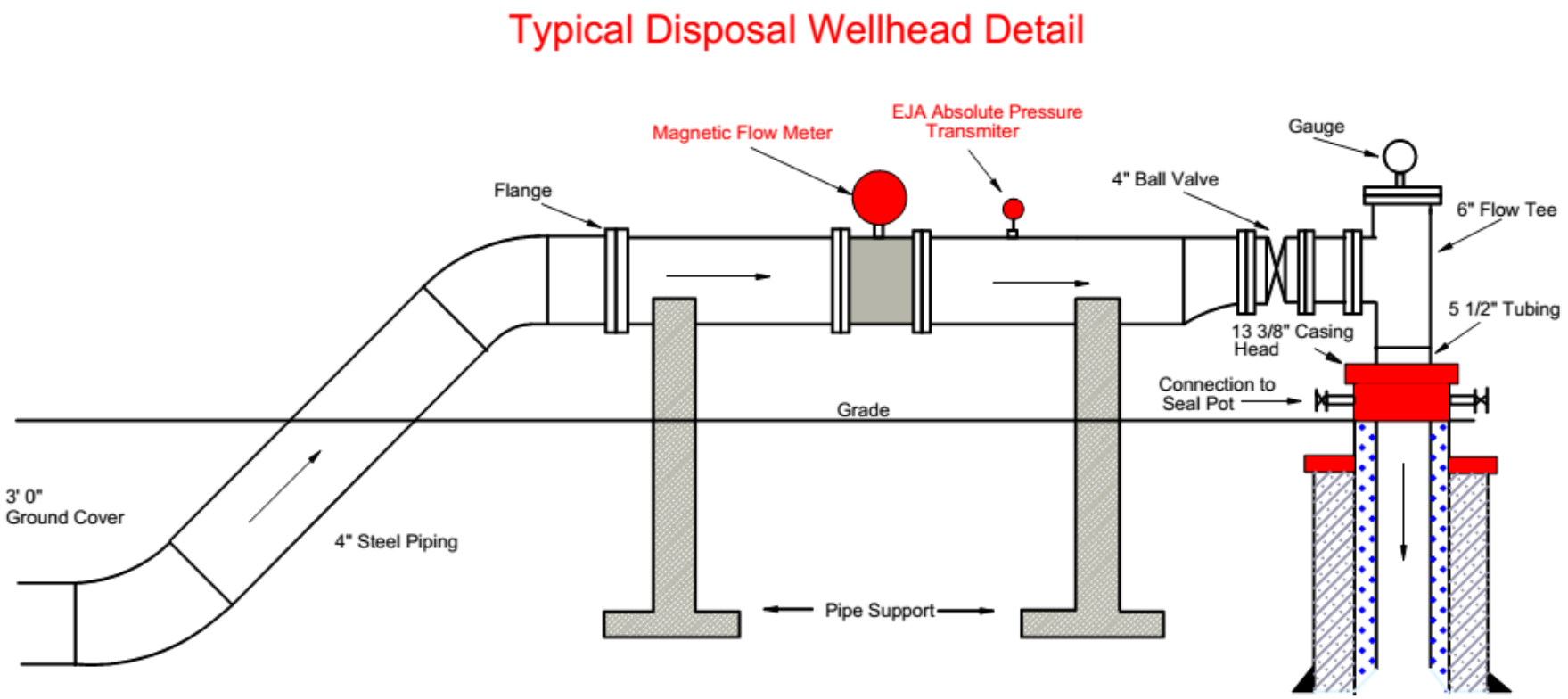
- EPA Region 5 previously used a fracture pressure gradient of 0.80 psi/ft for calculating MIPs for injection well permits in MI & IN, unless a lower pressure was suitable.
- OH has used a maximum pressure gradient of 0.75 psi/ft for MIP calculations.
- IL set MIPs on a case-by-case basis; all are presently less than 0.60 psi/ft.

Monitoring

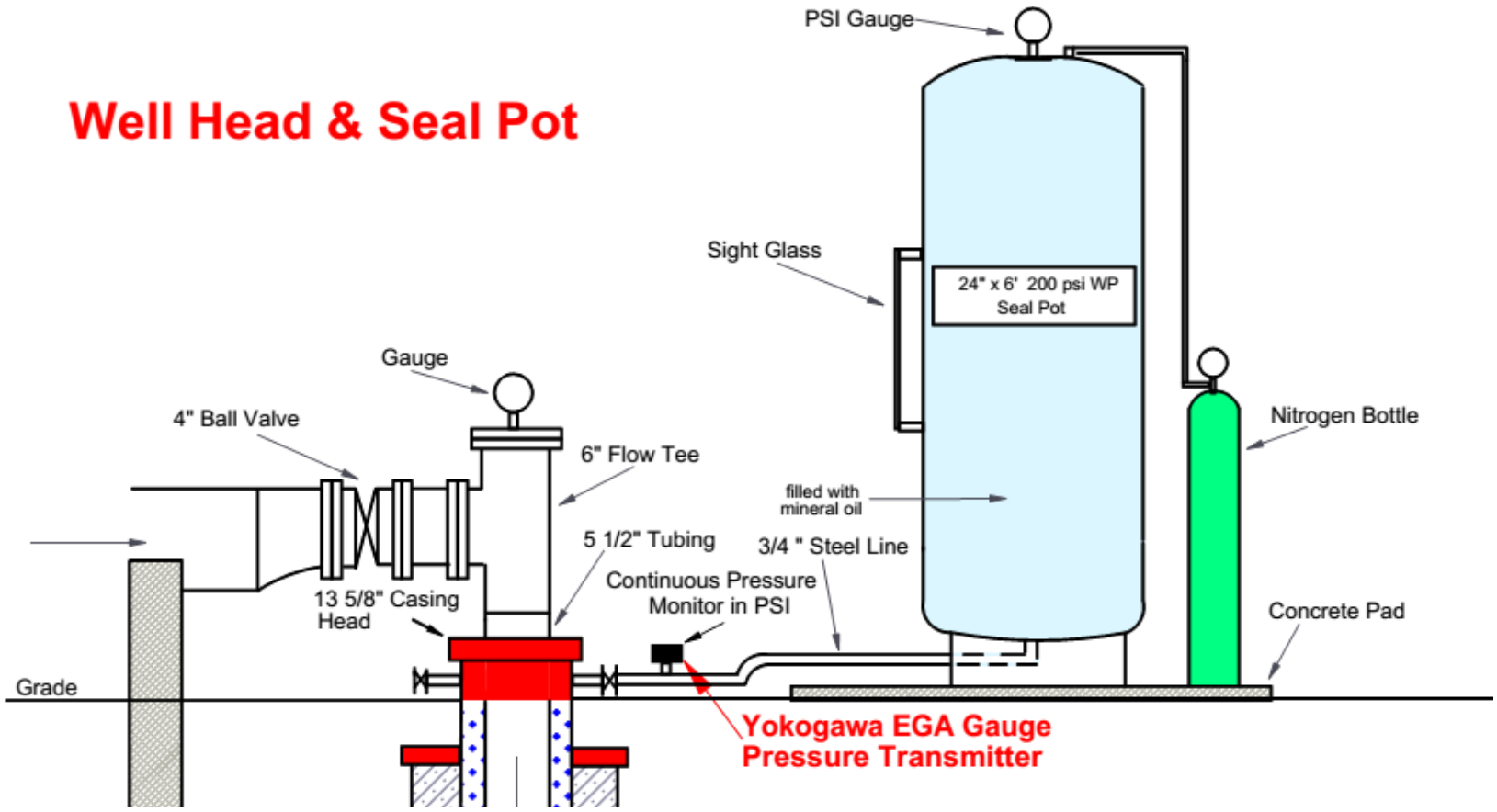
Monitoring Requirements.

- Continuous monitoring of annulus pressure, injection pressure, flow rate, and volume is required.
- An annual pressure falloff test of the injection reservoir must be performed in each Class I injection well. The results must be analyzed, including a comparison with previous tests, for major reservoir characteristics to determine if significant changes are occurring within the reservoir, especially immediately adjacent to the wellbore.
- Class I hazardous waste injection wells require a written waste analysis plan.
- The UIC Director may require Class I wells to obtain, interpret and submit seismic data for the site.[29]
- The UIC Director may require Class I wells to have ground-water monitoring in the 1st aquifer overlying the injection zone with quarterly sampling.
- Class I hazardous waste injection wells must have an annual RTS to test the adequacy of the bottom hole cement.
- Class I hazardous waste injection wells must have a casing inspection log whenever there is a well workover.
- Non-hazardous waste injection wells must demonstrate mechanical integrity at least once every five years unless the Director waives the requirement.

Monitoring Schematic



Annular Pressure Monitoring



Locate Injection Well Next to Pond

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Questions

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