EQuIS as the Key to Unlocking the Potential of Data

Jim Herberich, AECOM

Dave Scheer, MPCA

June 19, 2015

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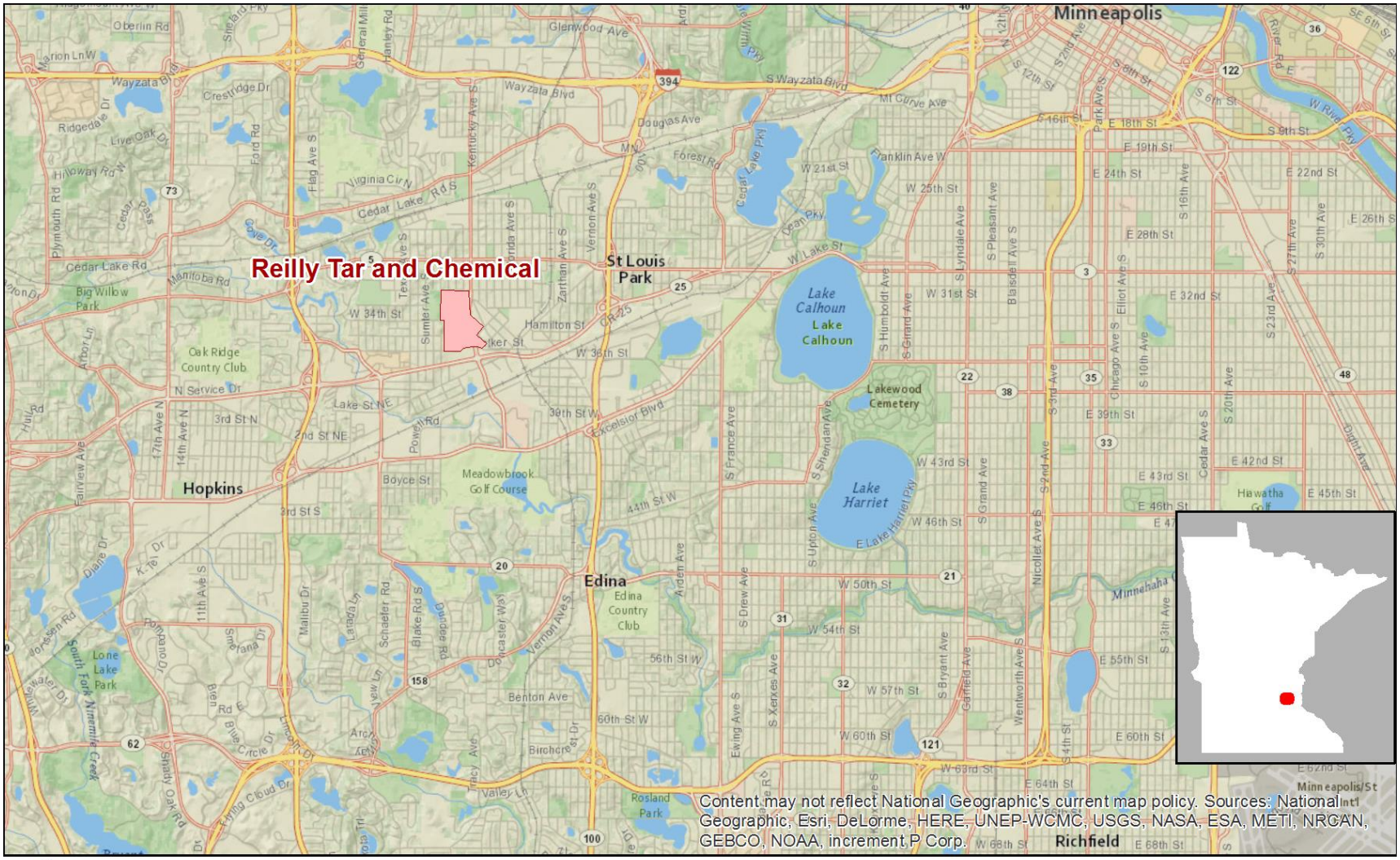
Saint Louis Park, MN



0 0.5 1 2 Miles

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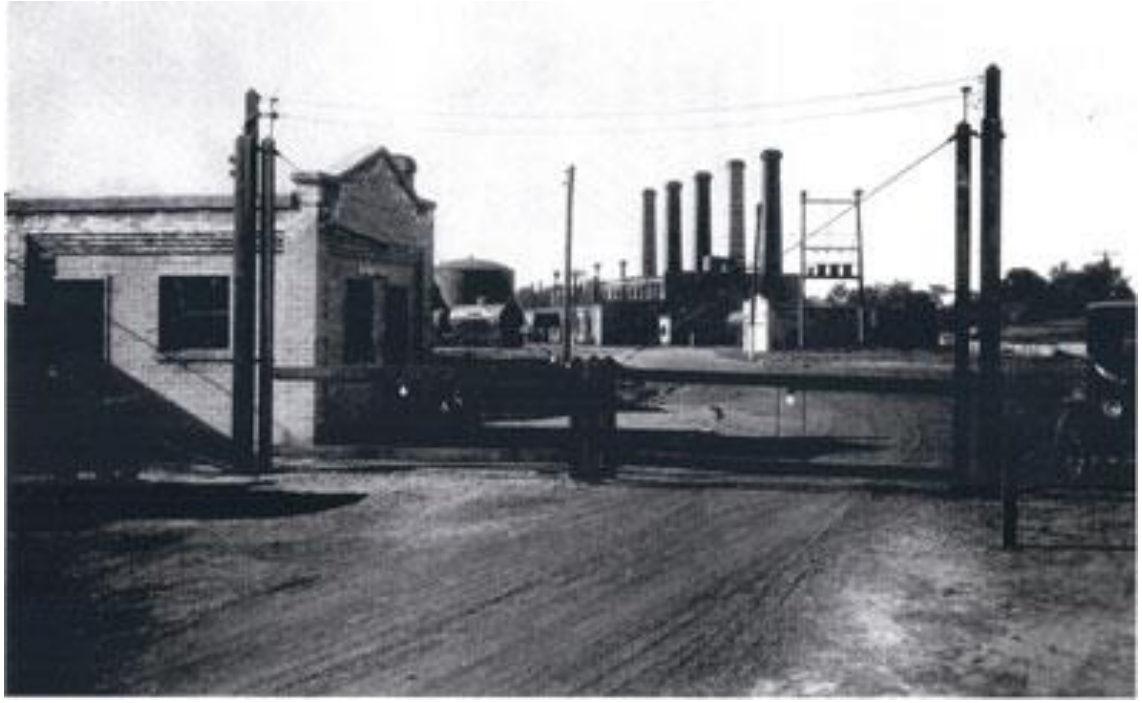
Polycyclic Aromatic Hydrocarbon (PAH) History
Reilly Tar and Chemical

- 80 acre property, operated 1917-1972
- Coal tar and distilled by-products discharged to ditch and peat bog through 1939
- Onsite industrial well with leaky casing



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PAH History Reilly Tar and Chemical

- 1934 the city's first water supply well started to draw creosote after two weeks of pumping
- Well shut down after 8 months
- 1970 MPCA/Attorney General filed lawsuit
- 1972 Reilly closed

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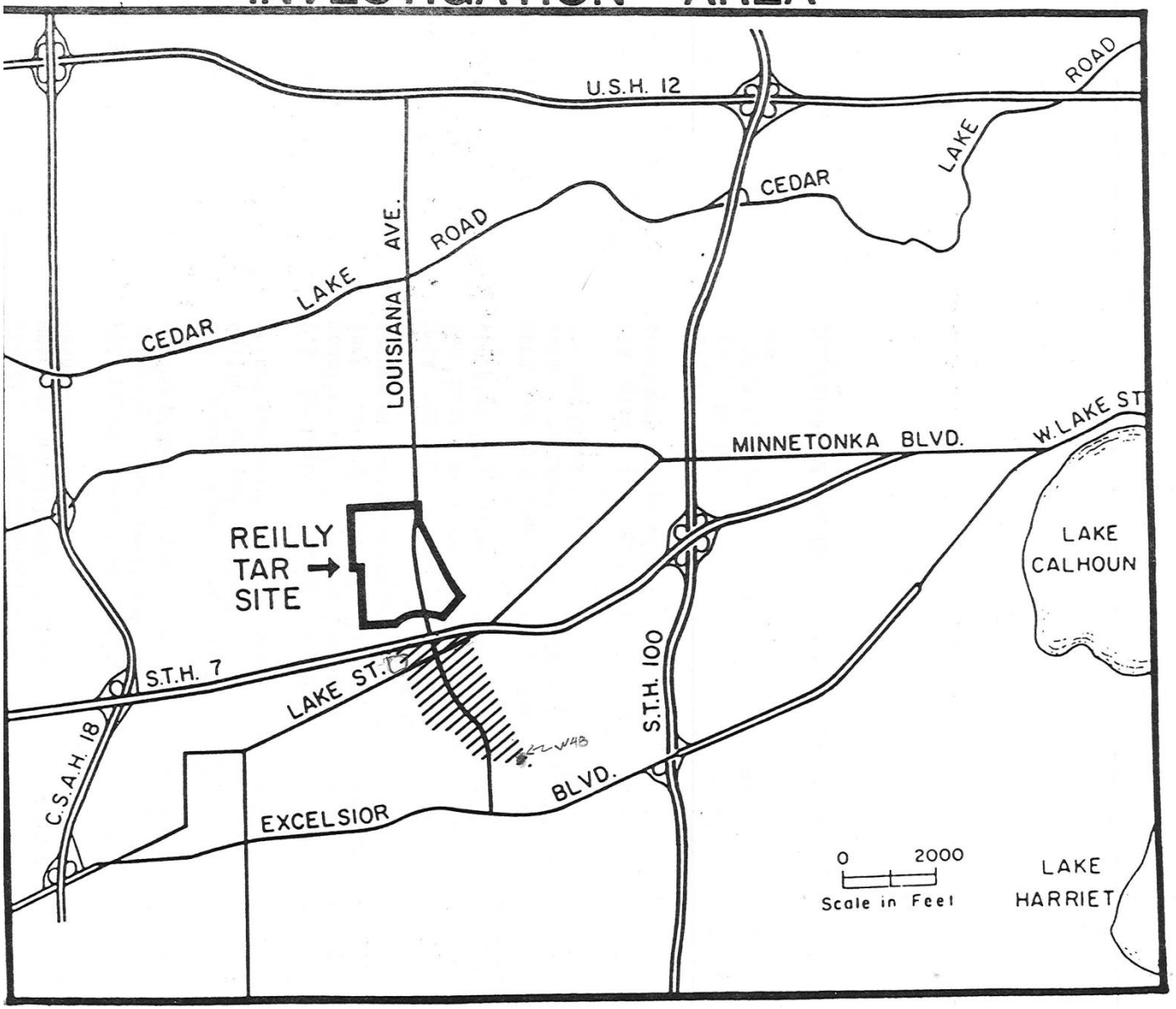
NEAR – SURFACE CONTAMINATION INVESTIGATION AREA



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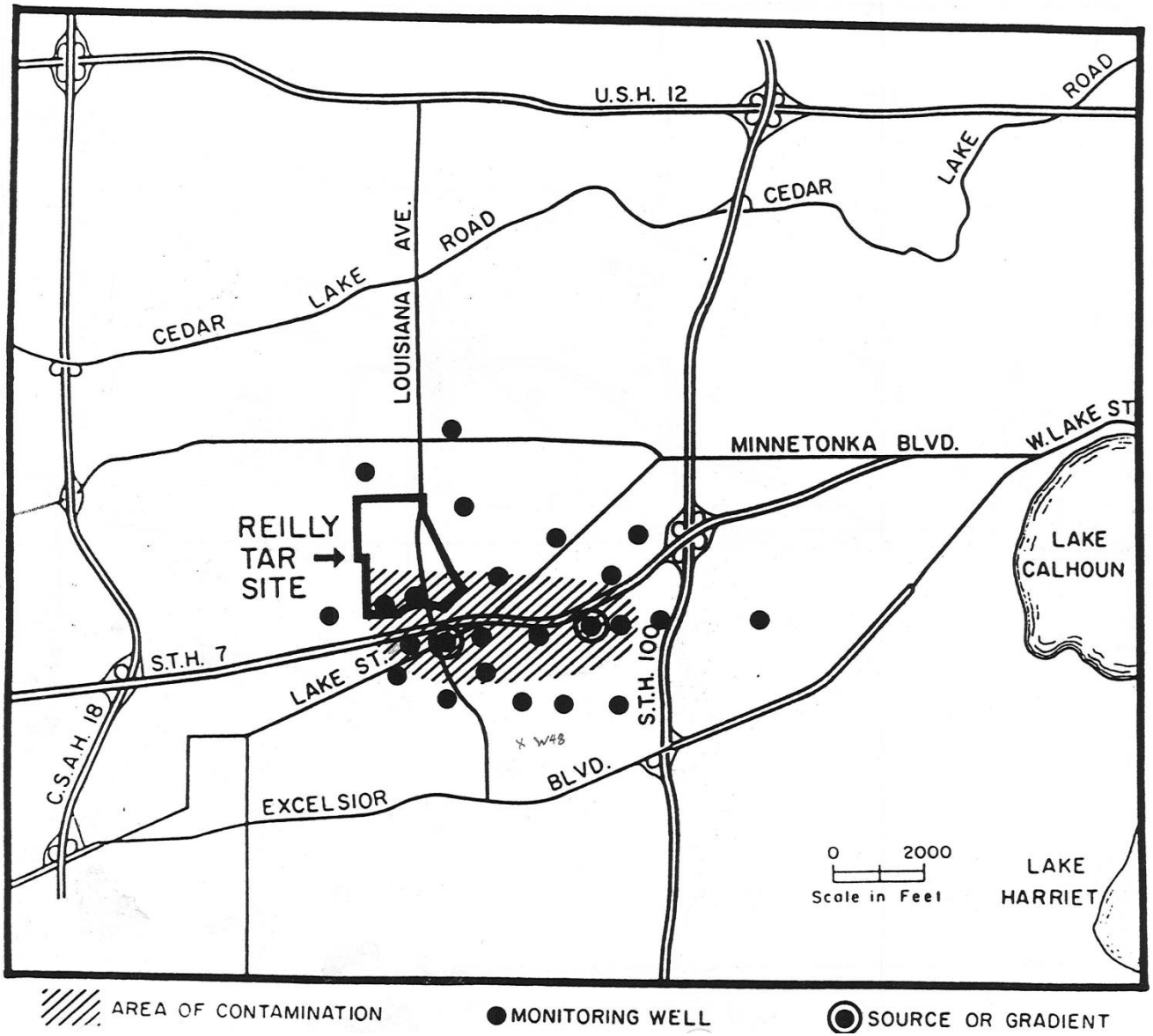
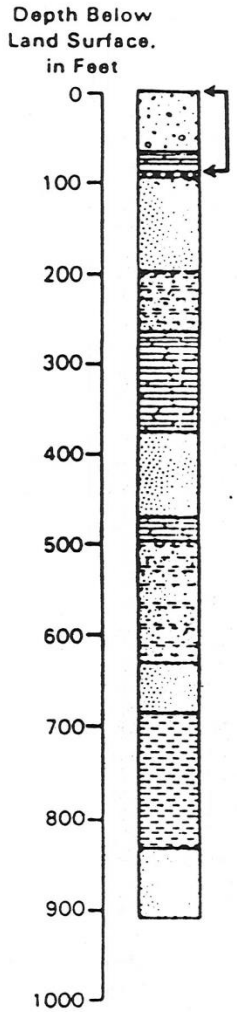
DRIFT AND PLATTEVILLE AQUIFERS





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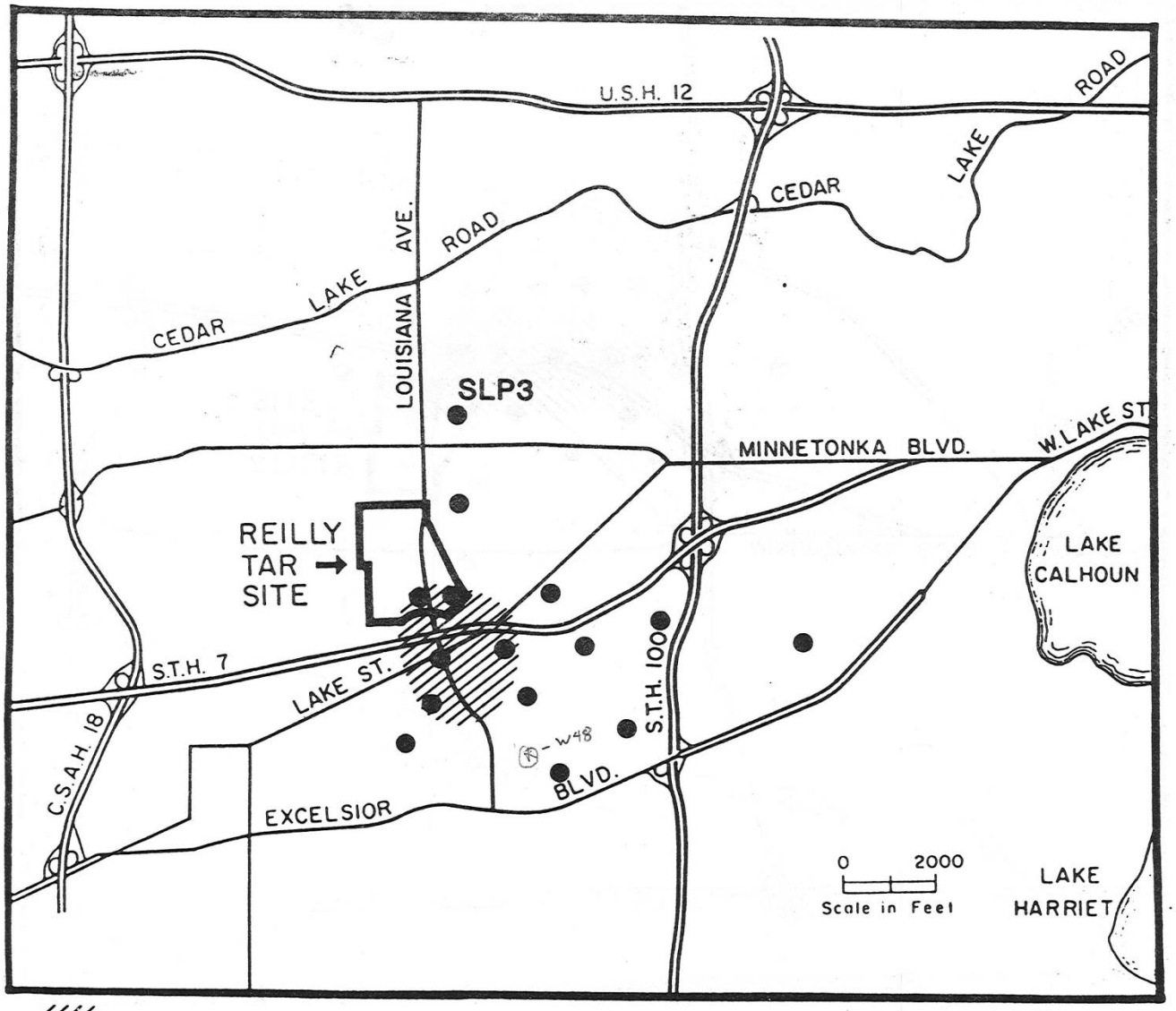
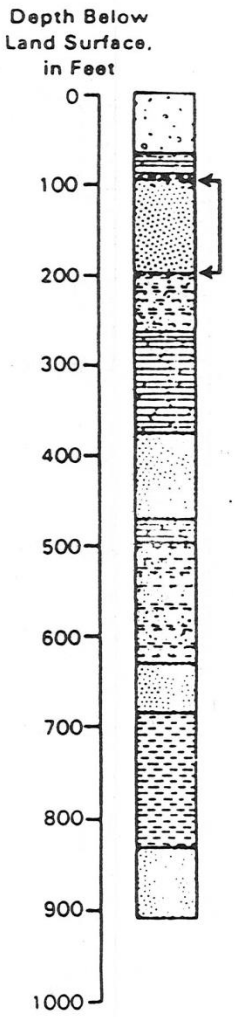
ST. PETER AQUIFER





AREA OF CONTAMINATION

MONITORING WELL

SOURCE OR GRADIENT CONTROL WELL

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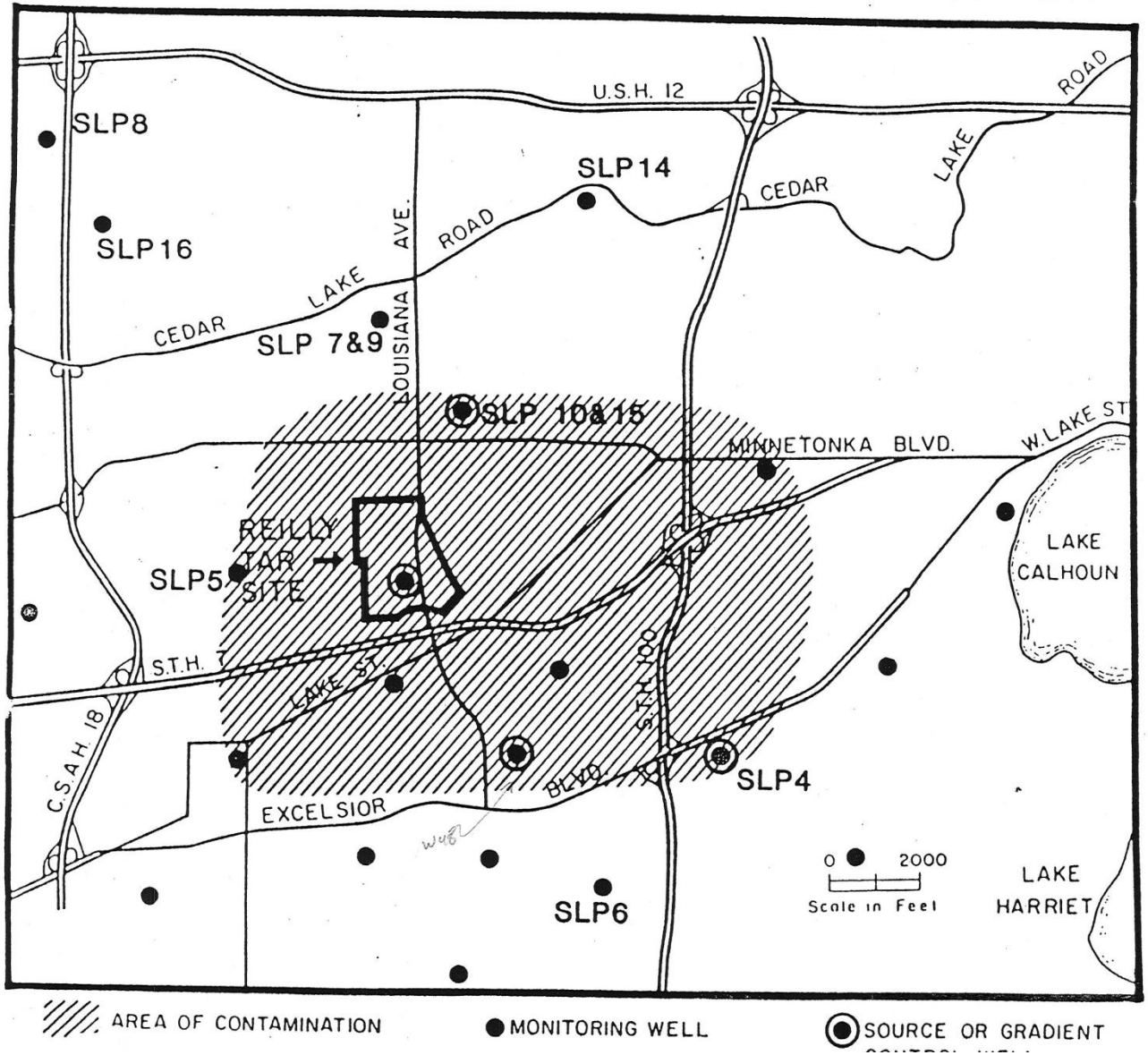
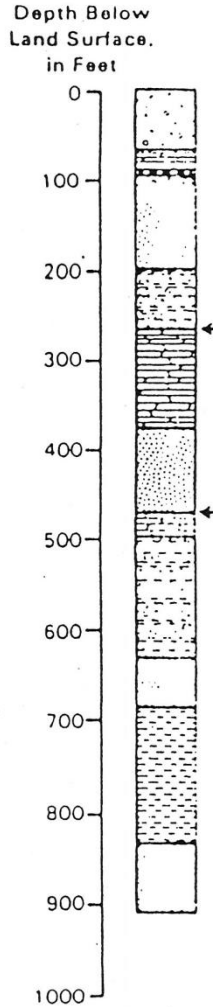
PRAIRIE DU CHIEN – JORDAN AQUIFER





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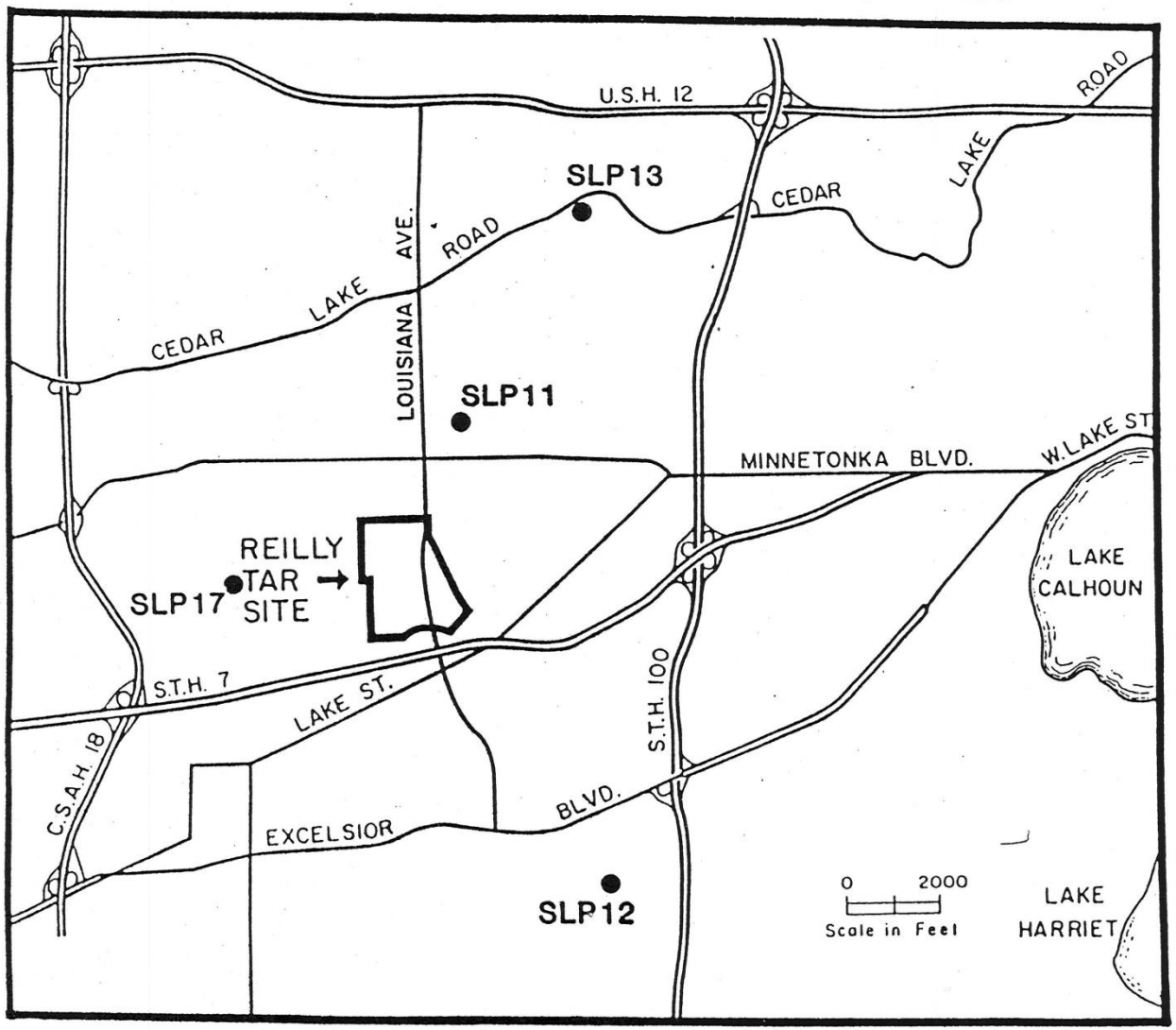
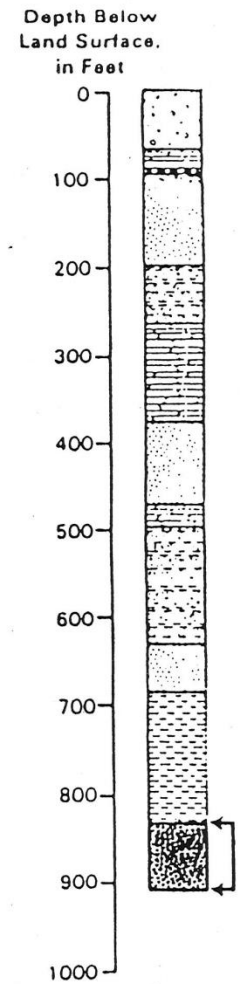
MT. SIMON – HINCKLEY AQUIFER





● MONITORING AND MUNICIPAL WELL

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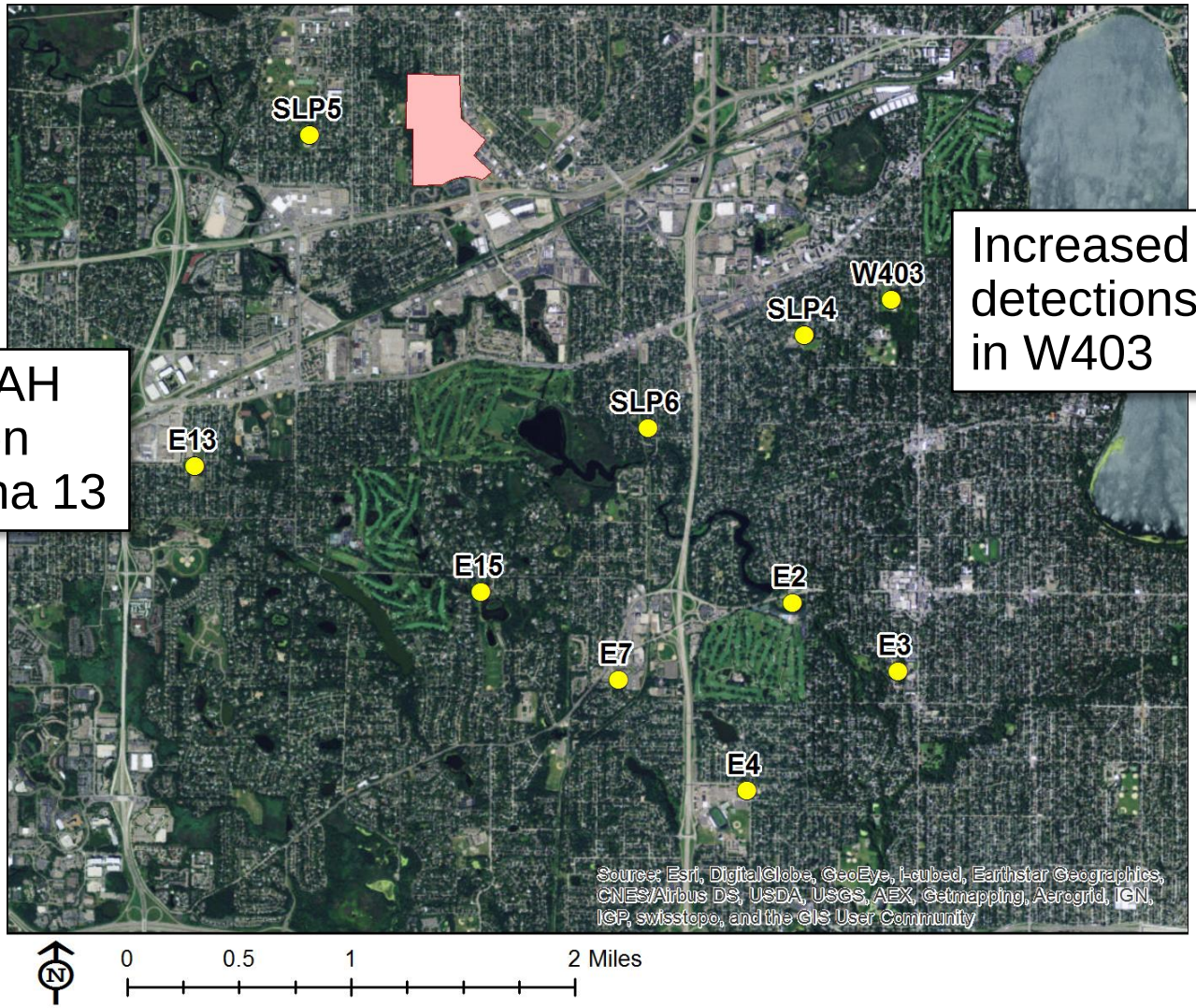
PAH Recent Data



Increased PAH concentration trend in Edina 13

Increased PAH detections in in W403

Remedy not performing as anticipated: Update Conceptual Site Model

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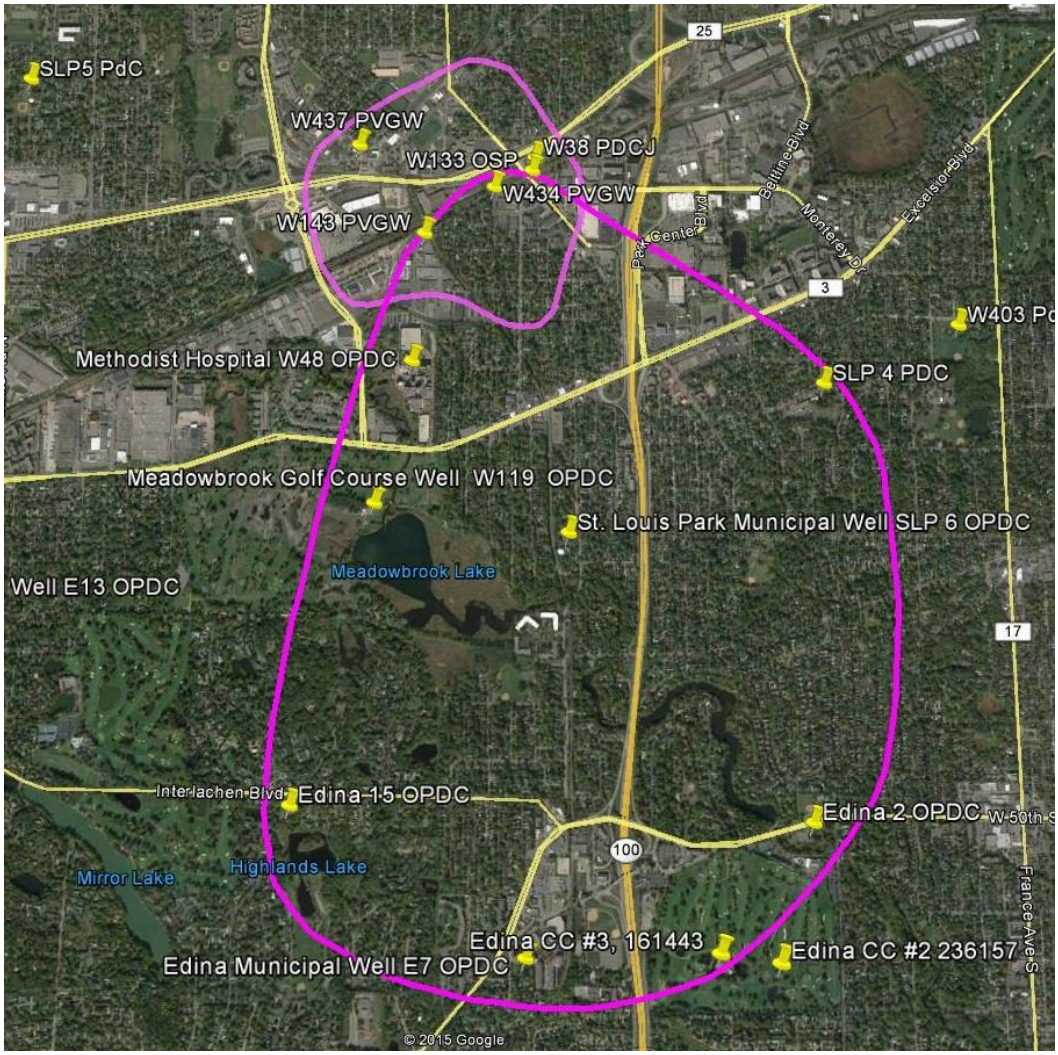
2004: Chlorinated Solvent History

- PCE and TCE Industrial solvents commonly used to degrease metals during manufacturing process
- Chemical dechlorination process:

  PCE→TCE → cDCE → VC
- 2004 Vinyl Chloride detected in Edina Municipal Well #7



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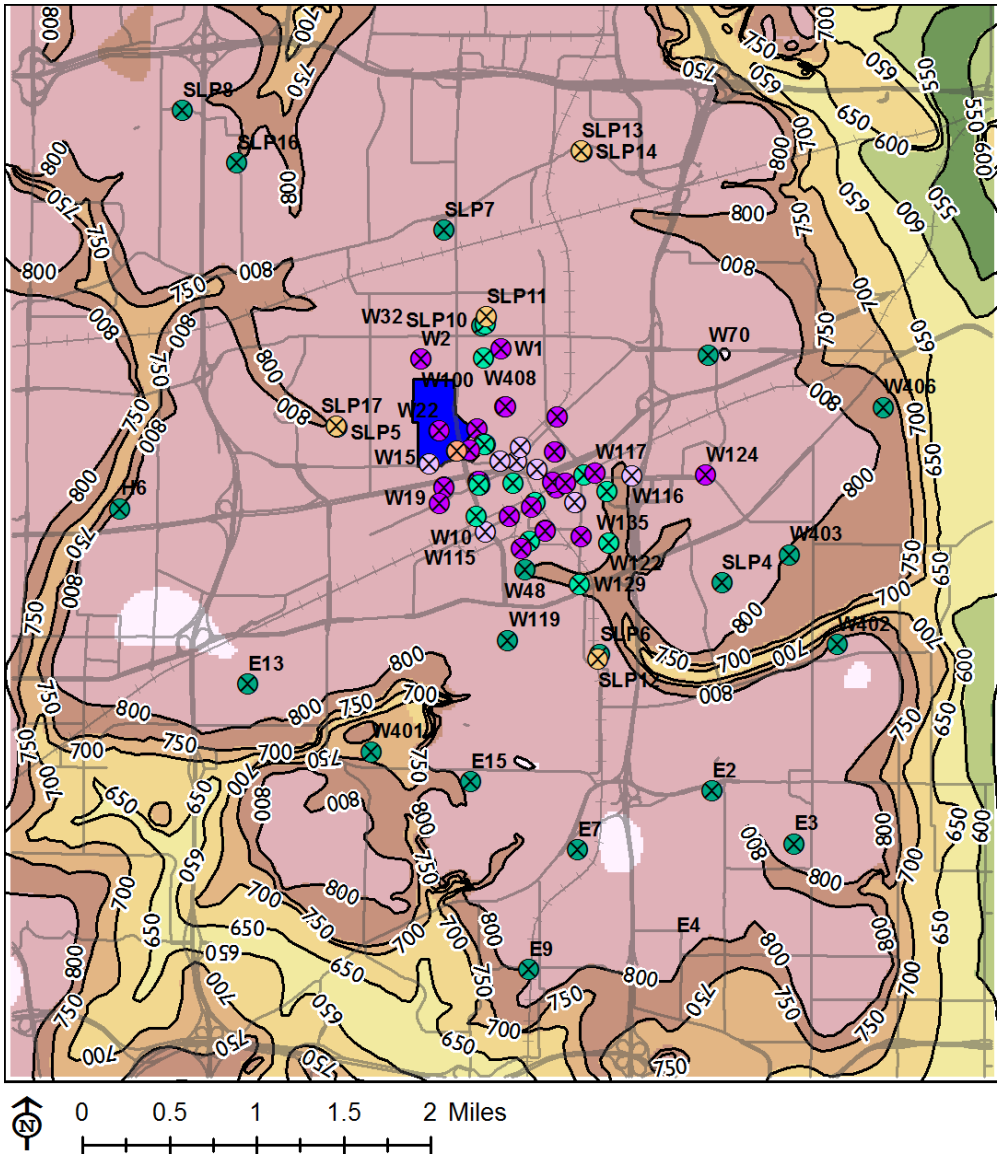
Complex Geology

- Valley in bedrock surface
- Multiple distinct aquifers
- Plume extends 2.5 miles from source
- Multiple pumping stresses



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Goal: Need Better Conceptual Site Model

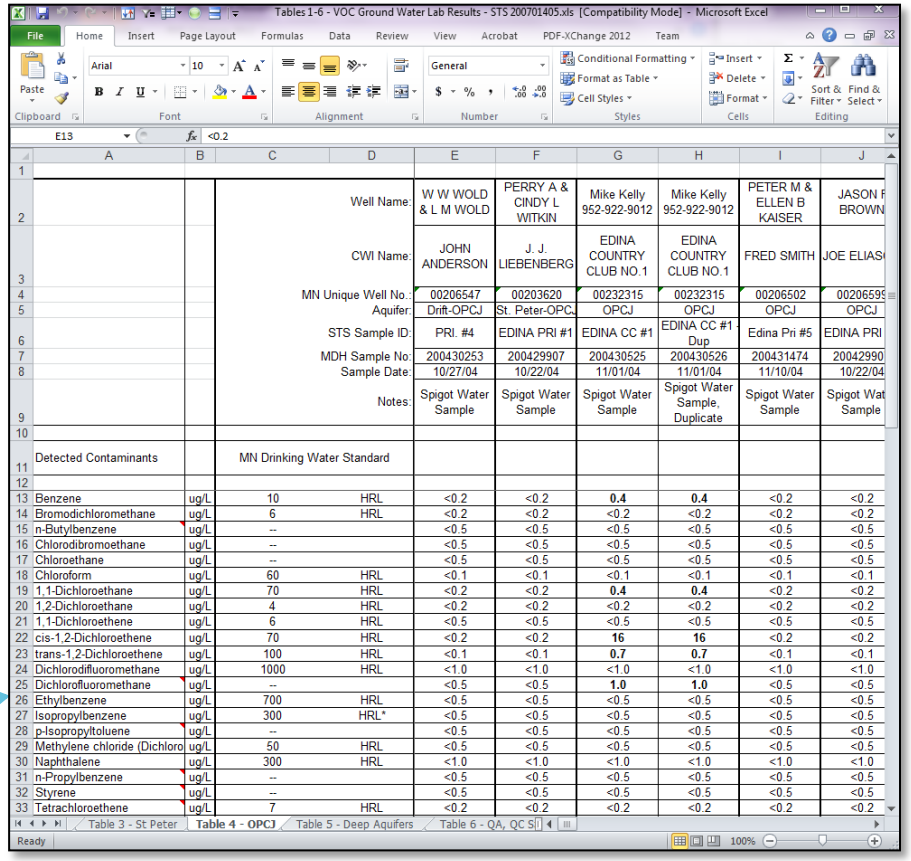
- Understand why Reilly Tar remedy was not operating as planned
- Need to tie cVOC contamination detected in municipal wells back to alleged source area and identify the responsible parties.

Data Sources

- >40 years PAH data.
  - Monitoring data since 1980s in consultant's databases, including EQuIS.
  - Not available in one place.
- cVOC data from focused investigation projects, plus sampling of supply and PAH monitoring wells.
  - No comprehensive repository, many different "data tables" from project reports.
  - Lab EDDs obtainable for much of the work since 2007.

Site Understanding & Communication

- Turn tables of numbers into visuals that account for:
  - Time
  - COPCs
  - Regulatory criteria
  - Horizontal extent
  - Vertical extent
  - Geologic context/Aquifer



			Well Name:	W W WOLD & L M WOLD	PERRY A & CINDY L WITKIN	Mike Kelly 952-922-9012	Mike Kelly 952-922-9012	PETER M & ELLEN B KAISER	JASON F BROWN
			CWI Name:	JOHN ANDERSON	J. J. LIEBENBERG	EDINA COUNTRY CLUB NO.1	EDINA COUNTRY CLUB NO.1	FRED SMITH	JOE ELIAS
			MN Unique Well No.:	00206547	00203620	00232315	00232315	00206502	00206595
			Aquifer:	Drift-OPCJ	St. Peter-OPCJ	OPCJ	OPCJ	OPCJ	OPCJ
			STS Sample ID:	PRI. #4	EDINA PRI #1	EDINA CC #1	EDINA CC #1 Dup	Edina Pri #5	EDINA PRI
			MDH Sample No:	200430253	200429907	200430525	200430526	200431474	20042990
			Sample Date:	10/27/04	10/22/04	11/01/04	11/01/04	11/10/04	10/22/04
			Notes:	Spigot Water Sample	Spigot Water Sample	Spigot Water Sample	Spigot Water Sample, Duplicate	Spigot Water Sample	Spigot Wat Sample
Detected Contaminants		MN Drinking Water Standard							
Benzene	ug/L	10	HRL	<0.2	<0.2	**0.4**	**0.4**	<0.2	<0.2
Bromodichloromethane	ug/L	6	HRL	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
n-Butylbenzene	ug/L	--		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorodibromoethane	ug/L	--		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroethane	ug/L	--		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroform	ug/L	60	HRL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1-Dichloroethane	ug/L	70	HRL	<0.2	<0.2	**0.4**	**0.4**	<0.2	<0.2
1,2-Dichloroethane	ug/L	4	HRL	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,1-Dichloroethene	ug/L	6	HRL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1,2-Dichloroethene	ug/L	70	HRL	<0.2	<0.2	**16**	**16**	<0.2	<0.2
trans-1,2-Dichloroethene	ug/L	100	HRL	<0.1	<0.1	**0.7**	**0.7**	<0.1	<0.1
Dichlorodifluoromethane	ug/L	1000	HRL	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dichlorofluoromethane	ug/L	--		<0.5	<0.5	**1.0**	**1.0**	<0.5	<0.5
Ethylbenzene	ug/L	700	HRL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Isopropylbenzene	ug/L	300	HRL*	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
p-Isopropyltoluene	ug/L	--		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Methylene chloride (Dichloro	ug/L	50	HRL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	ug/L	300	HRL	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
n-Propylbenzene	ug/L	--		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Styrene	ug/L	--		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	ug/L	7	HRL	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

You're not helping!

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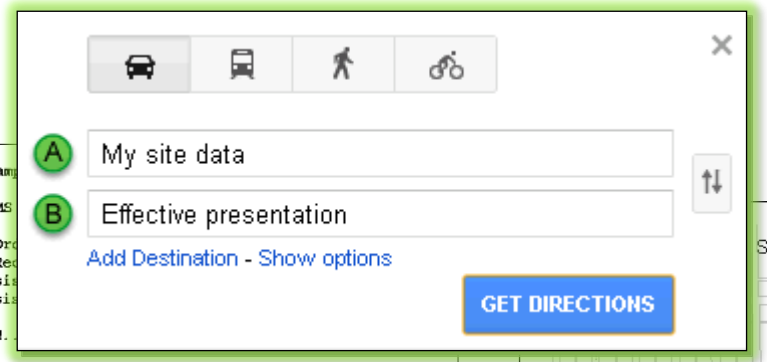
Site Understanding & Communication



A

Client Sam

GC/MS

Lot-Sample #...: D2C130250-001
Date Sampled...: 03/12/02
Prep Date.....: 03/18/02
Prep Batch #...: 2077395
Dilution Factor: 1

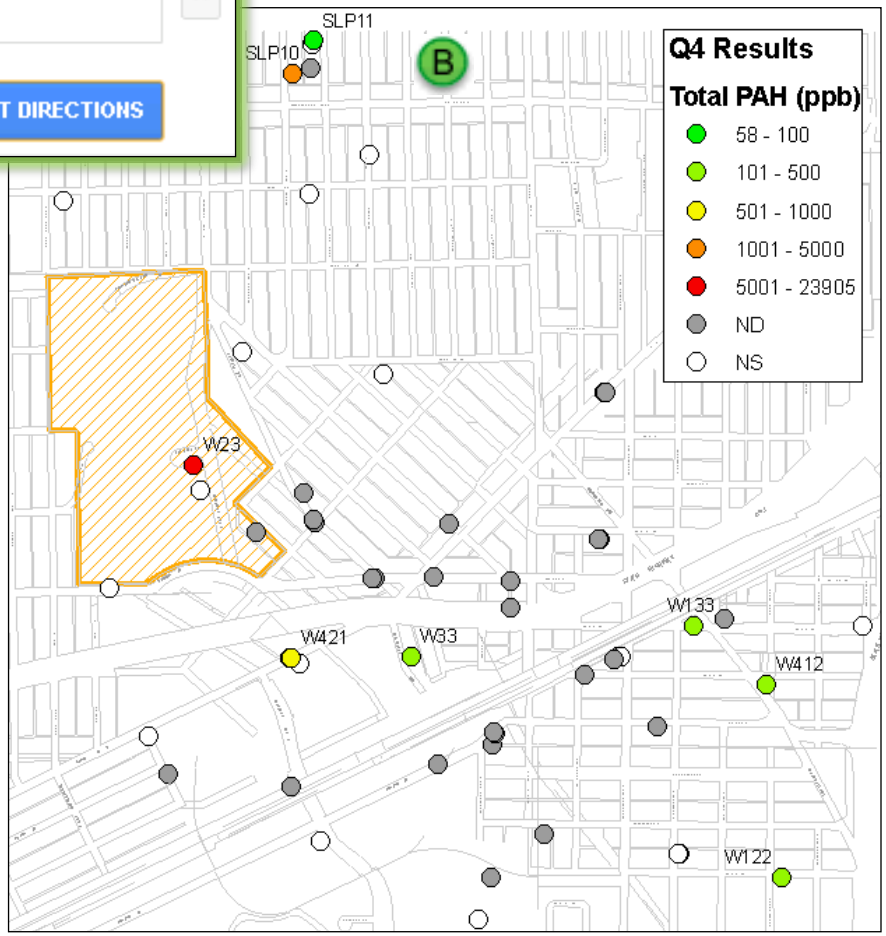
Work Ord
Date Rec
Analysis
Analysis

Method.

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acenaphthene	**110**	**1.9**	**ng/L**
Acenaphthylene	ND	1.6	ng/L
Acridine	**32**	**6.1**	**ng/L**
Anthracene	**7.9**	**1.8**	**ng/L**
Benzo(a)anthracene	ND	2.5	ng/L
Benzo(b)fluoranthene	ND	2.5	ng/L
Benzo(k)fluoranthene	ND	2.3	ng/L
2,3-Benzofuran	ND	5.1	ng/L
Benzo(ghi)perylene	ND	2.8	ng/L
Benzo(a)pyrene	ND	2.3	ng/L
Benzo(e)pyrene	ND	1.9	ng/L
Benzo(b)thiophene	**9.7**	**1.8**	**ng/L**
Biphenyl	ND	4.3	ng/L
Carbazole	**3.1**	**1.9**	**ng/L**
Chrysene	ND	2.8	ng/L
Dibenzo(a,h)anthracene	ND	2.0	ng/L
Dibenzofuran	ND	1.9	ng/L
Dibenzothiophene	ND	1.4	ng/L
2,3-Dihydroindene	**12**	**5.0**	**ng/L**
Fluoranthene	**3.2**	**3.1**	**ng/L**
Fluorene	ND	1.4	ng/L
Indene	**20**	**1.6**	**ng/L**
Indeno(1,2,3-cd)pyrene	ND	2.1	ng/L
Indole	ND	2.5	ng/L
2-Methylnaphthalene	**2.5 J**	**3.9**	**ng/L**
1-Methylnaphthalene	**2.9**	**2.8**	**ng/L**
Naphthalene	**4.2 J**	**6.5**	**ng/L**
Perylene	ND	2.5	ng/L
Phenanthrene	**3.3**	**1.6**	**ng/L**
Pyrene	**6.9**	**6.9**	**ng/L**
Quinoline	**3.8 J**	**6.9**	**ng/L**

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Chrysene-d12	46	(10 - 118)
Fluorene d-10	69	(41 - 162)
Naphthalene-d8	81	(21 - 108)

NOTE(S):
J Estimated result. Result is less than RL.



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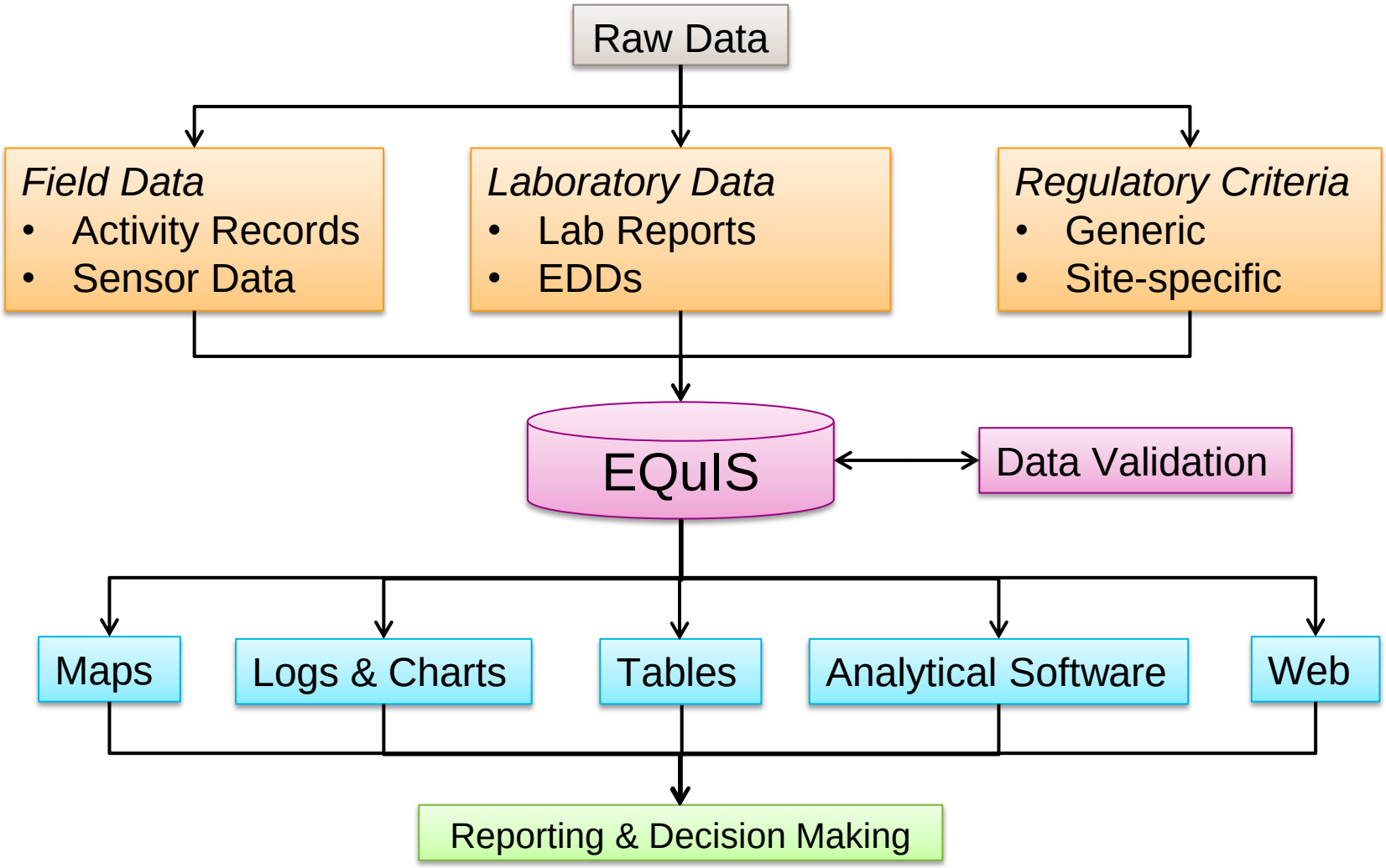
Solution: Data Management Roadmap



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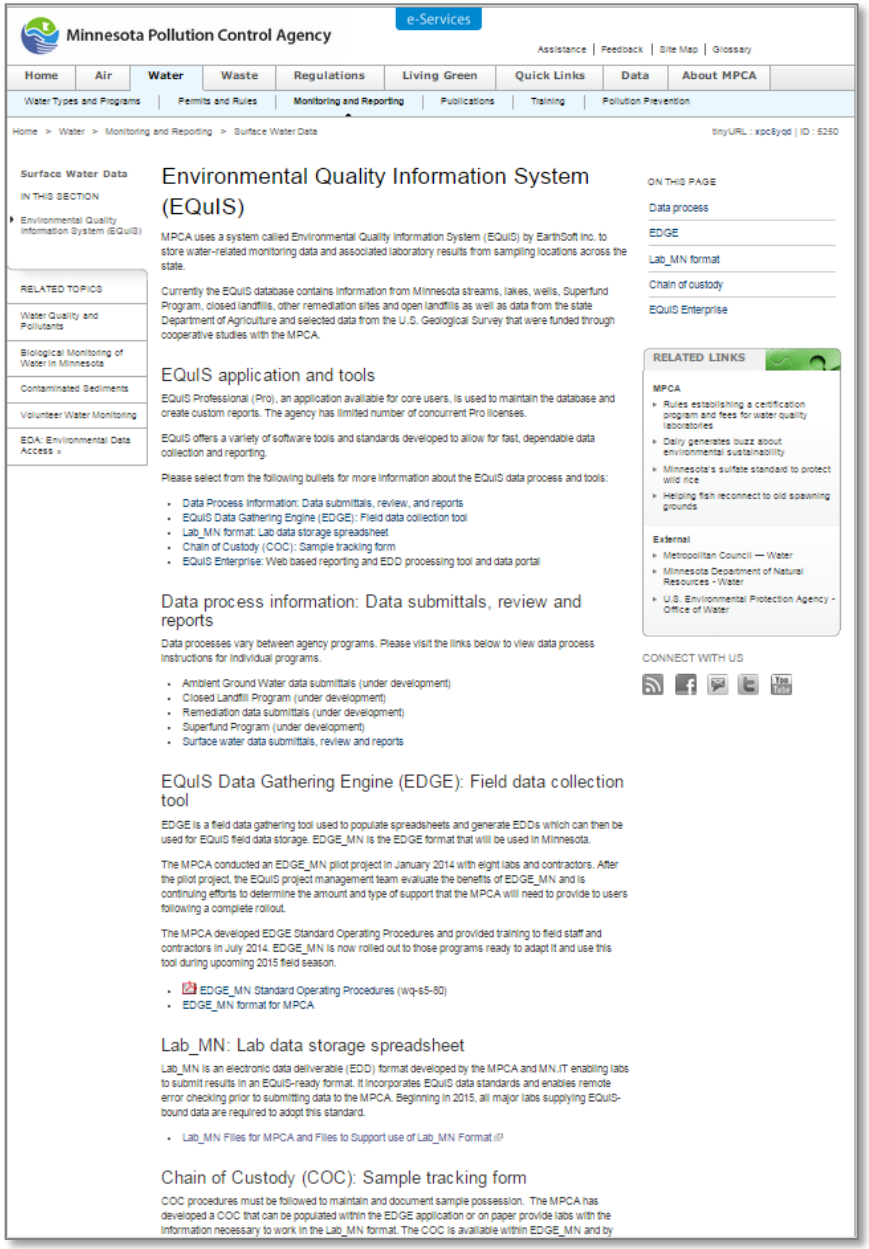
Key: MPCA EQuIS

- Learn more later today…
- Specifications online
- Easily queried
- Output in flexible formats
- Formats for lab data (EDP) and field data (EDGE)
- Lab's role vs. data provider's role



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e-Services

Assistance | Feedback | Site Map | Glossary

Home | Air | Water | Waste | Regulations | Living Green | Quick Links | Data | About MPCA

Water Types and Programs | Permits and Rules | Monitoring and Reporting | Publications | Training | Pollution Prevention

Home > Water > Monitoring and Reporting > Surface Water Data

tinyURL : xpc8yqd | ID : 5250

Surface Water Data

IN THIS SECTION

- Environmental Quality Information System (EQuIS)

RELATED TOPICS

- Water Quality and Pollutants
- Biological Monitoring of Water in Minnesota
- Contaminated Sediments
- Volunteer Water Monitoring
- EDA: Environmental Data Access »

Environmental Quality Information System (EQuIS)

MPCA uses a system called Environmental Quality Information System (EQuIS) by EarthSoft Inc. to store water-related monitoring data and associated laboratory results from sampling locations across the state.

Currently the EQuIS database contains information from Minnesota streams, lakes, wells, Superfund Program, closed landfills, other remediation sites and open landfills as well as data from the state Department of Agriculture and selected data from the U.S. Geological Survey that were funded through cooperative studies with the MPCA.

EQuIS application and tools

EQuIS Professional (Pro), an application available for core users, is used to maintain the database and create custom reports. The agency has limited number of concurrent Pro licenses.

EQuIS offers a variety of software tools and standards developed to allow for fast, dependable data collection and reporting.

Please select from the following bullets for more information about the EQuIS data process and tools:

- Data Process Information: Data submittals, review, and reports
- EQuIS Data Gathering Engine (EDGE): Field data collection tool
- Lab_MN format: Lab data storage spreadsheet
- Chain of Custody (COC): Sample tracking form
- EQuIS Enterprise: Web based reporting and EDD processing tool and data portal

Data process information: Data submittals, review and reports

Data processes vary between agency programs. Please visit the links below to view data process instructions for individual programs.

- Ambient Ground Water data submittals (under development)
- Closed Landfill Program (under development)
- Remediation data submittals (under development)
- Superfund Program (under development)
- Surface water data submittals, review and reports

EQuIS Data Gathering Engine (EDGE): Field data collection tool

EDGE is a field data gathering tool used to populate spreadsheets and generate EDDs which can then be used for EQuIS field data storage. EDGE_MN is the EDGE format that will be used in Minnesota.

The MPCA conducted an EDGE_MN pilot project in January 2014 with eight labs and contractors. After the pilot project, the EQuIS project management team evaluate the benefits of EDGE_MN and is continuing efforts to determine the amount and type of support that the MPCA will need to provide to users following a complete rollout.

The MPCA developed EDGE Standard Operating Procedures and provided training to field staff and contractors in July 2014. EDGE_MN is now rolled out to those programs ready to adapt it and use this tool during upcoming 2015 field season.

- EDGE_MN Standard Operating Procedures (wq-s5-80)
- EDGE_MN format for MPCA

Lab_MN: Lab data storage spreadsheet

Lab_MN is an electronic data deliverable (EDD) format developed by the MPCA and MN.IT enabling labs to submit results in an EQuIS-ready format. It incorporates EQuIS data standards and enables remote error checking prior to submitting data to the MPCA. Beginning in 2015, all major labs supplying EQuIS-bound data are required to adopt this standard.

- Lab_MN Files for MPCA and Files to Support use of Lab_MN Format

Chain of Custody (COC): Sample tracking form

COC procedures must be followed to maintain and document sample possession. The MPCA has developed a COC that can be populated within the EDGE application or on paper provide labs with the information necessary to work in the Lab_MN format. The COC is available within EDGE_MN and by

ON THIS PAGE

- Data process
- EDGE
- Lab_MN format
- Chain of custody
- EQuIS Enterprise

RELATED LINKS

MPCA

- Rules establishing a certification program and fees for water quality laboratories
- Dairy generates buzz about environmental sustainability
- Minnesota's sulfate standard to protect wild rice
- Helping fish reconnect to old spawning grounds

External

- Metropolitan Council — Water
- Minnesota Department of Natural Resources - Water
- U.S. Environmental Protection Agency - Office of Water

CONNECT WITH US

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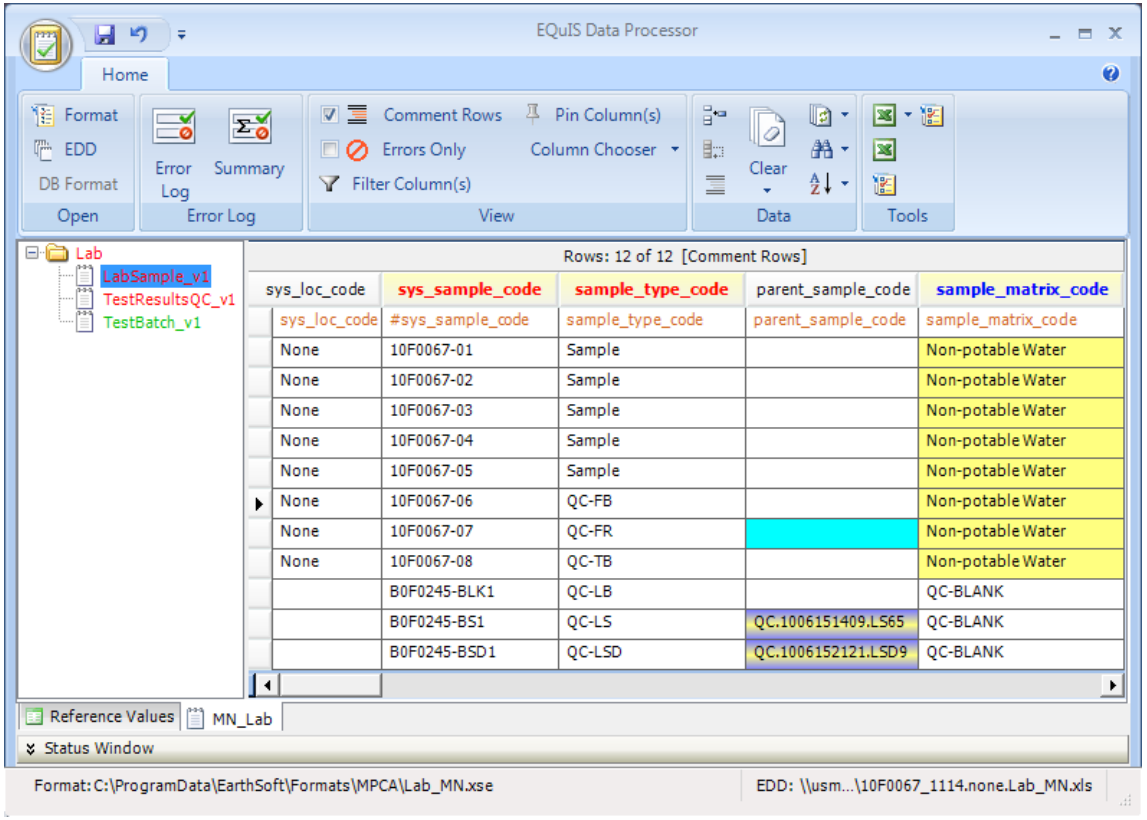
Problem: Too Many Data Repositories

- Commercial & State lab EDDs in Lab_MN format
  - Not complete: locations, field QC
- Other data in Excel summary tables
  - Crosstabbed, minimal metadata
- PAH data in consultant's database



sys_loc_code	sys_sample_code	sample_type_code	parent_sample_code	sample_matrix_code
sys_loc_code	#sys_sample_code	sample_type_code	parent_sample_code	sample_matrix_code
None	10F0067-01	Sample		Non-potable Water
None	10F0067-02	Sample		Non-potable Water
None	10F0067-03	Sample		Non-potable Water
None	10F0067-04	Sample		Non-potable Water
None	10F0067-05	Sample		Non-potable Water
None	10F0067-06	QC-FB		Non-potable Water
None	10F0067-07	QC-FR		Non-potable Water
None	10F0067-08	QC-TB		Non-potable Water
	B0F0245-BLK1	QC-LB		QC-BLANK
	B0F0245-BS1	QC-LS	QC.1006151409.LS65	QC-BLANK
	B0F0245-BSD1	QC-LSD	QC.1006152121.LSD9	QC-BLANK

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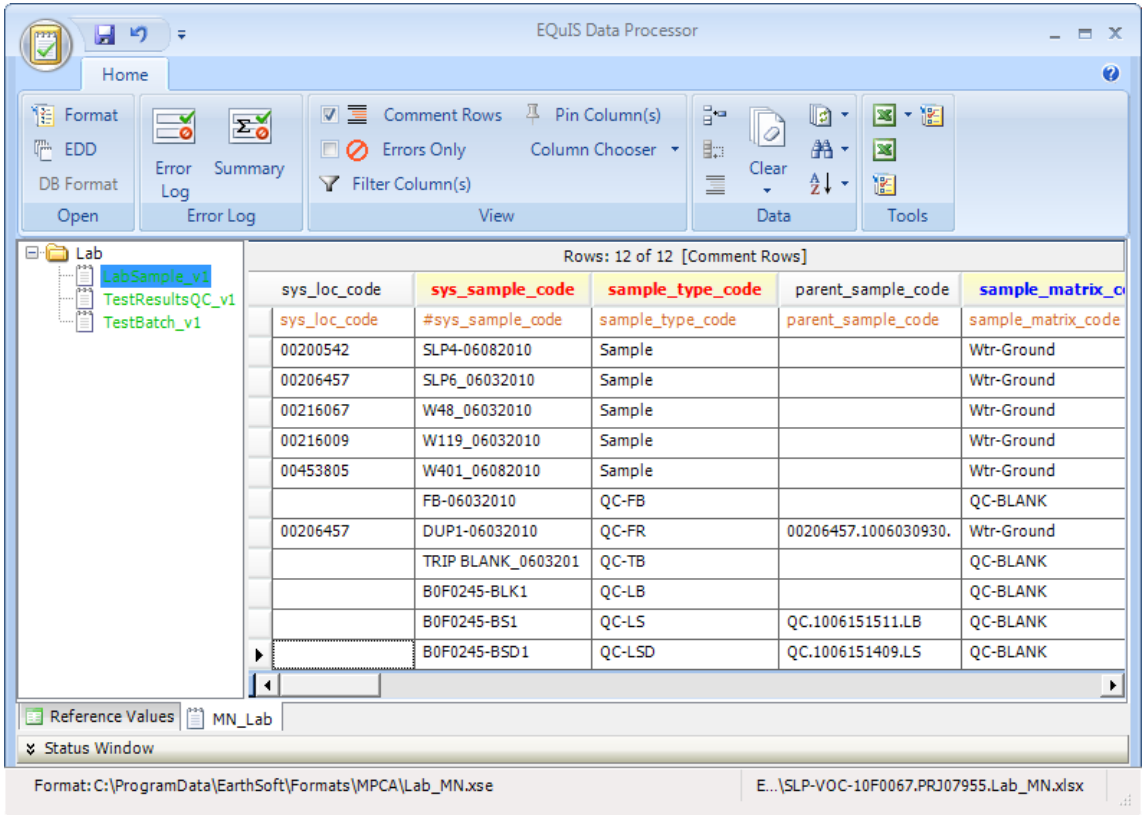
Solution: Load into EQuIS

- Commercial & State lab EDDs in Lab_MN format
  - Edit in Excel & EDP, create MPCA EDGE EDD for “new” locations
- Other data in Excel summary tables
  - Excel macros to reformat to MPCA EDDs
- Database ETL transfer



sys_loc_code	sys_sample_code	sample_type_code	parent_sample_code	sample_matrix_c
sys_loc_code	#sys_sample_code	sample_type_code	parent_sample_code	sample_matrix_code
00200542	SLP4-06082010	Sample		Wtr-Ground
00206457	SLP6_06032010	Sample		Wtr-Ground
00216067	W48_06032010	Sample		Wtr-Ground
00216009	W119_06032010	Sample		Wtr-Ground
00453805	W401_06082010	Sample		Wtr-Ground
	FB-06032010	QC-FB		QC-BLANK
00206457	DUP1-06032010	QC-FR	00206457.1006030930.	Wtr-Ground
	TRIP BLANK_0603201	QC-TB		QC-BLANK
	B0F0245-BLK1	QC-LB		QC-BLANK
	B0F0245-BS1	QC-LS	QC.1006151511.LB	QC-BLANK
	B0F0245-BSD1	QC-LSD	QC.1006151409.LS	QC-BLANK

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PAH Criteria Based on Sums

Total Carcinogenic PAHs 28 ng/l

(as listed in the CD/RAP (A.1.1), consist of the sum of:

benzo(a) anthracene	indeno(1,2,3-cd)pyrene	benzo(a)pyrene
quinoline*	benzo(b)flouranthene	benzo(j)fluoranthene
chrysene	benzo(g,h,i)perylene	dibenzo(a,h)anthracene

Total Other PAHs 280 ng/l

(as listed in the CD/RAP (A.1.2)), consists of the sum of:

acenapthene	biphenyl	indene	acenaphthylene
carbazole	indole	acridine	dibenzofuran
1-methylnaphthalene	anthracene	dibenzothiophene	2-methylnaphthalene
benzo(k)fluoranthene	,3-dihydroindene	naphthalene	2,3-benzofuran
fluoranthene	perylene	benzo(e)pyrene	fluorene
phenanthrene	benzo(b)thiophene	pyrene	

Result reported as 0 indicates that all parameters were not detected above the laboratory detection limit.

** Quinoline is included in the sum of CPAH if other CPAHs were detected. If no CPAHs are detected, quinoline is included in the Total Other PAH.*

PAH Criteria Based on Sums
Calculate with Crosstab-of-Crosstab Report

- Analytical Results Query
  - Use MAGs for PAH Groups: Carcinogenic, Other, & Quinoline
  - Set reporting units in MAG to convert to common units
  - ND Multiplier = 0

PAH Criteria Based on Sums
Calculate with Crosstab-of-Crosstab Report

- Analytical Results Query
- Crosstab 1: Reduce Multiple Results per Sample
  - Column Headers = Facility ID *just need a constant*
  - Row Headers = Well, Date, MAG, Analyte
  - Tabbed Data = Max(report result value)

This is correct only due to the ND = 0 rule

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PAH Criteria Based on Sums
Calculate with Crosstab-of-Crosstab Report

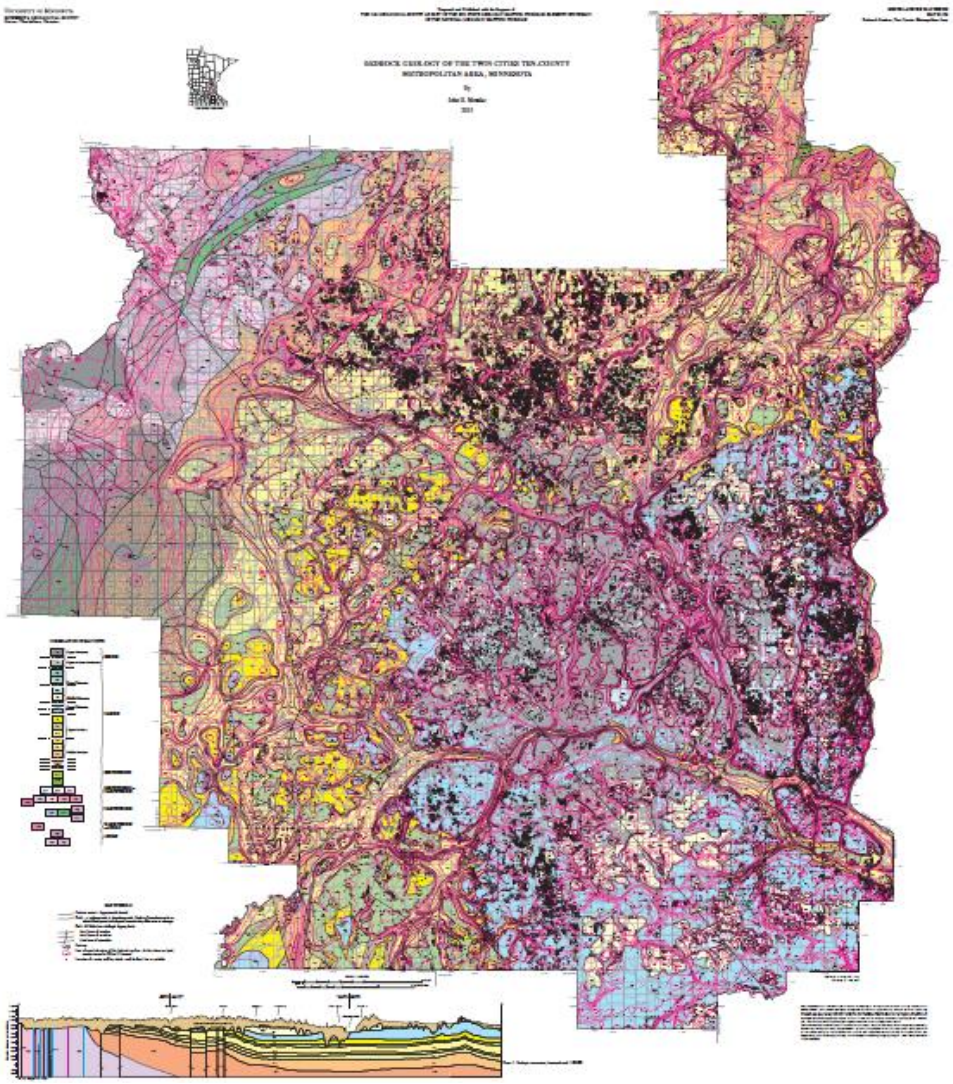
- Analytical Results Query
- Crosstab 1: Reduce Multiple Results per Sample
- Crosstab 2: Calculate Sums
  - Column Headers = MAG
  - Row Headers = Well, Date
  - Tabbed Data = Sum(max value)

PAH Criteria Based on Sums
Calculate with Crosstab-of-Crosstab Report

- Analytical Results Query
- Crosstab 1: Reduce Multiple Results per Sample
- Crosstab 2: Calculate Sums
- Final Step: Deal with quinoline
  - Export to Excel
  - For all rows
  - If Σcarcinogenic > 0 add quinoline to Σcarcinogenic, else add to Σother

Geology

- Not [currently] in MPCA EQuIS—boring locations not enough anyway
- Subsurface geologic mapping done by MNGS
  Bedrock Geology of the Twin Cities Ten-County Metropolitan Area
  Miscellaneous Map Series M-194
- GIS to convert contact contour maps into rasters and export for 3D solid modeling



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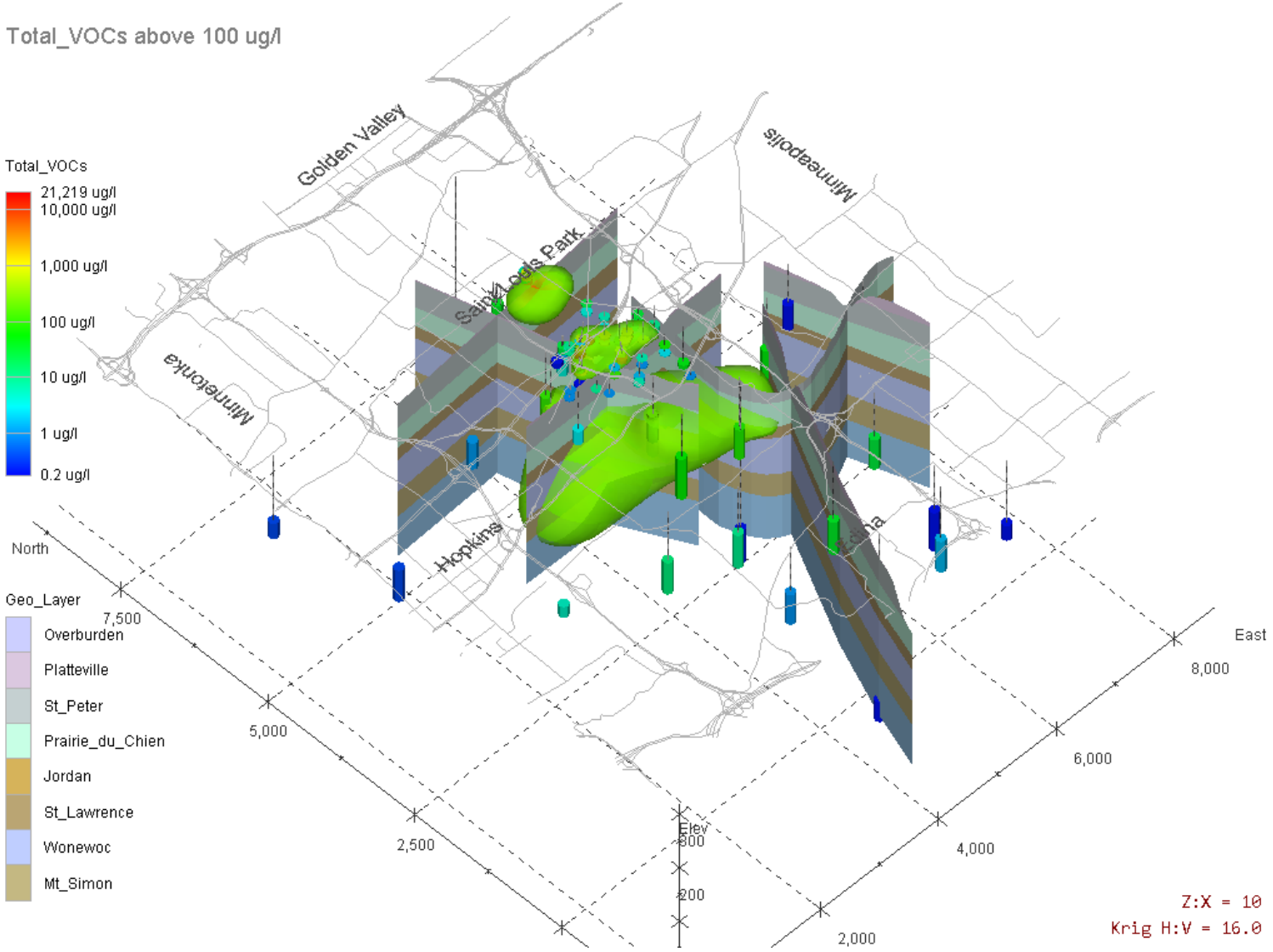
3D Visualization Considerations

- To place results in 3D, combine coordinates, depths/elevations, sampling results:
  X, Y, Start Depth, End Depth, Result Value, Well ID, GS Elevation
  – surf_elev not included in standard EQuIS reports…
- Coordinates consistent both in X/Y (*UTM = m*) & Z (*feet*) and with well screen & geologic data
  – Make sure units are always stored (custom EDP checks!?!)
- Dates—how to deal with multiple, incomplete sampling rounds:
  – Most recent / Maximum
  – Ever observed or within a defined time window
  – Different EQuIS report(s) to run depending on choices

Payoff: 3D Visualization



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Payoff: 3D Visualization

Example 3D Views…

Conclusion

- When data is not managed from the beginning of the project, much more time is spent on data compilation and reformatting than on reporting and understanding.
- EQuIS is a comprehensive repository for environmental data, with tools that make repurposing data easy for analysis and communication.
- Visualization leveraging comprehensive datasets enables efficient understanding of site conditions and processes.

Thank You

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