

Computer Assisted Data Management and the Triad Approach:

***A Case Study Addressing Problems and Potentials
for Successful Remedial Investigation***

Arnold L. Gray, Ph.D.

President

Gray Environmental Data Services

www.grayeds.com

arnold@grayeds.com

Computer assisted data management techniques applied to Triad investigations

- **Data Visualization**

- Help convert “data” into useful information.
- One tool does not fit all.
- Many users and purposes

- **Database**

- In order to make the TRIAD approach work, we need to process more data faster.
- Well organized databases provide an effective tool to store data in a powerful retrieval system.
- Automation where possible.

- **Conceptual Site Model**

- Dynamic Work Strategies—flexibility in the face of new information.
- Knowledge Transfer—Scientist to management to public.
- Social Capital—overcome sense of mistrust.

Conceptual Site Model

- **The Conceptual Site Model (CSM) is at the core of the systematic planning process.**
 - Clearly identify project decisions & end points.
 - Articulate project specific decision statements.
- **Project life cycle activity that is interactive in nature, structured so that project adjustments & course corrections can take place.**

KeyCSM by Keynetix (UK)

Plan Document

The screenshot displays the KeyCSM software interface. The main window shows a site plan with various features and a yellow highlighted area. The interface includes a toolbar with various drawing tools, a diagram manager, a data manager, and a data library.

Diagram Manager: Shows the current document structure, including Plan Document(1), CrossSection Document, and other related documents.

Data Manager: Lists various data types such as Sources, Contaminant, Pathways, Receptors, Linkages, and Zones.

Data Library: Provides a table of default data with columns for Name and Category.

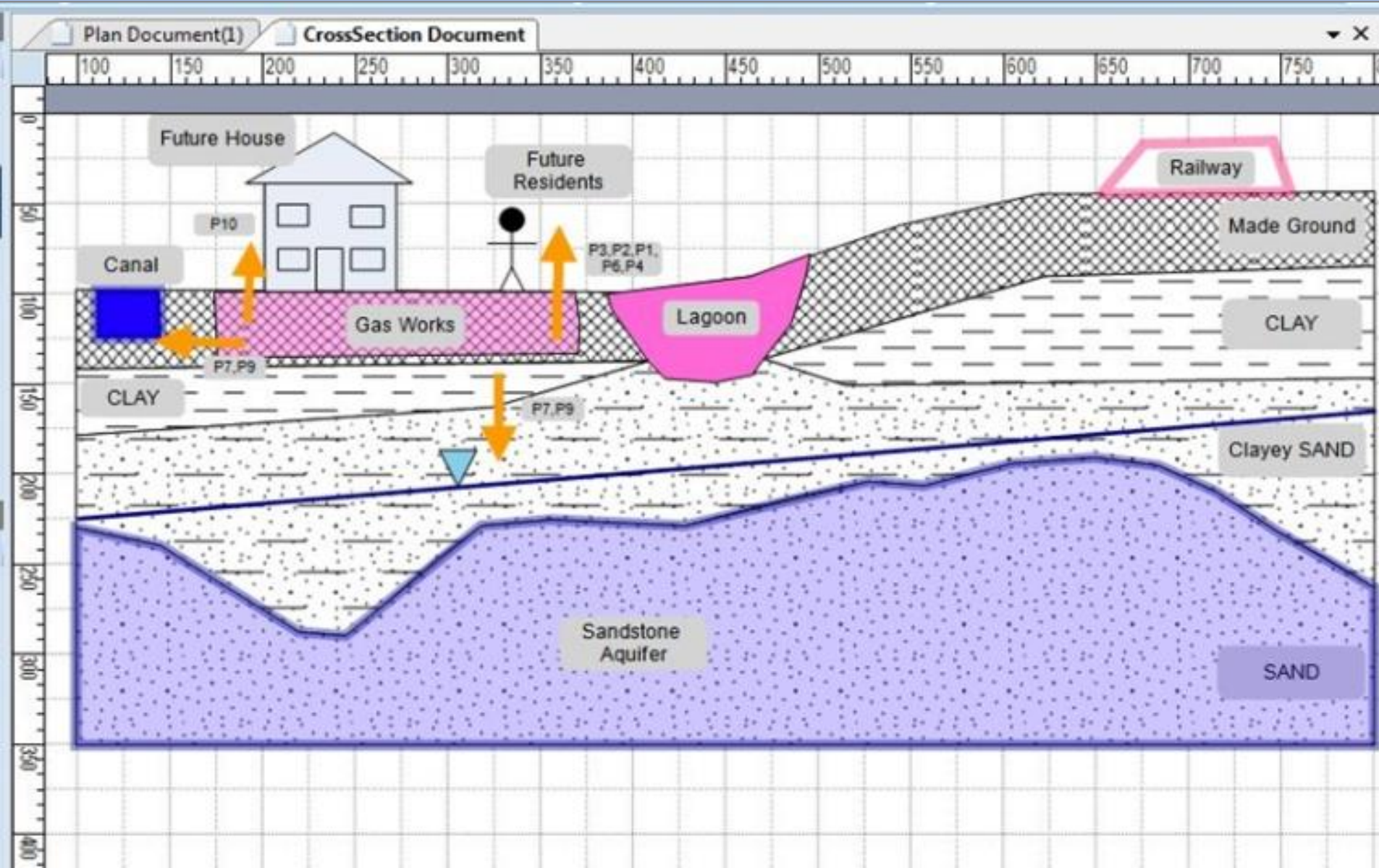
Site Plan Features: The plan shows a central area labeled 'Future House' and 'Future Residents' in pink. Other features include 'Gas Works', 'Canal', 'Lagoon', 'Railway', 'Line of section', 'A210', and 'A10'. A yellow highlighted area is shown across the plan, with arrows pointing to specific points labeled P7, P9, P10, P3, P2, P1, P6, P4.

Copyright 2008, EarthSoft, Inc., all rights reserved

Project: Quinley Gasworks | Model: Quinley phase 1 | Phase: 1 | Ready | Mouse pos: {18.00, 379.00} | Meter

KeyCSM by Keynetix (UK)

CrossSection Document



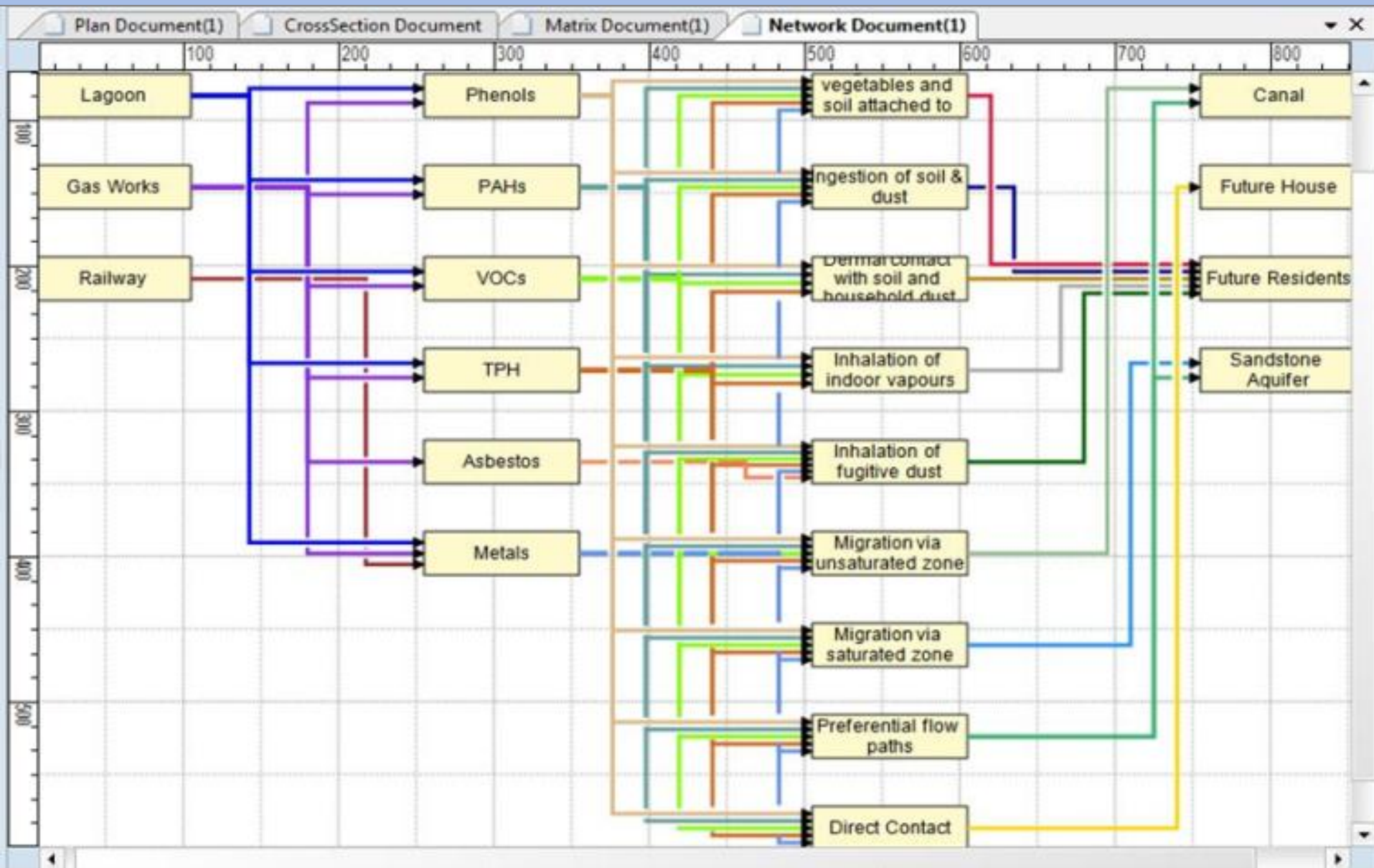
KeyCSM by Keynetix (UK)

Matrix Document

		Receptors			
		Canal	Future House	Future Residents	Sandstone Aquifer
Sources	Lagoon	No	No	No	No
	Gas Works	No	No	No	No
	Railway	No	No	No	No
Contaminants	Phenols	P7,P9	P10	P1,P2,P3,P4,P6	P8,P9
	PAHs	P7,P9	P10	P1,P2,P3,P4,P6	P8,P9
	VOCs	P7,P9	P10	P1,P2,P3,P4,P6	P8,P9
	TPH	P7,P9	P10	P1,P2,P3,P4,P6	P8,P9
	Asbestos	No	No	P6	No

KeyCSM by Keynetix (UK)

Network Document



Conceptual Site Model

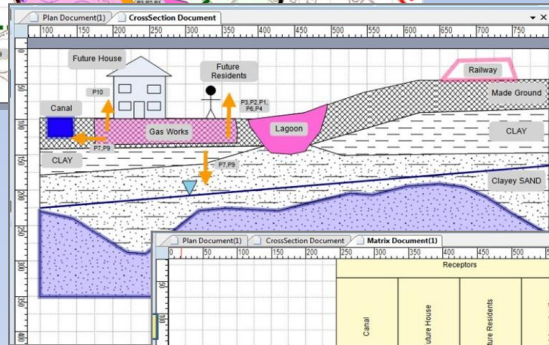
with KeyCSM by Keynetix (UK)

Dynamic: Easily edited in response to new information.

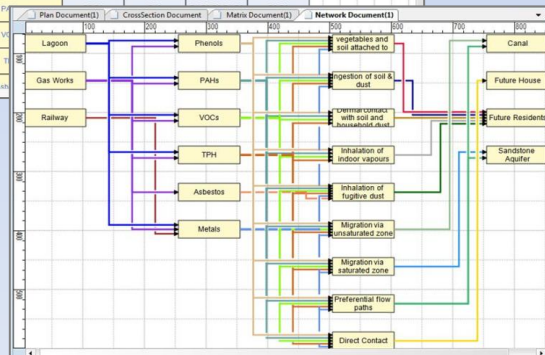
Establish trust: Clarity and transparency at every level.

Knowledge transfer: Goals and pathways clearly defined.

Results in clearly identified project decisions & end points.



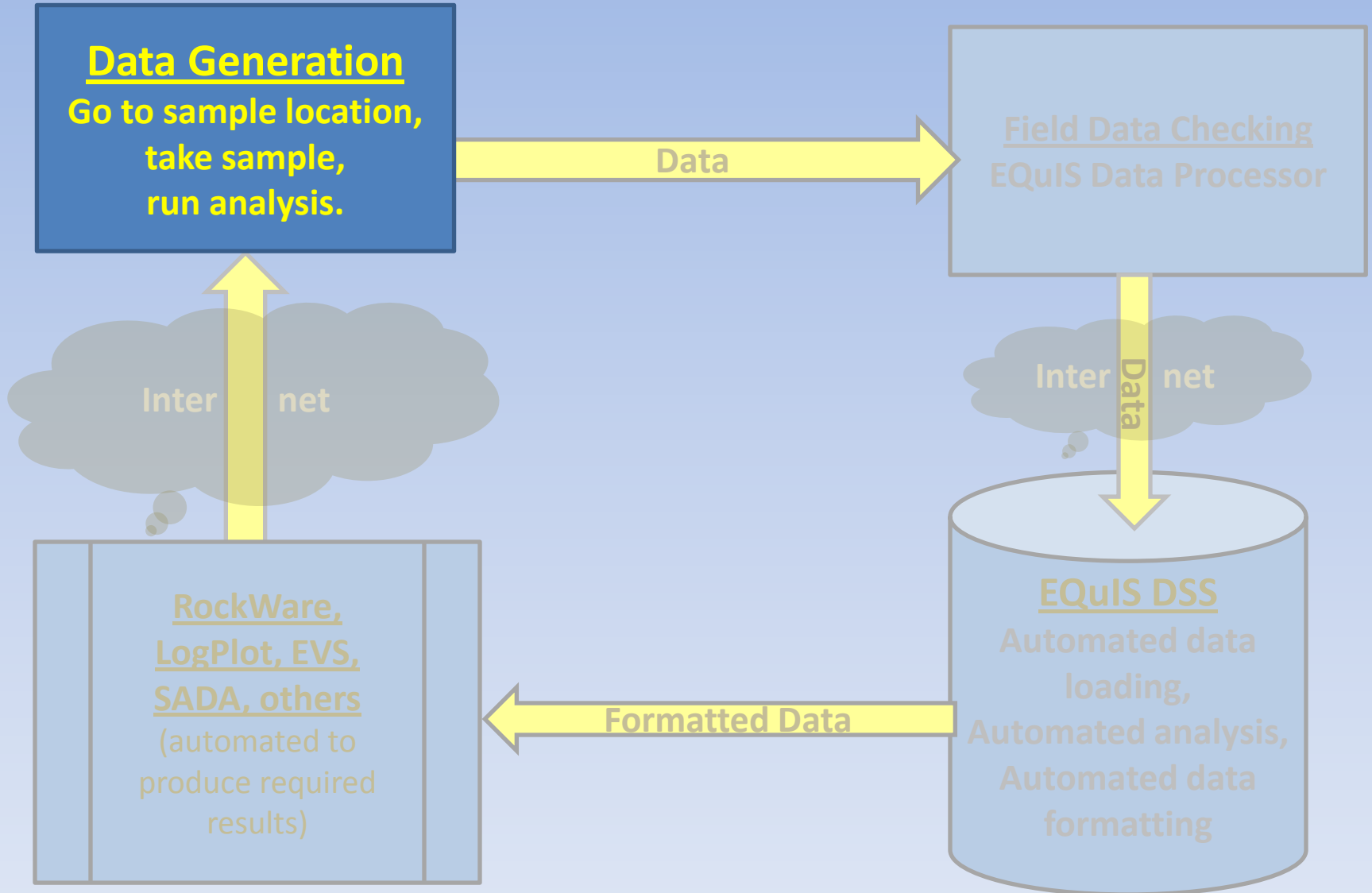
		Receptors			
		Canal	Future House	Future Residents	Sandstone Aquifer
Sources	Lagoon	No	No	No	No
	Gas Works	No	No	No	No
	Railway	No	No	No	No
	Phenols	P7, P9	P10	P1, P2, P3, P4, P6	P8, P9
Contaminants					



Required Database Capabilities

- **Decision Support System**
- **Advanced Data Management Capabilities**
- **Field Event Planning tools**
- **Data collection tools**
- **Field Data Checking**
- **Automated Database Loading**
- **Automated Report Generation**
- **Automated Report Delivery**

Database Automation in Field Investigation



Data Generation



A Direct Push Caterpillar enables **S2C2** to access difficult terrain to reduce sampling time and client cost.

S2C2 Mobile laboratory collects and processes large data sets that are loaded electronically into EQUIS.

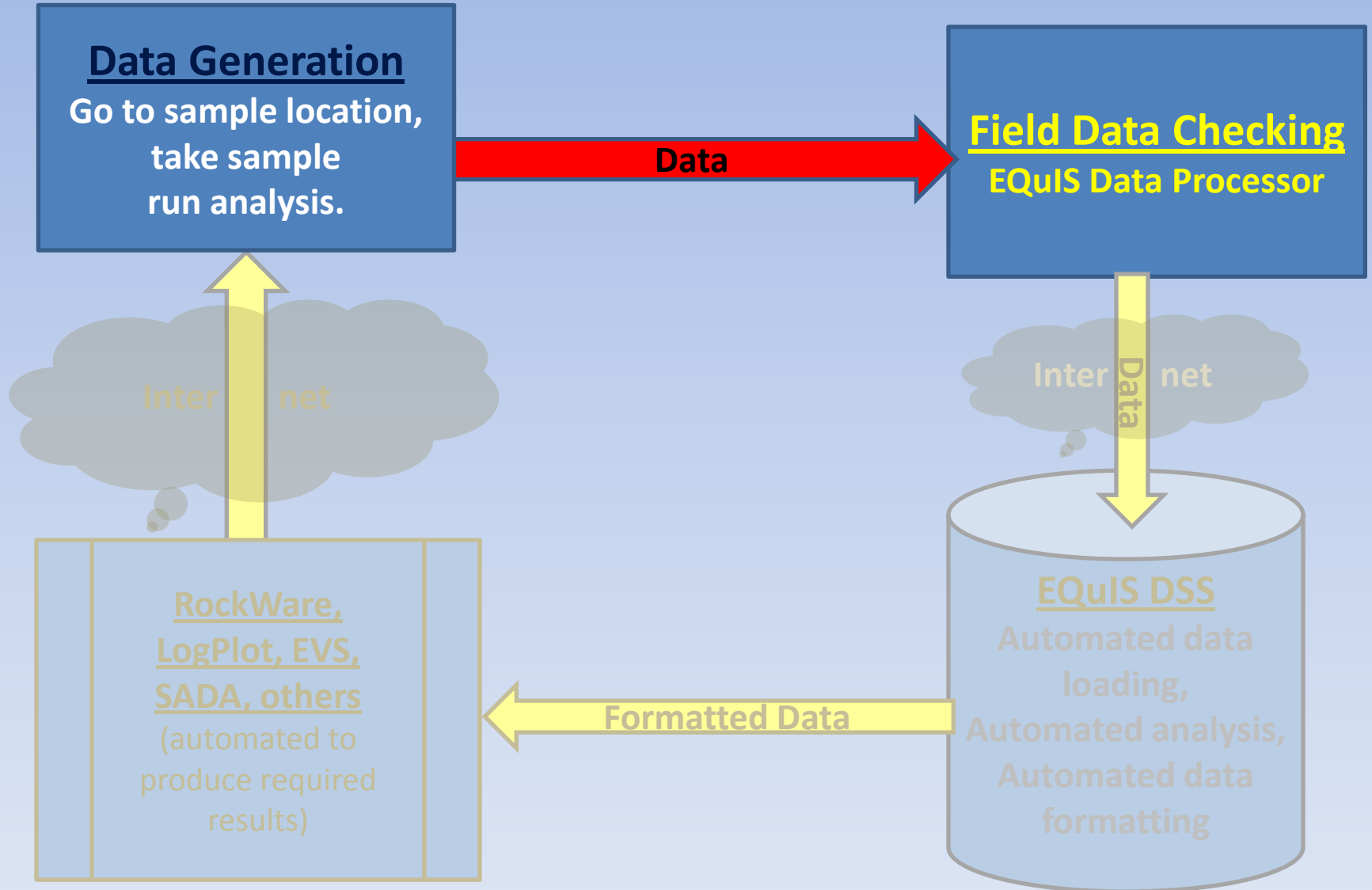


Data Generation

EQUS Data Gathering Engine (EDGE)



Database Automation in Field Investigation



Field Data Checking

EQUS Data Processor

File Edit View Tools Help

Clear Table

Rows: 9 of 9 [Comment Rows]

Line	sys_sample_code	sample_type_code	parent_sample_code	sample_date	sample_time	sys_loc_code	sta
1	#sys_sample_code	sample_type_code	parent_sample_code	sample_date	sample_time	sys_loc_code	start
2	120505-04-KW	N		12/05/2005		BH14	
3	120505-05-KW	N		12/05/2005		BH12	
4	120505-01-KW	N		12/05/2005		BH1	
5	120505-02-KW	BR	120505-01-KW	12/05/2005		BH1	
6	120505-03-KW	SD		12/05/2005		BH1	
7	120505-06-KW	N		12/05/2005		BH22	
8	120505-07-KW	TB				Trip Blank	
9	120505-08-KW	TS				Trip Spike	

Sample_date cannot be null when when sample_type_code=TB, N, MB, FD, FB, EB, AB. (1

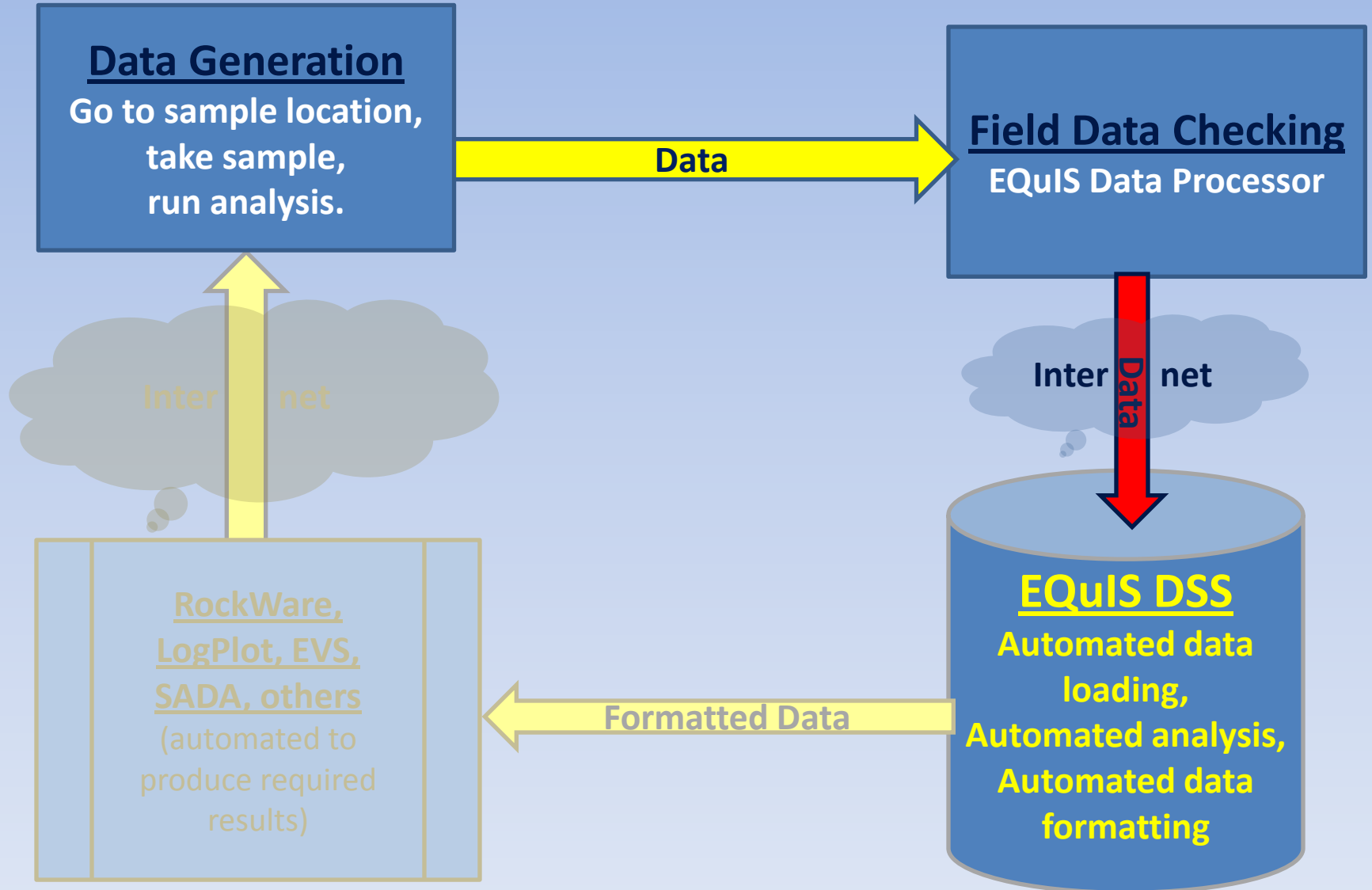
Field

- ProjectDetails
- Location
- Well
- DrillActivity
- SampleParameter
- Lithology
- LocationParamete
- WaterTable
- WaterLevel
- WellConstruction
- FieldMeasurement
- EFW2FSample

Lab

- EFW2LabSMP
- EFW2LabTST
- EFW2LabRES
- EFW2LabBCH

Database Automation in Field Investigation



Decision Support System

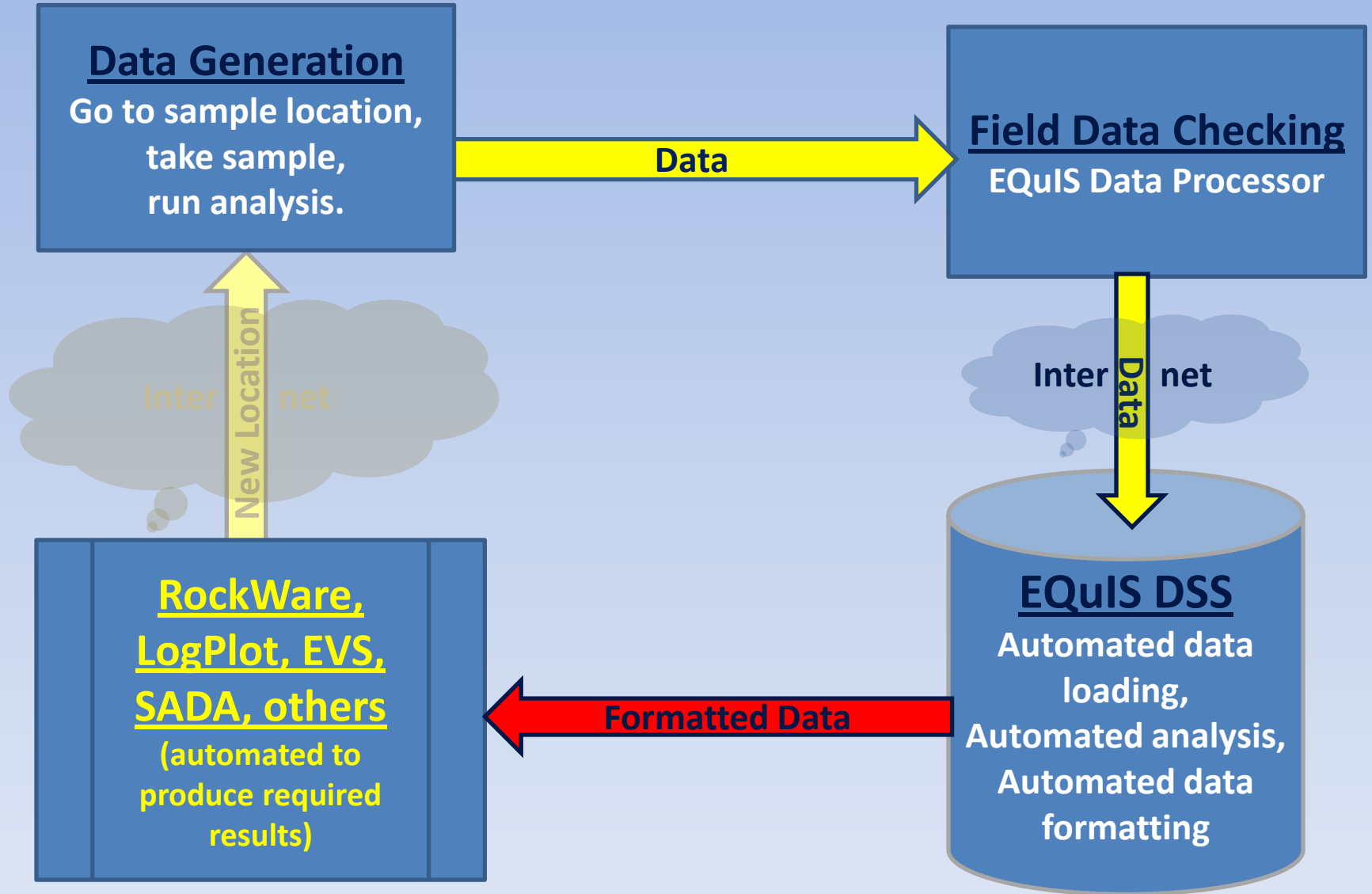
The screenshot shows the EQUS 5 Professional software interface. The window title is "EQUS 5 Professional". The interface is organized into four main functional areas, each with a set of icons and labels:

- Import:** Contains icons for "EDD (EDP)" and "EQUS 3.x Database".
- Edit:** Contains icons for "Action Levels", "Groups", and "Active Reports".
- Open:** Contains icons for "Reference Tables", "Data Tables", "Views", "Reports", and "Forms".
- Tools:** Contains icons for "Lithology", "Isopleth", "Vertical Profile", and "SPM".

The bottom of the screen shows the Windows taskbar with the following information:

- User: Arnold-PC\Arnold
- Current Directory: ARNOLD-PC\SQLXPRESS\Training\Springfield
- Running Application: Microsoft SQL Server 2005 - Express Edition

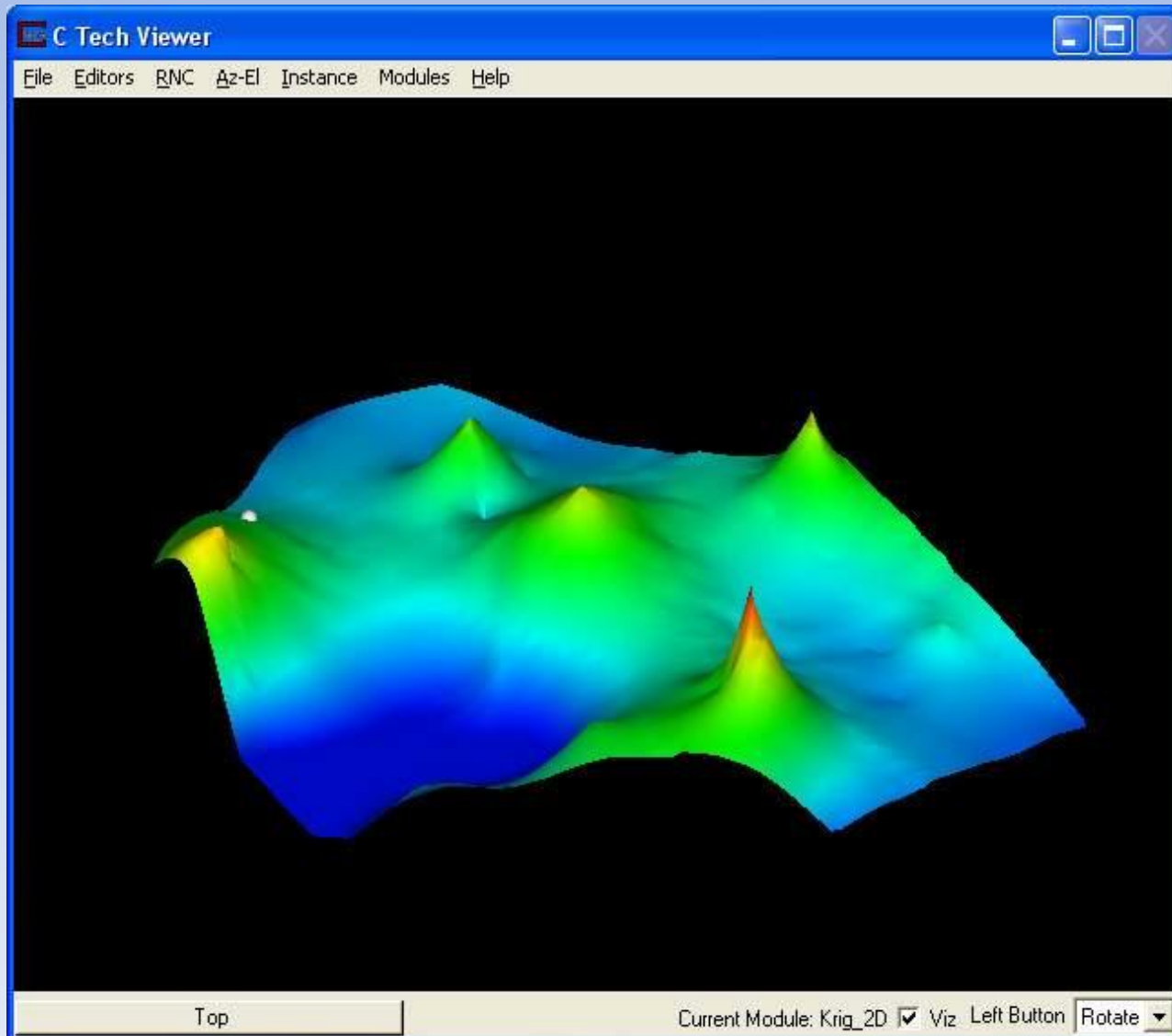
Database Automation in Field Investigation



Data Analysis

Confidence level enhancement—EVS by C Tech

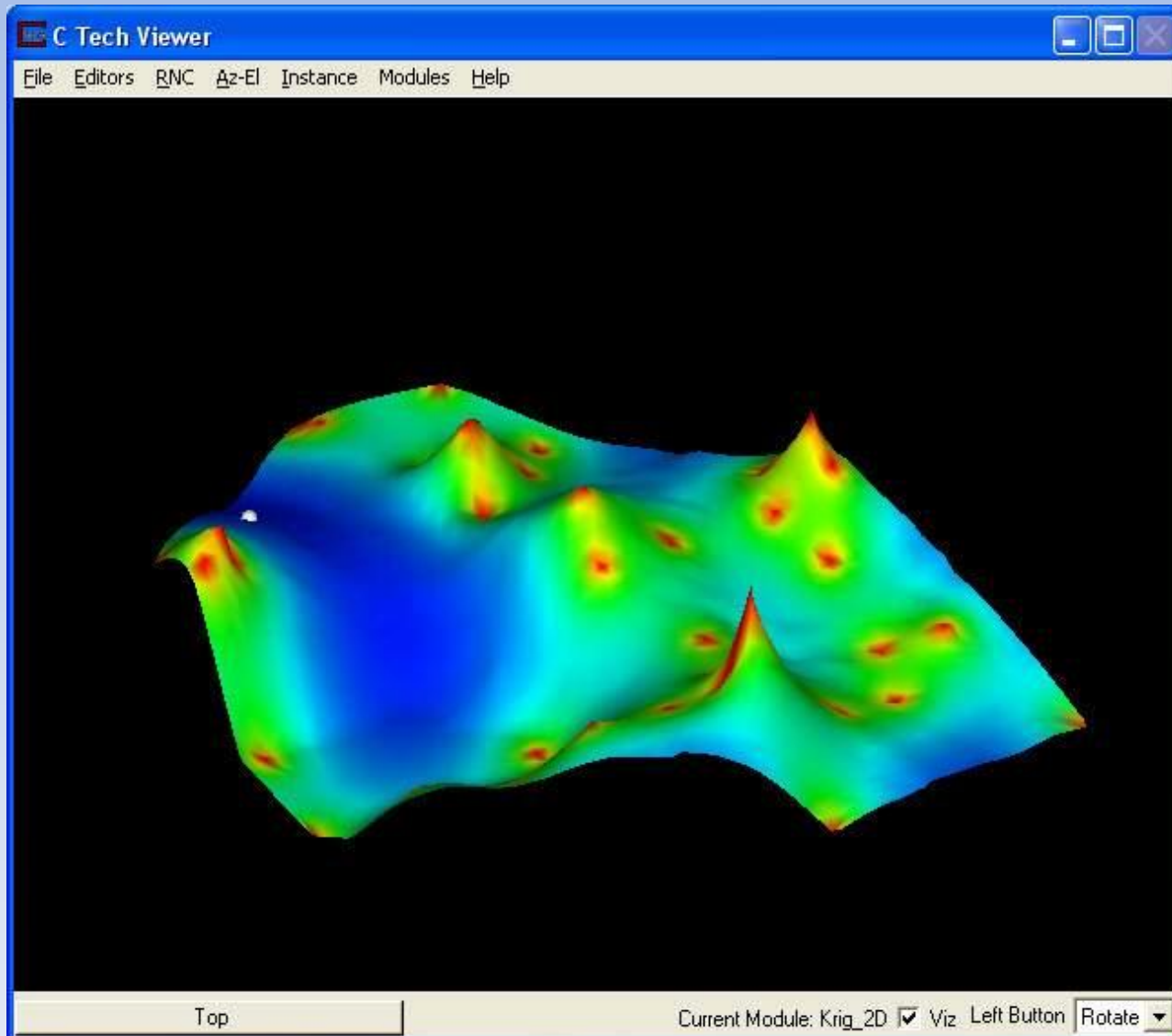
Results from initial biased screening



Data Analysis

Confidence level enhancement—EVS by C Tech

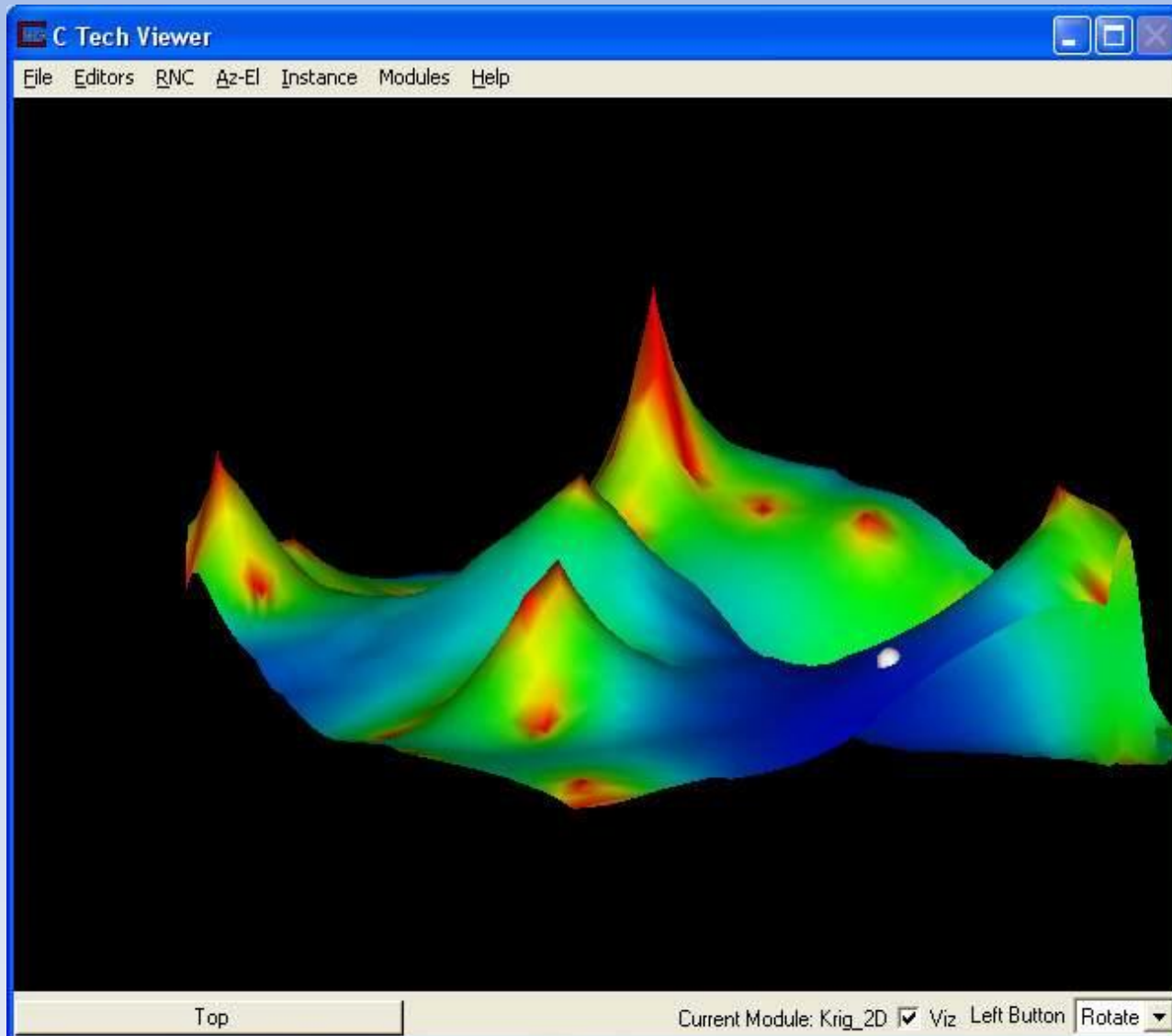
Highest confidence levels



Data Analysis

Confidence level enhancement—EVS by C Tech

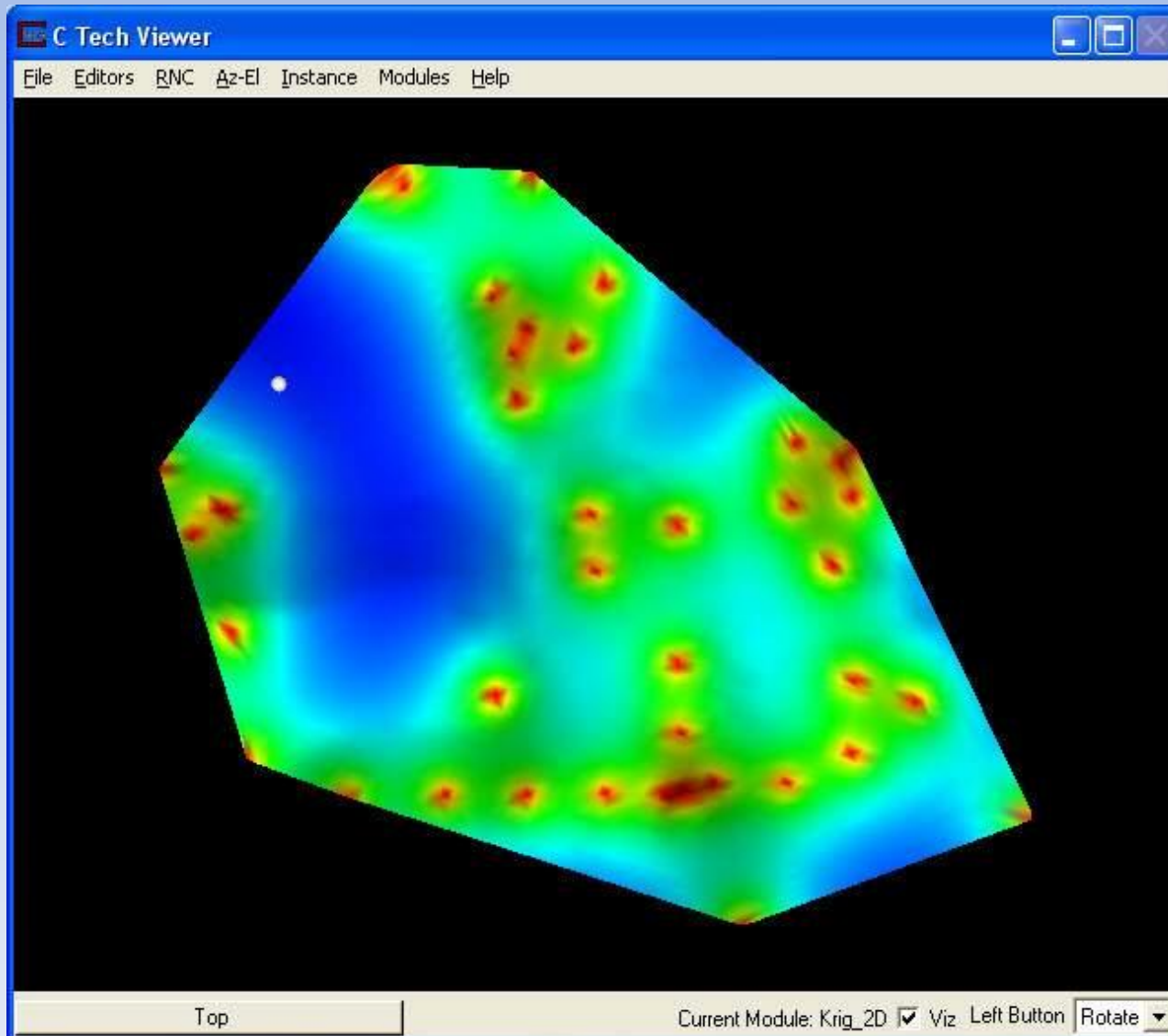
Confidences plus Concentrations



Data Analysis

Confidence level enhancement—EVS by C Tech

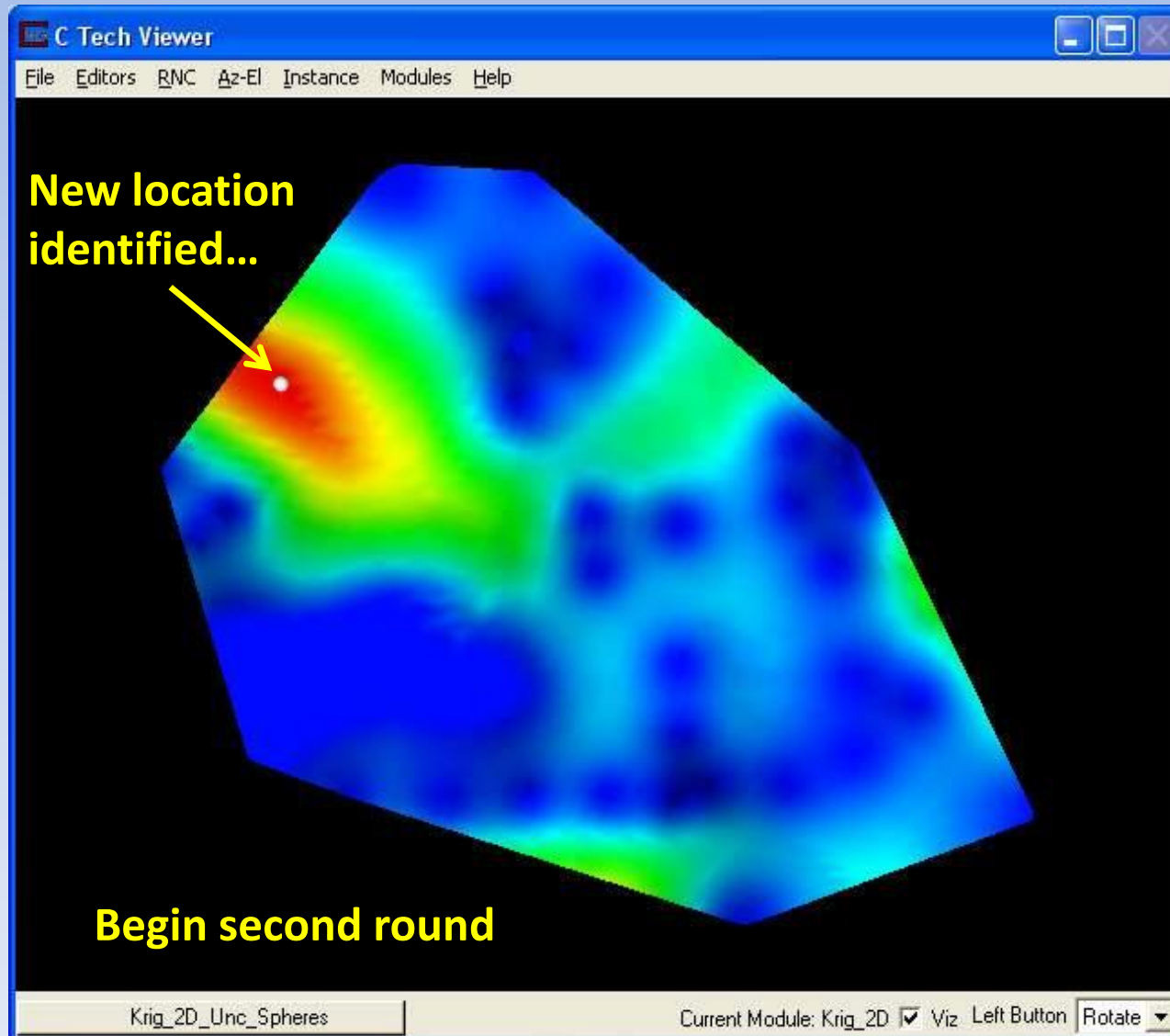
Confidences plus Concentrations Plan View



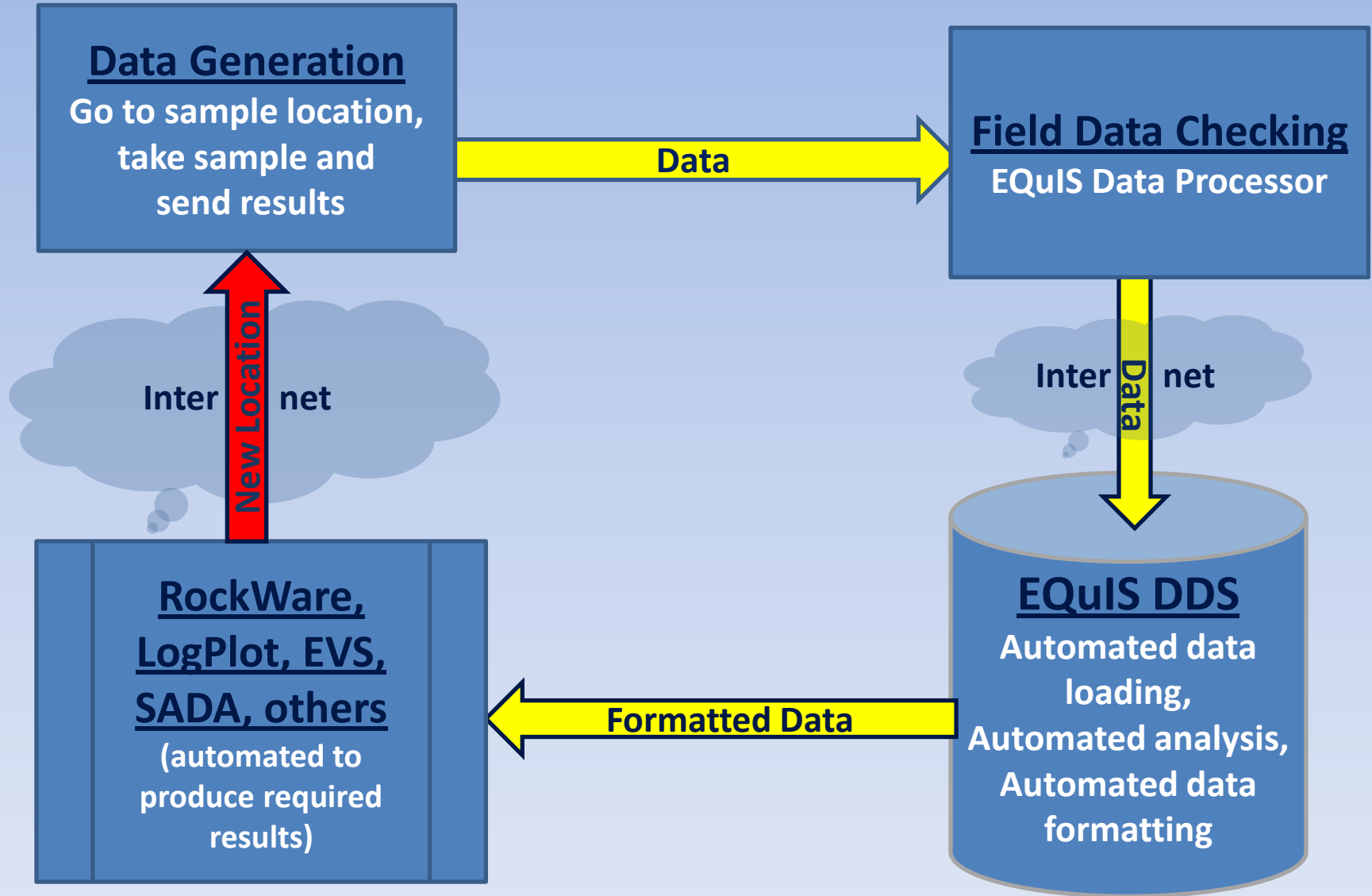
Data Analysis

Confidence level enhancement—EVS by C Tech

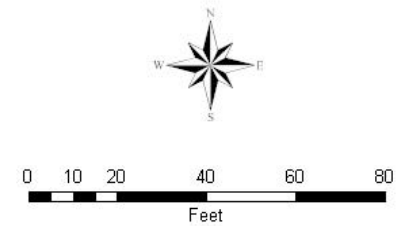
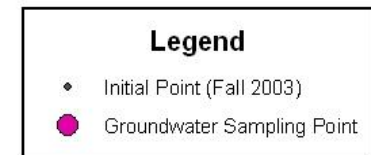
Convert to highest uncertainty



Database Automation in Field Investigation

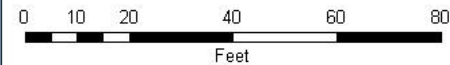
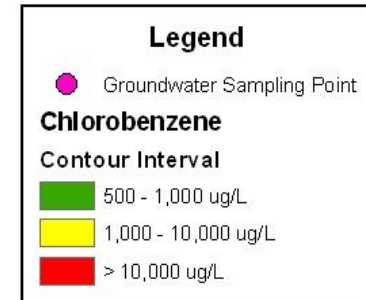


Preliminary Data Points



Sample Size

Initial Conceptual Site Model

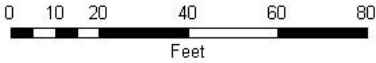


Groundwater Delineation Points – Day 1



Legend

- Groundwater Sampling Point
- Day1 Sampling Locations

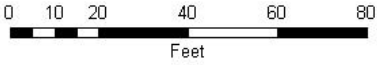


Groundwater Delineation Points – Day 2

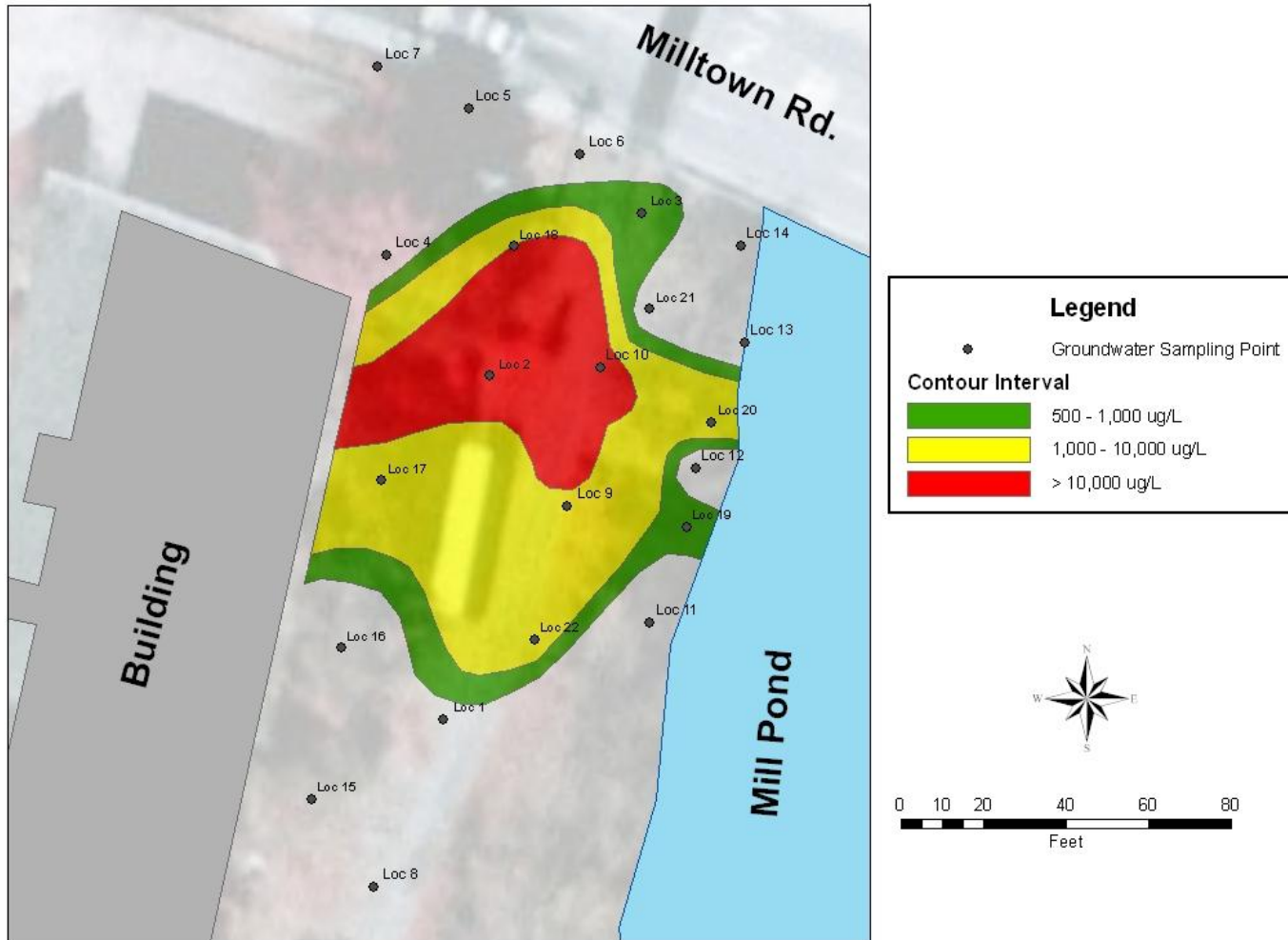


Legend

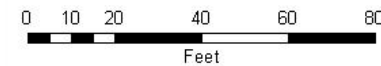
- Groundwater Sampling Point
- Day 2 Sampling Locations



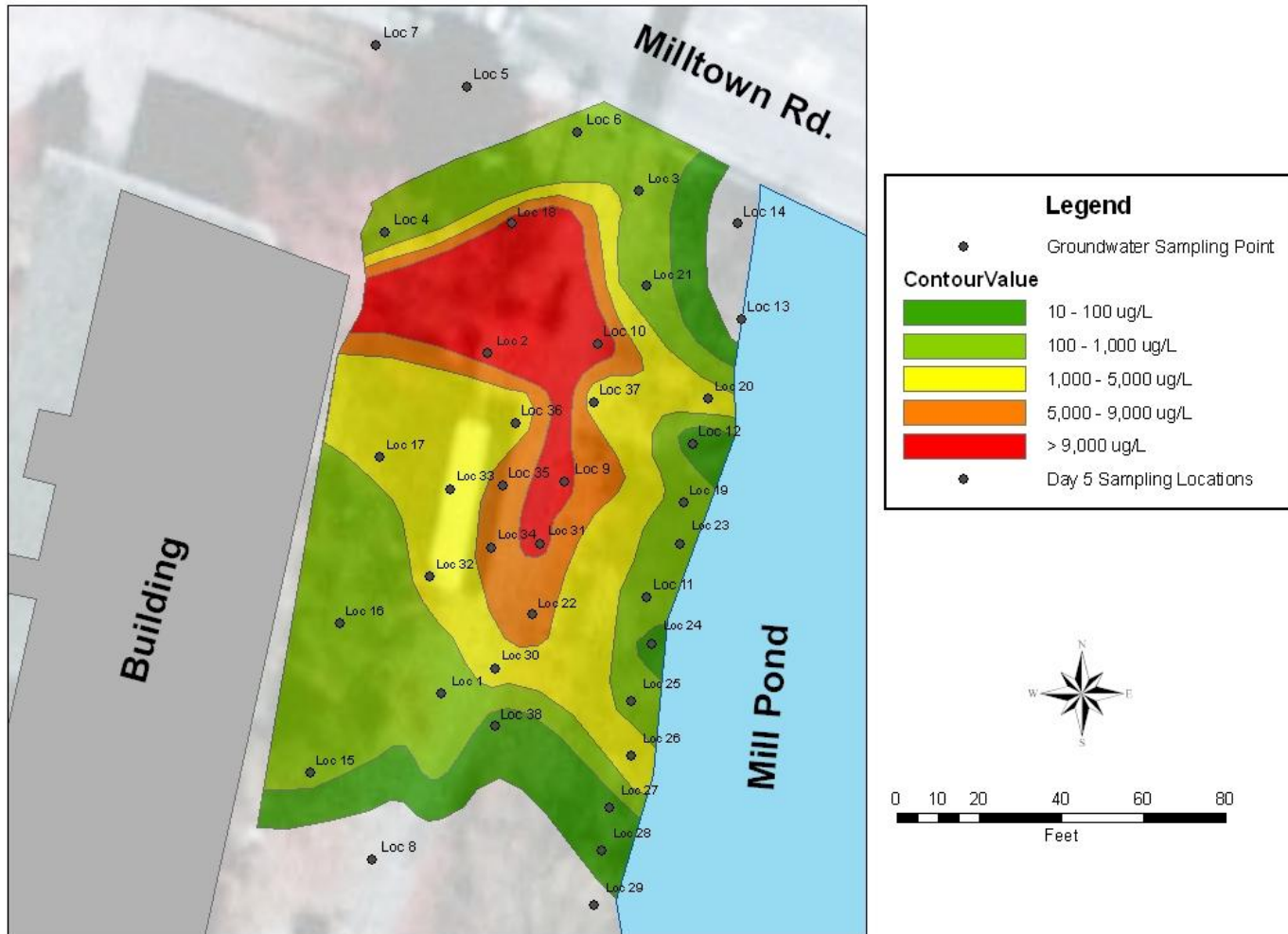
Modified CSM After 2 Days



Groundwater Delineation Points – Days 3 to 5



Final Conceptual Site Model



Map: demonstrates only 2 dimensional extent of contamination.

Data Visualization

Data visualization is key to making data understandable in the Triad Approach.

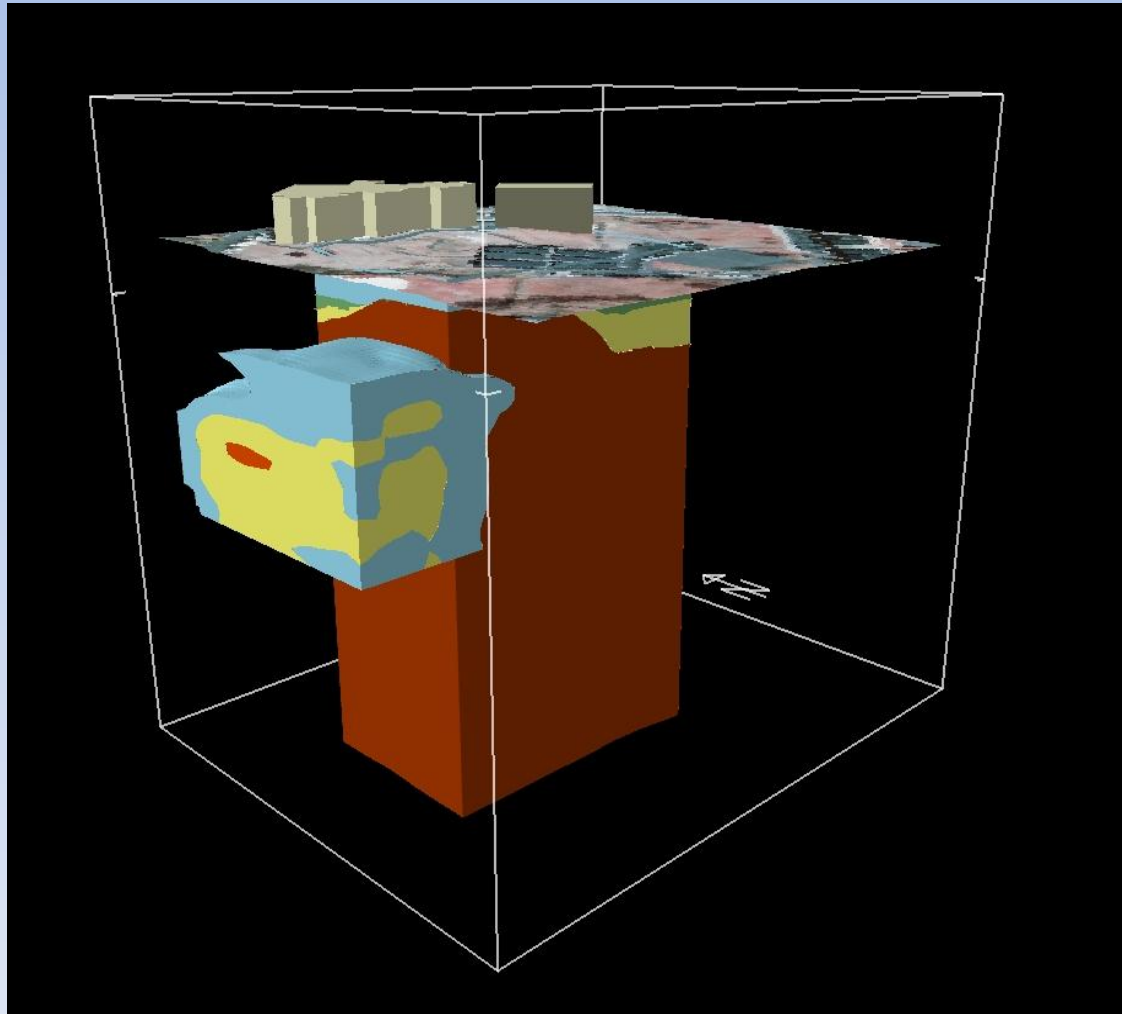
Knowledge Transfer—Scientist to management to public.

Social Capital—overcome sense of mistrust.

Share Results—convert “data” into useful information.

Decision Support System—should make it simple to visualize data from many sources and analyzed using the appropriate environmental analytic applications for the particular problem.

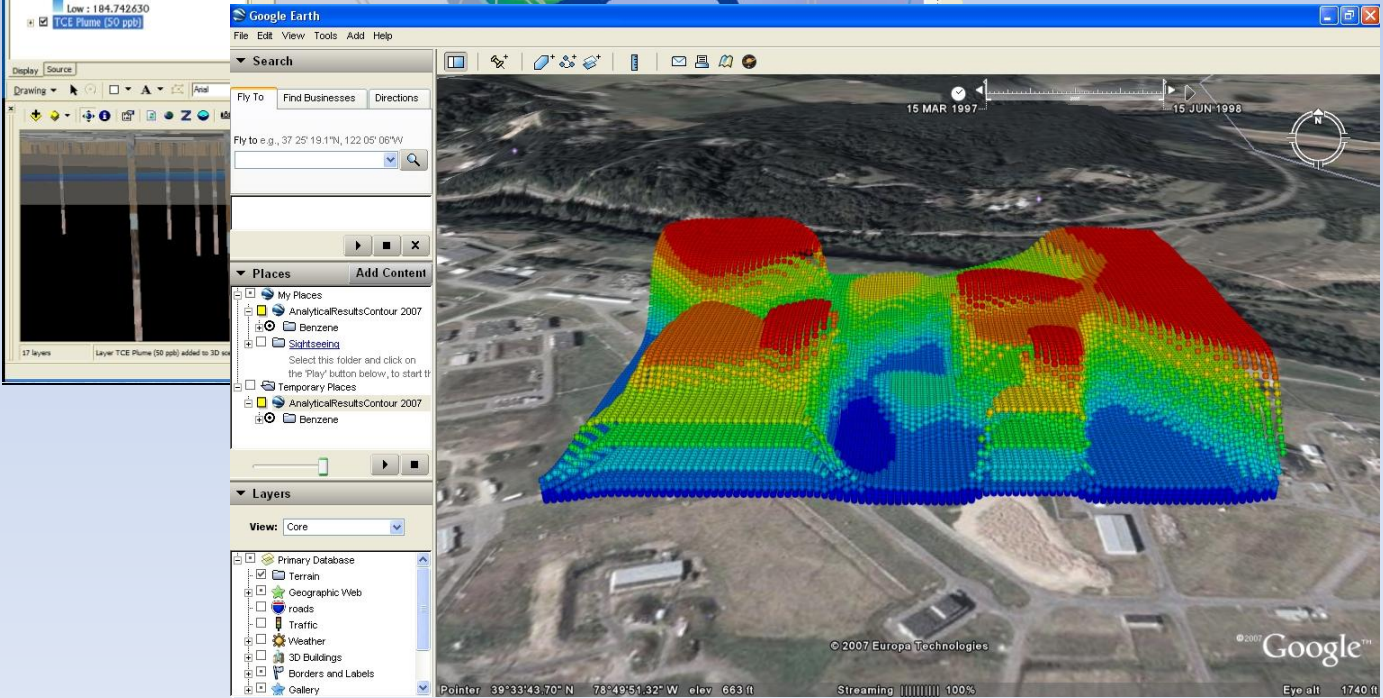
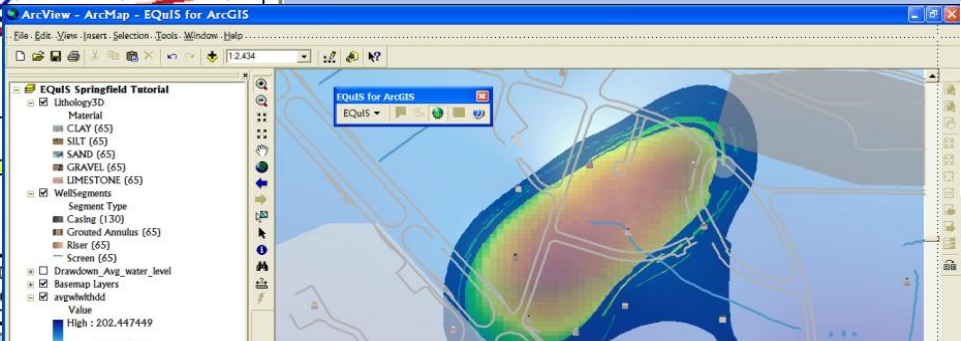
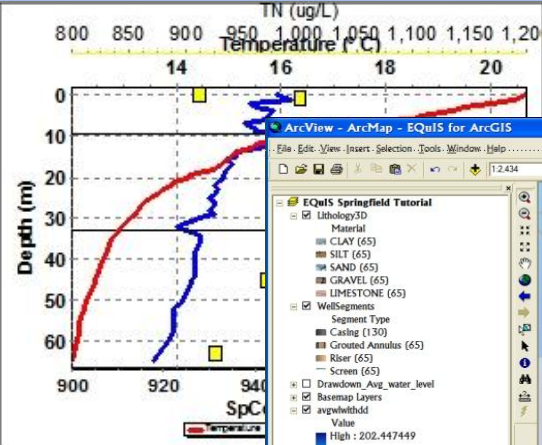
3-dimensional model of MIP response with interpreted geology



Data Visualization

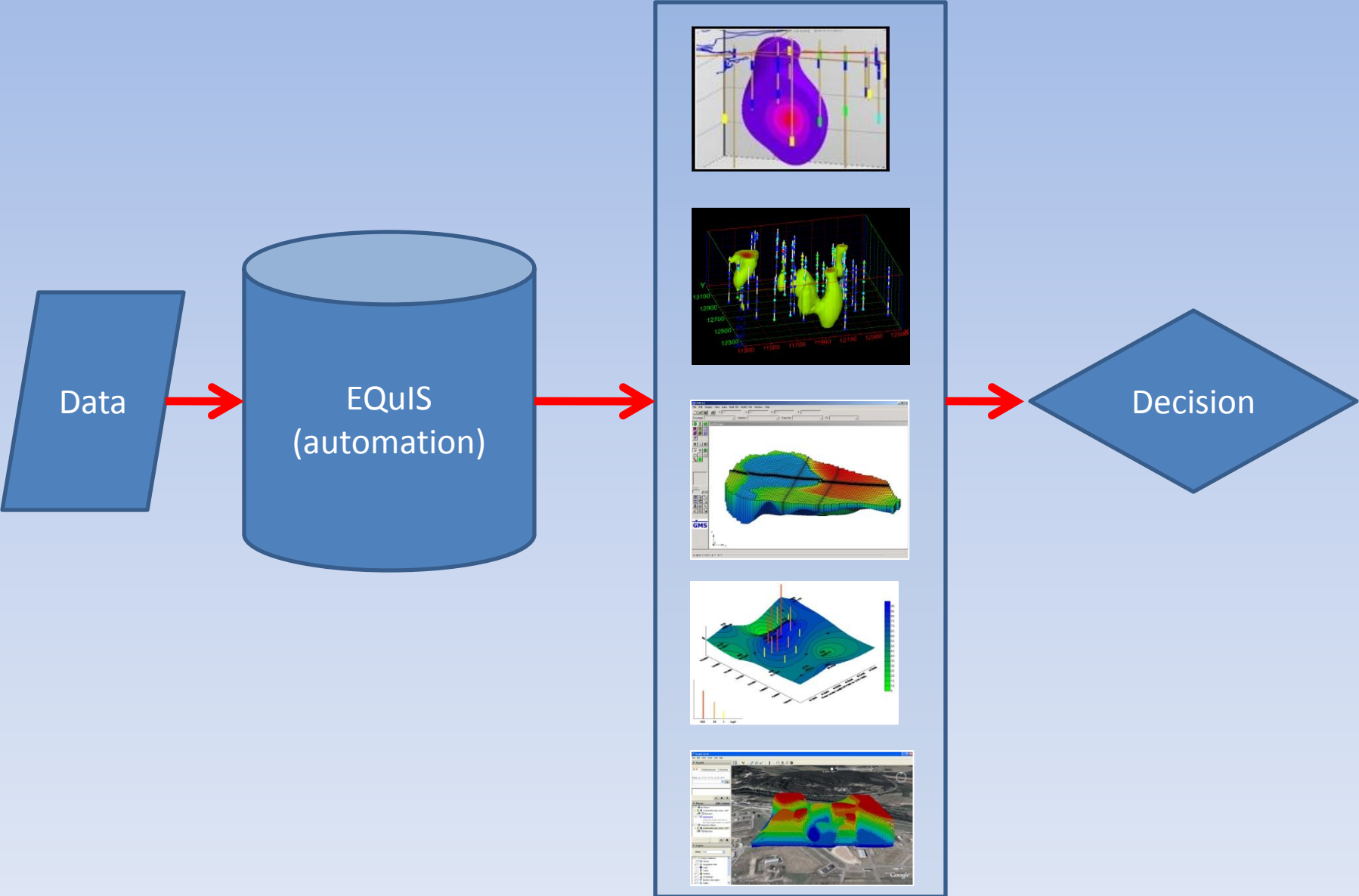
Graphs and charts

Geographic Information Systems



Google Earth—Everyman's system

Data Visualization



Comparative Issues

- **Laboratory Issues / Data Validation:**
 - CLP data, validation through certification
 - Other Lab data, lab validation checked independently
 - Most lab data...not so much...
 - So why such high reliance on “formal” methodology?
 - Mix n match analytic methods—total + dissolved?
 - Heterogeneity- Almost all sites are a complex system of soil, groundwater, surface water, etc., that interact w/chemicals released into the environment
 - Extrapolating small data sets to reflect larger portions of matrix is almost ALWAYS inaccurate & misleading

Comparative Issues

- **QA of Triad Field Methodology:**
 - Still not fully trusted
 - Regulatory technical requirement documents could reduce RP uncertainty leading to increased Triad implementations.
- **Research still needed:**
 - Documented cost comparisons
 - Reliability and validity demonstrations
 - Historic fill areas
 - Northeast fly-ash deposition

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