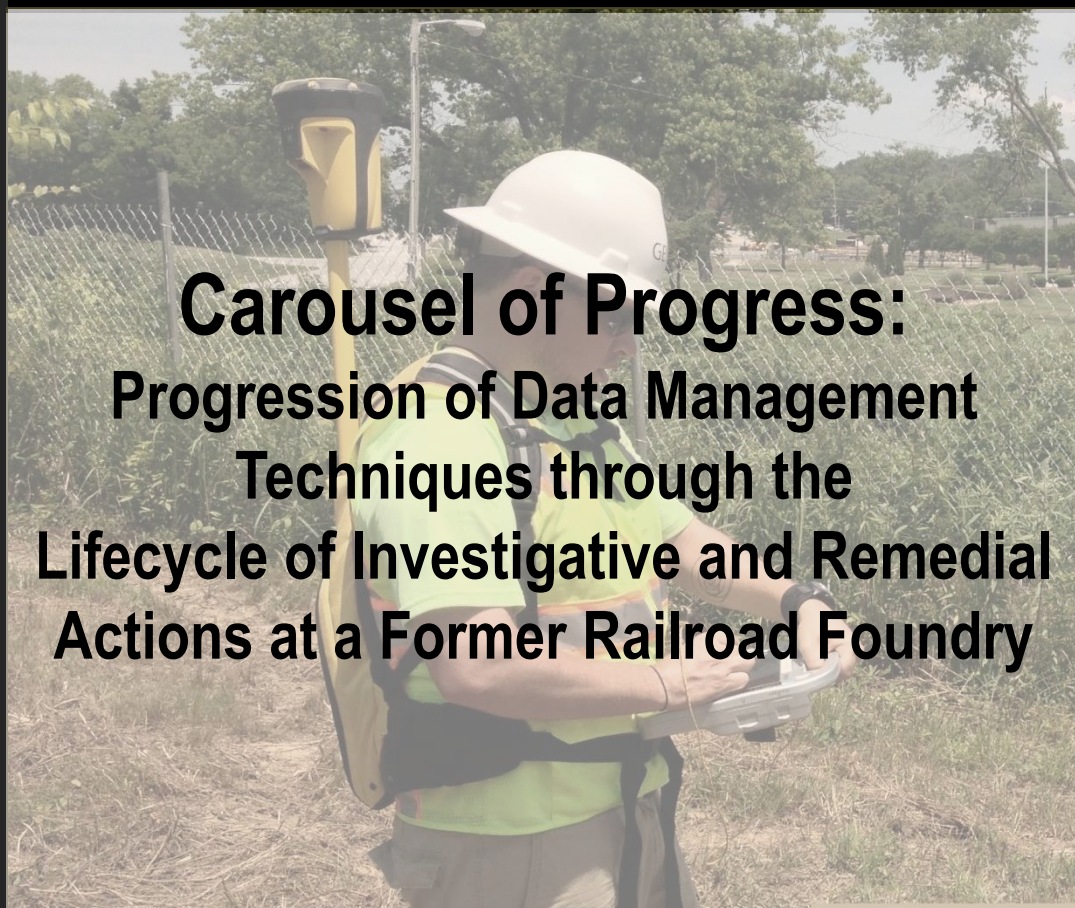
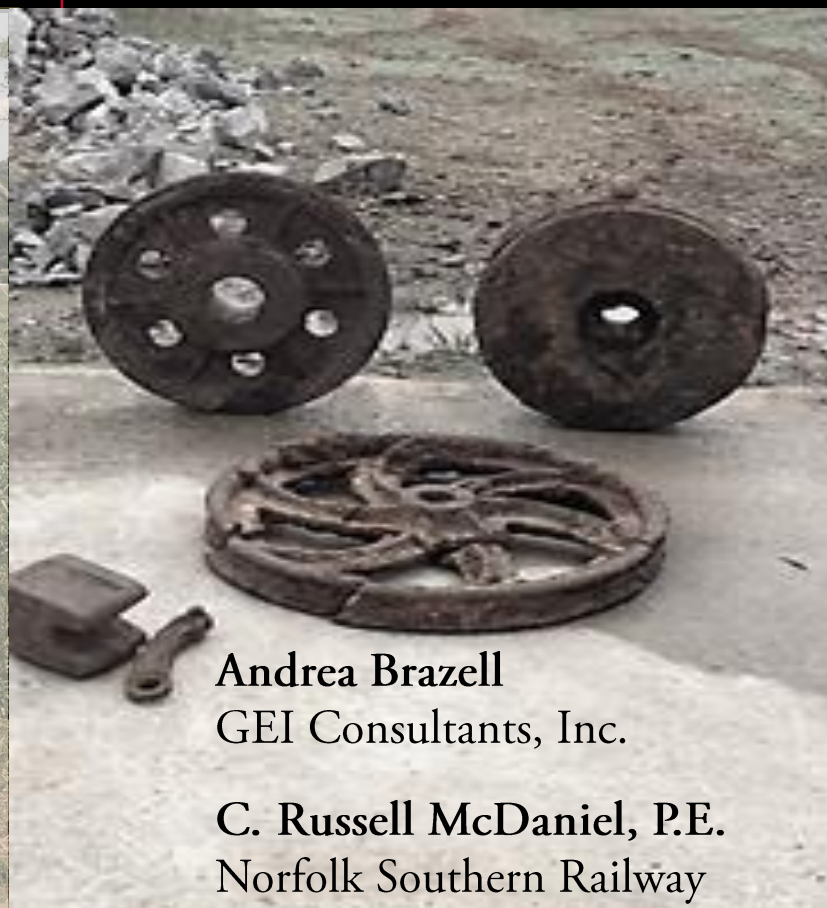


Progression of Data Management



**Carousel of Progress:
Progression of Data Management
Techniques through the
Lifecycle of Investigative and Remedial
Actions at a Former Railroad Foundry**



Andrea Brazell
GEI Consultants, Inc.

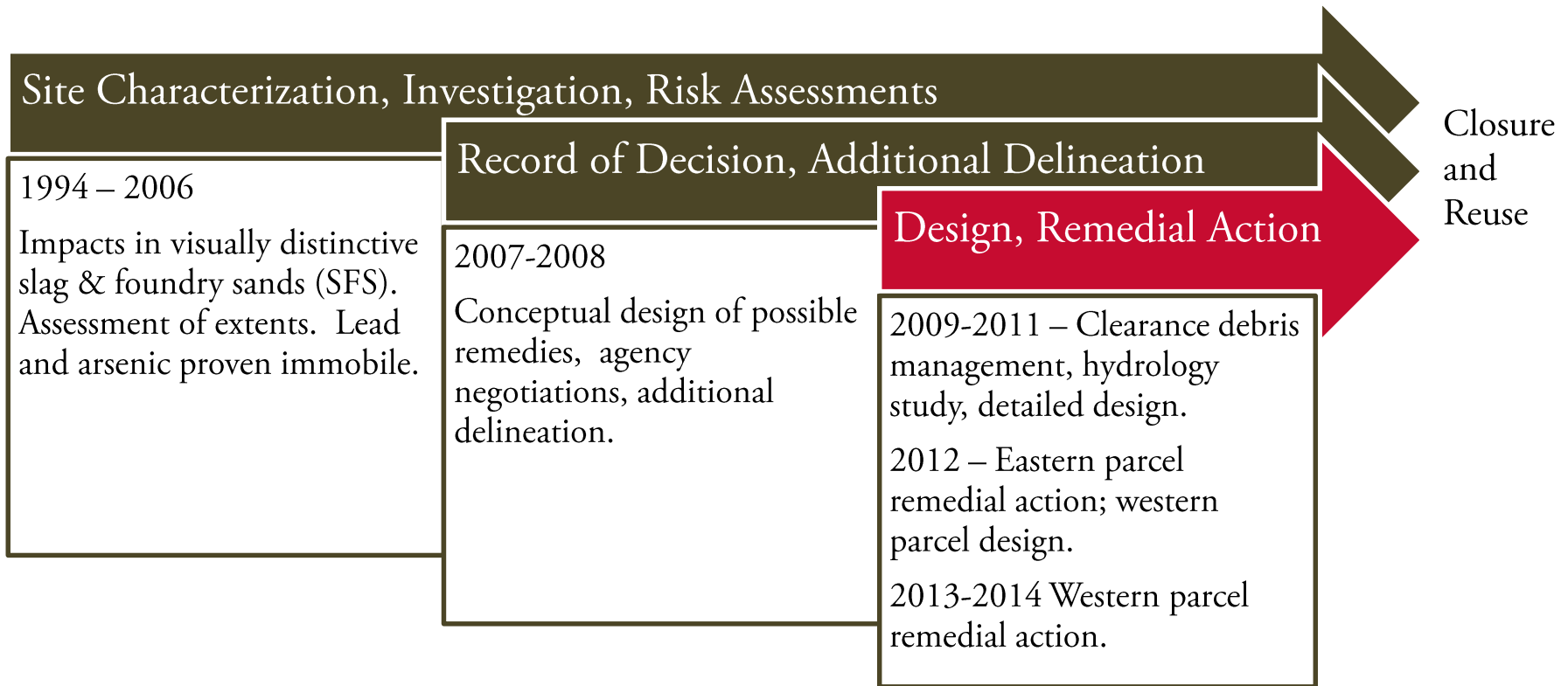
C. Russell McDaniel, P.E.
Norfolk Southern Railway



Railroad Environmental Conference
University of Illinois, Urbana-Champaign
October 28 - 29, 2014



Site Regulatory Setting and Timeline





Lenoir Car Works History and Operation





Investigation through Remediation



Investigation



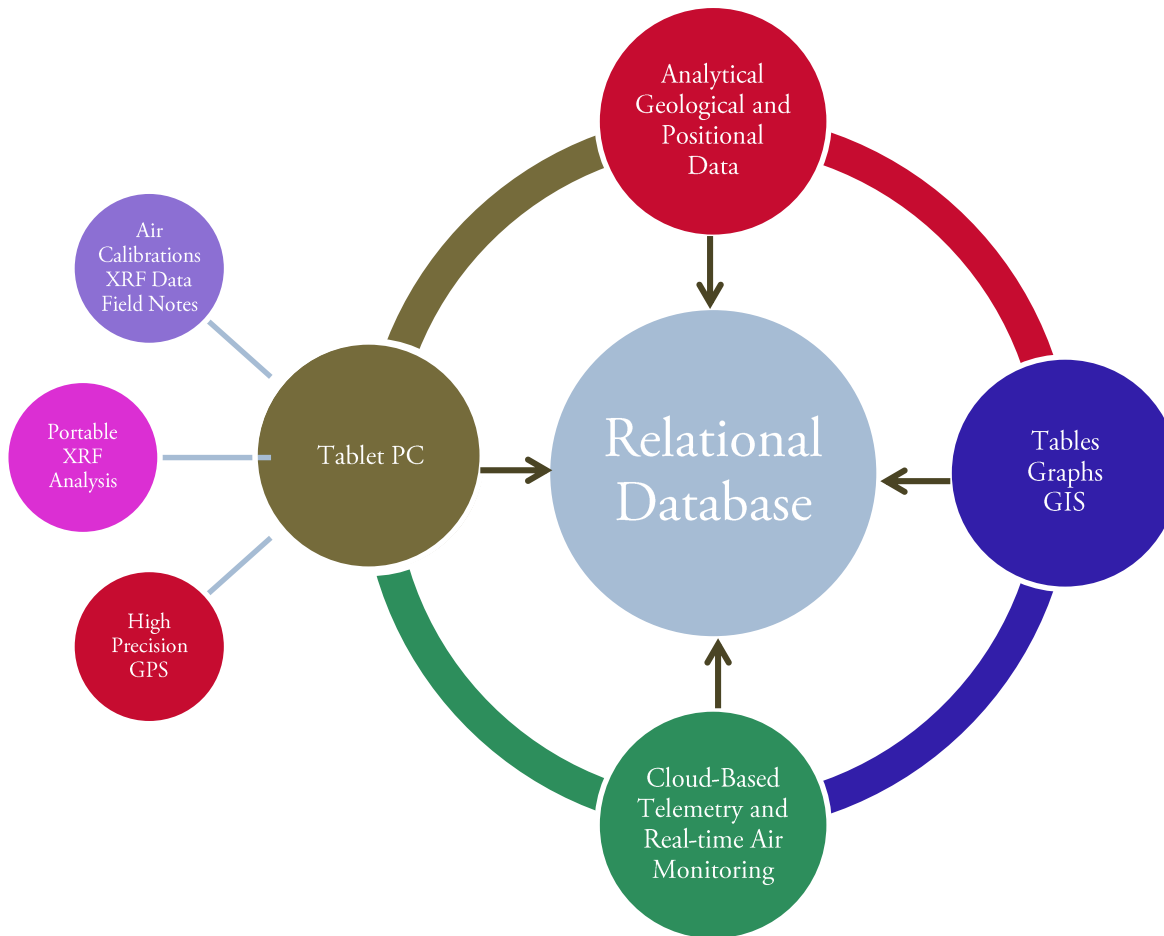


Investigation through Remediation





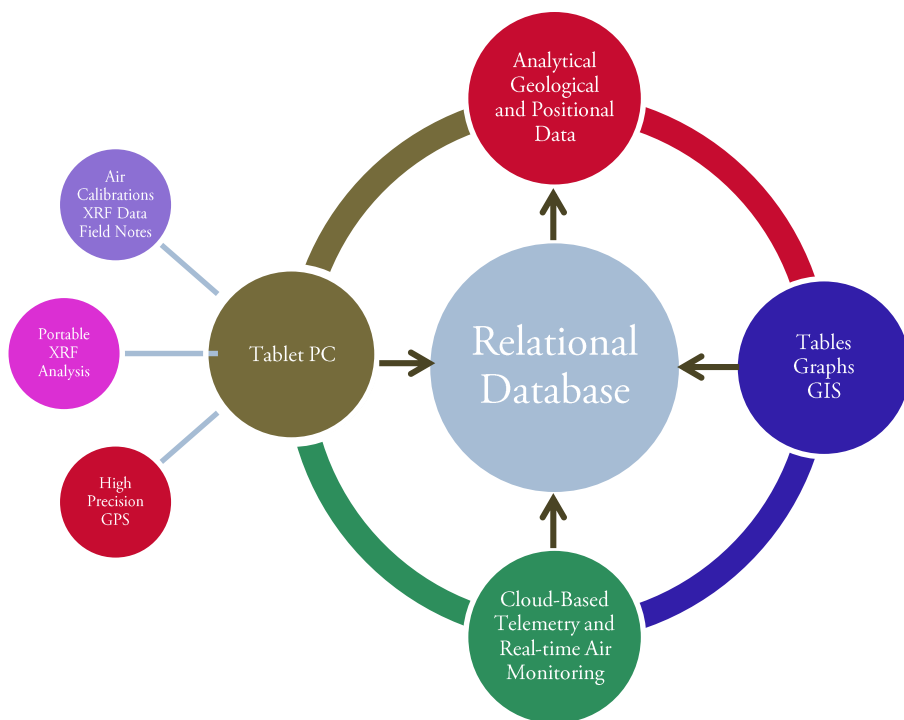
Carousel of Progress – Data Management





Historical Data

Analytical Geological and Positional Data



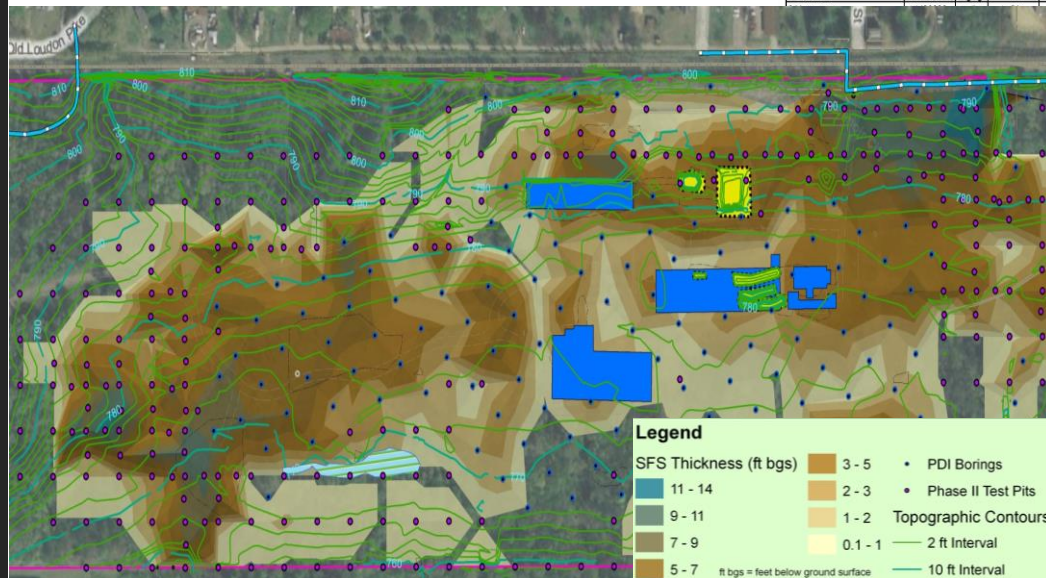
Historical Data



©Ron Leishman * illustrationsOf.com/437551

Table 3-2
Chemical Analytical Results - Off-Site Potential Borrow Source 12: Capping Soil and Topsoil
Former Car Works Site
Lenoir City, TN

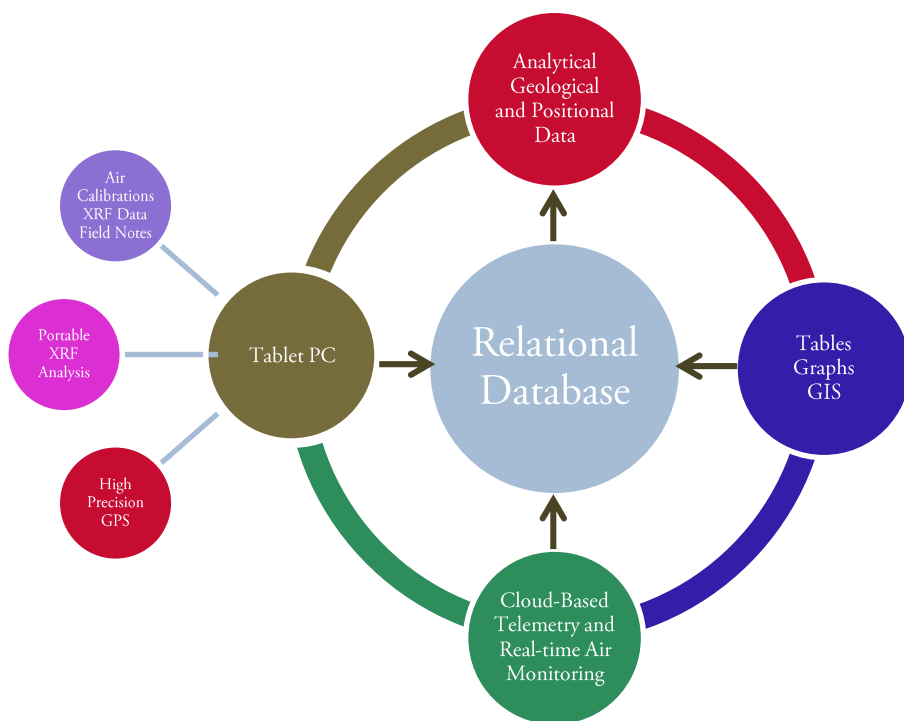
Compounds	Industrial Screening Levels	Units	Sampling Locations															
			BZTS1	BZTS2	BZTS3	BS1CAP1	BS1CAP2	BS1CAP2 DUP	BS1CAP3	BS1CAP4	BS1CAP5	BS2CAP1	BS	BS	BS	BS	BS	
Volatile Organic Compounds																		
1,1,1-Trichloroethane	38000000	ug/kg	<5.4	<5.7	<5.8	<6.3	<5.9	<6.0	<6.2	<6.6	<6.1	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
1,1,2,2-Tetrachloroethane	2900	ug/kg	<5.4	<5.7	<5.8	<6.3	<5.9	<6.0	<6.2	<6.6	<6.1	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
1,1,2-Trichloroethane	5300	ug/kg	<5.4	<5.7	<5.8	<6.3	<5.9	<6.0	<6.2	<6.6	<6.1	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
1,1-Dichloroethane	17000	ug/kg	<5.4	<5.7	<5.8	<6.3	<5.9	<6.0	<6.2	<6.6	<6.1	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
1,1-Dichloroethane	1100000	ug/kg	<5.4	<5.7	<5.8	<6.3	<5.9	<6.0	<6.2	<6.6	<6.1	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
1,2-Dichloroethane	2200	ug/kg	<5.4	<5.7	<5.8	<6.3	<5.9	<6.0	<6.2	<6.6	<6.1	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
1,2-Dichloroethane	—	ug/kg	<5.4	<5.7	<5.8	<6.3	<5.9	<6.0	<6.2	<6.6	<6.1	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
1,2-Dichloropropane	4500	ug/kg	<5.4	<5.7	<5.8	<6.3	<5.9	<6.0	<6.2	<6.6	<6.1	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
3-Butanone	200000000	ug/kg	<21	<23 U	<23	<25	<24 U	<24	<25 U	<26	<24 U	<25	<24	<25	<25	<25	<25	<25



<23	<23	<25	<24	<24	<25	<26	<24	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
<23	<23	<25	<24	<24	<25	<26	<24	<25	<26	<24	<25	<25	<25	<25	<25	<25	<25	<25
<23 U	<23 U	<25 U	<24 U	<24 U	<25 U	<26 U	<24 U	<25 U	<26 U	<24 U	<25 U	<25 U	<25 U	<25 U	<25 U	<25 U	<25 U	<25 U
<5.7	<5.8	<6.3	<5.9	<6.0	<6.2	<6.6	<6.1	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
<5.7	<5.8	<6.3	<5.9	<6.0	<6.2	<6.6	<6.1	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
<5.7	<5.8	<6.3	<5.9	<6.0	<6.2	<6.6	<6.1	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
<11	<12 U	<13 U	<12 U	<12 U	<12 U	<13 U	<12 U	<12 U	<12 U	<12 U	<12 U	<12 U	<12 U	<12 U	<12 U	<12 U	<12 U	<12 U
<5.7 U	<5.8 U	<6.3 U	<5.9 U	<6.0 U	<6.2 U	<6.6 U	<6.1 U	<6.2 U	<6.2 U	<6.2 U	<6.2 U	<6.2 U	<6.2 U	<6.2 U	<6.2 U	<6.2 U	<6.2 U	<6.2 U
<5.7	<5.8	<6.3	<5.9	<6.0	<6.2	<6.6	<6.1	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
<5.7	<5.8	<6.3	<5.9	<6.0	<6.2	<6.6	<6.1	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
<5.7	<5.8	<6.3	<5.9	<6.0	<6.2	<6.6	<6.1	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
<5.7	<5.8	<6.3	<5.9	<6.0	<6.2	<6.6	<6.1	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
<5.7	<5.8	<6.3	<5.9	<6.0	<6.2	<6.6	<6.1	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
<5.7 U	<5.8 U	0.27 J	0.27 J	<6.0 U	0.30 J	<6.6 U	<6.1 U	<6.2 U	<6.2 U	<6.2 U	<6.2 U	<6.2 U	<6.2 U	<6.2 U	<6.2 U	<6.2 U	<6.2 U	<6.2 U
<5.7	<5.8	<6.3	<5.9	<6.0	<6.2	<6.6	<6.1	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
<5.7	<5.8	<6.3	<5.9	<6.0	<6.2	<6.6	<6.1	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
<11	<12	<13	<12	<12	<12	<13	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12
<17	<17	<19	<18	<18	<19	<20	<18	<19	<20	<18	<19	<19	<19	<19	<19	<19	<19	<19
<35	<36	<40	<37	<37	<39	<40	<39	<37	<39	<41	<39	<37	<39	<41	<39	<37	<39	<37
<42	<43	<48	<44	<44	<47	<47	<46	<45	<47	<46	<45	<47	<46	<45	<47	<46	<45	<47
<39	<39	<44	<40	<40	<43	<43	<42	<41	<43	<45	<43	<41	<43	<45	<43	<41	<43	<41
<40	<41	<45	<42	<41	<44	<45	<44	<42	<44	<46	<44	<42	<44	<46	<44	<42	<44	<42
<40	<41	<45	<42	<41	<44	<45	<44	<42	<44	<46	<44	<42	<44	<46	<44	<42	<44	<42
<33	<34	<37	<34	<34	<37	<37	<36	<35	<37	<38	<37	<35	<37	<38	<37	<35	<37	<35
<40	<41	<45	<42	<41	<44	<45	<44	<42	<44	<46	<44	<42	<44	<46	<44	<42	<44	<42



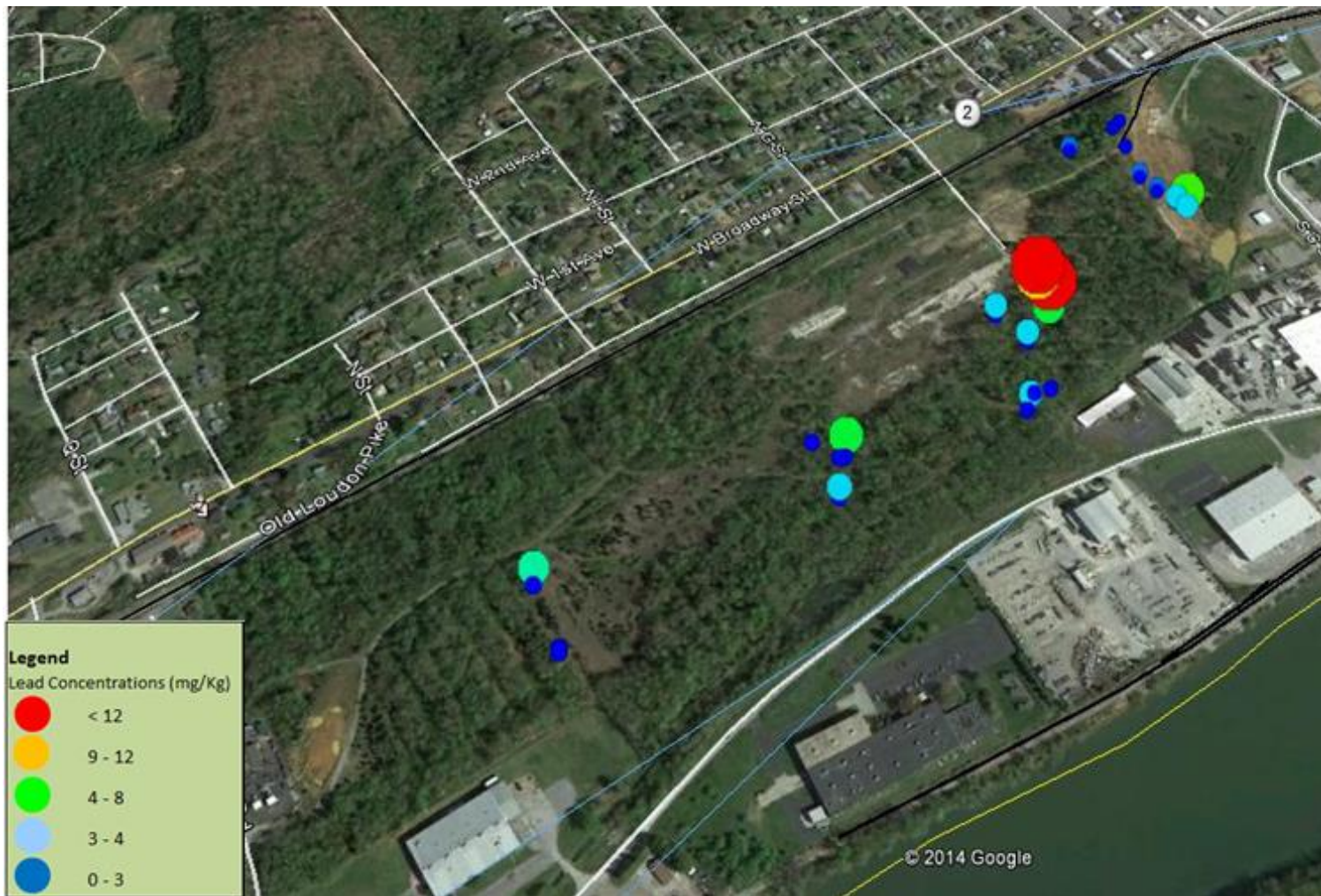
Analysis of Historical Data



Tables
Graphs
GIS



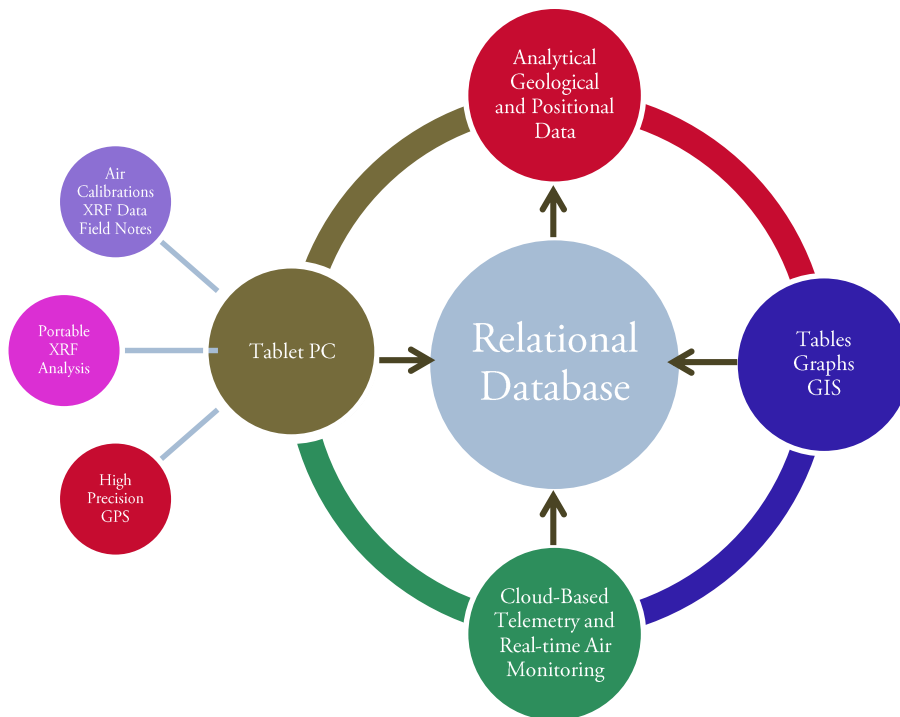
Tables, Graphs, and GIS



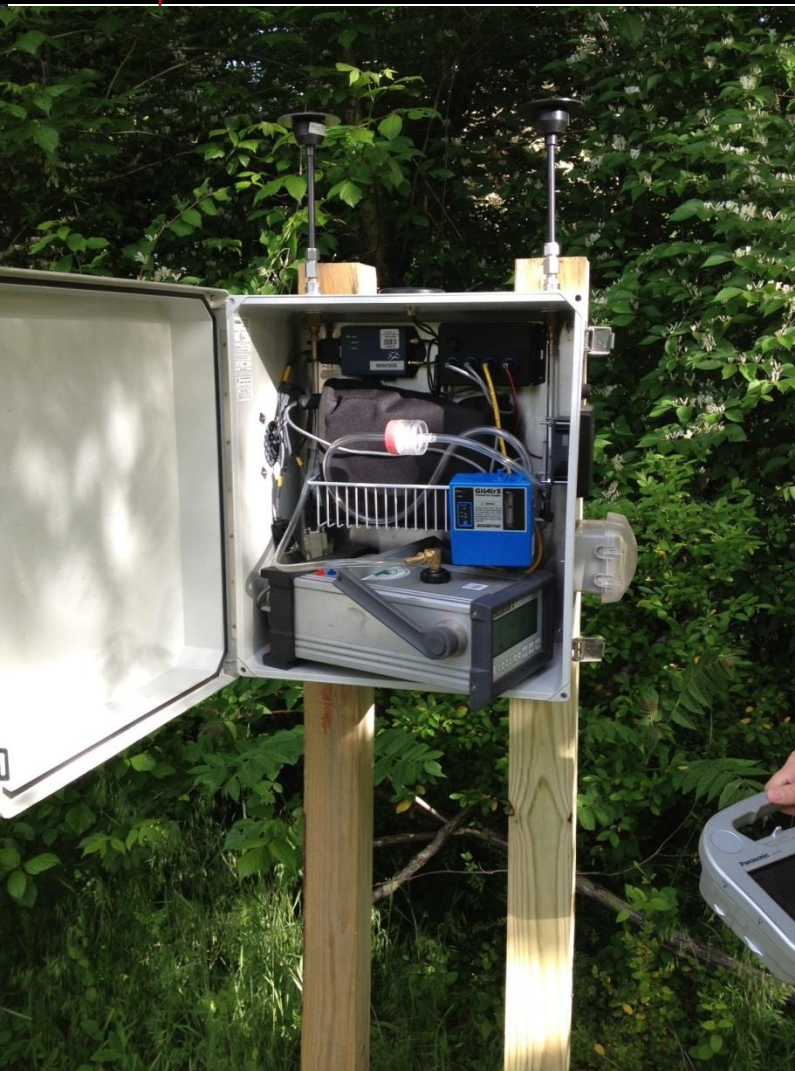


Real-time Data

Cloud-Based
Telemetry and
Real-time Air
Monitoring



Cloud-Based Telemetry and Real-time Air Monitoring



Dashboard **Monitor** Alerts Map Files Notes Forum Tutorials

TC00817779 [ASWP-01R_23591]

From 2014-10-02 To 2014-10-03 simple

Show

Select a Node
TC00817779 [ASWP-01R_23591] [add to dashboard](#)

Last Measurement

All

- Batt. Voltage: 11.74 V
- Current: 71.96 mA +9.2
- Air Pressure: 990.2 hPa
- Dewpoint: 35.9 °F +0.5
- Precipitation: 0.0 in
- Precipitation Intensity: 0.0 in/h
- Relative Humidity: 47.7 % +0.9
- Temperature: 55.4 °F
- Total Precipitation: 0.0 in
- Wind Direction: 201.3 °
- Wind Speed: 6.9 mph +0.1
- Humidity: 30.0 %
- Mass: 3.7 µg/m³ +0.7
- Particle size: 0.344 µm
- Temperature: 100.7 °F -0.1
- TWA: 0.0 µg/m³ -11.4
- Mass (Avg15): 5.2 µg/m³
- Mass (Avg30): 6.5 µg/m³
- Mass (Avg60): 5.0 µg/m³ -0.1

Last update 4 minutes

Graph Table

TC00817779
October 02, 2014 12:00 to October 03, 2014 12:00 (GMT-4)

Parameters

Parameters	Minimum	Average	Maximum
DataRAM4(C) > Mass (Avg15), µg/m³	3.200 µg/m³	5.12 µg/m³	8.200 µg/m³
DataRAM4(C) > Mass (Avg30), µg/m³	3.400 µg/m³	5.15 µg/m³	8.400 µg/m³
<none>	—	—	—

line chart histogram



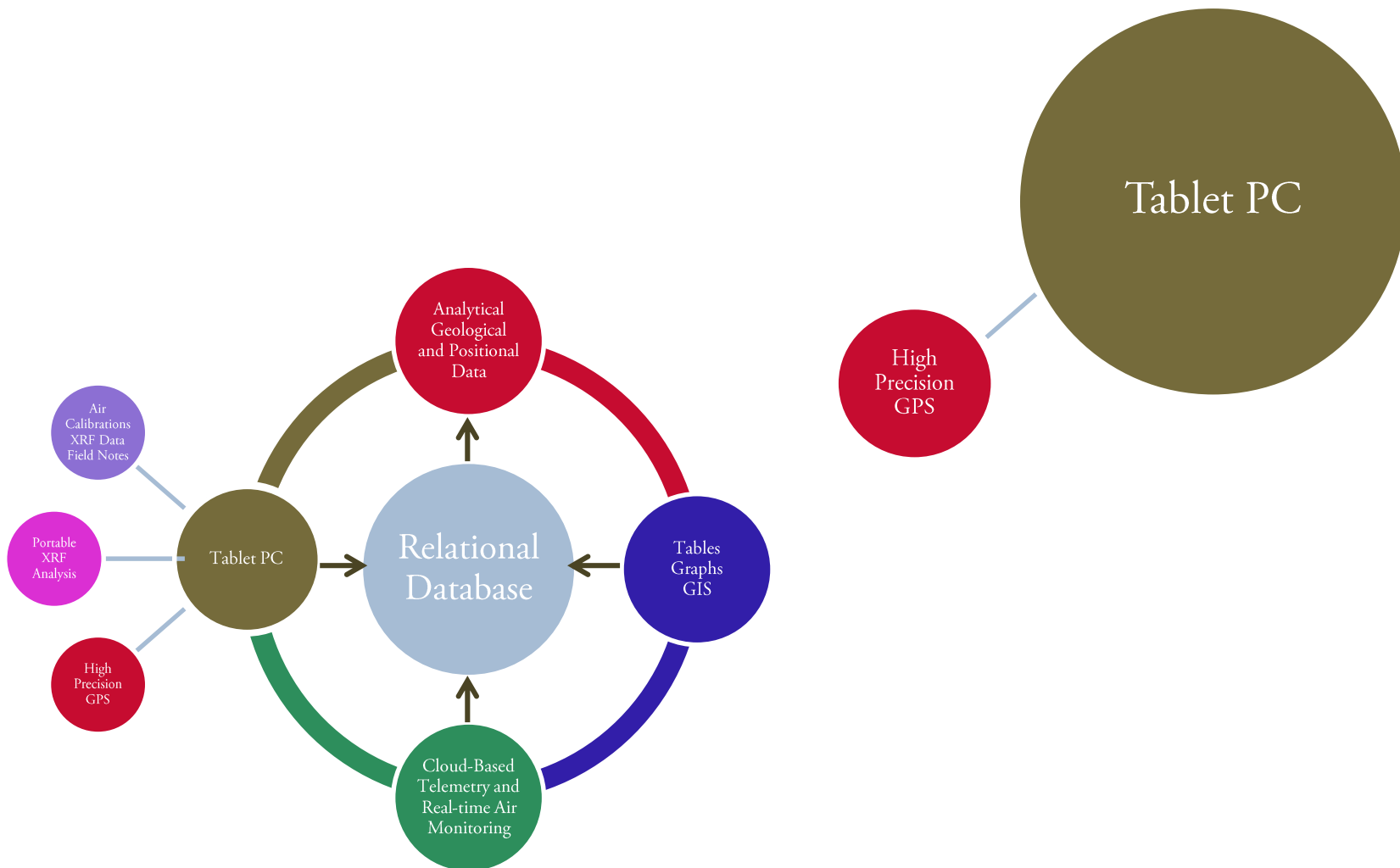
Technology Investments

- High Precision GPS
- Ruggedized Tablet PC with Camera and Wifi
- EDGE™ Software





High Precision GPS





Tablet PC and High Precision GPS



Terrasync

Map 10 23in 134

Options Layers

35°47'13.216"N
84°16'17.260"W

A56 A57 A58 A59 A60
B57 B58 B59 B60 B61
C59 C60 C61
D60

0 50ft

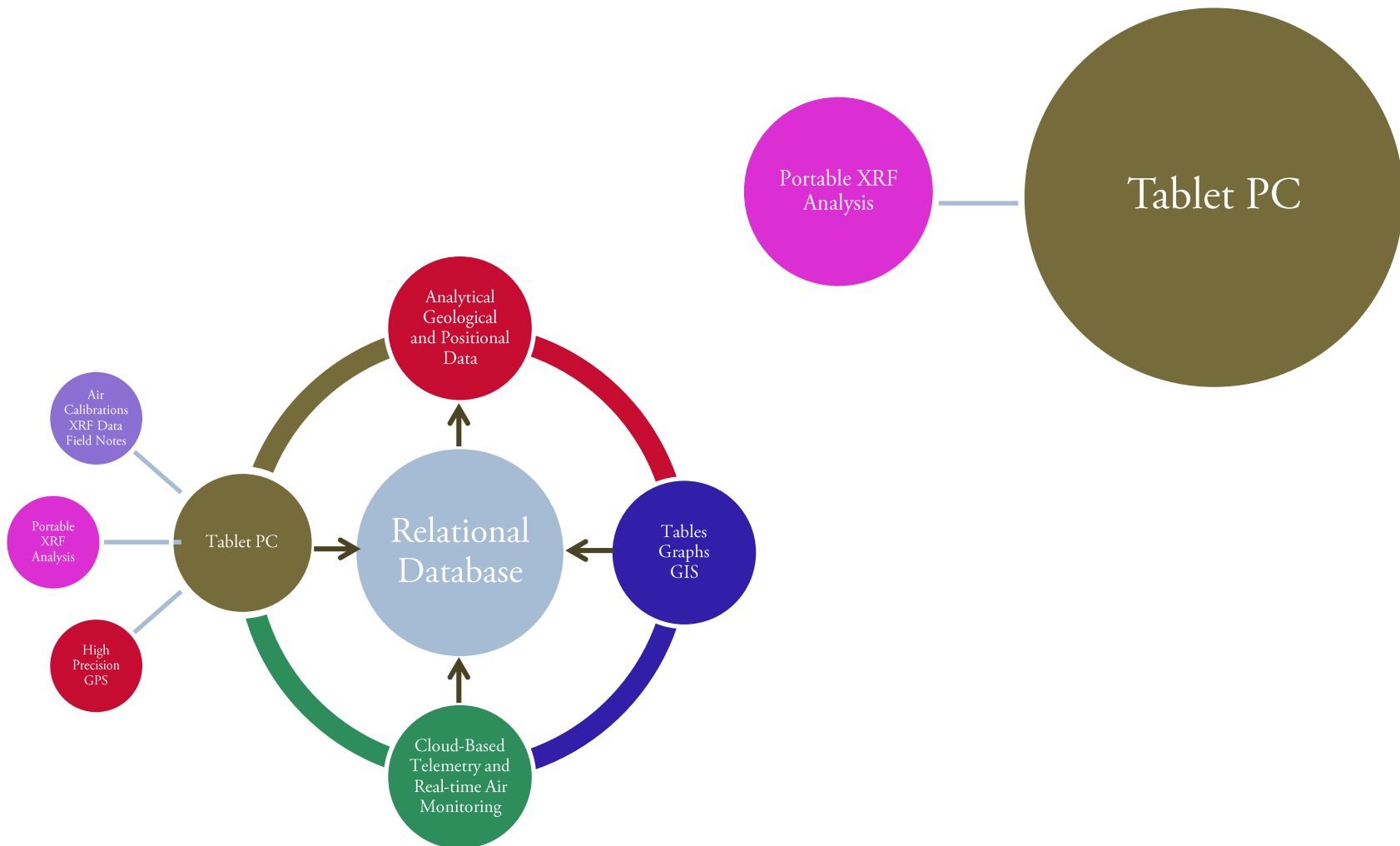
Tools

Collect	Options	Pause
1 Inspect_Pt	OK	Cancel
PointID:	100	
Arsenic_ppm:	35	
Arsenic_precision:	17	
Lead_ppm:	54	
Lead_precision:	16	
Comment:	B59 XRF	

Esc ~ ` ! @ # \$ % ^ & * () _ + = Bksp
Tab Q W E R T Y U I O P { } | \ Del
Caps A S D F G H J K L ; ' ←
Shift Z X C V B N M < , > ? / ↑ Shift
Ctrl Win Alt Ctrl Win Alt Ctrl ← ↓ → Fn

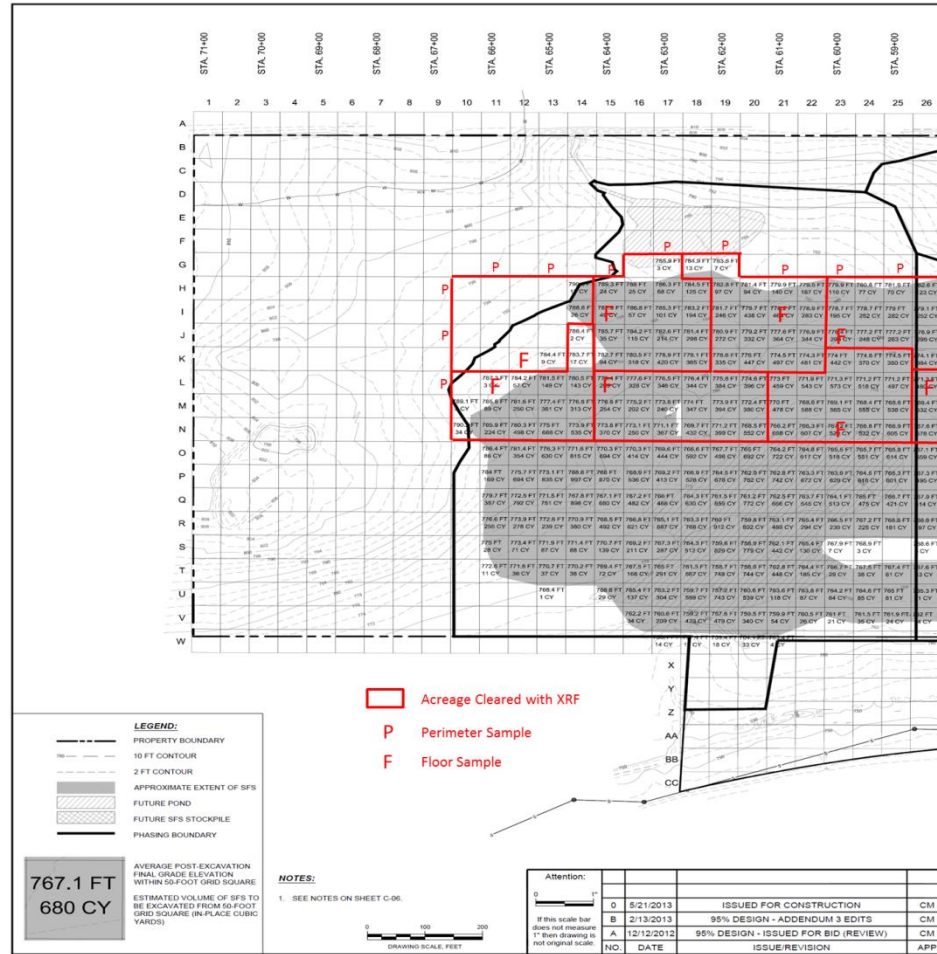


Field XRF Analysis



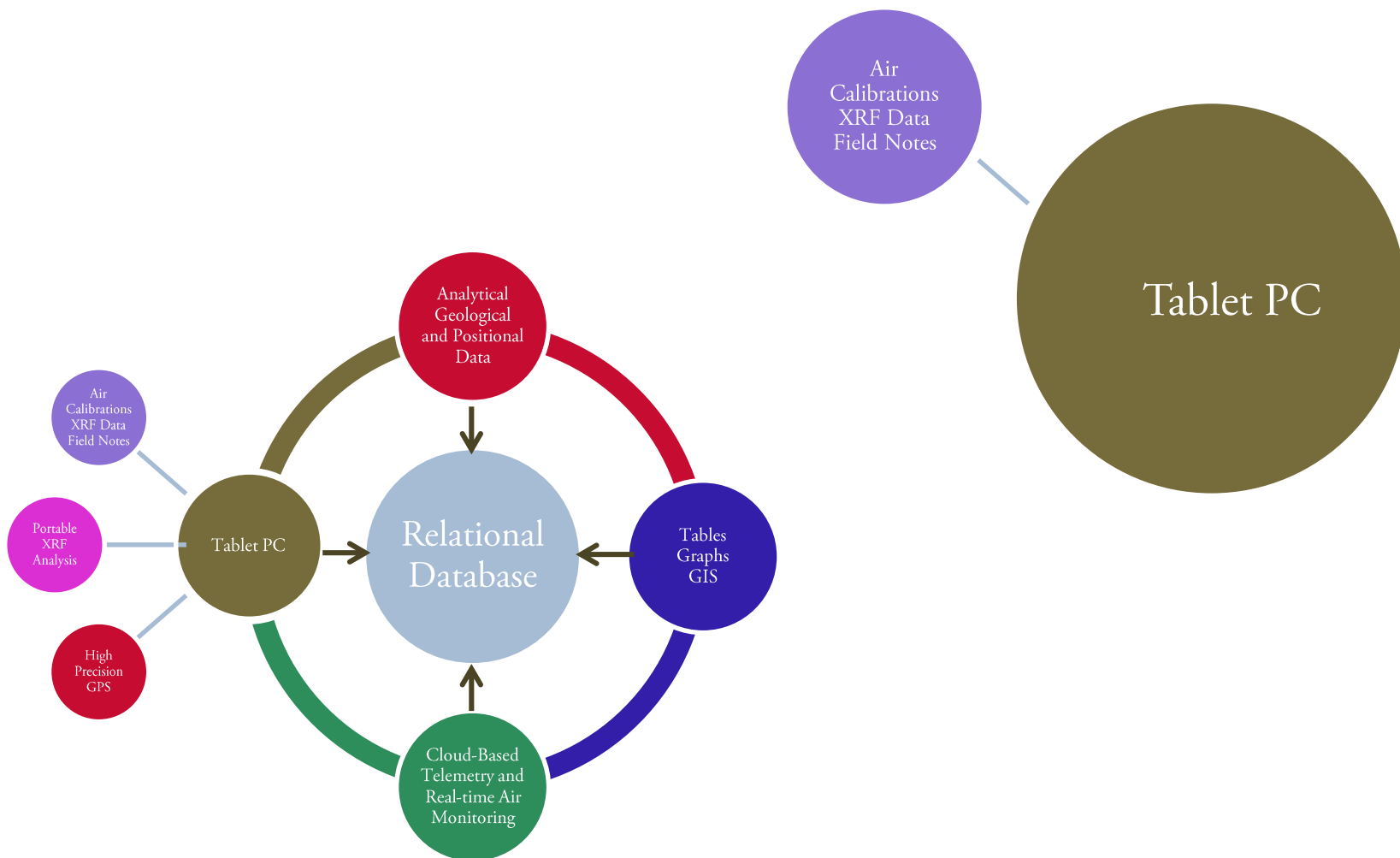


Portable Field XRF Analysis





Equipment Calibrations, Field Data and Field Notes - EDGE™





Air Monitoring Calibrations in EDGE™

EarthSoft EDGE - #facility_code

Home Devices Plugins

Task Location Activities Equipment Calibration Equipment Field Samples Lithology Field

Save Max/Rest Calibration: Add

Combustible Gas Detector High Volume Air Pump Low Volume Air Pump Multigas Haz. Gas Monitor Dust Meter Photoionization Detect

Remove

Equipment_Code	Calibration_Date	Calibration_Time	Calibration_Person	fld_qualifier
HVAP-ASWP-HV-06	05/03/2013	15:07		

1-Standards		2-Check No.1		3-Check No.2	
Calibrator Serial No.		Start Time		End Time	
Motor Serial No.		Start Amb Man Lf		End Amb Man Lf	
Orif Lf Man Open		Start Amb Man Rt		End Amb Man Rt	
Orif Rt Man Open		Start Filt Man Lf		End Filt Man Lf	
Smplr Lf Man Open		Start Filt Man Rt		End Filt Man Rt	
Smplr Rt Man Open		Complete (Y/N)		Complete (Y/N)	
Orif Lf Man Turn 1					
Orif Rt Man Turn 1					
Smplr Lf Man Turn 1					
Smplr Rt Man Turn1					
Orif Lf Man Turn 2					
Orif Rt Man Turn 2					
Smplr Lf Man Turn 2					
Smplr Rt Man Turn2					
Orif Lf Man Turn 3					
Orif Rt Man Turn 3					
Smplr Lf Man Turn 3					
Smplr Rt Man Turn3					

Intelligent Bar

50 - Opened saved EDD in: 141.50 s
49 - Filter Applied in: 1.95 s
48 - Updating Interface

Facility: #facility_code Plan: Format: E:\EDGE 5.7.0\EDGE\Formats\EDGE\EDGE.xse EDD: E:\EDGE 5.7.0\LCW\Templates\LCW_EDGE_Template 041113.xls



Field Notes in EDGE™

EarthSoft EDGE - #facility_code

Home Devices Plugins

Task Chooser
Filter (1 of 1) Show All
Task Co / Start Date Priority
LCW_TE...

Location Chooser/Filter
Location (2212 of 2212) Filter
 Filter By Selection
sys_loc_code x_▲
ASwP-01
ASwP-02
ASwP-03
ASwP-04
ASwP-05
ASwP-HV-06
WESTERN PARCEL
A01
A02
A03
A04
A05
A06
A07
A08
A09
A10
A11
A12

Task Location Activities Equipment Calibration Equipment Field Samples Lithology Field

Save Max/Rest Row(s) Add Copy Remove Excel Select Auto Fill Refresh

Activity Type: Electronic Field Note

Alerts	parameter_	measurum_	measurement_t_	parameter_value_	param_	remark
	Field Note	05/03/2013	15:15			This is a field note.

Intelligent Bar
56 - Column: measurement_date, DateTime: Date of parameter measurement or observation
NOTE: This is a key (unique) column.

Facility: #facility_code Plan: Format: E:\EDGE 5.7.0\EDGE\Formats\EDGE\EDGE.xse EDD: E:\EDGE 5.7.0\LCW\Templates\LCW_EDGE_Template_041113.xls



XRF Confirmation Samples - EDGE™ COC

LCW-SOIL-COC-05052013.xls [Compatibility Mode] - Microsoft Excel

Print COC Ver 5.7.0 13081

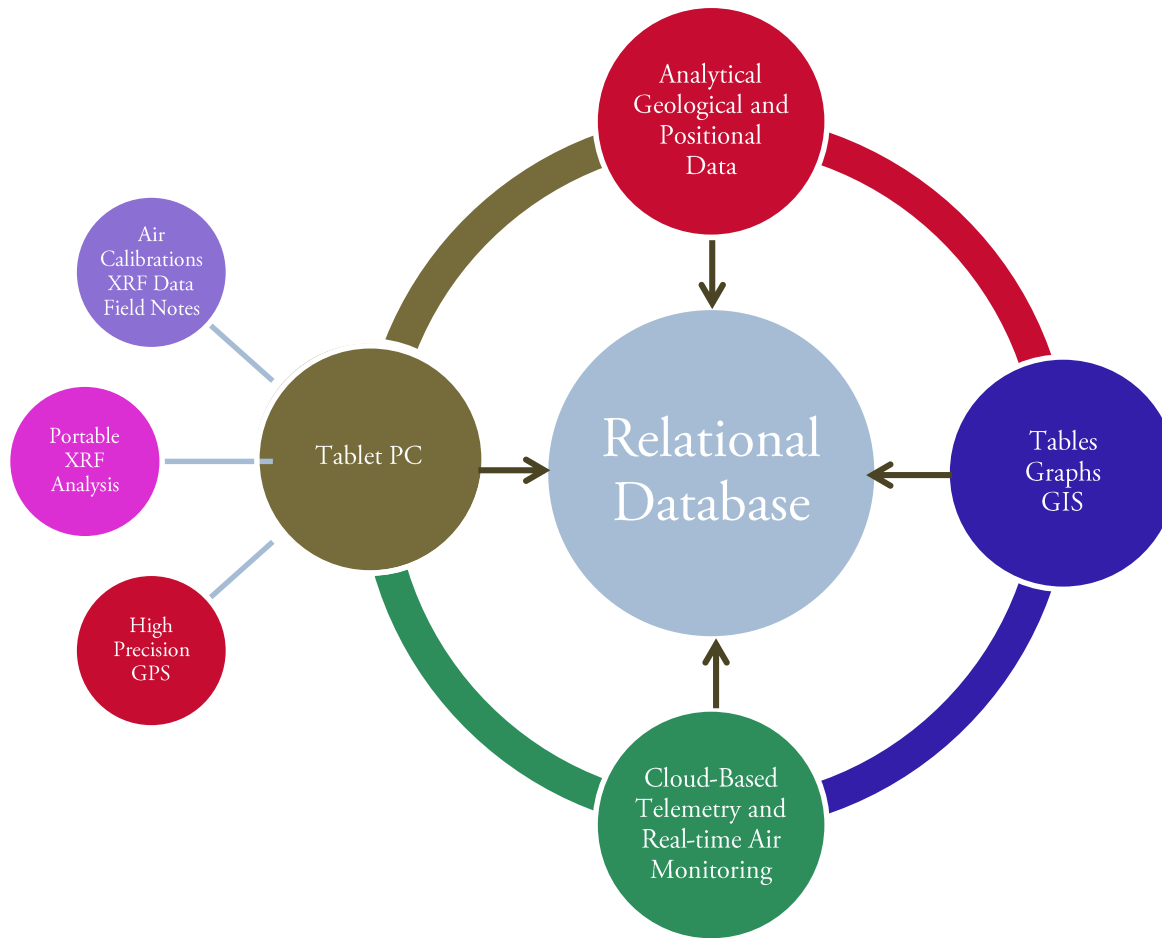
COC ID: **LCW-SOIL-COC-05052013** TURNAROUND TIME: RUSH 2-day RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO					
Facility Name	Lenoir City Car Works			Lab Name	TestAmerica Knoxville			Email Invoice To	abrazell@geiconsultants.com				
Project Number	133300-1010			Lab Contact	Tery Wasmund			Invoice Reports					
Project State	TN			Email	tery.wasmund@testamericainc.com			Email Report To abrazell@geiconsultants.com					
Address	1375 Peachtree Street NE			Address	5815 Middlebrook Pike			Email Reports					
	Suite A15							Shipping Company	COURIER				
City	Atlanta	State	GA	City	Knoxville	State	TN	Tracking Number					
Postal Code	30309	Country	USA	Postal Code	37921	Country	USA	Cooler Count 1					
Phone Number	404-592-0050			Phone Number	865-291-3065			Cooler Description					
Project Manager	Scott Keating			Quote Number				Sampler 2					
Email Address	skeating@geiconsultants.com			PO Number				Sampler 3					
SAMPLE DETAILS								ANALYSIS REQUESTED					
Sample ID	Start Depth	End Depth	Depth Unit	Field Matrix	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS				
A01FXN0505131				EX	05/05/2013	14:00	G		X				

Navigation: COC (Pg 1) | Containers Info | QRCode | Field Results | Setup | COC_v1 | Data | Data Field | FieldSample_v1 | 40%



Conclusion





Project Take-Aways

- Smart investment and application of data management technologies can:
 - Improve data management efficiency and accuracy.
 - Lower overall project costs by reducing assessment and remedial design costs, project completion times, and subcontractor fees.
 - Provide an elevated level of confidence to the regulatory community.



Questions



Questions?