

# An Evaluation of Electronic Field Data Collection Solutions: Lessons Learned

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- Based in GES' Blacksburg, Virginia office
- 15+ years experience in the environmental and geotechnical consulting fields
- Manage GES Environmental Informatics team
- Specialize in database architecture, model development, programming, and GIS applications



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## Benefits of Digital Data Collection



**Eliminate  
transcription, reduce  
typographical errors**



**Control of  
observational  
language**



**Reduce missing\  
overlooked required  
information  
Qualify Data  
objectives**



**Real time relay of  
critical information**

# Types and Purpose of Digital Data Collected

## Paper-like forms

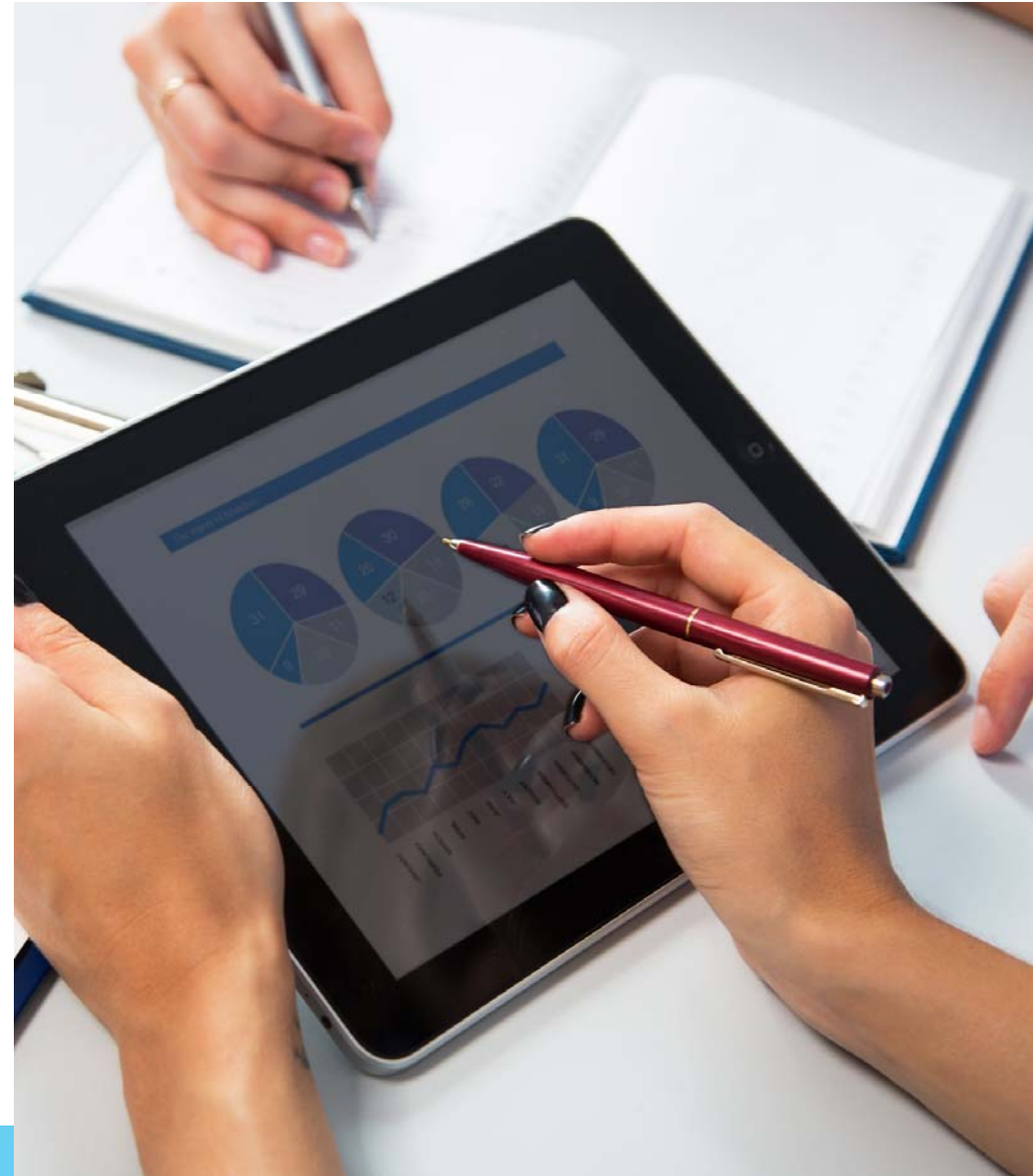
- Standardized paper space in appearance
- No or limited data use beyond form filling
- Generally signatures and record of approval are very important
- The form itself is a deliverable
- Examples – pdf with fields, html page, check out signature



# Types and Purpose of Digital Data Collected

## Data Collection

- Numerical and textual data to be uploaded into a specific database structure
- The form is not necessarily a deliverable in itself
- Open ended in terms of number of observations\pictures etc.
- Examples – Access Database, XML documents, Survey Monkey, custom solutions



# Current Technologies Reviewed

- Vendor Developed
  - Earthsoft's EDGE
  - ESRI Survey123
  - ESRI Collector for ArcGIS
  - Mi-Forms
  - Qnopy
- Internal Developed
  - MS Access Forms
  - Distributed Excel Files
  - Web based – Sharepoint forms

# Management

Roadblocks to Efficient Systems



# Issues



**Tank Registration** 10530 Registration Form Complete

**V. DESCRIPTION OF ABOVEGROUND STORAGE TANKS**

1. Status of Tanks  
 Tank Status: Active Property Use: Undeveloped

2. Date of Installation:  
 Tank Installation Date: 6/1/2001 Estimated: ☒

3. Year Tank Constructed:  
 Tank Construction Date: 1/1/2001 Estimated: ☒

4. Maximum Tank Capacity:  
 Maximum Tank Capacity (gal): 4200

5. Compartments:  
 Number of Tank Compartments: 1

Num	Status	Substance	Capacity (gal)	Mixed	Changed	Change Notes
1	In Use	Produced Fluids	4200	<input type="checkbox"/>	<input type="checkbox"/>	Active storage tank contains

Compartment Capacity (gal): 4200

6. Substance Stored:  
 Substance Stored Name: Produced Fluids  
 Substance Mixed: 0  
 Substance Stored Changes: ☐

7. National Fire Protection Association Health Rating: 1

8. Is tank regulated under existing State or Federal Programs? If Yes, provide identifying information concerning the program:  
 Regulated by State or Federal Program: ☐  
 State or Federal Program Name: N/A  
 Program Permit Number: N/A  
 Program Registration Number: N/A  
 Other (Specify): N/A

9. Tank Construction Material and Corrosion Protection (mark all that apply):  
 Brand/Model: Unknown

Steel: <input checked="" type="checkbox"/>	On saddles, legs, skirts, rack, or cradle: <input type="checkbox"/>
Stainless Steel: <input type="checkbox"/>	In direct contact with ground, asphalt, or concrete: <input checked="" type="checkbox"/>
Fiberglass Coated Steel: <input type="checkbox"/>	Cathodic Protection (galvanic): <input type="checkbox"/>
Plastic: <input type="checkbox"/>	Cathodic Protection (impressed current): <input type="checkbox"/>
Fiberglass Reinforced Plastic: <input type="checkbox"/>	Unknown: <input type="checkbox"/>
Other (Specify): <input type="checkbox"/>	

Tank Wall Type: Single Tank Bottom Type: Single

# Case Study

## Tank Inspection Forms

- No existing data structure adequately addressed field data collection or data upload needs
- Regulatory requirements for website submittal did not allow batch uploading
- Field form needs to be flexible during production to accommodate additional client requests
- Costs for development were presented along with estimate for increase in efficiency in submittals

# Solutions



# Workflows

Roadblocks to Efficient Systems



EarthS

Home Devices Plugins EDGE Lite

Task Chooser

Filter (1 of 1) Show All

Task Code Start Date Pr

2016-Q1 SAMPLING

Location Chooser/Filter

Location (3 of 3) Filter

Filter By Selection

Alerts data\_provider sys\_loc\_code

M/W-1

M/W-2

M/W-3

Location FieldSampleForm ActivityForm Boring Log ActivityForm2 SafetyForm WaterLev

New Save Delete Print Max/Restore Sample (2) Default Layout Setup Sections Signatures Files (0) Disp

sys\_sample\_code M/W-3-20160115-WG start\_depth

end\_depth depth\_unit

sample\_date 01/15/2016 00:00 (24hr) composite\_yr N

filter\_type filtered\_screened

parent\_sample\_code sampler TW

sampling\_company\_code GES sampling\_method Bailer

sent\_to\_lab\_date 01/15/2016 00:00 (24hr) task\_code 2016-Q1 SAMPLING

sample\_matrix\_code WG sample\_type\_code N

comment

Field Results

# Case Study

## E&P Groundwater Sampling Forms

- Presented in similar format and size as existing paper forms
- Added real time checking of values as the forms were populated
- Eliminated data transcription and QC
- Thorough documentation of and training for QA processes. Identified downstream use of the data and better way to record information.

### Part F: SAMPLING

Sample ID 006-PA-131-110817-1630-1-499

Sampled		Sampling Point Location	
<input type="radio"/> Before Treatment	<input type="radio"/> After Treatment	<input type="radio"/> Inside Faucet	<input checked="" type="radio"/> Outside Faucet
<input checked="" type="radio"/> No Treatment	<input type="radio"/> Not Sure	<input type="radio"/> Seep	<input type="radio"/> Pressure Tank
		<input type="radio"/> Wellhead	<input type="radio"/> Other: <input type="text"/>

Was the water source purged before sampling? ☒ Yes ☐ No Volume 60 GALLON Time (min) 15

Is it possible to run water for 30 minutes? ☒ Yes ☐ No If No, please explain

Average water usage within the last 24 hours  Chain of custody attached? ☒ Yes ☐ No

#### Field Analyses:

Turbidity (ntu): 1.87 pH (ph units): 8.25

Specific Conductance (umhos/cm): 0.510 Temperature (deg c): 11.32

#### Gas Readings:

Type	PPM	% LEL	% GAS
Wellhead	<input type="text"/>	<input type="text"/>	<input type="text"/>
	<input type="radio"/> Peak <input type="radio"/> Sustained	<input type="radio"/> Peak <input type="radio"/> Sustained	<input type="radio"/> Peak <input type="radio"/> Sustained
Cold Tap	80	0	0
	<input checked="" type="radio"/> Peak <input type="radio"/> Sustained	<input checked="" type="radio"/> Peak <input type="radio"/> Sustained	<input checked="" type="radio"/> Peak <input type="radio"/> Sustained
Cold Headspace	3320	6	0
	<input checked="" type="radio"/> Peak <input type="radio"/> Sustained	<input checked="" type="radio"/> Peak <input type="radio"/> Sustained	<input checked="" type="radio"/> Peak <input type="radio"/> Sustained
	<input type="text"/>	<input type="text"/>	<input type="text"/>
	<input type="radio"/> Peak <input type="radio"/> Sustained	<input type="radio"/> Peak <input type="radio"/> Sustained	<input type="radio"/> Peak <input type="radio"/> Sustained
	<input type="text"/>	<input type="text"/>	<input type="text"/>
	<input type="radio"/> Peak <input type="radio"/> Sustained	<input type="radio"/> Peak <input type="radio"/> Sustained	<input type="radio"/> Peak <input type="radio"/> Sustained

### Part G: SITE SKETCH and PHOTOGRAPHS

Add Images 4 pictures attached to the form

#### SAMPLER

Please sign in the box below acknowledging that I have supplied the correct information to the best of my knowledge.

*2nd Party*

Accept

Clear

# Lessons Learned and *Better* Practices

## Issues can arise when...

- The digital application is based on receipt of paper forms
- The QA/QC process is poorly defined and/or documented
- The purpose of collected information is poorly defined
- The data collection process lacks structure

## There's a better way!

- Review and adjust the workflow to best use digital collection for collating and organizing structured data
- Minimize unstructured and/or redundant data requirements
- Take advantage of the opportunity to create better QC\QA process

# Field Staff

Roadblocks to Efficient Systems

# The Challenge

- Confusing UI
- This isn't how it was done before
- I don't know how to use the hardware
- It takes too much time

Section Name SF-S2 Visit Crew RC Reid Visit Date 7/8/2013

Structure Condition

Structure Integrity: Completely Structure Porosity: Partly Porous Posts Remaining: 7-8 Post Integrity: Mostly Solid % Channel Constriction: 60-70

LWD Accum.: Not Present SWD Accum.: Certain Visit Type: Post High Flow Conditions: Low Flow/No

General Habitat Wood Photos

Unit #	Geo Tier 4	Unit Loc	% Bar Exp	Start Dist	Unit Lgth	Unit Width	Max Depth (cm)	Riffle Crest/Ave Depth (cm)	Dominant Forcing Mechanism	Dominant Substrate
9	Bar Forced Pool	DS	NA	3.5	1	.5	55	15	Bar	Cobble

Unit #	Geo Tier 4	Unit Loc	Start Dist	Unit Lgth	Unit Width	Cross Dist	UC	RR	RL	UC
1	Glide	US	0.0	1.0	1.0	0				
2	Undercut	US	0.25	0.75	NA	0				
3	Point Bar	DS	0.0	1.0	0.75	.25				
4	Rapid	DS	0.0	1.0	0.25	0				



Site Recon & Project Description (Section 3.2.2.1)				
Date Completed:			Inspector(s):	
Weather:		Wind (mph)	Temp (F)	
Project Address:	1401 Charlotte Ave., Nashville, TN			
Land Area (Acres):				
Buildings (List):				
Car Wash:			Auto Repair:	
Areas observed:				
Access Limitations:				
On-Site Interview				
Name:			Relation to Site:	
Contact Info:			# Years at Site:	
Aware of any past environmental testing / studies / concerns:				
Utilities				
Utility	In area	At Site	Status	Comment
Potable Water				
Process Water		Well		
Storm Sewer		Public		
Electric		Surface		
		Unknown		

# Case Study

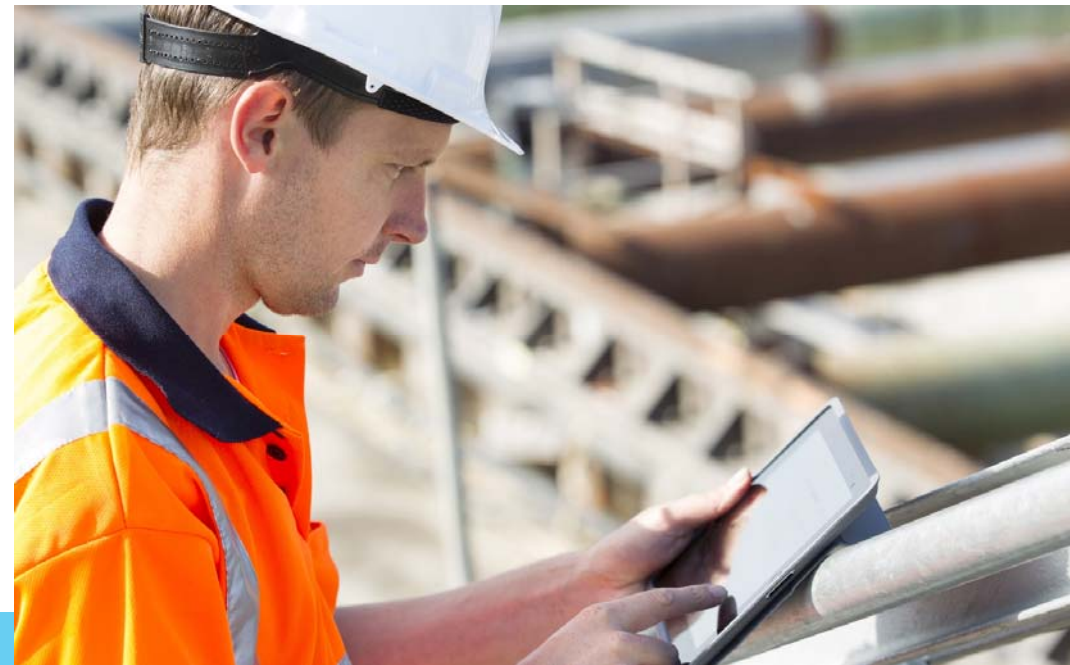
## Phase I Environmental assessments

- Nationwide scope (700+ sites), disparate hardware
- Well defined information requirements
- Delivery to 3<sup>rd</sup> party for final report collation
- Integration into existing work order system



# Solutions

- Present senior field staff with example\demo interface
- Sell on the benefit of use
- Simplify\automate forms



# Key Findings

# Key Questions for Successful Implementation

**Questions to consider during planning and preparing for digital field data collection...**

- What is the purpose of collecting field data?
- What downstream decisions are made based on the field data?
- What has been missed in historical data collection? What is actually needed? Are the number of observations, photos, etc. fixed or open?
- What is the final deliverable? How is it submitted?
- Who needs to review forms before final submittal?
- What decisions must be made by field staff based on observations? What information must have controlled data entry?



## Benefits of Digital Data Collection



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**Reduce missing\  
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Qualify Data  
Objectives**



**Real time relay of  
critical information**

# THANK YOU.

Questions & Answer

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