

Elevating Water Level Data to Dynamic Groundwater Visualization

John Dustman

Summit Envirosolutions, Inc.

2012 MWGWA Midwest Groundwater Conference

Presentation Overview

- Technology Overview
 - Field Instrumentation
 - Software
- Field Applications
- Demonstration
- The Future

Technologies and Definitions – Perfect Storm of Convergence

Hardware

- Chemical and physical parameter sensors with data loggers
- Programmable Logic Controllers (PLCs)
- Variable Frequency Drives (VFDs)
- Computer processing speeds

Software

- Data visualization and rendering software
- Database programming
- Global Positioning Systems (GPS) and related software
- Geographic Information Systems (GIS) software
- Supervisory Control and Data Acquisition (SCADA) software
- Groundwater data analysis and modeling software
- Artificial Neural Networks (ANN)



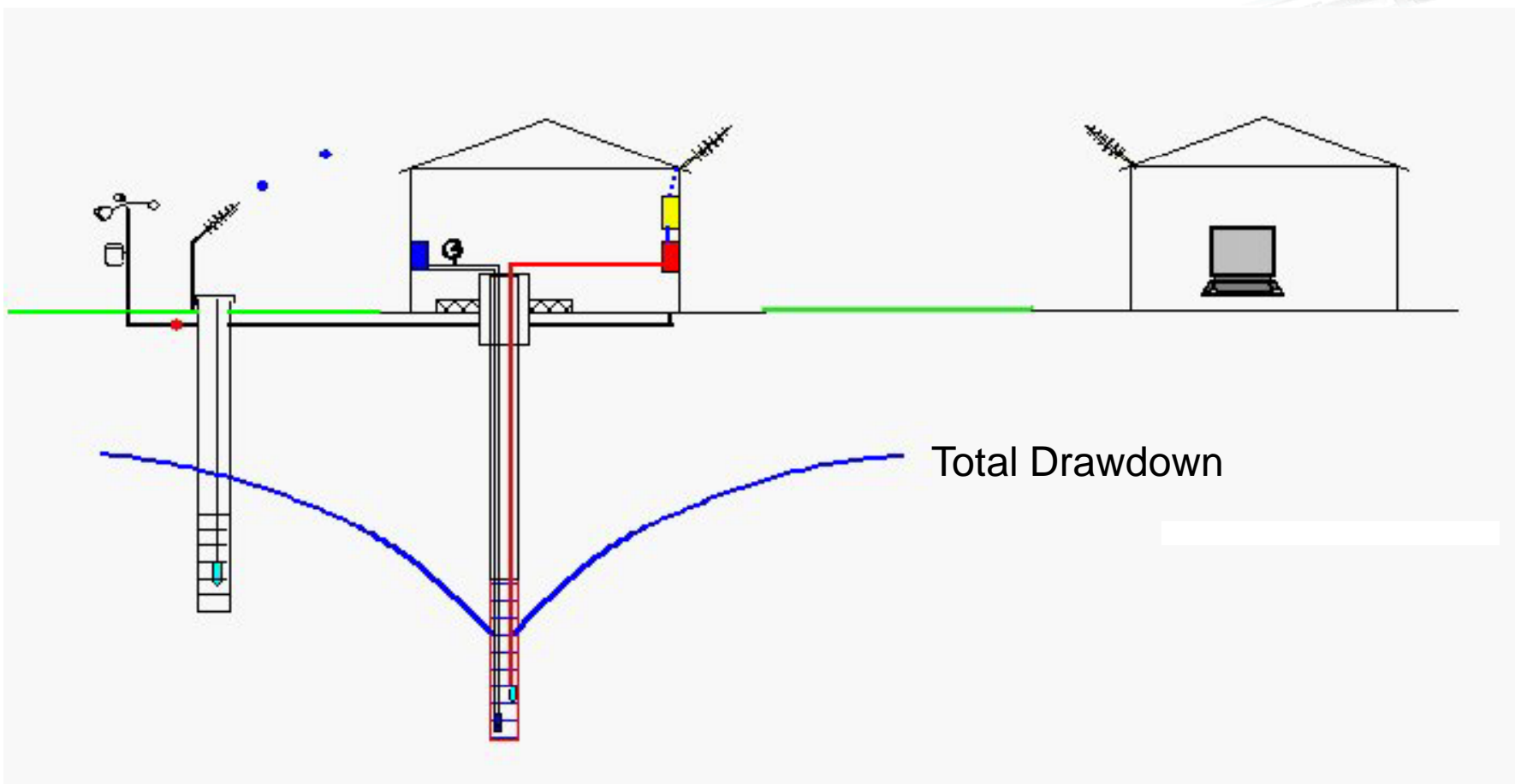
Technologies and Definitions – Perfect Storm of Convergence (continued)

Others

- On-line GIS data
- Wireless telecommunications
- Solar panels
- Artificial Neural Networks (ANN)



Process Schematic



Field Instrumentation



Telemetric Data Acquisition

Name: WWLT-4

Serial Communications

Port Number: COM4

Baud: 19200

Data Bits: 8

Parity Bits: None

Stop Bits: 1

Mode: ASCII

IP Communications

IP Address: 166 . 136 . 235 . 112

Port Number: 3001

Modem Communications

Modem: Bluetooth Fax Modem

Phone Number:

Configure


Other

Device Address: 1

Transmission Delay (secs): 15

Retries: 3

Max Packet Size (bytes): 512

 These settings represent the computer configuration, not the device. For example, if IP is used, the device settings are still serial based. To change a device's serial/Modbus settings, first connect and then go to the device setup tab and click the Modbus Setup button.

Revert To Defaults Save As New Defaults Save

Software

- Campbell Scientific LoggerNet[®]
- Win-Situ TrollLink and Win-Situ 5[®]
- INW Aqua4Plus[®]
- Microsoft Access[®], MySQL[®], etc.
- EPIPHINY[®]
- Aqua TruVue[®]

Need for Database Tool:

- Expedient data entry
- Relational database
- Ability to trend, graph, and export report-ready data
- Easily export data into GIS and modeling/visualization software



AQUA TRUE VUE

Sensor Data Import

The screenshot shows a software window titled "Set up location name and sample date/time". The window contains a table with the following data:

FileName	SampleLocation	Starting Date/	Ending Date/T	FilePath	SheetName	Well_Referenc	Well_SensorD
20080109_w412 2008	W412	1/9/2008 11:45	3/4/2008 10:30	C:\Projects\QRS\S	From CSV	915.17	70.431
20080109_w133 2008	W133	1/9/2008 11:30	3/4/2008 10:15	C:\Projects\QRS\S	From CSV	921.06	76.903
20080109_w409 2008	W409	1/9/2008 10:00	3/4/2008 9:45	C:\Projects\QRS\S	From CSV	923.61	75.134
20080109_w411 2008	W411	1/9/2008 11:00	3/4/2008 10:00	C:\Projects\QRS\S	From CSV	896.25	50.584
*							

Below the table, there are two buttons: "Fill Location Name with File name" and "Fill Location Name based on Position". At the bottom right, there are "Back" and "Next" navigation buttons. An orange circle highlights the "Well_SensorD" column in the table.

Field Operating Procedures are Important!

Set up query criteria

Basic Options More Options

Location

Location Group PW-1 and OB1

Single Location PW1

Parameter

Parameter Group _AllParameter_Fagen EIPHINY

Single Parameter Groundwater Elevation

Medium Mixed (All)

Time

Start 8 15 2012 8/15/2012 12:00:00 AM
08/15/2012 12:00 AM

End 8 21 2012 8/21/2012 12:00:00 AM
08/21/2012 12:00 AM

Group User Defined Duration

Template

Options ...

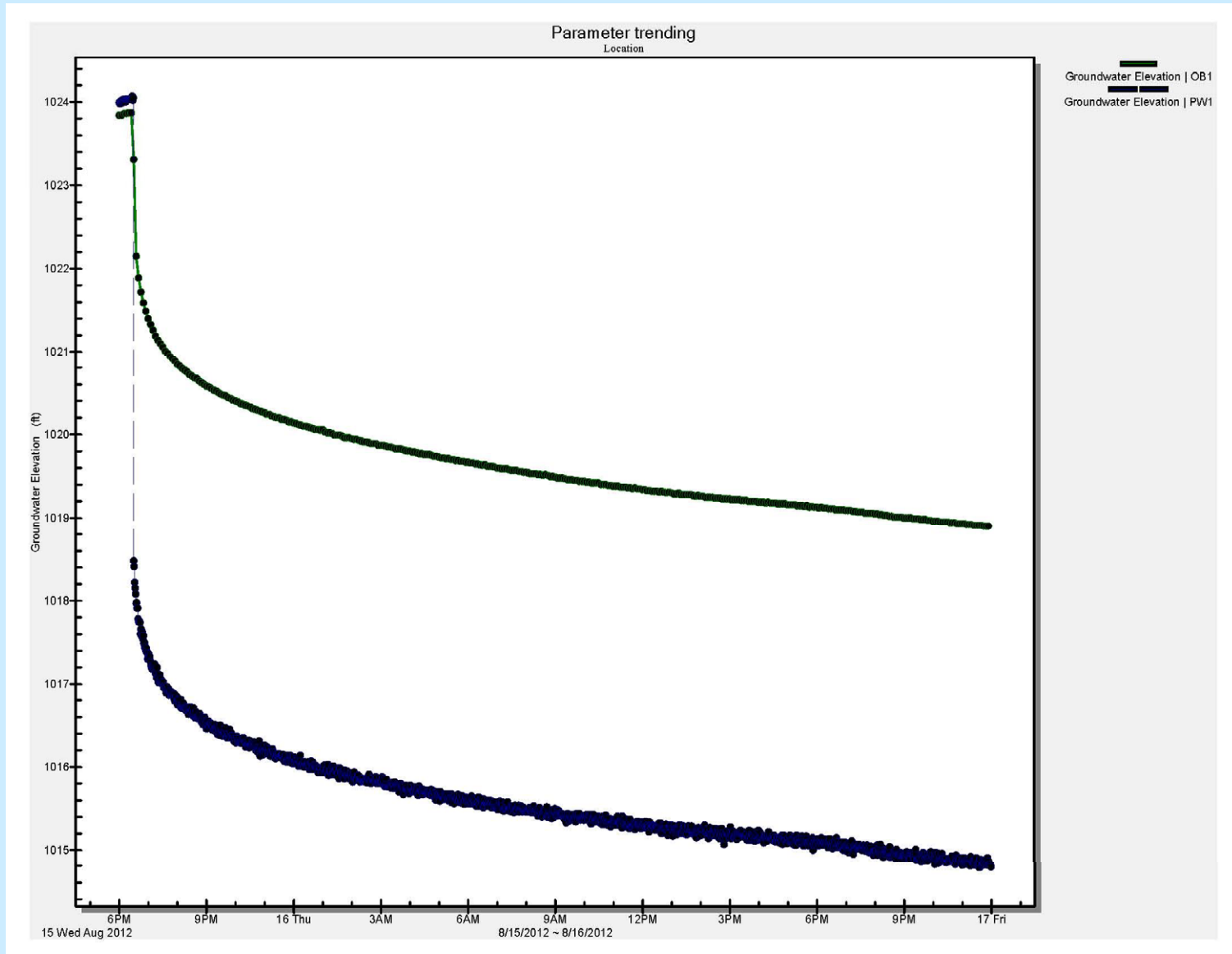
Reload

Graph

Result

< Current DB: C:\Projects\DEF\FagenEngineering-2154\0001-RonFagenIrrigationWell\DataAnal\Fag >

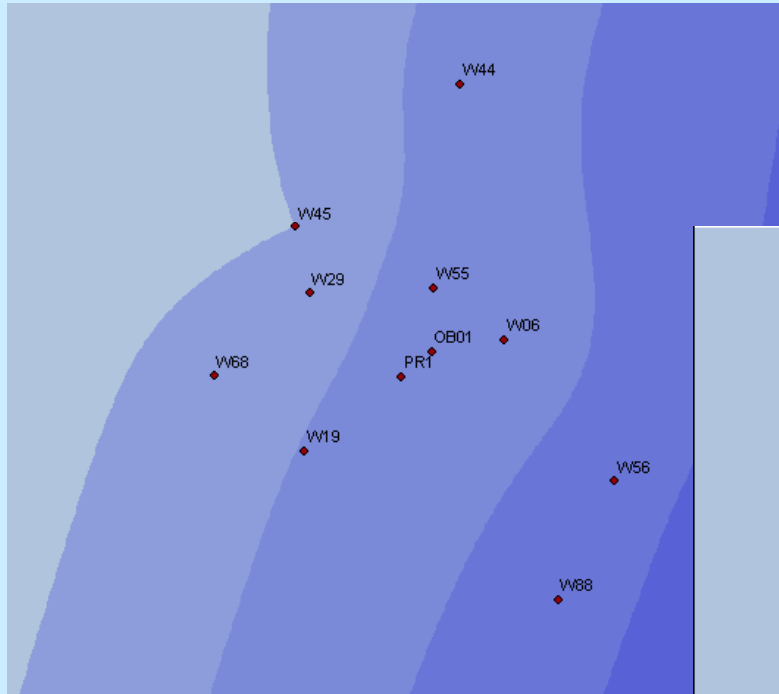
Data Trending



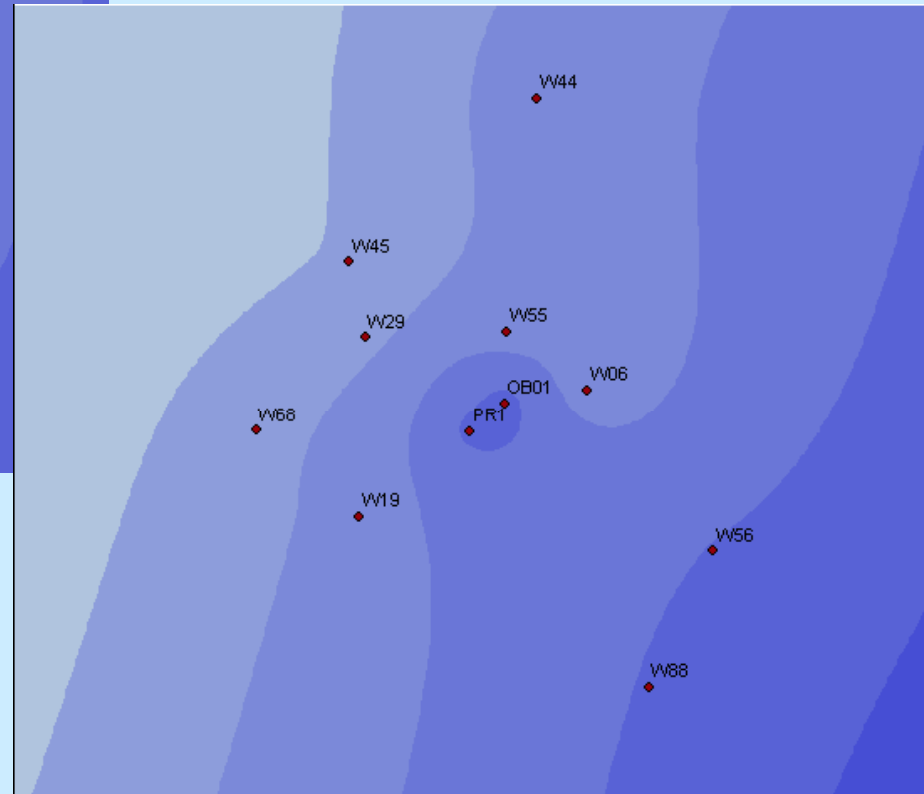
Well Hydraulics and Hydrogeologic Tools



Automated Potentiometric Surfaces



Static Conditions



Pumping Conditions (Linear Log Kriging)

Existing Field Applications

- Municipal (Water Supply and Water Rights)
- Mining (Characterization/Monitoring)
- Industrial (Water Supply/Remediation)
- Agricultural (Irrigation)
- Petroleum Refining/Distribution (Remediation)

Demonstration

Municipal Well Field

Setting: 11 water production wells

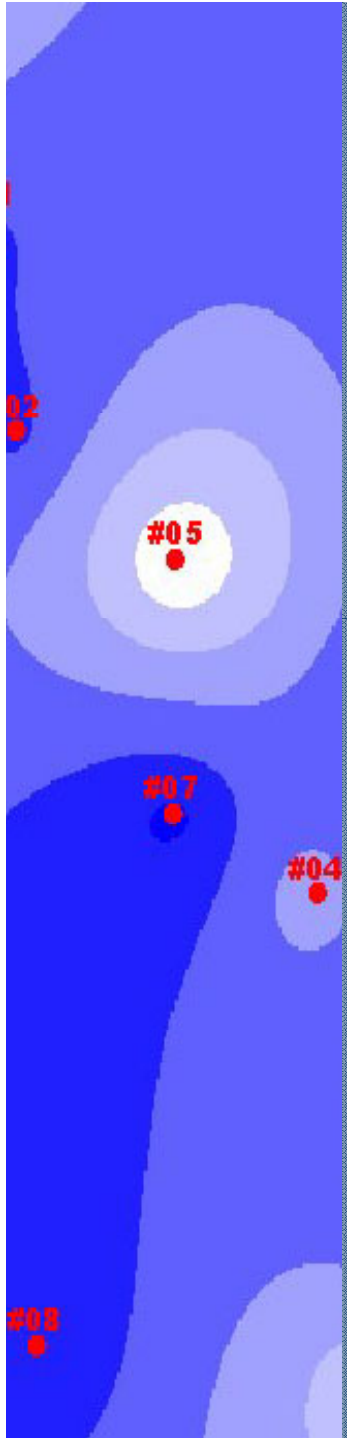
- Transducers continually logging water levels
- Campbell Scientific LoggerNet and Python scripts import data into EPIPHINY platform
- Aqua TrueVue contours data in real time and performs well hydraulic and aquifer parameter calculations

Summary

- Sensors are and will increasingly become available for a wide range of parameters
- Computing power and internet speeds will enable real-time modeling for both physical and chemical parameters
- By combining relational databases, kriging algorithms, and GIS, spatial analysis of continuous data streams is fast and efficient

Conclusions

- The ability to control and continuously monitor groundwater conditions leads to “smart” wellfields that learn over time
- The technology is as applicable to surface water, air quality, and noise as it is to groundwater



Point of Contact

John Dustman

jdustman@summite.com

www.summite.com