Well Asset Management: Not Just for Utility Water Supply

groundwater week
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Ground Water Science
Science and Planning for Earth's Most Critical Resource

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Water Supply Asset Management

Concept introduced in the public water supply sector, still sometimes neglected, increasingly applied

Small and agricultural wells: the final frontier

- Small-community applications
- Rural commercial locations, houses of worship, etc.
- Domestic wells
- Agricultural

Much of the world depends on the 6-inch PVC-cased borehole

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Asset management is:

A planning process to reduce cost, and increase efficiency and reliability while achieving service performance and business goals.

Or Sustainable Infrastructure …

- The water supply is safe, consistent, and in good shape
- Supplying water does not require excessive amounts of energy
- Minimizes chemicals and other consumable inputs
- Can be managed using locally available technical expertise

www.awwa.org/resources-tools/water-and-wastewater-utility-management/sustainability.aspx

Steps of Water System Asset Management (more or less)

- Asset Identification
- Asset Valuation – Objective assessment of depreciation … another talk in its own right
- Inspection and data collection
- Condition assessment/assess deterioration model
- Life-cycle cost analysis
- Maintenance/rehab planning and implementation
- Prioritizing, financial planning
- Water security

Risk evaluation: Probability vs. Impact

- How likely and how often?
- What happens if it fails or degrades?
- Cost when it does?
- This is qualitative and subjective

Impact (Consequence)	Probability (Likelihood) Low	Medium	High
High	0	2	1
Medium	3	1	1
Low	4	2	2

Wells can be bit different from the rest of the engineered water supply system

- In close contact with the non-engineered natural system
- Multiple rock layers, each with its own chemistry and electrical potential
- Large surface areas in contact with untreated water: Well screens and pumps
- Long and slim with limited access, no way to dig up and replace

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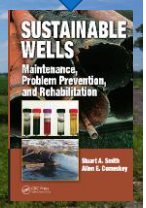
Asset ID and Valuation

- Distinct ID and location
- Valuation:
  - Replacement cost (physical)
  - Value of water produced
  - To replace it (asset + yield)

Chap 3 and elsewhere …



What does it cost us when this well production is down or lost?

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Inspection and data collection for the following:

- Condition assessment/assess deterioration model
- Life-cycle cost analysis
- Maintenance/rehab planning and implementation
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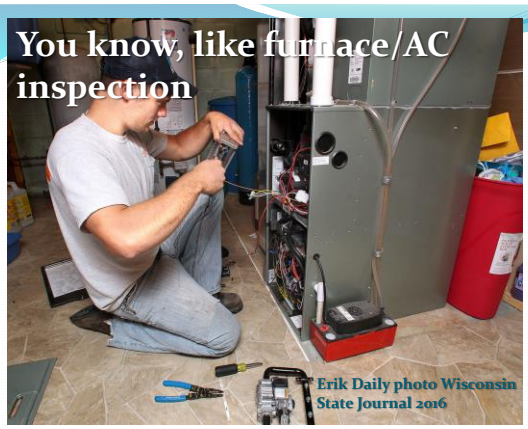
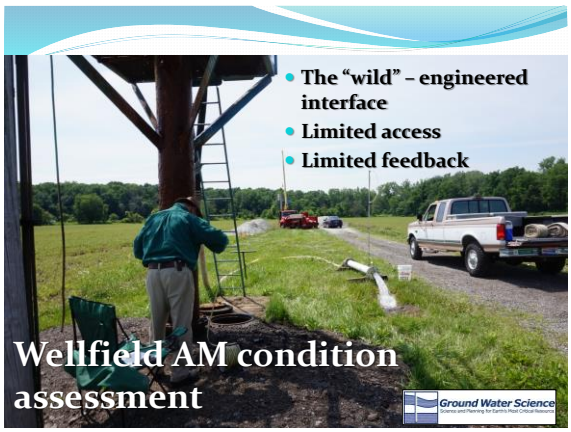
You know, like furnace/AC inspection

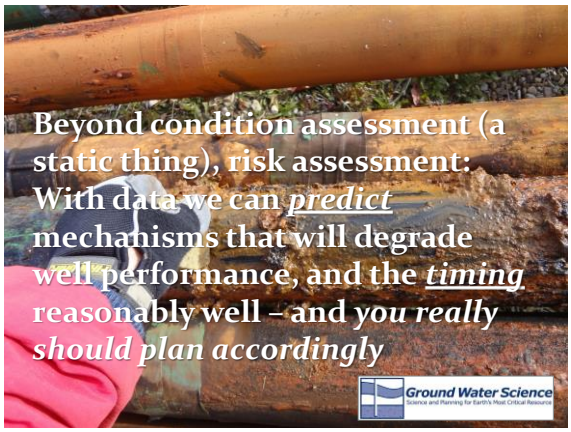


Erik Daily photo Wisconsin State Journal 2016

Condition Assessment: Wells

- As with distribution pipes (less like a furnace), well deficiencies or failures can remain hidden.
- Unlike distribution pipelines, reactive repair or replacement of wells (or parts of wells) is at best undesirable and at worst not feasible.
- However, current or potential problems can be
  - Prevented or slowed
  - Detected and tracked with available methods, permitting preventive maintenance actions and treatment.





Diagnostic Methods: How to find out what you need to know

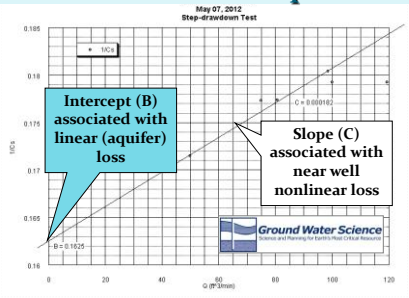
- Well performance analysis: Ongoing water levels, flow rates, well test results
- Physical-chemical water quality (pH, conductivity, Fe, hardness, etc.)
- Microbial indicators of biofouling and biocorrosion
- Pulled components (examine)
- Downhole video
- Power usage, indications of wear

Well performance testing

- Test plan
- Accurate water level measurement
- Timed for analysis

- Accurate flow measurement
- Geologist taking data

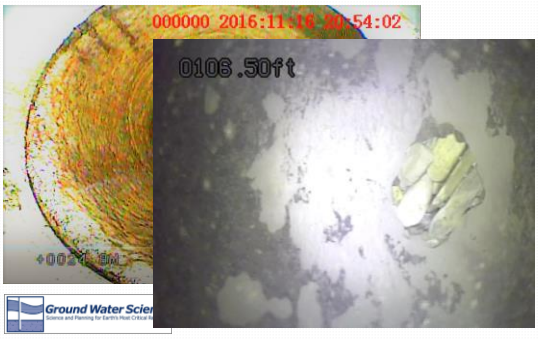
Specific capacity not the whole story: Step-drawdown test analysis to determine well loss components

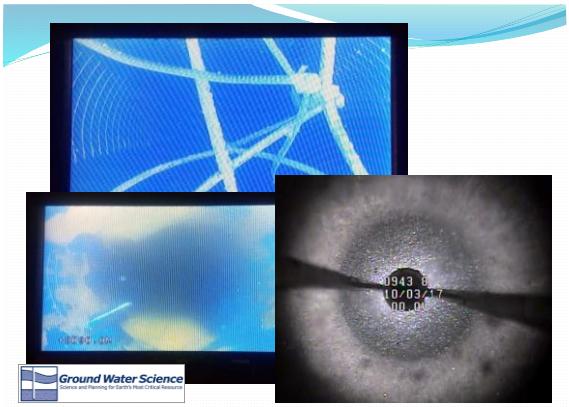


Component inspection

Video

- Before and after well service
- Assessing problems
- Quality
- Archiving over time to see change
- Archiving can be a problem: media, bulk, storage system?





Biological testing for asset management or tracking contaminant sources

Biological testing

- Baseline and troubleshooting: What is the problem, or what are the challenges?
- Basic: Much easier than it used to be
- Advanced: Incredible amounts of useful data
- Municipal/major industrial (brewery) or environmental clean up: Long-term trend line monitoring, early warning
- Domestic or irrigation: Analyze a problem, then switch to performance or time basis
- Interpretation and explaining – another skill set

All bio testing combined with physical-chemical

Sand and fines (grit)

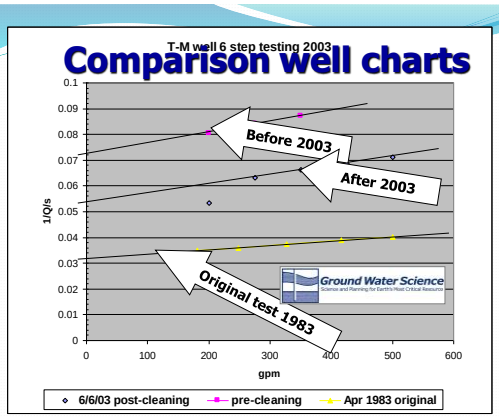
Rossum Sand Tester on Flickr

- Obviously hard on pumps (risk assessment: what's that worth to you)
- Impacts downstream (irrigation emitters)
- Evaluation by testing, triggering
- Well inspection and response

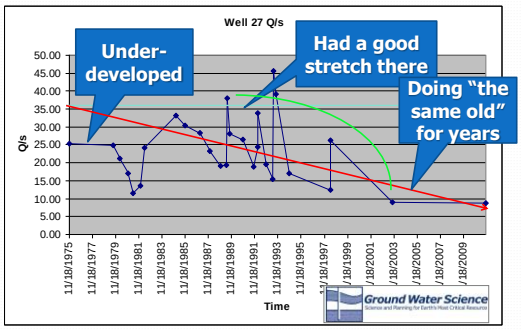
Facility Memory

- Wells/wellfields: Need long-interval (days to weeks) data point collection intervals
- Storage and retrieval: need scale of decades
- Customer *should* store their own data (vendors – even you and I – come and go)…
- Think long-term: Store as something retrievable long-term
- Hard-copy (paper records) a really good choice, especially for smaller systems (domestic, a few irrigation wells, village)

Comparison well charts



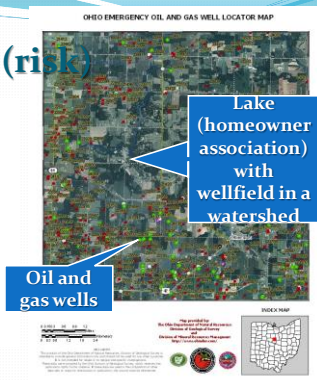
Histories: A 34-year well specific capacity history



Detect anomalies ("anomaly" – not normal, unusual)

Assessing vulnerability (risk)

- Contamination has to be within the watershed – surface or ground water
- There has to be an active source
- Hydrologic constraints
- What are the mitigating factors?



Then, use the information!

- You do not have to guess and work in the dark
- Knowing your costs, hydrologic factors such as specific capacity, water quality, power usage
- Keeping good records to do this
- Know your benefits as well as costs

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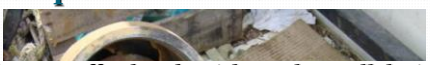
Count the cost: Can you afford to skip the PM or risk assessment?



- Can you afford to do without that well during the dry season?
- New pump every 5 years?
- The only water supply you have, and you haven't budgeted to drill a new well?
- The new treatment system if contaminated?
- And so forth?

Small system? Remote? Developing world? Can't afford these methods?

1. You can't afford the alternatives
2. We mostly work with small systems
3. You *can do it*: It need not be complicated

Small system AM

- Everything is smaller and more delicate (PVC casings, plastic this and that)
- Less likely to try heroic rehabilitation
- Pumps more likely remove and replace
- Diagnostics at a troubleshooting point, then time or performance-based
- Available funds margins lower than for competent municipal or industrial
- More likely run to failure – how to "bend the curve"?

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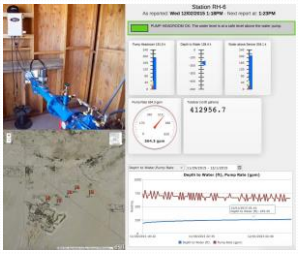
Some smaller video units pretty good

Remote automated AM

- "SCADA" has become more user friendly and cost-effective
- Provide a remote-monitor service
- Service triggered by performance factor
- Annual contract
- Check with vendors at the show



Valarm LLC

Any questions? You can do this.

We do this talk all day in more depth, BTW

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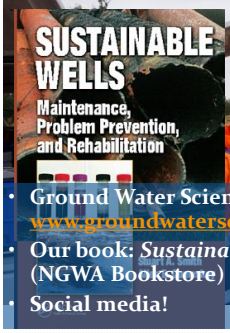
Thanks for your attention!



- Ground Water Science web site: www.groundwaterscience.com
- Our book: *Sustainable Wells* (NGWA Bookstore)
- Social media!

Queensland Government
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Inspection Exercise

- Are you doing maintenance programs or asset management for customers?
- What would make it worth your while?
- What would make it worth their while (usually level of service, as with furnace/AC): No water = bad.
- What would that service look like in your organization? How many people? Costs? Time?
- What to include? Levels of service?
- What to charge?
- Benefits to your organization and the clientele?

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