

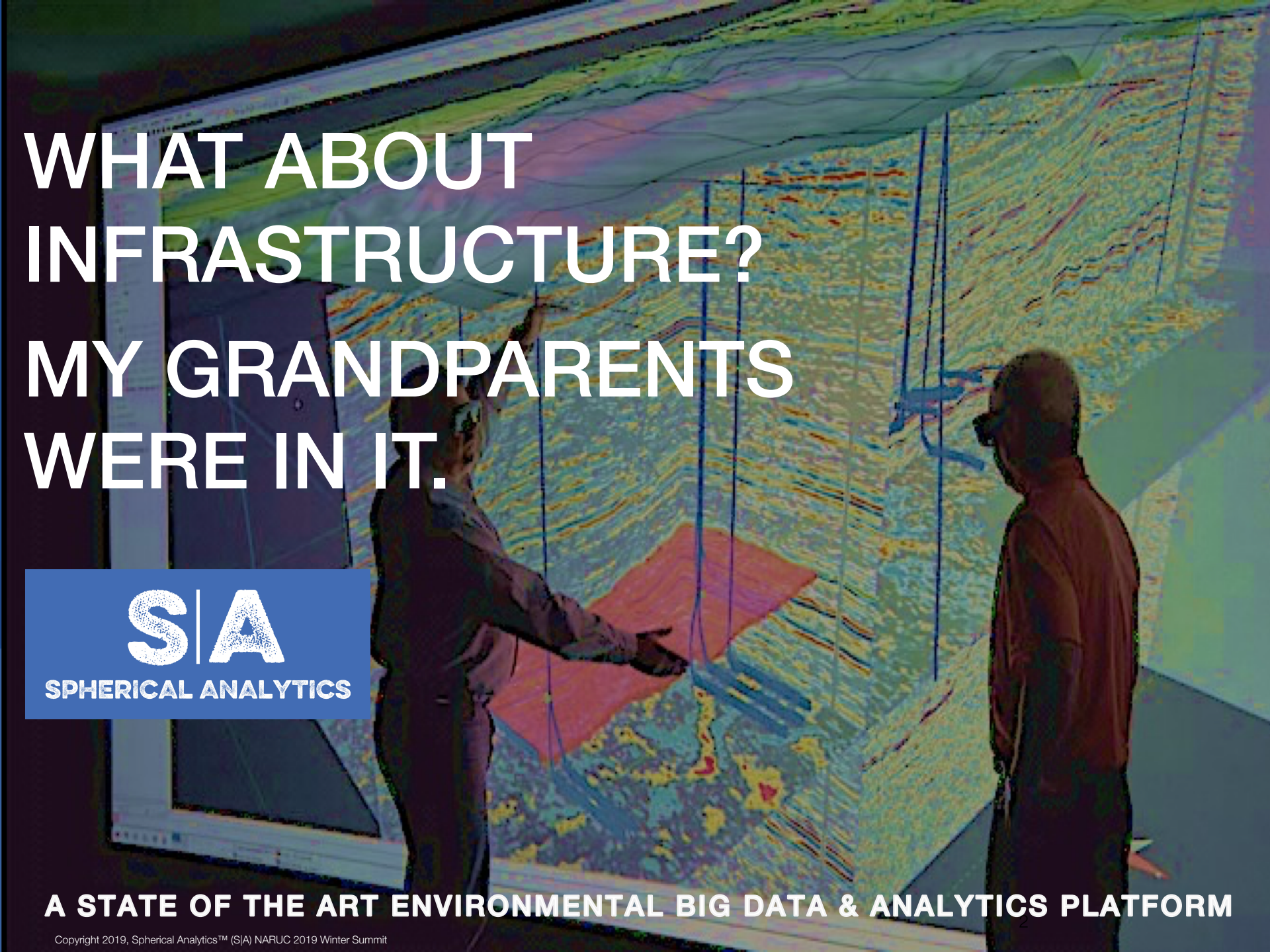
# S|A

## SPHERICAL ANALYTICS

GROUND TRUTH, TRUST, LEDGERS, WATER SECURITY

COMBINING DISPARATE BIG DATA & NETWORK GRAPH SCIENCE,  
WITH BLOCKCHAIN TECHNOLOGY AND MACHINE LEARNING  
TO DRIVE DEEPLY DESCRIPTIVE ANALYTICS &  
INSIGHTFUL PREDICTIVE ANALYTICS

FOR MORE INFORMATION, PLEASE CONTACT:  
CHRIS REZENDES, CBO, [CHRIS.REZENDES@SPHERICALANALYTICS.IO](mailto:CHRIS.REZENDES@SPHERICALANALYTICS.IO), 508-415-5022, OR



**WHAT ABOUT  
INFRASTRUCTURE?  
MY GRANDPARENTS  
WERE IN IT.**

**S|A**

**SPHERICAL ANALYTICS**

**A STATE OF THE ART ENVIRONMENTAL BIG DATA & ANALYTICS PLATFORM**

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A nighttime photograph of a city skyline, likely New York City, with several skyscrapers illuminated. The scene is reflected in a body of water in the foreground. A red rectangular box is overlaid on the left side of the image, containing the word "WE" in white. The rest of the text is overlaid on the image in white and red.

**WE WILL BUILD MORE INFRASTRUCTURE  
IN THE NEXT 40 YEARS...  
THAN THE LAST 4,000.**

PARAGKHANNA.COM

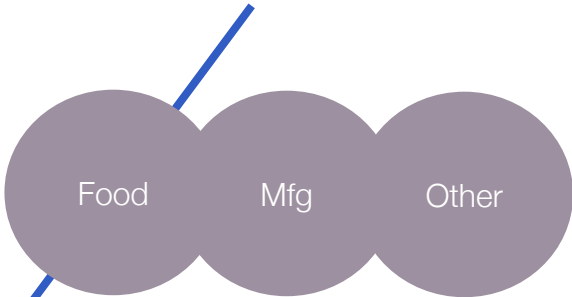
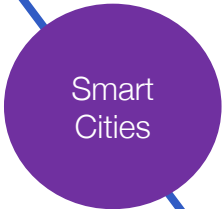
#CONNECTOGRAPHY

*Credit: Parag Kahn, Sharjah Industrial Development/ Investment Forum, 2016*

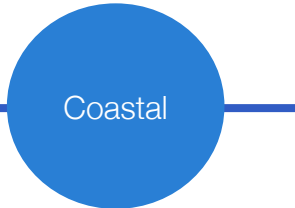
We need to change the conversation about infrastructure because we need to change our approach to infrastructure

Y = Public Market Opportunities

Z = Private/ Industrial Commercial Market Opportunities



X Natural Resources Opportunities





# CORE PRINCIPLE: EVERYTHING IS CONNECTED

Cyberphysical infrastructure has:

1. Complex supply chains
2. High risk of stall, loss, damage
3. Heavily regulated, compliance risk
4. Fragmenting/ federating markets
5. IP challenges

*Cyberphysical resilience demands:*

- *Transparency*
- *Agility*
- *Veracity*
- *Velocity*
- *Trust*

*Tools for baseline  
assessment/ as-  
is/ as-built (risk)  
conditions*

## RISK

### Internal Value Propositions

- Operational impacts
- Financial impacts
- Verifiable social impacts (ESG)

*Tools for  
enhancing on-  
going monitoring,  
management  
systems*

### External Value Propositions

- Access to customer \$\$\$
- Access to capital/ debt
- Access to Insurance / reinsurance

*Tools for  
engaging partners  
with new levels of  
trusted data/  
proof*

## RESILIENCE

*Tools for  
enabling,  
evidencing, new  
levels of  
operational,  
financial, climate  
resilience*





# S|A A TRUST PLATFORM SOLUTION OVERVIEW



**SPHERICAL ANALYTICS**

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## Water Data Current Realities

- Environmental & infrastructure data is highly fragmented and “noisy”
- Many data layers are not structured or standardized in a way to make it accessible/ shareable
- Many data sources are nodal and not Interconnected (edge connections)
- Few data sources are trusted
- Most data, ecosystems are thus not being leveraged to their maximum impact potential

## S|A Core Strategic Principles

- Leverage our IP to radically ingest and interconnect widespread trusted climate data (*TCD Everywhere*) and climate analytics with infrastructure, industrial, related data sets
- Enable the “TCD Network Graphs”
- Leverage and scale analytics for a variety of stakeholders to accelerate climate-responsive/ regenerative outcomes, that scale, are profitable and persist
- We need a “ticker for the environment”

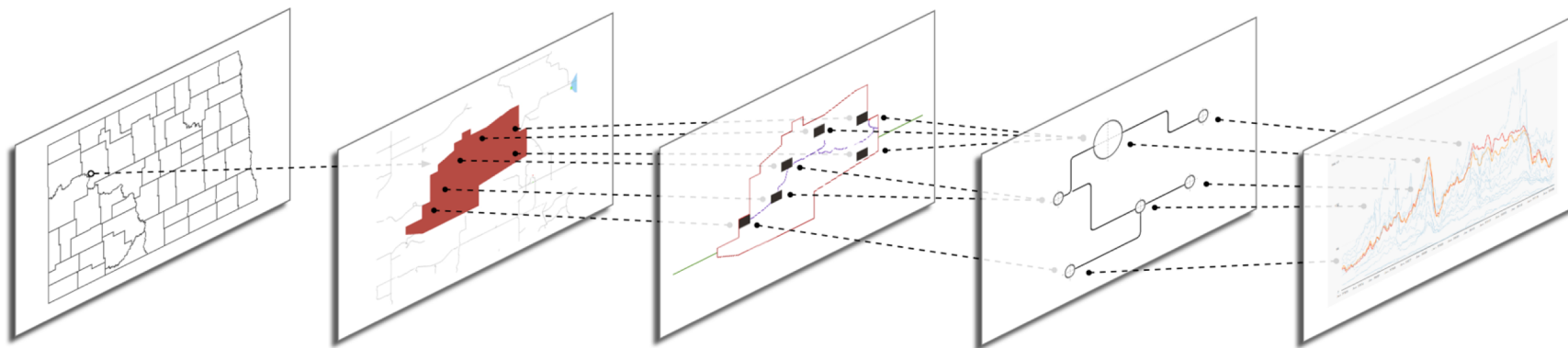
Geospatial/ Oceans Layers

Landowner/ Lease Layer

Infrastructure Ops Layers

SDG Layers

Risk/ Finance Layers

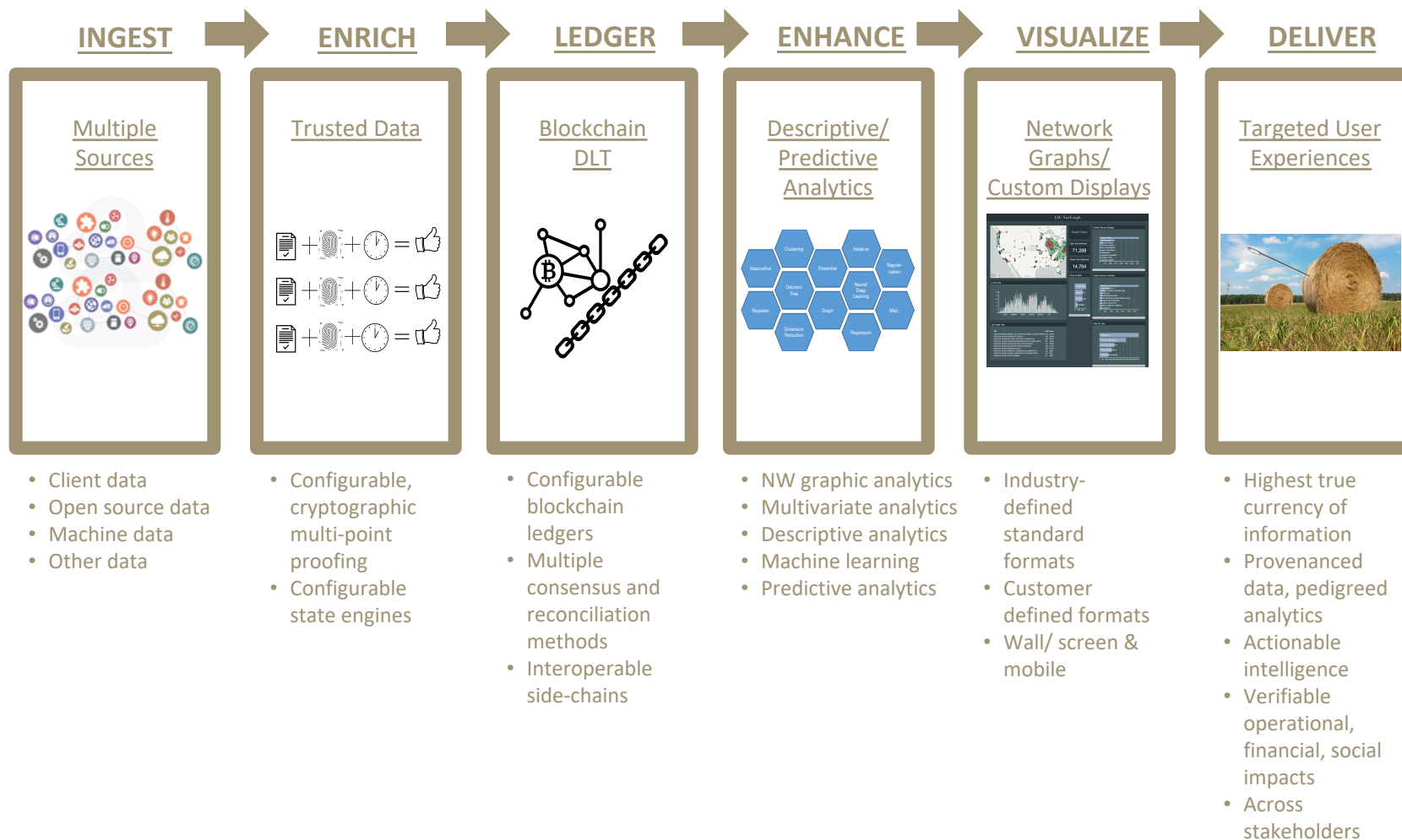




# CORE PRINCIPLE:

## Blockchain is sometimes necessary, always insufficient.

1. Ledger administration – adaptive ABAC, not rigid (goes for all services)
2. Private permissioned -- not public open access
3. All source ingestion – machine data matters more than social
4. Cryptographic proofs on source, data, models – no GIGO
5. State machines to model workflows/ dataflows – ground the ledger
6. Flexible consensus and reconciliation – not one size fits all
7. Distributed/ decentralized – hyperconcentrations are unstable





# S|A DEPLOYMENT SNAPSHOT



SPHERICAL ANALYTICS

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## CORE PRINCIPLE:

Trusted data is the oxygen of the enterprise;  
from quantum (one person part time) to F50

Recent/ ongoing S|A implementations

1. Energy and emissions in PA with EDF
2. Sustainable fisheries and oceans health in MA with New Bedford Port Authority
3. Risk mitigation for inclusive OZ investment in US with multiple investors
4. Groundwater/ townwater monitoring in multiple communities
5. Surfacewater asset monitoring/ management in multiple communities
6. EP grid edge monitoring/ management with new P3 entities
7. Coastal resilience with multiple communities, P3 entities
8. New asset pricing models with high pedigree 'E' with a top 10 asset manager
9. New risk rating models with multiple 'ESG' factors with a top 10 credit agency
10. New distributed commercial ecosystem models with a F50 brand






# Environmental Data Initiative

Finding the ways that work

[Home](#)
[News](#)
[Explorer](#)
[Scenarios](#)
[Methodology](#)
[Analytics](#)
[Sources](#)




## News

Latest News on EDF efforts



## Explorer

See the data projected on the map



## Analytics

Slice and dice the data

ID	Name	Year	Industry	State	Lat	Long	Source
10000001	2014-02 Central Valley Plant	2014	Electric	CA	37.5	-122.5	2014-02-01
10000002	2014-03 Central Valley Plant	2014	Electric	CA	37.5	-122.5	2014-03-01
10000003	2014-04 Central Valley Plant	2014	Electric	CA	37.5	-122.5	2014-04-01
10000004	2014-05 Central Valley Plant	2014	Electric	CA	37.5	-122.5	2014-05-01
10000005	2014-06 Central Valley Plant	2014	Electric	CA	37.5	-122.5	2014-06-01
10000006	2014-07 Central Valley Plant	2014	Electric	CA	37.5	-122.5	2014-07-01
10000007	2014-08 Central Valley Plant	2014	Electric	CA	37.5	-122.5	2014-08-01
10000008	2014-09 Central Valley Plant	2014	Electric	CA	37.5	-122.5	2014-09-01
10000009	2014-10 Central Valley Plant	2014	Electric	CA	37.5	-122.5	2014-10-01
10000010	2014-11 Central Valley Plant	2014	Electric	CA	37.5	-122.5	2014-11-01
10000011	2014-12 Central Valley Plant	2014	Electric	CA	37.5	-122.5	2014-12-01
10000012	2015-01 Central Valley Plant	2015	Electric	CA	37.5	-122.5	2015-01-01
10000013	2015-02 Central Valley Plant	2015	Electric	CA	37.5	-122.5	2015-02-01
10000014	2015-03 Central Valley Plant	2015	Electric	CA	37.5	-122.5	2015-03-01
10000015	2015-04 Central Valley Plant	2015	Electric	CA	37.5	-122.5	2015-04-01
10000016	2015-05 Central Valley Plant	2015	Electric	CA	37.5	-122.5	2015-05-01
10000017	2015-06 Central Valley Plant	2015	Electric	CA	37.5	-122.5	2015-06-01
10000018	2015-07 Central Valley Plant	2015	Electric	CA	37.5	-122.5	2015-07-01
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10000028	2016-05 Central Valley Plant	2016	Electric	CA	37.5	-122.5	2016-05-01
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10000031	2016-08 Central Valley Plant	2016	Electric	CA	37.5	-122.5	2016-08-01
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10000100	2022-05 Central Valley Plant	2022	Electric	CA	37.5	-122.5	2022-05-01

## Sources

Track data availability and contents



**Environmental Data Initiative**  
Powered by Spherical Analytics™

[Home](#) [Explorer](#) [GHGRP](#) [Sources](#) [Reports](#)

### Tracking Public Data

This platform tracks the availability and consistency of public data and preserves a copy of each available dataset for redundancy.

Availability and consistency of the data is tracked automatically, and detected faults are flagged.

There are three types of consistency checks:

- Resource availability: It is possible to access data source;
- Shallow consistency: Dataset has same size in bytes and/or same number of records as archived copy;
- Deep consistency: Dataset contents are identical to archived copy.

### Data Tracker

PA DEP Department of Environmental Protection						
Name	Available / Size Match / Consistent	Latest Update	Latest Track&Check	First Track&Check		
Gas Emissions By County 2015	OK / OK / OK	Aug 24, 2017	Jun 20, 2018	Jan 21, 2017	<a href="#">Data</a>	<a href="#">Page</a>
Waste Reports	OK / OK / OK	Oct 15, 2017	Jun 20, 2018	Jan 21, 2017	<a href="#">Data</a>	<a href="#">Page</a>
Production Report	OK / OK / OK	Oct 15, 2017	Jun 20, 2018	Jan 21, 2017	<a href="#">Data</a>	<a href="#">Page</a>
Permits Issued	OK / OK / OK	Jun 20, 2018	Jun 20, 2018	Jan 21, 2017	<a href="#">Data</a>	<a href="#">Page</a>
Gas Emissions By Source Category 2015	OK / OK / OK	Aug 24, 2017	Jun 20, 2018	Jan 21, 2017	<a href="#">Data</a>	<a href="#">Page</a>

Census United States Census						
Name	Available / Size Match / Consistent	Latest Update	Latest Track&Check	First Track&Check		

Data Sources: Dozens of public databases from federal and state agencies.

Data Source Identity Attestation: Ensuring that the source website/ portal/ database is authentic and not spoofed/ hacked

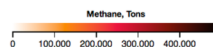
Data Veracity: Multi-factor authentication of veracity of the data sets being polled using trusted cryptographic methods. Any anomaly triggers and alert/ alarm.

Persistence: Performing these attestation, verification and authentication services at regular time intervals, and/ or on event basis, per customer need

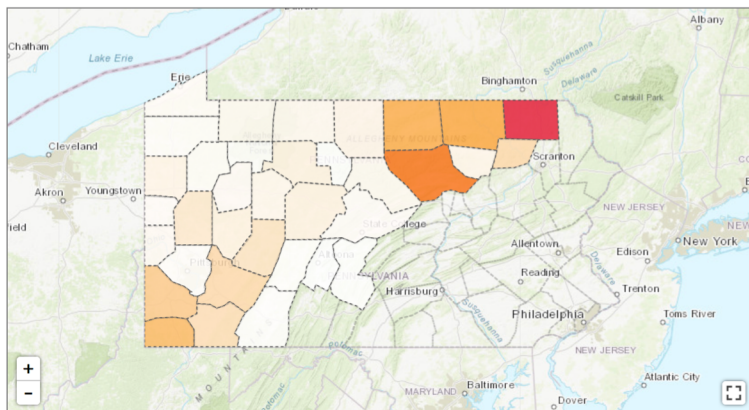
Explore: METHANE | [AIR TOXICS/VOCS](#) | [WELLS](#)

### Methane Pollution

Projected emissions, 2018-2025 | [Current annual emissions \(2015 baseline\)](#)  
[Compare Datasets: Reported vs EDF Inventories](#) | [Pre & Post NSPS](#)



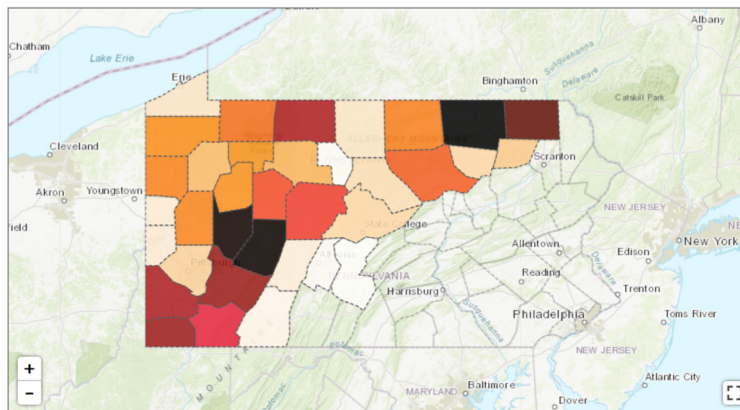
**Projections from Reported Emissions**  
1,020,700 tons of methane



Emissions reported by oil & gas companies for 2015, the most current data available.

**Projections from EDF Estimated Emissions**  
5,443,600 tons of methane

Wells: ☐ Unconventional ☒ All

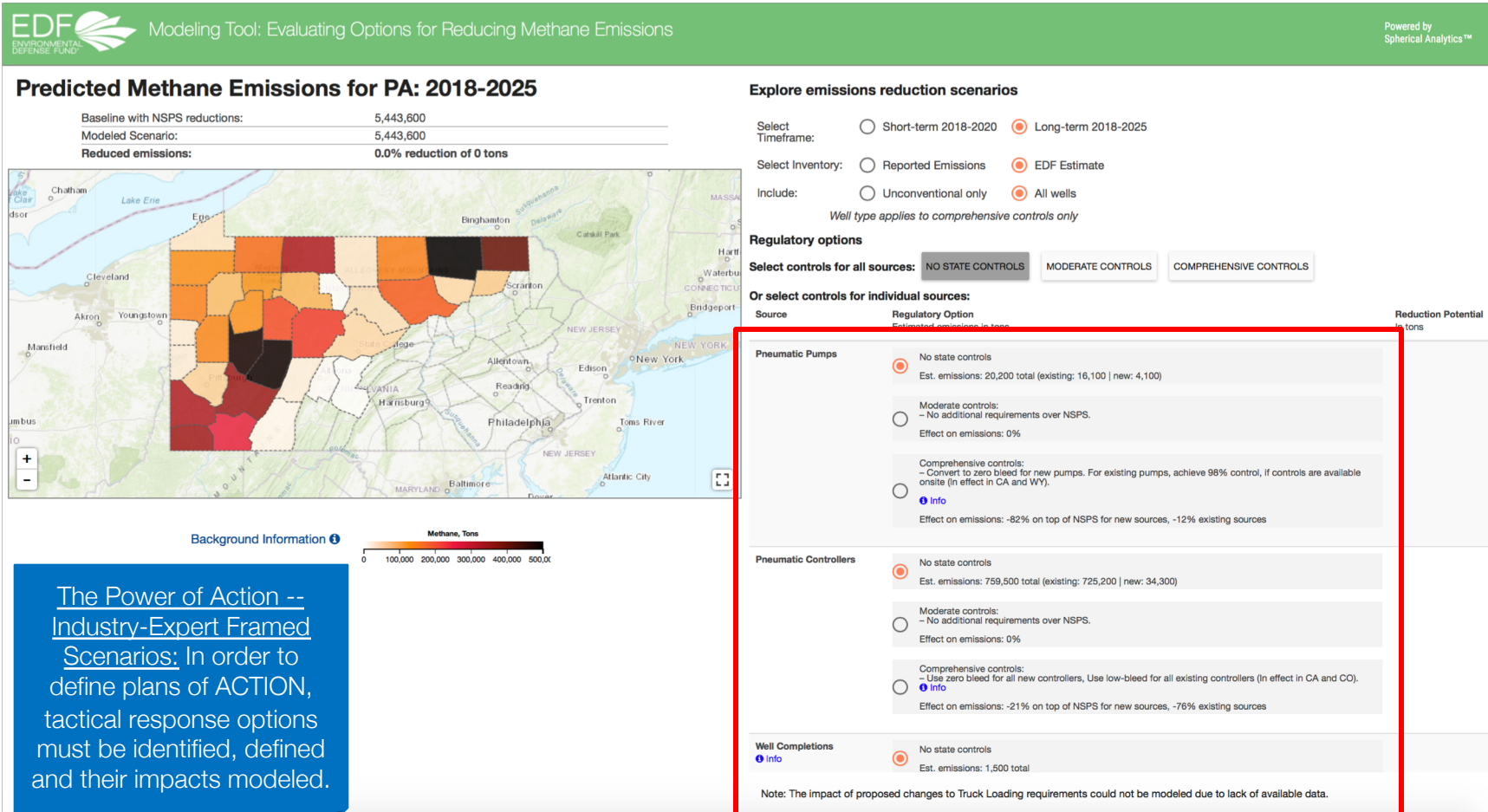


Estimated total emissions, based on field measurements.

Click on the to enlarge map and access more information

### The Power of Comparison:

The map on the left displays color/ shade scaled emissions as reported by EPA, based on EPA requirements for monitoring only certain types of wells. The map on the right displays same scale, but this one rooted in a model of emissions if emissions from every well were captured accurately and reported.



The Power of Action -- Industry-Expert Framed Scenarios: In order to define plans of ACTION, tactical response options must be identified, defined and their impacts modeled.



# S|A

## SPHERICAL ANALYTICS

GROUND TRUTH, TRUST, LEDGERS, WATER SECURITY

COMBINING DISPARATE BIG DATA & NETWORK GRAPH SCIENCE,  
WITH BLOCKCHAIN TECHNOLOGY AND MACHINE LEARNING  
TO DRIVE DEEPLY DESCRIPTIVE ANALYTICS &  
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FOR MORE INFORMATION, PLEASE CONTACT:  
CHRIS REZENDES, CBO, [CHRIS.REZENDES@SPHERICALANALYTICS.IO](mailto:CHRIS.REZENDES@SPHERICALANALYTICS.IO), 508-415-5022, OR



# Using Private Wells to Complement and Extend Groundwater-Level Monitoring Networks, Build Stakeholder Consensus, and Facilitate Sustainable Management

Joe Fillingham, PhD  
Science & Information Manager, WellIntel Inc.  
NARUC Policy Summit 2019

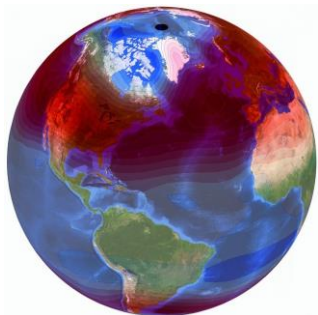
February 11, 2018

# Communities need groundwater data to inform local decisions



- Sustainable Usage
- Development
- Permitting
- Infrastructure
- Conservation
- Fees

# Regulators and policy makers need dense, rich groundwater data to meet growing pressures



Change  
&  
Risk



Costs  
&  
Budget



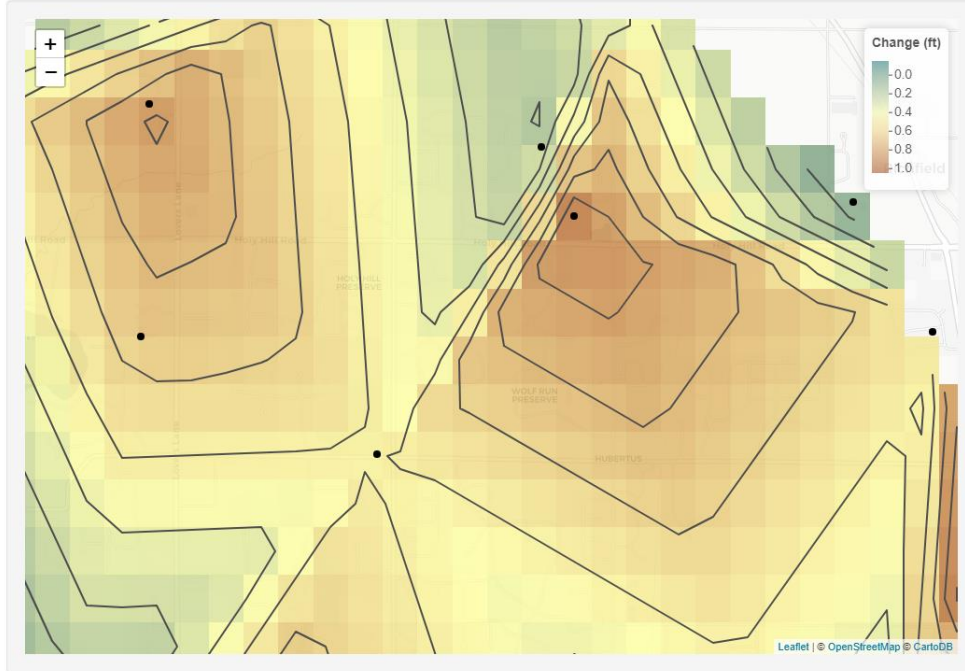
Management  
&  
Reporting



Engagement  
&  
Trust



# A new approach is needed, one that...

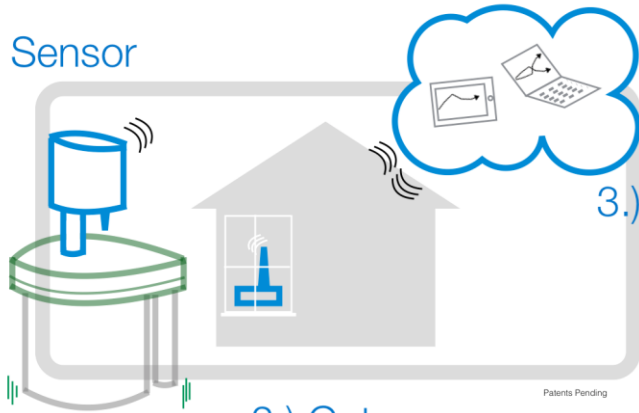


- Complements and extends existing monitoring efforts
- Leverages assets in the field (e.g. local internet)
- Enables real-time analysis to create meaningful metrics
- Engages community members
- Supports sustainable management and policy

# Cloud based monitoring tech enables real-time analytics and provides new opportunities

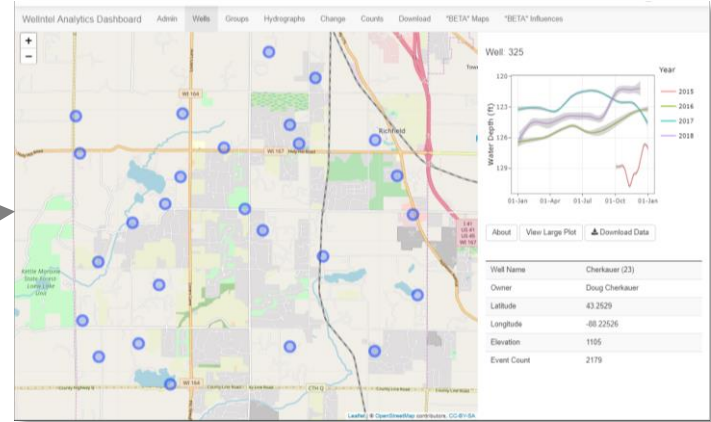


1.) Sensor



2.) Gateway

3.) Cloud

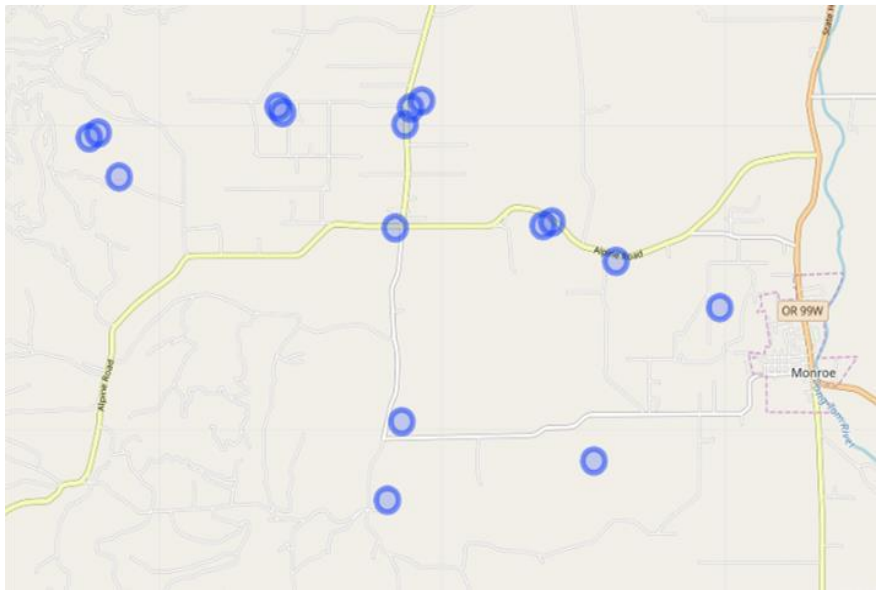
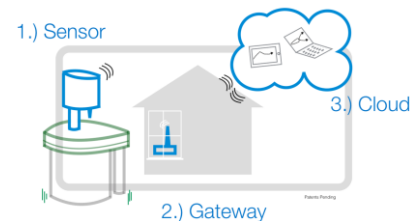


# Case Study - South Benton County, OR



- Growing community
- Hyper-local hydrogeologic environments
- Community needs data density to support factual understanding, develop trust, and engage with resource managers
- Network Goal:  
Support aquifer boundary mapping with dense groundwater level data to inform smarter permitting

# Monitoring Network Deployment

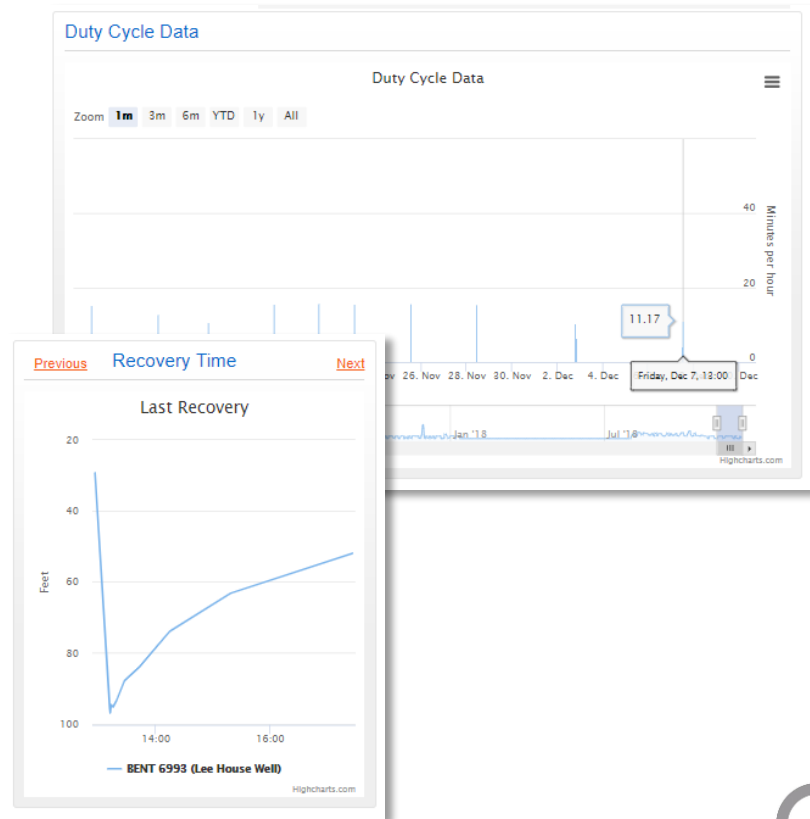
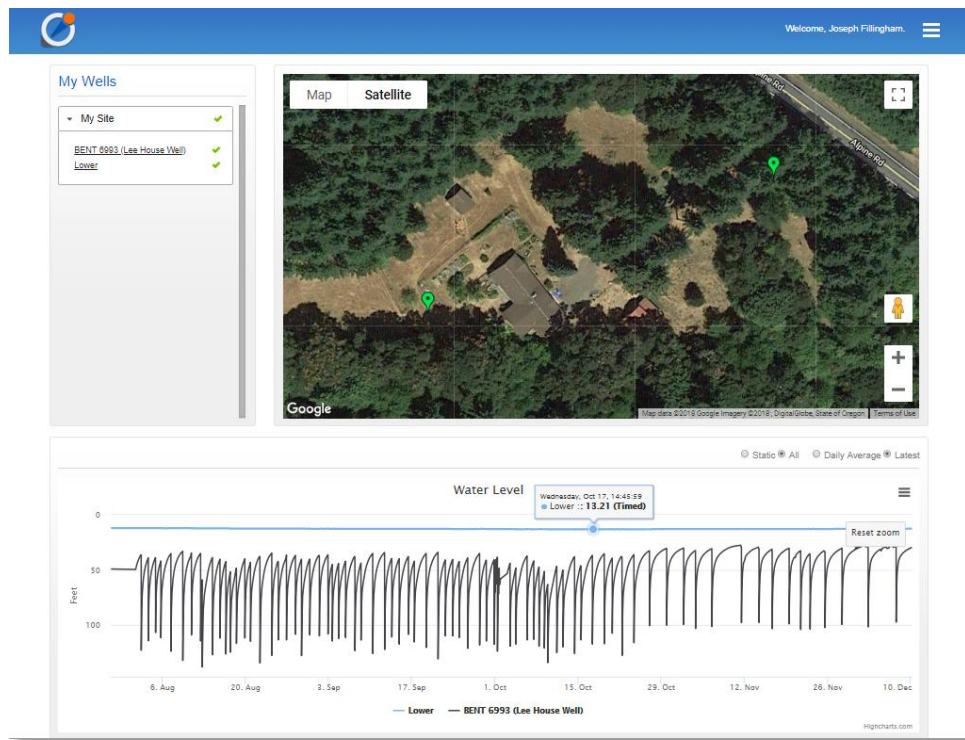


- 15 monitoring points (wells)
- 10 square miles
- Domestic & irrigation use wells
- WelIntel w/ “Standard” Telemetry
- Sensor Settings:
  - 4-hour timed readings
  - Pump start, stop & recovery tracked and readings tagged

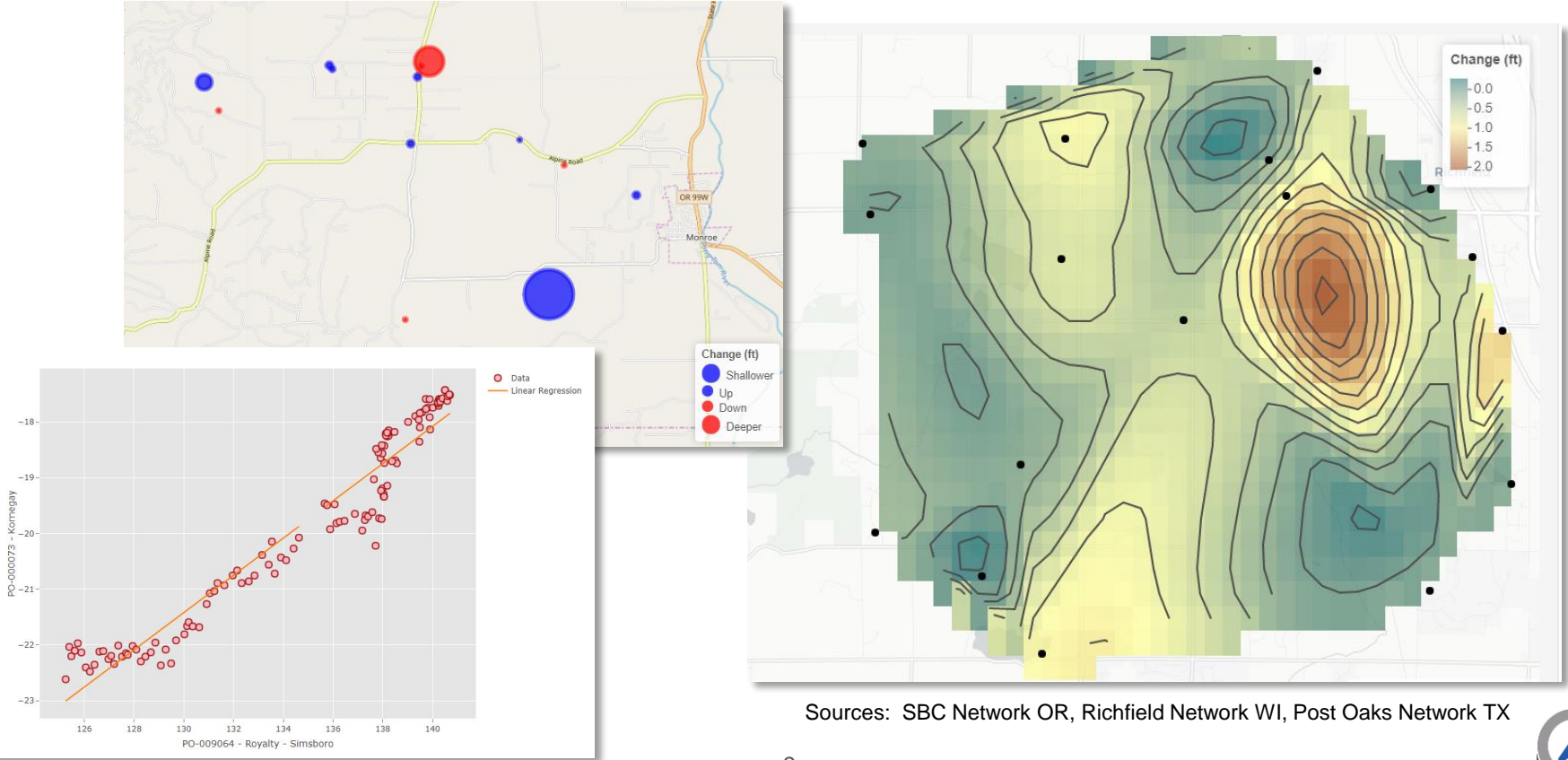
Source: SBC Network, January - November 2018



# Well owners learn about trends and basic dynamics

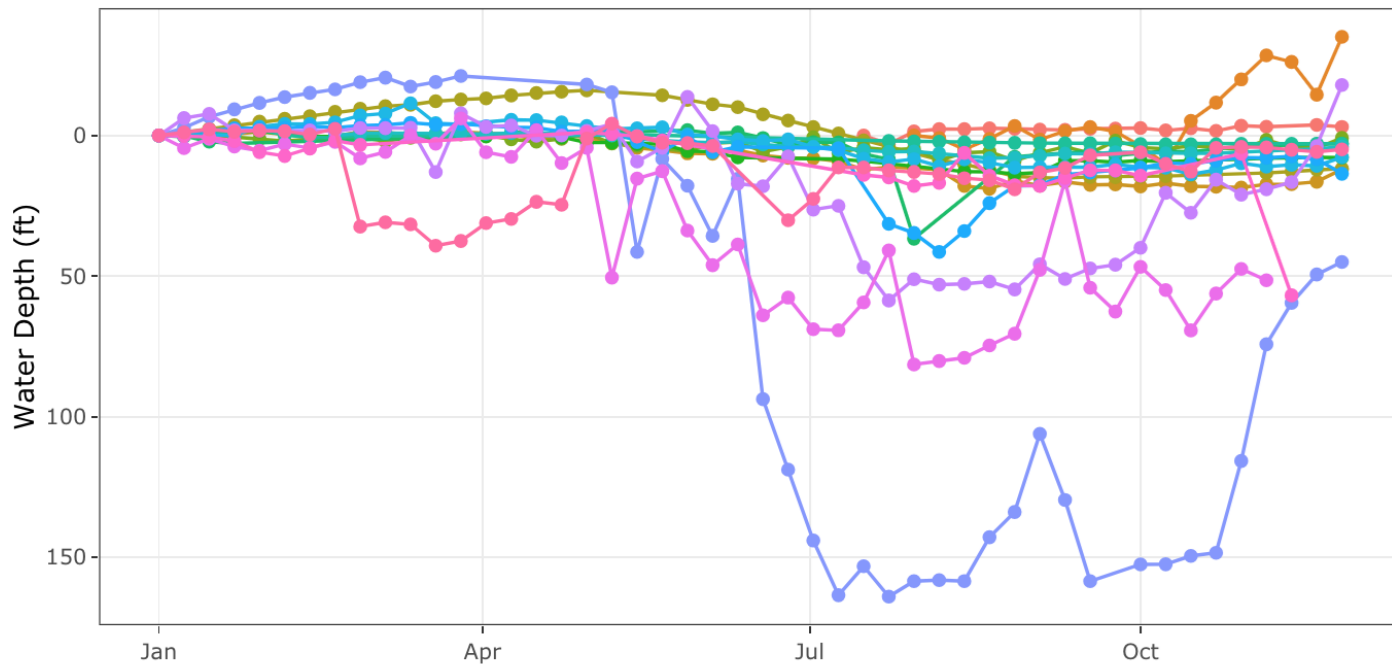


# Managers evaluate and analyze data at network scale...



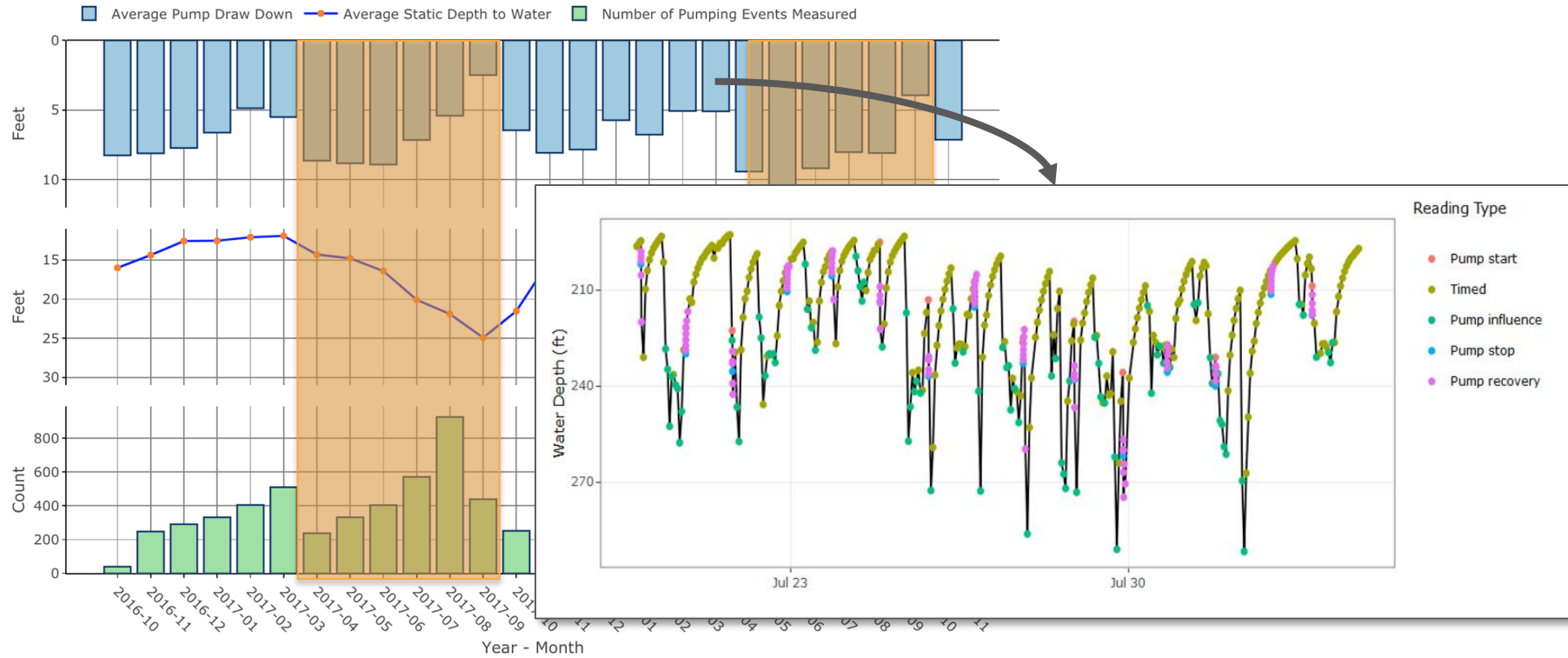
Sources: SBC Network OR, Richfield Network WI, Post Oaks Network TX

... with tools to see change and variability ...



Source: SBC Network, January - November 2018

# ...and analytics to understand use, risk, and influences



Source: SBC Network, January - November 2018



# New and Expanding Networks Informing Sustainability

Network/Sponsor	Goal	Resulting
Tri-Counties County conservation districts in partnership with state of WI and USGS	25 year time study to understand impact of dewatering from mining	15 sites in 3 counties Growing to 25 sites in 4 counties +1 USGS site



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