



Empowering Greener Practices: Optimizing Remediation Injection Operations with Digital Tools

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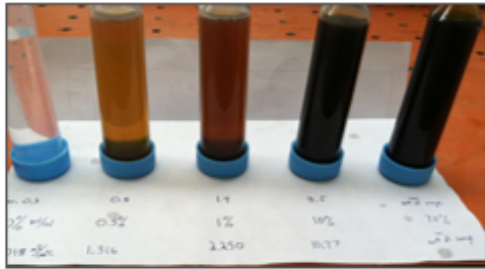
November 4, 2025

Agenda

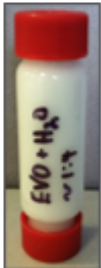
- 1 What do digital tools for injections look like?
- 2 What are the benefits of implementing digital tools?
- 3 How can digital tools make remedial injections more sustainable?
- 4 What was challenging? Where can we grow?



Sodium Persulfate



Molasses

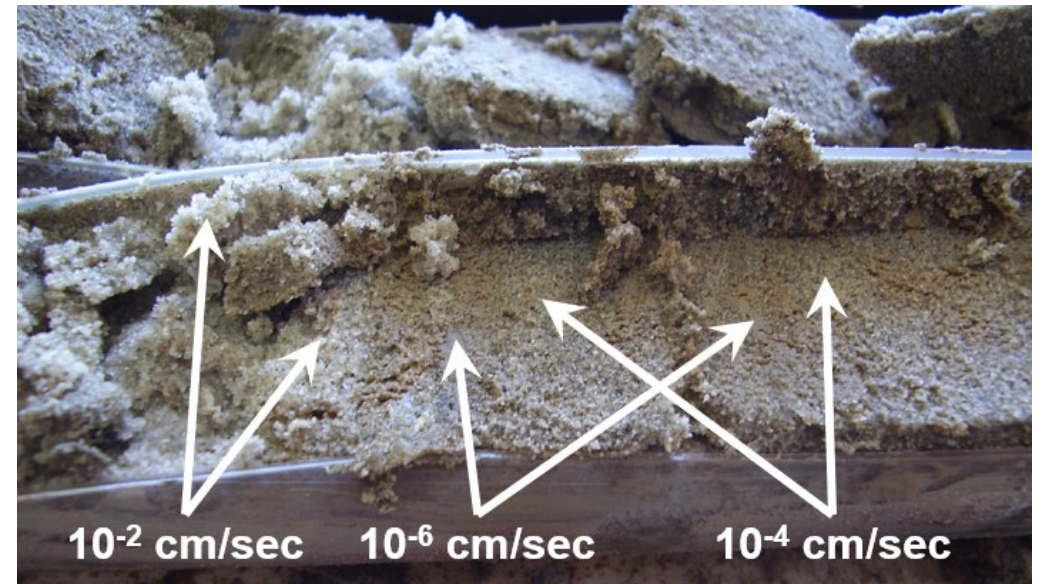
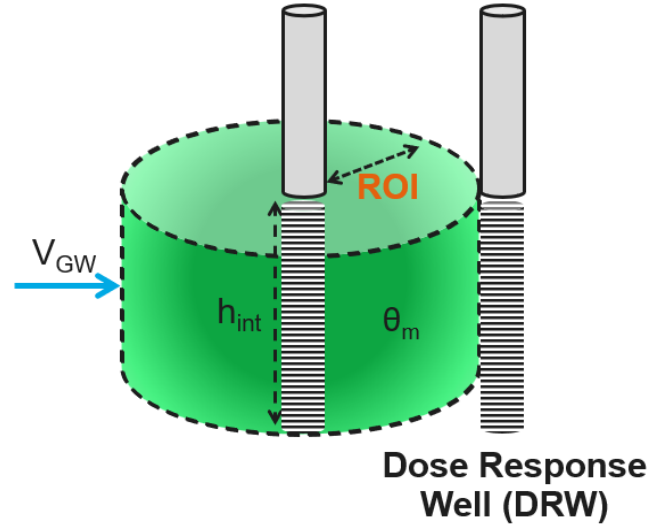


**Emulsified
Vegetable Oil**

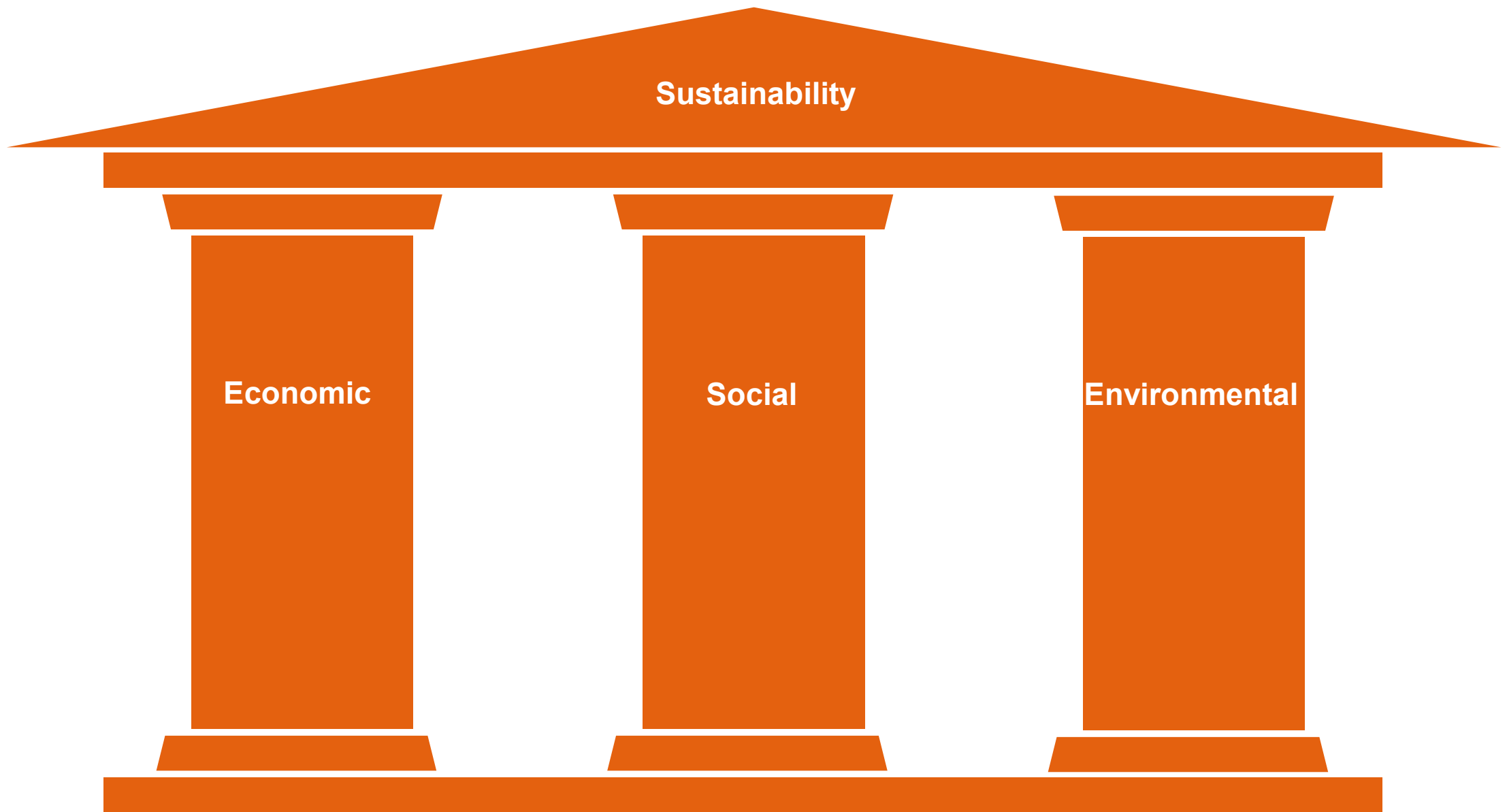


Fluorescein

Injection Well (IW)

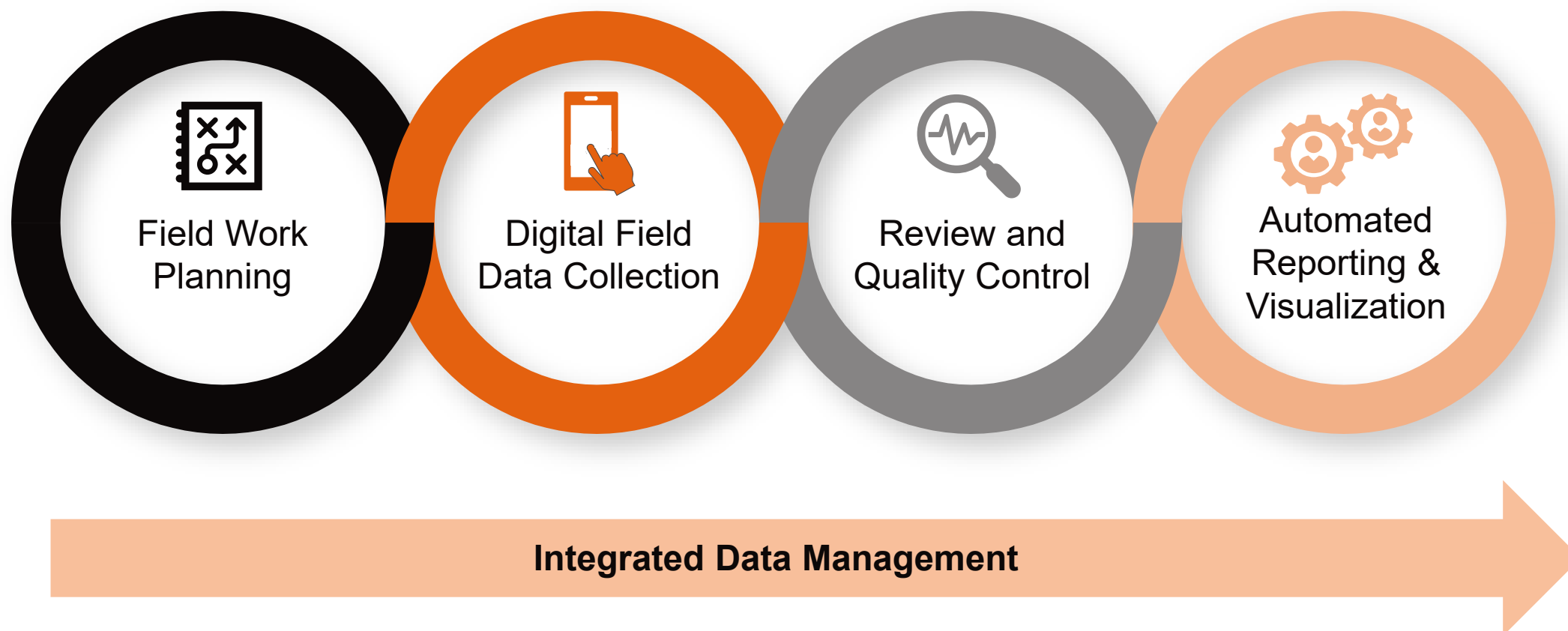


Digital tools can help make complex injection remedies more efficient and supports agile, data-driven decision-making.

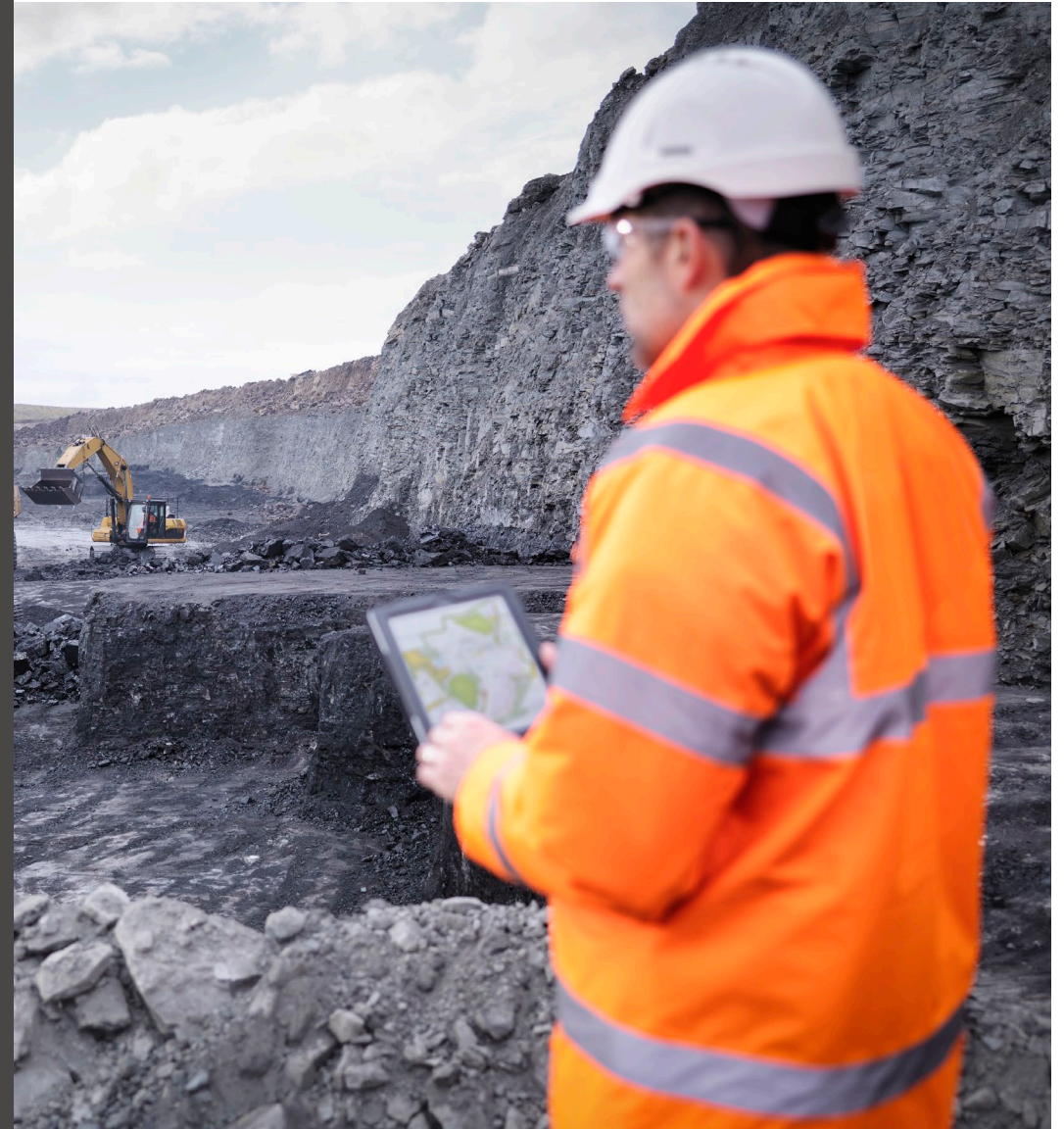


Process Improvements and efficiencies often double as sustainability wins!
So what about digital tools?

Digital Standard Workflows



FieldNow is Arcadis' digital program providing standardized tools and workflows for field data management.



FieldNow Standard Solutions

Supports over 70 solutions, including standard solutions for environmental sampling, reporting, and visualization.

		PLAN	COLLECT	REPORT & VISUALIZE		
		Planning	Field Data Collection	Field Logs	QA/QC Dashboards	Site Characterization
Solutions	Groundwater Monitoring	●	●	●	●	●
	Surface Water Monitoring	●	●	●	●	●
	Soil & Rock Sampling	●	●	●	●	●
	Sediment Sampling	●	●	●	●	●
	Vapor Intrusion	●	●	●	●	●
	Well Installation	●	●	●	●	●
	Well Development	●	●	●	●	
	Lysimeter Sampling	●	●	●	●	●
	Injections	●	●	●		
	Slug Tests		●			
	Pressure Transducer		●			

Digital Data Collection

FieldPlan and Fulcrum



FieldNow

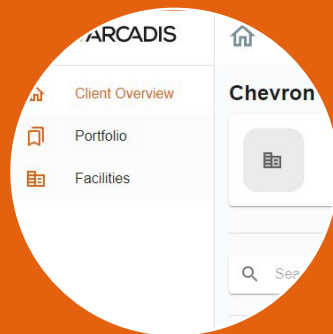
Arcadis' digital program providing standardized tools and workflows for field data management.

FieldPlan

An Arcadis-developed website that supports planning of fieldwork and interfaces with FieldNow Standard Fulcrum apps

Fulcrum

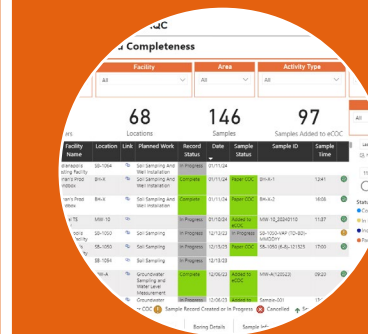
The third-party digital data collection platform that Arcadis is using for the Standard Field Data Collection.



Planning
FieldPlan



Collection
FieldNow Apps



QC
PowerBI



Power BI



Automated Reporting and Visualization



Power BI



ArcGIS



FieldPlan

- ☐ Used for standardized preparation prior to field events
- ☐ Reusable for all field activities at same facility
- ☐ Prepopulates many of the data fields in FieldNow forms => fewer empty fields and higher quality logs
- ☐ Familiar workflow project to project
- ☐ Forms (and field progress) can be QC'ed remotely

New Activity ⓘ

Activity Name *
Injection Test

Select Service Area *
Environmental Remediation

GROUNDWATER MONITORING

SOIL SAMPLING

SEDIMENT SAMPLING

SURFACE WATER MONITORING

LYSIMETER

WELL DEVELOPMENT

PFAS FOAM SITE ASSESSMENT

PFAS FOAM TRANSITION

INJECTION

VAPOR INTRUSION

PLANT TISSUE SAMPLING

Assets (undefined)
Edit Assets

FieldPlan

- ❑ Used for standardized preparation prior to injection events
- ❑ Allows for injection monitoring and dose response monitoring/ sampling within one FieldNow Application – fewer forms to complete










View Activity

Activity Name
Injections

Activity Type
Injection

Activity Status
Completed

Service Area
Environmental Remediation

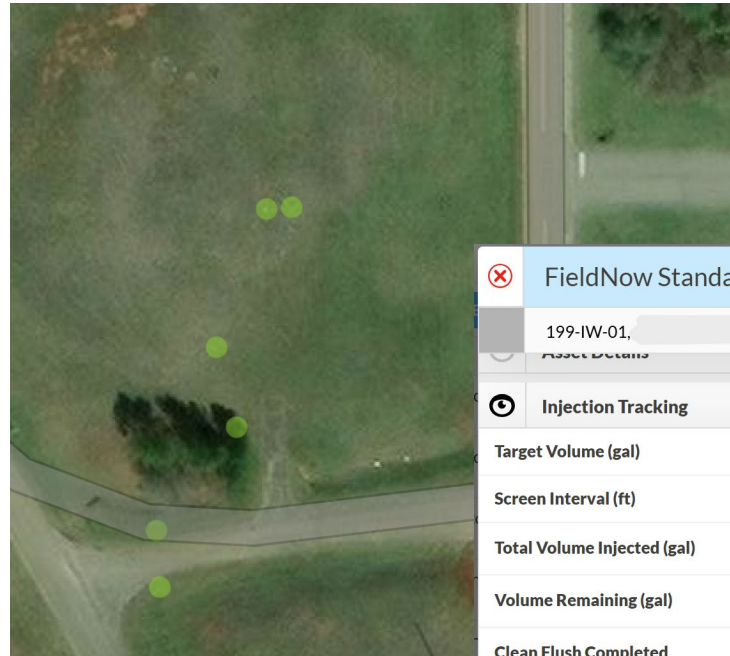
	Asset Name	Area Name	Asset Type	Scope Of Work	Injection Volume (gallons)	SYNC STATUS	Notes
+	RC-03	Chromium Depart...	Well	Injection	6770		Injection Well
+	RC-04	Chromium Depart...	Well	Injection	6770		Injection Well
+	DPI-01	Chromium Depart...	Well	Injection	900		Direct-Push
+	DPI-02	Chromium Depart...	Well	Injection	900		Direct-Push
+	DPI-03	Chromium Depart...	Well	Injection	900		Direct-Push
+	DPI-04	Chromium Depart...	Well	Injection	900		Direct-Push
+	MW-111	Chromium Depart...	Well	Monitoring			Monitoring Location
+	RC-01	Chromium Depart...	Well	Injection	6770		Injection Well
+	RC-06	Chromium Depart...	Well	Injection	6770		Injection Well

Total Rows: 9

Fulcrum Apps

FieldNow Standard – Injections

- ☐ Record is geolocated based on well coordinates from FieldPlan
- ☐ Pre-filled entries can be edited in the field if needed
- ☐ Some fields are calculated based on user entries



FieldNow Standard - Injections (editing)

199-IW-01, Asset Details

Injection Tracking

Target Volume (gal)5600.00

Screen Interval (ft)

Total Volume Injected (gal)350

Volume Remaining (gal)5250

Clean Flush Completed

YES

NO

Injection Well Tracking4 Items

Average Instantaneous Flow Rate (gpm)1.5

Average Overall Flow Rate (gpm)0.24

Samples Taken?

YES

NO

Field Notes0 Items

Close Out

Scope of Work Status

In Progress

In Progress Type

Photos

ADD PHOTOS

Fulcrum Apps

FieldNow Standard – Injections

- ☐ Record is geolocated based on well coordinates from FieldPlan
- ☐ Pre-filled entries can usually be edited in the field
- ☐ Some fields are calculated based on user entries
- ☐ Data input screen =>

The screenshot shows the 'FieldNow Standard - Injections' app interface. At the top, there is a header bar with a red 'X' icon, the title 'FieldNow Standard - Injections (editing)', a red '+' icon, and a green checkmark icon. Below the header, there is a navigation bar with a blue arrow icon, the text '199-IW-01', and the text '/ Injection Well Tracking (3 Items)'. The main content area displays a list of three injection records, each with a red 'X' icon, a timestamp, and a 'View' link with a right arrow.

Record	View
199-IW-01: 10/2/2025, 14:45 - Initial Totalizer Reading	View >
199-IW-01: 10/2/2025, 15:45 - 100 gal	View >
199-IW-01: 10/2/2025, 16:46 - 122 gal	View >



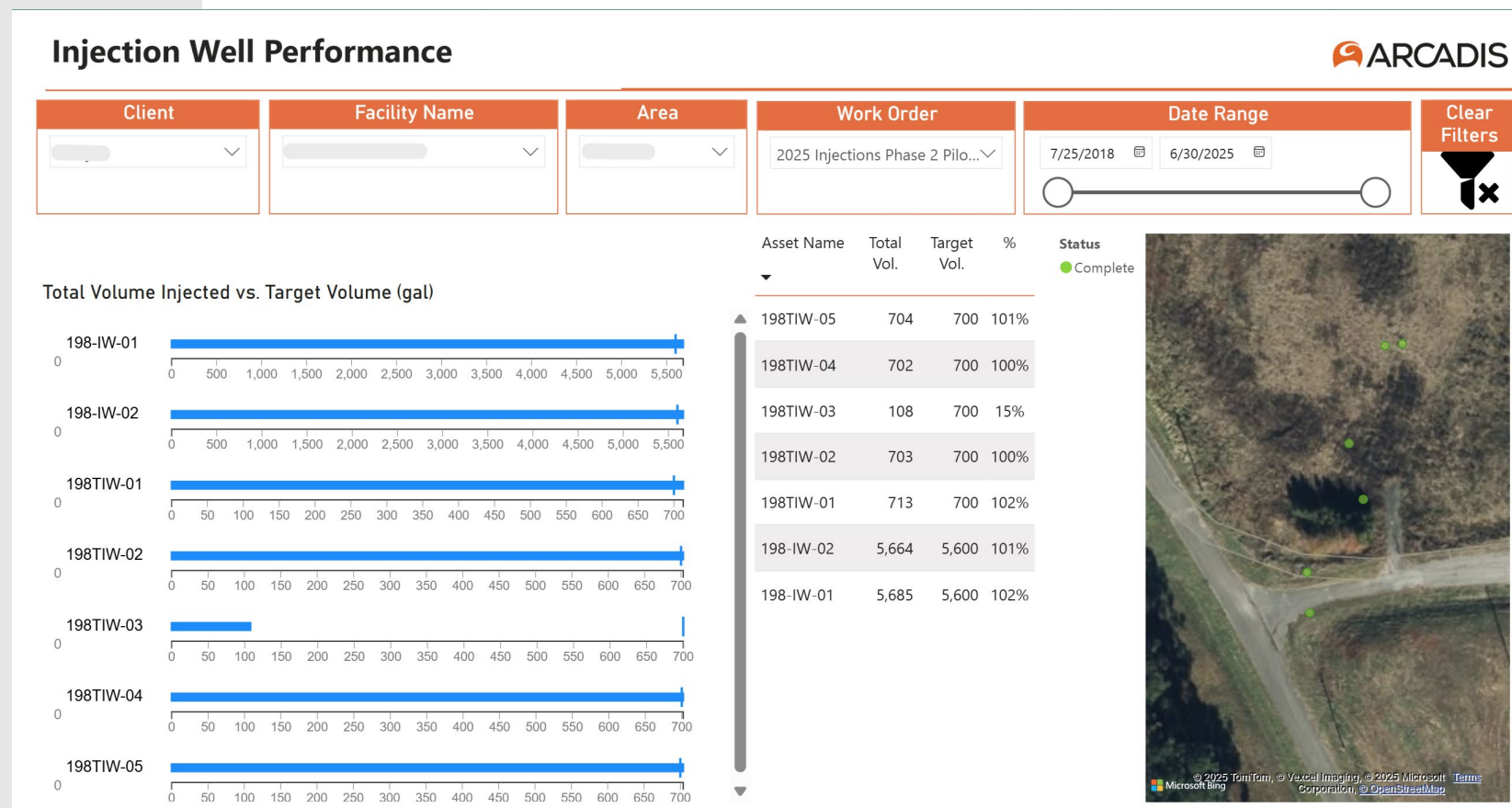
The screenshot shows the 'Injection Well Tracking' app interface. At the top, there is a header bar with a red 'X' icon, the title 'Injection Well Tracking (editing)', and a green checkmark icon. Below the header, there is a navigation bar with a blue arrow icon, the text '199-IW-01: 10/2/2025, 15:45 - 100 gal', and a green checkmark icon. The main content area displays a form with several sections: 'Metadata', 'Totalizer Info', and 'Pressure and Flow'. Each section contains various input fields and buttons.

Section	Field	Value
Metadata	Duration	18 seconds (First Creation)
	Injection Type	GRAVITY FEED TOTALIZER DPT
	Previous Activity	Starting Injections
	Activity Type	Totalizer Reading
Totalizer Info	Previous Totalizer (gal)	1100
	Totalizer (gal)	1200
	Subtotal (gal)	100
Pressure and Flow	Pressure (psi)	0.5
	Flow Gallons Measured (gal)	1.5
	Flow Time Basis (sec)	60
	Instantaneous Flow (gpm)	1.5
	Average Flow Since Last Reading (gpm)	1.67
Comments		

PowerBI

Dashboards

- ☐ Injection Well Performance



PowerBI

Dashboards

☐ Injection Well Performance

Injection Well Summary

Placeholder

5,600

Cumulative Volume Injected (gal)

97.97

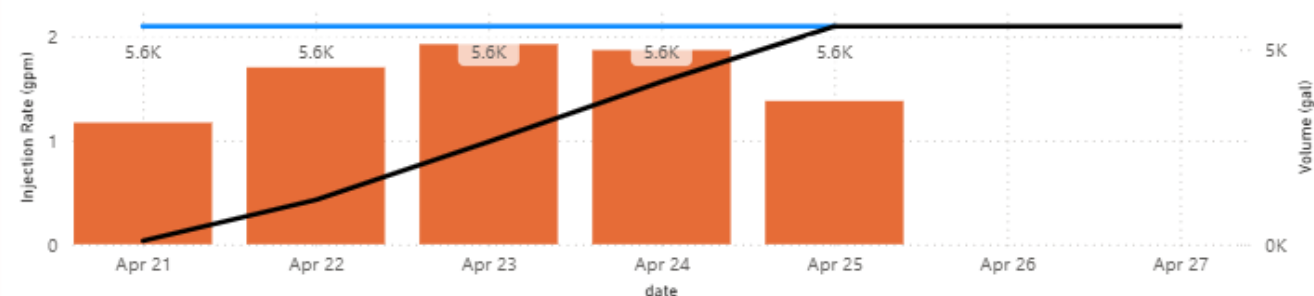
Cumulative Injection Time (hr)

1.69

Avg Injection Rate to Date (gpm)

Injection Rate (gpm), Cumulative and Total Target Volumes (gal) by Date

● Injection Rate (gpm) ● Target Injection Volume (gal) ● Cumulative Volume injected (gal)

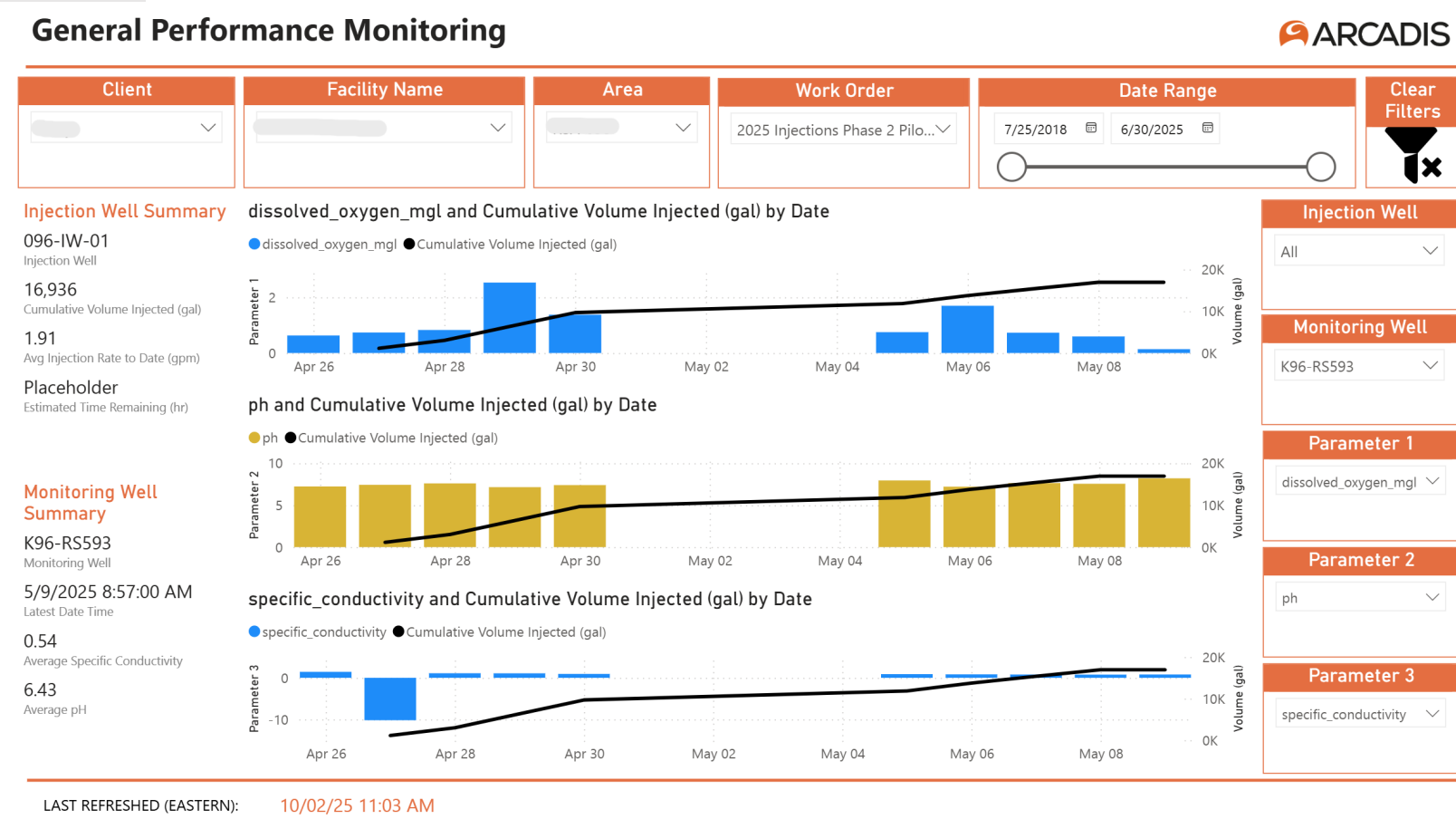


Injection Location	Date/Time	Scope of Work Status	Totalizer (gal)	Volume Subtotal (gal)	Inst. Flow (gpm)	Wellhead Pressure (psi)	Injection Volume (gal)
194-IW-01	04/21/2025 16:11	Complete	5,013	0.00			0
194-IW-01	04/21/2025 17:11	Complete	5,086	73.00	1.20	0.00	73
194-IW-01	04/21/2025 17:25	Complete	5,102	16.00	1.14	0.00	16
194-IW-01	04/22/2025 08:18	Complete	5,102	0.00	1.18	0.00	0
194-IW-01	04/22/2025 09:18	Complete	5,173	71.00	1.18	0.00	71
194-IW-01	04/22/2025 10:18	Complete	5,263	90.00	1.50	0.00	90
194-IW-01	04/22/2025 11:18	Complete	5,403	140.00	2.00	0.00	140
194-IW-01	04/22/2025 12:18	Complete	5,499	96.00	1.60	0.00	96
Total				5,600.00			

PowerBI

Dashboards

General Performance Monitoring



PowerBI

Dashboards

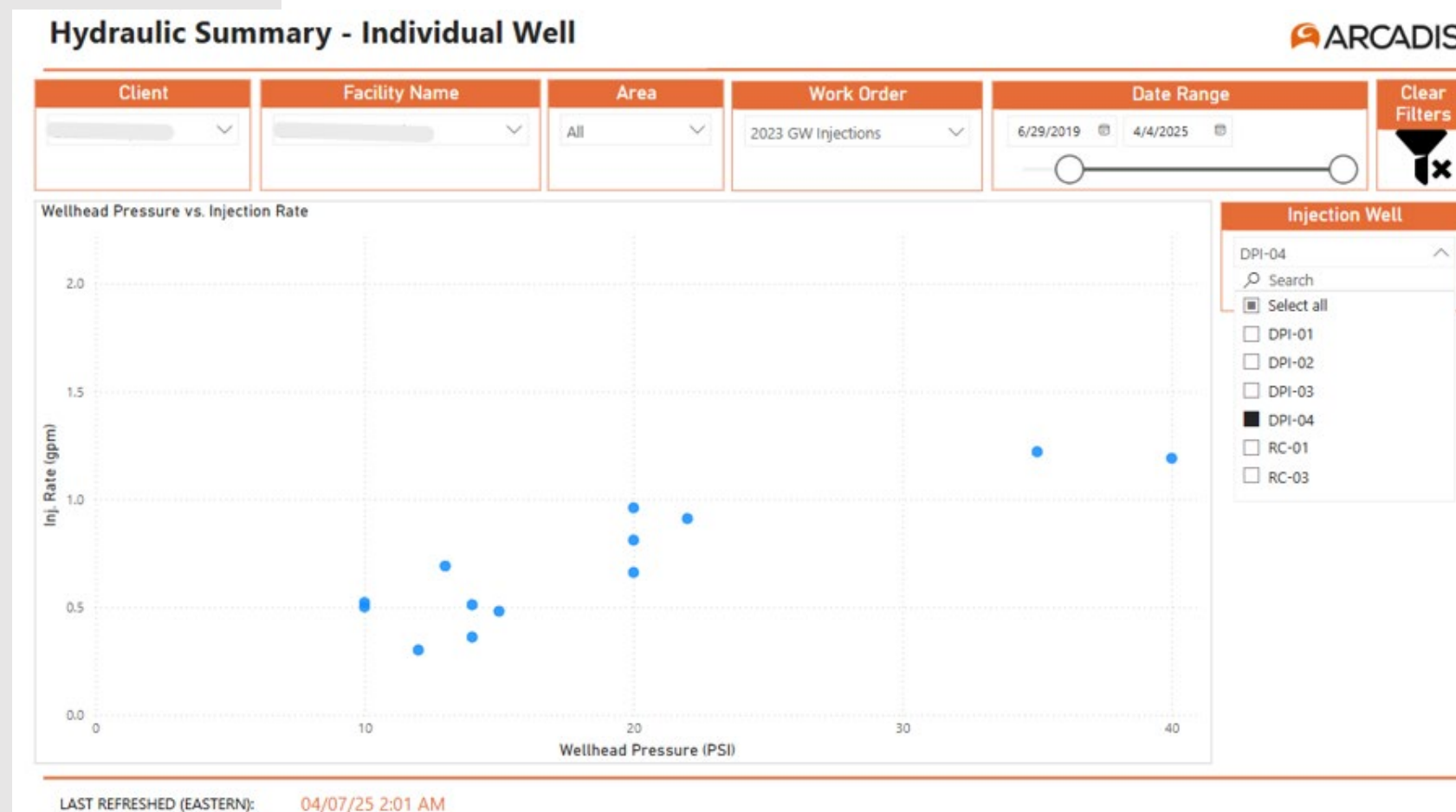
- ☐ Hydraulic Summary – Injection Capacity



PowerBI

Dashboards

- ☐ Hydraulic Summary – Individual Well



PowerBI

Paginated Reports

- ☐ Injection Summary Table
- ☐ Injection Well Log

Injection Well Data Collection Form Operations and Maintenance Plan



Well ID: DPI-04

Target Volume: 900.0

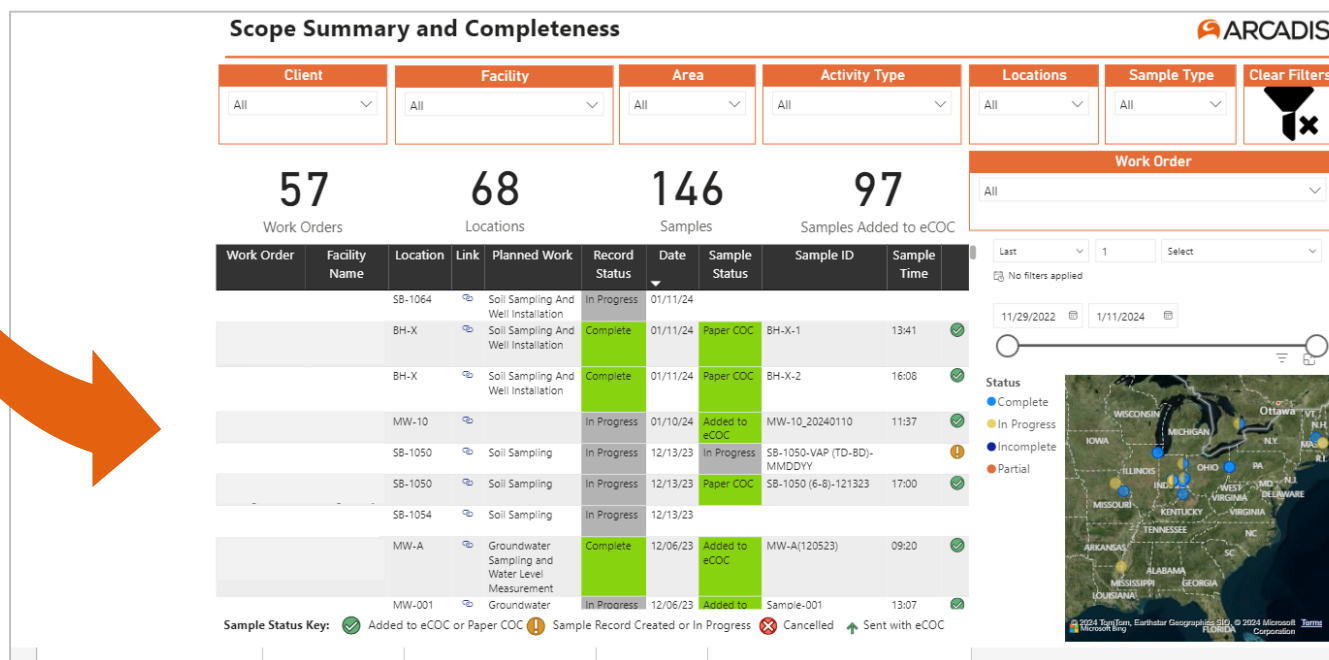
Date/Time	Pressure (psi)	Volume Subtotal (gal)	Totalizer Reading (gal)	Flow Rate (gpm)	Notes/Observations
04/12/2023 7:30 AM		0.0	0.0		
04/12/2023 9:00 AM	13.0	29.3	29.3	0.7	Minor surfacing through borehole. Paused to reset rod.
04/12/2023 11:00 AM	10.0	77.7	107.0	0.5	
04/12/2023 1:00 PM	20.0	58.0	165.0	0.8	
04/12/2023 3:45 PM	10.0	102.0	267.0	0.5	End of Day. Clean flush 10 gal.
04/13/2023 7:30 AM		0.0	0.0		
04/13/2023 1:45 PM	20.0	82.0	160.0	0.7	
04/13/2023 3:22 PM	22.0	30.0	78.0	0.9	
04/13/2023 3:45 PM	14.0	68.0	228.0	0.5	End of Day. Clean flush 10 gal.
04/13/2023 9:00 PM	15.0	48.0	48.0	0.5	
04/14/2023 7:30 AM		0.0	0.0		
04/14/2023 9:00 AM	14.0	30.0	30.0	0.4	
04/14/2023 11:00 AM	12.0	33.0	63.0	0.3	
04/14/2023 1:00 PM	20.0	99.0	162.0	1.0	
04/14/2023 2:30 PM		83.0	245.0		End of Day. Clean flush 10 gal.
04/17/2023 11:00 AM		0.0	0.0		
04/17/2023 11:30 AM	40.0	46.3	46.3	1.2	
04/17/2023 12:40 PM	35.0	70.7	117.0	1.2	Injection Complete. Clean flush 10 gal.

Well ID	Target Volume of Injection Solution (gallons)	Actual Volume of Injection Solution (gallons)	Total Injection Duration (hours)	Average Flow Rate (gpm)	Average Instantaneous Flow Rate (gpm)	Average Pressure (psi)
096-IW-01	11,200.0	11,231.0	273.3	0.7	2.0	0.0
096-IW-02	5,600.0	5,705.0	185.6	0.5	2.7	0.0
142-IW-01	5,600.0	5,600.0	117.8	0.8	1.9	0.0
142-IW-02	5,600.0	5,622.0	158.8	0.6	1.0	3.0
144-IW-01	5,600.0	2,526.0	220.1	0.2	0.8	0.0
144-IW-02	5,600.0	19.0	2.0	0.2	0.2	0.0
194-IW-01	5,600.0	5,600.0	98.0	1.0	1.7	0.0

QAQC Dashboard for FieldNow Apps

- Designed to view progress and status of samples collected with the suite of Standard FieldNow Data Collection Apps.

Standard Fulcrum App	Use Cases
FieldNow Standard - Groundwater Monitoring and Surface Water Sampling	Groundwater sampling, groundwater gauging, surface water sampling, surface water gauging, well inspection
FieldNow Standard - Soil & Rock Boring	Soil sampling, well installation, grab groundwater sampling, VAP sampling, lysimeter installation, soil gas port installation
FieldNow Standard – Sediment Sampling	Sediment sampling
FieldNow Standard – Lysimeter Sampling	Lysimeter sampling
FieldNow – Vapor Intrusion	Vapor Intrusion Sampling



Digital Advantages



Reduced field preparation time



Fewer physical field materials



Quick data access



Better field organization



Facilitates communication



Data security and reliability



Fewer QC issues



Increased cost certainty



Lower risk of remobilization

Real-time data-driven decision making, standardized and organized data, shorter project lifecycle

Sustainability



Fewer QC
issues



Reduced field time



Increased
cost certainty



Data security
and reliability



Quick data
access

Economic

Social

Environmental



Communication



Fewer physical
field materials



Better field
organization



Lower risk of
remobilization



Challenges and Improvements

- ✓ Seek user feedback for continuous improvement;
- ✓ Adapt tools to meet new technical and logistical needs;
- ✓ Integration with internal tools and development of new apps and dashboards.



Thank you! Questions?

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