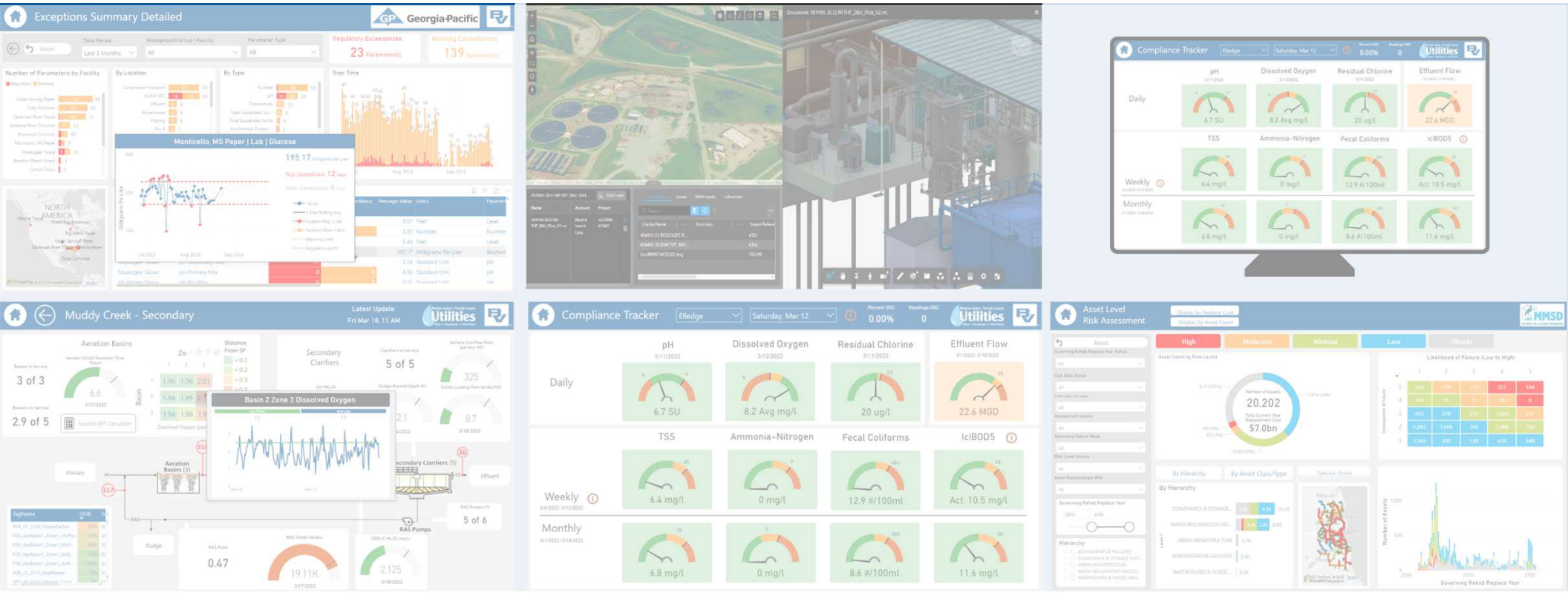


Data Driven Decisions

PNWS AWWA

May 7, 2026

BLACK & VEATCH

Who’s Here Today?



Lorena Tello

Project Manager

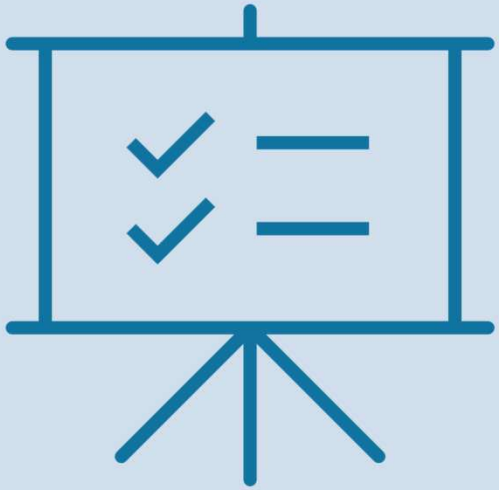


Evelyn Choudhary, PE

Project Manager

Agenda

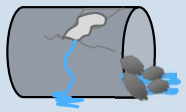
1. The Data Challenge
2. The Data Journey
3. Case Study 1: Water Audit
4. Case Study 2: Water Supply Planning
5. Case Study 3: Machine Learning is Here



The Data Challenge

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A Familiar Data Challenge…



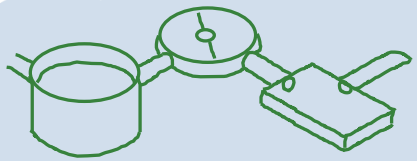
How bad is my aging infrastructure?



Where's the funding?



What do I do with all this data?



How can I Optimize Capital and O&M Expenditure?



How do I meet organizational goals?

Utilities Want to Be More Data-Driven

Data Driven organizations experience improved efficiency and productivity, faster, more effective decision-making and better financial performance.
-Arizona State Thunder School of Management

Businesses that are using “big” data effectively saw an 8% increase in profit.
-BARC Research

Data-driven organizations are 19 times more likely to be profitable.
-McKinsey Global Institute

Businesses that effectively using data saw a 10% decreases in costs.
-BARC Research

Companies that embrace data driven decision-making have output and productivity that is 5-6% higher.
-Forester Research

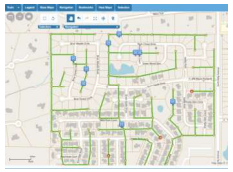
Of businesses surveyed that are effectively utilizing data:

- 69% cited better strategic decisions
- 54% cited improved control of operational processes

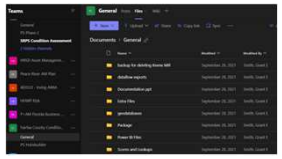
-BARC Research

Solving the Data Challenge

Information



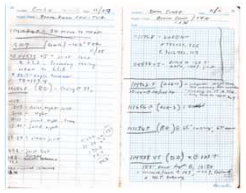
GIS



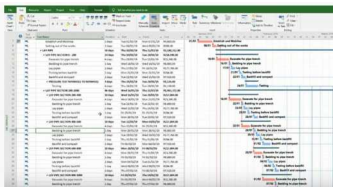
MS Teams Sites

ERP

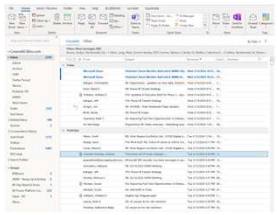
Finance Data



Handwritten Notes



Project Schedules



Emails



Institutional Knowledge



Excel Files (many!)

SCADA

Ops Systems

eLogger

Staff + Safety

Objectives

- *Asset Management Planning*
- *Operation & Maintenance*
- *Condition Assessment*
- *Project Management*
- *KPI Tracking*
- *Reporting & Analytics*
- *…*



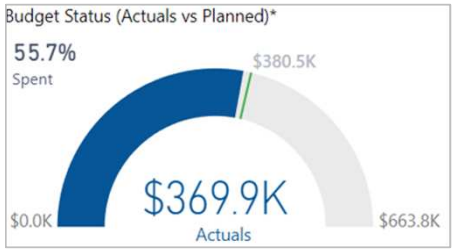
Solving the Data Challenge

Answers



Your data, presented when and where you need it.

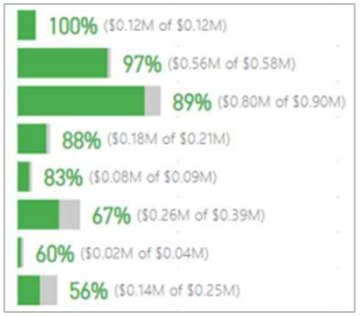
What's our status, overall?



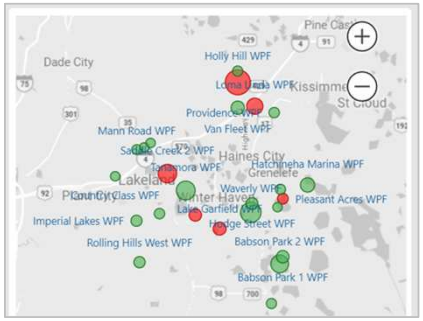
How are we trending?



How do my projects compare?



Where should I be looking?



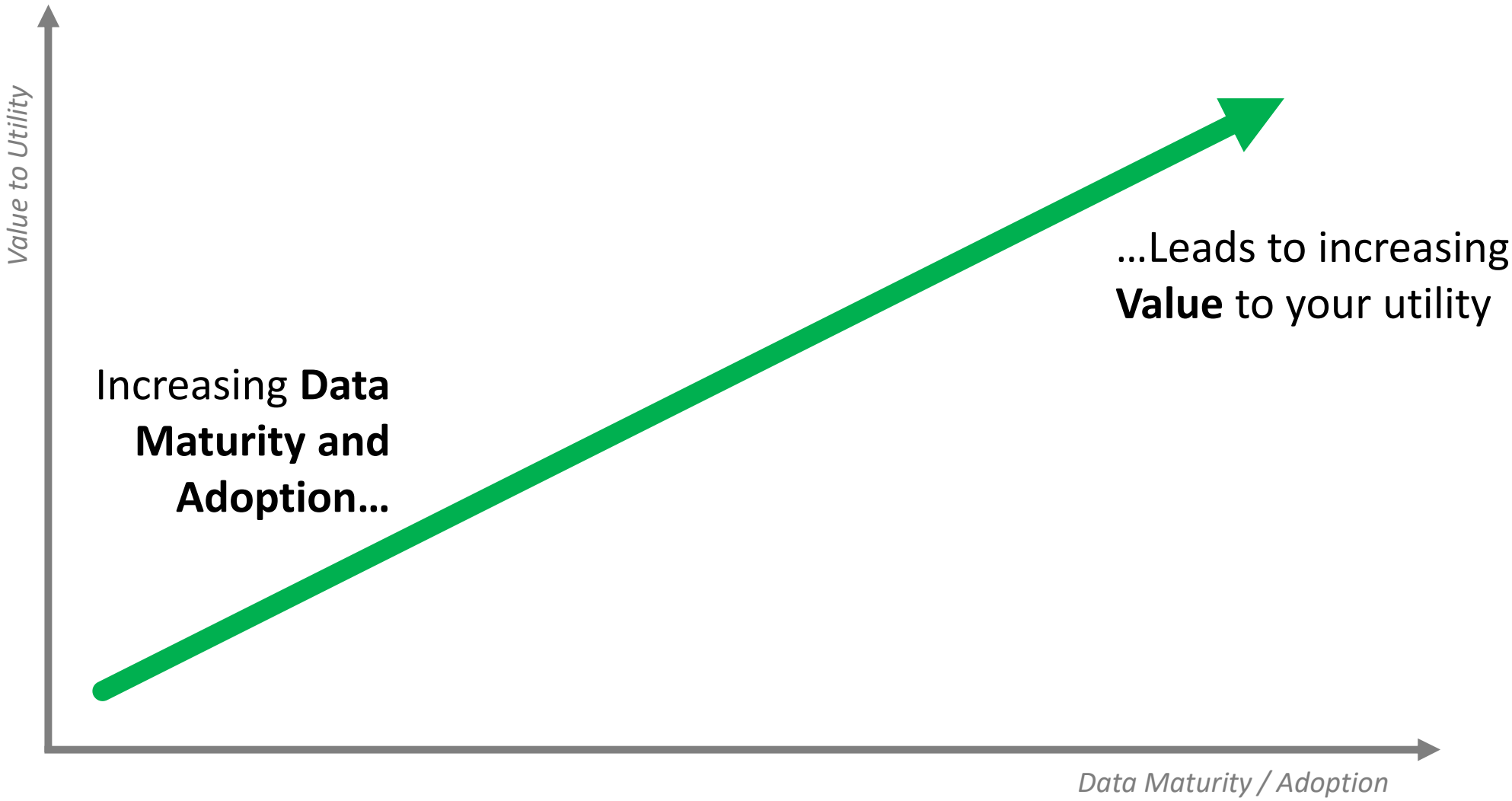
When are we in compliance?

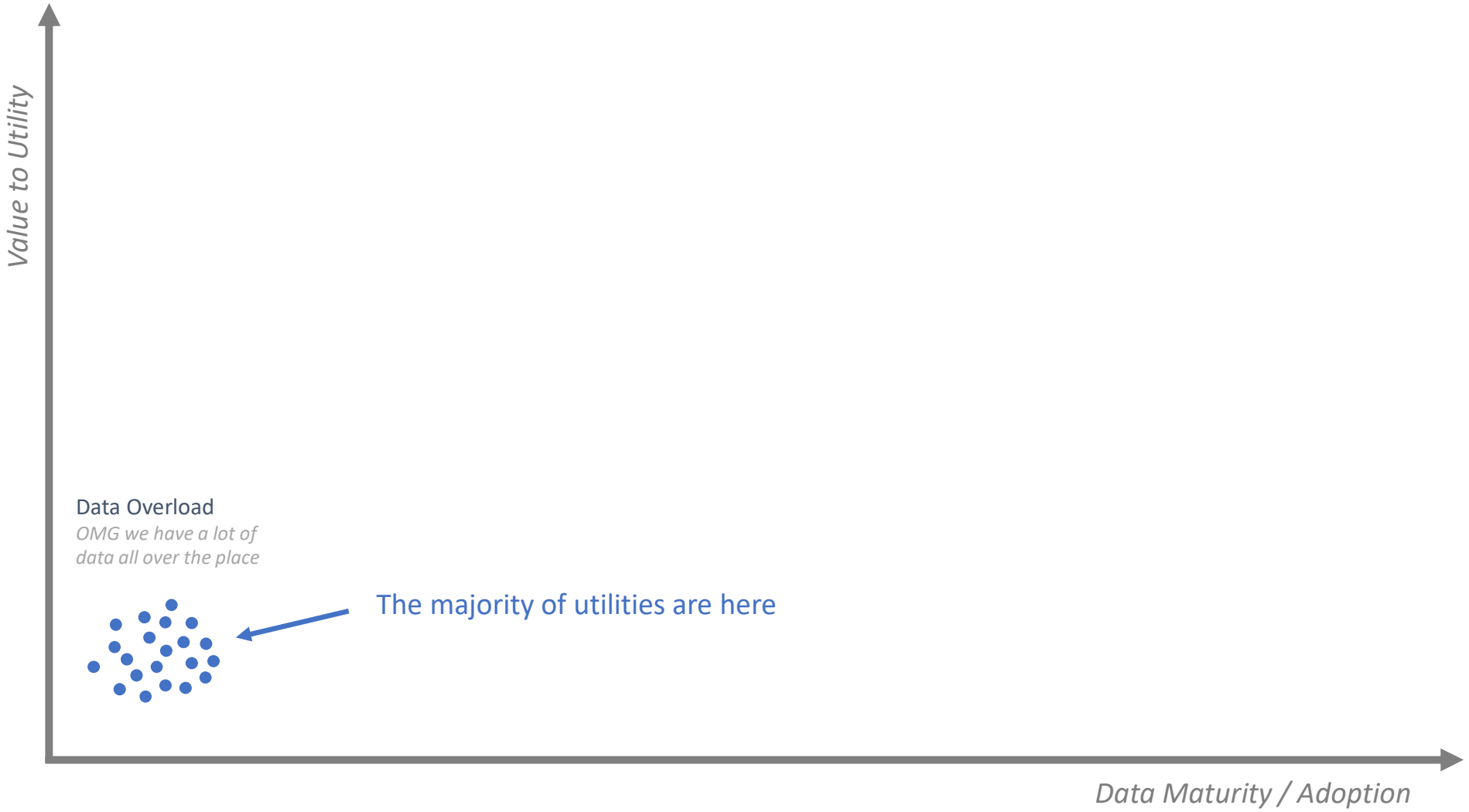
Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023	Jun 2023	Jul 2023
✗ 119	✗ 63	✗ 64	✗ 11	✗ 116	✗ 502	✓ 6
✗ 95	✗ 32	✗ 70	✗ 96	✗ 39	✗ 14	✓ 4
✗ 78	✓ 0	✗ 12	✗ 48	✗ 6	✗ 54	✗ 144
✓ 0	✓ 0	✓ 0	✓ 0	✓ 0	✗ 12	✓ 0
✗ 3	✓ 0	✓ 0	✗ 3	✓ 0	✓ 0	✓ 0
✓ 0	✓ 0	✗ 1	✗ 2	✓ 0	✗ 1	✗ 2
✓ 0	✓ 0	✓ 0	✓ 0	✓ 0	✓ 0	✓ 0
✓ 0	✓ 0	✓ 0	✓ 0	✓ 0	✓ 0	✓ 0
✓ 0	✓ 0	✓ 0	✓ 0	✓ 0	✓ 0	✓ 0
✓ 0	✓ 0	✓ 0	✓ 0	✓ 0	✓ 0	✓ 0
✗ 0	✗ 1	✗ 1	✗ 1	✗ 1	! 2	✗ 1

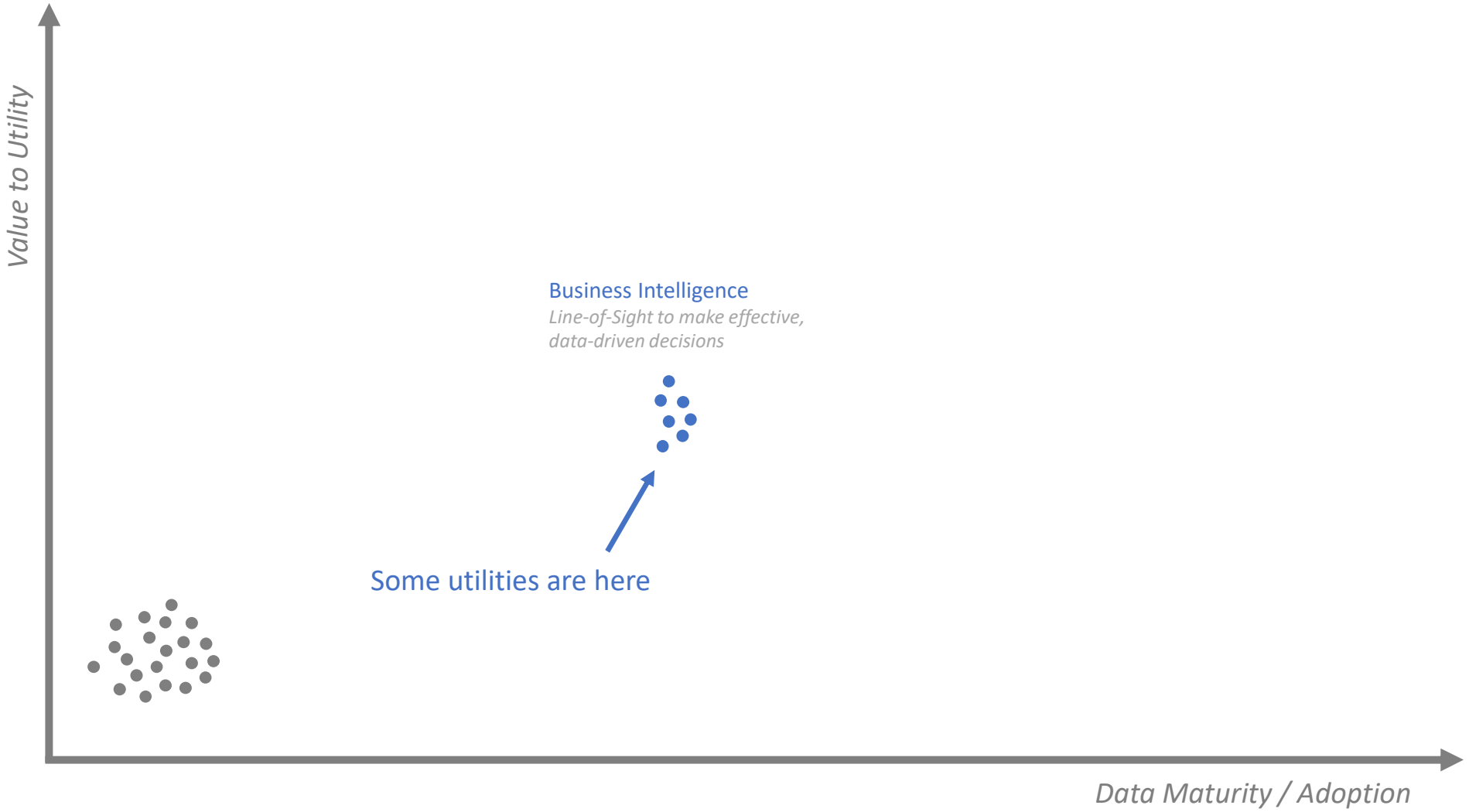
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The Data Journey

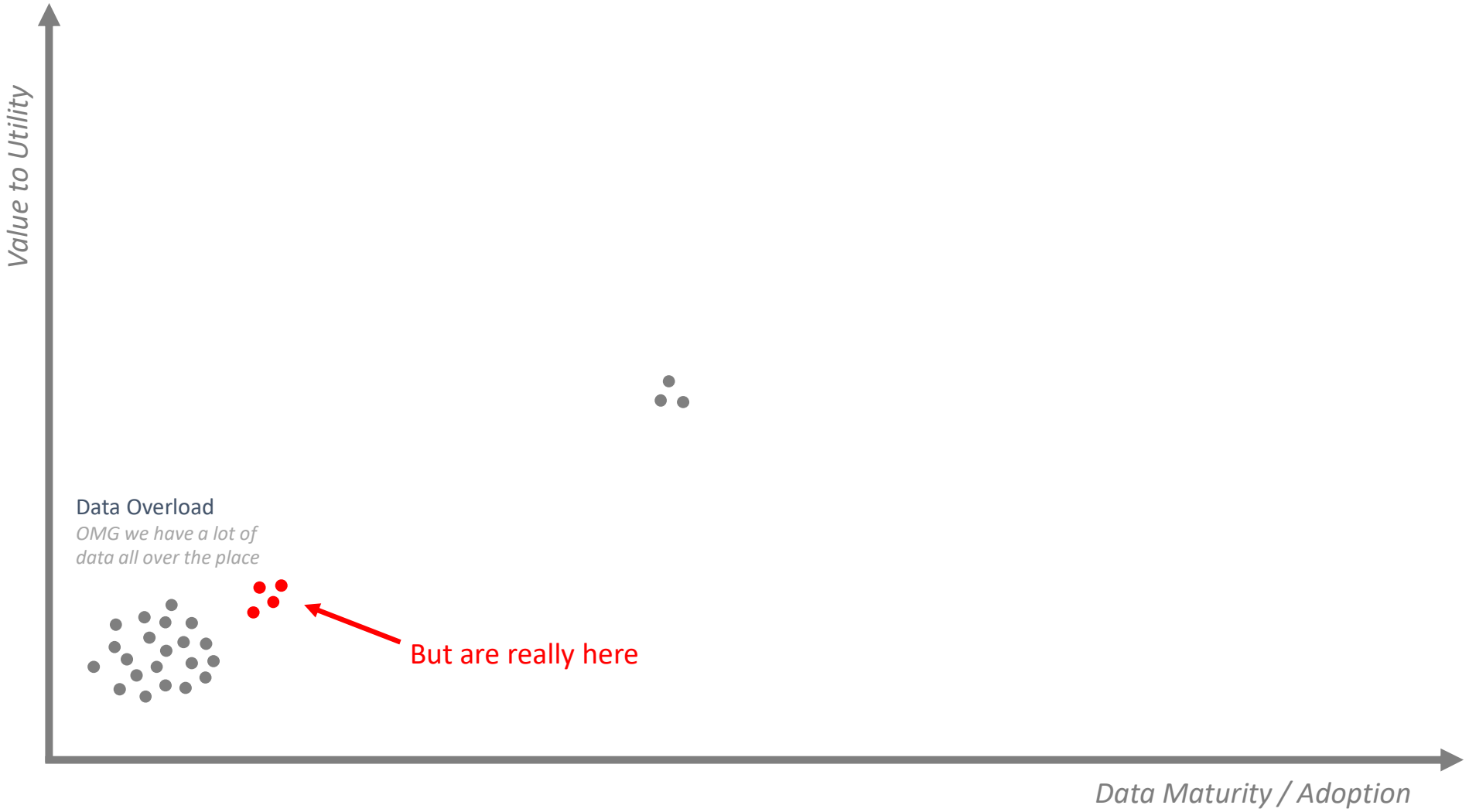
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Value to Utility
Increasing **Data Maturity and Adoption…**
…Leads to increasing **Value** to your utility
Data Maturity / Adoption

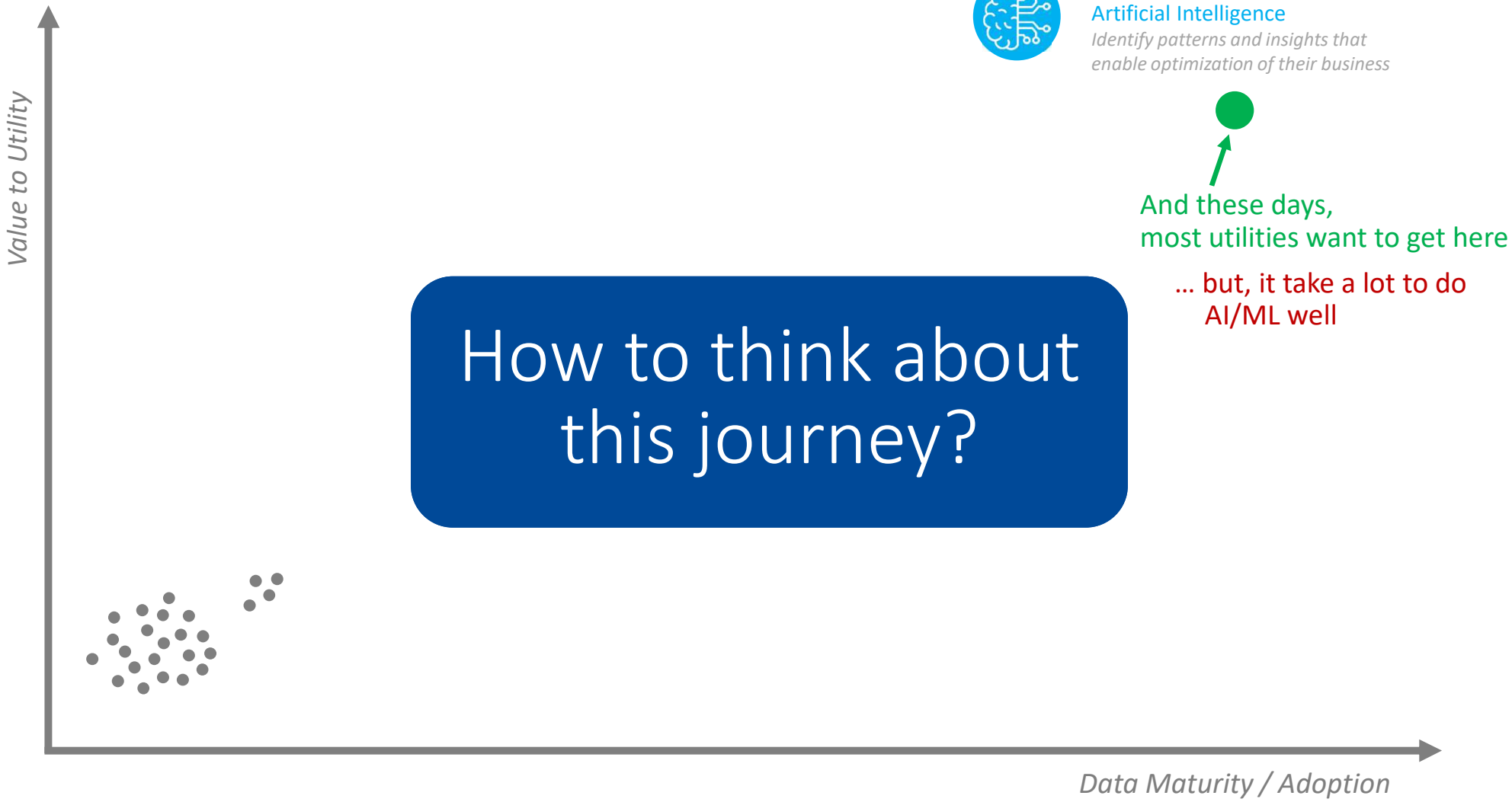

Value to Utility
Data Overload
OMG we have a lot of
data all over the place
The majority of utilities are here
Data Maturity / Adoption


Value to Utility
Business Intelligence
Line-of-Sight to make effective, data-driven decisions
Some utilities are here
Data Maturity / Adoption


Value to Utility
Business Intelligence
Line-of-Sight to make effective, data-driven decisions
Some utilities think they are here
Data Maturity / Adoption


Value to Utility
Data Overload
OMG we have a lot of
data all over the place
But are really here
Data Maturity / Adoption


Machine Learning /
Artificial Intelligence
Identify patterns and insights that
enable optimization of their business
And these days,
most utilities want to get here
… but, it take a lot to do
AI/ML well
Value to Utility
Data Maturity / Adoption


Machine Learning /
Artificial Intelligence
Identify patterns and insights that enable optimization of their business
And these days, most utilities want to get here
… but, it take a lot to do AI/ML well
How to think about this journey?
Value to Utility
Data Maturity / Adoption

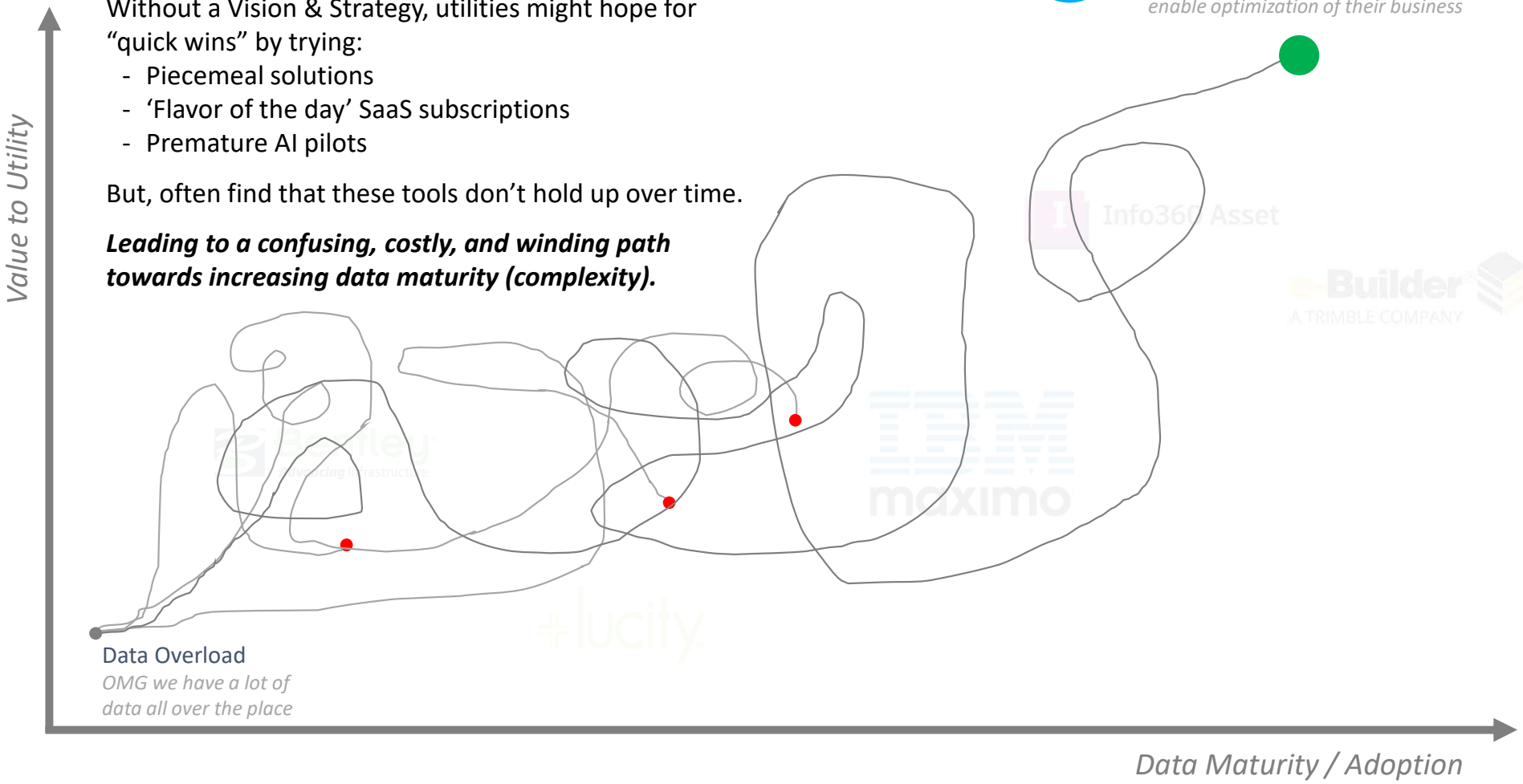
An Ad-Hoc Approach

Without a Vision & Strategy, utilities might hope for "quick wins" by trying:

- Piecemeal solutions
- 'Flavor of the day' SaaS subscriptions
- Premature AI pilots

But, often find that these tools don't hold up over time.

Leading to a confusing, costly, and winding path towards increasing data maturity (complexity).



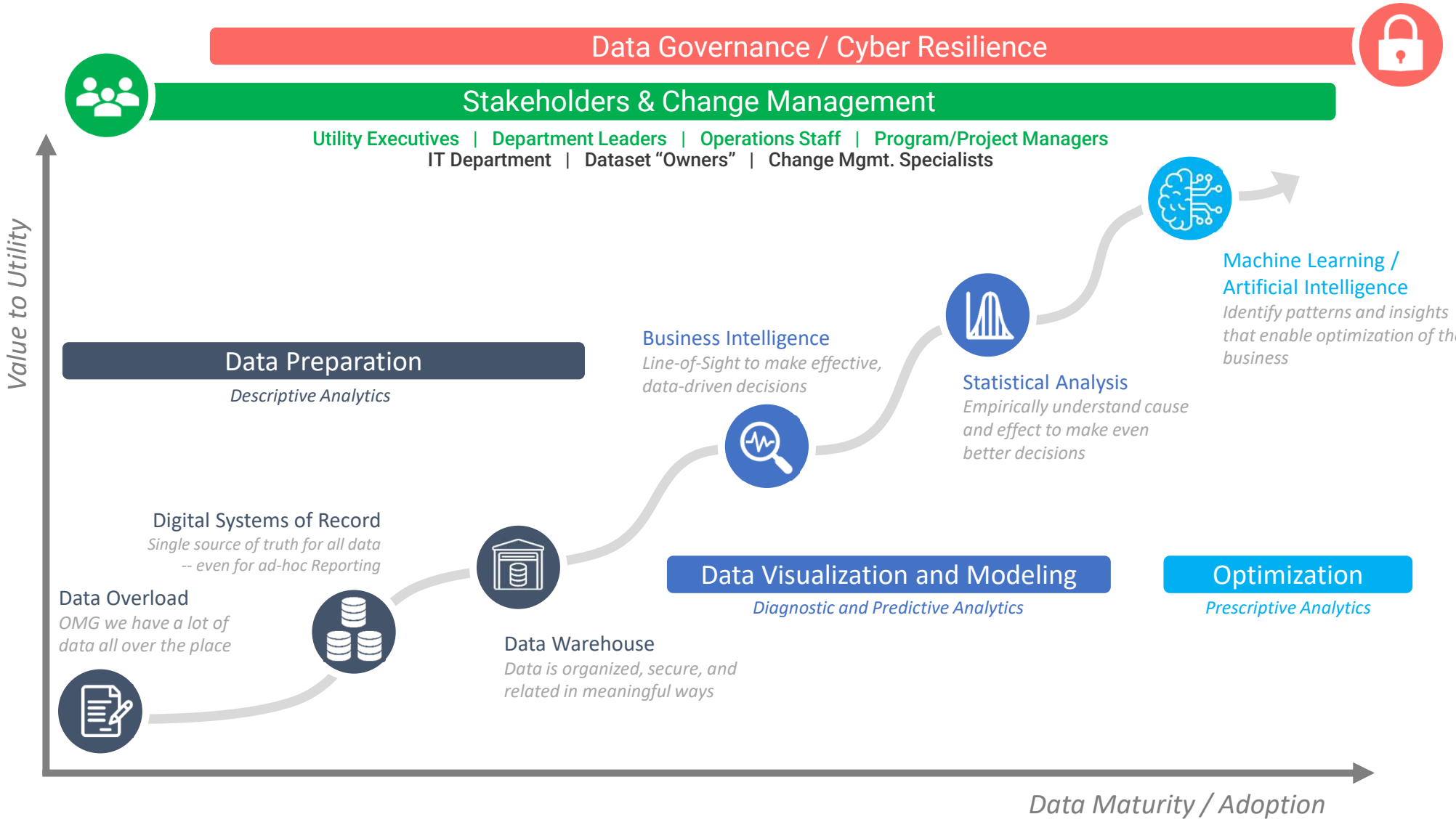
A Systematic Approach

A Digital Transformation Journey:

A strategic process that provides utilities with a clear roadmap, and which has these features:

- Start where you are today
- Take small, purposeful steps towards your goal
- Realize increasing value at every stage

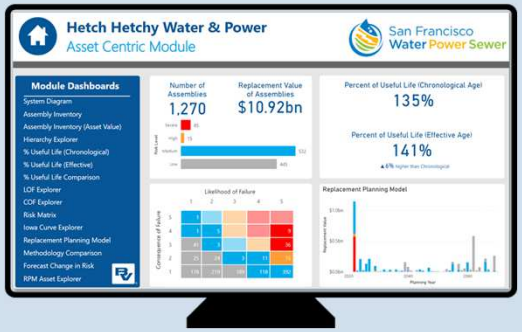



Data Governance / Cyber Resilience
Stakeholders & Change Management
Utility Executives | Department Leaders | Operations Staff | Program/Project Managers
IT Department | Dataset "Owners" | Change Mgmt. Specialists
Value to Utility
Data Preparation
Descriptive Analytics
Digital Systems of Record
Single source of truth for all data
-- even for ad-hoc Reporting
Data Overload
OMG we have a lot of
data all over the place
Data Warehouse
Data is organized, secure, and
related in meaningful ways
Business Intelligence
Line-of-Sight to make effective,
data-driven decisions
Data Visualization and Modeling
Diagnostic and Predictive Analytics
Statistical Analysis
Empirically understand cause
and effect to make even
better decisions
Machine Learning /
Artificial Intelligence
Identify patterns and insights
that enable optimization of their
business
Optimization
Prescriptive Analytics
Data Maturity / Adoption

Water Utility Applications of Business Intelligence



Water Loss Auditing



Asset Risk & Resilience



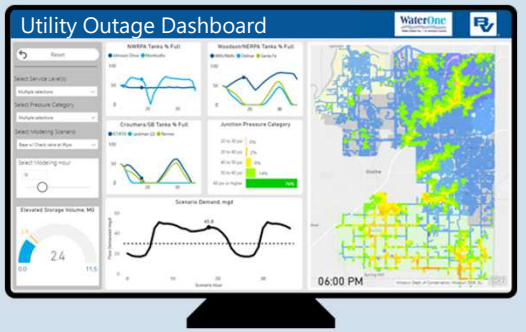
Program + Project Monitoring (CIP)



Compliance Reporting & Analytics



WW Operations & Performance

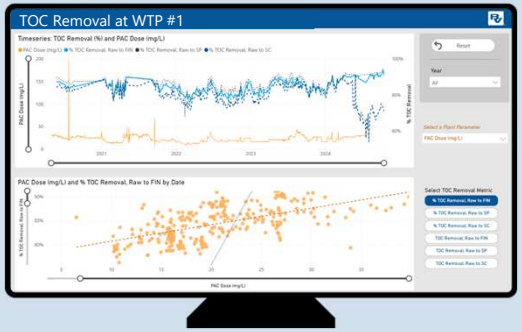


System & Disruption Monitoring

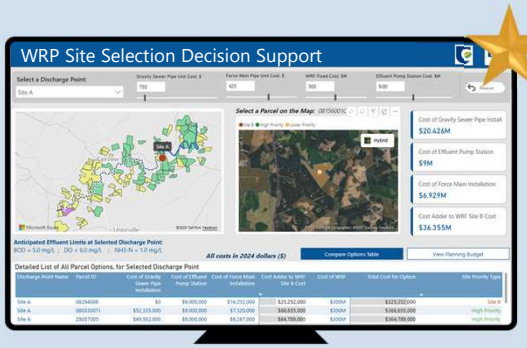
Water Utility Applications of Business Intelligence (2)



Pipeline Risk Assessment



WQ and PFAS Treatment Analysis



Feasibility Stage Decision Support

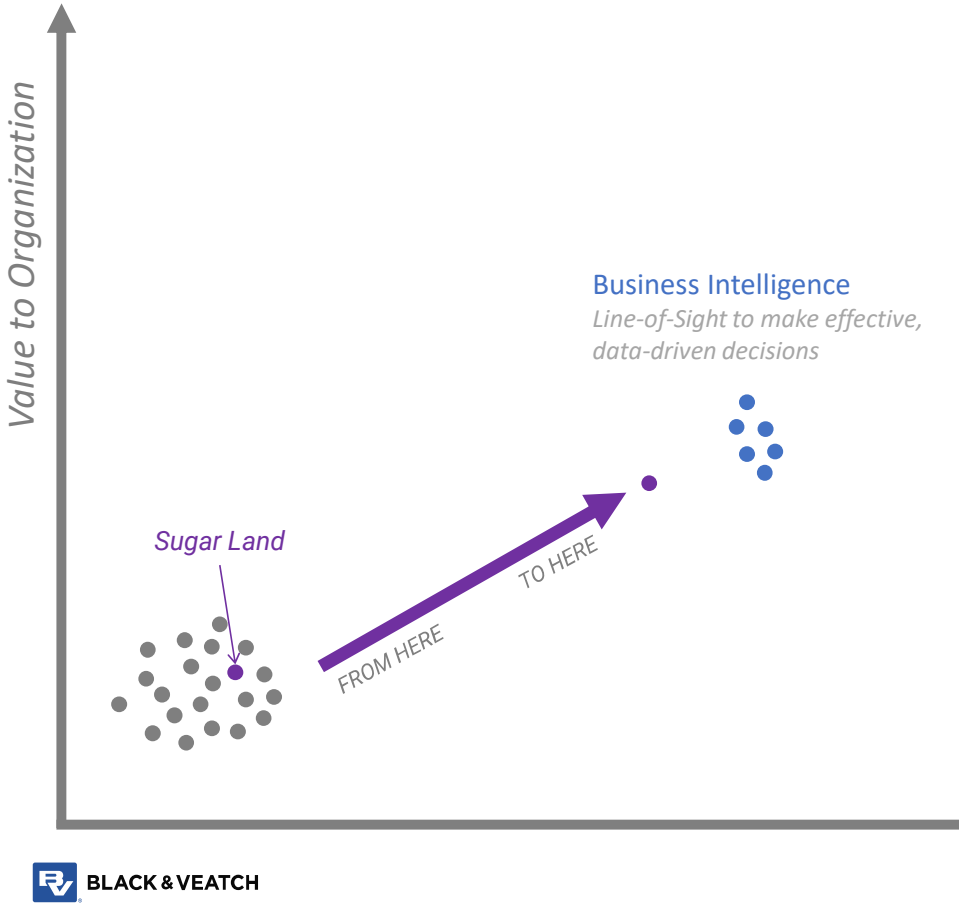
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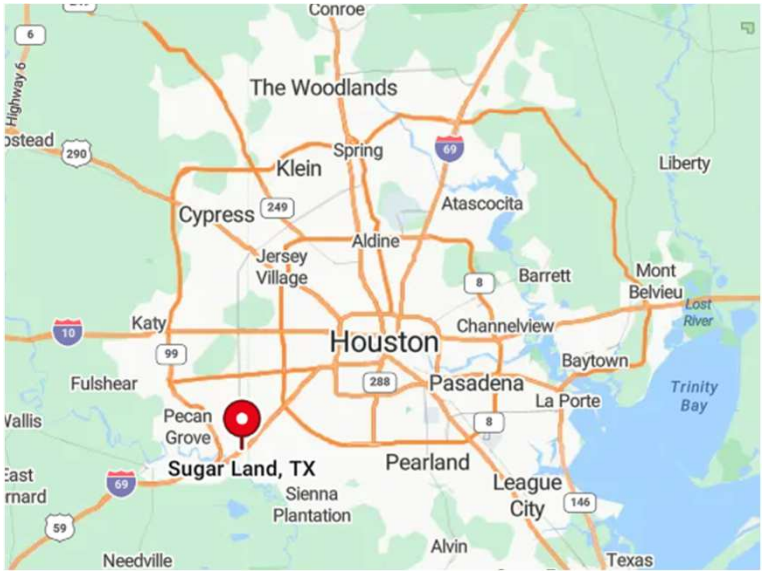
Case Study 1

Water Loss Audit

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Sugarland Water Loss Audit



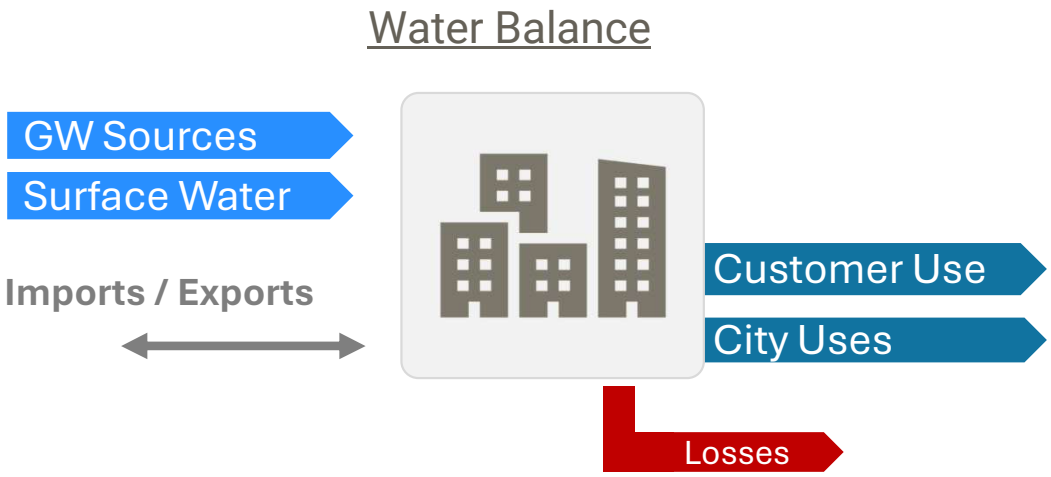


- Medium-sized suburb of Houston
- 109,000 population
- ~30,000 water service connections

Manual → Automated Water Loss System

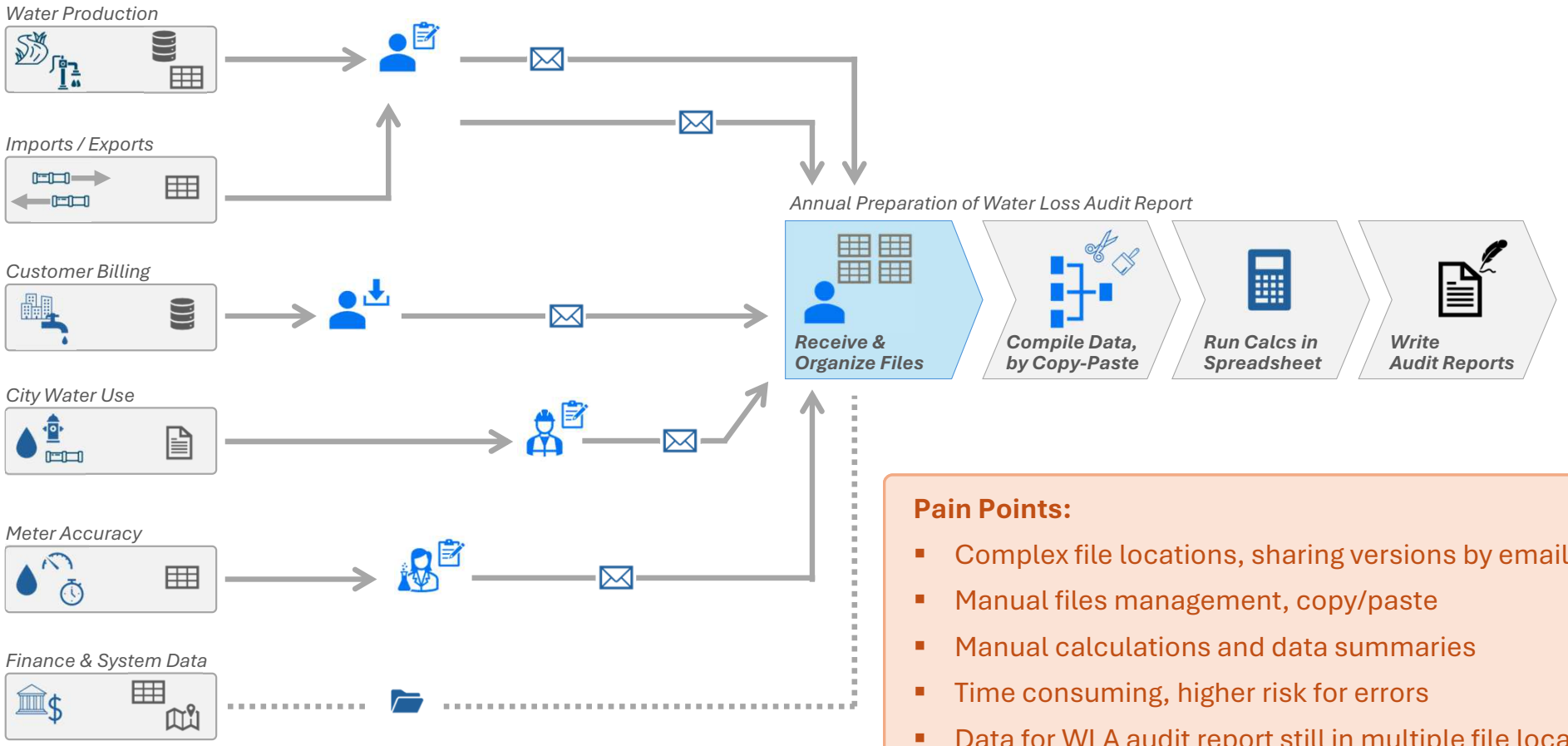
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Water Loss Audit



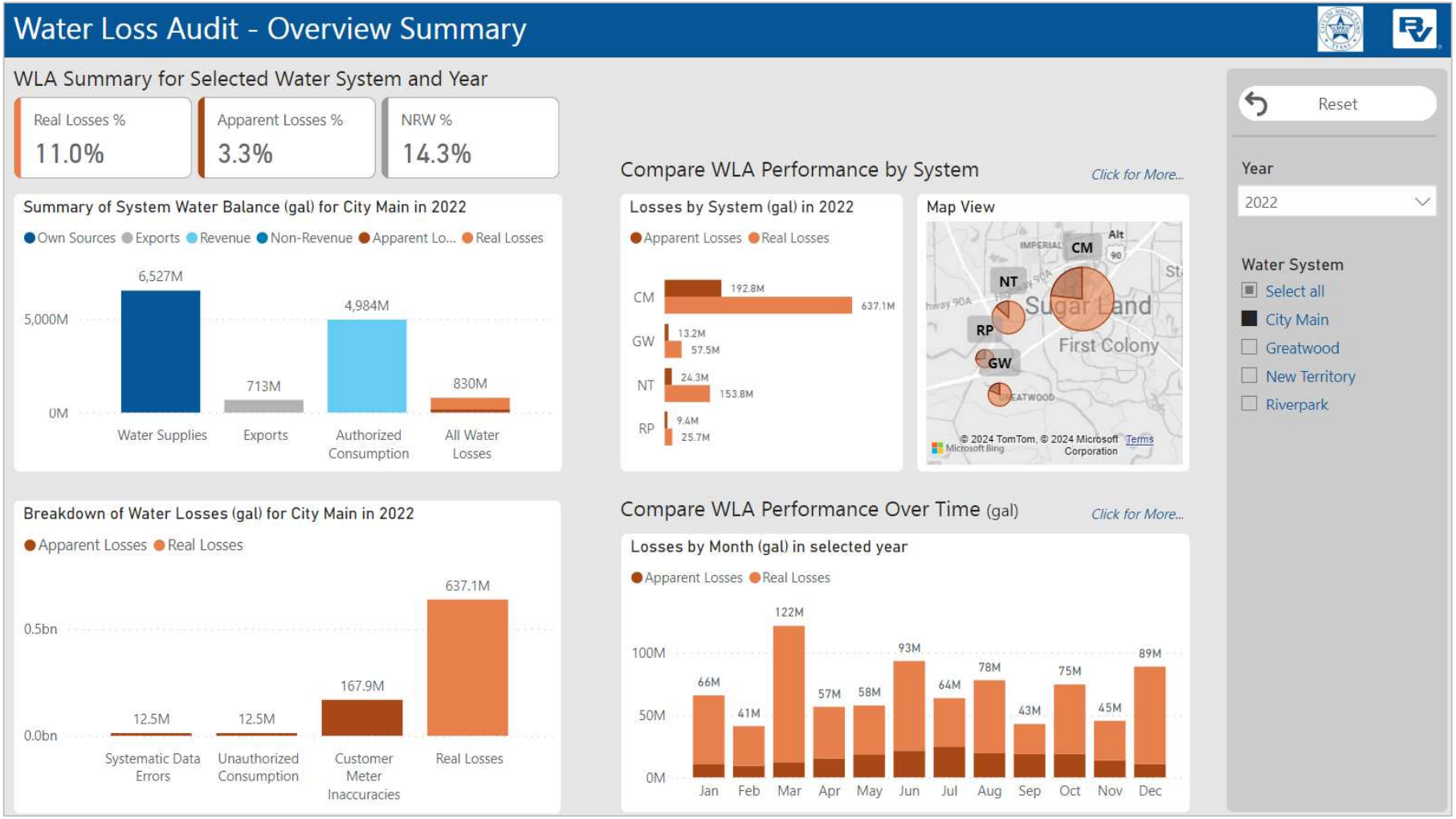
(Before) Data Workflow

Manual Data Collection and Annual Water Loss Reporting



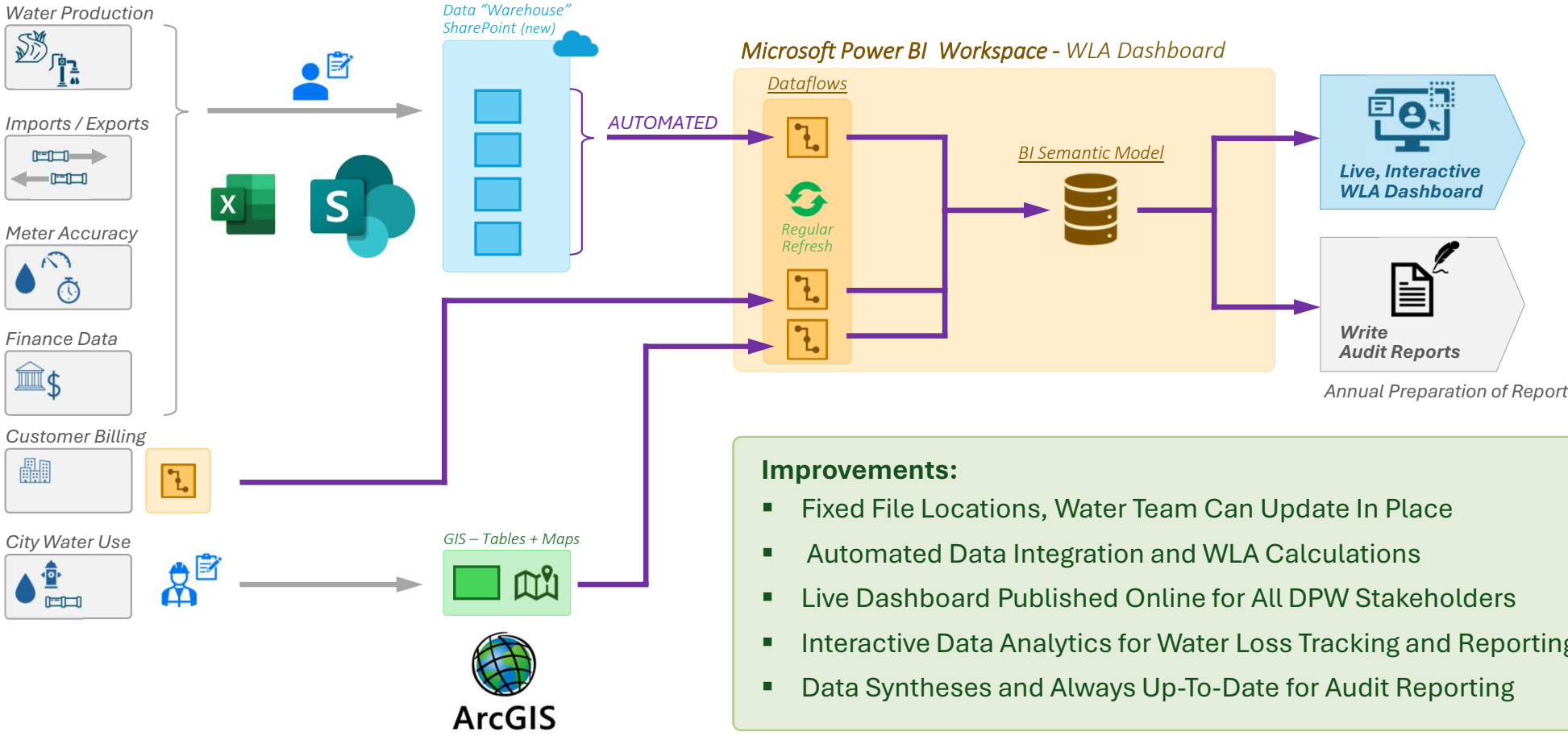
Pain Points:

- Complex file locations, sharing versions by email
- Manual files management, copy/paste
- Manual calculations and data summaries
- Time consuming, higher risk for errors
- Data for WLA audit report still in multiple file locations


Water Loss Audit - Overview Summary
WLA Summary for Selected Water System and Year
Real Losses %
11.0%
Apparent Losses %
3.3%
NRW %
14.3%
Summary of System Water Balance (gal) for City Main in 2022
Own Sources
Exports
Revenue
Non-Revenue
Apparent Lo...
Real Losses
6,527M
5,000M
0M
4,984M
713M
830M
Water Supplies
Exports
Authorized Consumption
All Water Losses
Breakdown of Water Losses (gal) for City Main in 2022
Apparent Losses
Real Losses
637.1M
0.5bn
0.0bn
12.5M
12.5M
167.9M
Systematic Data Errors
Unauthorized Consumption
Customer Meter Inaccuracies
Real Losses
Compare WLA Performance by System
Click for More...
Losses by System (gal) in 2022
Apparent Losses
Real Losses
CM
192.8M
637.1M
GW
13.2M
57.5M
NT
24.3M
153.8M
RP
9.4M
25.7M
Map View
IMPERIAL
CM
Alt
90
NT
Sugar Land
RP
First Colony
GW
GREATWOOD
© 2024 TomTom, © 2024 Microsoft Corporation
Terms
Microsoft Bing
Compare WLA Performance Over Time (gal)
Click for More...
Losses by Month (gal) in selected year
Apparent Losses
Real Losses
100M
50M
0M
66M
41M
122M
57M
58M
93M
64M
78M
43M
75M
45M
89M
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Reset
Year
2022
Water System
Select all
City Main
Greatwood
New Territory
Riverpark

(After) Data Workflow

Integrated Data Management System, Auto Data Refresh, Monthly Tracking



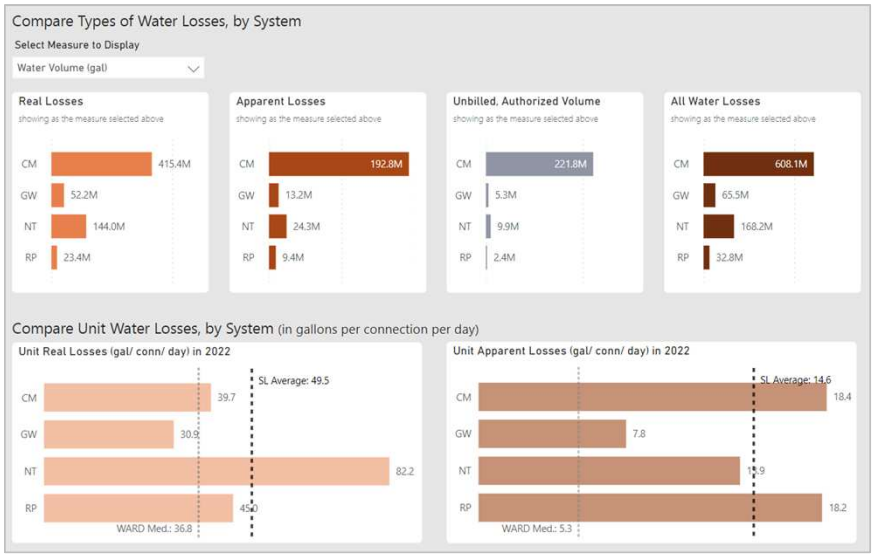
Improvements:

- Fixed File Locations, Water Team Can Update In Place
- Automated Data Integration and WLA Calculations
- Live Dashboard Published Online for All DPW Stakeholders
- Interactive Data Analytics for Water Loss Tracking and Reporting
- Data Syntheses and Always Up-To-Date for Audit Reporting

Dashboard: Detailed Water Loss Analysis

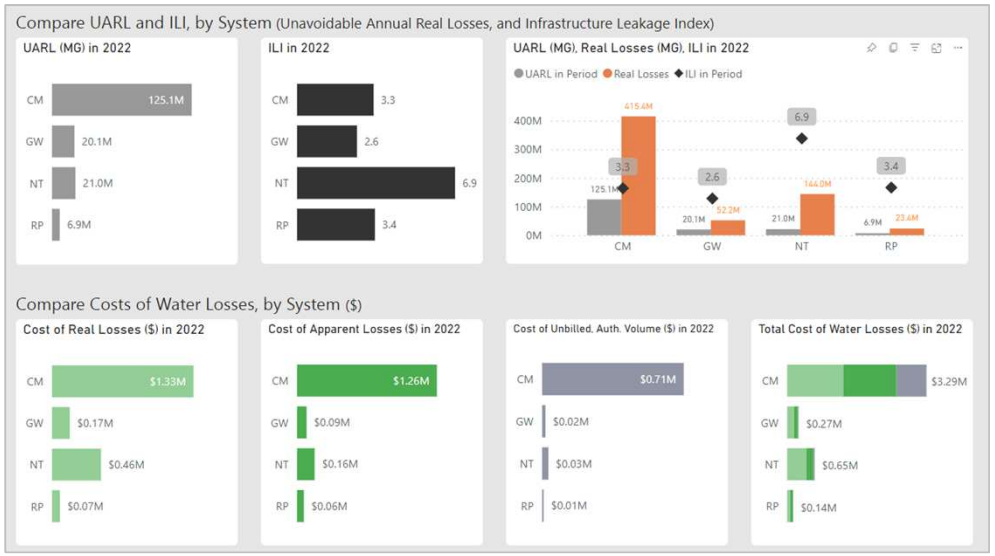
Compare City Water Sub-Systems

Examine water losses by sub-system, on a volumetric basis, on a % basis, or as gallons per connection per day.



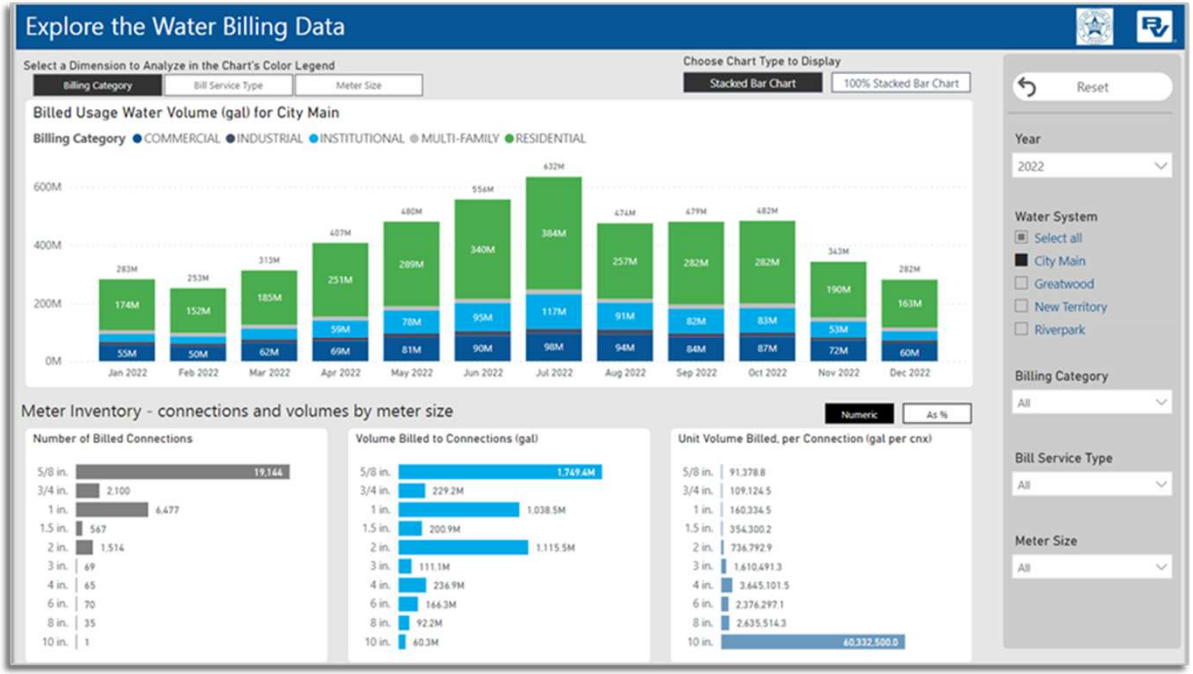
Examine WLA Performance Indicators

Compare KPIs such as: unavoidable annual real losses (UARL), infrastructure leakage index (ILI), and costs for different types of loss.



Dashboard: City Water Billing Data Explorer

- ✓ Dashboard module for analysis of customer billing records
- ✓ Displays the seasonal consumption
- ✓ View and filter visual charts by:
  - Billing category (commercial, residential, etc.)
  - Service type (water supply, sprinkler, fire flow)
  - Customer meter size
- ✓ Drill into the data to investigate water use and find opportunities for efficiency



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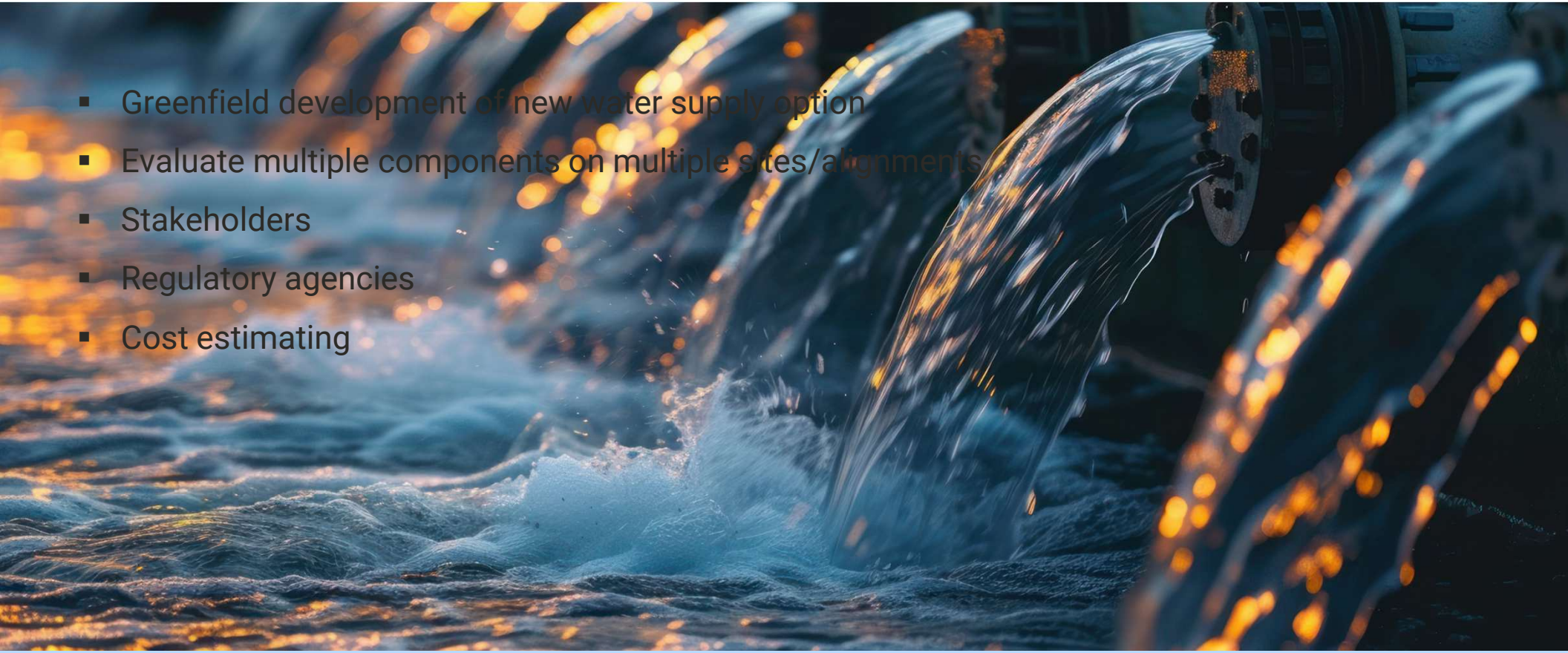
Case Study 2

Water Supply Planning

Statistical Approaches

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Water Supply Planning Objective



- Greenfield development of new water supply option
- Evaluate multiple components on multiple sites/alignments
- Stakeholders
- Regulatory agencies
- Cost estimating

Goal is a defensible decision that can be explained to a wide audience

Decision Framework

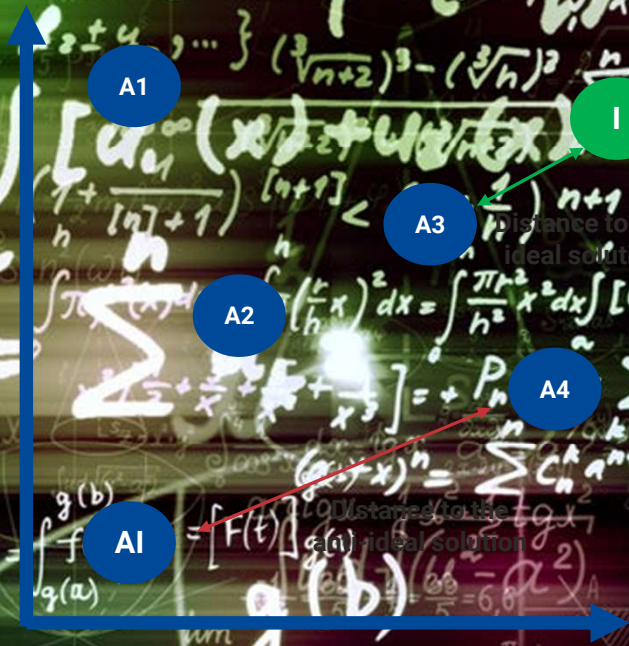
- Major Criteria
- Sub-Criteria
- Coordination & Definition with Stakeholders
- Establishing Updatable
- Alignment with Priorities



Criteria and sub-criteria that can be tweaked with the evolution of the project/program

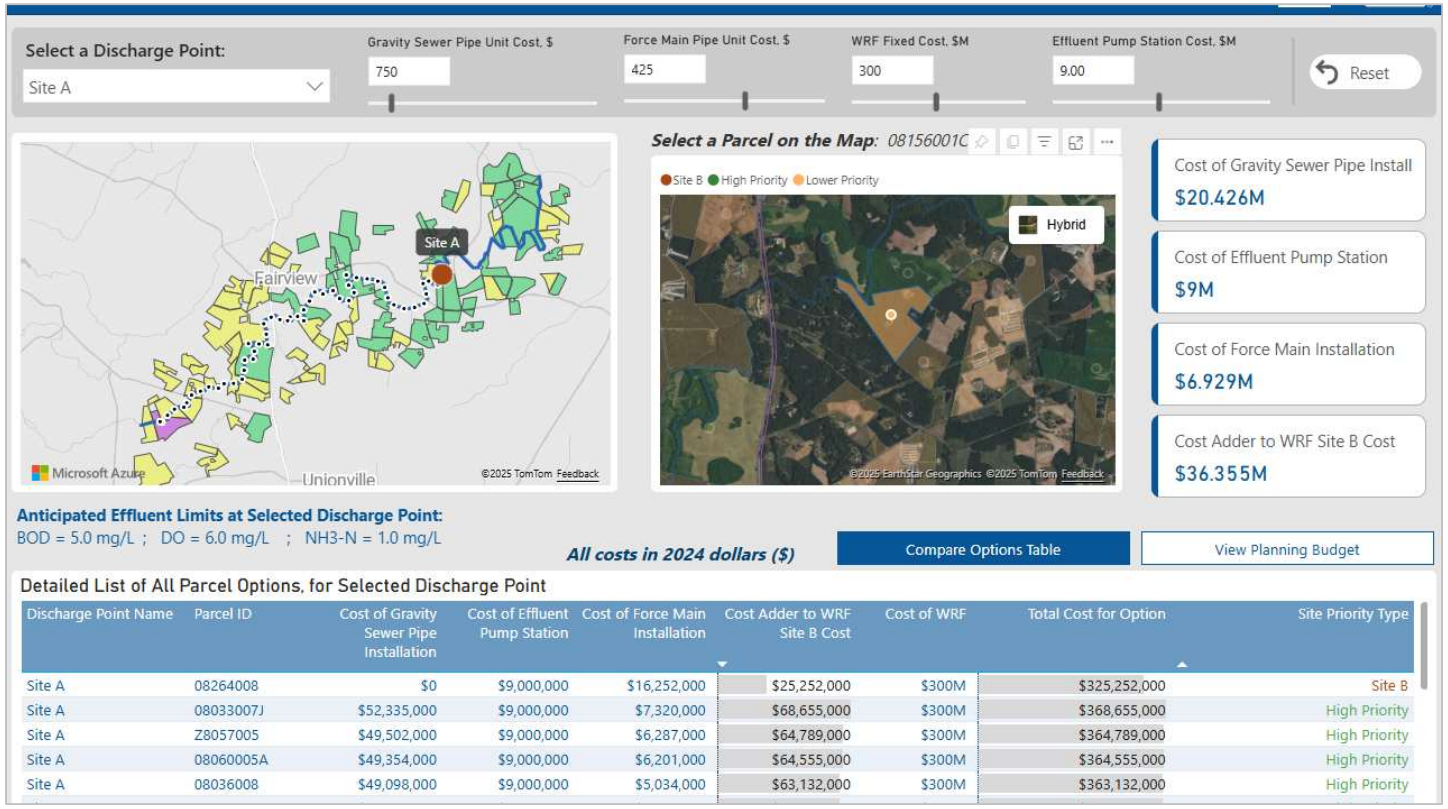
Statistical Approach

- 2 parallel calculation approaches
  - Weighted Sum
  - Technique for Order of Preference by Similarity of Ideal Solution (TOPSIS)
- Sensitivity Analysis
- Statistical Significance



2 Methods can be better than 1, but can complicate communication to stakeholders

Site Selection Dashboard



Discharge Point Name	Parcel ID	Cost of Gravity Sewer Pipe Installation	Cost of Effluent Pump Station	Cost of Force Main Installation	Cost Adder to WRF Site B Cost	Cost of WRF	Total Cost for Option	Site Priority Type
Site A	08264008	$0	$9,000,000	$16,252,000	$25,252,000	$300M	$325,252,000	Site B
Site A	08033007J	$52,335,000	$9,000,000	$7,320,000	$68,655,000	$300M	$368,655,000	High Priority
Site A	Z8057005	$49,502,000	$9,000,000	$6,287,000	$64,789,000	$300M	$364,789,000	High Priority
Site A	08060005A	$49,354,000	$9,000,000	$6,201,000	$64,555,000	$300M	$364,555,000	High Priority
Site A	08036008	$49,098,000	$9,000,000	$5,034,000	$63,132,000	$300M	$363,132,000	High Priority

Data visualizations, automated calculations, on-the-fly “what ifs”

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Case Study 3

Machine Learning

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Machine Learning for Monitoring & Diagnostic Services

ASSET360™

CONVENTIONAL POWER

RENEWABLES

OIL & GAS

COMMERCIAL & INDSUTRIAL

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Nitrogen Tank Case Study

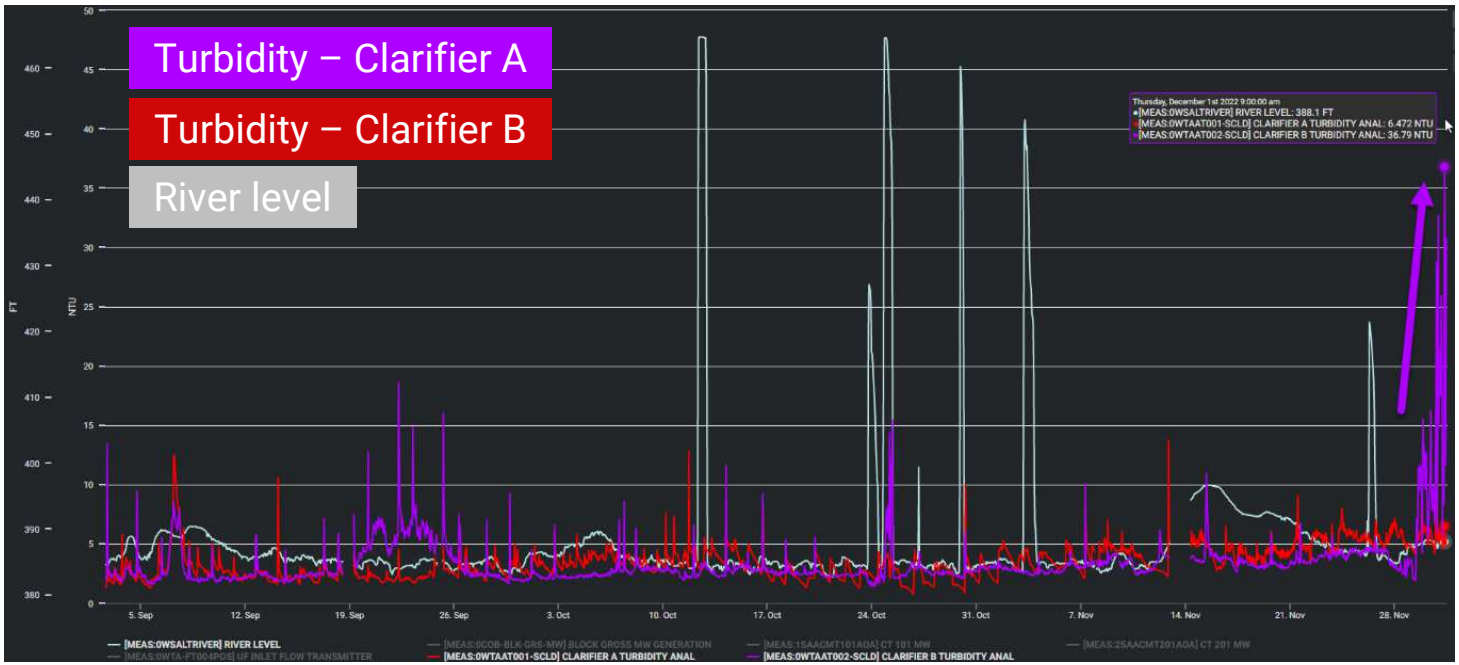
- Change in rate of decrease of nitrogen tank level
- Decreased nitrogen tank pressure
- Found nitrogen valve leaking
- To alleviate, unit throttled back a drain valve



ML used to identify faster rate of decline in tank level that led to identification of leaking valve.

Clarifier Turbidity Case Study

- Increasing Clarifier A turbidity observed
- Clarifier B turbidity value remaining constant
- Does not appear to be high river levels



ML diagnosed increasing clarifier turbidity values in one of the clarifiers. Identified polymer feed was plugged up to the reactor tank.

Summary & Discussion

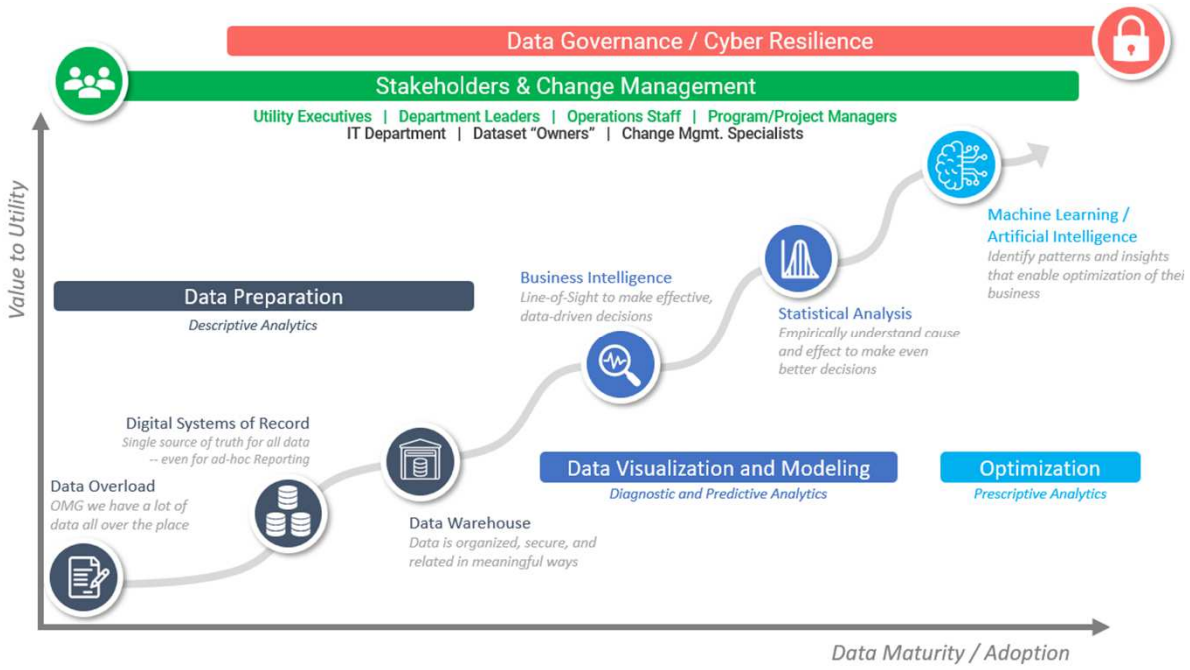
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1. **Well-Organized Data Adds Value**

2. **Start Where You Are…**
   Get value from your data today

3. **…and Plan for the Future** the Digital Transformation Journey

4. **Data as a Platform**
   build advanced apps on a solid foundation



Planning for a Utility Digital Transformation

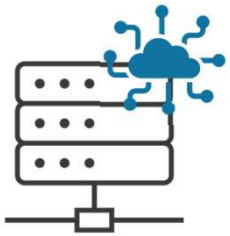
Define Data + BI
Vision & Objectives



Conduct a
Data Inventory



Plan Infrastructure
w/ IT Department



Set a Development
Roadmap



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Thank You

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