North Central Texas Council of Governments

AI: Challenges and Opportunities for Water Resources

NCTCOG Webinar
May 15, 2025

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EPA United States Environmental Protection Agency

Texas Commission on Environmental Quality

North Central Texas Council of Governments Environment & Development

www.nctcog.org/WaterResources

This project was funded by the U.S. Environmental Protection Agency through the Texas Commission on Environmental Quality.

Webinar Procedures

- The webinar is being recorded and will be posted to NCTCOG's website under the green banner called "Webinars" here:

  https://www.nctcog.org/envir/natural-resources/water-resources

- If you submitted an RSVP for this webinar, you will receive an email with the presentation slides and a link to the recording. If you did not RSVP and would like these webinar materials, please email cbuckley@nctcog.org.
- Please keep your microphone on mute until the Question-and-Answer period at the end of the presentations.
- Thank you!

Welcome and Introduction of Speakers

Webinar Agenda

- Audience Polling Questions
- **"Ft Worth Water – Driving Performance through Data Analytics and Dashboards" –** Shela Chowdhury and Gage Muckleroy
- Discussion and Q & A

Audience Polls

Speaker Introduction

Shela Chowdhury

Assistant Director – Strategic Operations, City of Fort Worth

Gage Muckleroy

Principal Management Consultant, GHD

Ft Worth Water - Driving Performance through Data Analytics and Dashboards

May 15, 2025

Project Objectives

Every successful project starts with clear objectives.

STEP 01
Develop an approach to create and apply a data-driven performance measurement framework

STEP 02
Utilize existing work order data (no new data to be collected)

A strong foundation ensures a successful data-driven approach.

Understanding business goals is key to meaningful insights.

STEP 03
Develop as a pilot to identify lessons learned for application at other facilities

STEP 04
Identify any insights based on the analysis and results

A well-defined strategy leads to measurable success.

Agenda

- Background on Fort Worth’s Asset Management Journey
- Asset Management Framework
- Application of Performance Framework
- Results
- Lessons Learned

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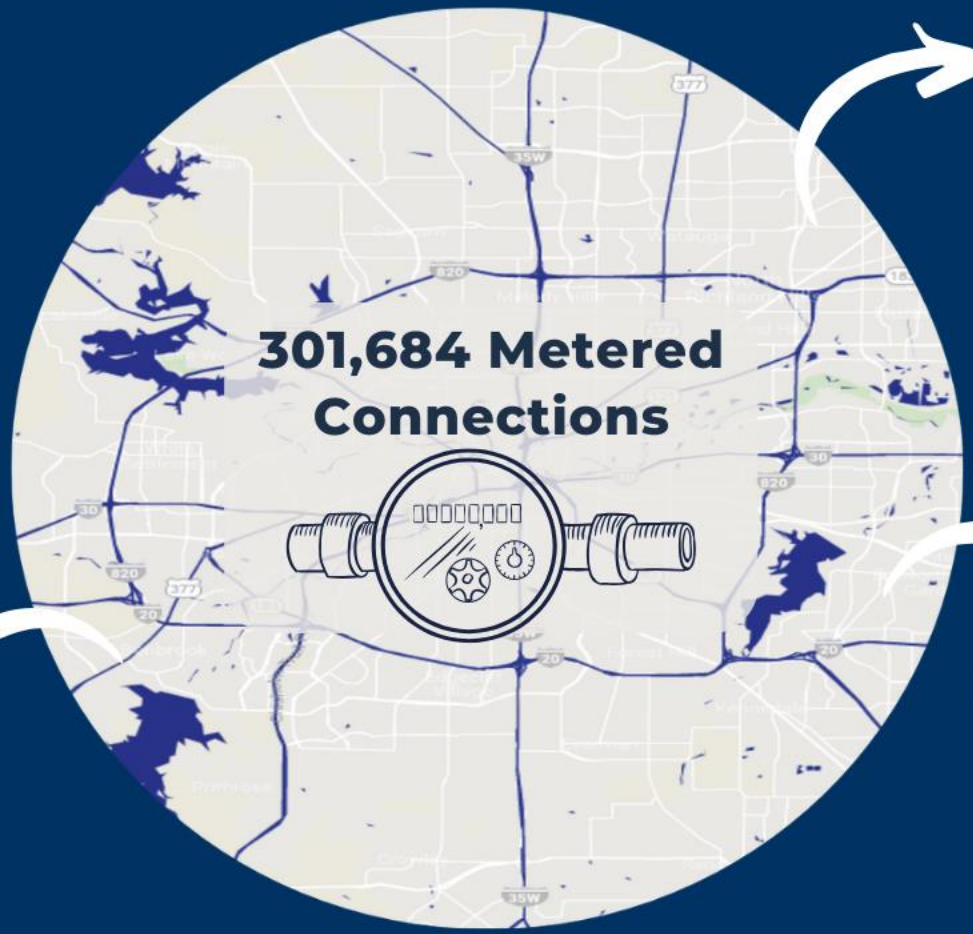
FORT WORTH REGIONAL SYSTEM OVERVIEW

Water, Wastewater & Reclaimed Services:

- 4,040 miles of water distribution
- 3,926 miles of sewer collection
- 11.5 miles of reclaimed distribution



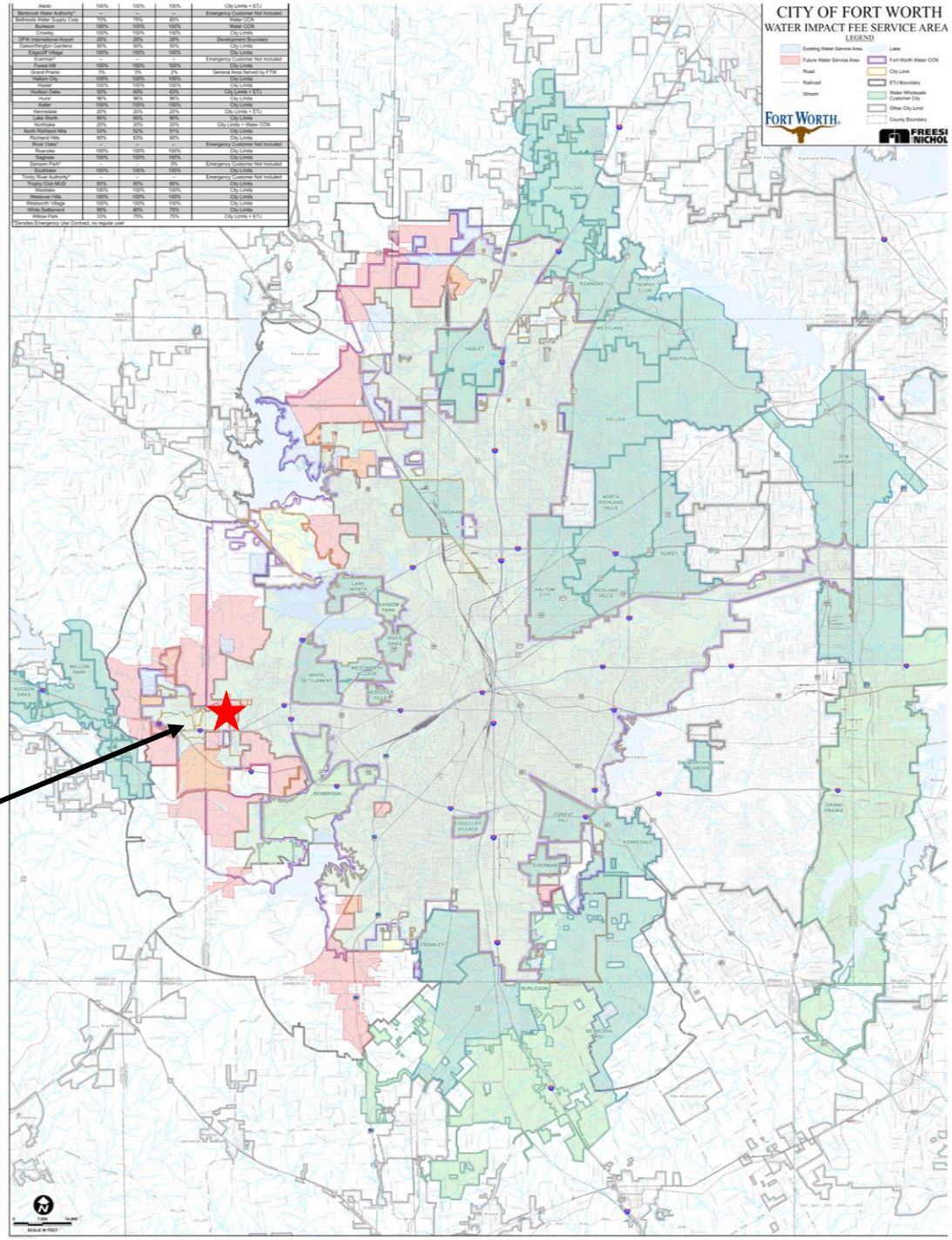
5 Water Treatment Plants 512 MGD

1 Water Reclamation Facility 166 MGD

1,021 Employees

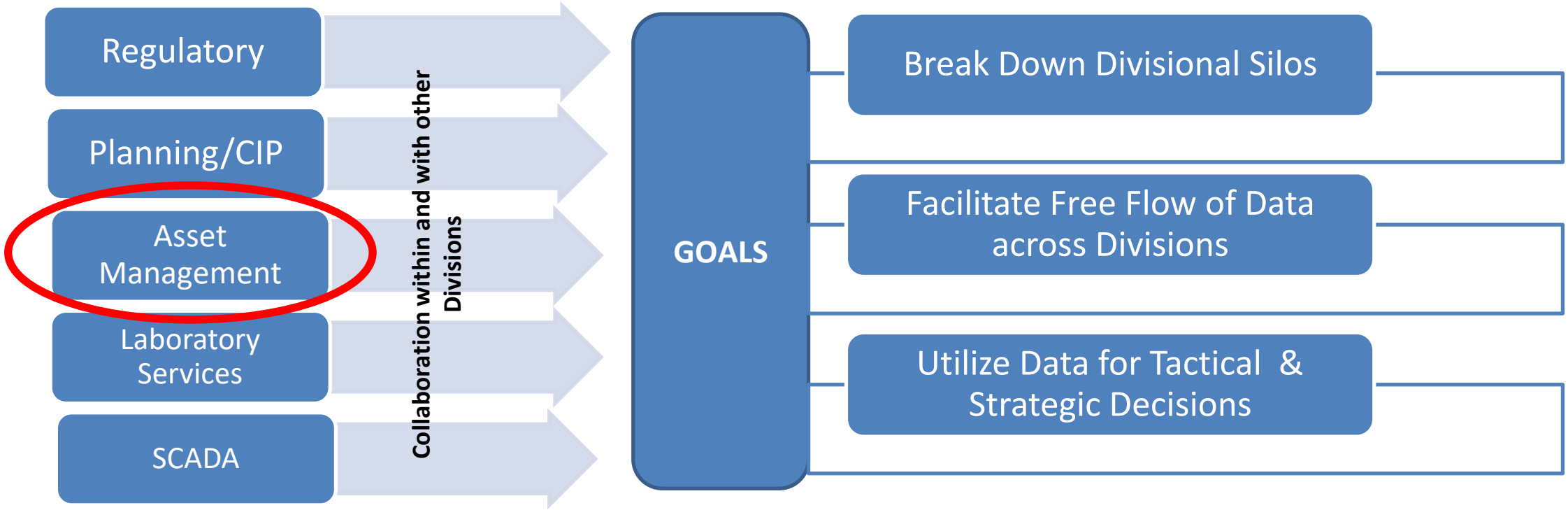
Water Service Area

Westside Water Treatment Plant



Strategic Operations Purpose

To promote an enterprise-wide focus on:



FORT WORTH®

Asset Management Journey

Asset Mgmt. Subject Groups
- Group 1: Strategy & Planning
- Group 2: Asset Management Decision-Making
- Group 3: Life Cycle Delivery
- Group 4: Asset Information
- Group 5: Organization & People
- Group 6: Risk & Review

1900-1975

1946: Report on Water Distribution & Sanitary Sewer Systems
1960: Tarrant County - County Wide Sewage Study
1964: Metropolitan Fort Worth - Water System Study
1913: Ward Maps
1935: Vault Bluelines
1950: Vault Baker Books
1940: Telemetric Control System
1960: Vault ABC Maps
1960: Vault Intersection Maps
1971: Mainframe

1975-1995

1979: City of Fort Worth Distribution System Study
1984: Fort Worth 201 Facilities Plan (Village Creek)
1986: Water and Wastewater Master Plan
1986: Access Fee
1990: Impact Fee Ch. 395
1988: Water Faciliest
1990: AutoCAD and Microstation Map
1991: Water Facilities Upgrade
1989: Fixed Assets Tracking System
1991: City of Fort Worth Master Comprehensive Plan

1995-2005

1997: Static CIP Spreadsheet
2005: CPMS - Life Cycle Scenario
1990: CCTV
2004: GIS
2005: TMA Vertical
2000: City of Fort Worth Comprehensive Plan (New)
1999: Risk Management Plan
2002: Vulnerability Assessment
2004: Water Conservation & Drought Plan

2005-2015

2009: Dynamic CIP Spreadsheet
2009: Adoption of Effective Utility Management Principles Into Utility Business Plan
2007: Fixed Asset Spreadsheet
2010: Reclaimed Facilities
2013: Peoplesoft Financial Asset Management Module
2013: Water Privatization Study
2012: Emergency Response Plan

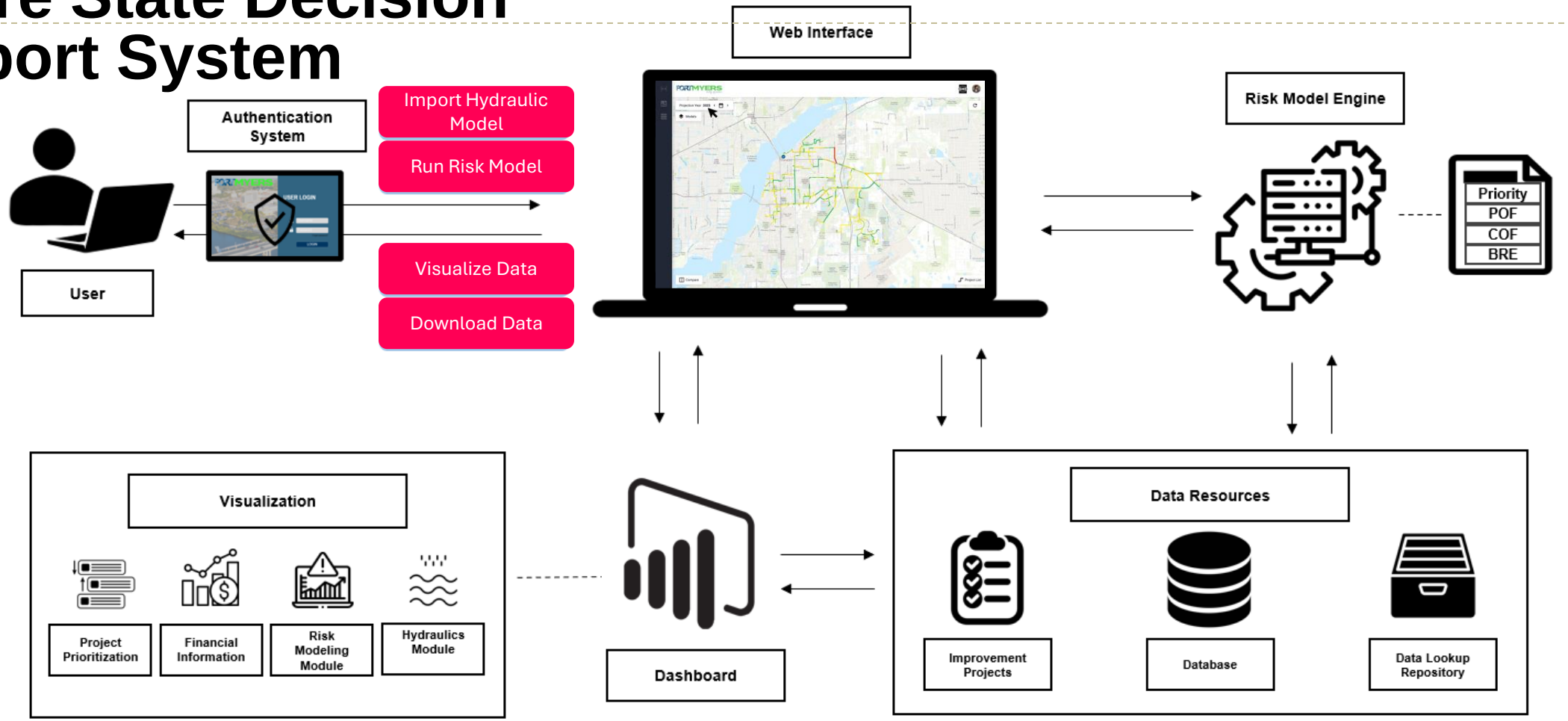
2015-2019

2019: Asset Management Maturity Assessment
2019: Update Design Criteria & Policy
2016: MAXIMO Phase 2 Vertical
2016: MAXIMO Phase 2 Horizontal
2019: SCADA Reassessment
2019: Risk Based Scoring of Horizontal Assets
2017: Water Department Reorganization
2019: Risk & Resiliency Assessment

2022-2026

2019-2022: AM Maturity Assessment
2022: CIP Framework Implementation
2022: Finalize Strategic Asset Management Plan
2022: Restructuring Asset Hierarchy in MAXIMO
2022: Condition Assessment Scoring Data Collection for Plants
2023: Implement Level of Service Framework

Future State Decision Support System



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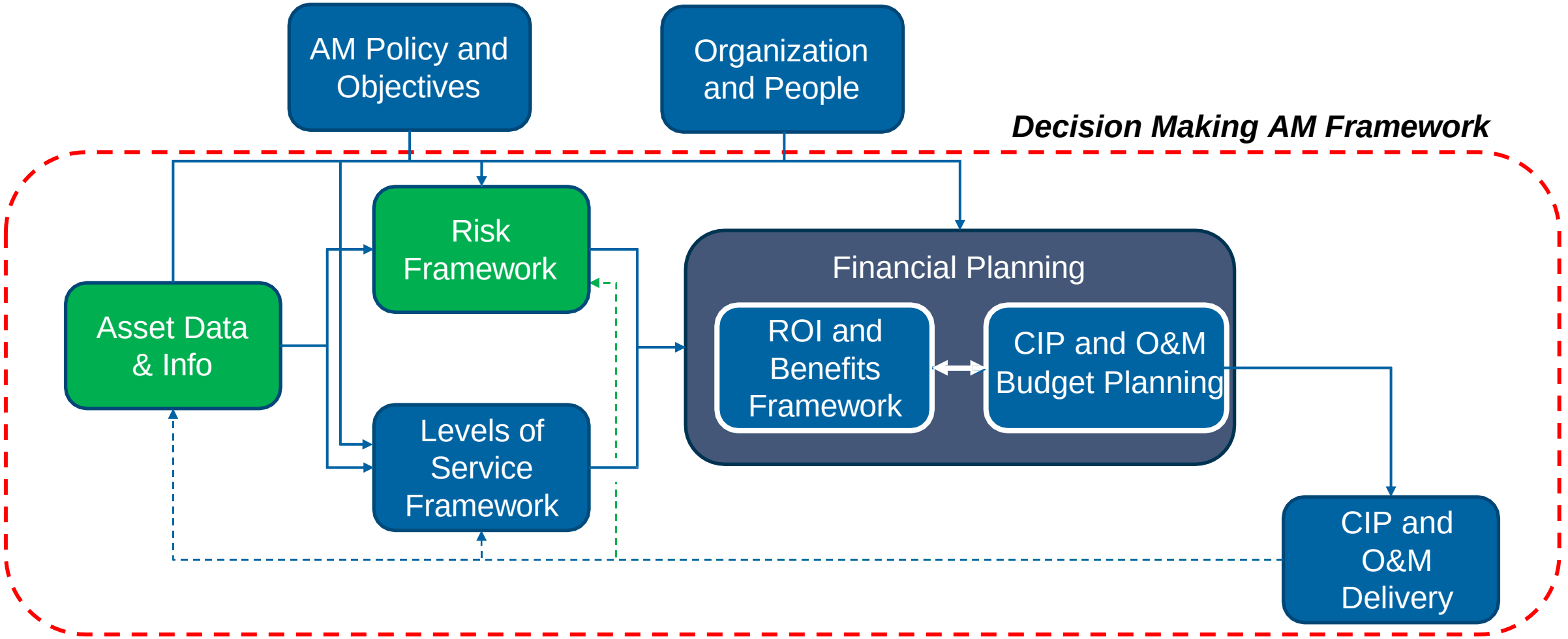
Asset Management Framework



FORT WORTH®

Risk = POF x COF

Probability of Failure x **Consequence of Failure** = **Business Risk Score**

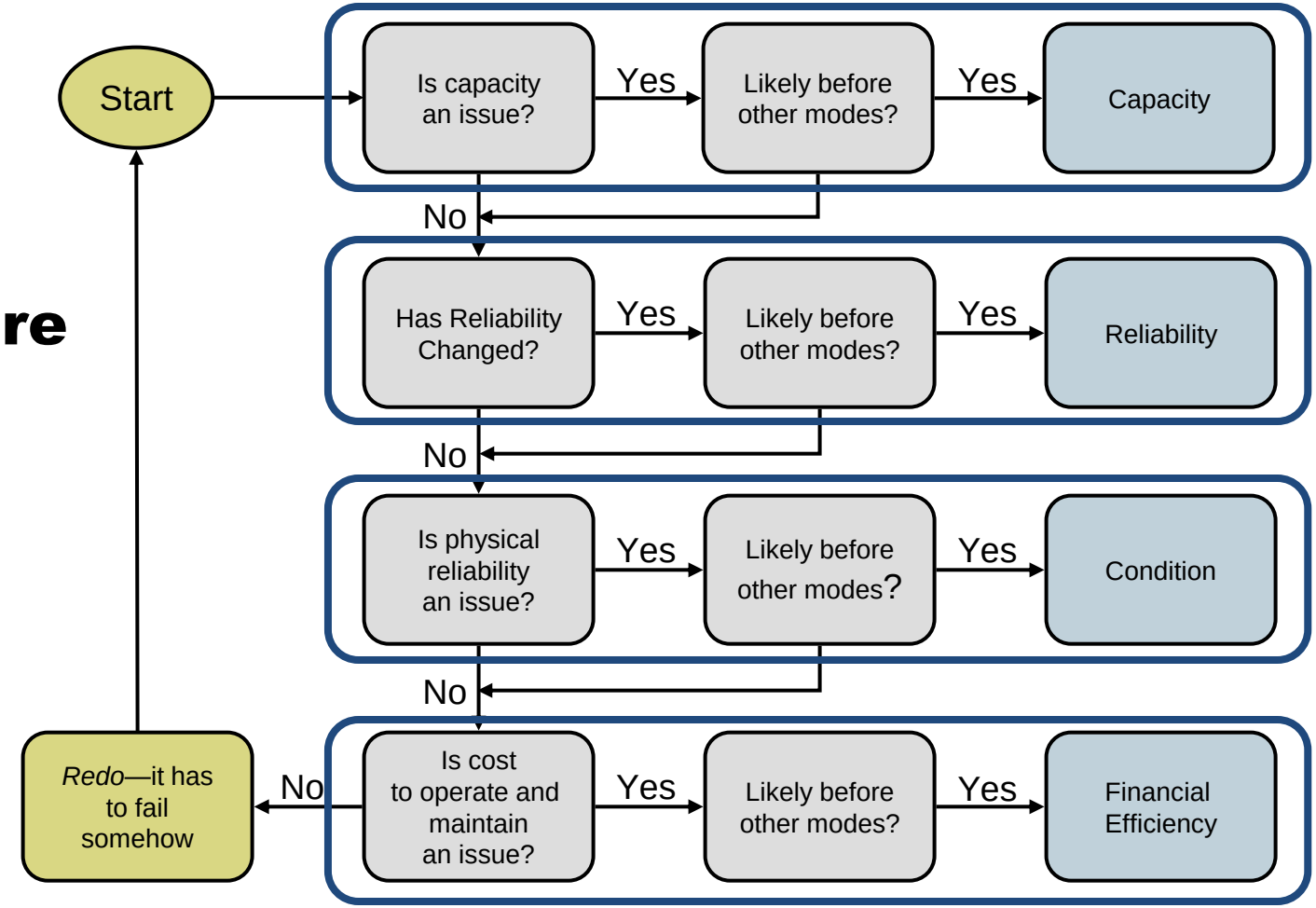
Consider…
- Failure mode
- Condition
- Operating Performance
- Reliability
- Availability
- Maintainability

Consider…
- Safety, health, and welfare
- Environmental impact
- Process criticality
- Repair costs
- Revenue and aggravation impact on customers

Consider…
- Mitigation
- Redundancy
- Diversion/Pipe around
- Spares on site
- SCADA
- Etc.

Focus of Project is on the Probability of Failure – Asset End of Life

Determining Probability of Failure (POF) with Performance Framework



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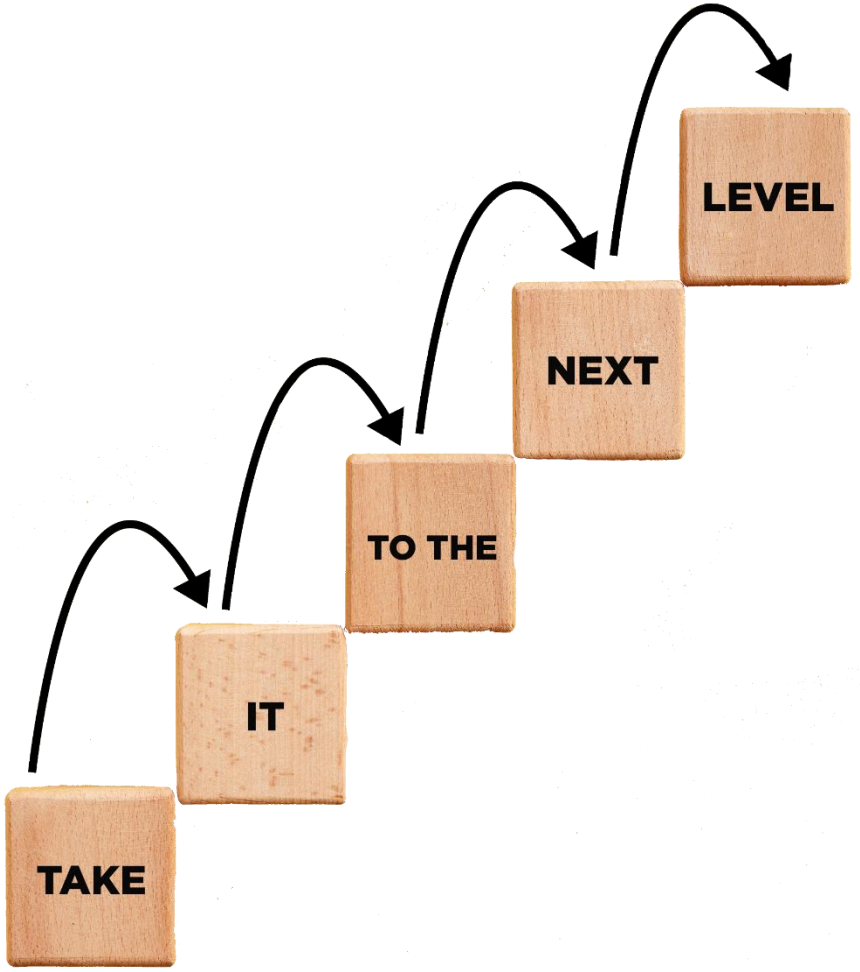
Additional Objectives

- Addressing the Limitations of Conventional Methods
- Making the Complex Simple
- Using the Dashboard for Better Insights
- Demonstrating the Functionality of the Dashboard + Leveraging the Right Visualizations



Making the Complex Simple

The “5 Second Rule”

Glance at your BI dashboard for 5 seconds, then look away. If you remember the specifics of what was important, you're good. If not, it's time for a rethink

The Inverted Pyramid

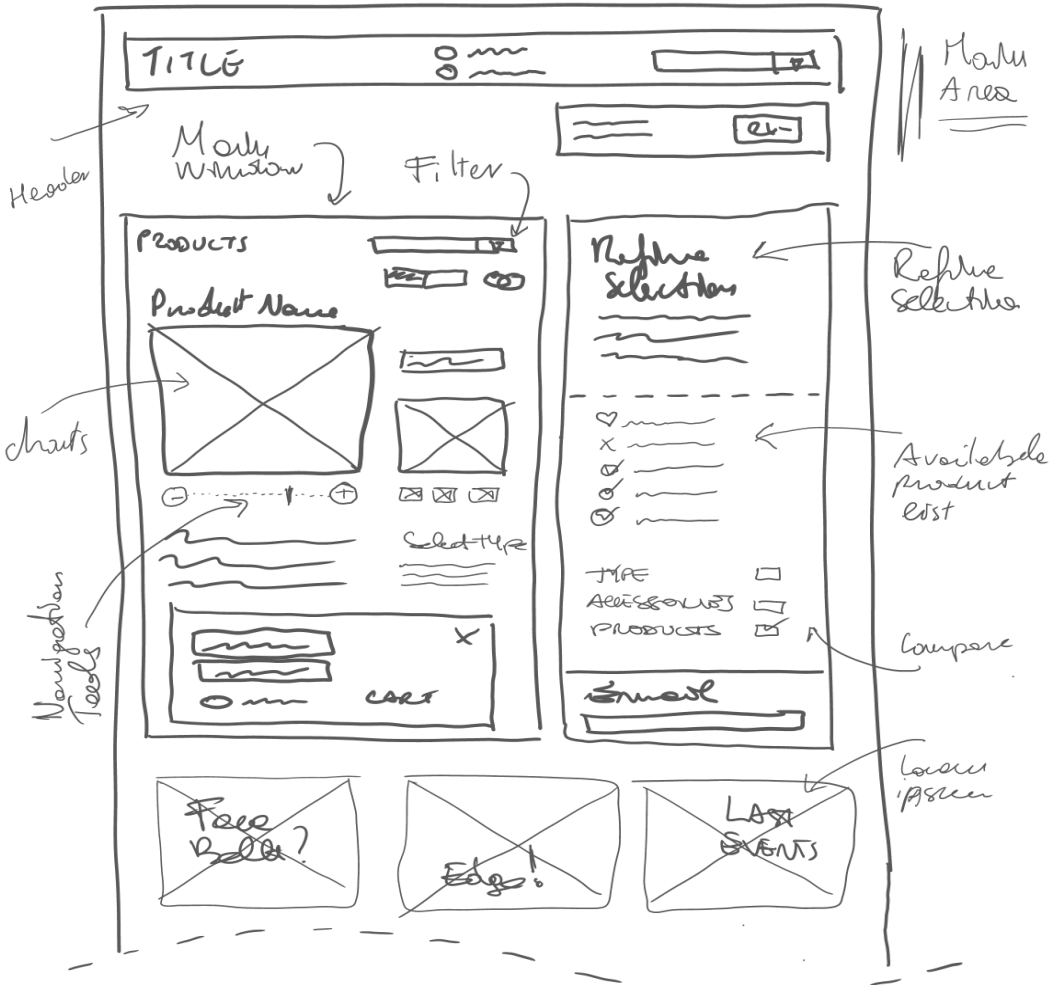
Display the most significant insights on the top part of the dashboard, trends in the middle, and granular details in the bottom

Less is More

Cognitive psychology tells us that the human brain can only comprehend around 7 +/- 2 in one time, and this is the amount of items you want in your dashboard

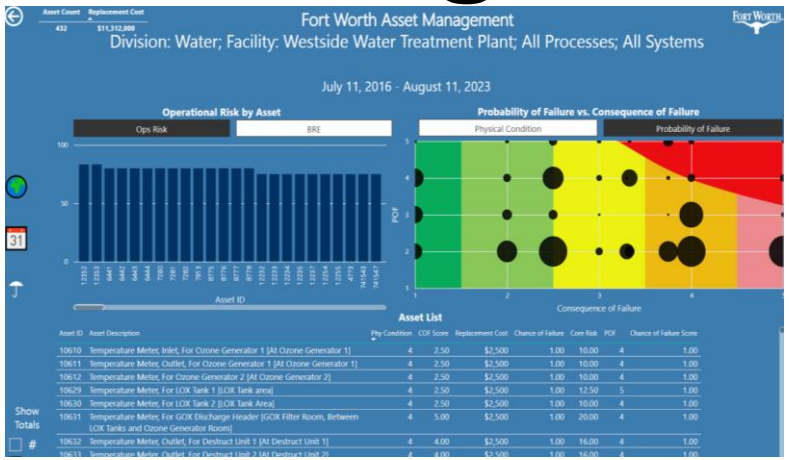
Data Storytelling

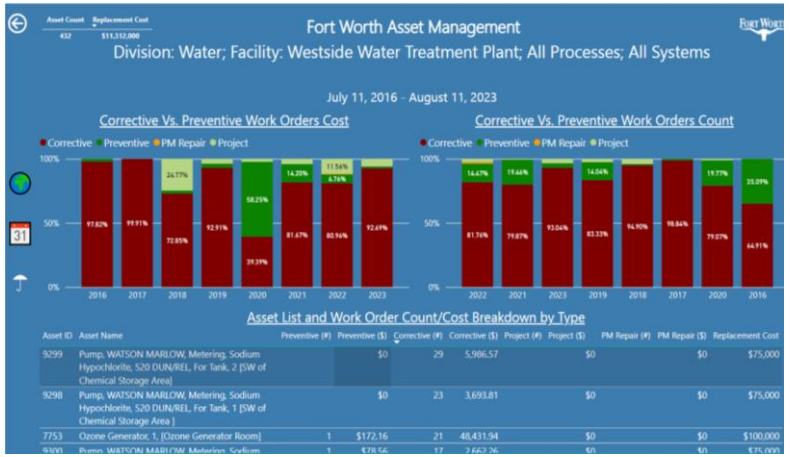
Explain with visualization and is simple and intuitive



Using the Dashboard for Better Insights

- Increase visibility into data
- Improve decision-making
- Reduce costs
- Optimize work orders
- Enhance operations





Initial Performance Scoring Framework

Criteria	Condition	Score				
		1	2	3	4	5
Capacity	Ability to meet current capacity	Avg. – Yes* Peak – Yes*	Avg. – Yes* Peak – Yes**	Avg. – Yes* Peak – No**	Avg. – Yes** Peak – No**	Avg. – No** Peak – No**
Regulatory	Ability to meet current regulations	Yes – Greatly Exceeds	Yes – Acceptable Factor of Safety	Yes – Minimal Factor of Safety	No – Minor modifications required	No
Reliability	Avg. time equipment is available when needed	99 - 100% (4 days O/S)	95 – 99% (up to 18 days O/S)	90 – 94% (up to 36 days O/S)	85 – 89% (up to 55 days O/S)	< 84% (over 55 days O/S)
O&M Issues	Frequency of O&M issues (excluding breakdowns)	None	Very Infrequently (Bi-Annually)	Infrequently (Quarterly)	Frequently (Monthly)	Very Frequently (Weekly/Daily)
Obsolescence	Equipment technology	Best Available / State of the Art	Industry Standard/ "Tried and True"	Considered Appropriate	Nearing Obsolescence	Obsolete / Out of Date
			**With all units in		O/S – Out of Service	

Note:

[1] This is a recommendation and for future asset management, weight % can be adjusted.

Subjective Scoring
(No GPS)

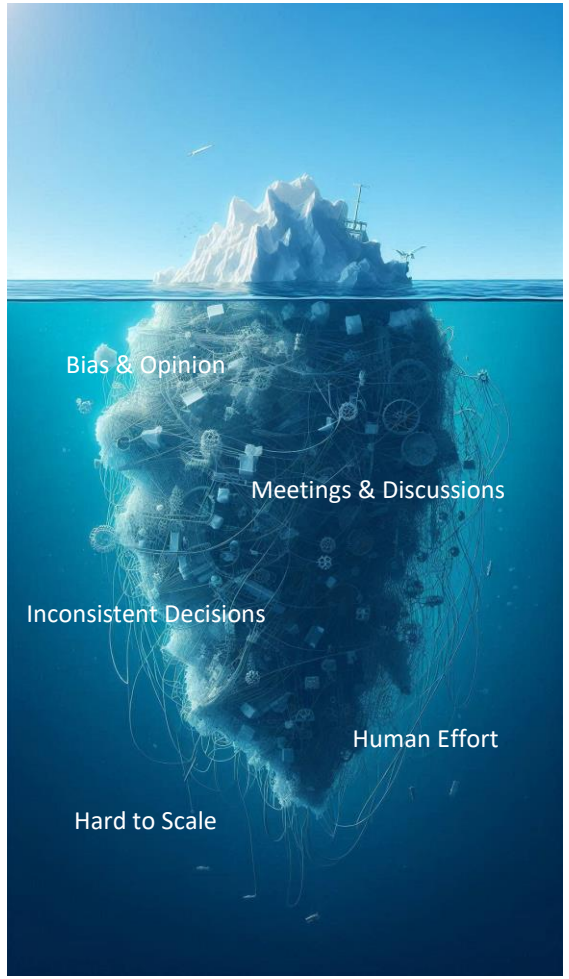
- ✅ Decisions depend on personal judgment, not facts
- ✅ Different people = different results, no consistency
- ✅ Time-consuming, inefficient
- ✅ Process may not be easily repeatable

Are we in control of our path… or just reacting to what's in front of us?

Data-Driven Scoring
(GPS)

- ✅ Uses live data to find the best route every time
- ✅ Same conditions = same decisions, no surprises
- ✅ Fast, accurate, and efficient
- ✅ No second-guessing—just facts

FORT WORTH®



Subjective Scoring
(What You See vs. Reality)

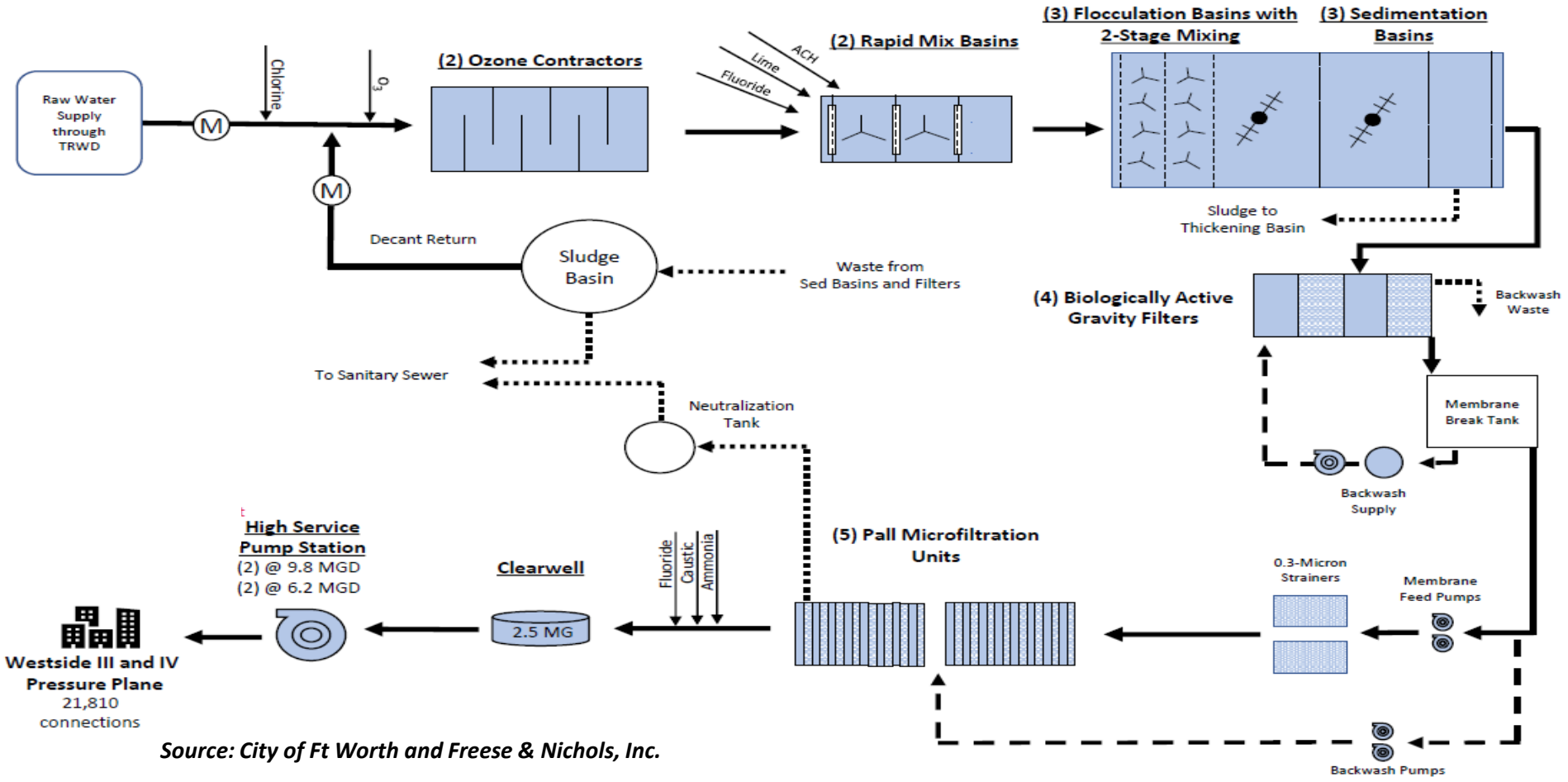
- ✅ Looks easy… but hides effort, bias, and inconsistency
- ✅ Requires human judgment & experience
- ✅ Hidden complexities lead to inconsistencies
- ✅ Prone to bias & variation

Are we making decisions based on what we see… or what's really happening below the surface?

Data-Driven Scoring
(What You See vs. Reality)

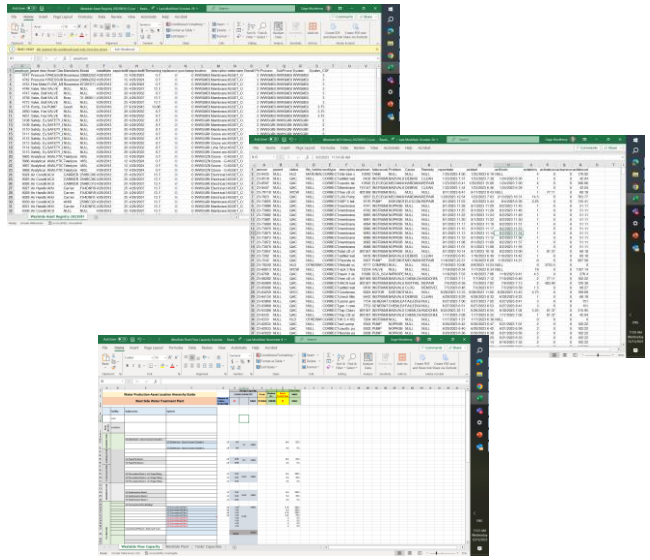
- ✅ Built for efficiency
- ✅ Decisions are data-driven, not subjective
- ✅ Efficient, scalable, and repeatable
- ✅ No human bias, just facts

Westside Water Treatment Plant (WTP) 18 MGD

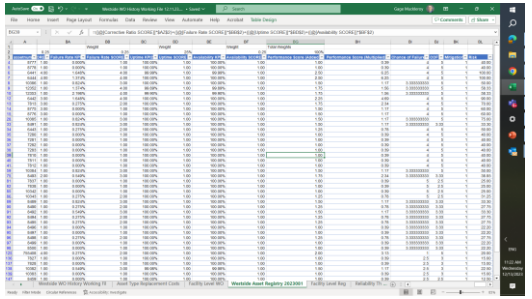


Source: City of Ft Worth and Freese & Nichols, Inc.

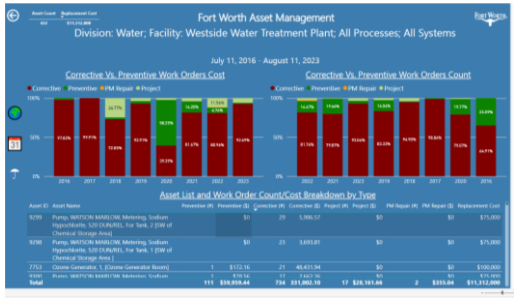
Data Review, Cleaning/Preparation and Analysis



Clean



Analyze



<u>Source Data for Assets</u>
- Asset Register
- Work Order History
- Chance of Failure and COF System Scores

<u>Clean/Consolidate</u>
- Python
- Excel Functions
- Filters

<u>Apply Perf. Criteria</u>
- Mock-up Dashboard
- WO Analysis
- Performance Scoring

Data Scrubbing

- Overall Data is “good” but not complete
- Inconsistencies in the Data
  - Failure Codes, Failure Reasons
- Using Work Order Time Stamps as “proxies” for Reliability Performance
  - WO Report Date, Actual Start, Actual Finish
  - Used for MTBF, MTTR, Failure Rate, Uptime, Availability
- Incomplete Data
  - COF Scores
  - Capacity Related Scores
  - Units In Service vs Out of Service
  - Half of assets with no WO history

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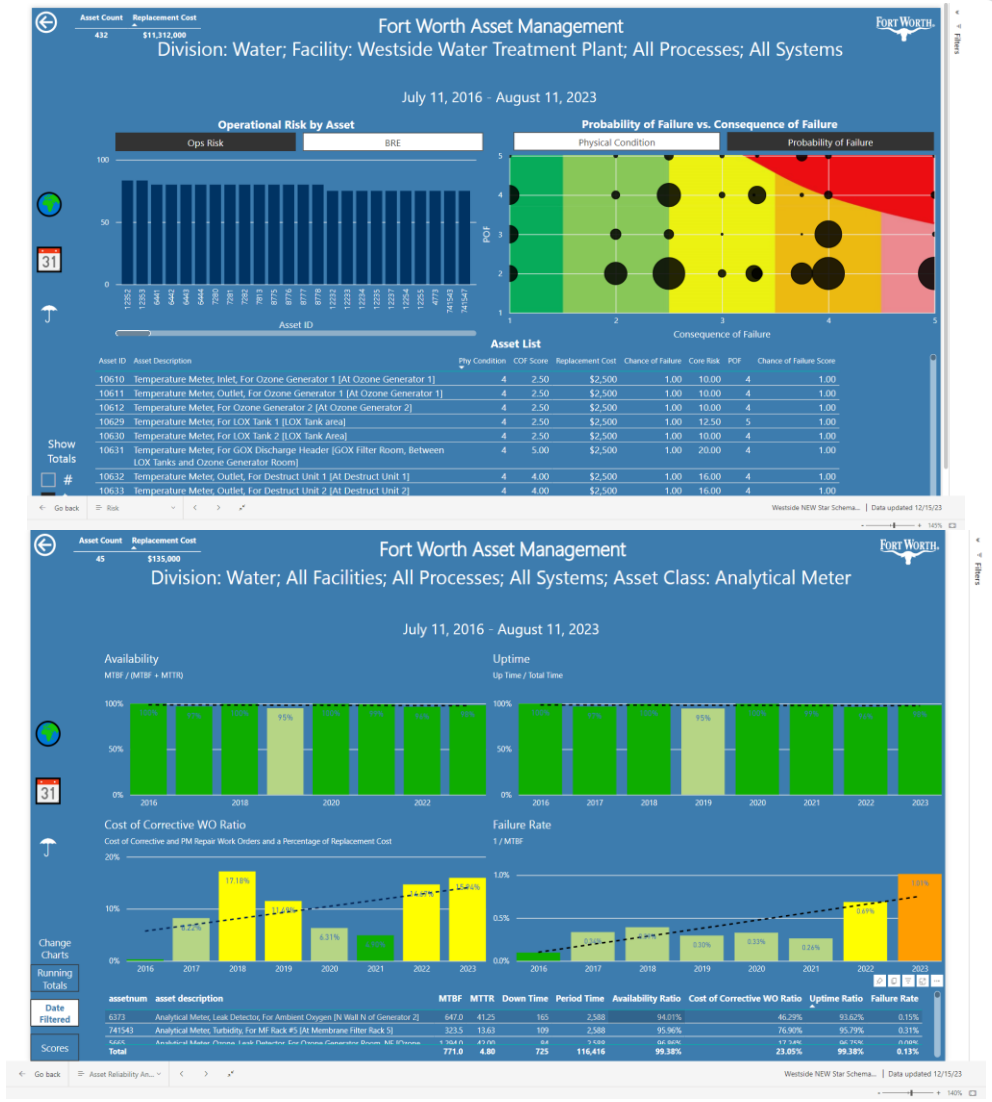
Review Results (Dashboard)

- Age based vs Staff Condition Scores
- Capacity and Chance of Failure
- Reliability Scoring
- Financial Efficiency Scoring
- POF and COF
- Risk Results
- Work Order Analysis
- Failure Codes



Fort Worth Asset Management System

Water

- Westside
- Eagle Mountain
- Rolling Hills
- Holly North & South
- Distribution System

Wastewater

- Village Creek
- Mary's Creek
- Collection System

AM Planning Criteria

- AMP Development Process
- Condition and Performance Scoring Process
- AMP Definitions and Scoring Process
- Management Strategy Groups

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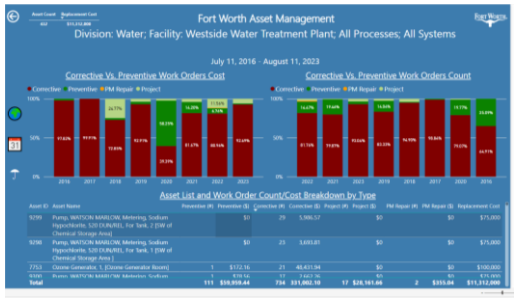
Findings and Lessons Learned

- Performance Scoring most applicable to assets that have consistent WO information
- Data associated with WOs is informative and can be used to optimize WO process – CM vs PM, MTTR, etc.
- Data is incomplete in many areas, with less than half of all assets having work order information
- Data Analysis is limited to frequency of WOs and associated Failure Codes

Next Steps - Phasing of the Asset Dashboard Plan (i.e. Uniting Data and Decisions)

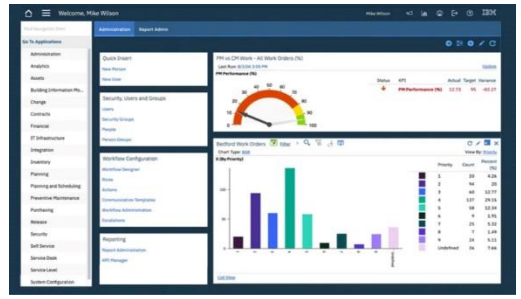


Power BI (GHD)

Mine, interpret, and facilitate from a variety of raw data sources into meaningful visualizations, dashboards, and reporting

Looker (Water IT)

In-depth analysis of large data to explore, visualize and share business intelligence insights



Maximo Upgrade – Asset Health Insights (Water IT)

Track, monitor, and maintain assets

Thank you!

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Questions & Discussion

Webinar Feedback

- Please provide your feedback on today's webinar in this brief survey. Thank you!

Provide Webinar Feedback Here

Water for North Texas Online Library

- Resources related to today's topic and other water-related subjects can be found on the Water for North Texas Online Library

Wrap-Up

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