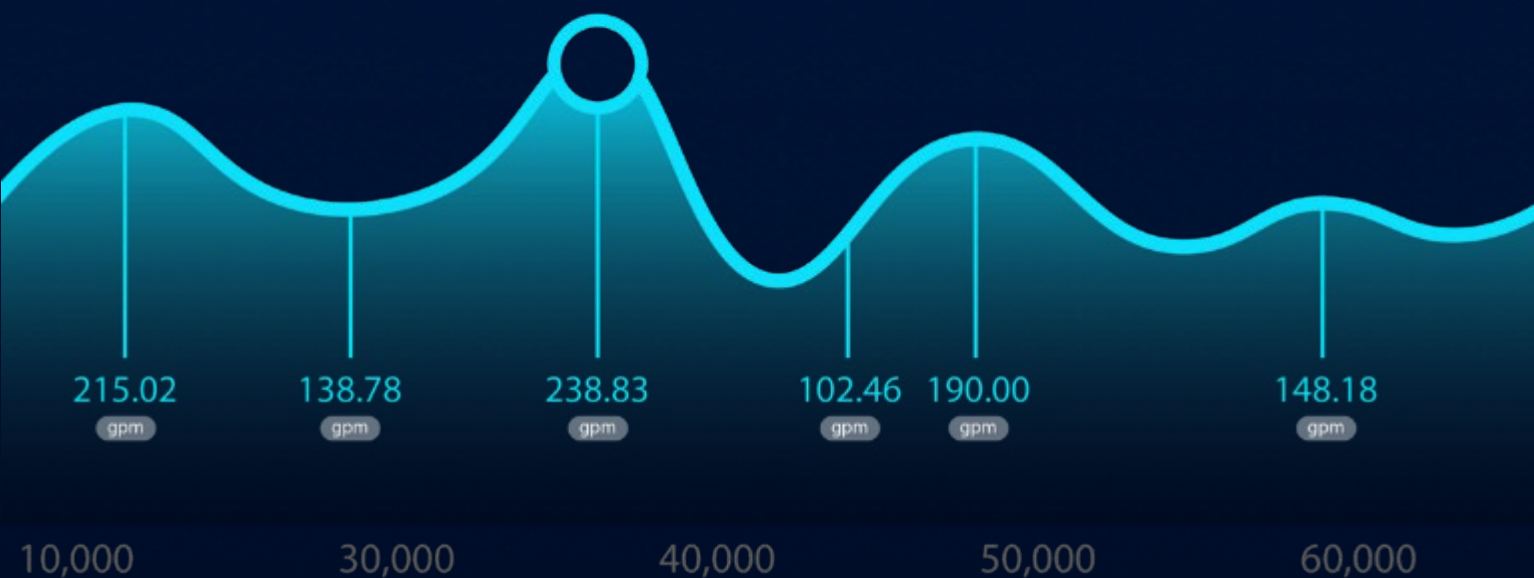


21st Century Tech for Order of Magnitude Improvements in Collection Systems





“If you know the enemy and know yourself, you need not fear the result of a hundred battles.

If you know yourself but not the enemy, for every victory gained you will also suffer a defeat.

If you know neither the enemy nor yourself, you will succumb in every battle.”

— Sun Tzu, The Art of War

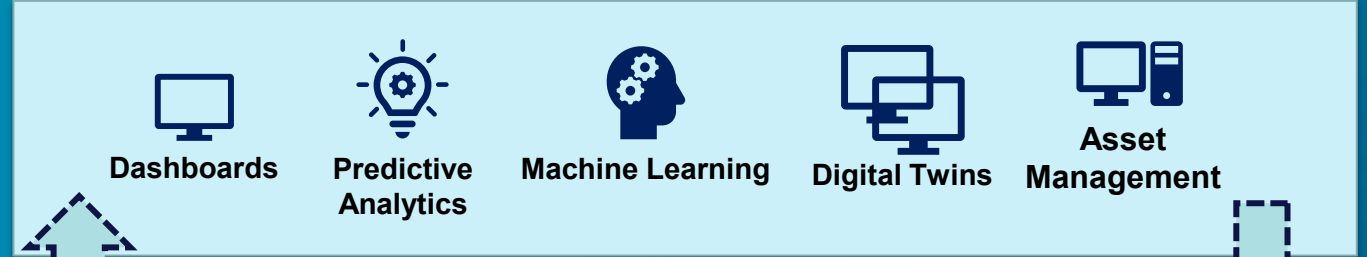
Smart Water Approach

The structure spans the three levels of **Equipment, Communications, and Analytics.**

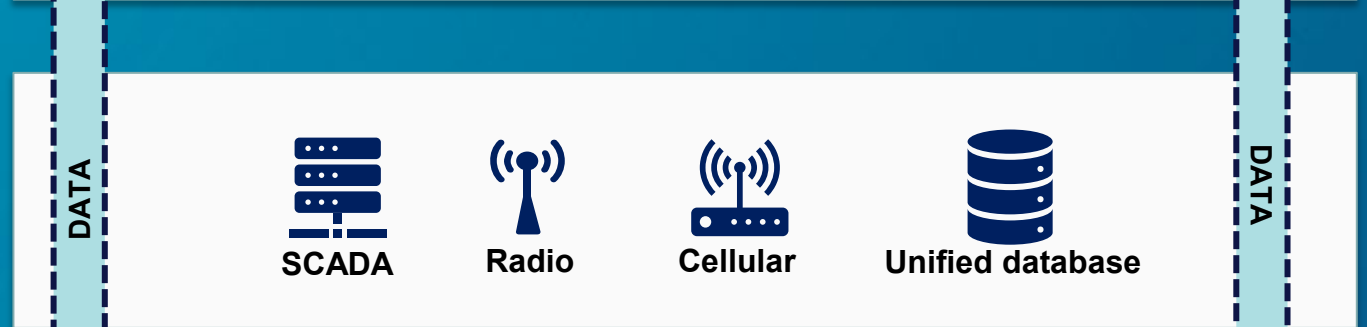
This works to fill the data stream across from equipment to analytics and then back to the equipment.

Make decisions on demand, not with last week's information

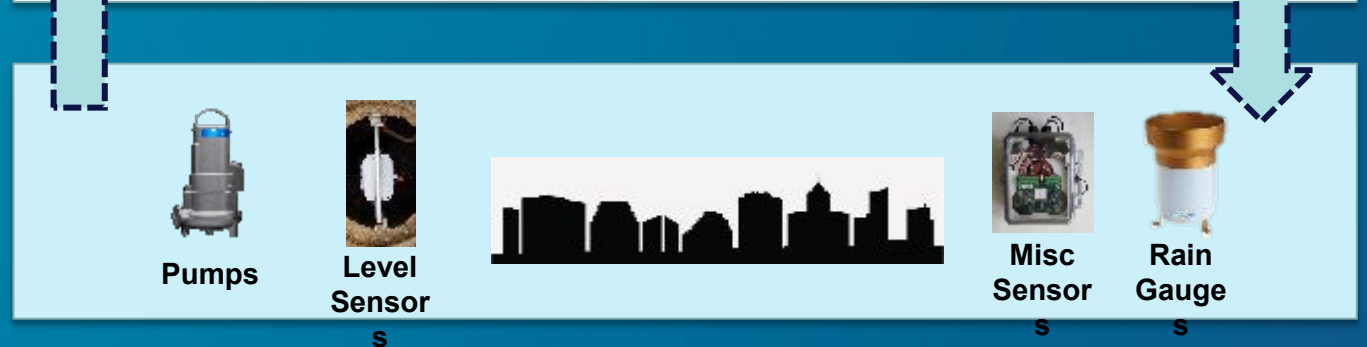
3 - Visualization and Analytics



2 - Communications and Data



1 - Equipment and Sensors



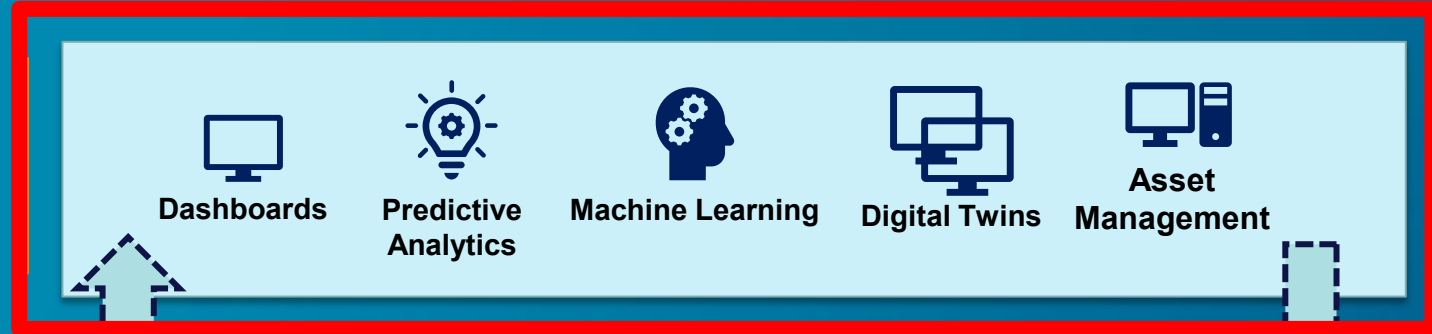
Smart Water Approach

The structure spans the three levels of **Equipment, Communications, and Analytics.**

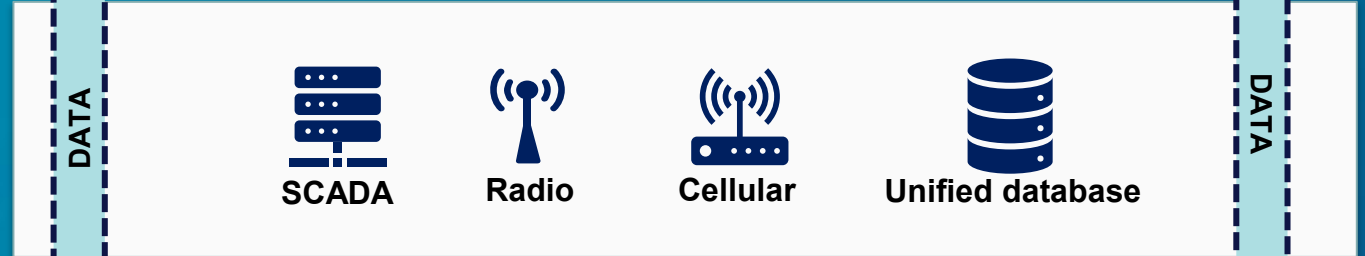
This works to fill the data stream across from equipment to analytics and then back to the equipment.

Make decisions on demand, not with last week's information

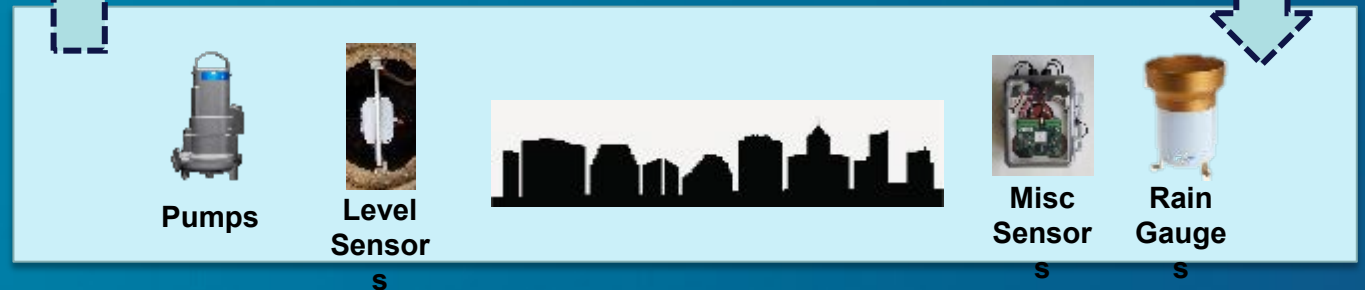
3 - Visualization and Analytics



2 - Communications and Data



1 - Equipment and Sensors



Digital Twins

So many evolving definitions...

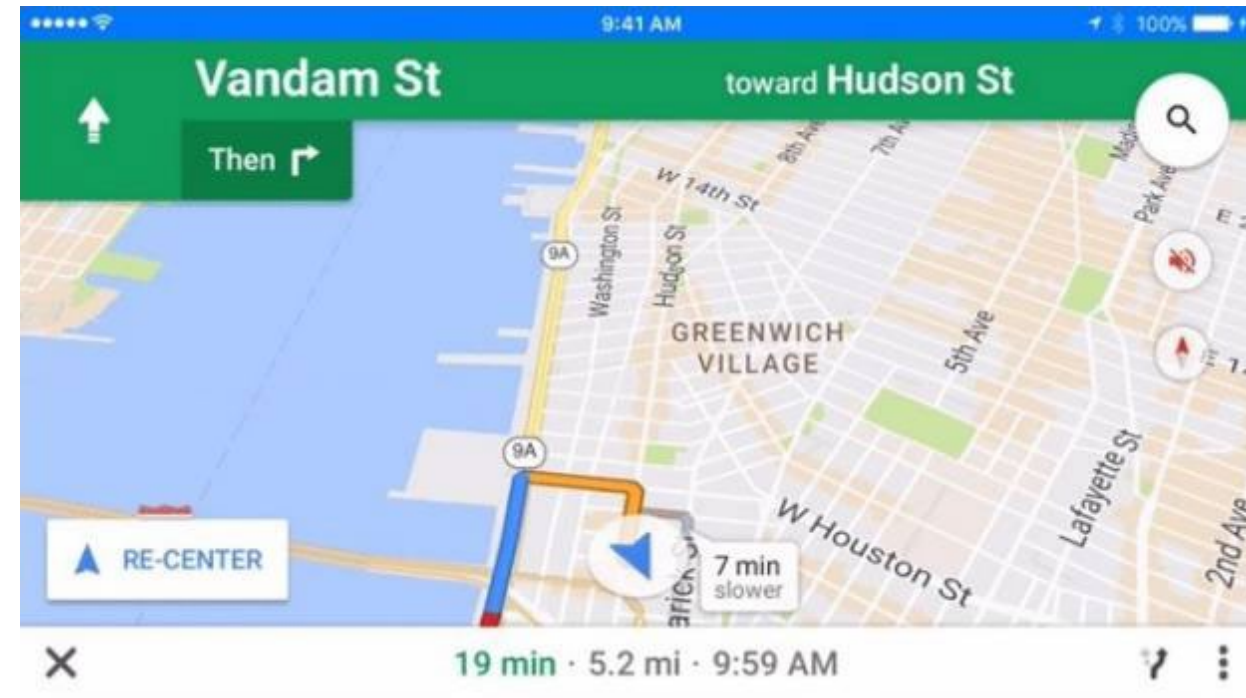
Components of a Digital Twin:

Dynamic + Data + Integration + Digital + Model + Outputs + Automatic + Actionable +
Decisions

Everyday Digital Twins

Real Time Decision Support Systems (RT-DSS) are computerized systems that help people make decisions.

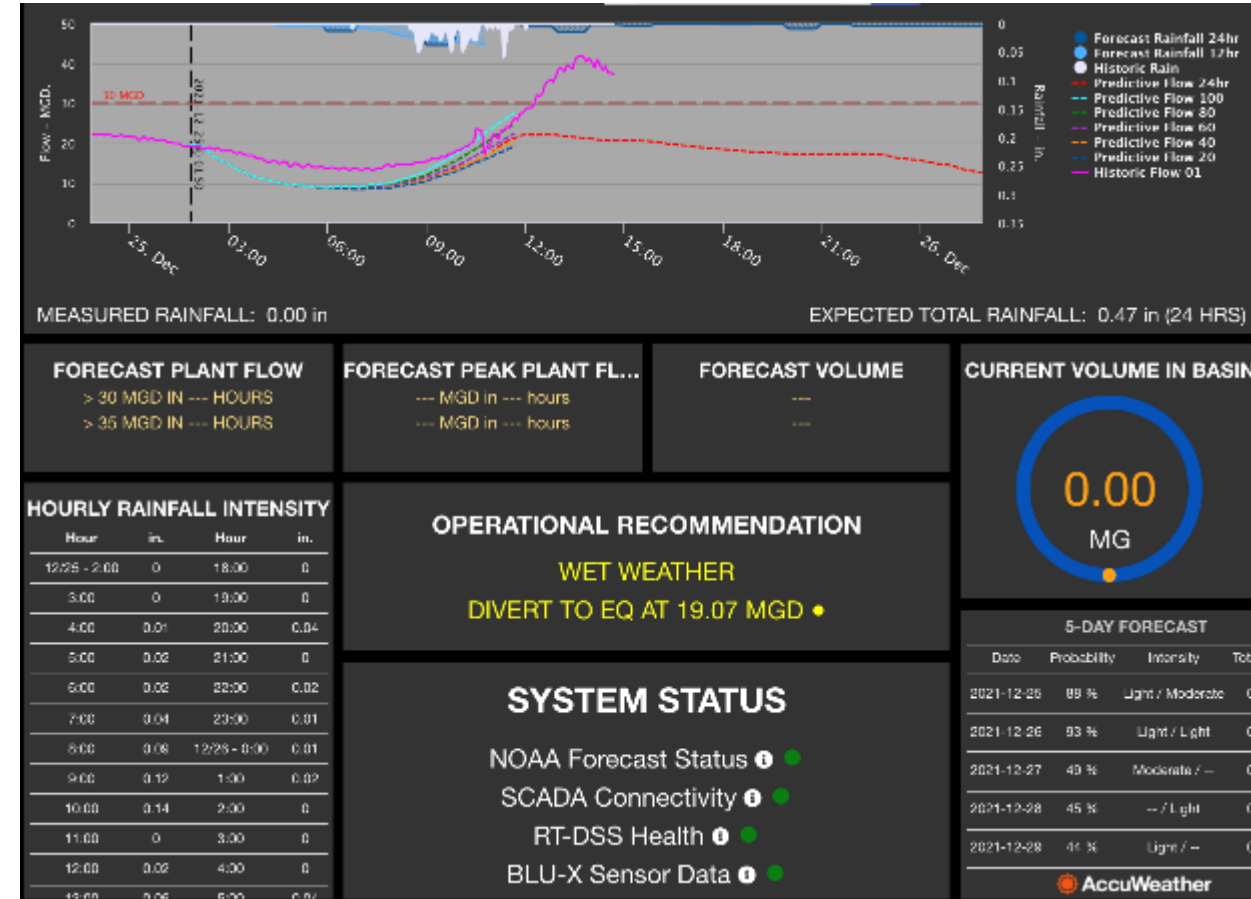
They can account for a multitude of variables and can help people achieve objectives faster and cheaper.



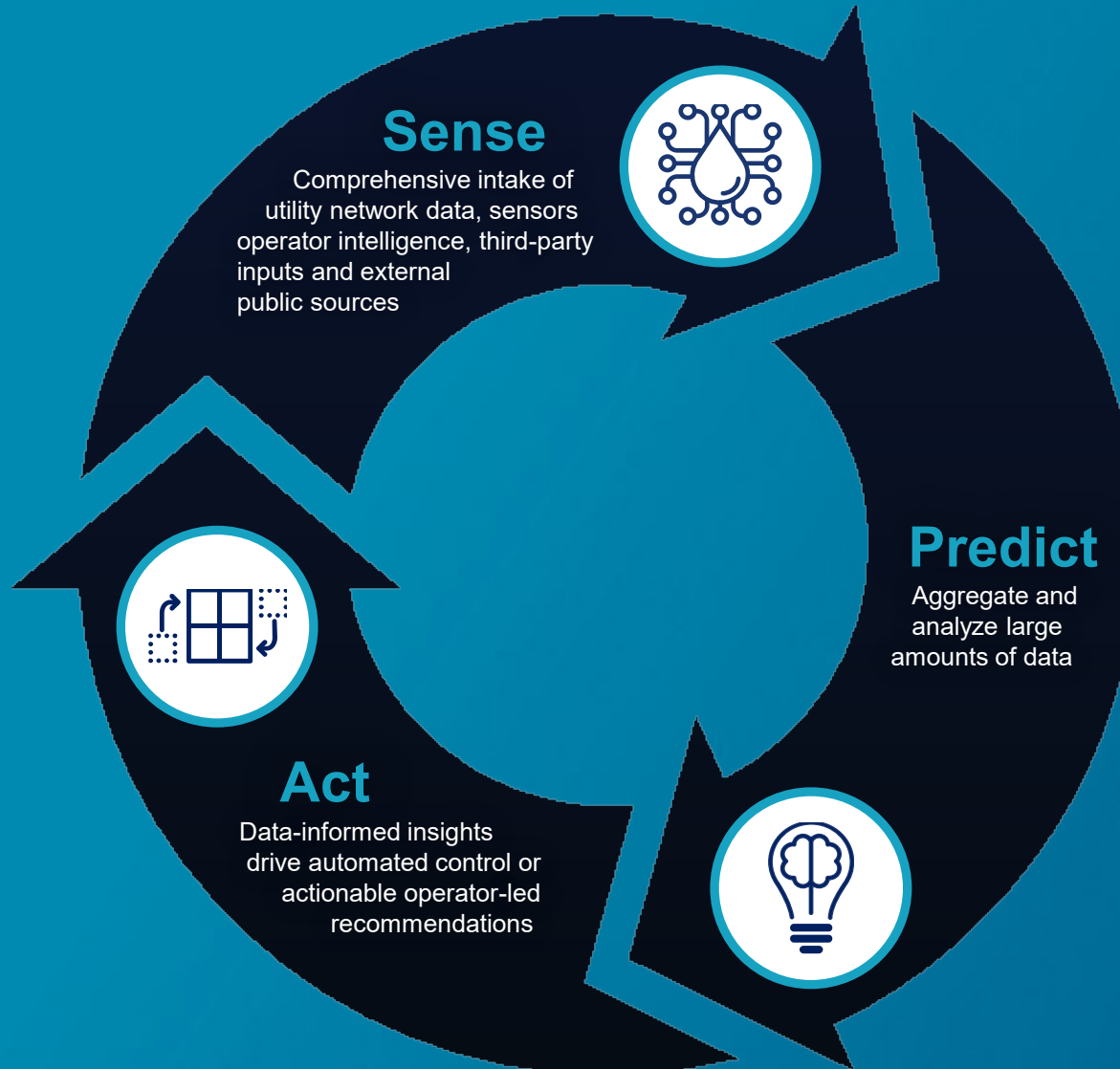
Everyday Digital Twins

Real Time Decision Support Systems (RT-DSS) are computerized systems that help people make decisions.

They can account for a multitude of variables and can help people achieve objectives faster and cheaper.



Real Time Decision Support System





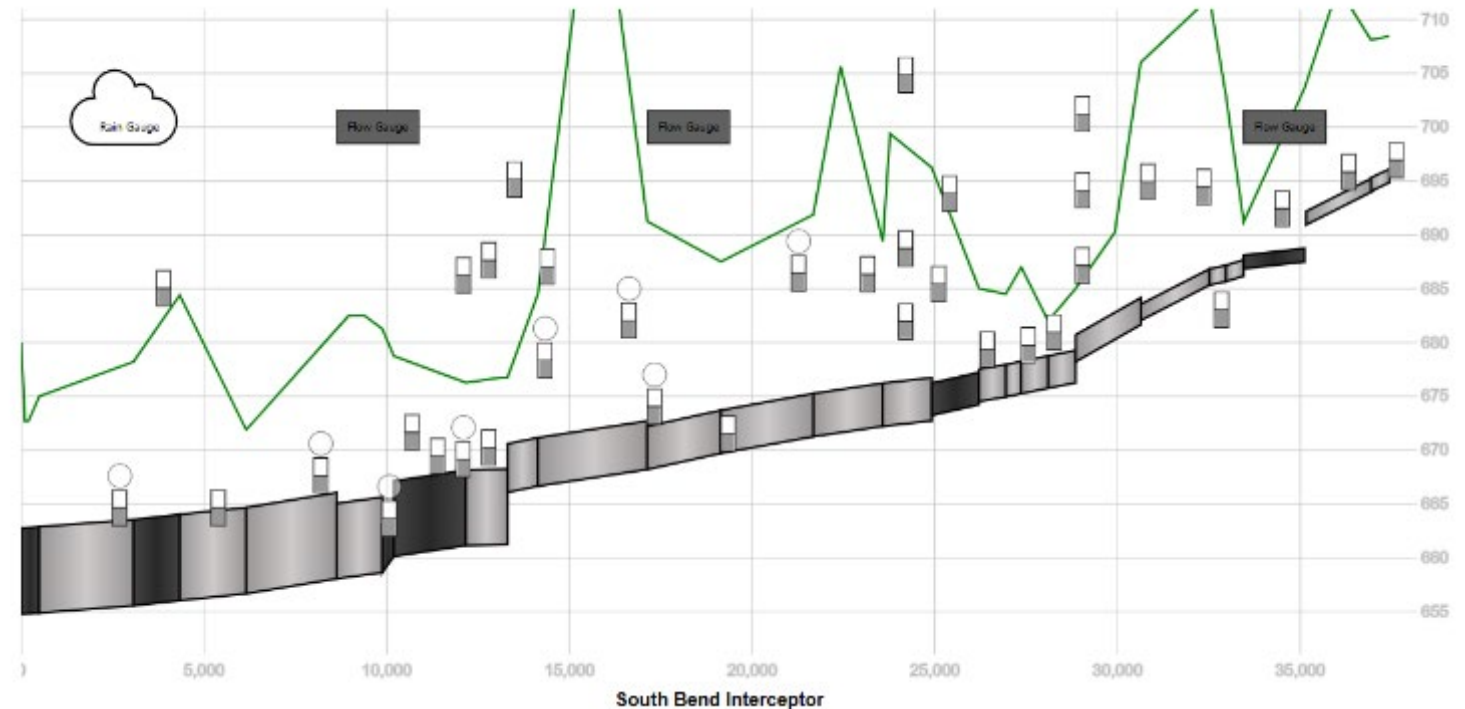
Sense: Turn On the Lights Before

Static representation of a collection line.

You can see pipes, connections, topography, but no visibility into the current status.

How can operators know what manholes are overflowing?

How can you know where spare capacity is?





Sense: Turn On the Lights After

Red levels in the pipes show pressurized parts of the system

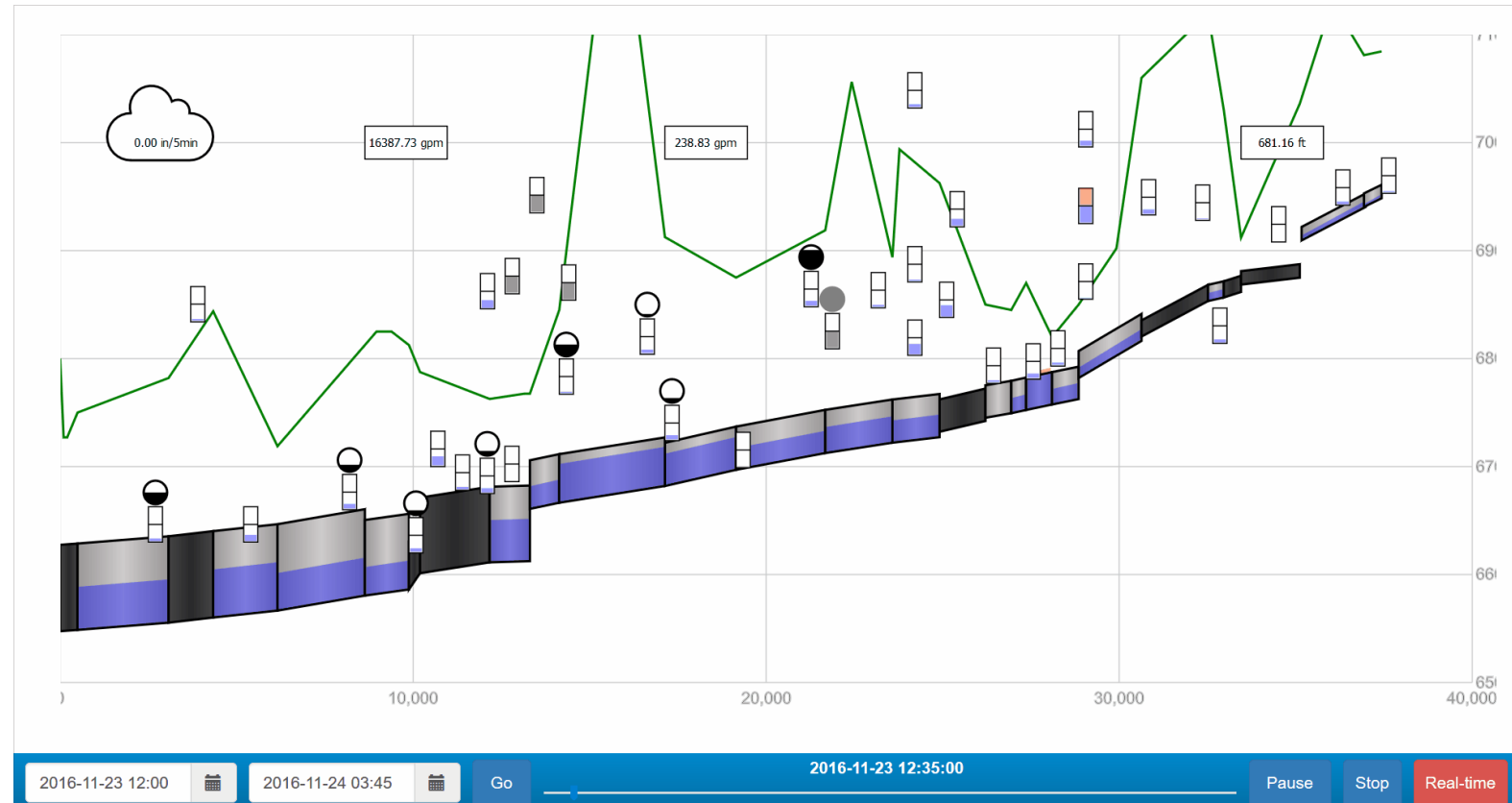
Red levels on the squares shows overflows

Circles filling are valves opening and closing

NOW operators can see what's going on

NOW operators can make informed decisions

Half-full pipes downstream still had capacity during initial phases of storm



Example of the Profiler dashboard showing the hydraulic grade line along an interceptor for dynamic capacity management and utilization in South Bend, IN. The tool is actively used by both Xylem and the Utility to identify underutilized capacity and operational issues.



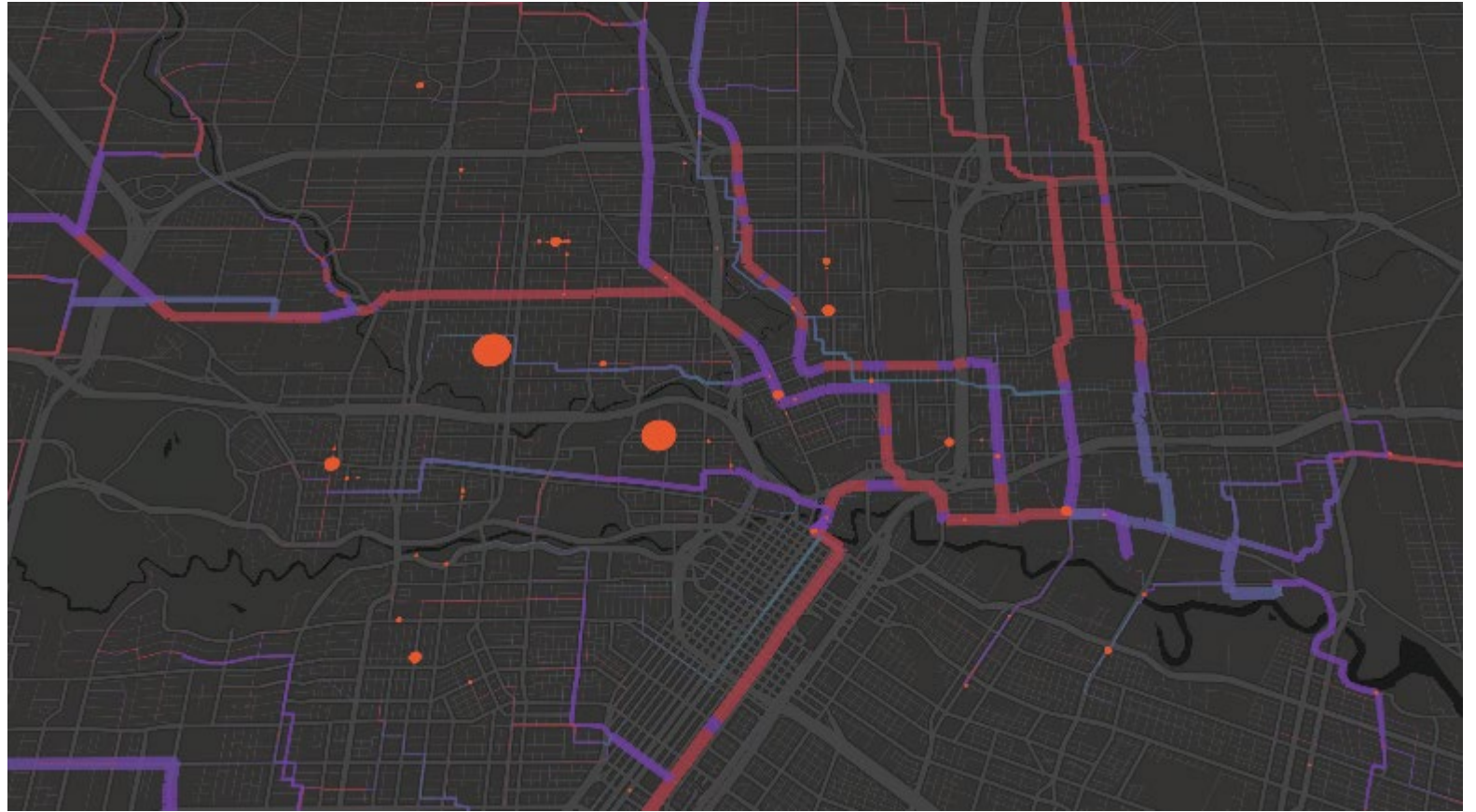
Predict: Using AI & ML to Have Model Mimic Actual Operations

The remaining capacity, total flow, and flooding are represented by line color, line thickness, and red circle size, respectively.

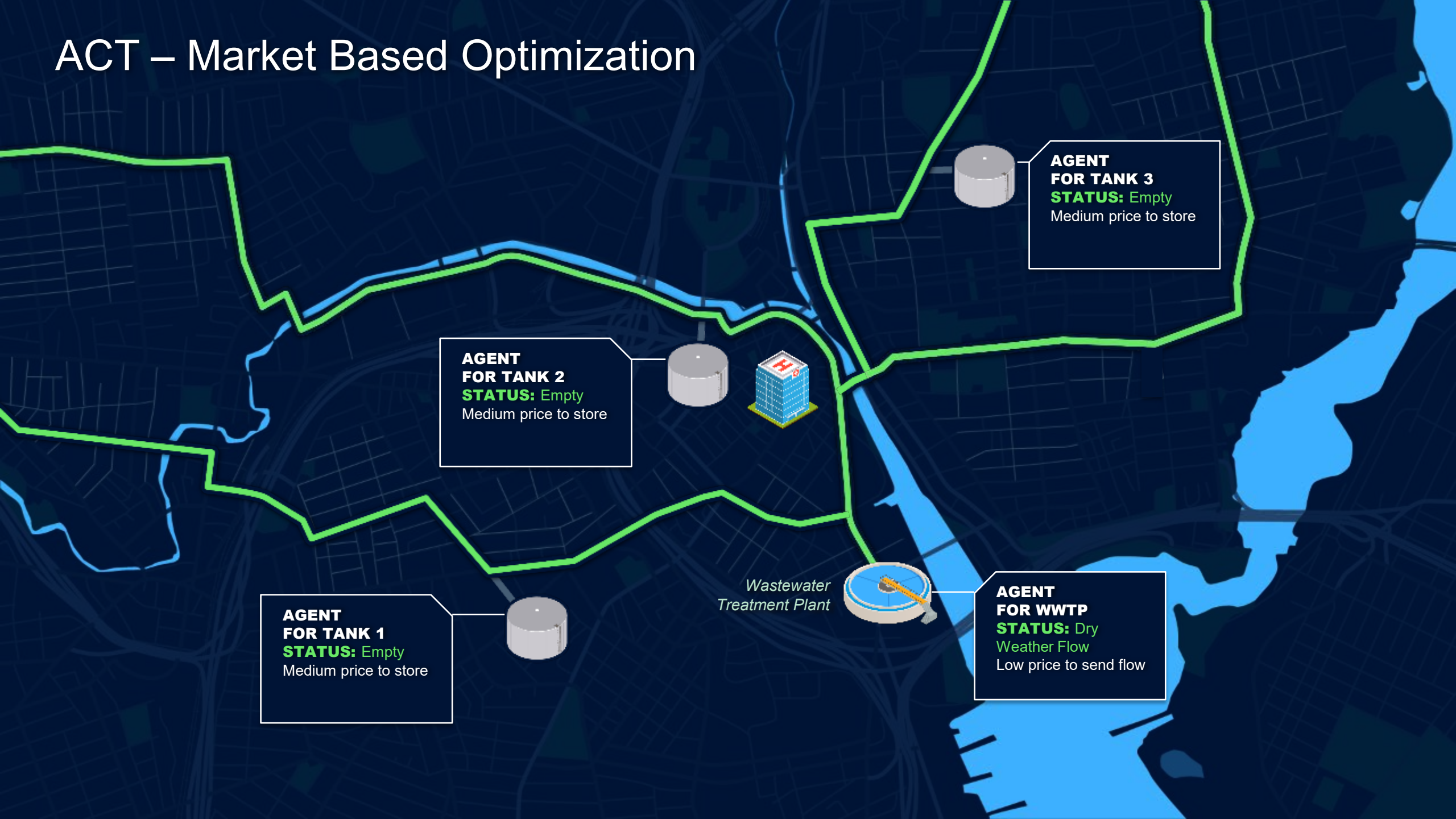
Thick red lines represent large sewers with high total flow that are surcharged.

Light blue lines represent sewers that have a lot of remaining capacity.

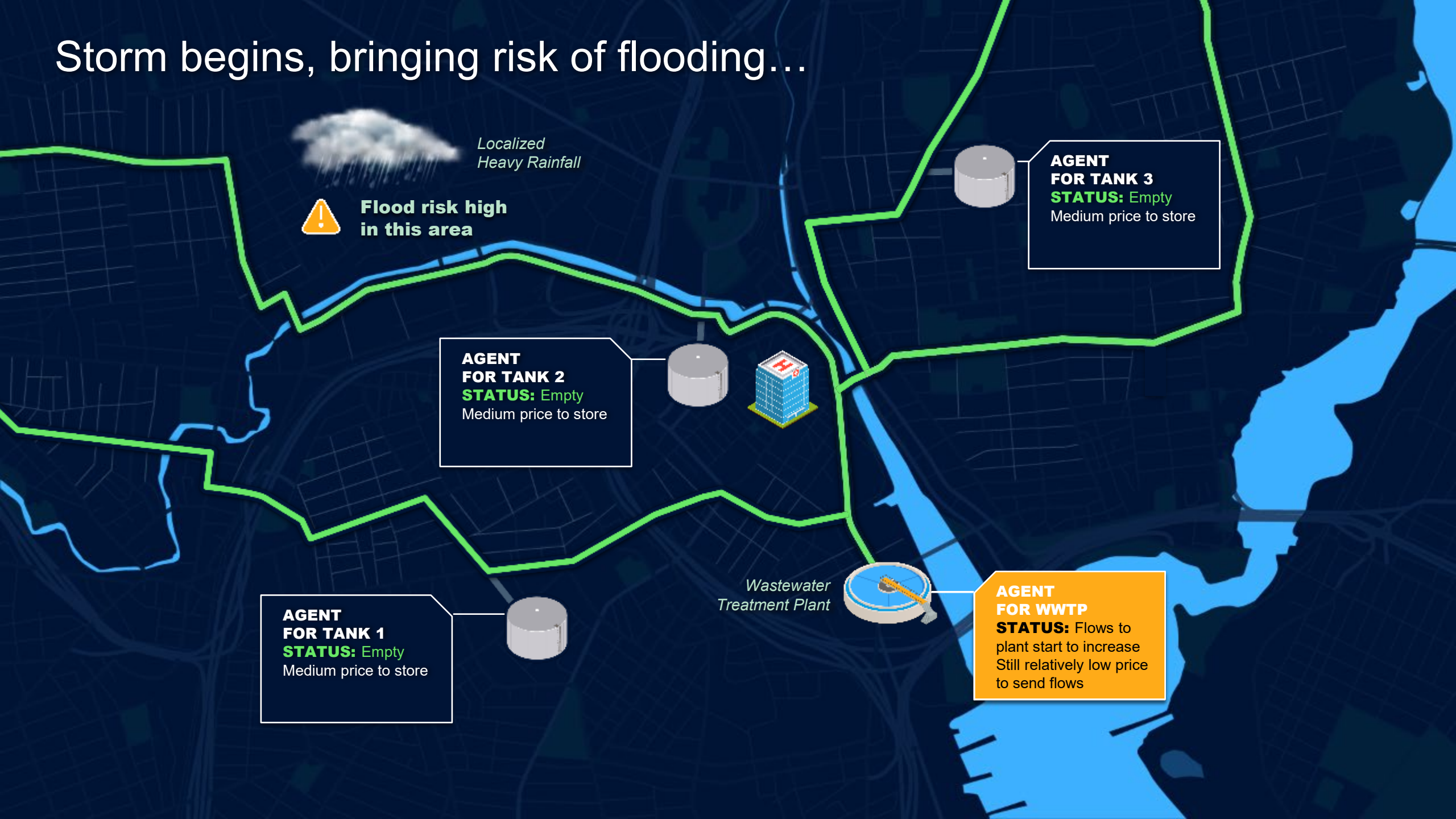
Provides immediate visibility.



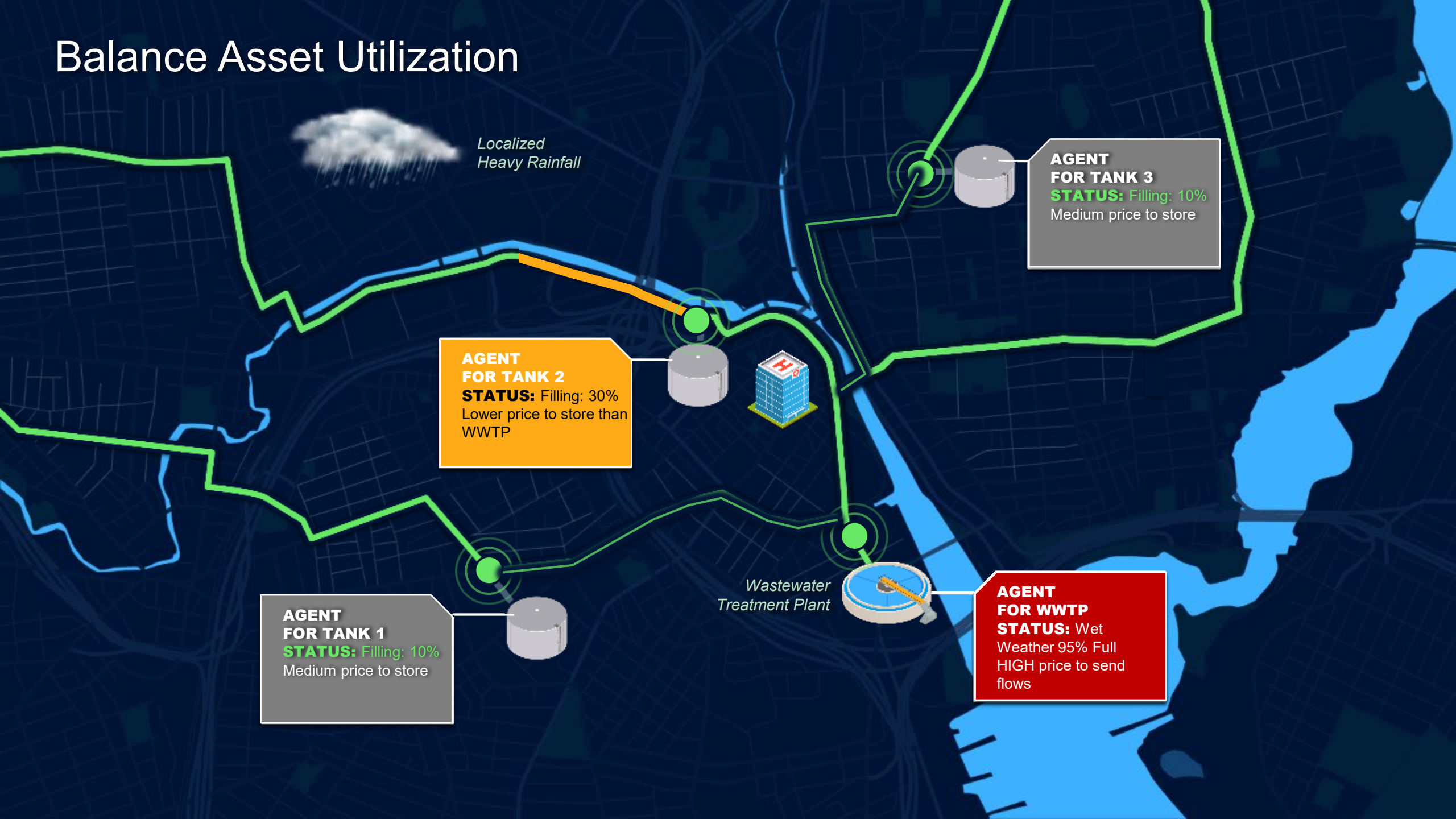
ACT – Market Based Optimization



Storm begins, bringing risk of flooding...



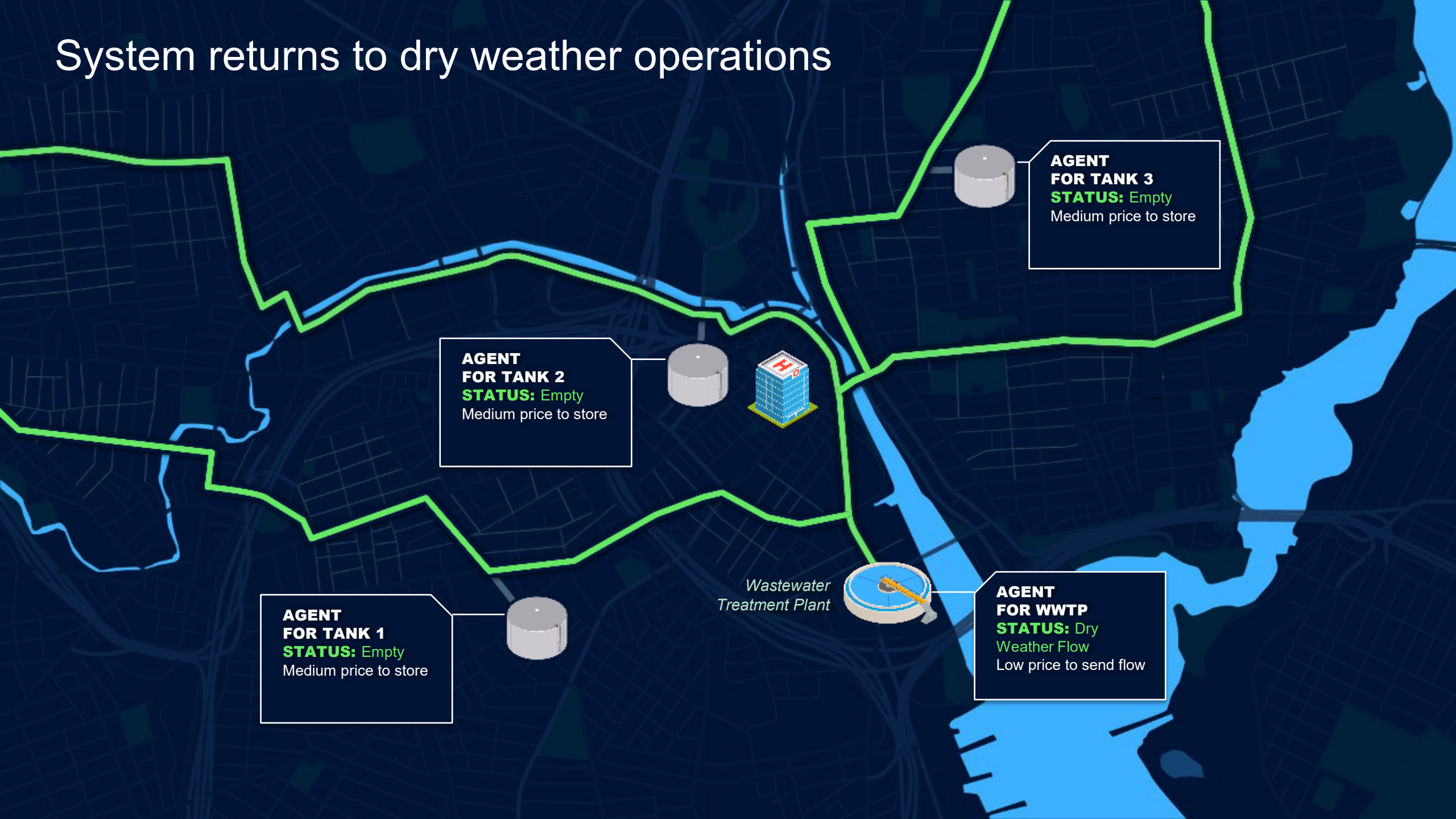
Balance Asset Utilization



Storm abates...



System returns to dry weather operations



Realized Results From Utilities

Overflows
Reduced by
450M GAL.
ANNUALLY

Buffalo Sewer
Authority

Aeration energy
usage reduced by

26%

EWE Wasser GmbH

Overflow
volumes reduced by
247M GAL.
ANNUALLY

Metropolitan Sewer
District of Greater
Cincinnati

Solved infiltration
and inflow for
\$950M
ANNUALLY

City of Grand Rapids

Overflow volumes
reduced by more than

100M GAL.
ANNUALLY

Evansville Water
and Sewer Utility

Let's see what's possible for water.