Smart Watersheds: Changing the Way We Think About Water Management

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In Partnership with: The Nature Conservancy

Stormwater Impacts to Florida Communities

Flooding

Over **$18 billion** in damages from flooding and severe storms **in 2023 alone**

Water Quality

$13.8 billion required for stormwater treatment over the **next 5 years**

Infrastructure

Florida has the **third-fastest** growing population density over the past 50 years

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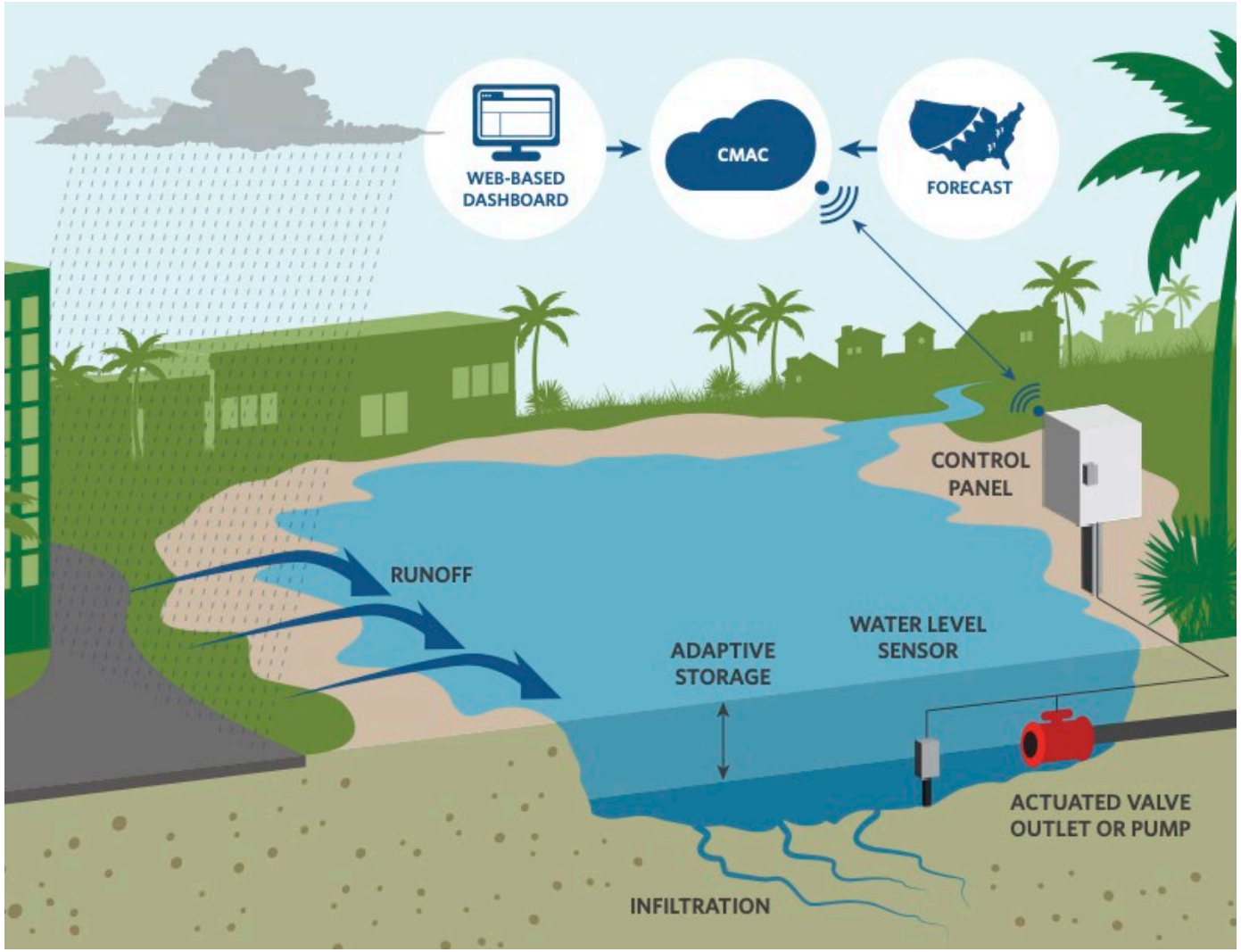
We can’t tear down the infrastructure we’ve built
but we can reprogram it
to act more like nature.

Making Progress: ‘Smart Pond’ technology is established in Florida



Continuous Monitoring and Adaptive Control (CMAC)

10 years of testing & implementation along with advancements in reliability and performance

2 billion data points collected, 200 million control decisions made, 7 billion gallons of wet weather flows captured

Florida CMAC-equipped ponds are improving water quality and reducing flooding across the state

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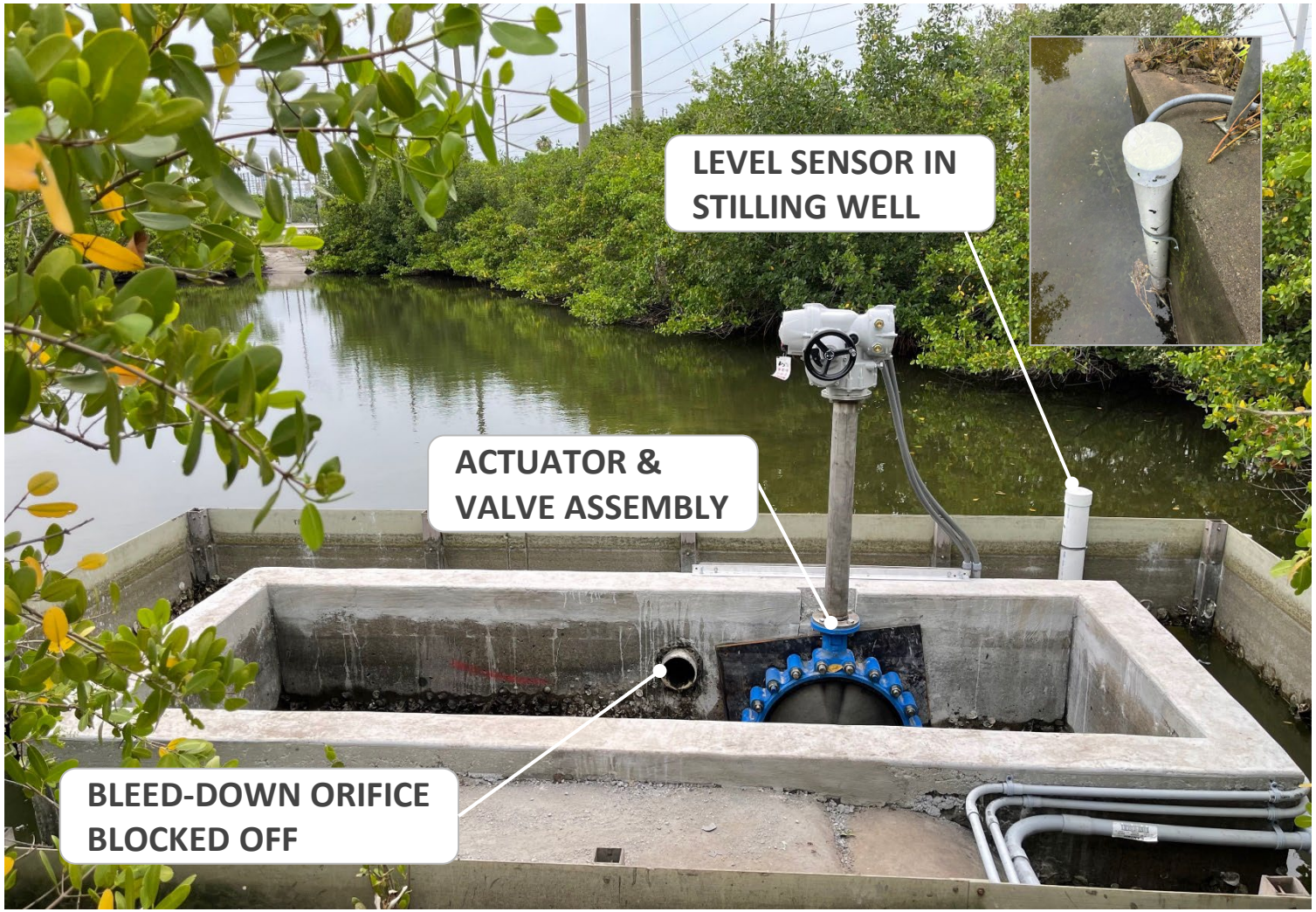
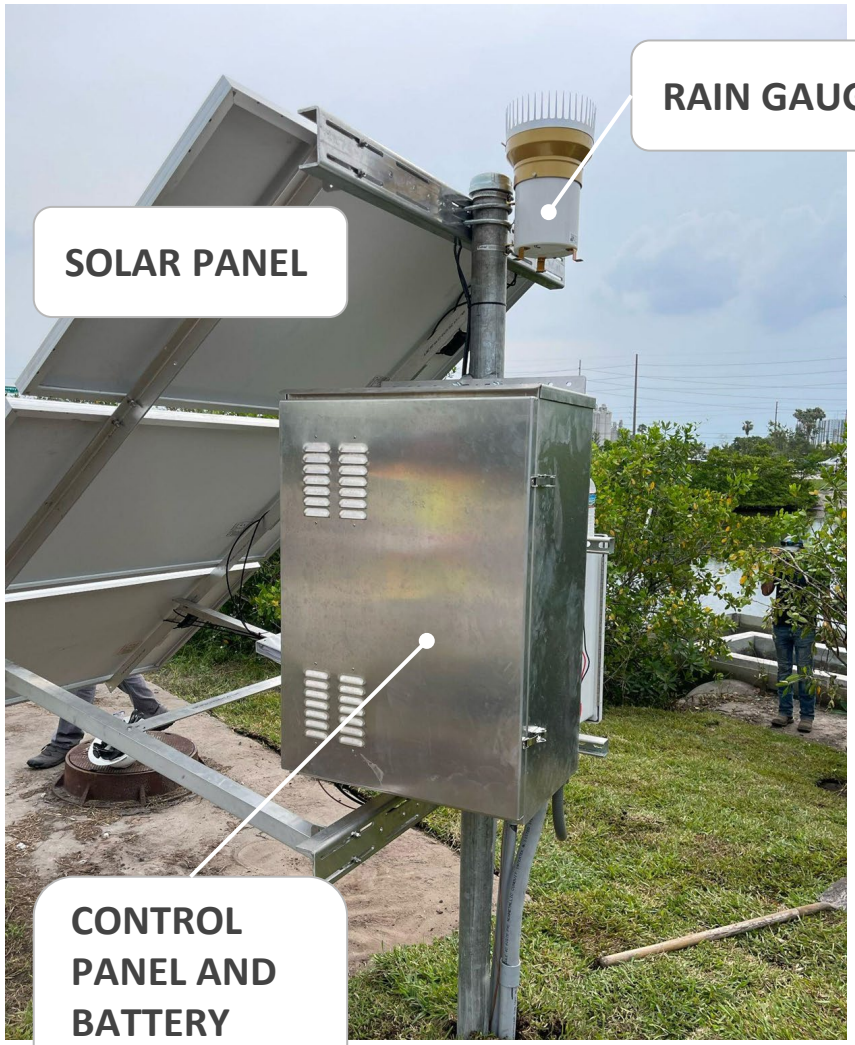
CMAC-Equipped FDOT Pond





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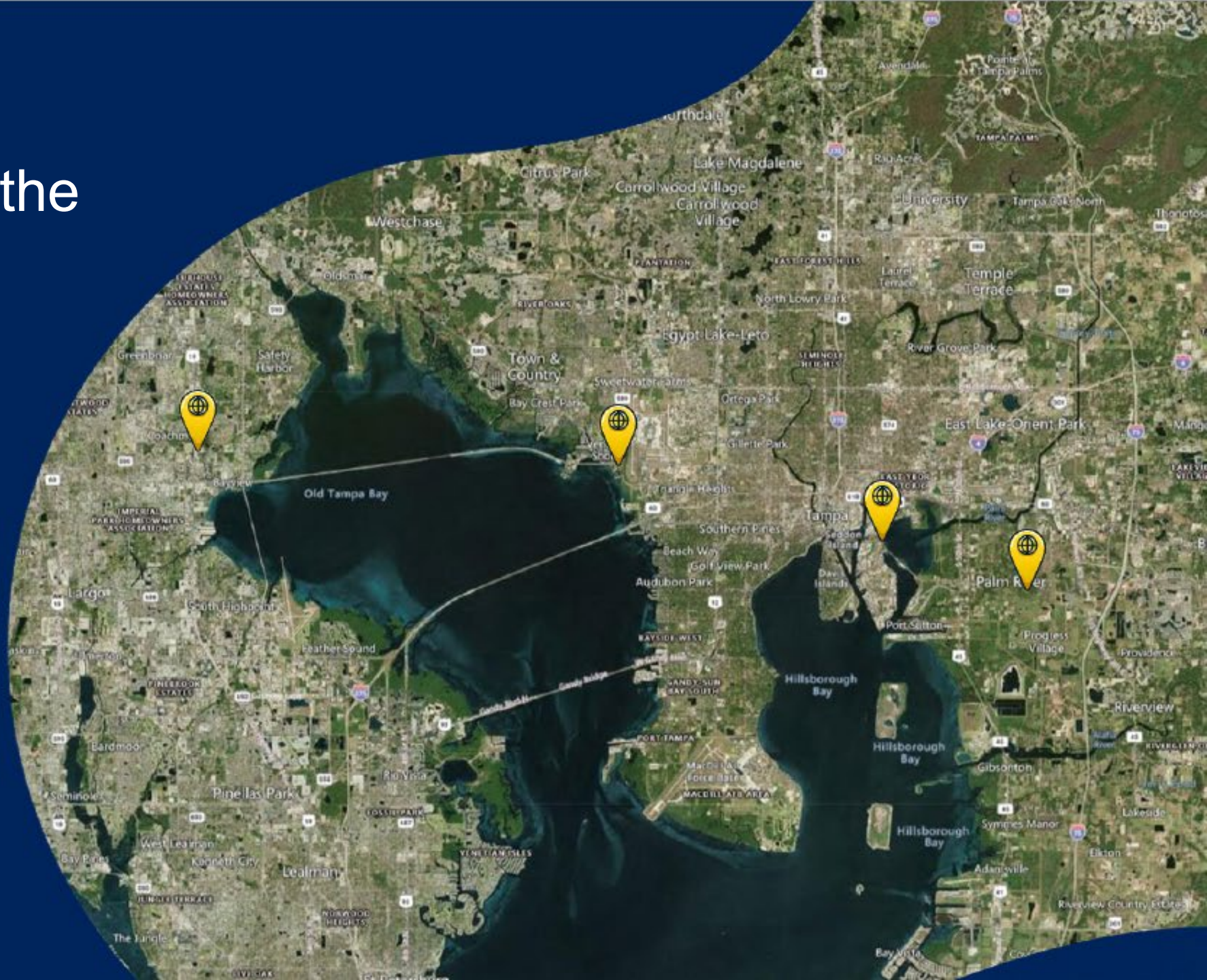
4 Smart Ponds in the Tampa Bay Area



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Evolution of CMAC Control Strategies:

Rules-based control:

Preconfigured settings based on knowledge of the systems and based on trial and error.

Often inefficient, based on 'expert' input

Predictive control:

Given a forecast window, system uses the current state to solve a finite horizon, open-loop optimal control problem.

Current area of focus, room for improvement

Agent-based control:

A deep neural network 'learns' a control strategy based on interaction with a system and feedback based on the effectiveness of each decision.

The next frontier…

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TNC's Smart Watershed Network Management Pilot

- Pilot study to integrate new technologies into water management strategies
- Broad partnerships to make transparent and repeatable
- Multi-year upfront modeling and design phase followed by pilot implementation and real-world testing

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Current State

Desired Future State

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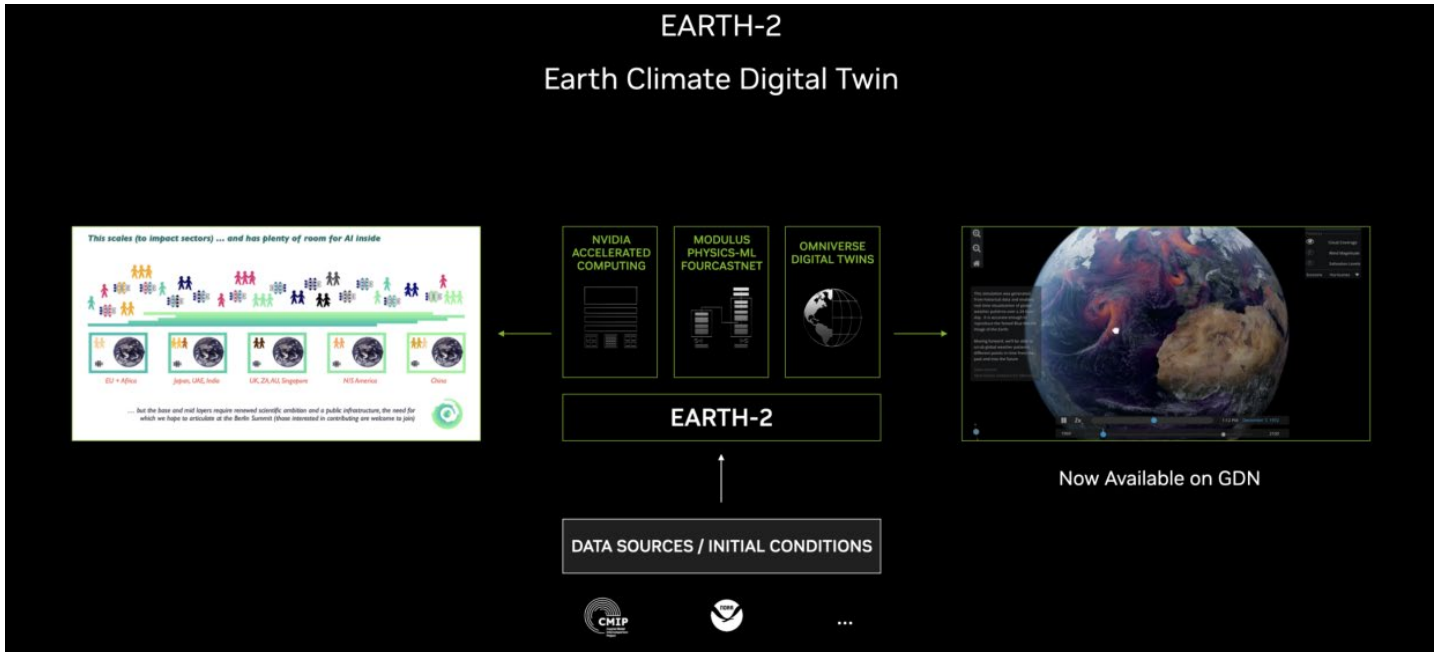
Using Computational Power & Emergence of Hybrid Analytics…



We can now create **digital twin models** that can quickly and accurately predict a **watershed response** with CMAC-enabled infrastructure.

Source: https://esto.nasa.gov/ai-powered-terrahydro-could-help-hydrologists-better-understand-the-water-cycle/

Source: Nvidia's Earth-2 AI tool @ https://www.nvidia.com/en-us/high-performance-computing/earth-2/

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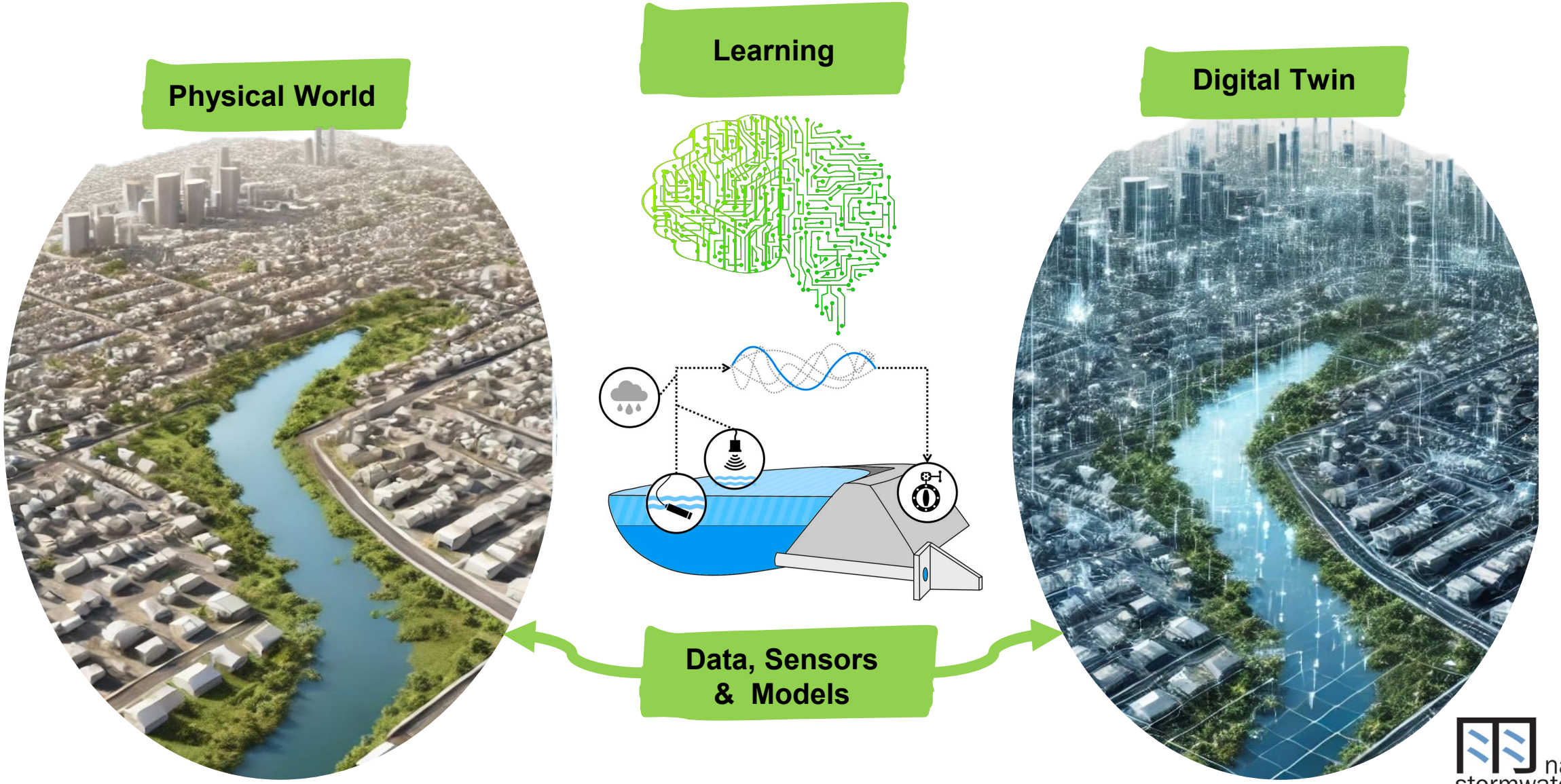
…to Create a ‘Smart Watershed’ that Learns and Adapts



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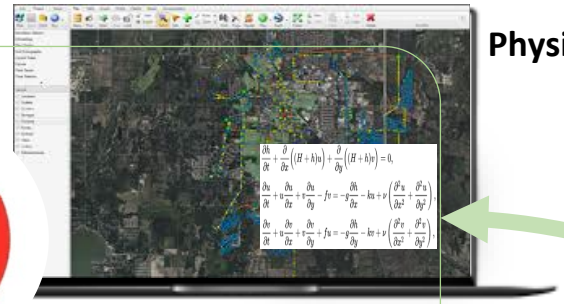
Smart Watershed Network Management

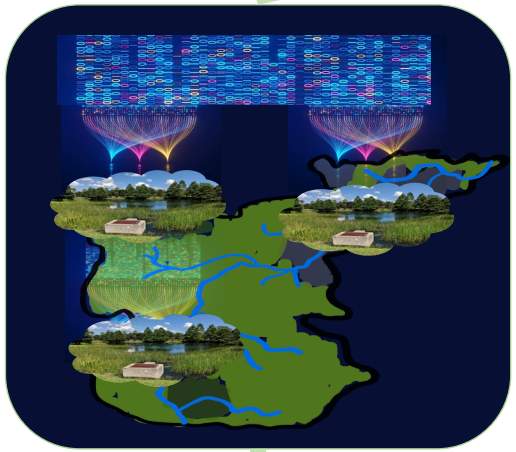


Physical Model of Watershed

New scenarios

CMAC AI/ML Watershed Model Engine

Refinement of AI/ML models



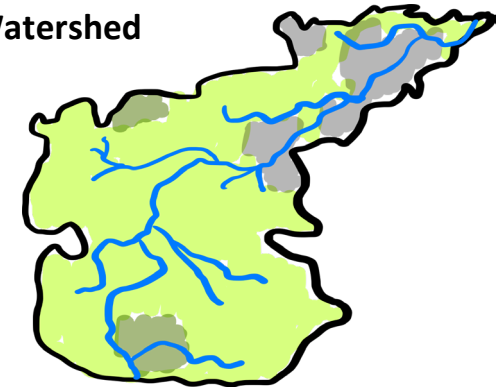
Sensors

Network info

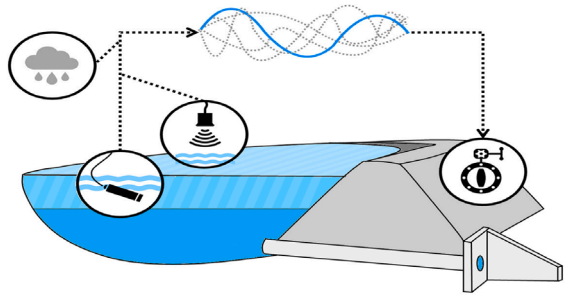
Land use

Weather Observations

Real Watershed



Systems Conditions Settings



Performance observations

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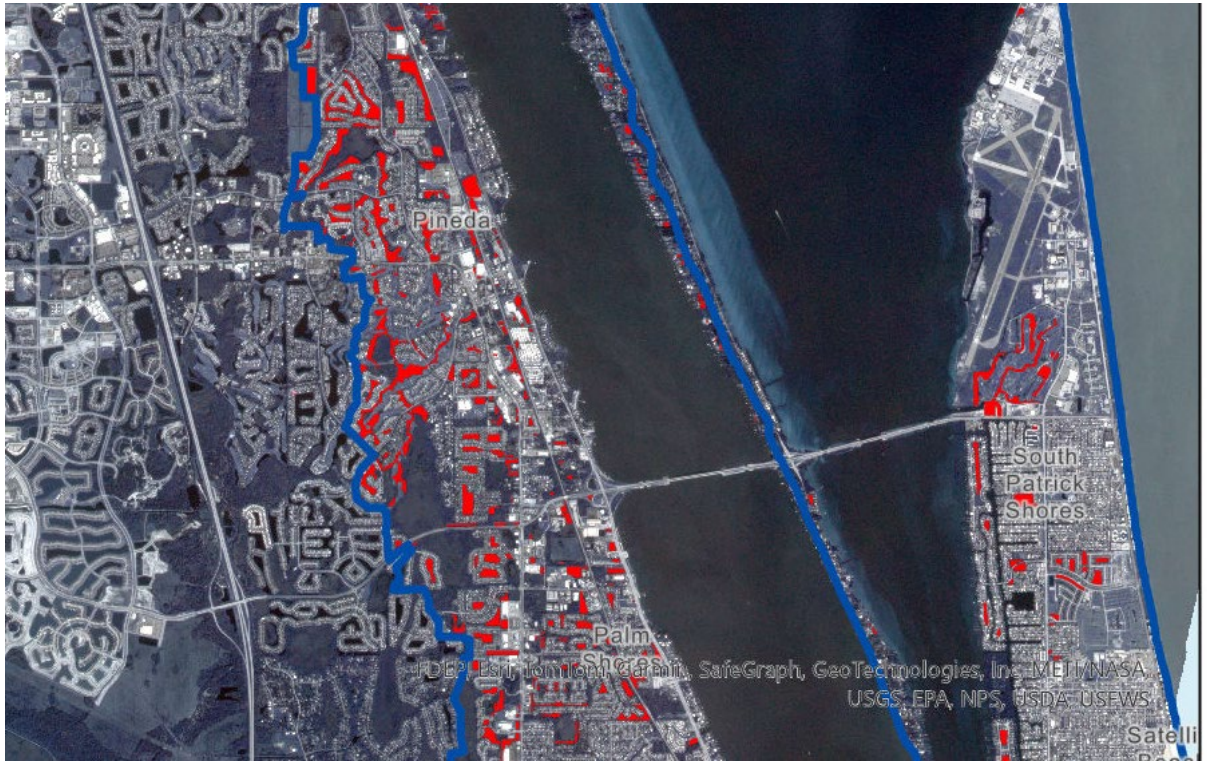
Why Florida, Why the IRL?

Development and poor performing infrastructure are threatening North America's most productive and biodiverse estuary, the Indian River Lagoon.



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Strategically located for maximum impact

Lots of stormwater ponds (>10,000)

Regulators, policymakers, and the public are willing to embrace technology solutions.

Implementation partners to build, monitor, and maintain projects