



**CLIMATE-RESILIENT DAMS AND  
HYDROPOWER INFRASTRUCTURE  
INTEGRATING  
ENVIRONMENTAL SUSTAINABILITY  
IN PLANNING AND DEVELOPMENT**

**aquaWISE™: Integrating Climate Change, Multi-Sector Water Allocation, and Infrastructure Ageing for Future-Ready Dam Management in India**

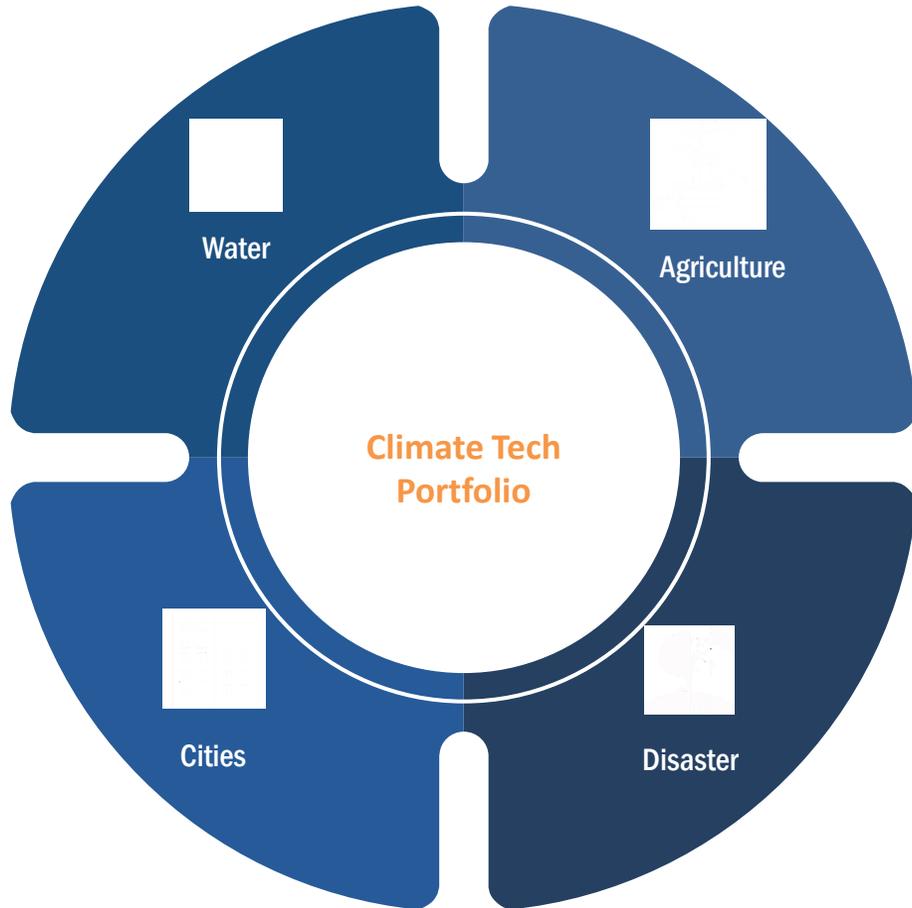
Nikhilesh Kumar (Co-Founder & CEO), Vassar Labs, India



# About Vassar Labs



We are a global Climate Tech company leveraging technologies such as AI, GenAI, Remote Sensing, Cloud Computing, Big Data, and Digital Twins etc. to build solutions for effective monitoring and management.



**Overview:**  
*Building scalable Digital Public Infrastructures which are interoperable, cloud agnostic and low code integrations.*

- 6+ Country Scale Projects
- 17+ State Level Projects
- 40+ Implementations for Fortune 500s
- Founded in 2014
- 420+ employees from IITs, NITs, ISB, IIMs
- HQ: Woburn, MA, USA  
Dev Centre: Hyderabad, India

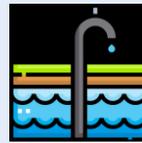
## Various Deployments for countries, states, F500 enterprise and industries



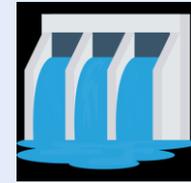
# India's Water Storage Infrastructure: Key Challenges



Changing climate that is drastically changing the inflow pattern



Rapidly growing and competing sectoral water demands



Aging dams whose capacity and safety margins are steadily eroding

# Viksit Bharat 2047 Vision: Path Towards Climate Resilience & Sustainability



**AI/ML** forecasts,  
and workflow  
tools for  
operations,  
maintenance and  
**policy.**



**Integrated tools** that  
ensures transition  
from crisis  
management to  
**predictive system**  
scale management

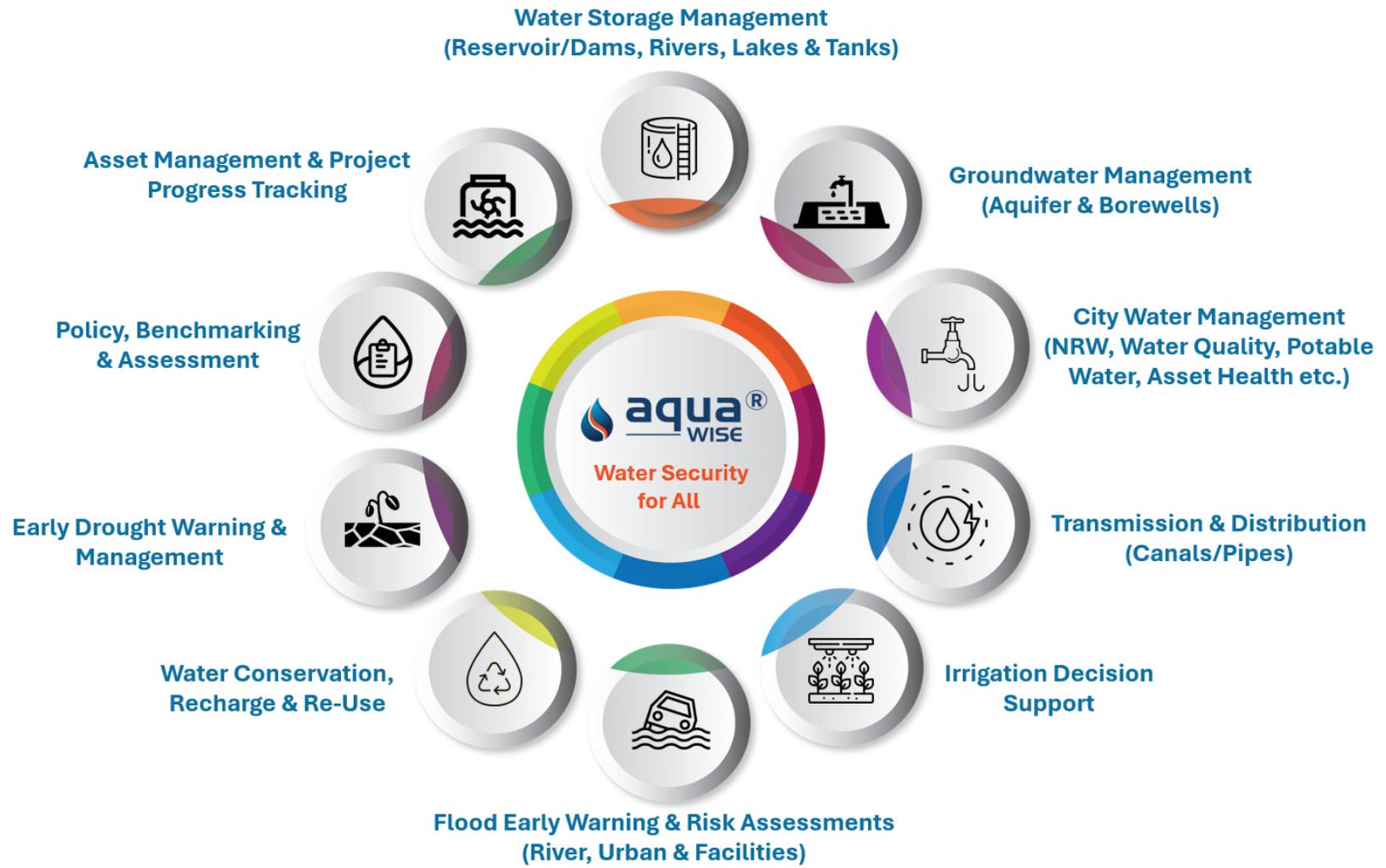


A **360-degree**, data  
driven approach is  
therefore integrate  
**inflow and climate**  
projections and dam  
deformation signals.



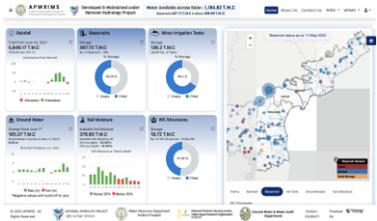
Realtime operations,  
and **socio-economic**  
exposure into one  
decision frame across  
multiple  
**dams/basins.**

# Combining Data & Science to Advance Water Security for All

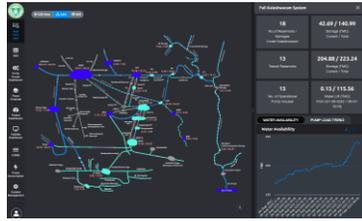


Building knowledge-driven digital platform by leveraging AI and Geospatial Tech products that secure water resources, addressing the full lifecycle of water. Our solutions extend water security to critical nexuses in food, energy, agriculture and climate resilience.

# Experience in Large Scale Water Management



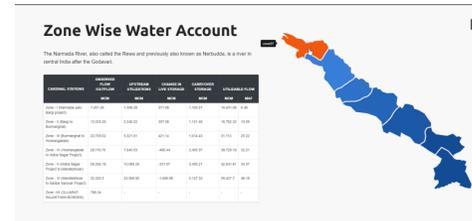
**Andhra Pradesh**  
Water Resources  
Management System



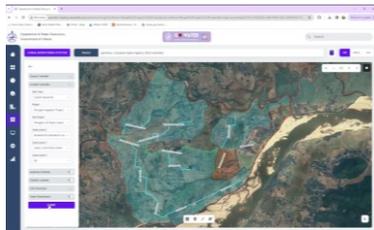
**World's Largest Lift**  
Scheme Optimization for  
Govt. of Telangana



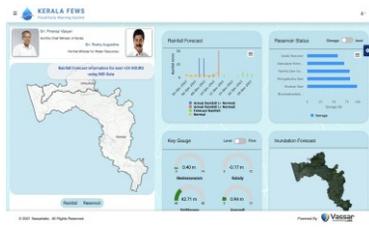
**Reservoir Operations**  
& Hydropower  
Optimization



**Narmada River Basin**  
Optimization Model for  
Water Accounting



**Canal Irrigation &**  
Monitoring Management  
for Odisha



**Kerala Flood**  
Forecasting Early  
Warning System



**KUIDFC**  
End-to-end Urban Water  
Management



**Saudi Arabia**  
Water Resources Information  
Management System

- Digital Twin deployed covering **1832 Km** water conductor system for real time monitoring
- Managed water system with **8 GW, 180 pumps, 57 storage**; mitigate floods and save power
- **10-day water allocation** for **14 reservoirs, 4 power plants, 18 irrigation zones**
- Covering More than **35 Major Irrigation Projects** covering **120 million hectares farmlands** across **3 states**
- Flood monitoring done for **406 reservoirs** and **35 river basins**

# Scaling Integrated Reservoir, River, Hydro Power and Pump Optimization

## Managing

Reservoirs: **205**

States: **10**

River Basins : **25**

## Helping



Irrigation Officers :  
**3K**



Hydropower  
Operators : **50 K+**



River Basin  
Authority: **200**

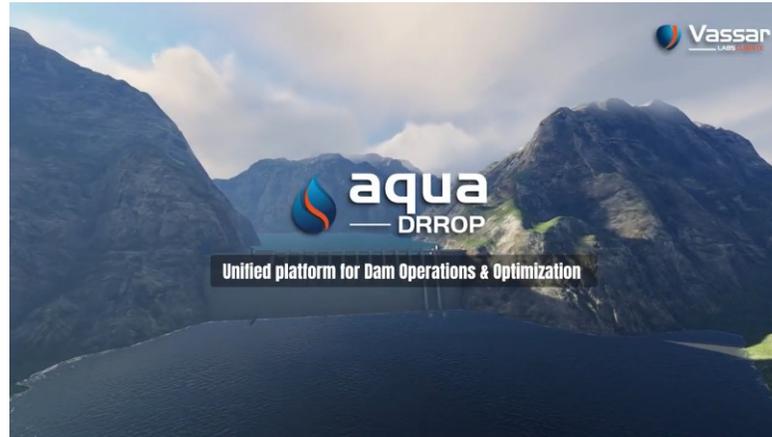


Policymakers: **500**

## Monitoring



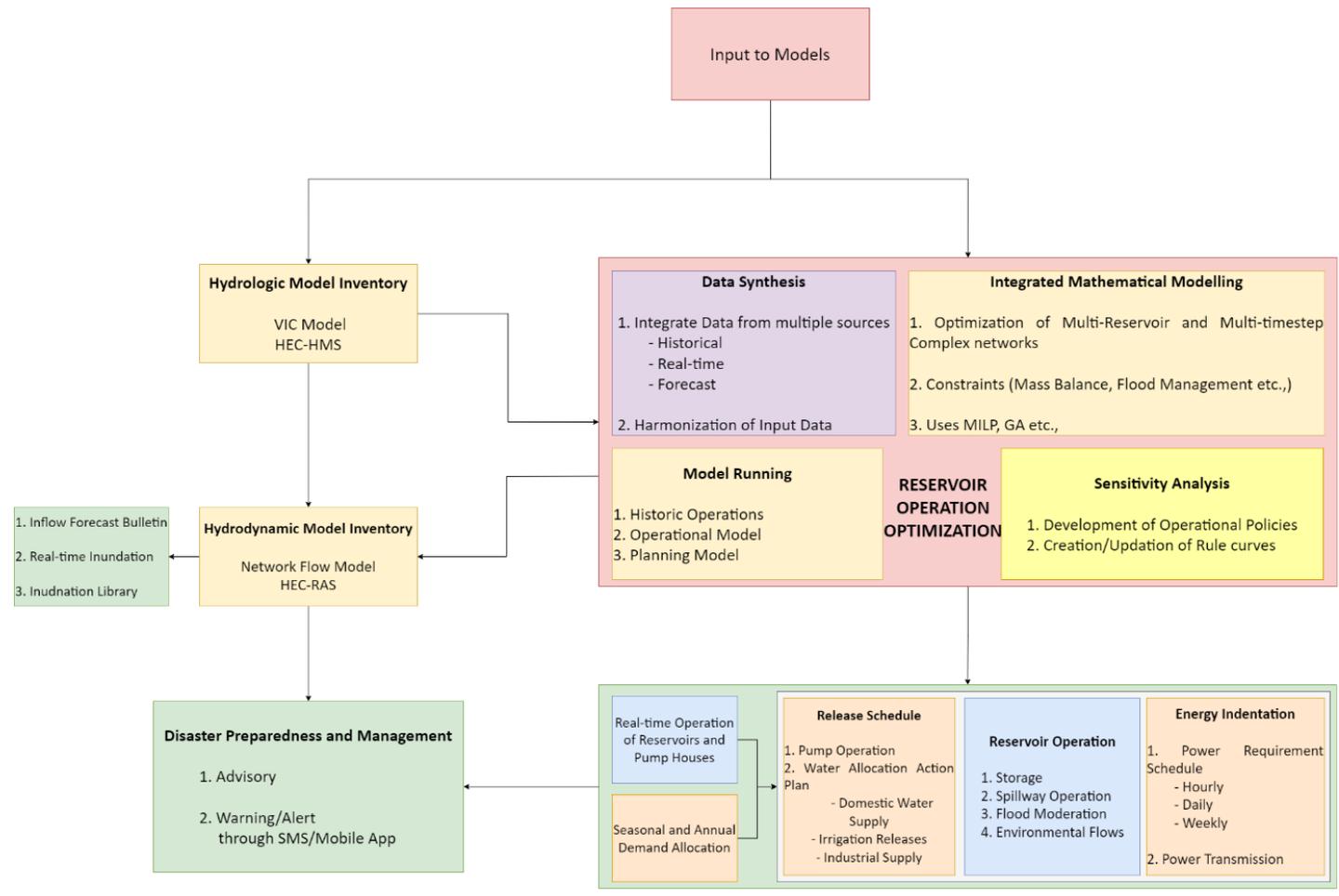
**Type of Assets:** Weather, Dams, Barrages,  
Rivers, Canal, Hydropower Stations, Pump  
Houses, Crops etc.,



[Play the Video](#)

A 360-degree approach towards making use of technologies like **AI/ML, Geospatial Tech** and other advanced assessments to solve today's **Dam problem**. Real world applications have been helping policymakers, water authorities and operators to **maximize water utilization and energy efficiency**.

# Flowchart detailing Reservoir Operations Optimization



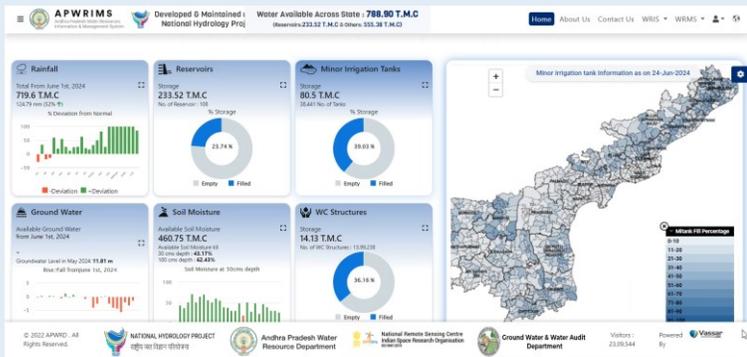
The current framework is deployed at state scale in systems such as:

- AP Water Resources Information Management System
- Narmada Reservoir Optimization Model
- TN Water Resources Information Management System
- Smart Water Governance System for Odisha

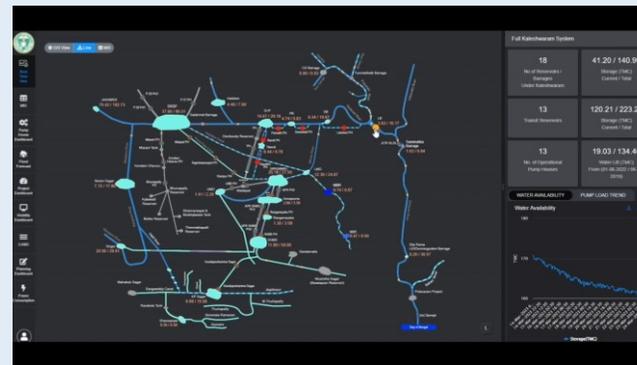
*These platforms are implemented as cloud/SaaS or on-premise decision support layers that sit above existing departmental infrastructure, offering real time dashboards, AI/ML forecasts, and workflow tools for operations, maintenance, and policy.*

# Integrated Water Resources Management

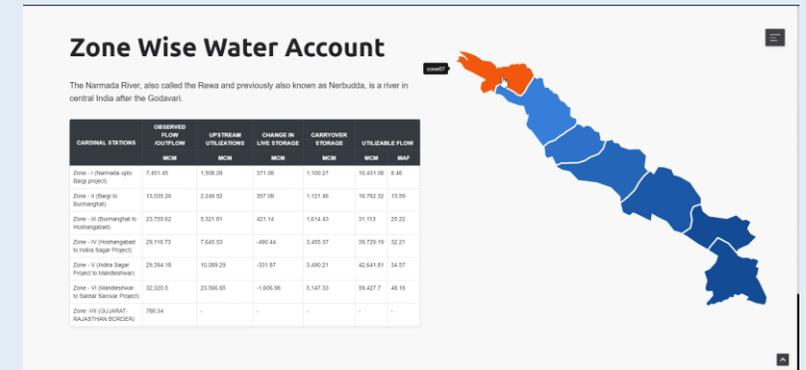
- Establish a unified, real-time visibility framework across water resources and reservoir systems to support integrated water management, water allocation and accounting



Unified Water Resources Management



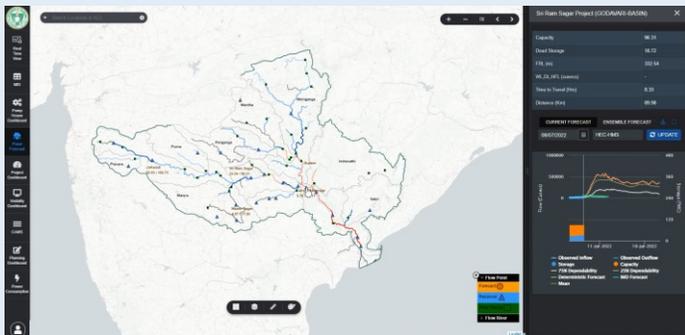
Digital Twin of Water Transmission Network



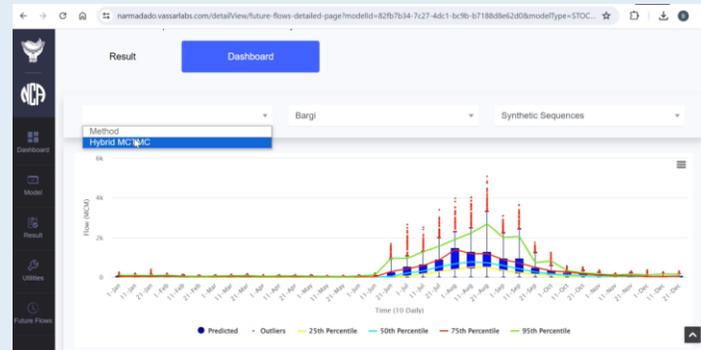
Water Allocation & Accounting

# Long Range Forecasts & Water Demand Estimation

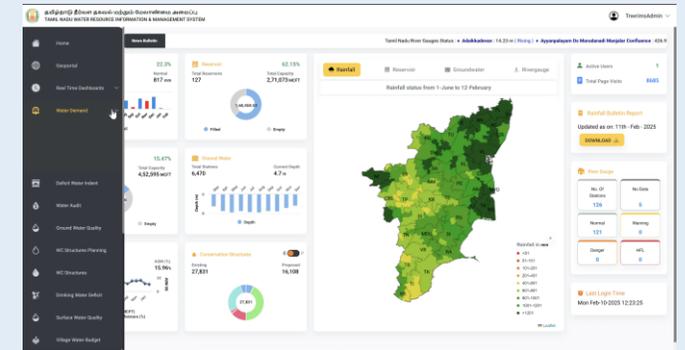
- Balances **inflow vs. demand** to prevent overflows, shortages, and ensure sustainability
- Models **seasonal and climate-based variations** to **plan dam operations** effectively
- Water demand forecasting ensures sectoral water accounting and demand estimations



Inflow Forecast



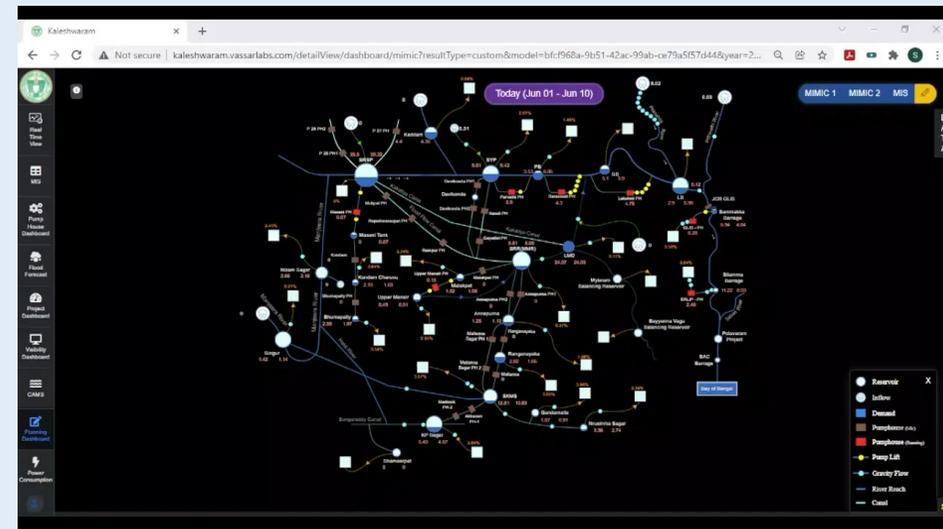
Future Flow Projection



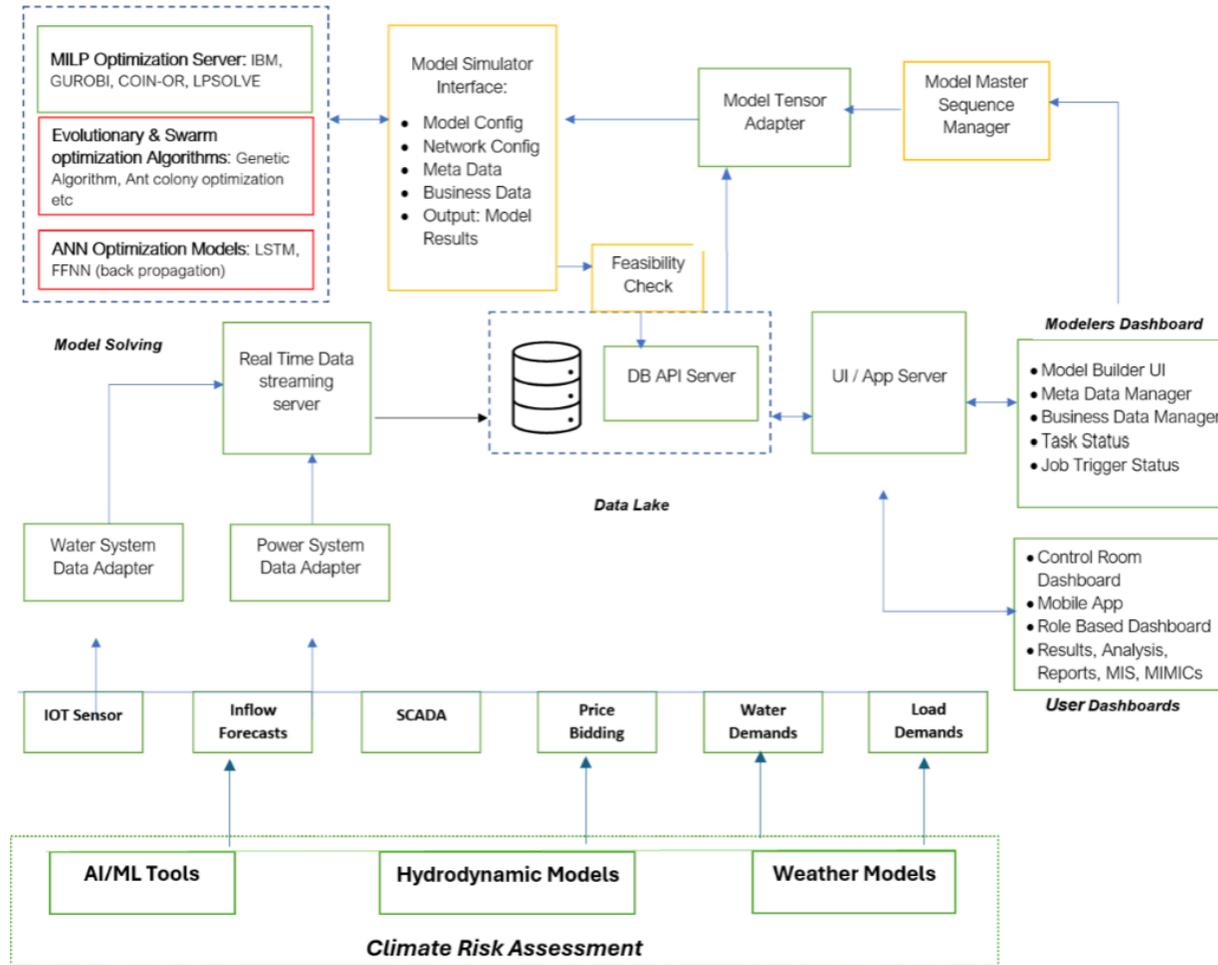
Water Demand Forecasting

# Digital Twins for Planning & Analytics

- **Simulate and optimize transmission network performance** using digital twin models that reflect real-time flow, pressure, and asset behavior.
- **Enable scenario-based water allocation planning** by virtually modeling supply-demand dynamics across regions, sectors, and climatic conditions



# Architecture depicting Water & Power System Optimization



# Dam Network & Hydropower Optimization

Manage water system with 8 GW, 180 pumps, 57 storage; mitigate floods and save power

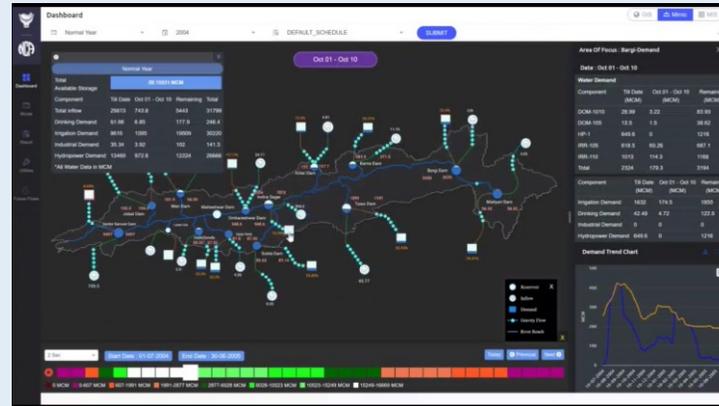
10-day water allocation for 14 reservoirs, 4 power plants, 18 irrigation zones

Dispatch planning at 1 hr step for 90 days horizon

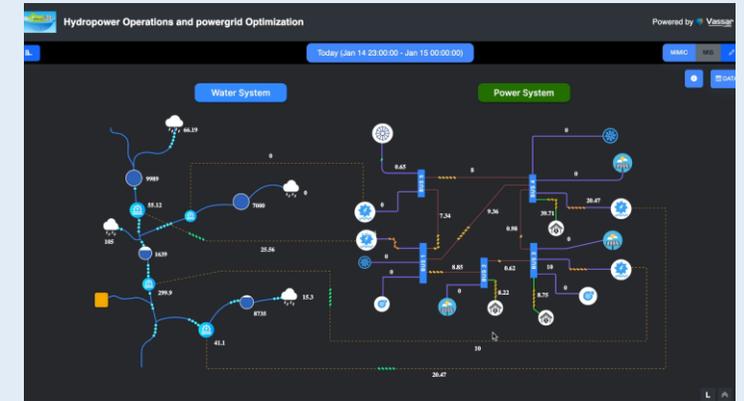
Hydropower generation optimization with environmental goals



Gate Operations



Dam Operations & Hydropower Optimization



Dispatch Planning, LMP prediction, and Generator Scheduling

# Asset Health & Pump Optimization

To optimize water transmission at scales of dams and cities. This gives enhanced **monitoring of large water networks, predictive analytics pump operations, asset health monitoring and maintenance**

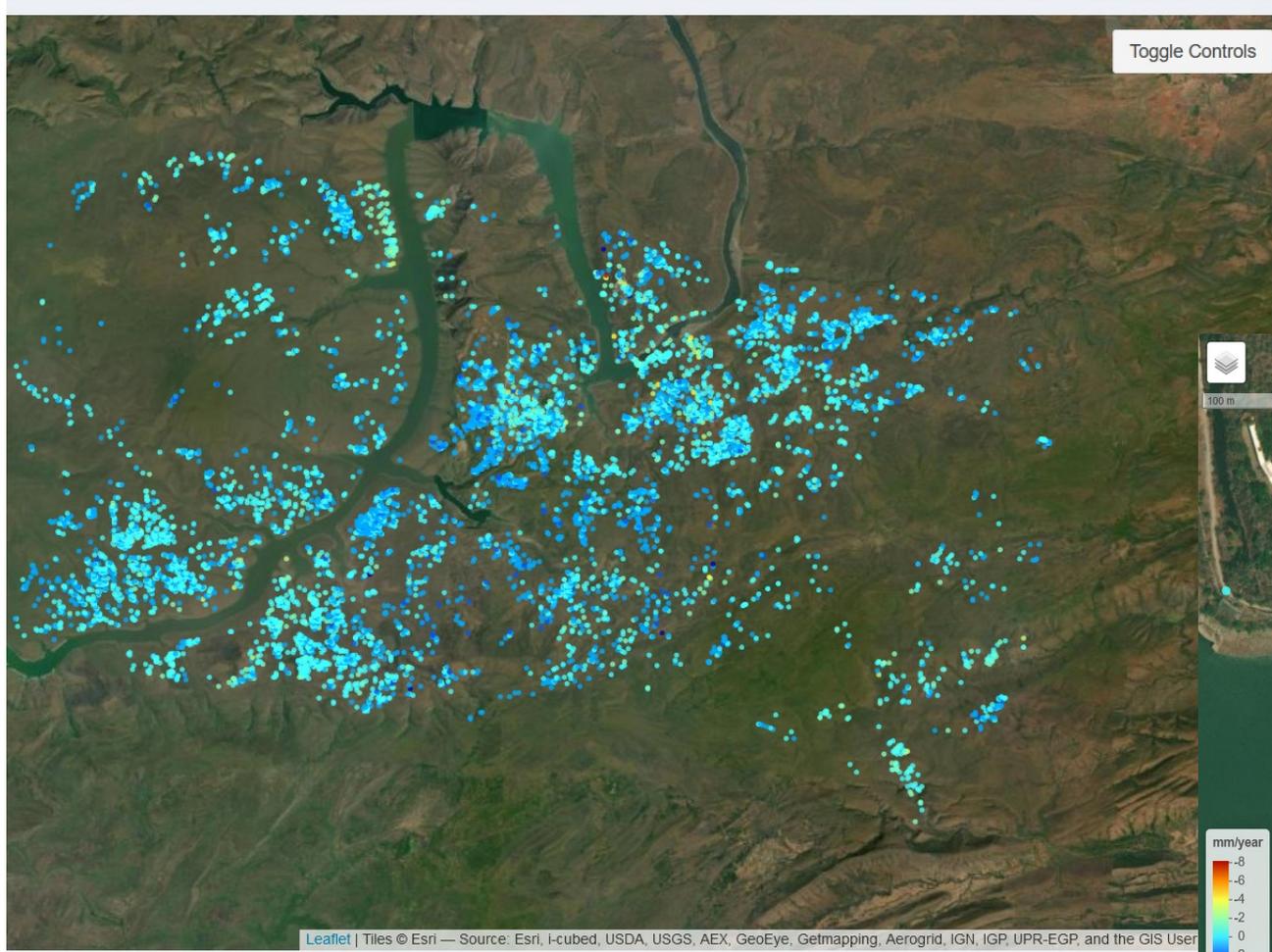


Pump Optimization & Asset Health



Pump Scheduling, energy consumption & trends

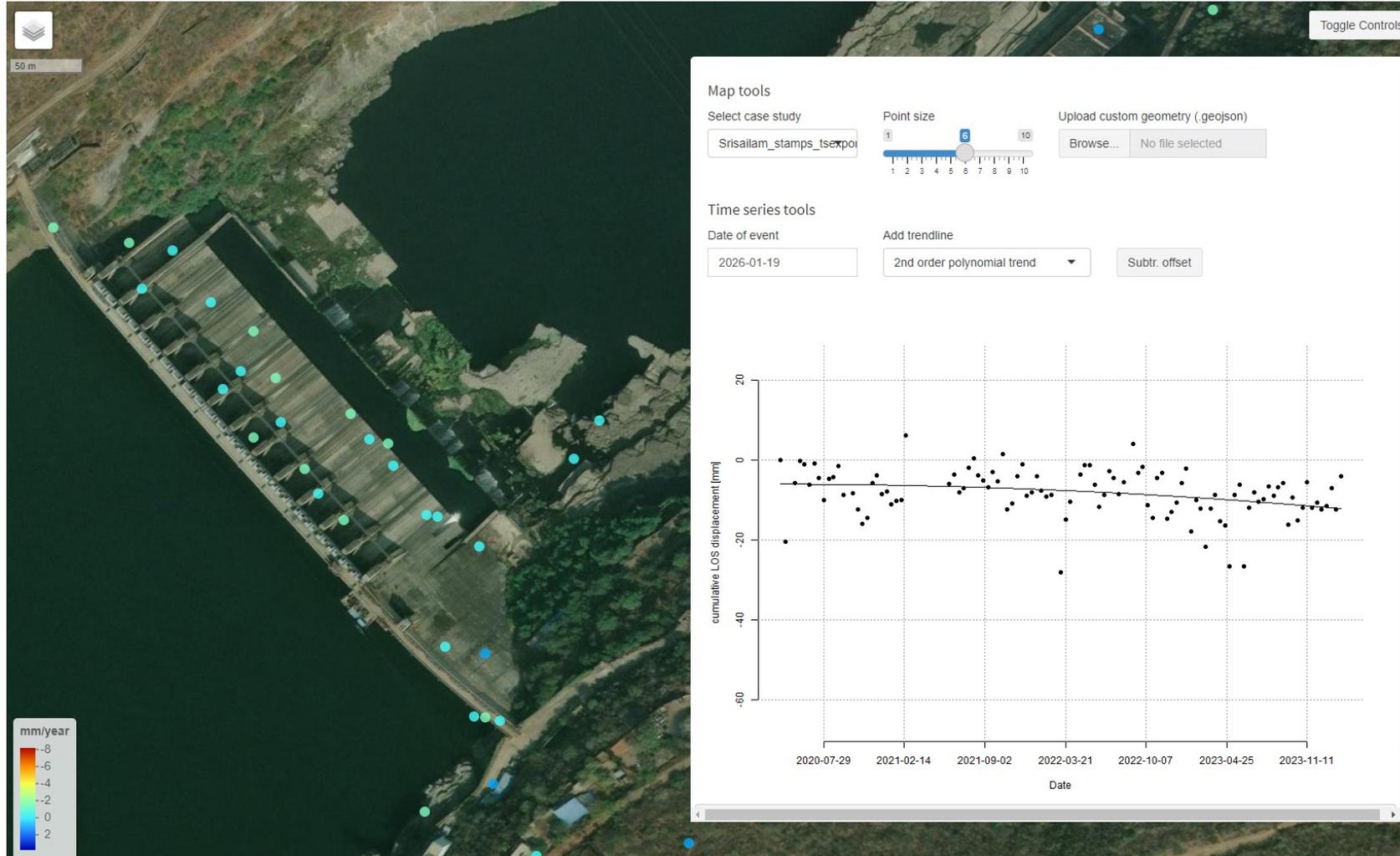
# Ageing Reservoirs, Subsidence and Safety critical Operation



**SRISAILAM** : Mean Ground Velocity Estimation using PS-InSAR Technique

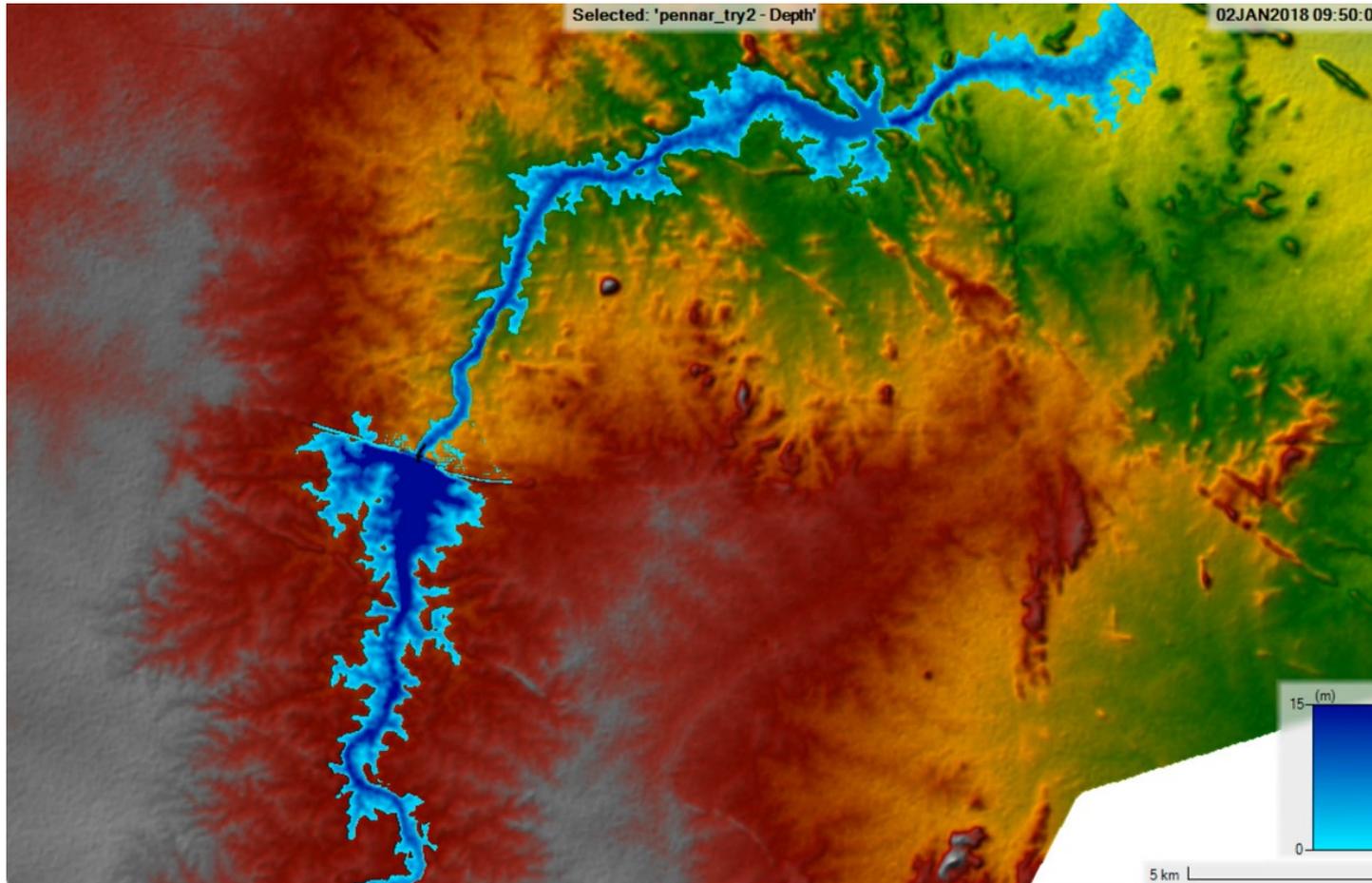


# Ageing Reservoirs, Subsidence and Safety critical Operation



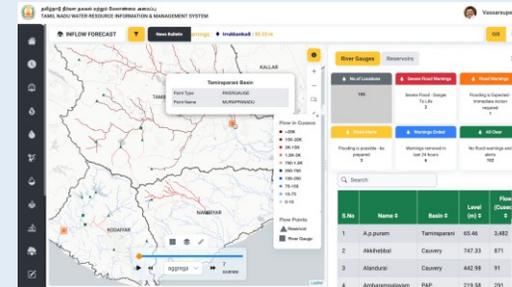
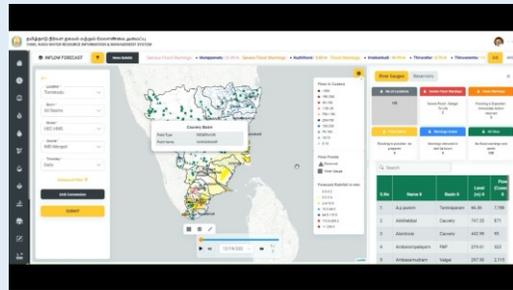
**SRISAILAM** : Mean Ground Velocity Estimation using PS-InSAR Technique

# Dam Break Analysis

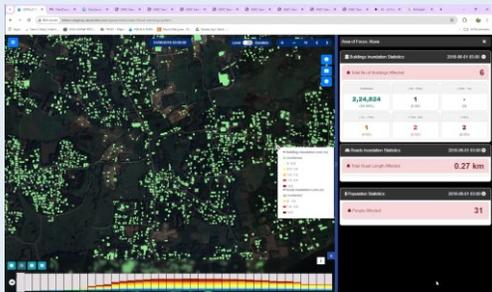


**Assessment of potential dam failure scenarios** to estimate flood wave propagation, **inundation extent**, depths, velocities, and arrival times downstream. It integrates hydraulics, terrain, and breach modeling to support emergency **planning, risk mitigation,** and infrastructure resilience.

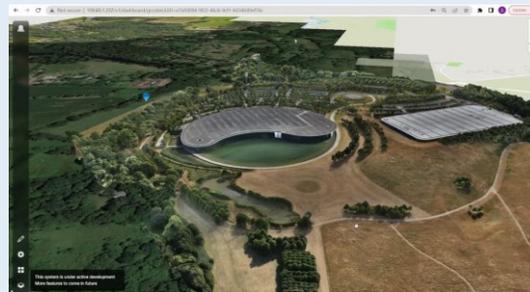
# Climate Change Projections & Flood Early Warnings



Riverine Floods



2D Simulation of impact assessments



3D Simulation: Flood Risk Analysis



Levee Analysis



Climate Risk Projections

# Thank You

Reach us at: [info@vassarlabs.com](mailto:info@vassarlabs.com)

