WATER SUSTAINABILITY SUMMIT 2025

Groundwater Modeling

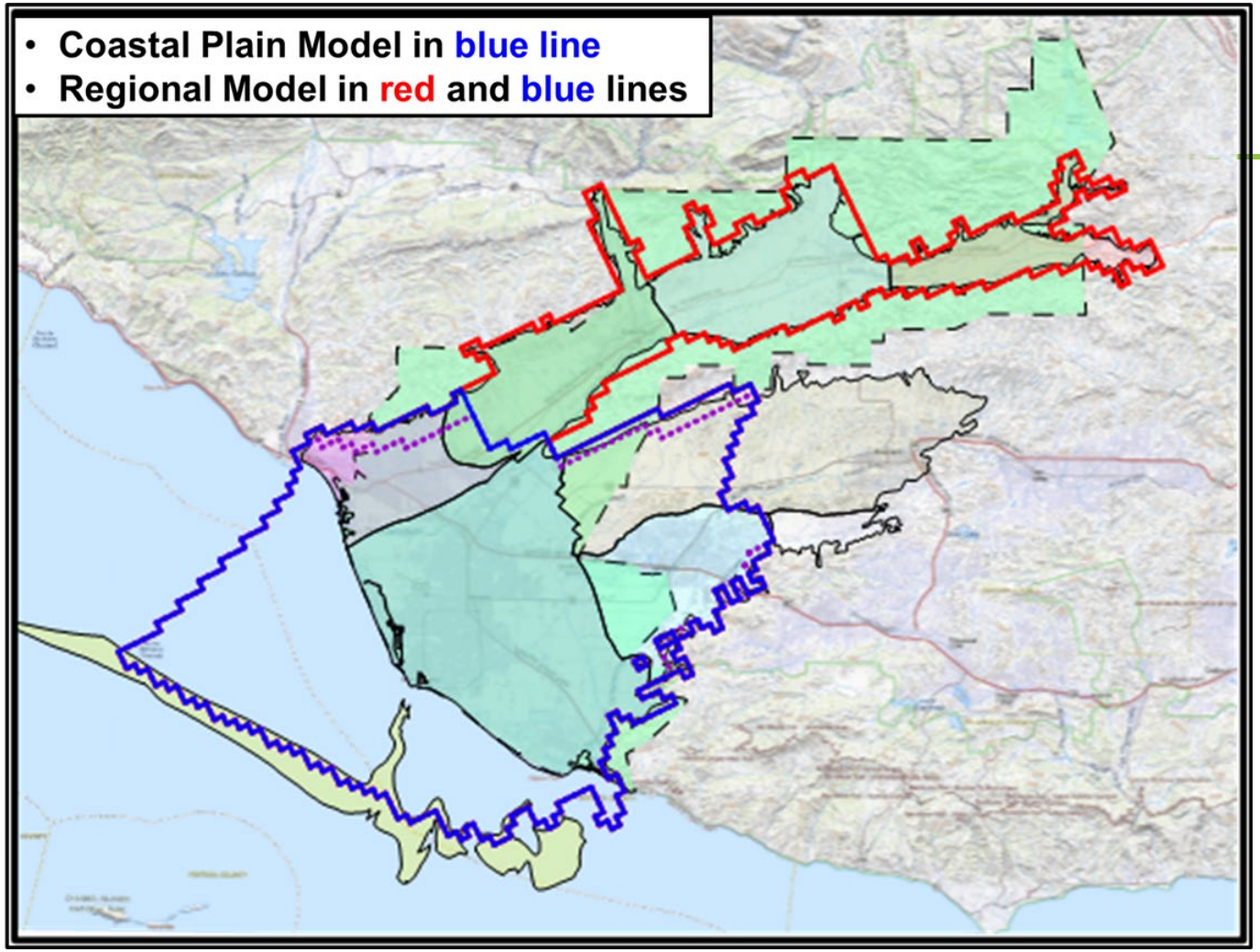
The Tool for Basin Management

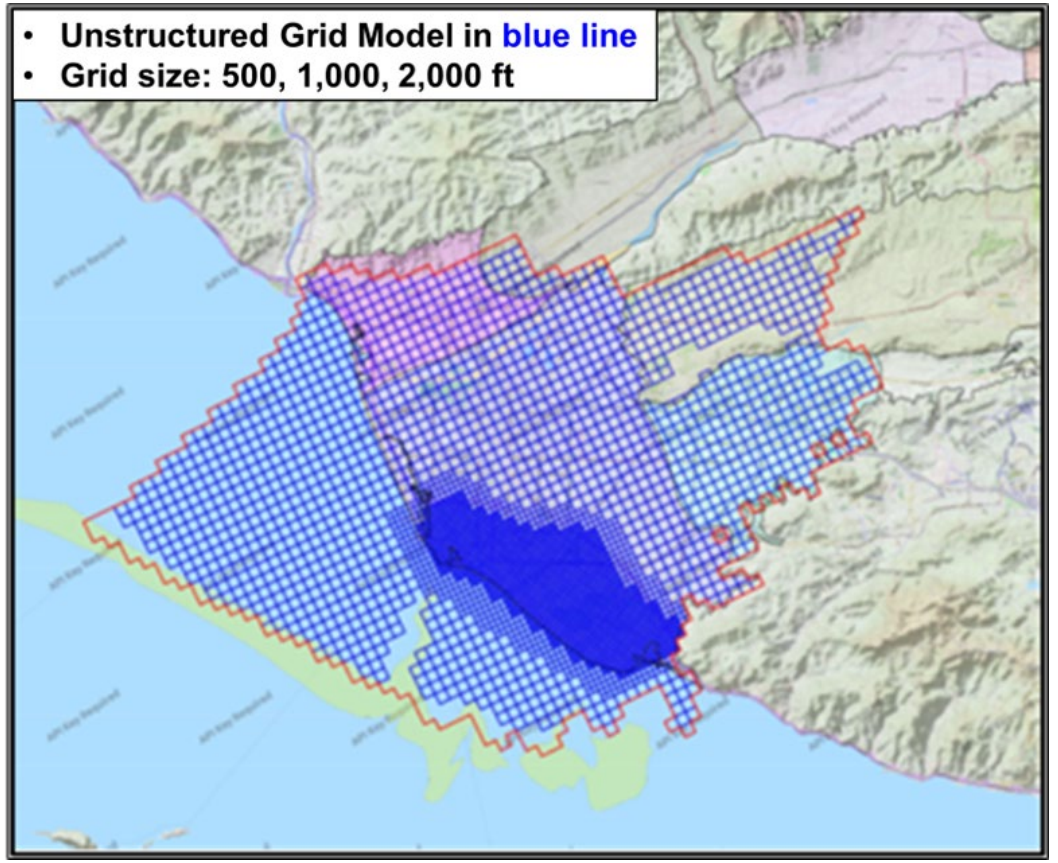
OCTOBER 16, 2025

Evolution of United's Groundwater Modeling Efforts

- **1998-2002:** The **U.S. Geological Survey (USGS)** published a regional groundwater model with two layers in 2002. *(United had obtained the model files prior to its release.)*
- **2002–2006:** Several consultants — **ETIC, CH2M Hill, and HydroMetrics** — were contracted to improve the USGS regional model.
- **2012–2013:** United initiated development of a new groundwater model from scratch.
- **2018:** United released the **Coastal Plain Model** with 13 layers.
- **2020:** United released the **Regional Model**.
- **2021–present:** United began developing a **Density-Dependent Solute Transport Model** using an **unstructured grid**.

UWCD Groundwater Models





- **Coastal Plain Model: 287 mile^2**
- **Regional Model: 384.7 mile^2**

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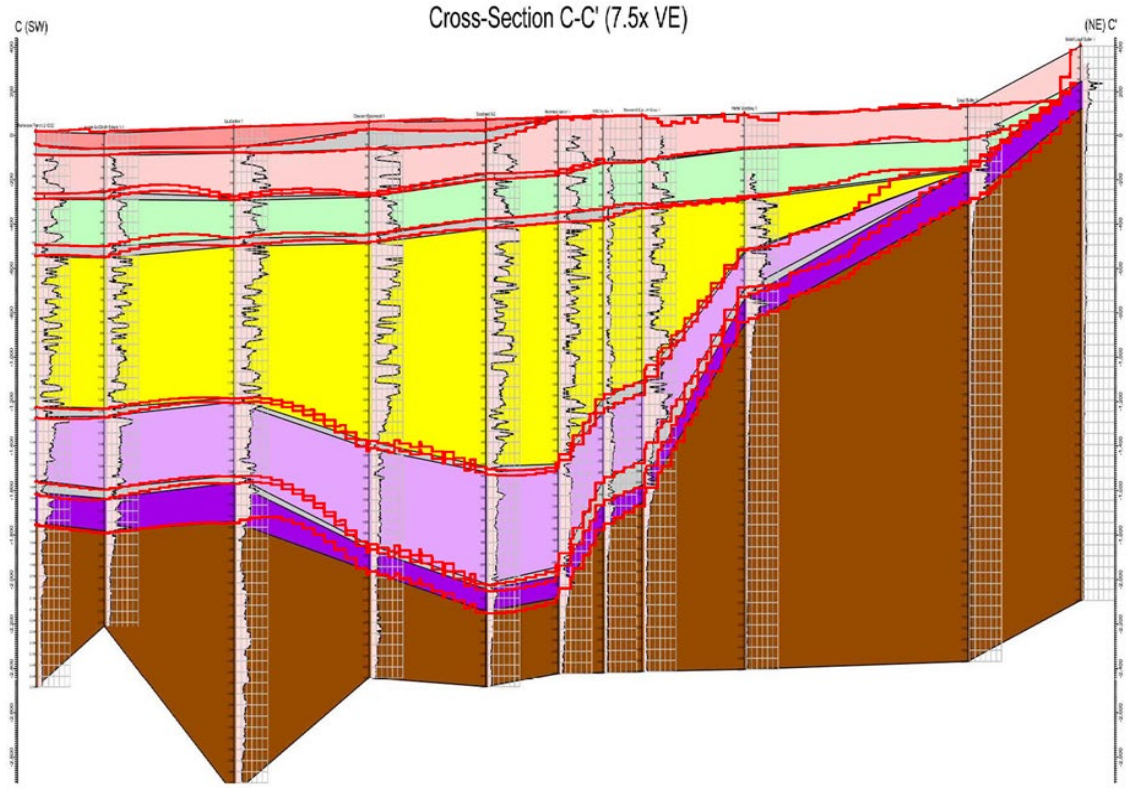
UWCD Groundwater Models

Coastal Basins (Oxnard Basin, PV, Mound, and West LP)

Aquifer System	Hydrostratigraphic Unit	Model Layer
Shallow	Ground Surface to the bottom of Semi-Perched Aquifer	1
UAS	Semi Perched-Oxnard Aquitard	2
	Oxnard Aquifer	3
	Oxnard-Mugu Aquitard	4
	Mugu Aquifer	5
LAS	Mugu-Hueneme Aquitard	6
	Hueneme Aquifer	7
	Hueneme-Fox Canyon Aquitard	8
	Fox Canyon Aquifer - upper	9
	Fox Canyon upper - basal Aquitard	10
	Fox Canyon Aquifer - basal	11
	Santa Barbara and/or other Formation - upper	12
	Grimes Canyon Aquifer	13
Deep	Older sedimentary rocks and Conejo Volcanics	Boundary



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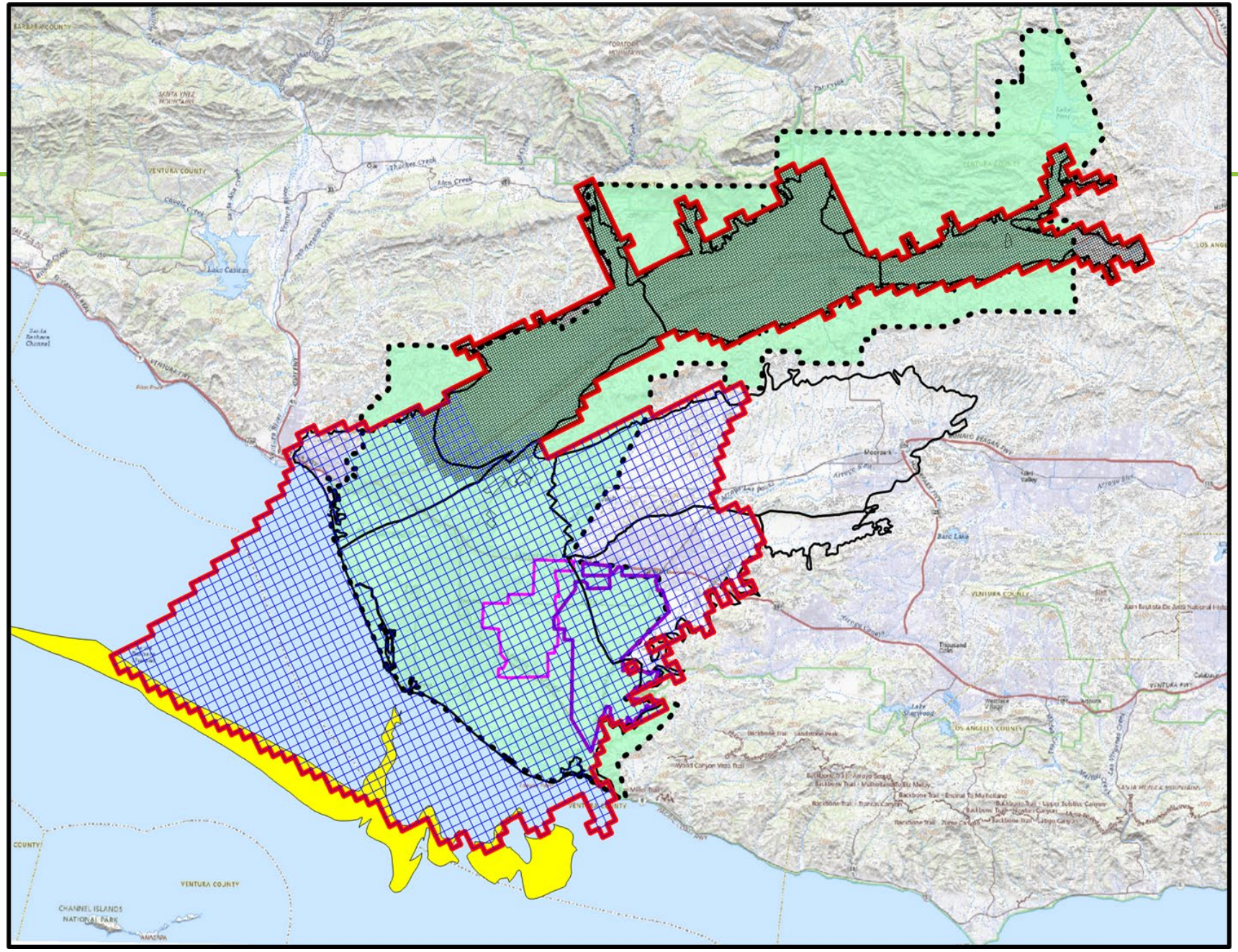
Past and Ongoing Modeling Support

- **Fox Canyon Groundwater Management Agency (FCGMA):** Groundwater Sustainability Plan development for the **Oxnard**, **Pleasant Valley basins**, and **West Las Posas** sub-basin.
- **Mound, Fillmore, and Piru GSAs:** Groundwater Sustainability Plan development.
- **City of Oxnard: Recycled Water Pumping Allocation (RWPA)** analysis.
- **City of Ventura: Indirect Potable Reuse (IPR)** analysis.
- **Calleguas Municipal Water District: Recharge analysis** in the **northern Pleasant Valley** area.

2025 UWCD Groundwater Models

Model	Coastal Plain Model (CPM)	Valley Basin Model (VBM)
Type	Flow	Flow
Software	MODFLOW-NWT	MODFLOW-NWT
GSA	GSPs for FCGMA and Mound	GSPs for Fillmore and Piru
Grid size	2,000 ft	500 ft
Time step	Monthly	Daily
Simulation period	1985 - September 2022	1985 - 2023



Valley Basin Model in 500 ft grid: CPU time >4 hours

Coastal Plain Model in 2000 ft grid : CPU time 5 minutes

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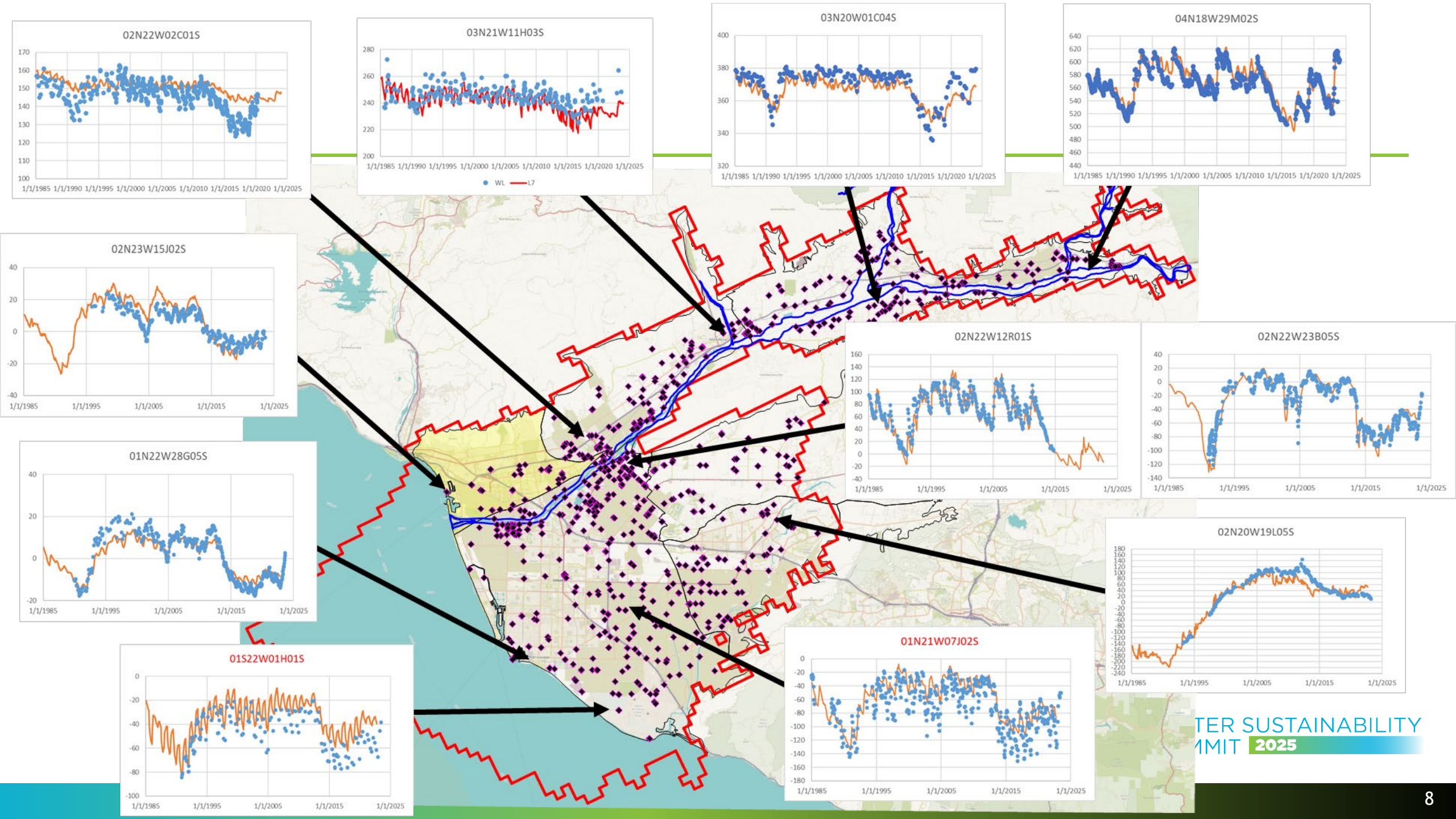
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03N21W11H03S
WL
L7
03N20W01C04S
04N18W29M02S
02N23W15J02S
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02N22W23B05S
01N22W28G05S
02N20W19L05S
01S22W01H01S
01N21W07J02S

What Makes United's Model Robust

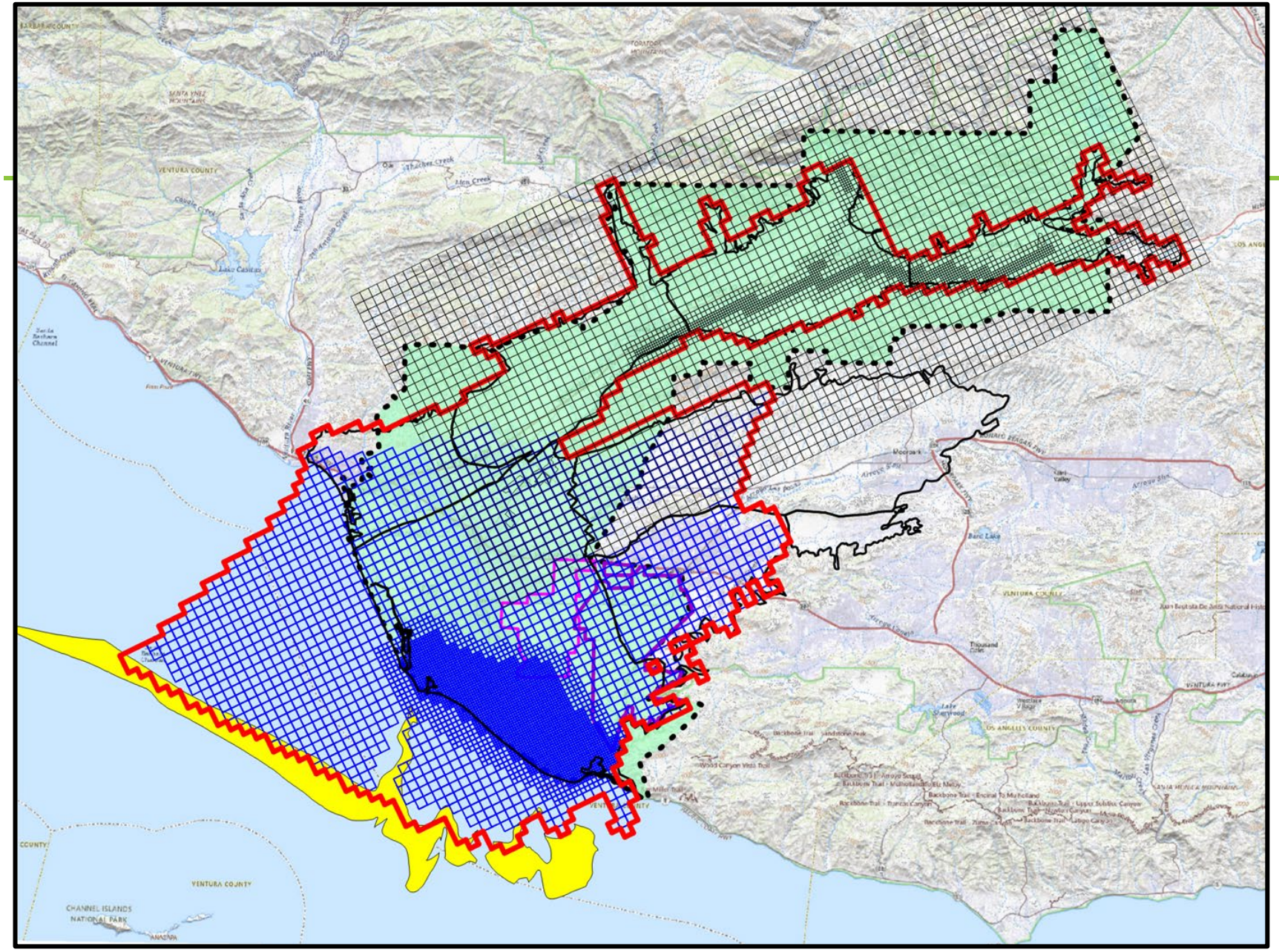
- **Decades of data** — water level measurements and pumping records from hundreds of wells.
- **Robust conceptual model** — built on decades of in-house staff expertise and published studies.
- **Credible modeling software** — MODFLOW (open-source, widely accepted).
- **Thorough model review** — ensuring reliability and defensibility.

Model Review

- **United's surface water hydrologists and hydrogeologists.**
- **An expert panel composed of nationally recognized modelers (Dr. Sorab Panday, Mr. John Porcello, and Mr. Jim Rumbaugh).**
- **Stanford professor, Dr. Daniel Tartakovsky, contracted by FCGMA.**
- **Experts during the OPV Adjudication lawsuit.**

Coastal Plain Model Upgrade			
Type	Flow	Flow	Density Dependent Solute Transport
Software	MODFLOW-NWT	MODFLOW-NWT	MODFLOW-USG-TRANSPORT
Grid size	2,000 ft	2,000 ft	2,000 ft to 500 ft
Time step	Monthly	Daily	Monthly
Goal		Better streamflow simulation, re-calibration	Brackish water simulation

Valley Basin Model Upgrade		
Type	Flow	Flow
Software	MODFLOW-NWT	MODFLOW-USG
Grid size	500 ft	2,000 ft to 500 ft
Time step	Daily	Daily
Goal		Computational efficiency



Un-Structured Grids:

- **Valley Basin Model** (10 model layers)
- **Density Dependent Solute Transport Model** (13 model layers)

- **384.7 mile^2**
- **Grid size: 2,000, 1,000, 500 ft**

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Future Groundwater Model Development

- **Coastal Plain Model**
  - **Re-calibration and daily streamflow simulation**
  - **Better documentation**
- **Valley Basin Model**
  - **Un-structured grid model**
  - **Santa Clara River streamflow routing model (HEC-RAS)**
- **Density Dependent Solute Transport Model**
  - **Brackish water simulation**

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Questions?