Groundwater Modeling

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Santa Margarita Groundwater Agency

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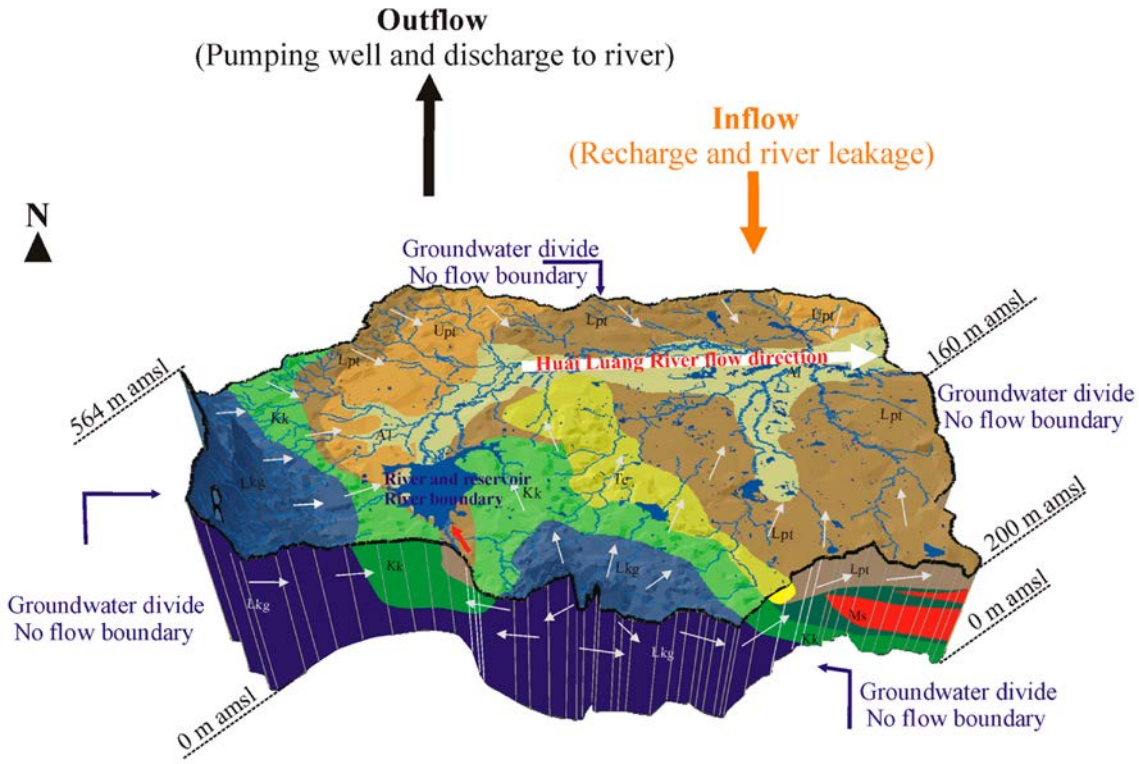
Objectives

1. Provide an introduction to groundwater modeling
2. Describe how the groundwater model will be used for GSP development
3. Update on model improvements to date

Introduction to Groundwater Models

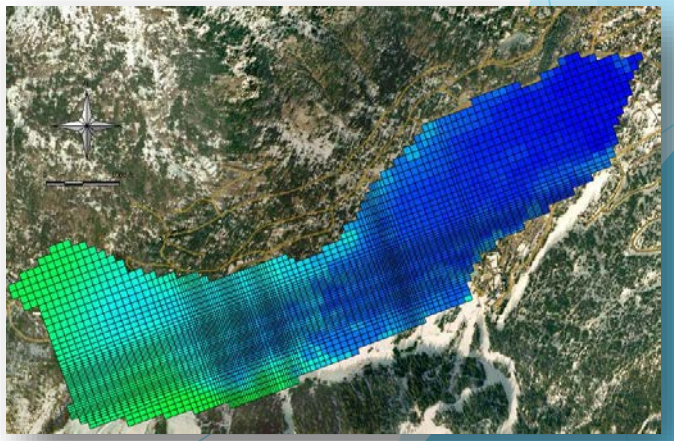
What is a Model?

- Conceptual representation of a physical reality
- Can be used to simulate future conditions



Types of Groundwater Models

- Analytical model
  - Mathematical model with a closed form solution
  - Simplistic, single layer, simplified aquifer characteristics
- Numeric model
  - Captures more of the aquifers' complexity
  - Solves groundwater flow equations
  - Divides model area up into model cells



Why a Numeric Groundwater Model

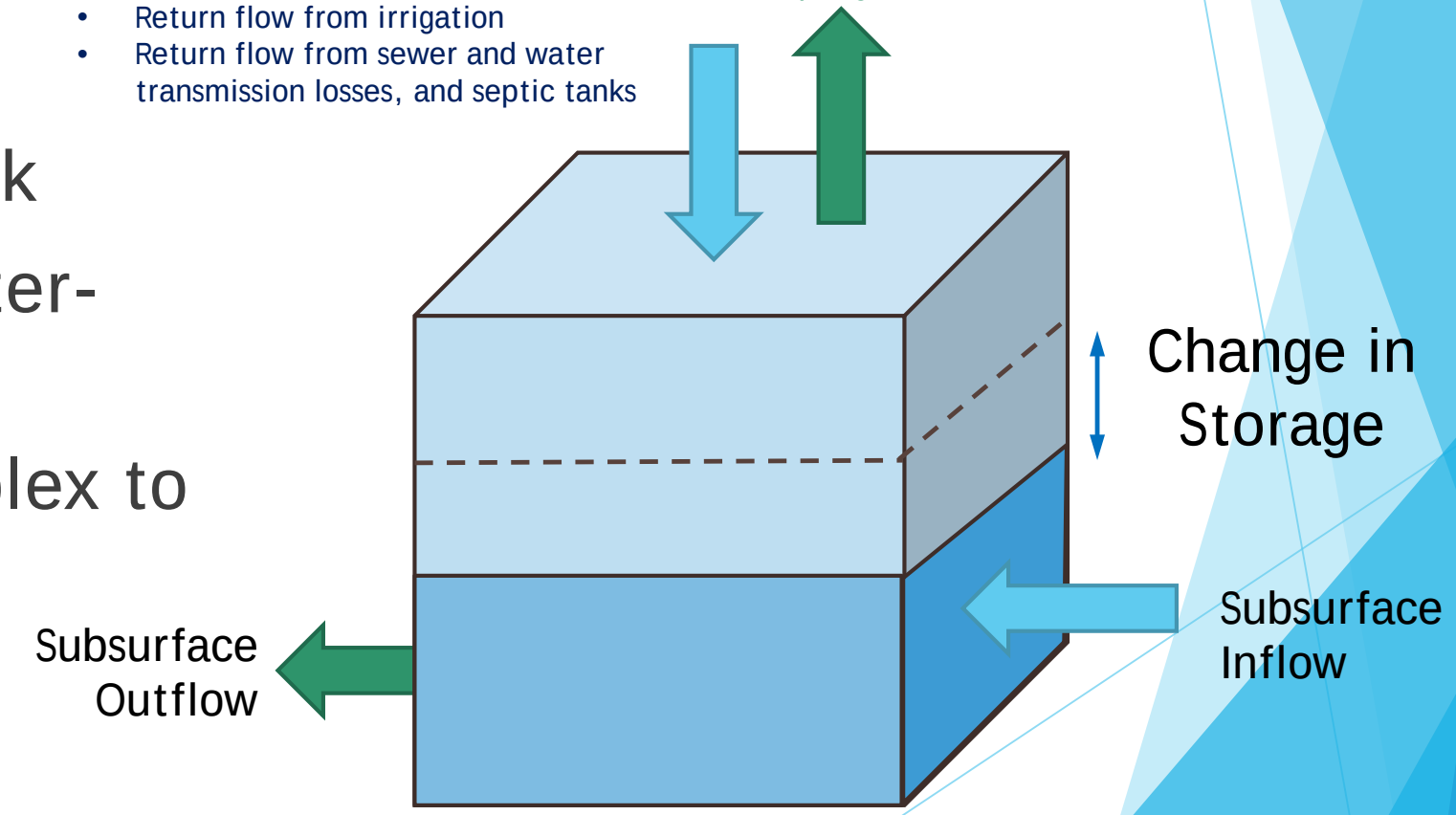
- Many flows to track
- Some flows are inter-dependent
- Difficult and complex to estimate all items accurately

Inflow (Intermittent)

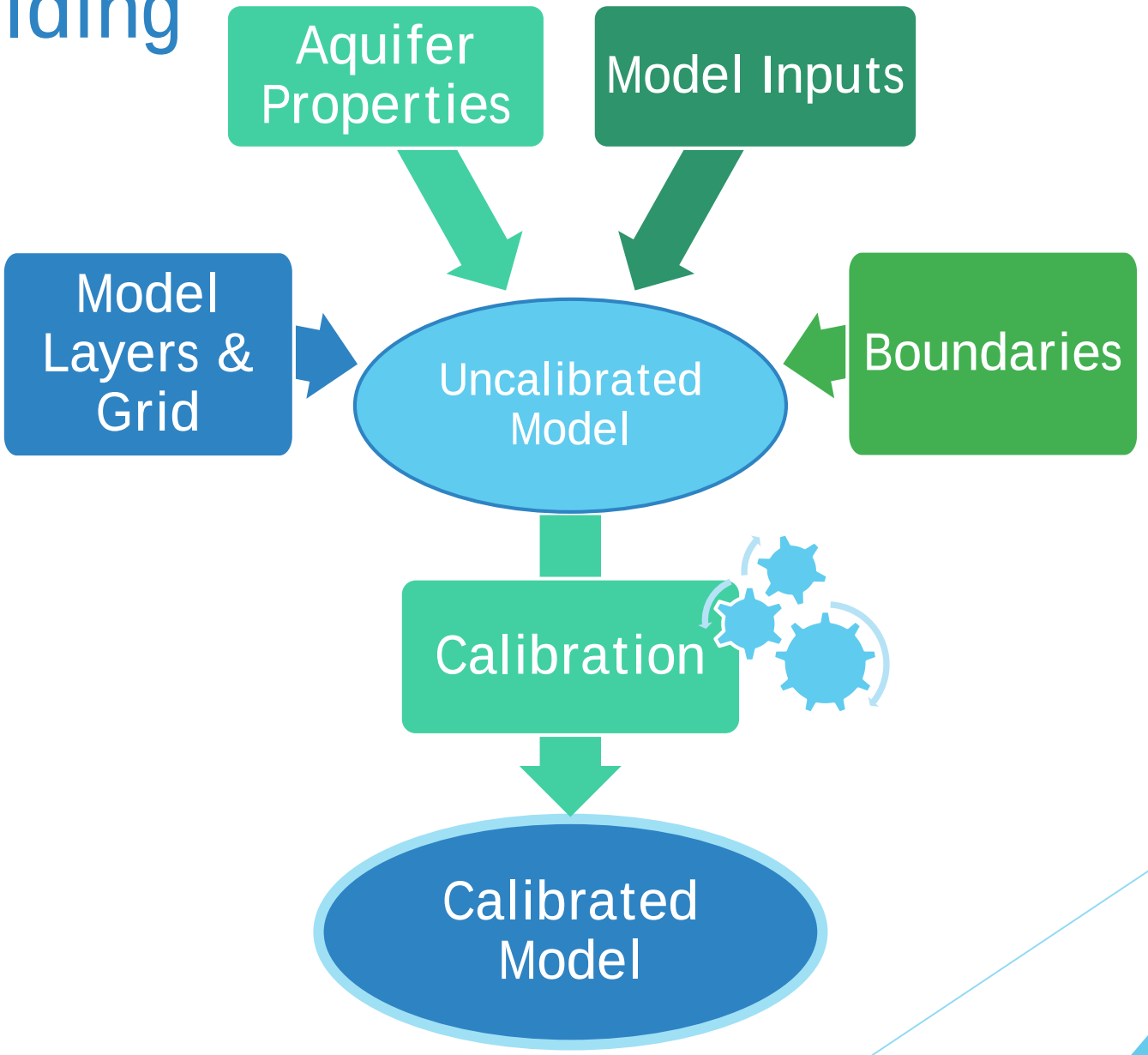
- Direct percolation of precipitation
- Streambed percolation
- Managed aquifer recharge
- Return flow from irrigation
- Return flow from sewer and water transmission losses, and septic tanks

Outflow (Continuous)

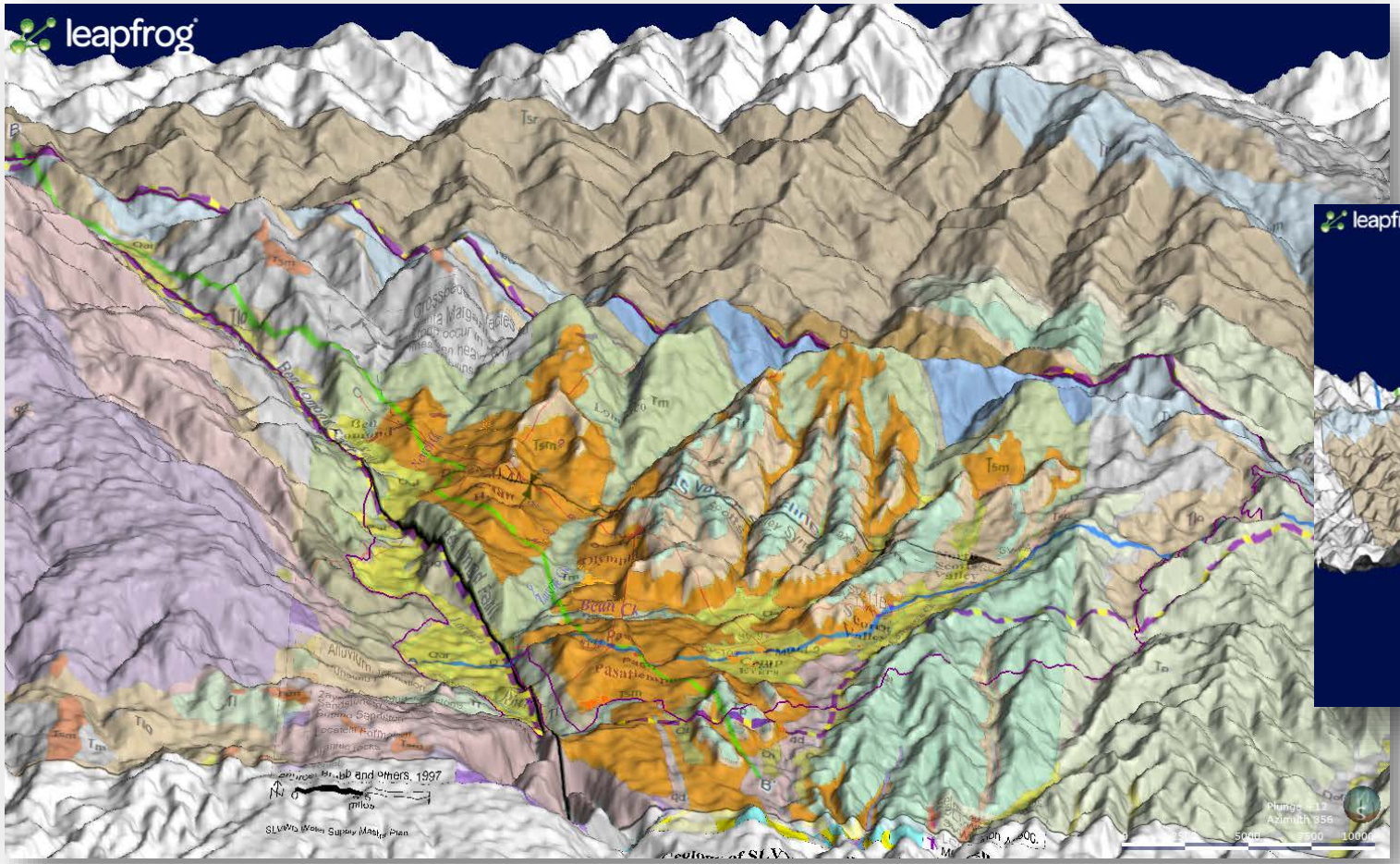
- Evapotranspiration
- Well pumping
- Streams and Creeks
- Springs

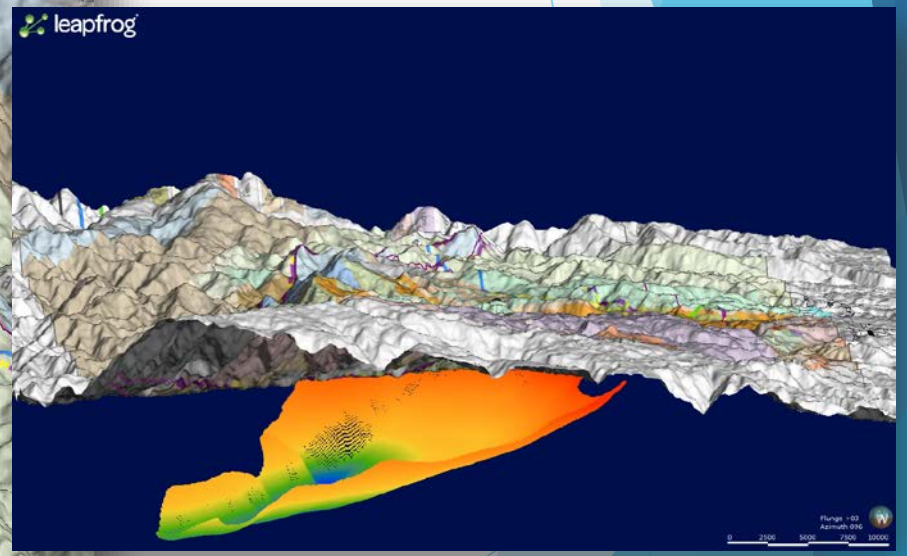


Model Building



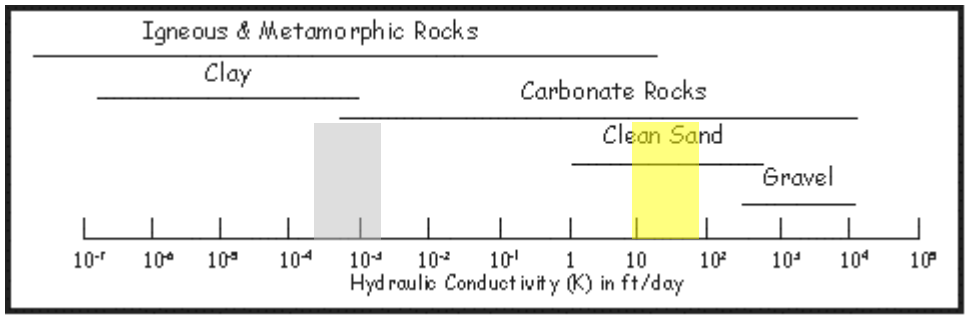
Basin Geometry to Create Model Layers

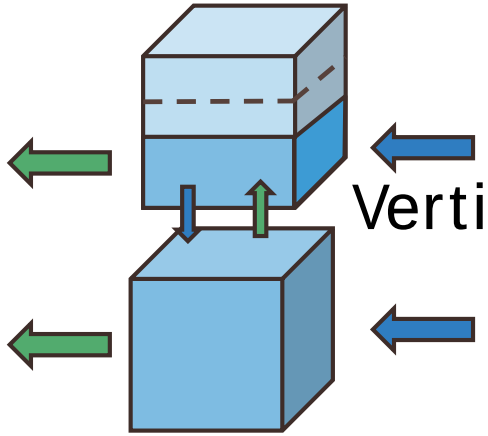




Aquifer Properties

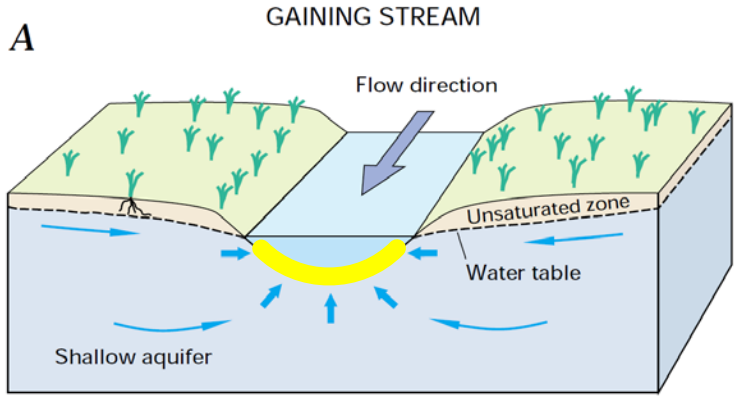
Horizontal Hydraulic Conductivity





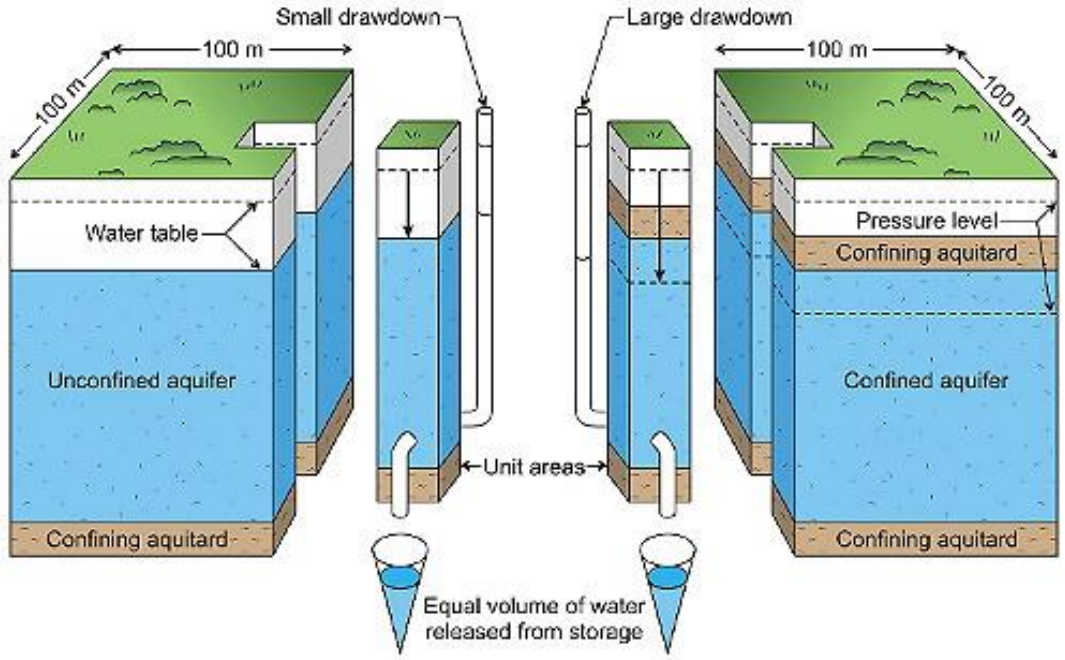
Vertical Hydraulic Conductivity

Streambed Conductance



Aquifer Properties

Storage Properties



Specific Yield

Unconfined

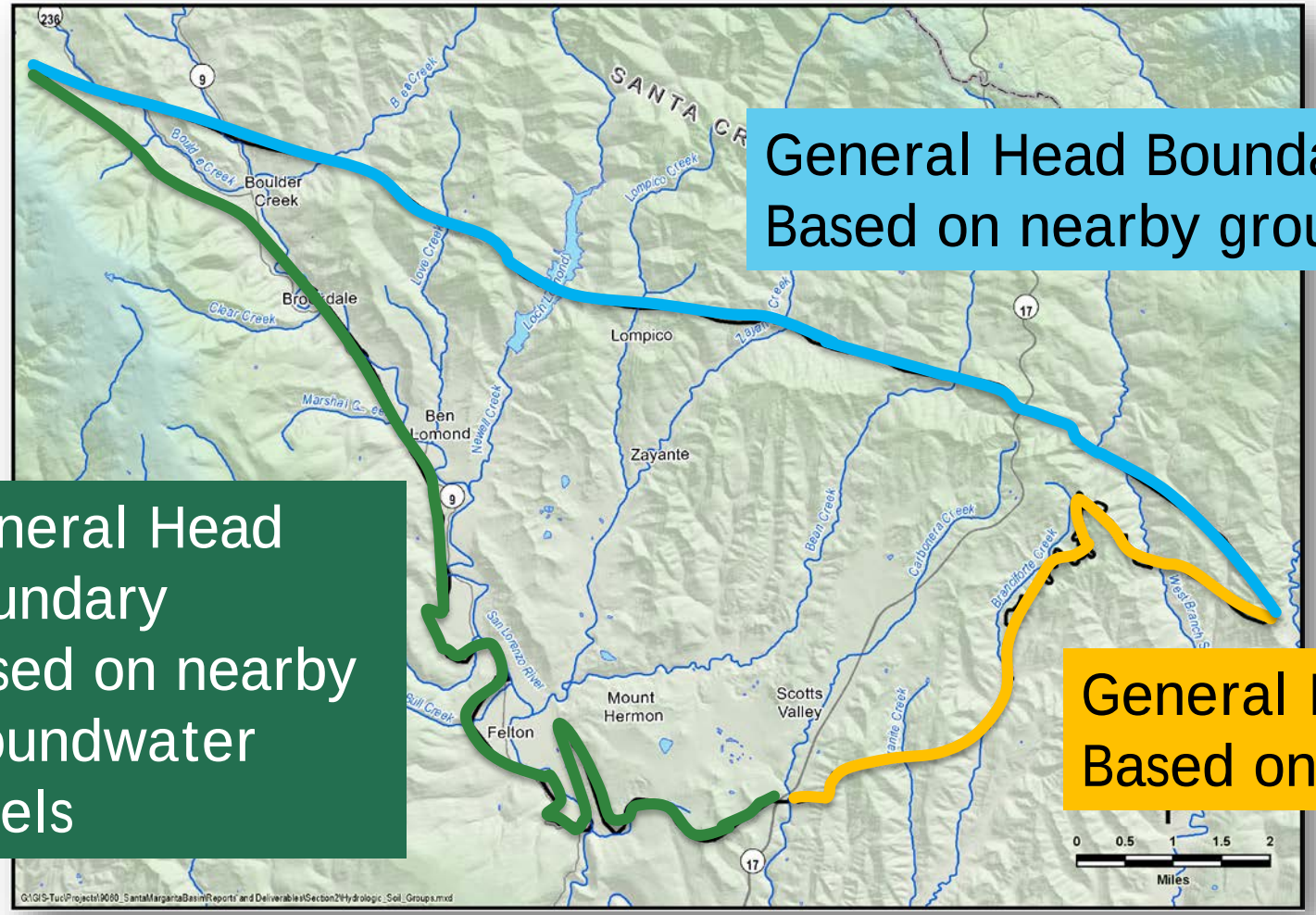
Small drawdown

Specific storage/ storativity

Confined

Large drawdown

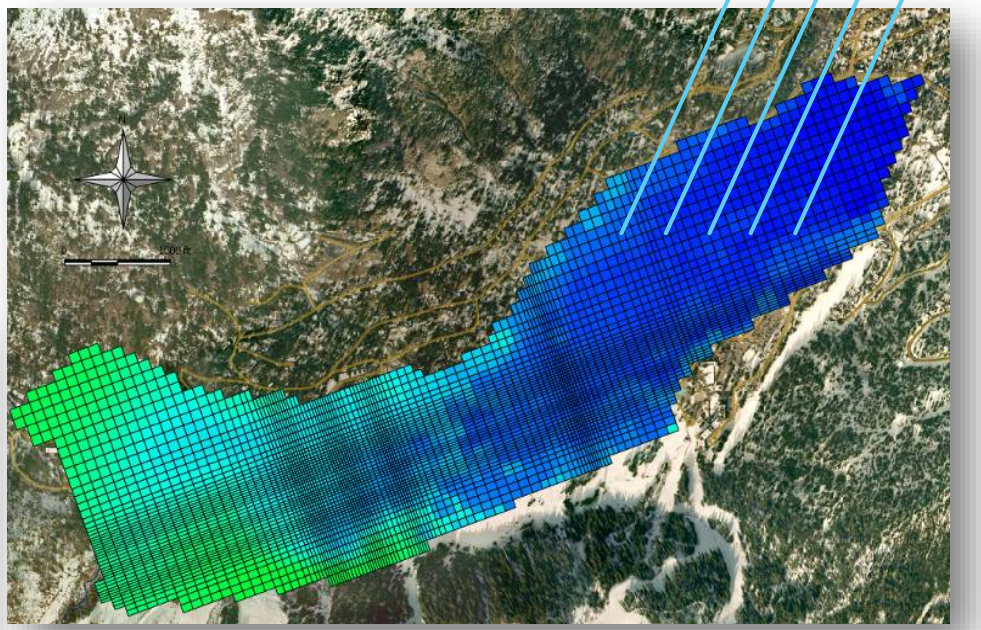
Model Boundaries



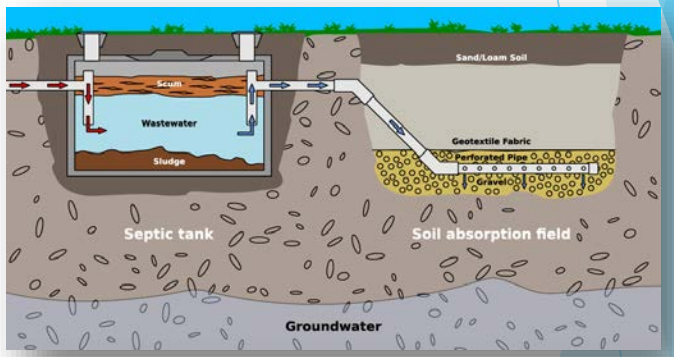
Groundwater Model Input Data

Climatic Data

Assumptions about how much rainfall becomes recharge and runoff

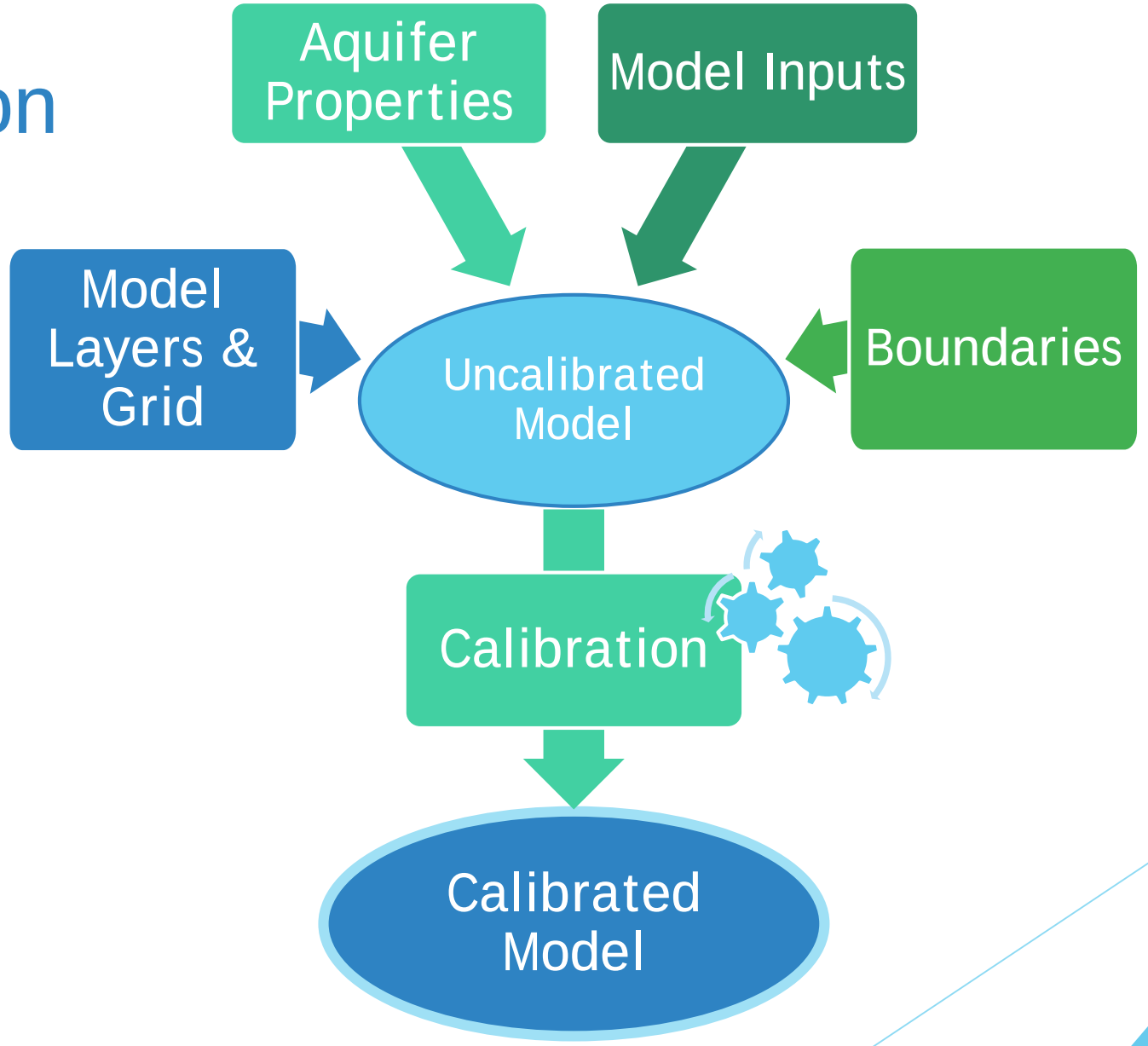


Return Flow



Groundwater Use Data

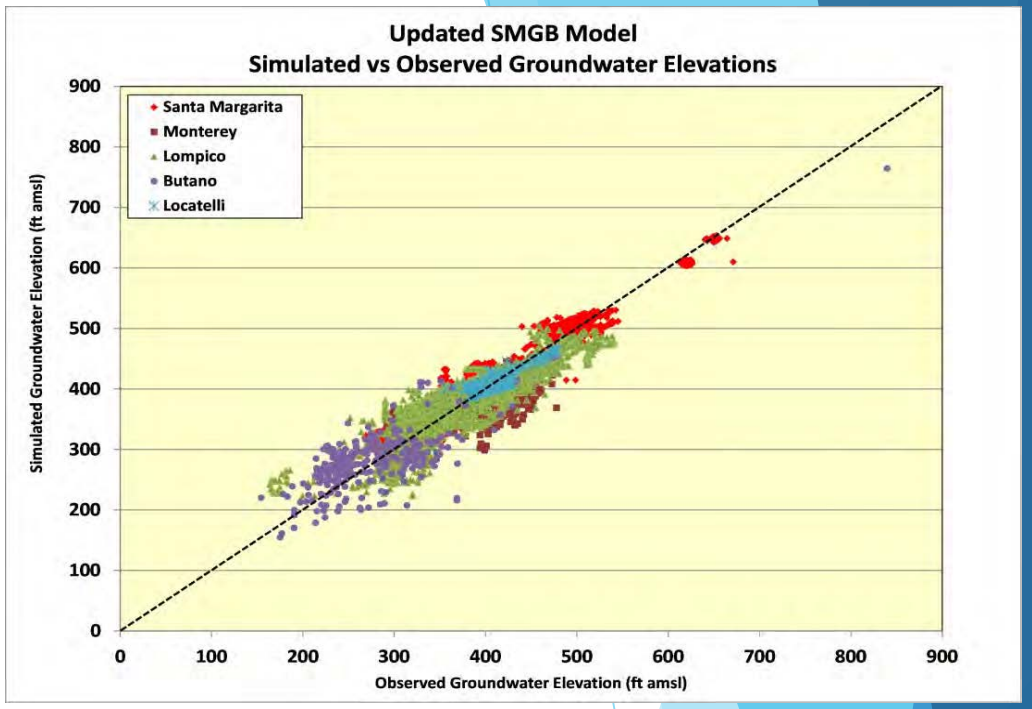
Model Calibration

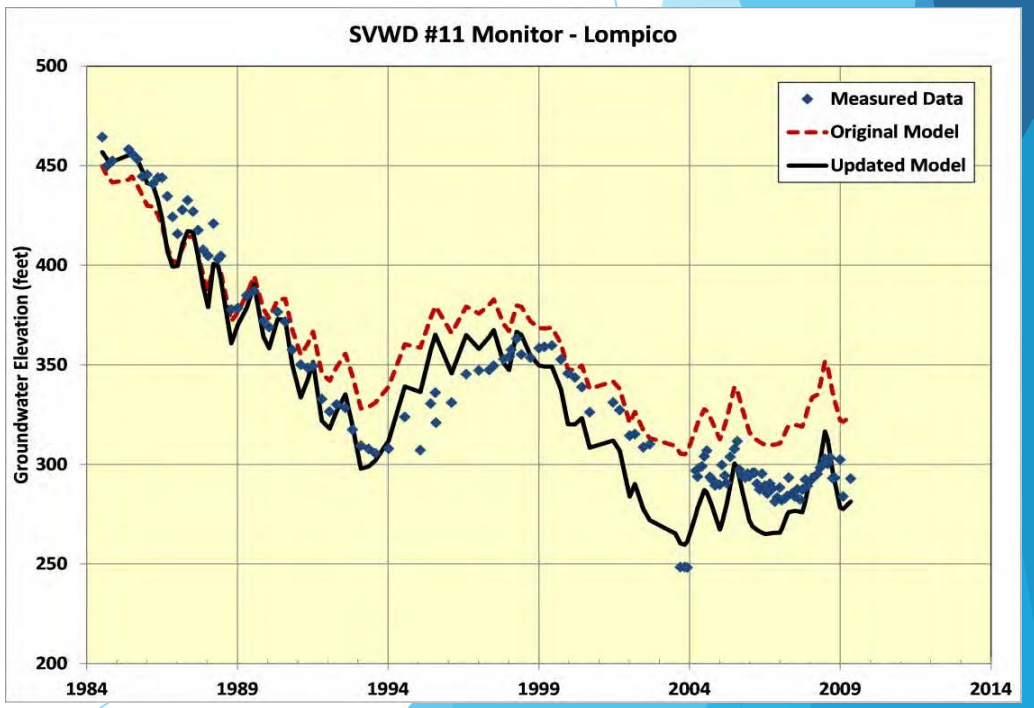


Model Calibration

WHY?

to be used for predictive purposes, it must be demonstrated that the model can successfully simulate observed aquifer behavior

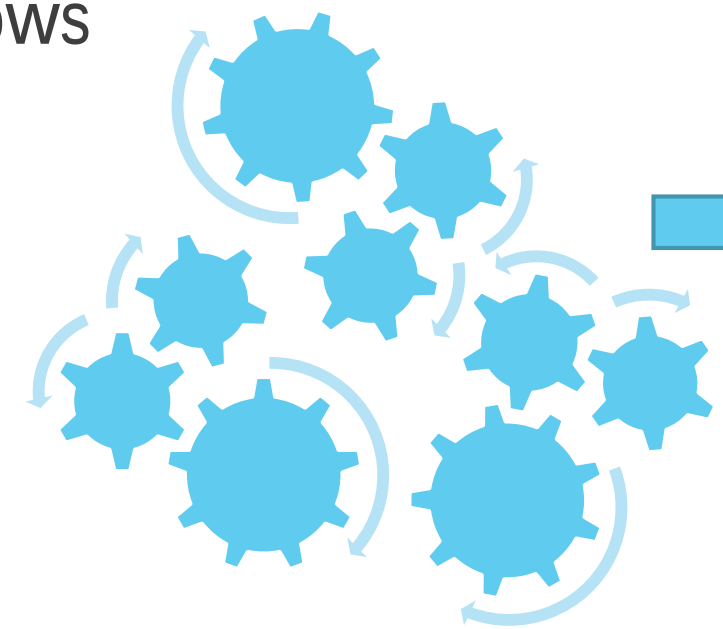


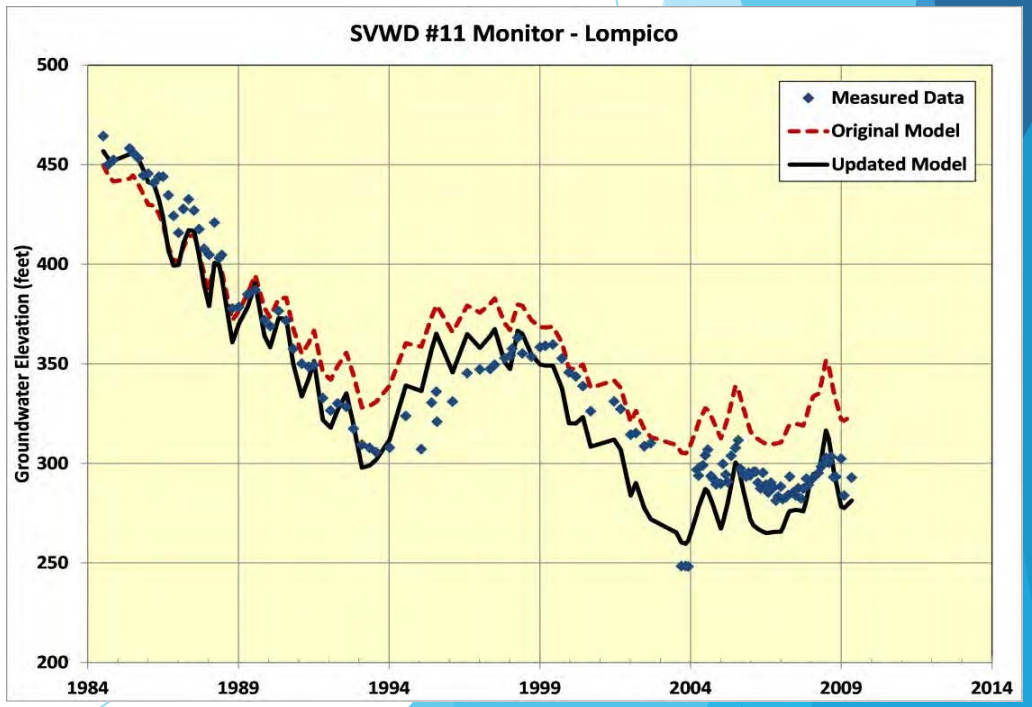


Model Calibration

HOW?

adjust aquifer properties and model boundaries to match observed groundwater levels / surface water flows

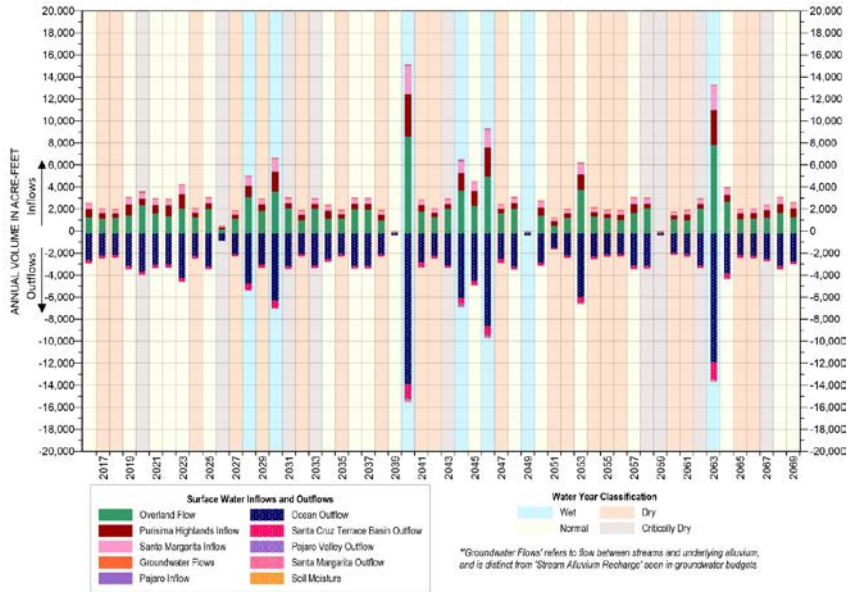




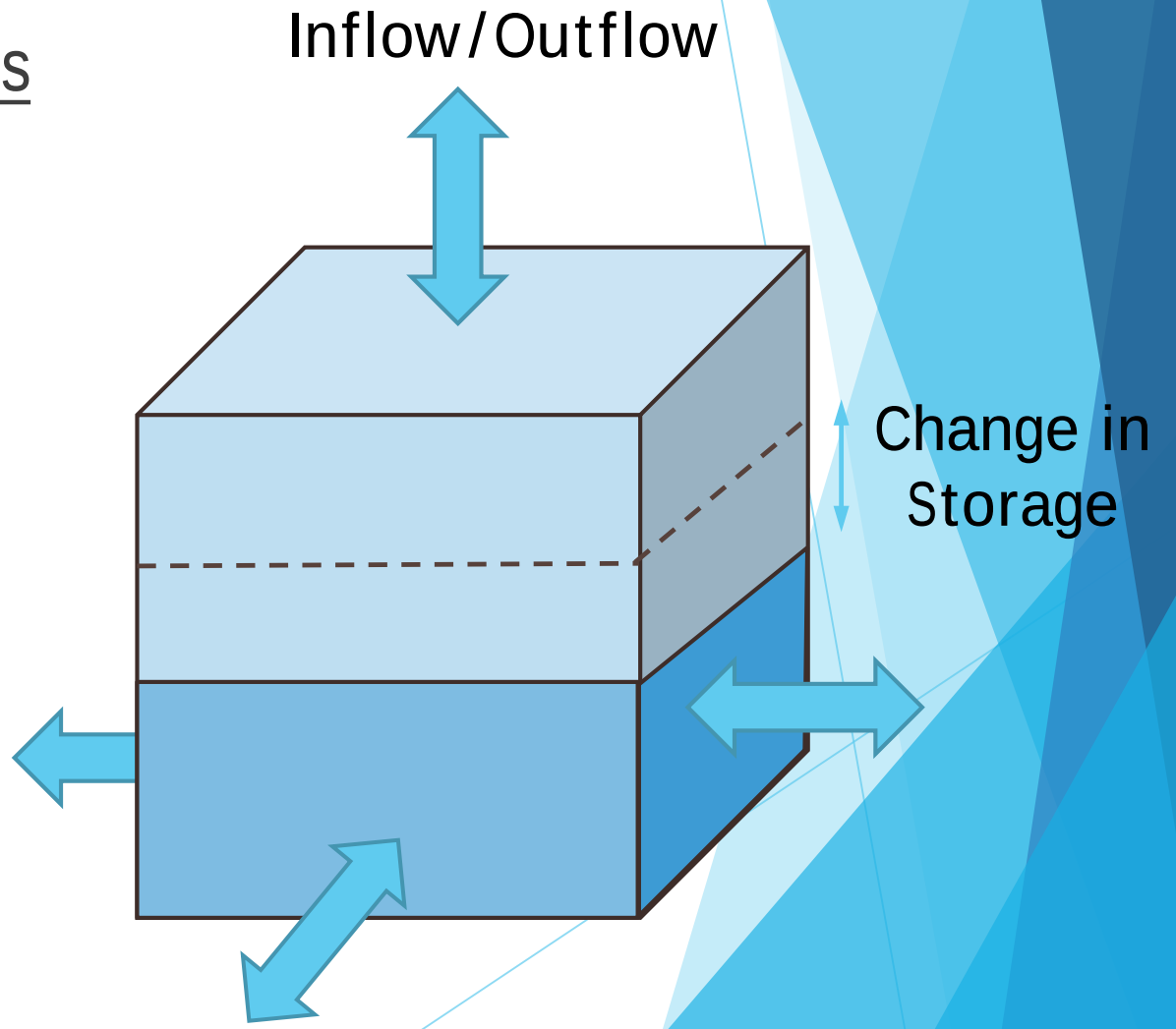
How the Groundwater Model will be used for GSP Development

How Models Calculate Outputs from Inputs

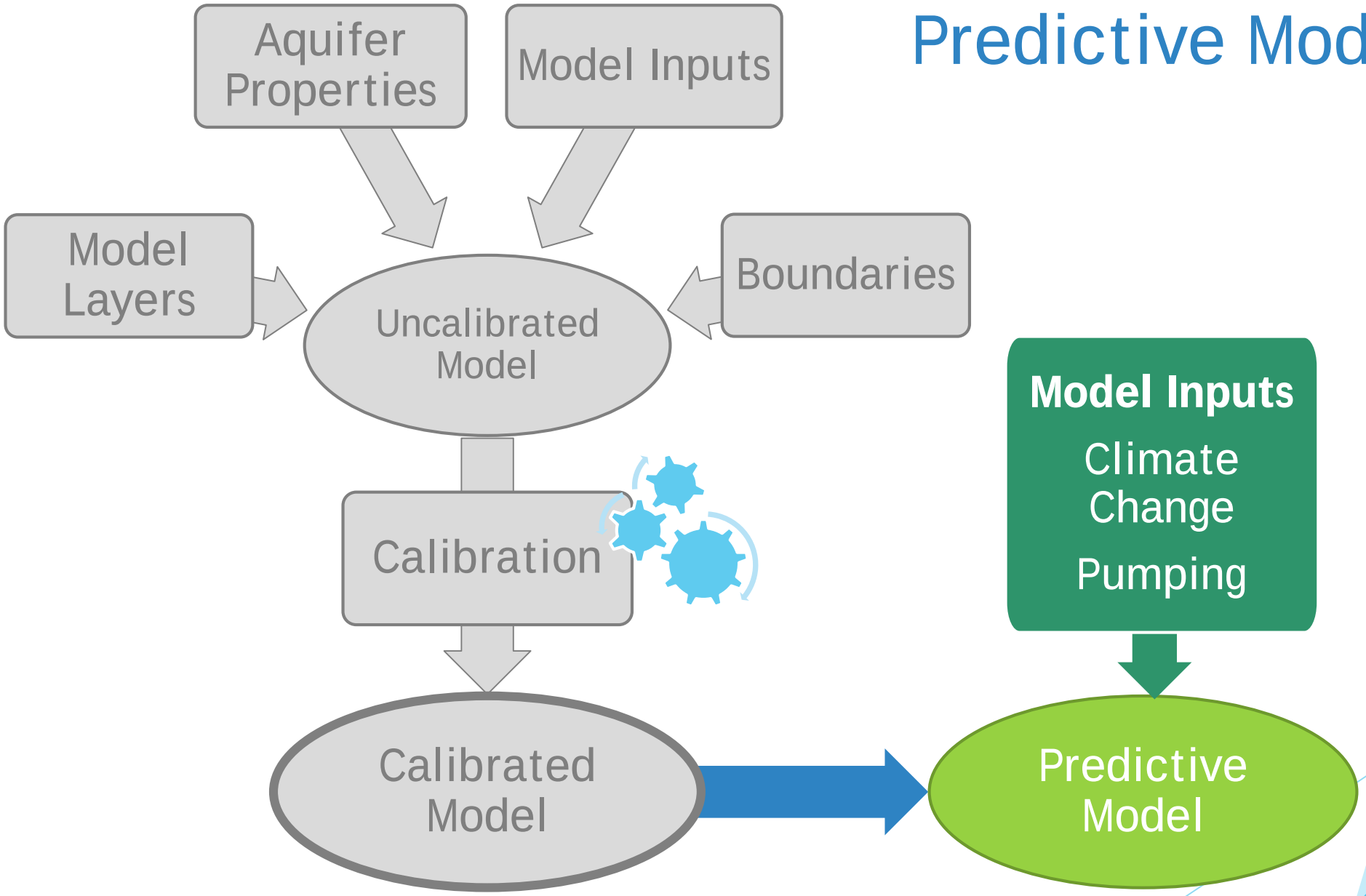
- Models Calculate Water Budgets



- Inflow – Outflow = Change of Storage
- Change of Storage ~ Change in Groundwater Level

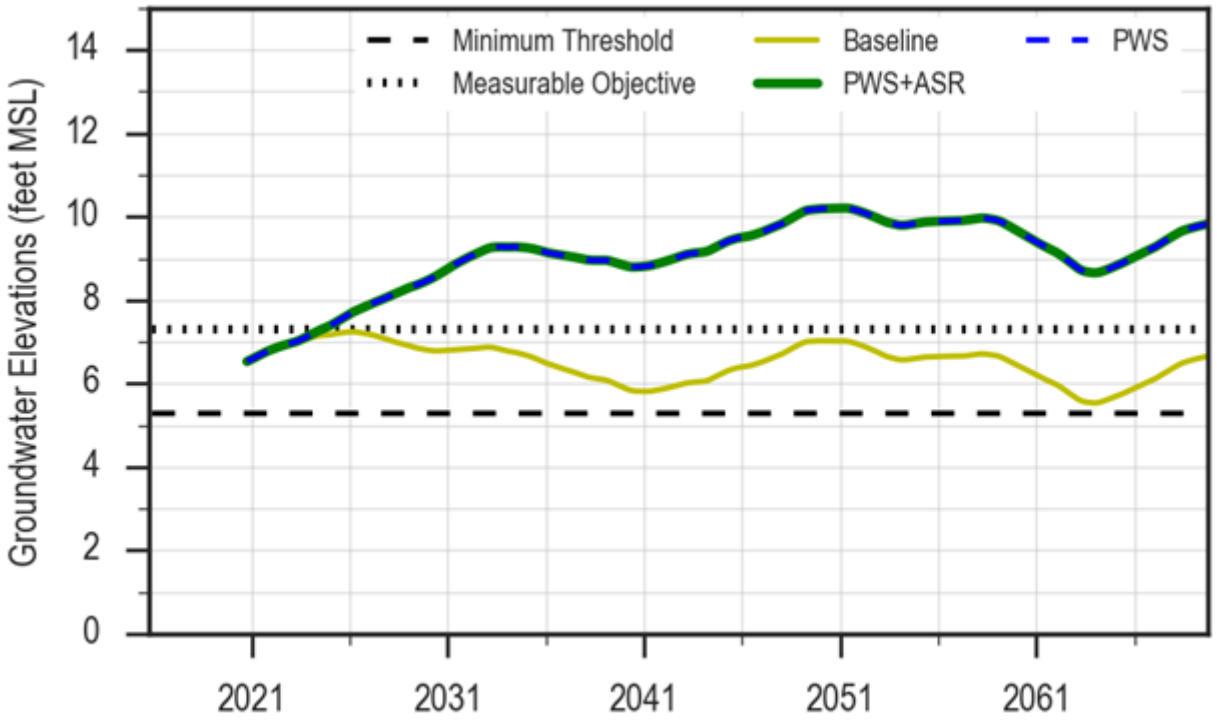


Predictive Modeling



Predictive Modeling Outputs

- Predictive Groundwater Levels



Projects & Management Actions

Measurable Objective

Baseline (no project)

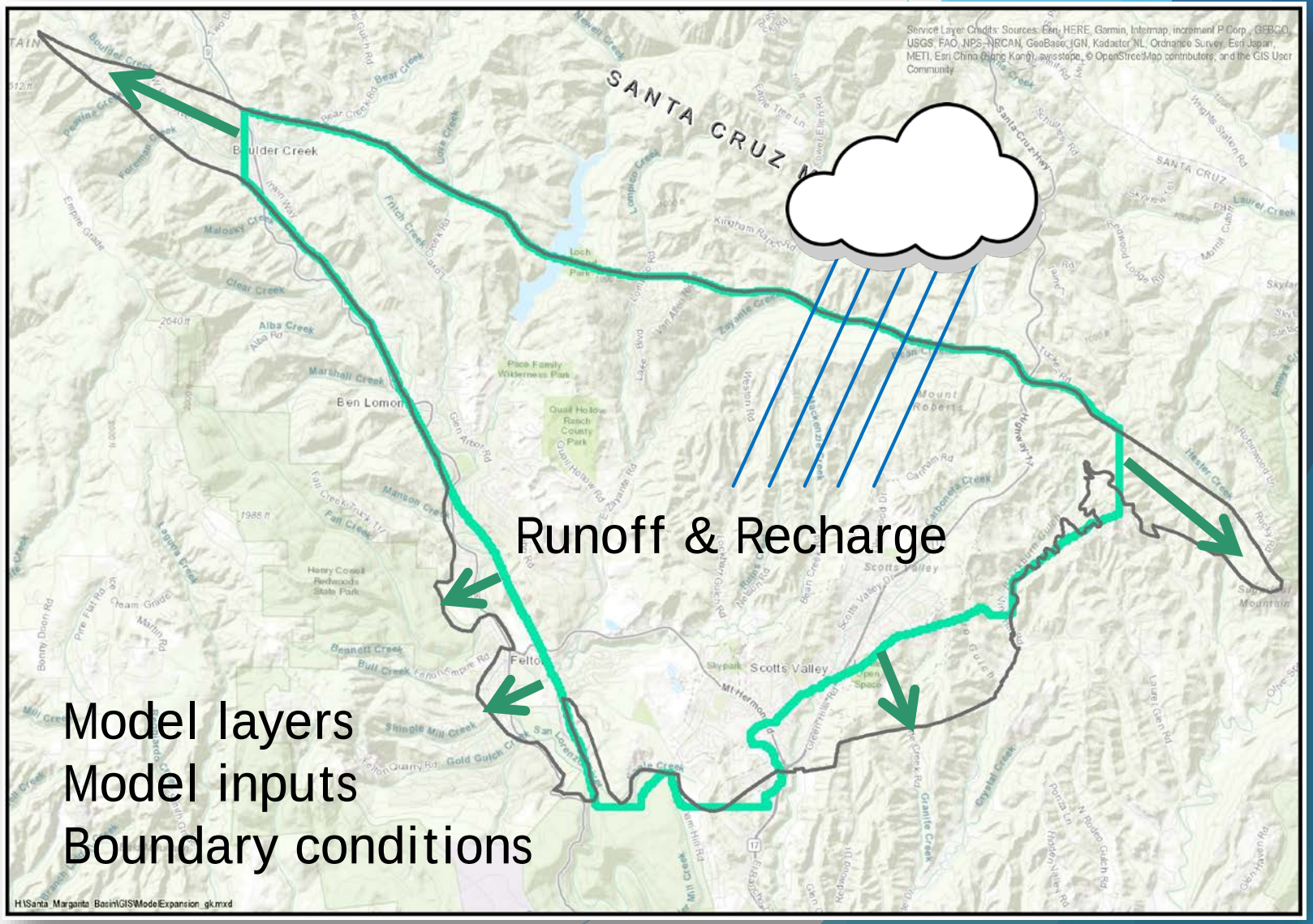
Minimum Threshold

- Future Water Budgets

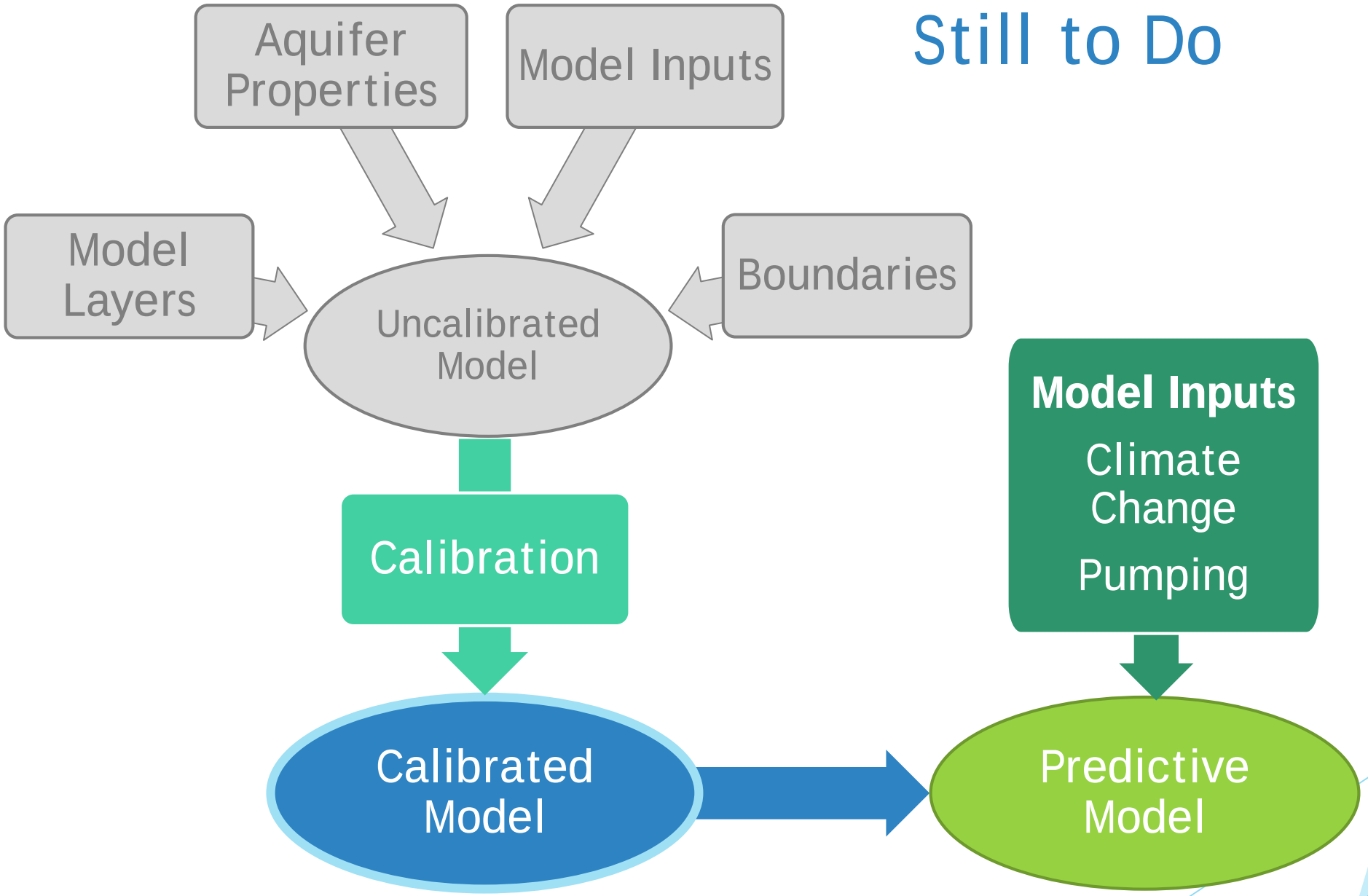
Update on Model Improvements

Model Improvements

- Changing model version to one that handles pinchouts
- Remove evapotranspiration that is double counted
- Improve unmetered pumping estimates and return flow
- Extend all model inputs through September 2018



Still to Do


Aquifer Properties
Model Inputs
Model Layers
Boundaries
Uncalibrated Model
Calibration
Calibrated Model
Model Inputs
Climate Change
Pumping
Predictive Model

Questions