GROUNDWATER & SGMA 101

Santa Cruz Mid-County GSA

Public Orientation Workshop #1

Presenter: Derrik Williams, HydroMetrics Water Resources Inc.

SANTA CRUZ MID-COUNTY GROUNDWATER AGENCY

Thursday, October 5, 2017

Session Objectives

1. Understanding fundamental hydrogeologic terms and concepts needed for Sustainable Groundwater Management Act (SGMA) and groundwater modeling

2. Understanding the background, purpose, and basics of developing a Groundwater Sustainability Plan (GSP) under SGMA

Groundwater 101

Groundwater 101 Outline

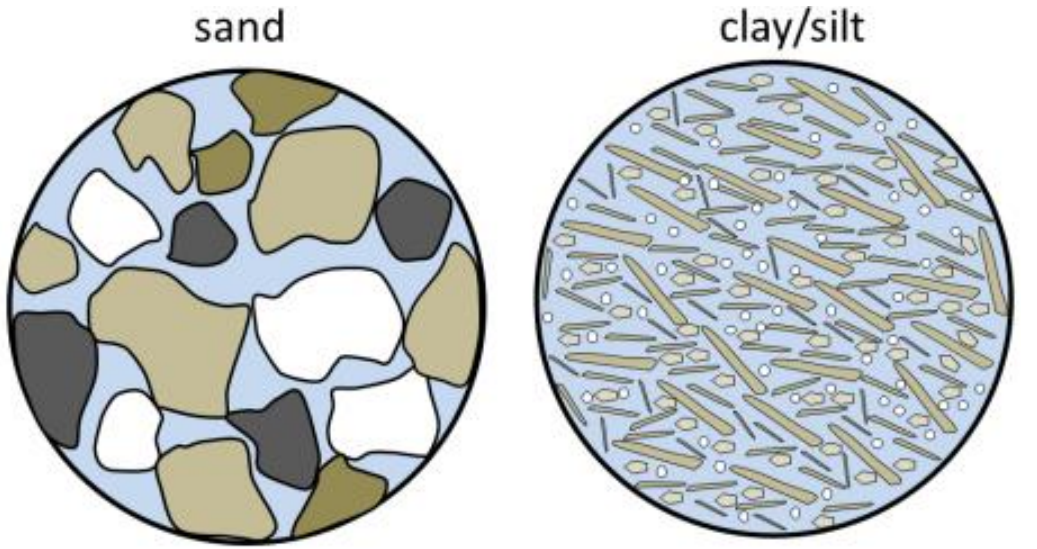
1. Basic groundwater flow and properties
2. Measuring groundwater
3. Groundwater budgets
4. Advanced topics
    a. Seawater intrusion
    b. Groundwater / surface water interactions
    c. Aquifer recharge
    d. Land subsidence

Basic Groundwater Flow & Properties

What is Groundwater?

- Groundwater is water flowing in sediments or rock fractures
  - This is not the legal definition, it is a practical definition
- Sediments can be sands, gravels, silts, or clays

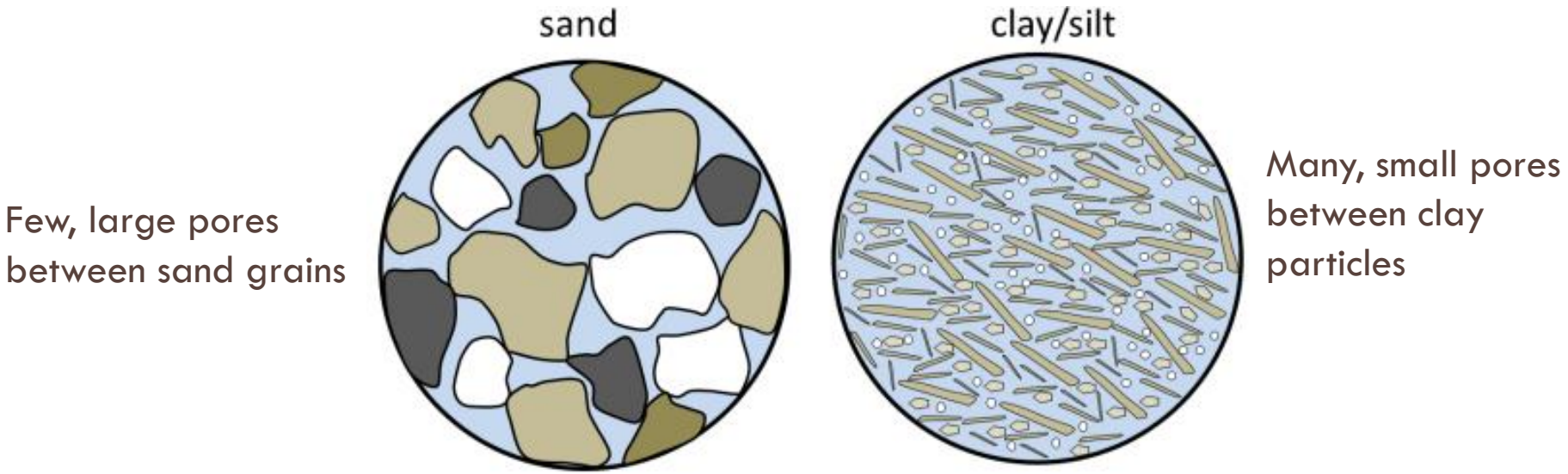
Few, large pores between sand grains



Many, small pores between clay particles

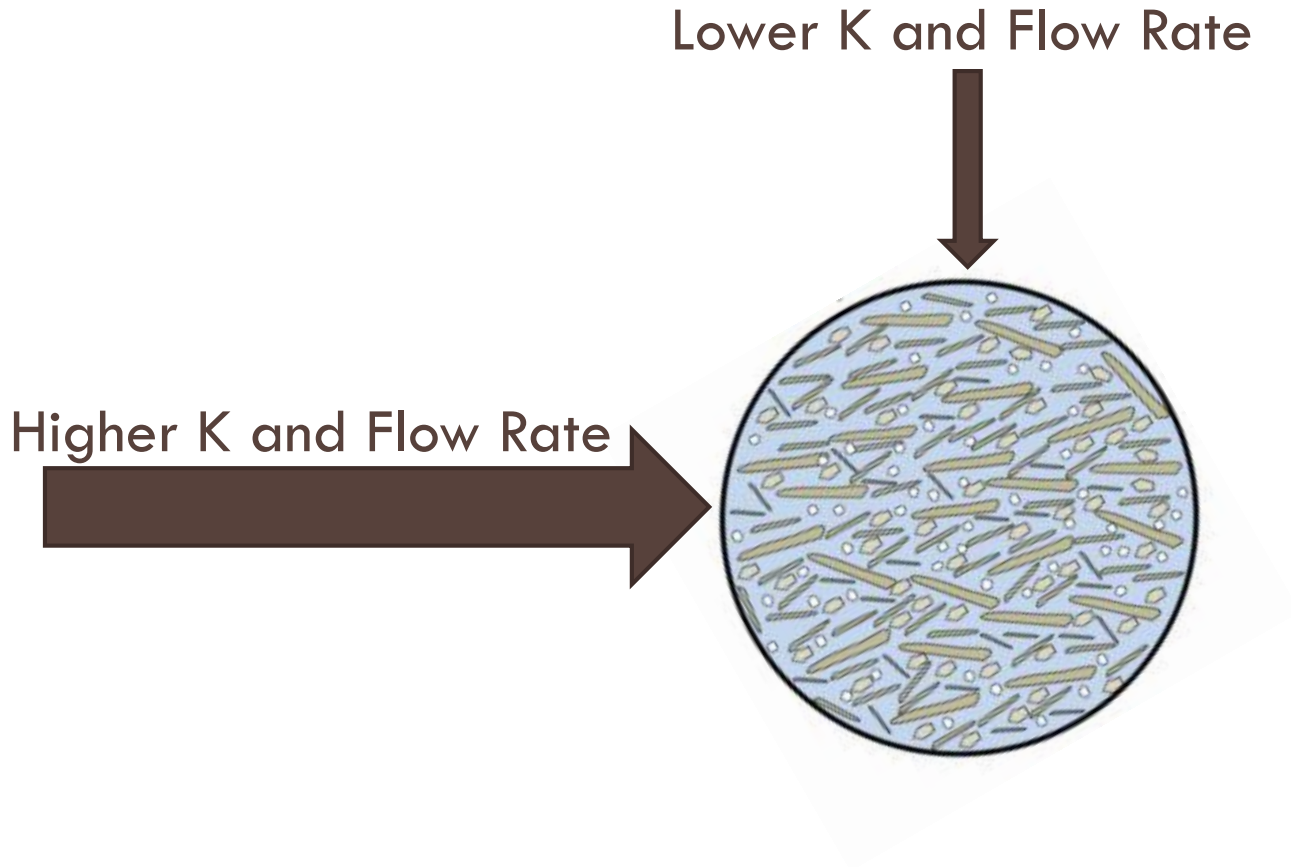
Hydraulic Conductivity (K) - Measures Ease of Flow

- The large pores between the sand grains are larger, allowing water to flow more rapidly. High hydraulic conductivity
- The pores between the clay platelets are small, slowing down the flow of water. Low hydraulic conductivity



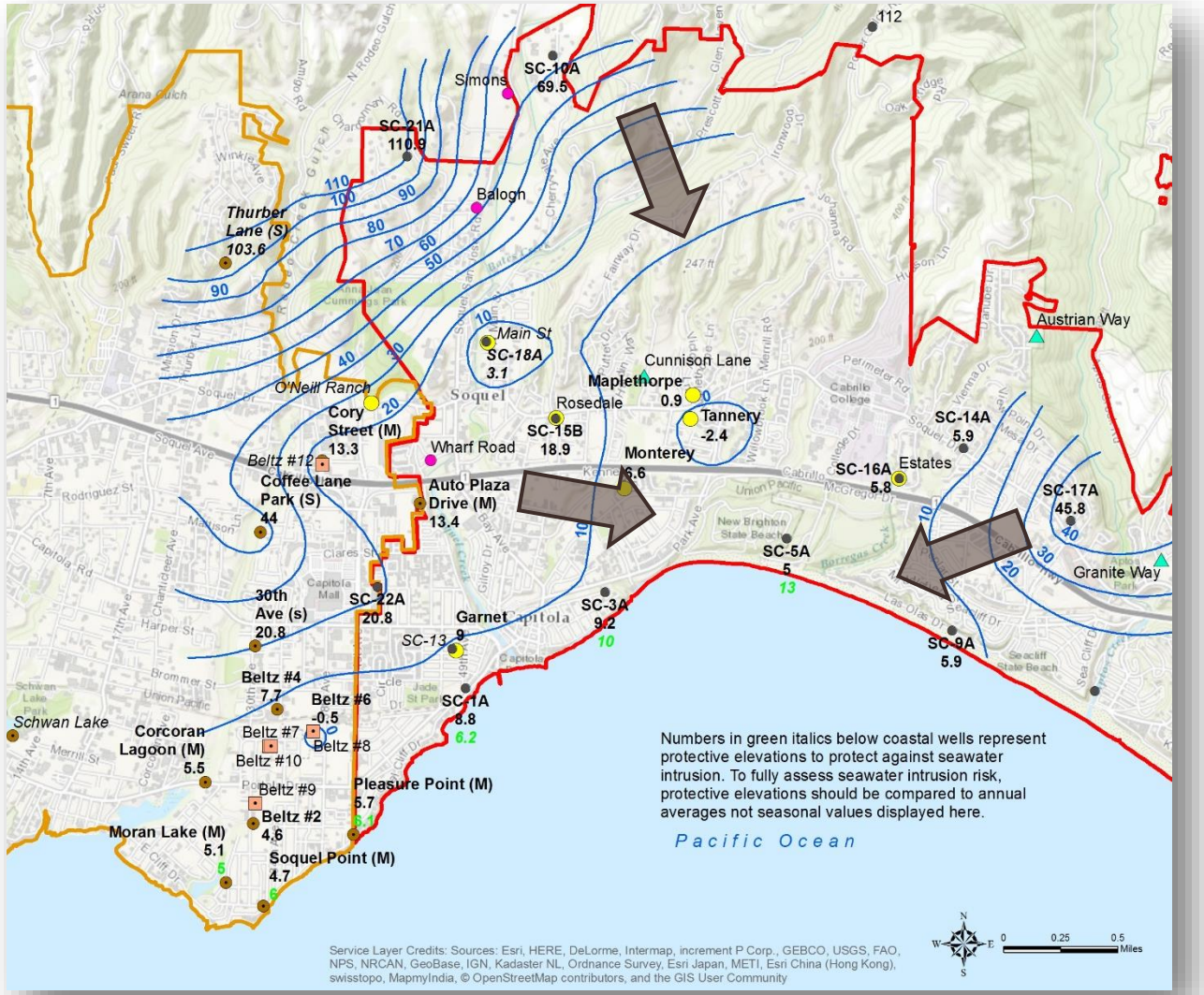
Directional Hydraulic Conductivity (Anisotropy)

Water molecules "bump into" fewer clay particles moving horizontally than moving vertically

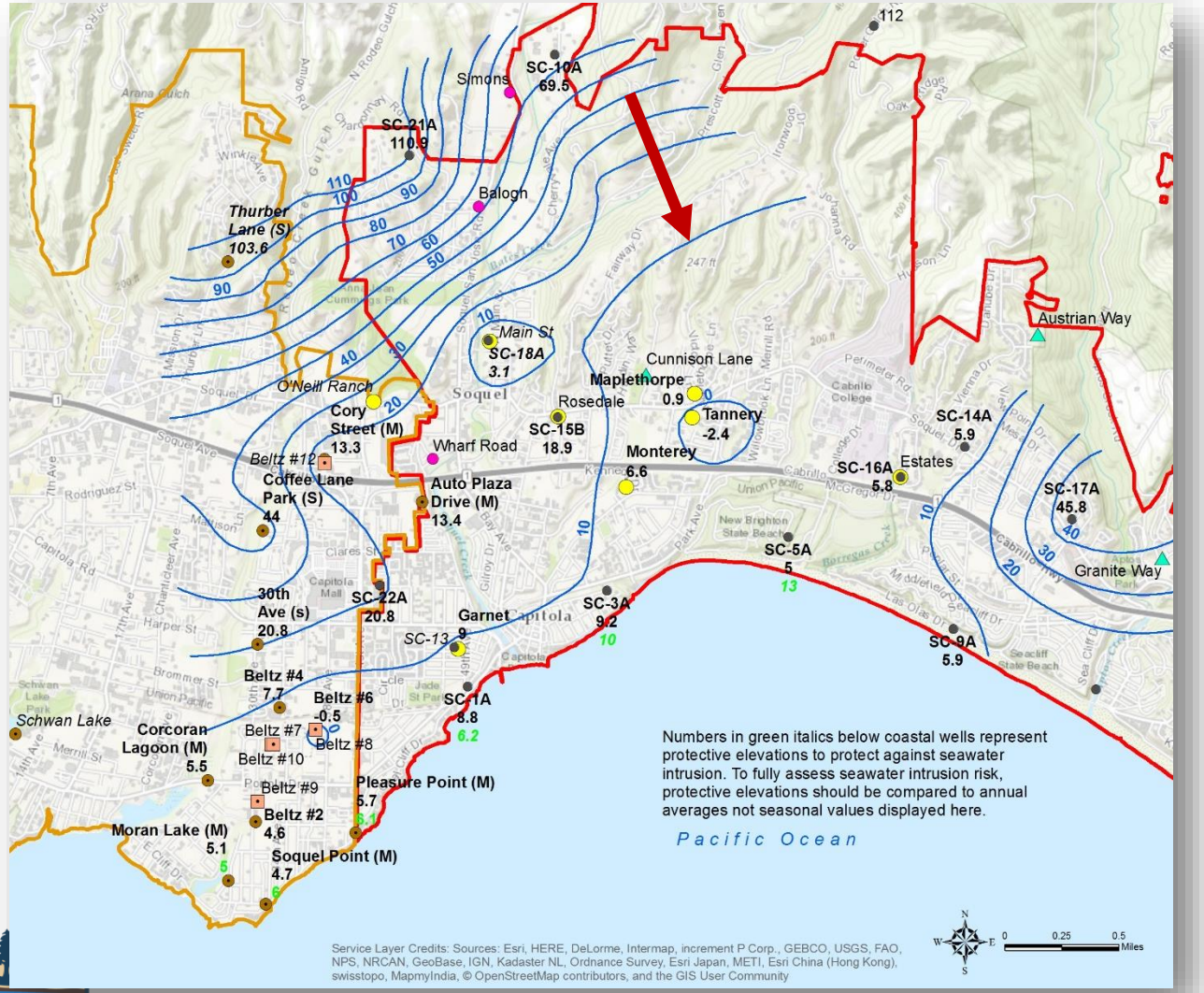


Groundwater Flow

- Water flows from high to low elevations
- A contour line represents equal groundwater elevation
- Groundwater elevation (or head) is the level of groundwater above or below sea level

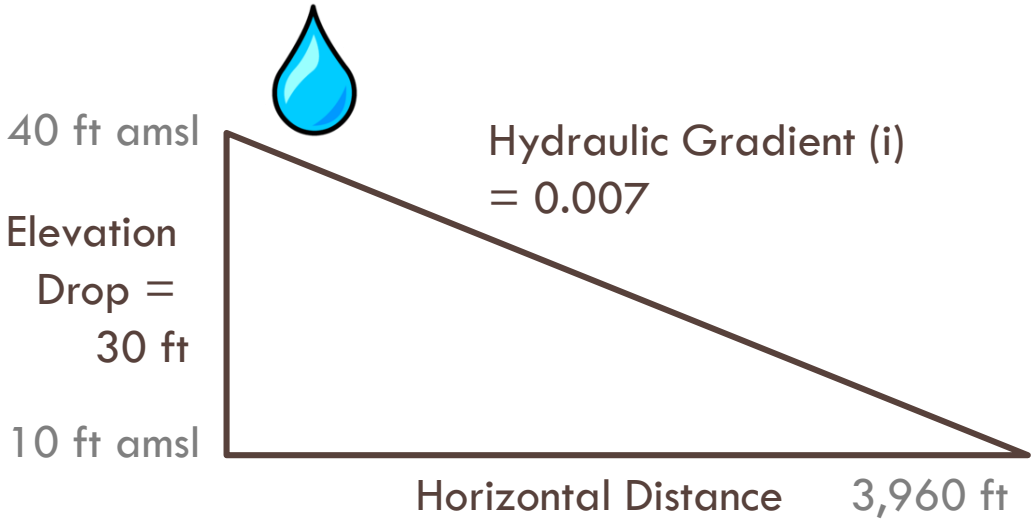


Hydraulic Gradient (i)



Hydraulic gradient (i)

$$\text{Hydraulic gradient (i)} = \frac{\text{Elevation drop}}{\text{Horizontal distance}}$$



amsl = above mean sea level

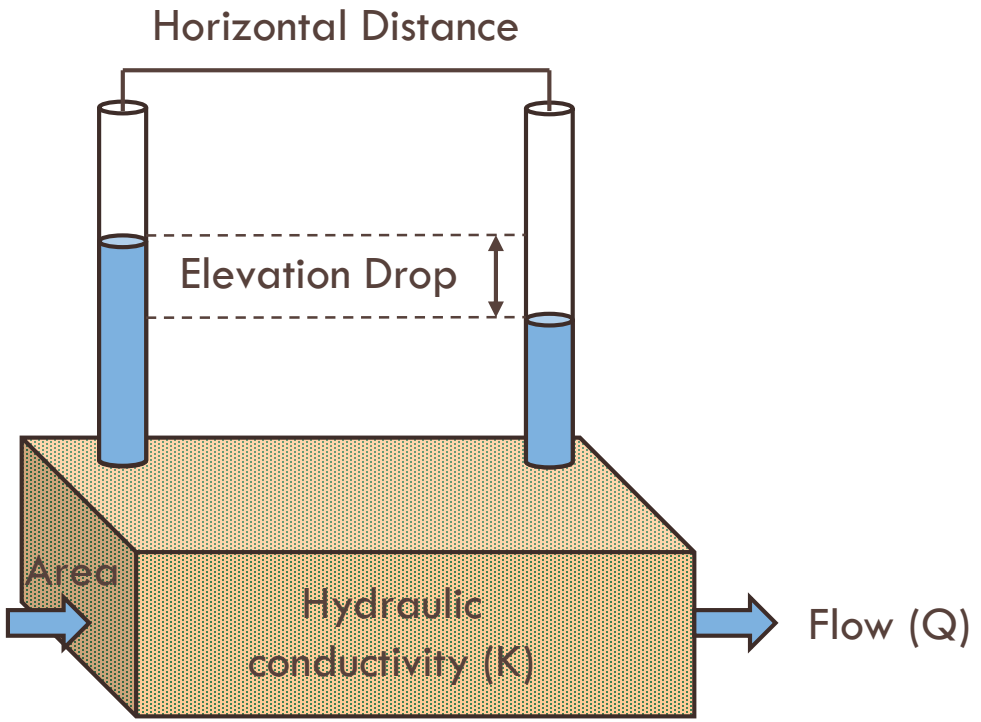
Darcy's Law of Groundwater Flow

Groundwater Flow (Q)

depends on:

1. Hydraulic conductivity (K)
2. Hydraulic gradient (i)
3. Cross-sectional area of flow (A)

$$Q = KiA$$



Storage and Specific Yield (Sy)

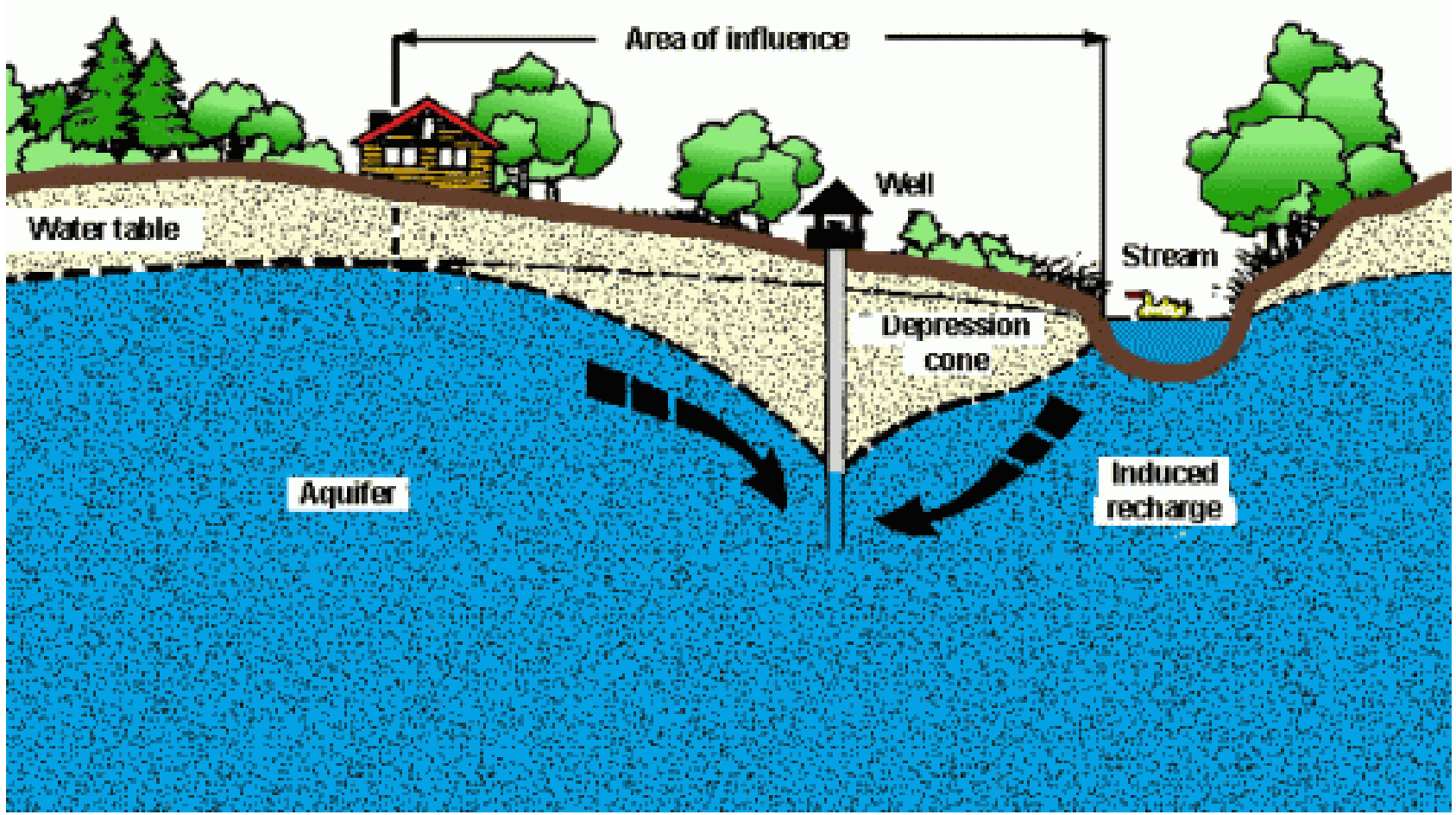
- Storage – how much water is in the pores of an aquifer
- Most storage changes occur in shallow unconfined aquifers
- Specific Yield is the amount of water that drains from an unconfined aquifer

For an Sy of 0.17, two inches of recharge raises groundwater levels in your well almost one foot

Drain 1 cubic foot of saturated sediments

Get 0.15 to 0.3 cubic foot of water
(Sy commonly between 0.15 and 0.3 for sands)

Effects of Groundwater Pumping



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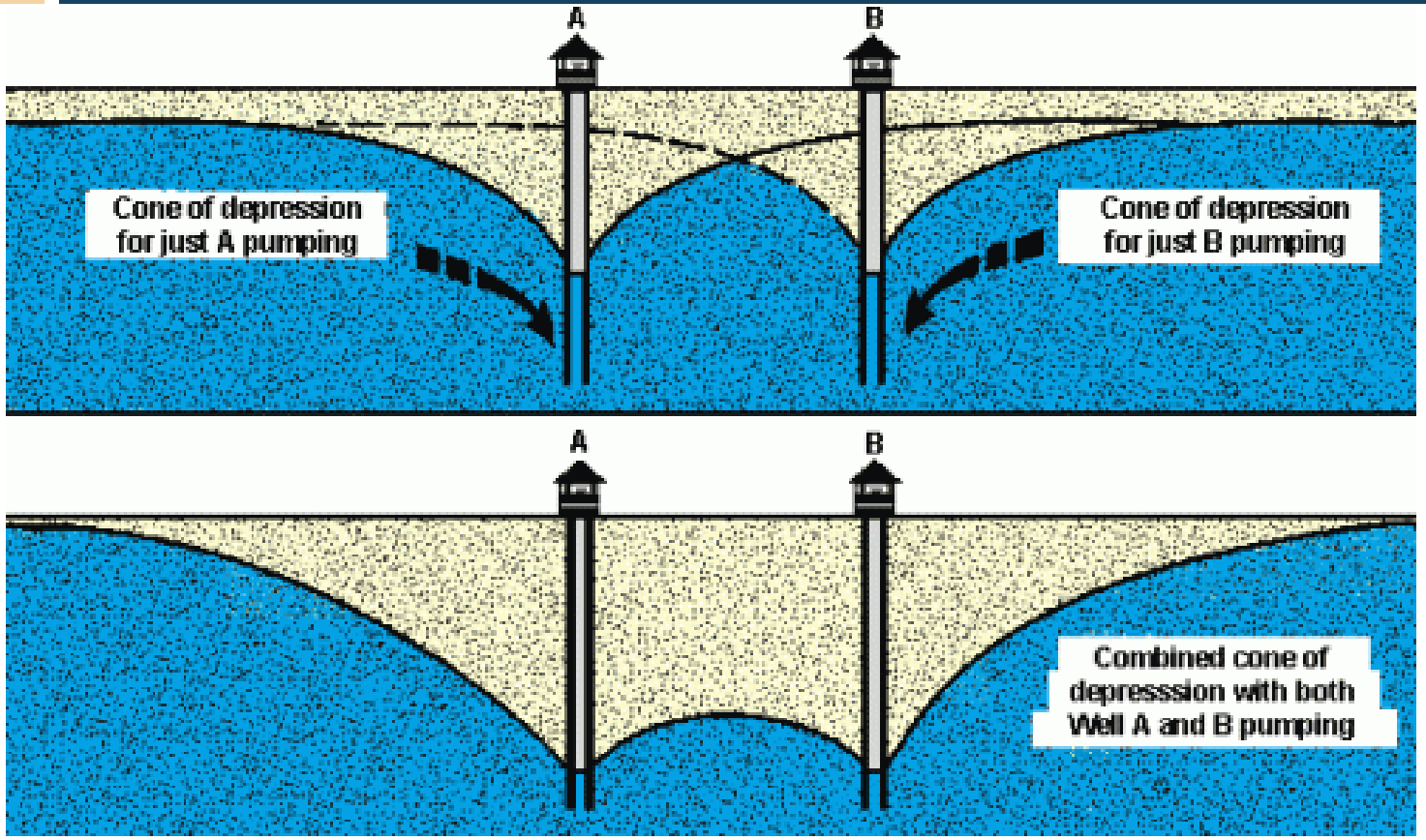
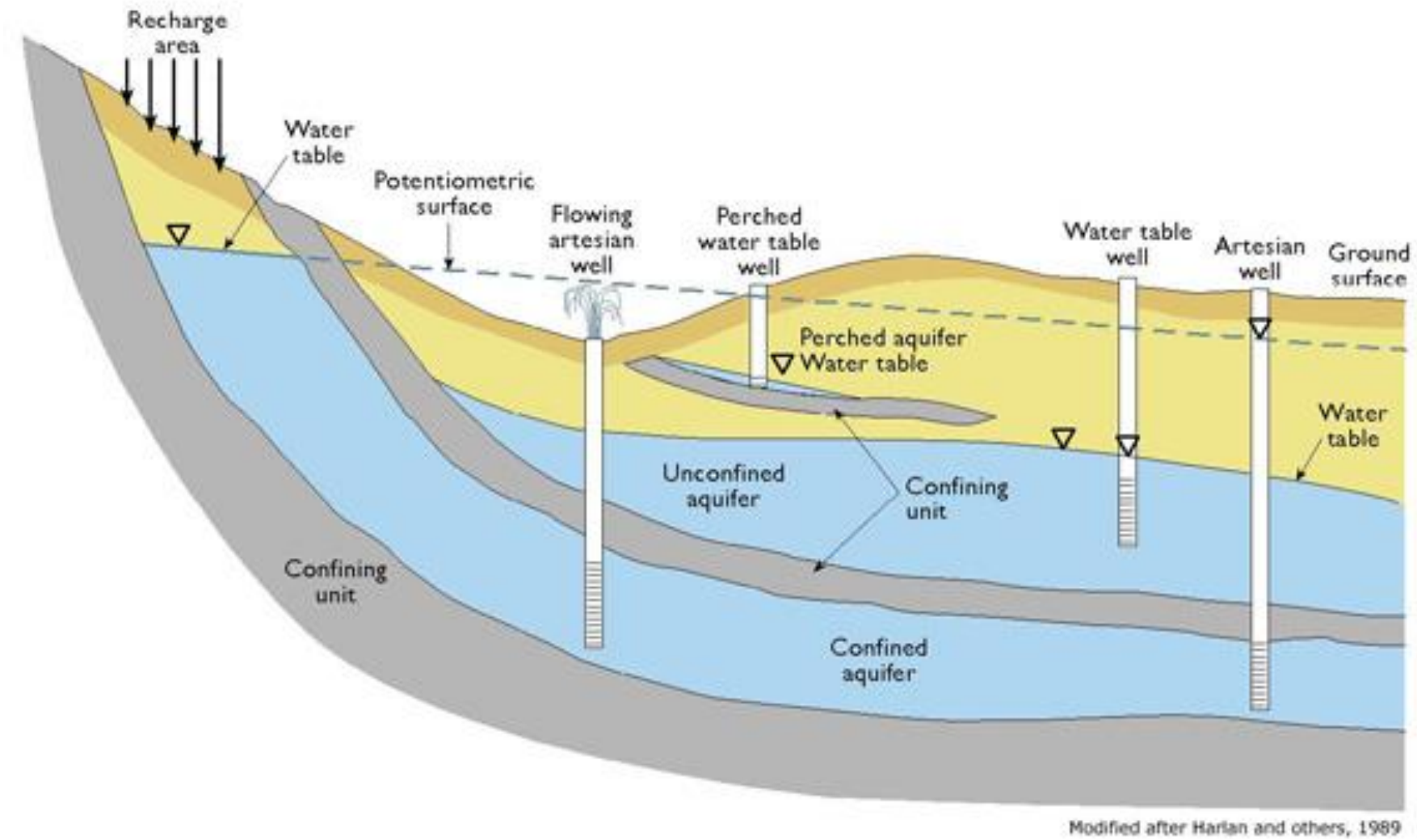


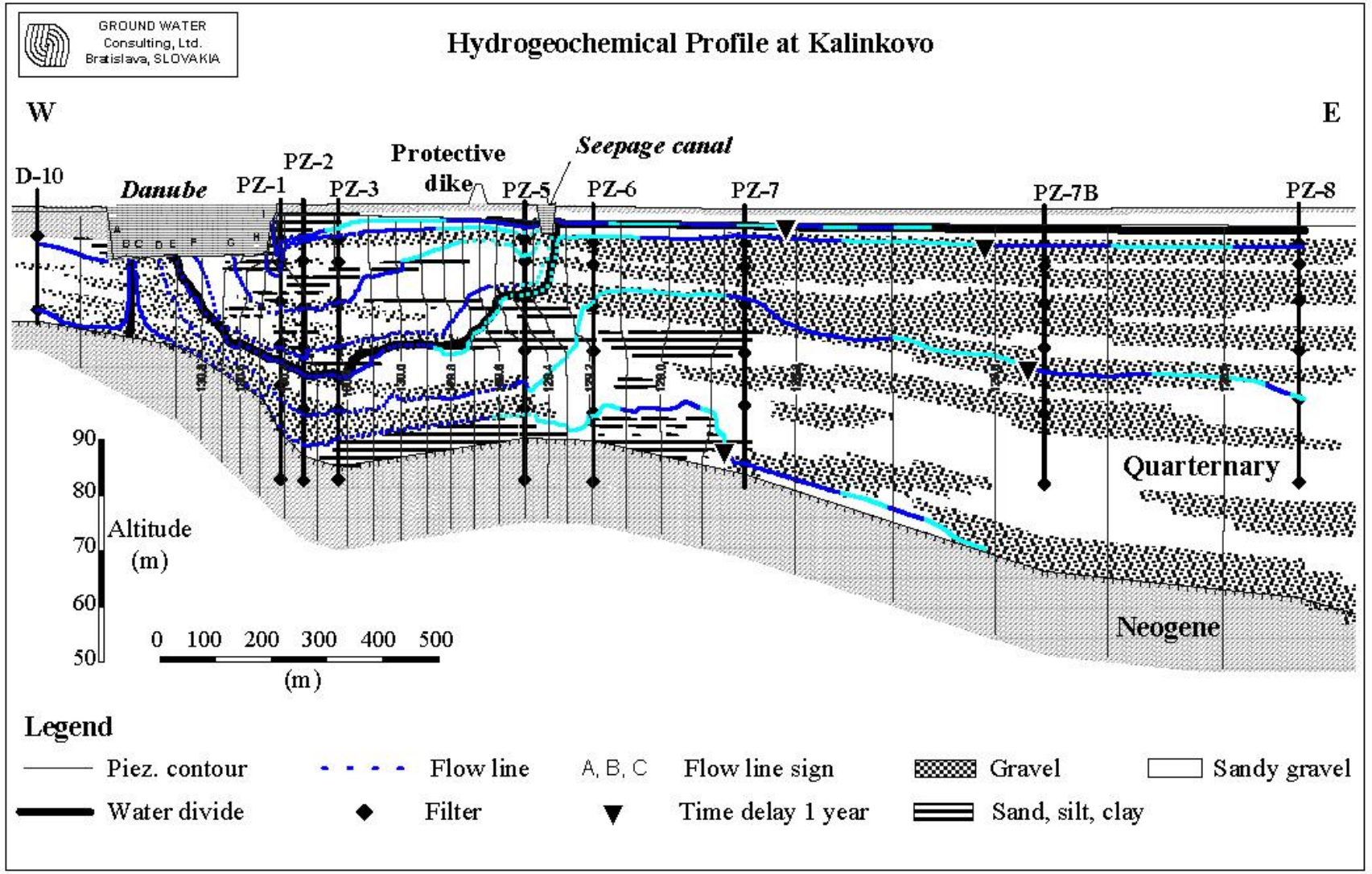
Three Effects

1. Remove Groundwater from storage (lower basin groundwater levels)
2. Cone of depression (locally lower groundwater levels)
3. Interference with nearby wells

Aquifers and Aquitards



Lateral Variability Adds Complexity

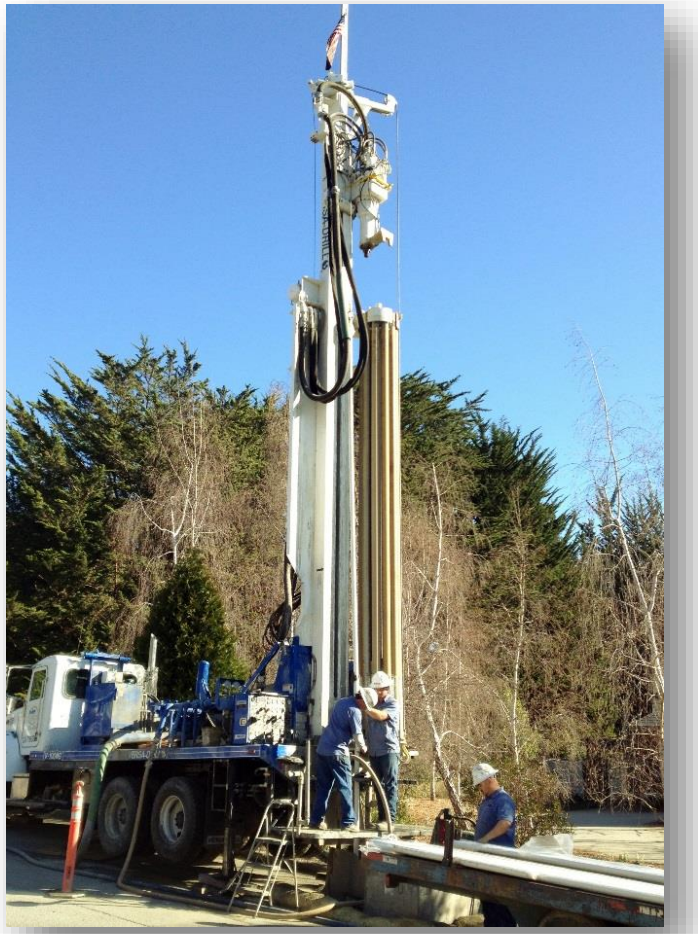


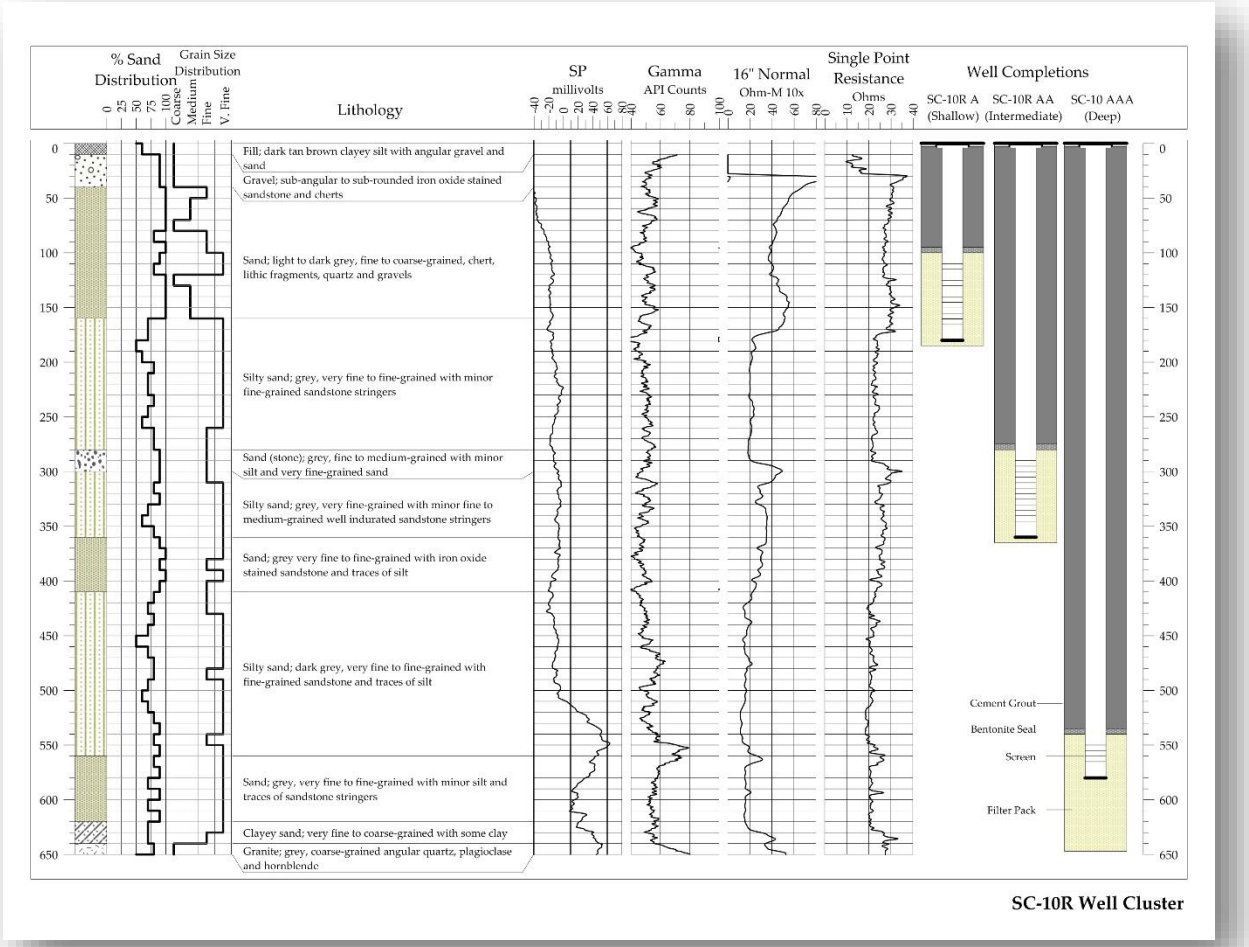
Measuring Groundwater

How do we know what we know?

Almost all Data Comes from Groundwater Wells

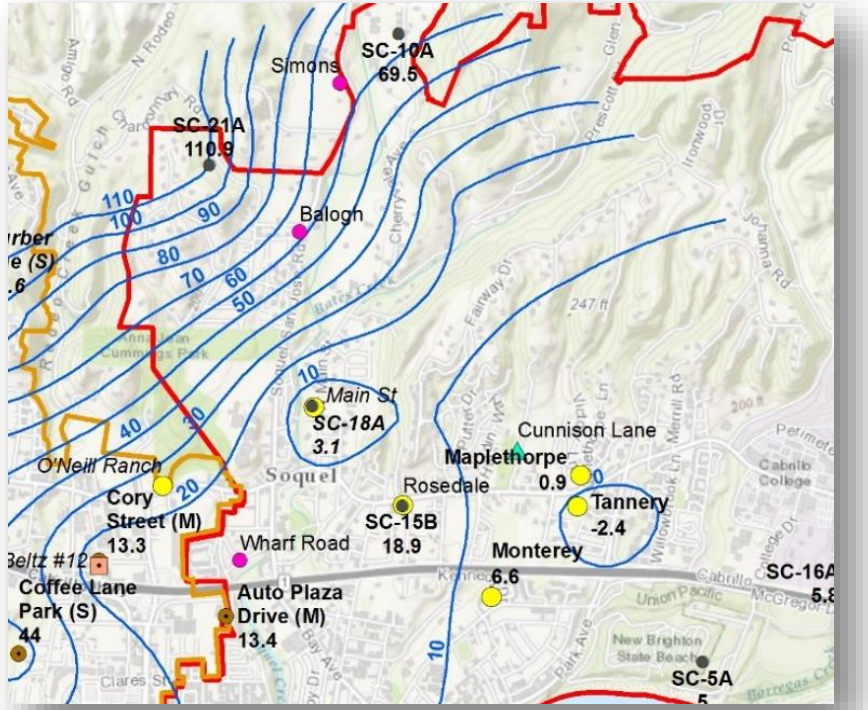
Geology is known from well cuttings



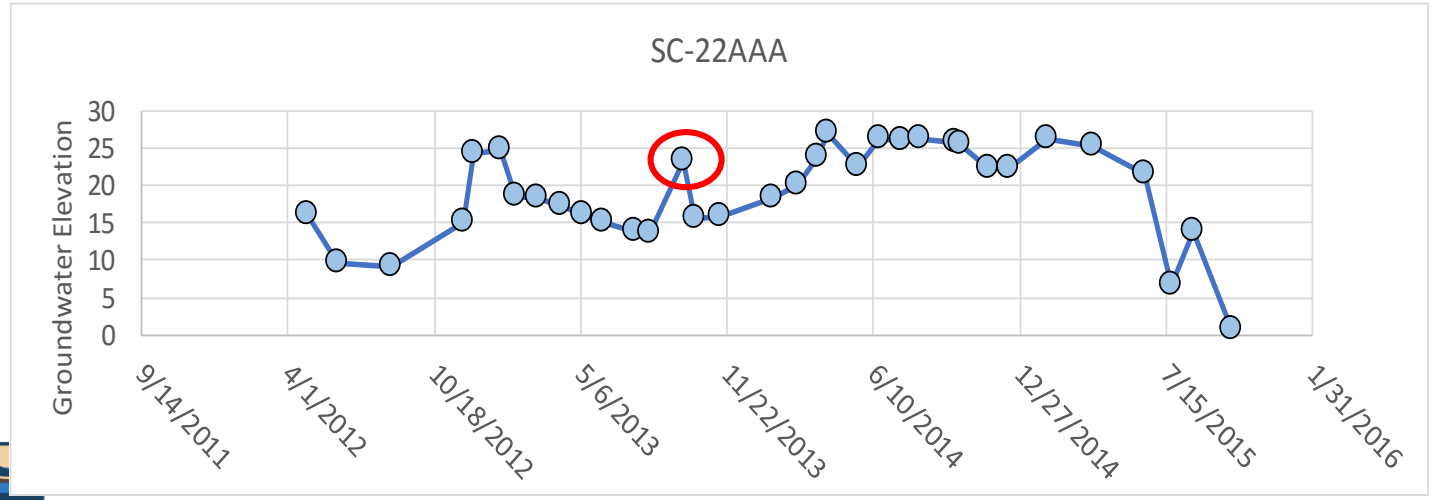


Groundwater Levels

- Basic measurement in hydrogeology
- Used to plot hydrographs
- Used to contour groundwater elevations

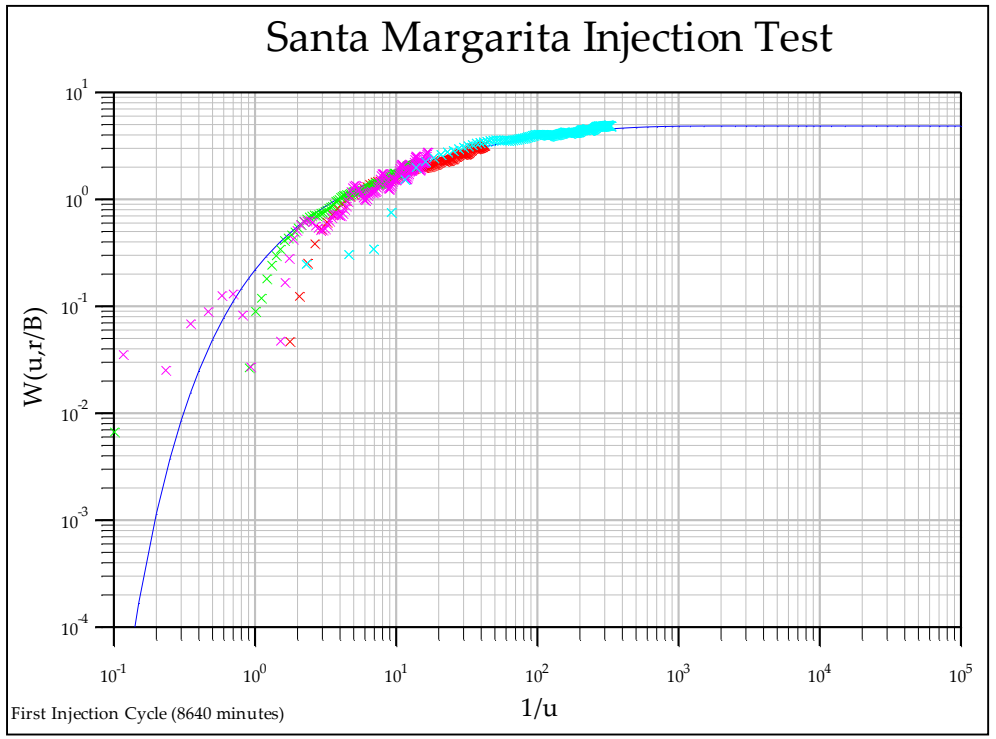


Groundwater Elevation Hydrograph



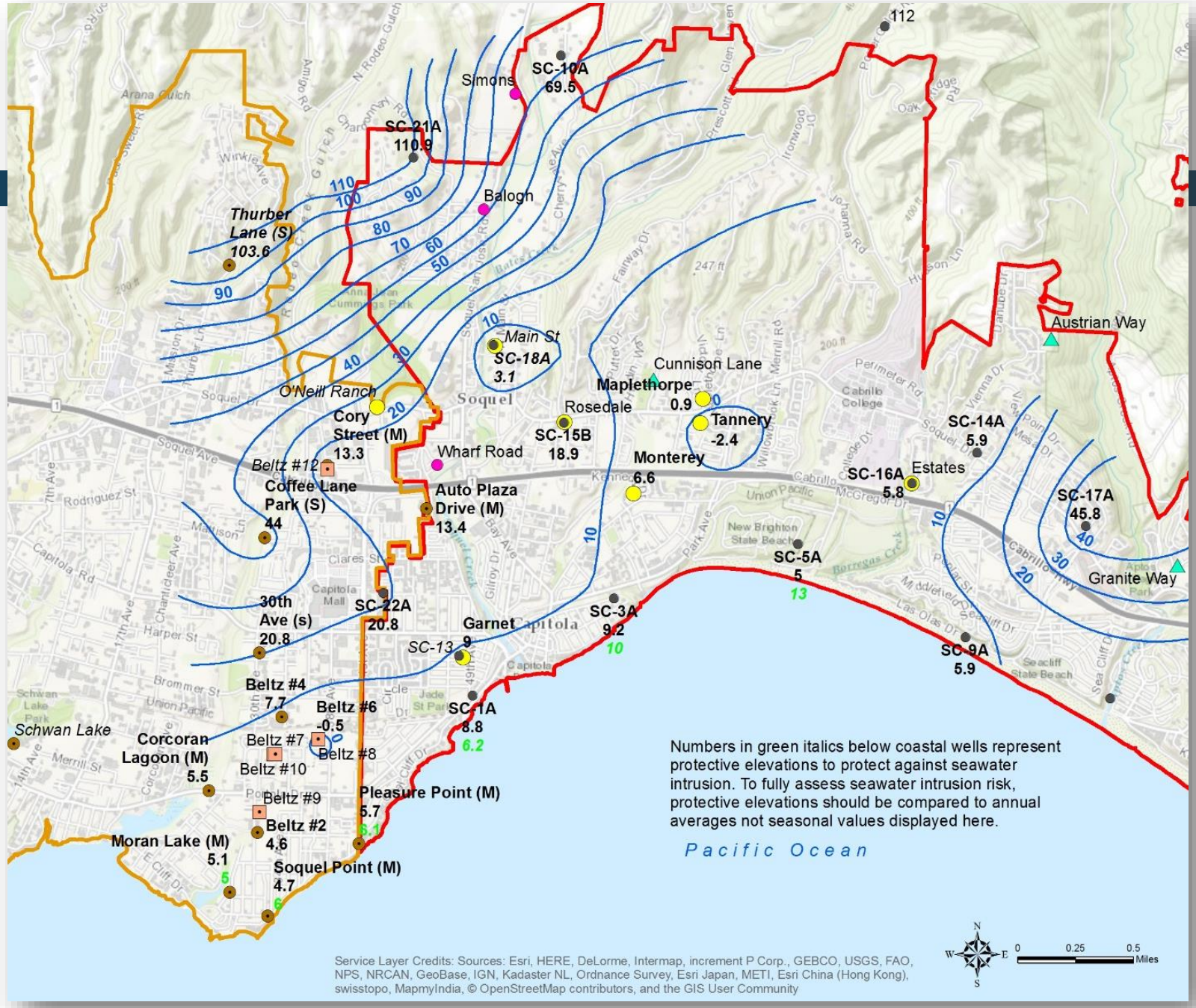
Measuring Aquifer Properties

- Measured at individual wells
- Field measurement of K and SY from aquifer tests of wells
- These are local estimates only



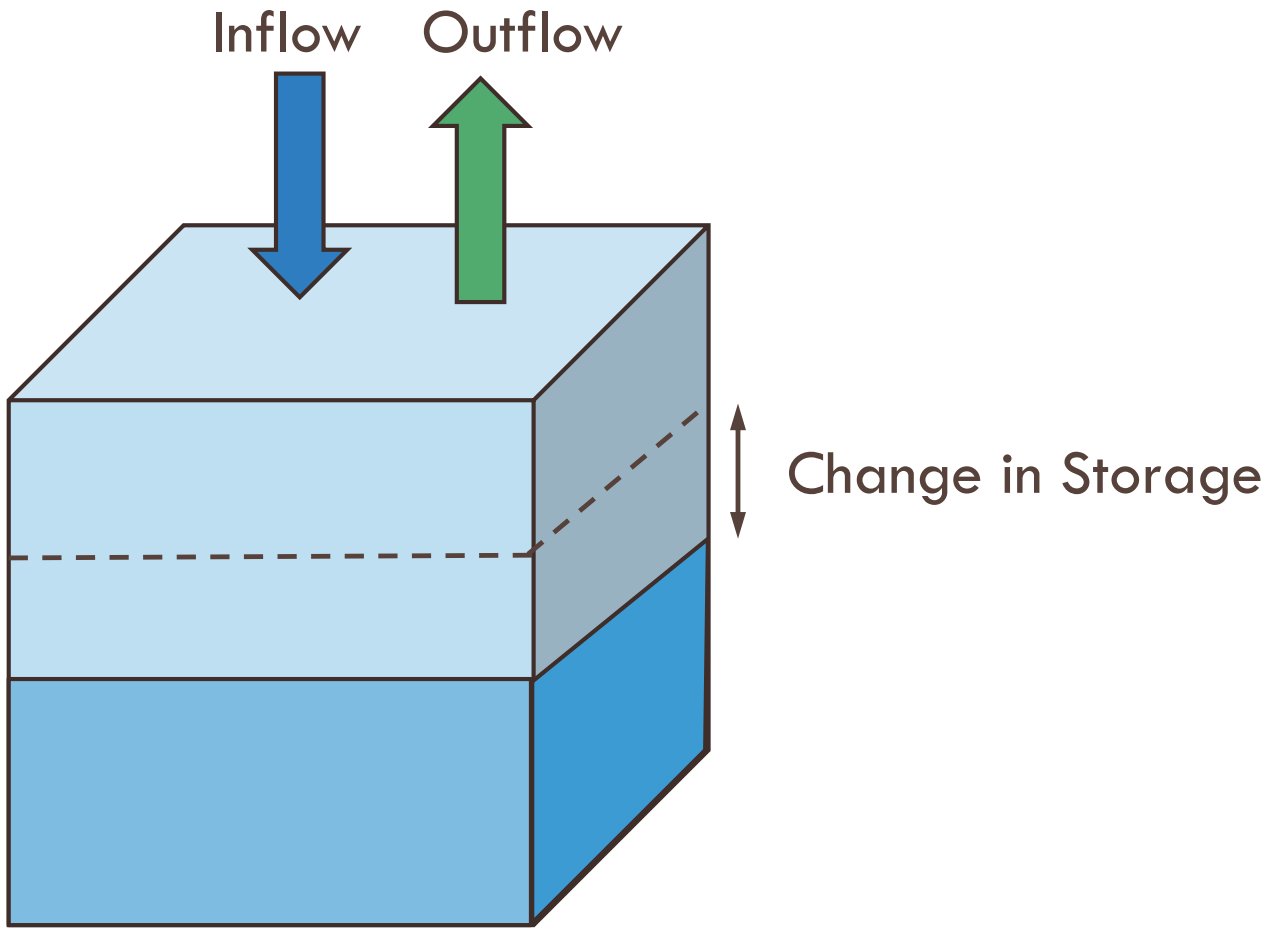
Hydrogeologic Interpretation

- Data only collected at wells
- Everything else is interpretation



Groundwater Budgets

Inflow – Outflow = Change in Storage



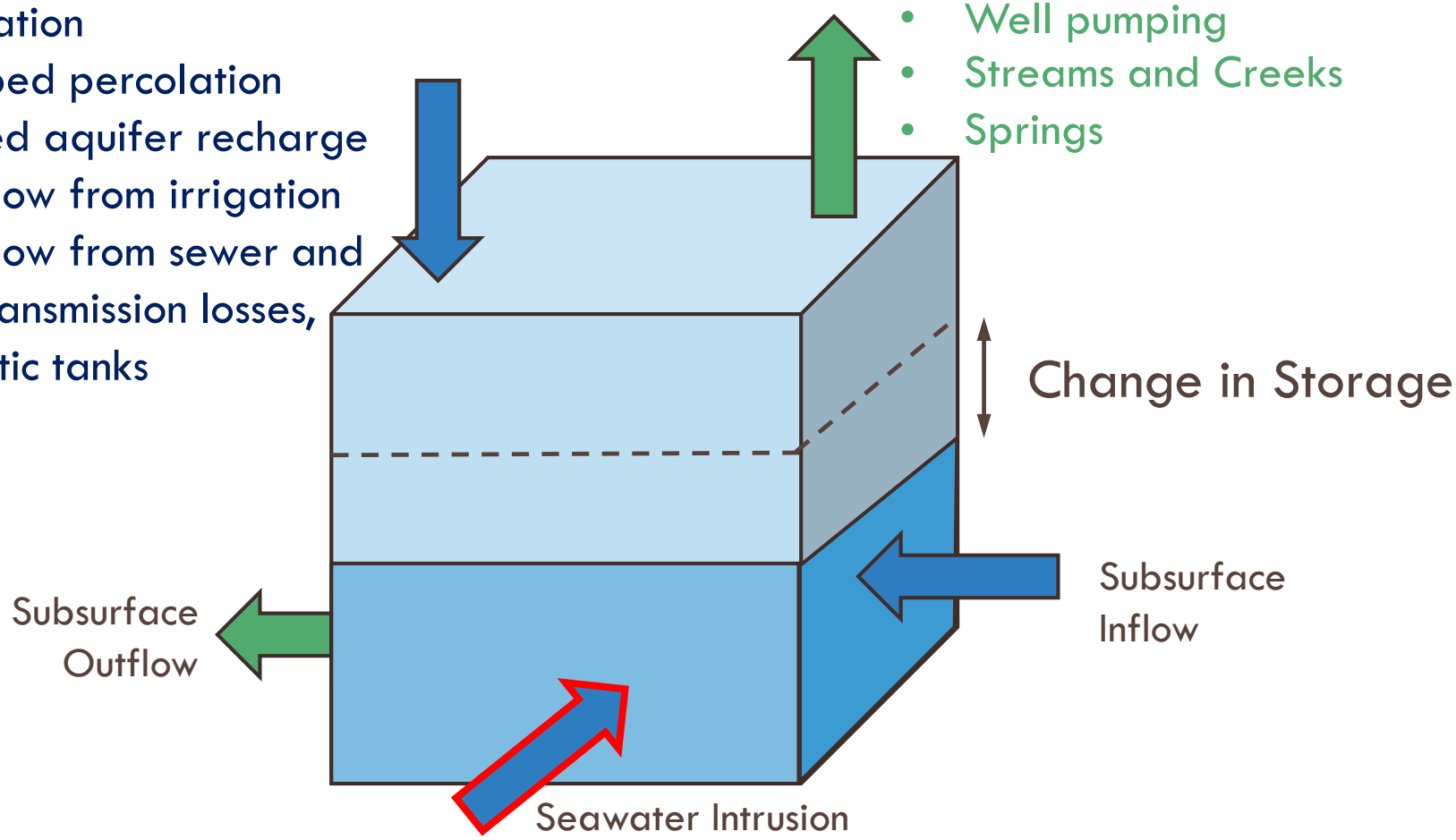
Inflow – Outflow = Change in Storage

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)

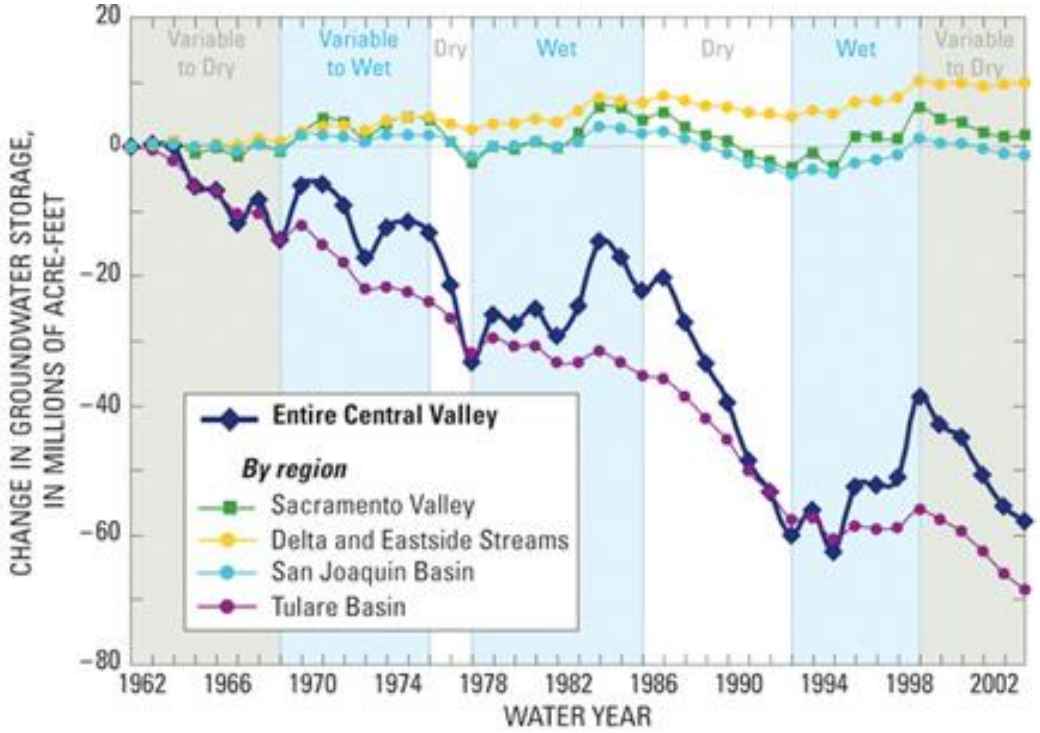
- Evapotranspiration
- Well pumping
- Streams and Creeks
- Springs



Difficult and complex to estimate all of these items accurately

Overdraft

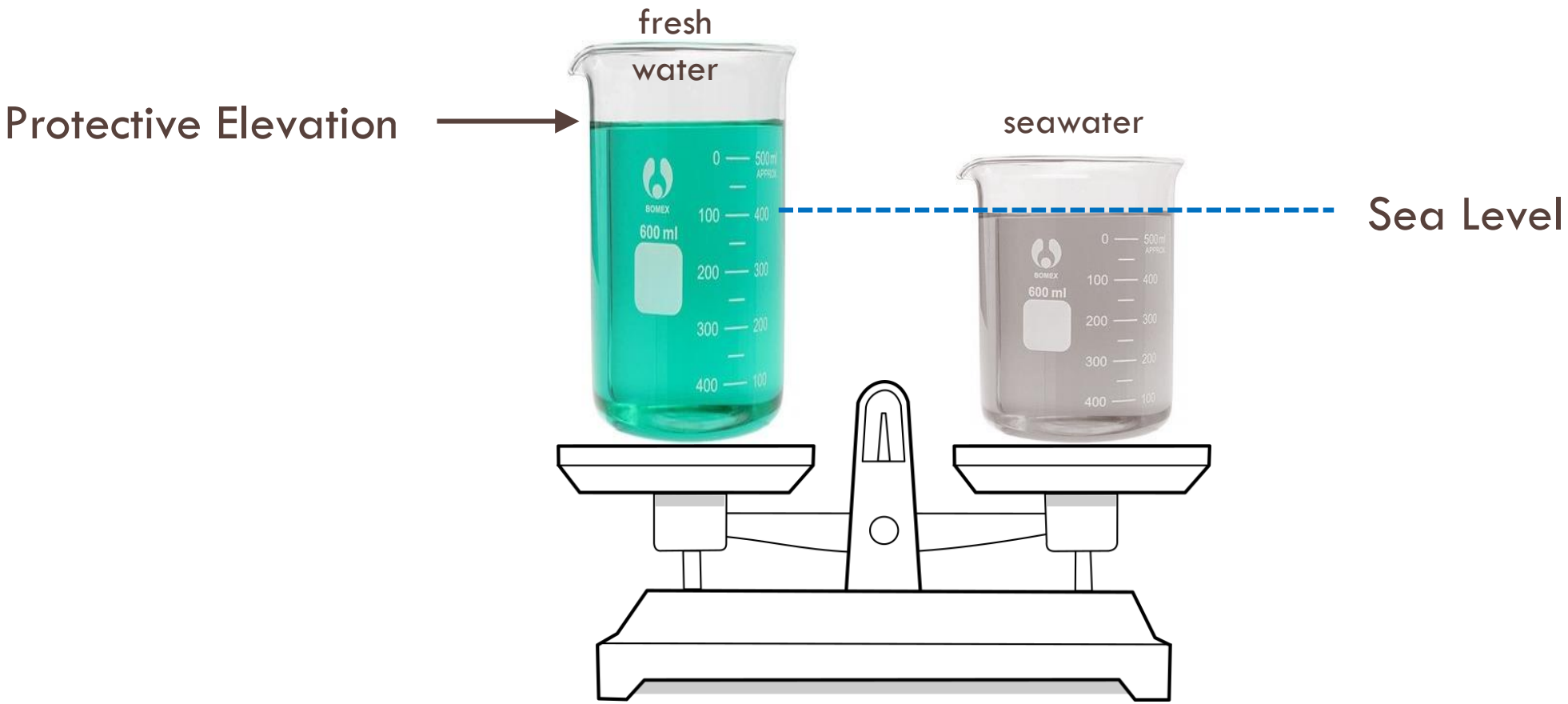
- Overdraft is the persistent loss of USABLE groundwater in storage
  - Usually accompanied by persistent lowering of groundwater elevations
  - In the Santa Cruz Mid-County Basin, lowered groundwater elevations due to overdraft are masked by seawater intrusion. Simply maintaining groundwater elevations is NOT an indicator of no overdraft
- The State of California has declared the Santa Cruz Mid-County Basin as critically-overdrafted



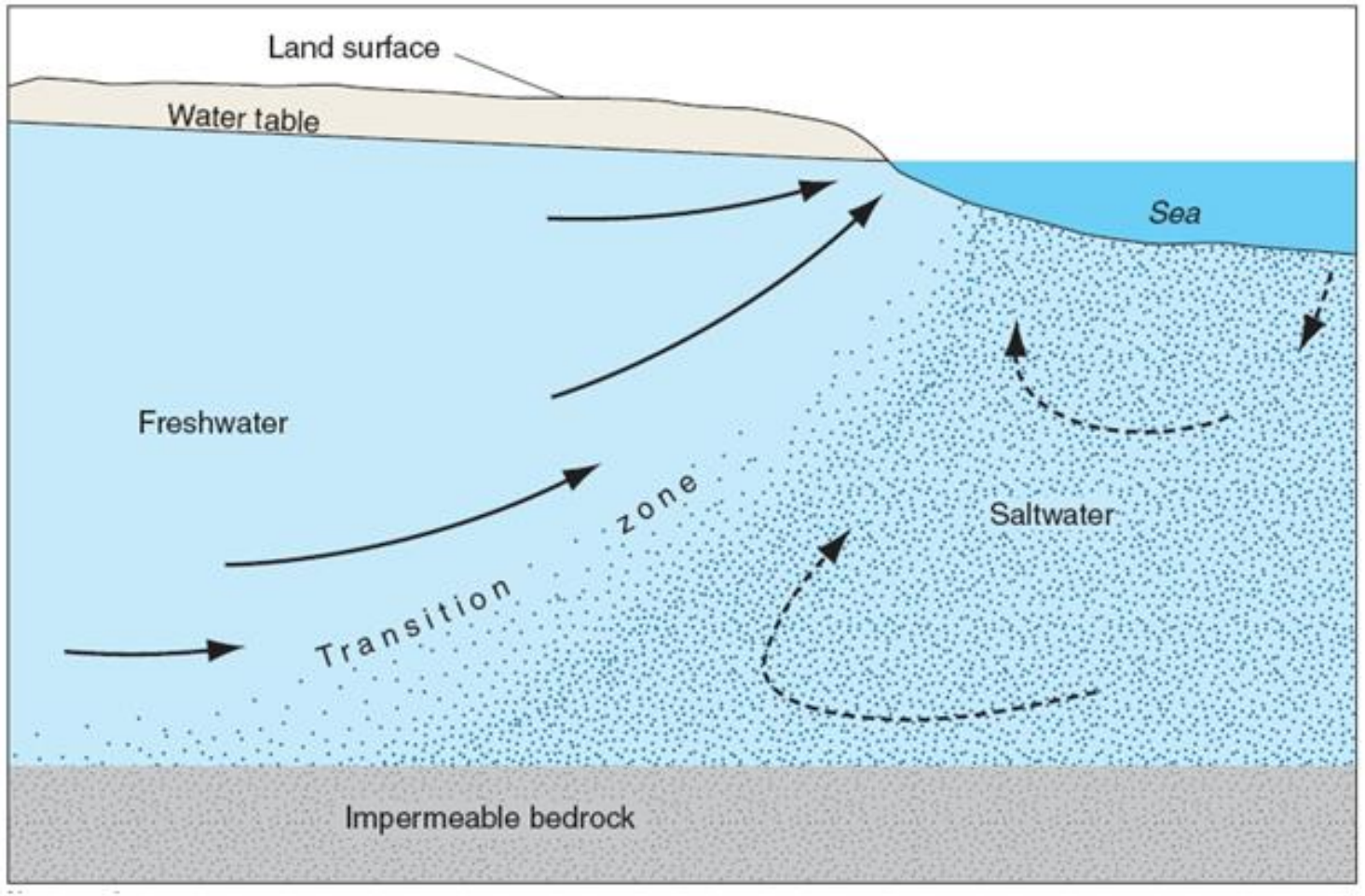
Advanced Topics

Seawater is Heavier than Fresh water

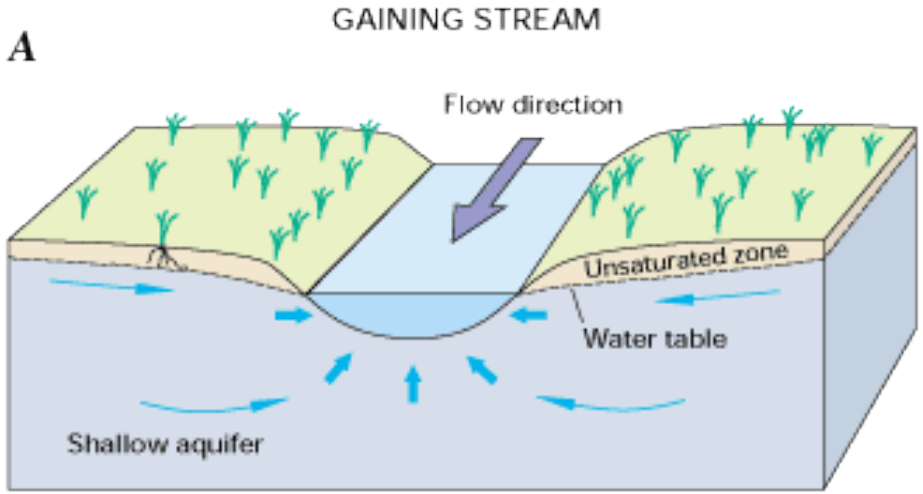
Higher Freshwater Elevation Needed to Balance Seawater

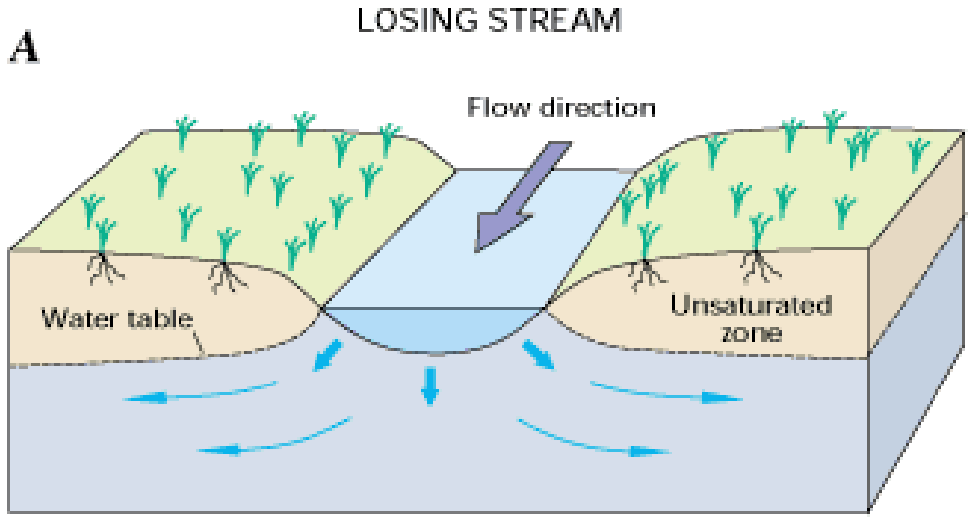


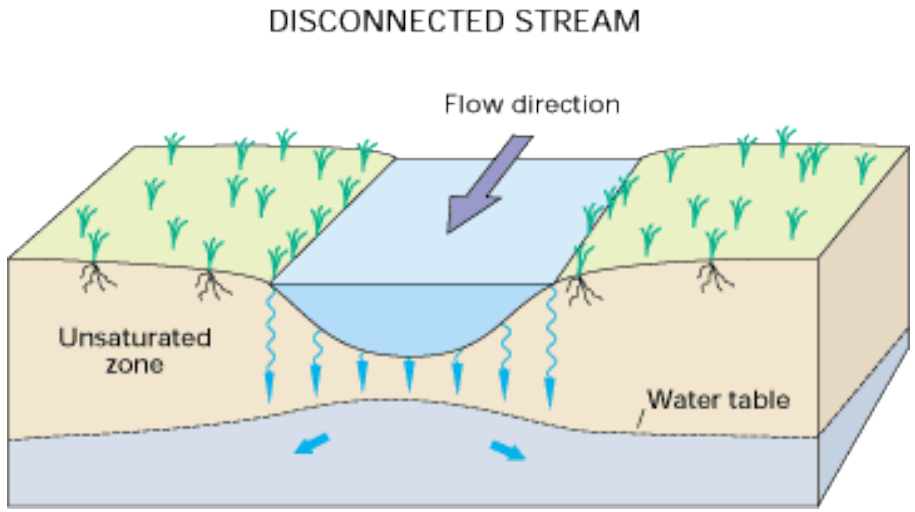
Freshwater Outflow Necessary to Prevent Seawater Intrusion



Groundwater / Surface Water Interactions







Managed Aquifer Recharge – Water Types

Storm Runoff

River Water

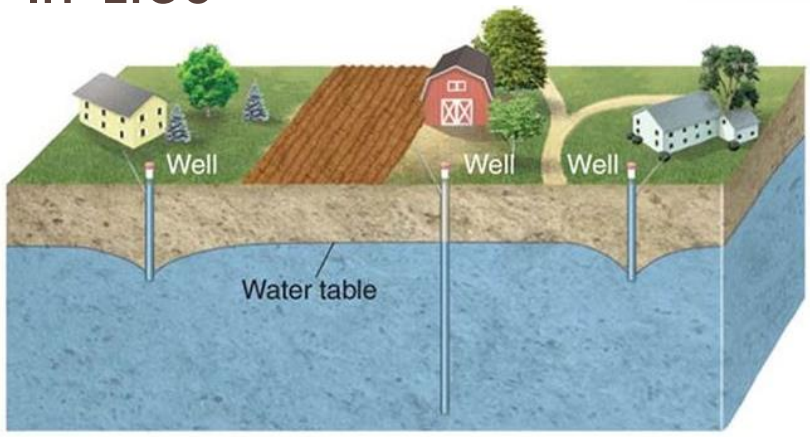
Desalinated Water

Very Highly Treated Water

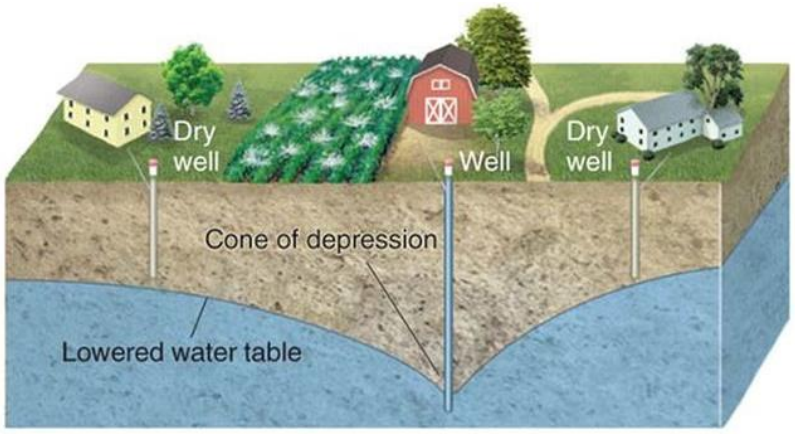
Managed Aquifer Recharge Methods

Percolation

In-Lieu



(a) Before heavy pumping



(b) After heavy pumping

Injection (ASR)

Land Subsidence

- Mining groundwater beneath thick clay layers (e.g., many basins in CA)
- Drainage of organic soils (e.g., Sacramento-San Joaquin Delta)
- Unlikely a problem in the Mid-County Basin, but must be addressed

Questions

SANTA CRUZ MID-COUNTY GROUNDWATER AGENCY

SGMA 101

SGMA 101 Outline

- SGMA History
- What is SGMA?
- Who does SGMA Apply To?
- Groundwater Sustainability Plans

Groundwater Management History

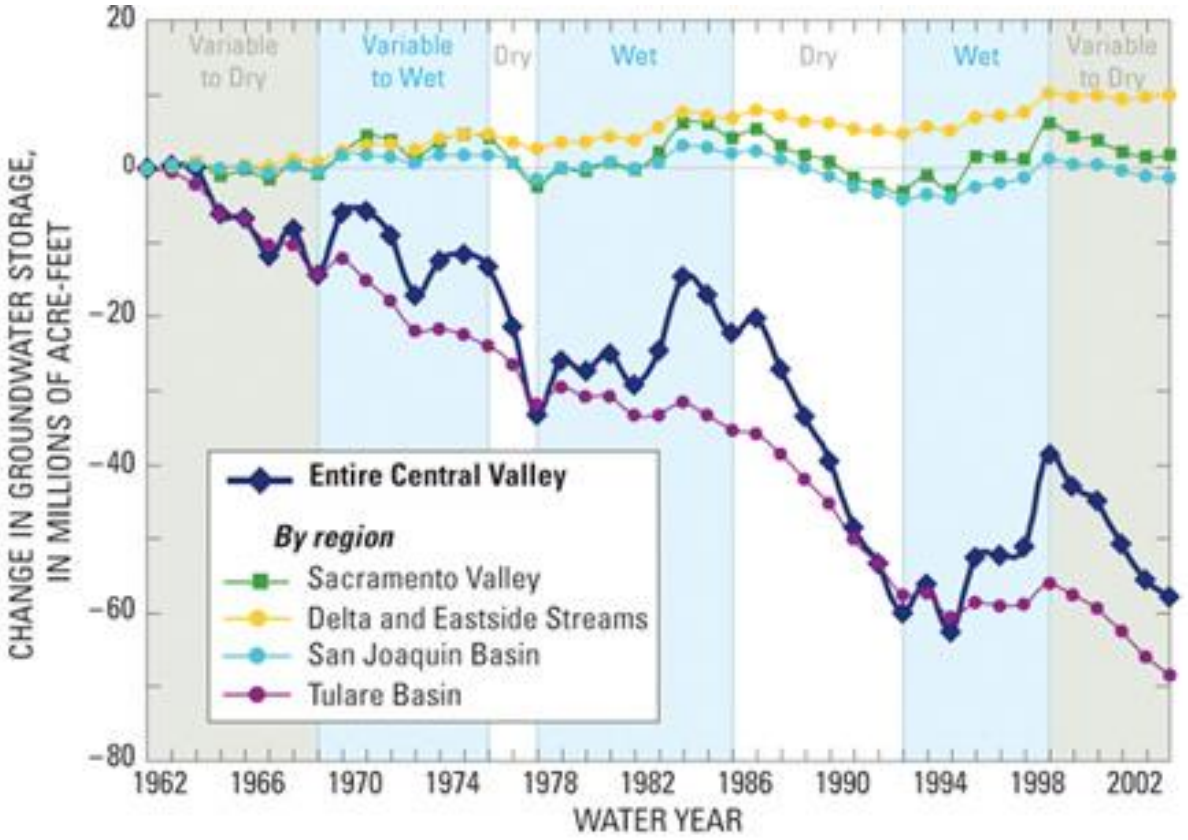
- State Water Resources Control Board
  - Managed surface water use since 1914
  - Very limited authority to manage groundwater use
  - Results in two separate water management systems

- Groundwater in California historically managed by:
  - Groundwater Management Plans (AB3030/SB1938)
  - Adjudications (Seaside Basin)
  - Special districts (PVWMA)
  - Potential County police authority

AB3030/SB1938 Groundwater Management Plans

A Good Start at Local Groundwater Management, but…

- Voluntary
- Local agencies lack some authorities for strong oversight
- No state oversight of progress
- Limited definition of what constitutes acceptable groundwater management



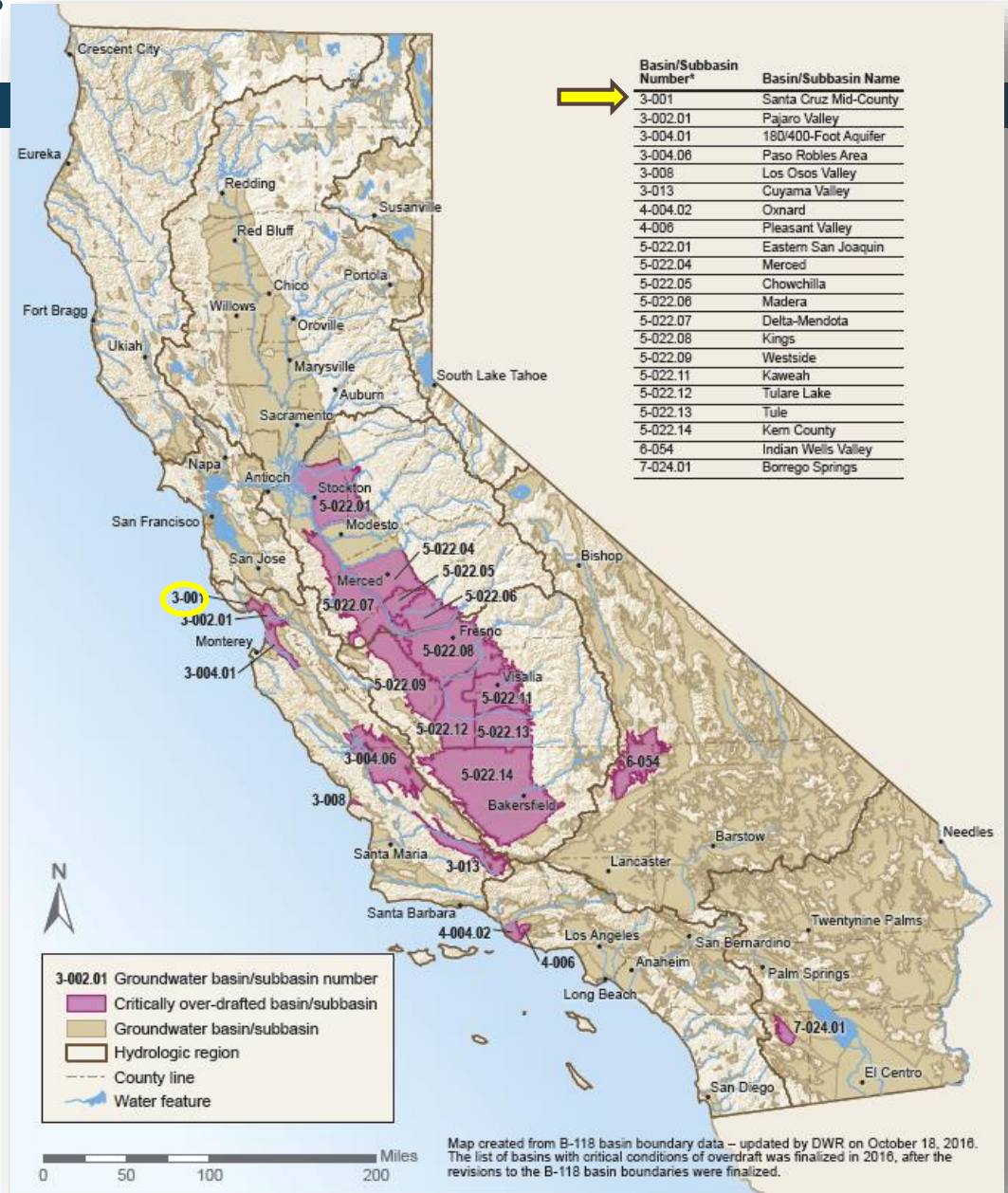
The Sustainable Groundwater Management Act (SGMA) Passed in September 2014

A compromise between one faction wanting State regulation of groundwater rights, and one faction insisting on local management.

- Locally driven
  - Groundwater is best managed locally, but this comes with responsibilities
  - Local definition of what constitutes sustainability
  - Locally agreed to plans for achieving sustainability
- State backstop
  - State can temporarily take over groundwater management if a basin fails to meet certain requirement or milestones in SGMA

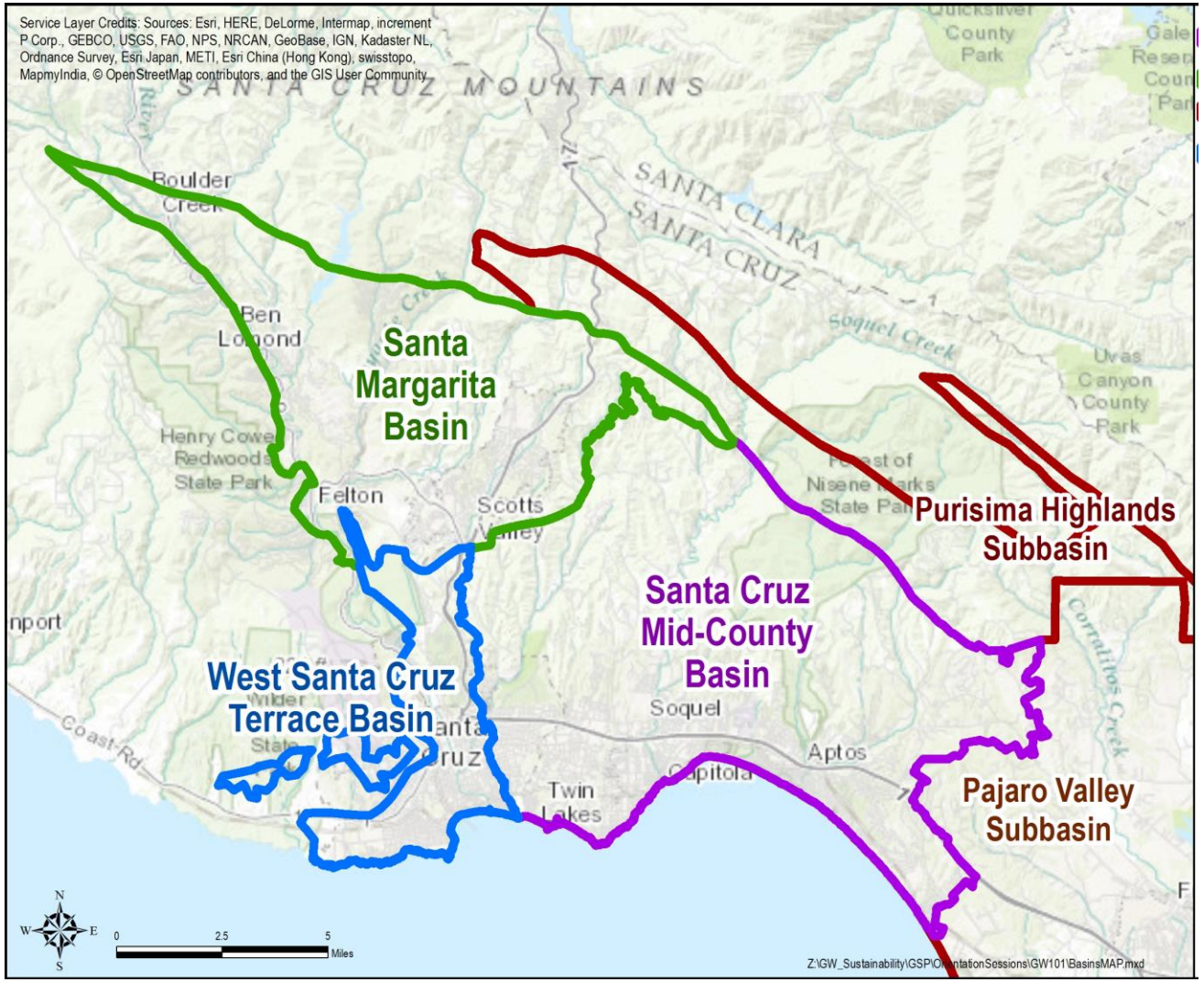
Who Does SGMA Apply To?

- There are 515 groundwater basins in the State
- SGMA applies to the 127 “high and medium priority” basins
- 21 basins are critically-overdrafted
  - Santa Cruz Mid-County
  - Pajaro Valley
  - Part of Salinas Valley



Basin/Subbasin Number*	Basin/Subbasin Name
3-001	Santa Cruz Mid-County
3-002.01	Pajaro Valley
3-004.01	180/400-Foot Aquifer
3-004.06	Paso Robles Area
3-008	Los Osos Valley
3-013	Cuyama Valley
4-004.02	Oxnard
4-006	Pleasant Valley
5-022.01	Eastern San Joaquin
5-022.04	Merced
5-022.05	Chowchilla
5-022.06	Madera
5-022.07	Delta-Mendota
5-022.08	Kings
5-022.09	Westside
5-022.11	Kaweah
5-022.12	Tulare Lake
5-022.13	Tule
5-022.14	Kern County
6-054	Indian Wells Valley
7-024.01	Borrego Springs

Local Basins



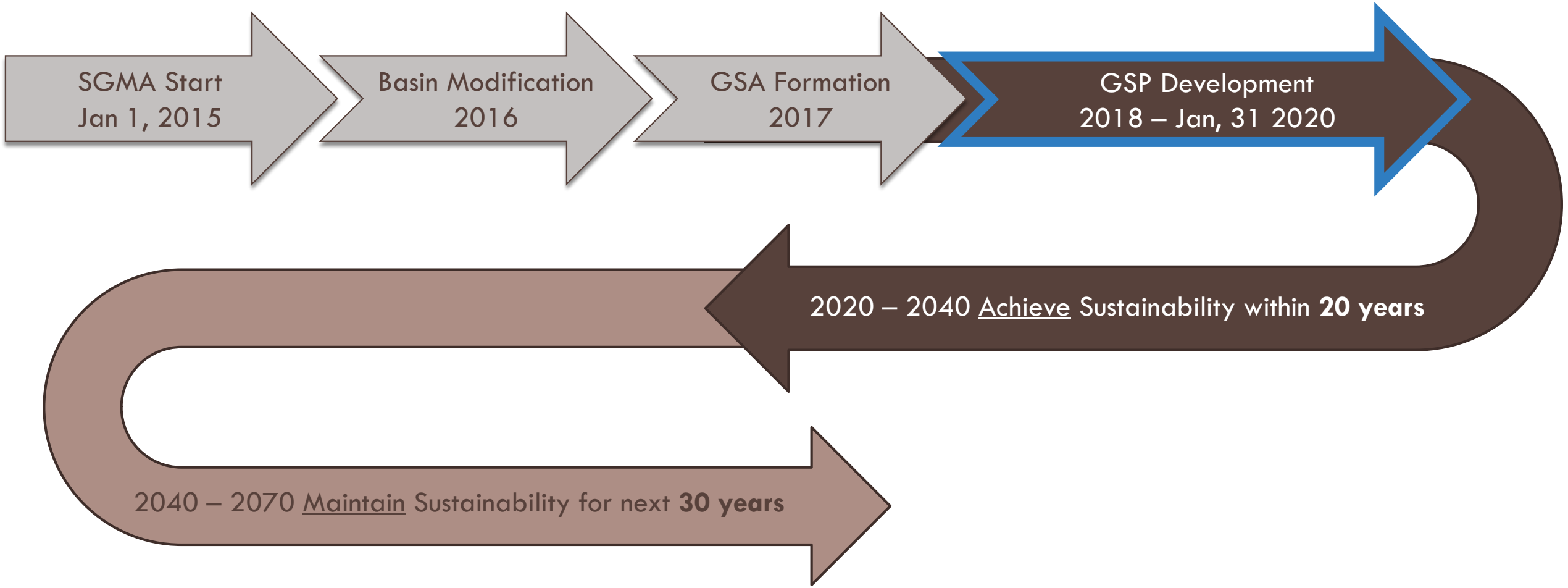
SGMA is Implemented by New Agencies

- Groundwater Sustainability Agencies (GSA)
- GSAs are locally defined, but must comprise existing public agencies with water or land use authority
  - City of Santa Cruz
  - County of Santa Cruz
  - Soquel Creek Water District
  - Central Water District
  - Potentially others
- GSAs must take public input, and acknowledge the needs of all the "beneficial uses and users" of groundwater

GSAs Get New Authorities

- Raise funds
  - Regulatory fees
  - Taxes on land, pumping, etc.
- Register wells
- Require pumping be measured and reported
- Control well spacing
- Regulate pumping amounts
- Buy, trade, or sell water
- Do whatever "necessary and proper" to carry out SGMA's purposes

SGMA Timeline



Groundwater Sustainability Plans (GSP)

- SGMA requires critically-overdrafted high and medium priority basins to be managed under a GSP by **January 31, 2020**
- DWR Info on GSPs: http://www.water.ca.gov/groundwater/sgm/pdfs/GSP_Emergency_Regulations.pdf

What is Sustainability?

- All hinges on avoiding undesirable result

- SGMA Workshop in November will have more detail on sustainability criteria

GSP Ultimate Goal

According to the California Constitution, the waters of the State shall be , "… put to beneficial use to the fullest extent of which they are capable… in the interest of people and for the public welfare".

In other words

- Manage sustainably
- Avoid waste
- Promote the economy, society, and the environment

Questions

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