

Assessing Groundwater Availability in Hawai'i's Diverse Hydrogeologic Settings

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Groundwater Availability — a Definition

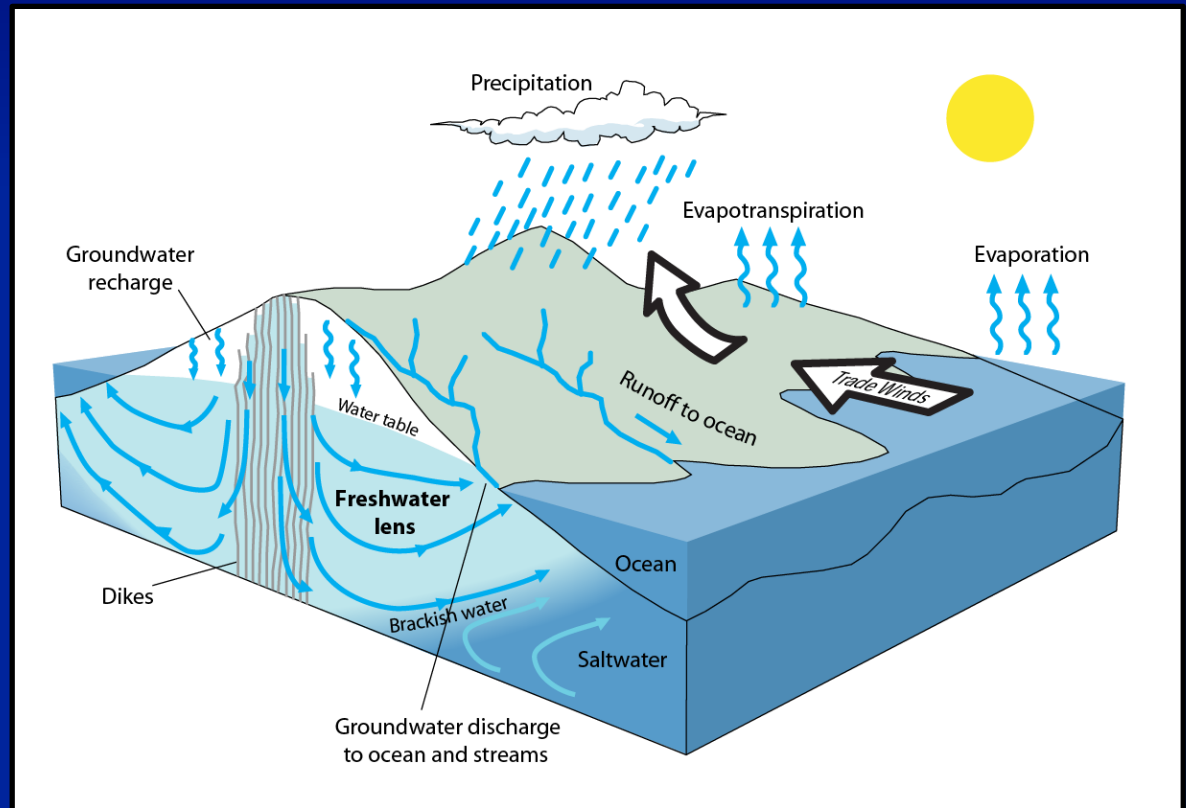


Availability of fresh
groundwater

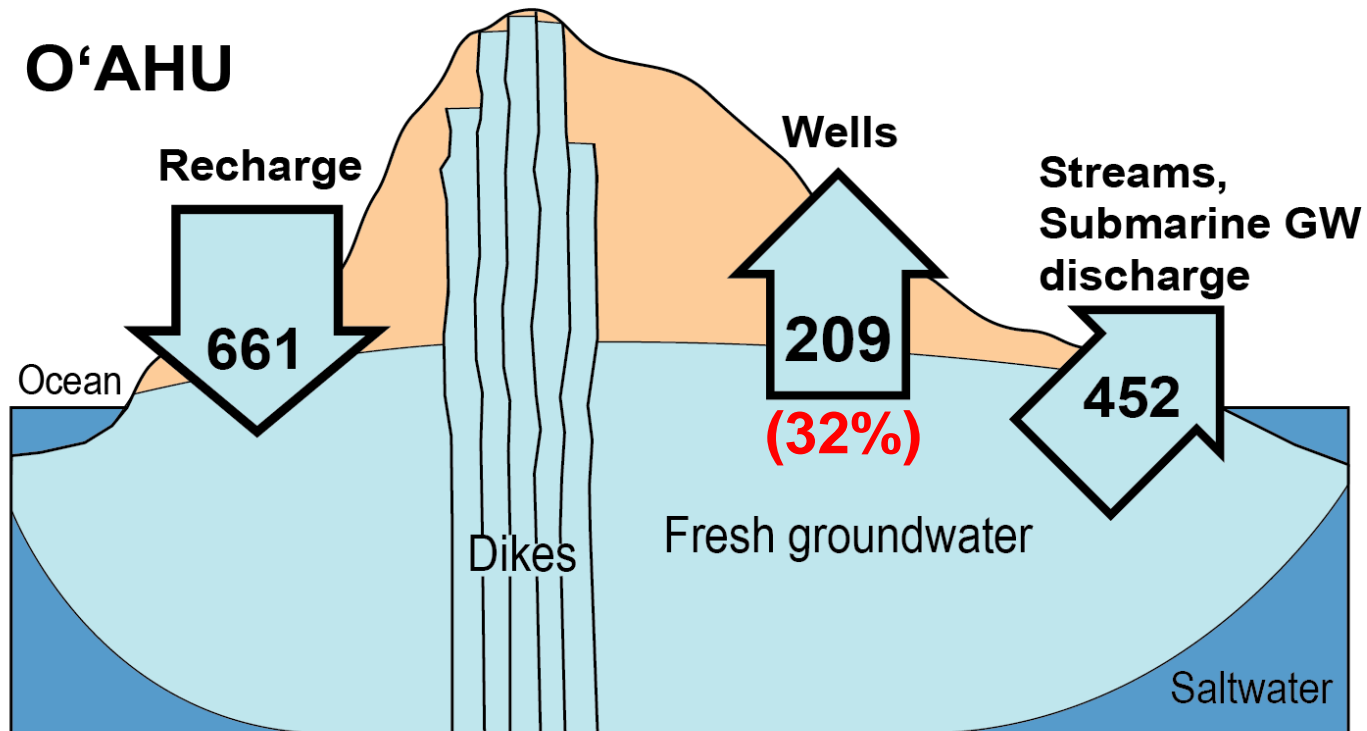
What Limits Groundwater Availability?

Quantity

Consequences

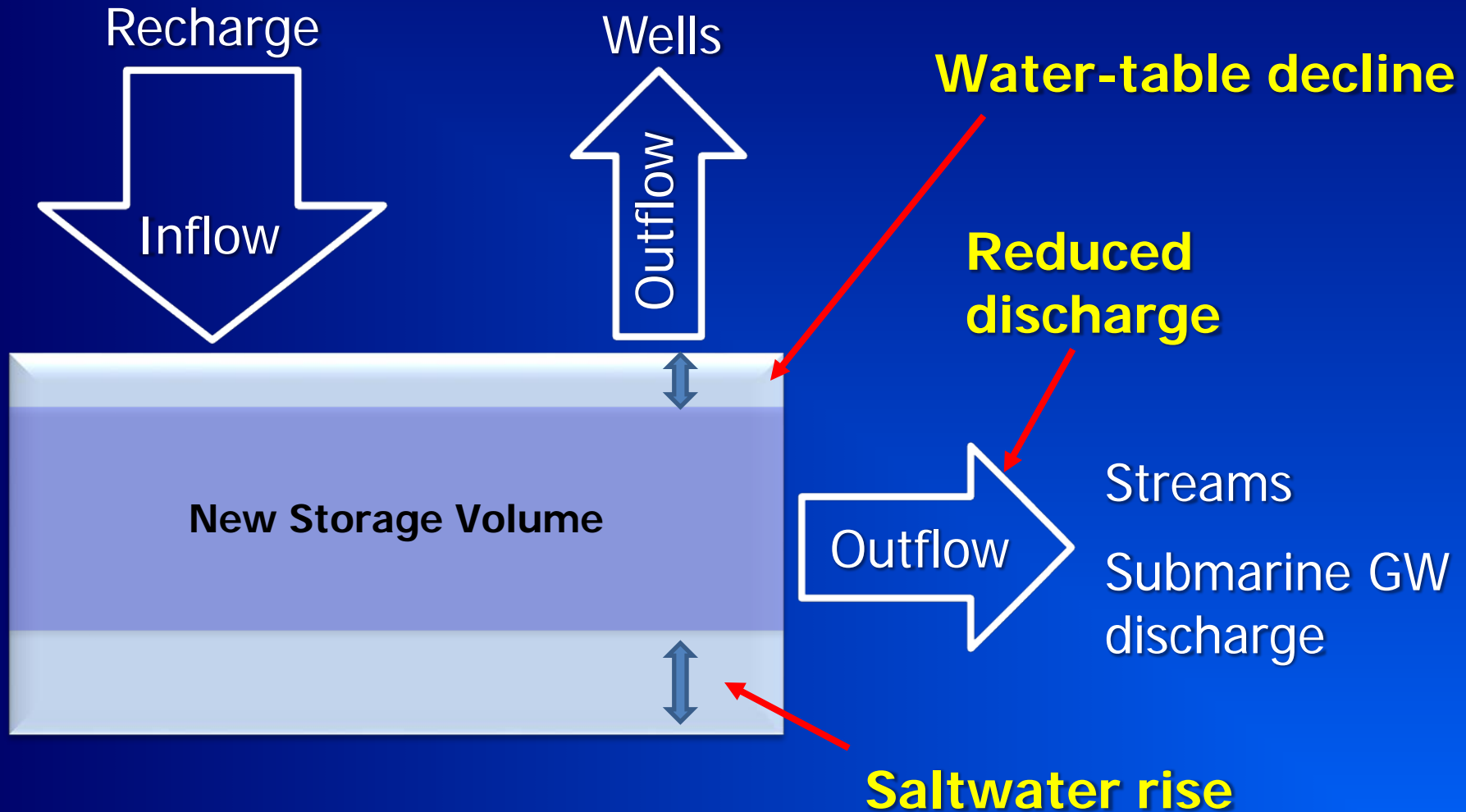


In Hawai'i, Pumping is Less Than Recharge



Water budget, in million gallons per day

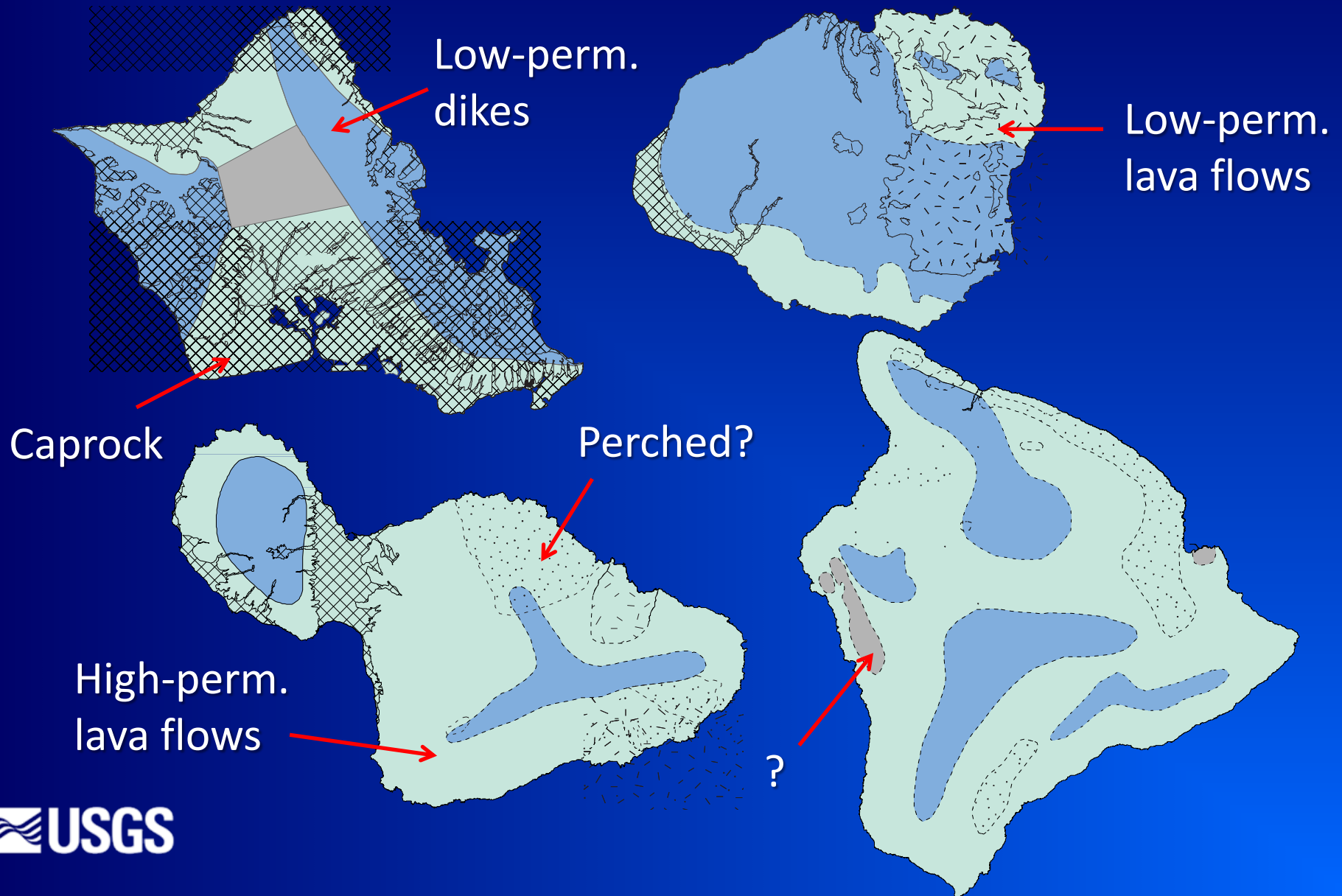
Consequences of Pumping



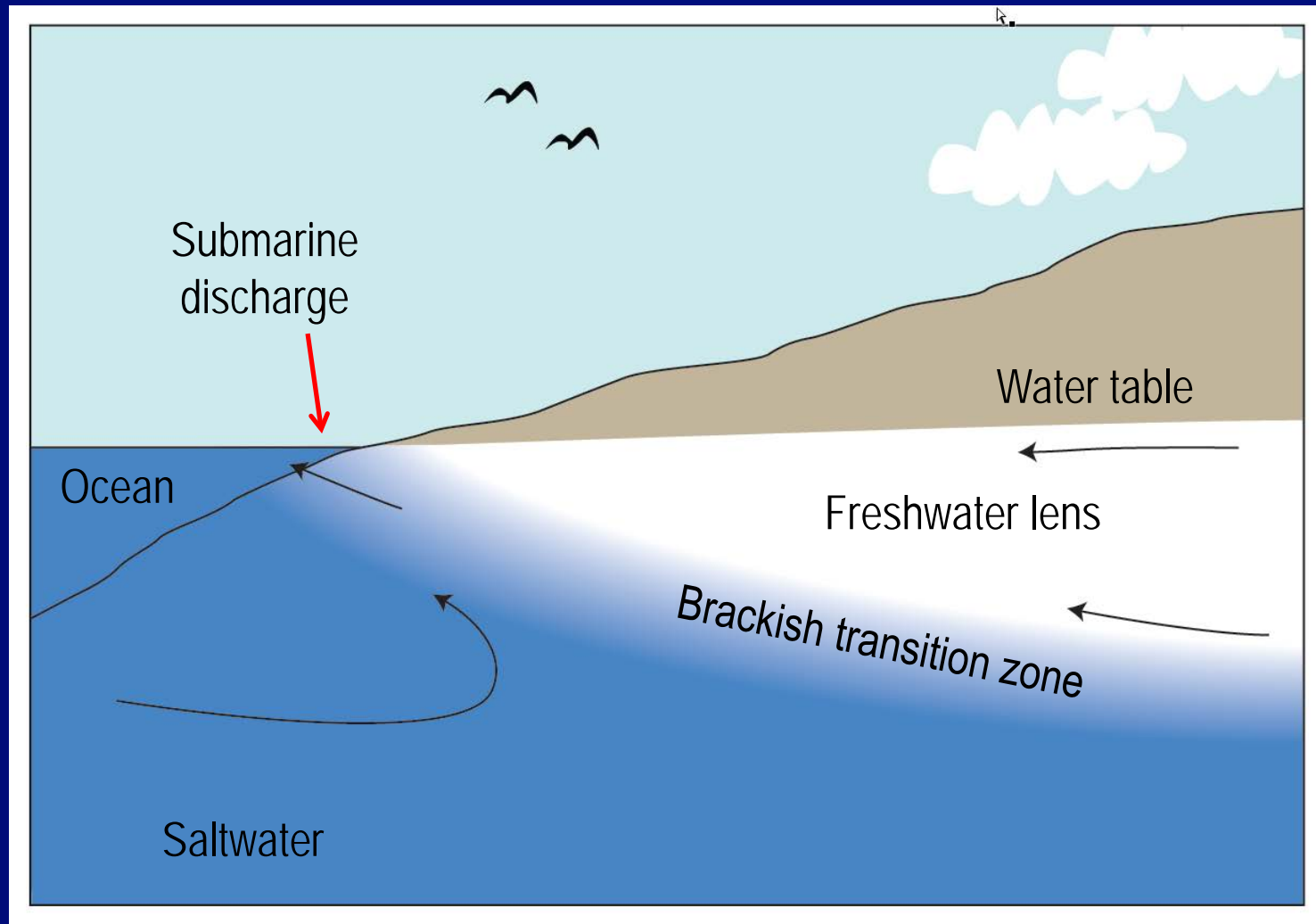
Consequences and Availability

- Any amount of groundwater withdrawal has consequences
- Availability of groundwater depends on what consequences are deemed acceptable
- Type and magnitude of the consequences depend on
 - How much water is withdrawn
 - Hydrogeologic setting

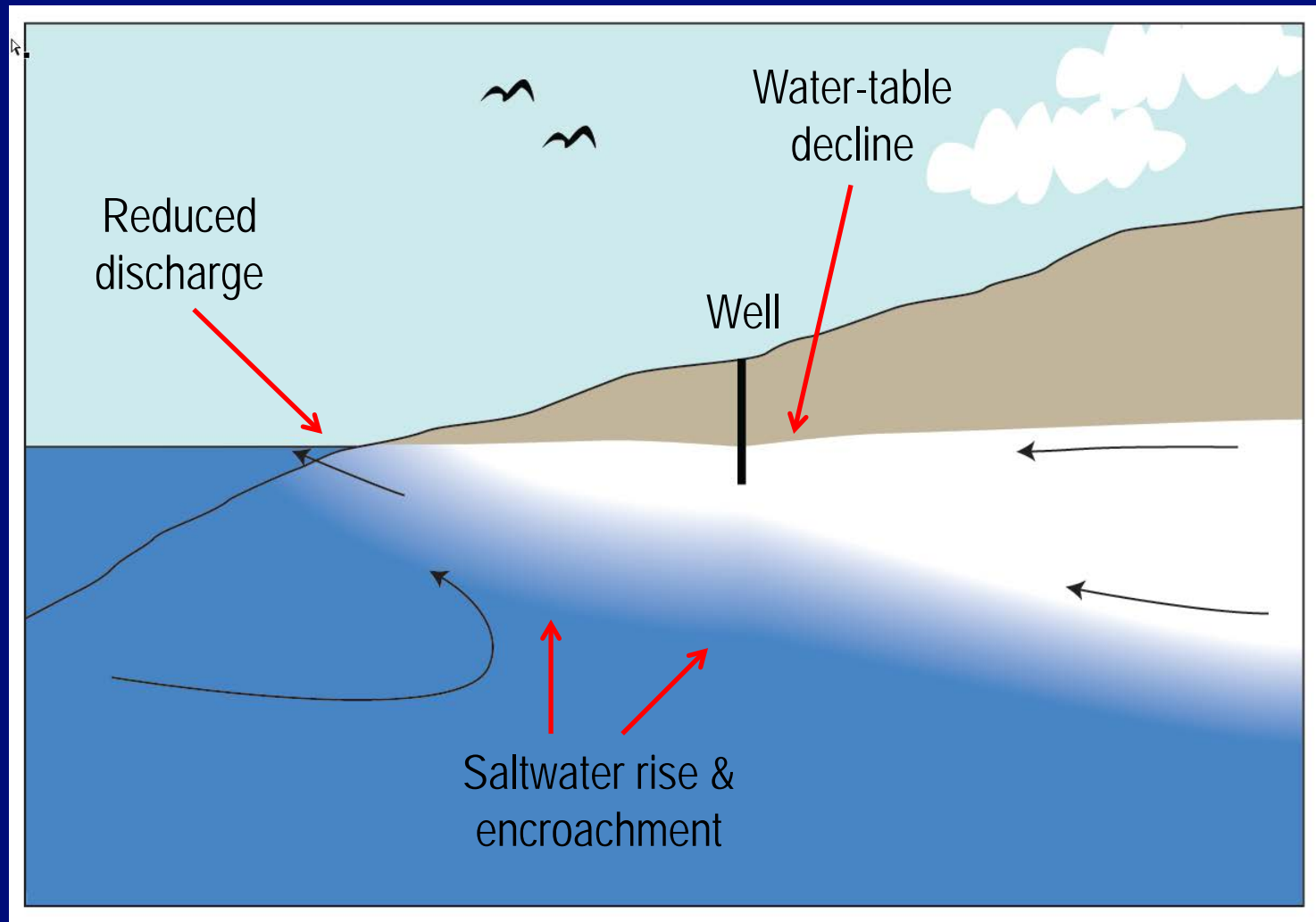
Hawai'i's Diverse Hydrogeologic Settings



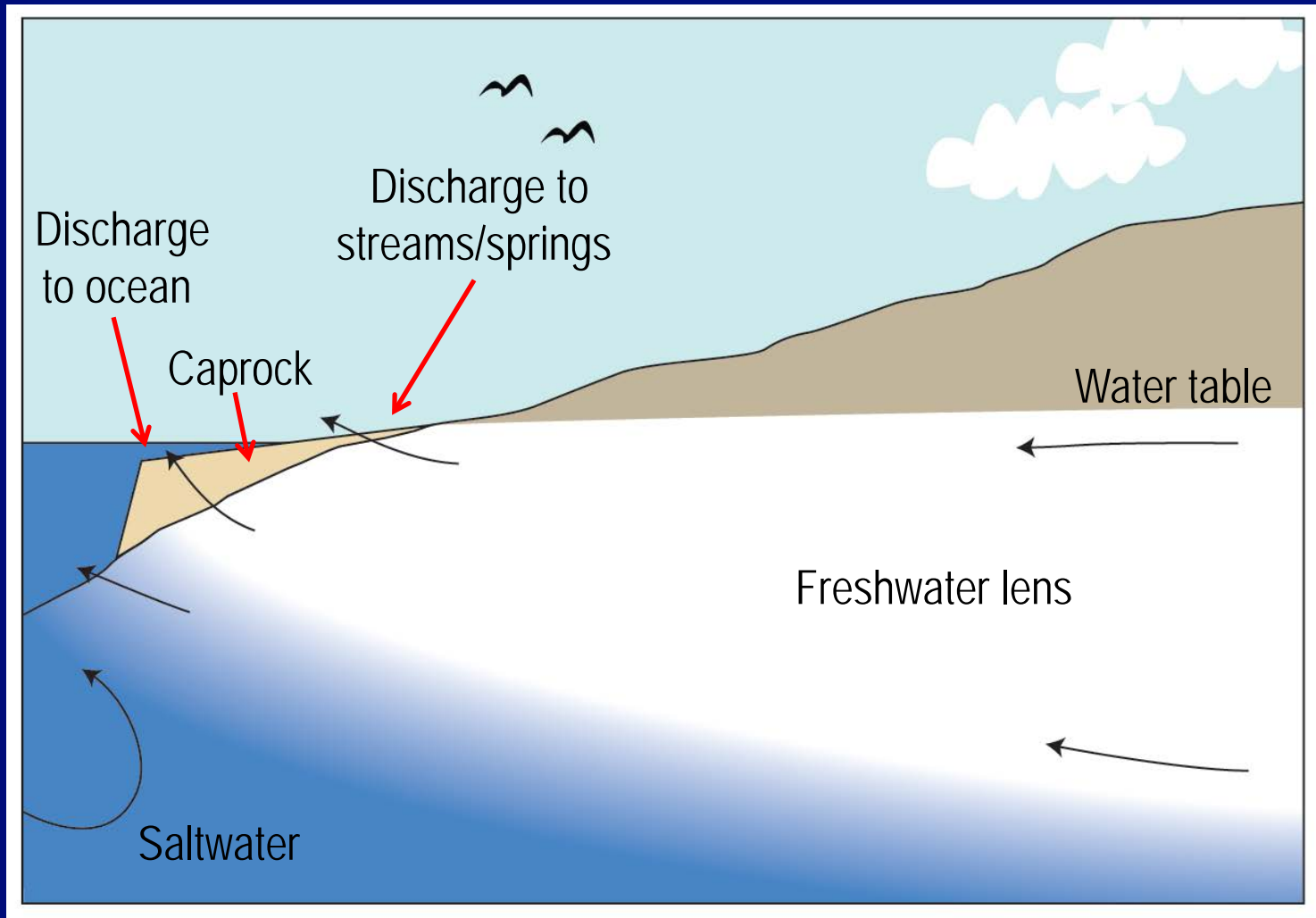
High-Permeability Lava Flows, no Caprock



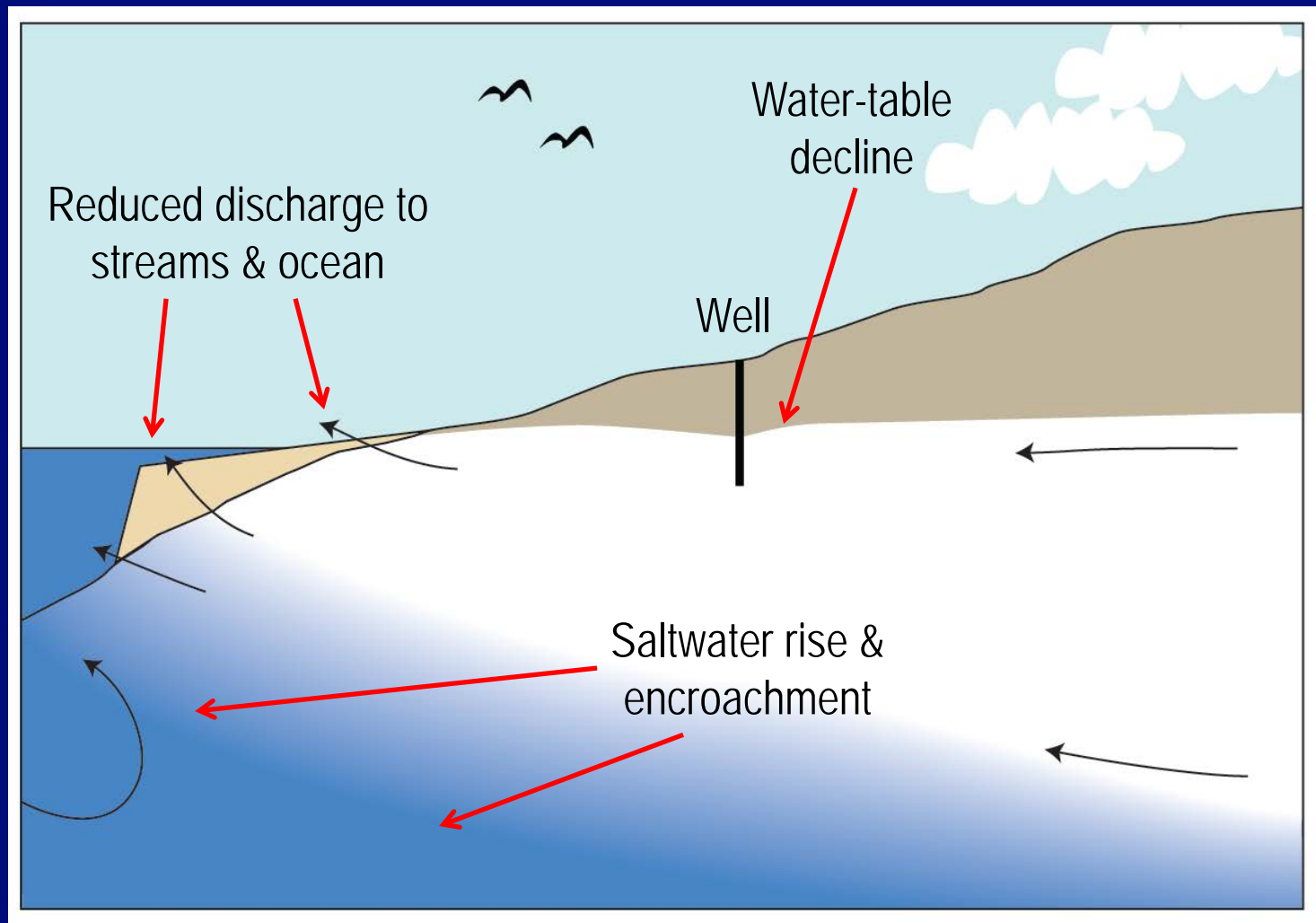
Pumping from Thin Freshwater Lens



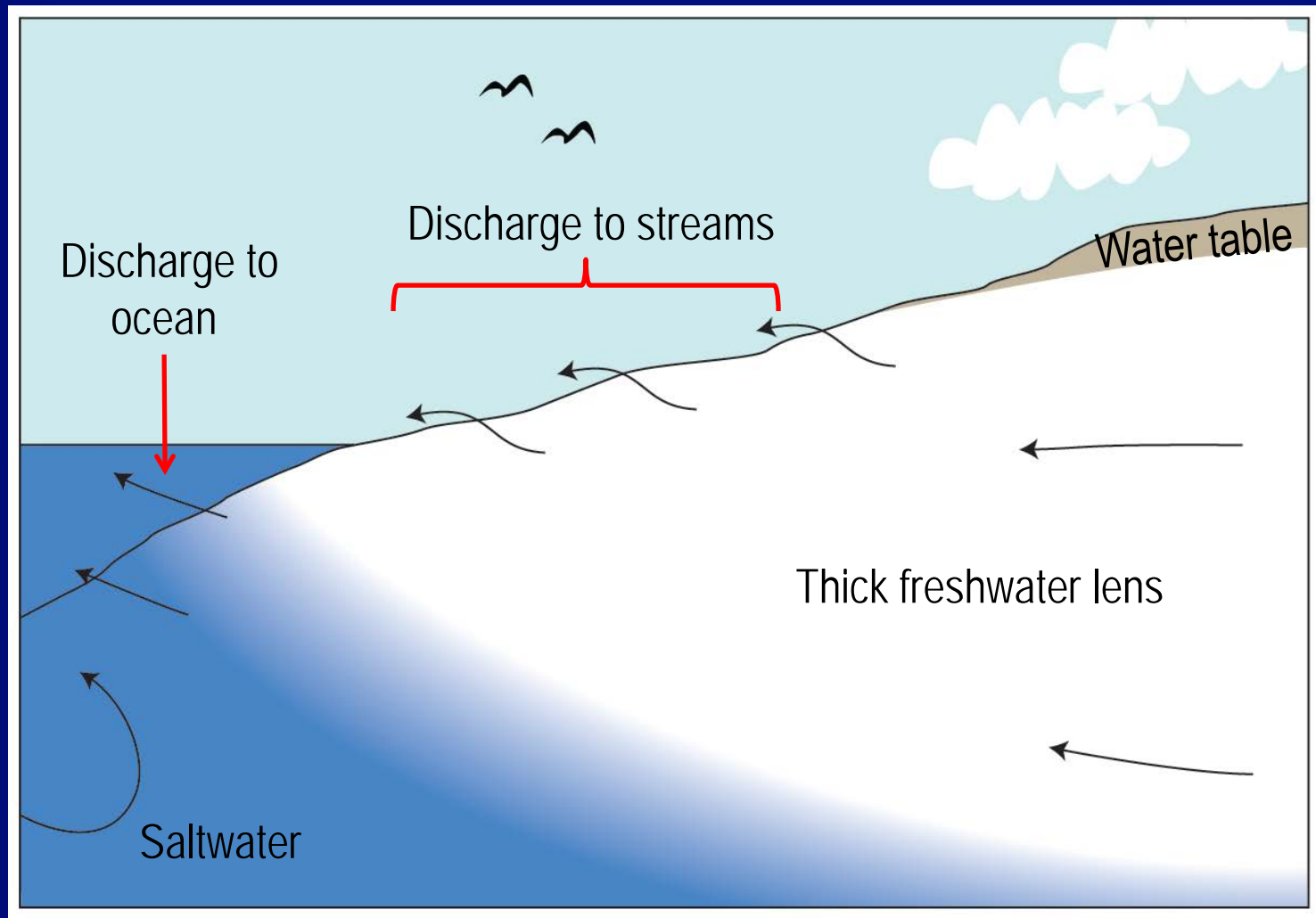
Freshwater Lens with Caprock



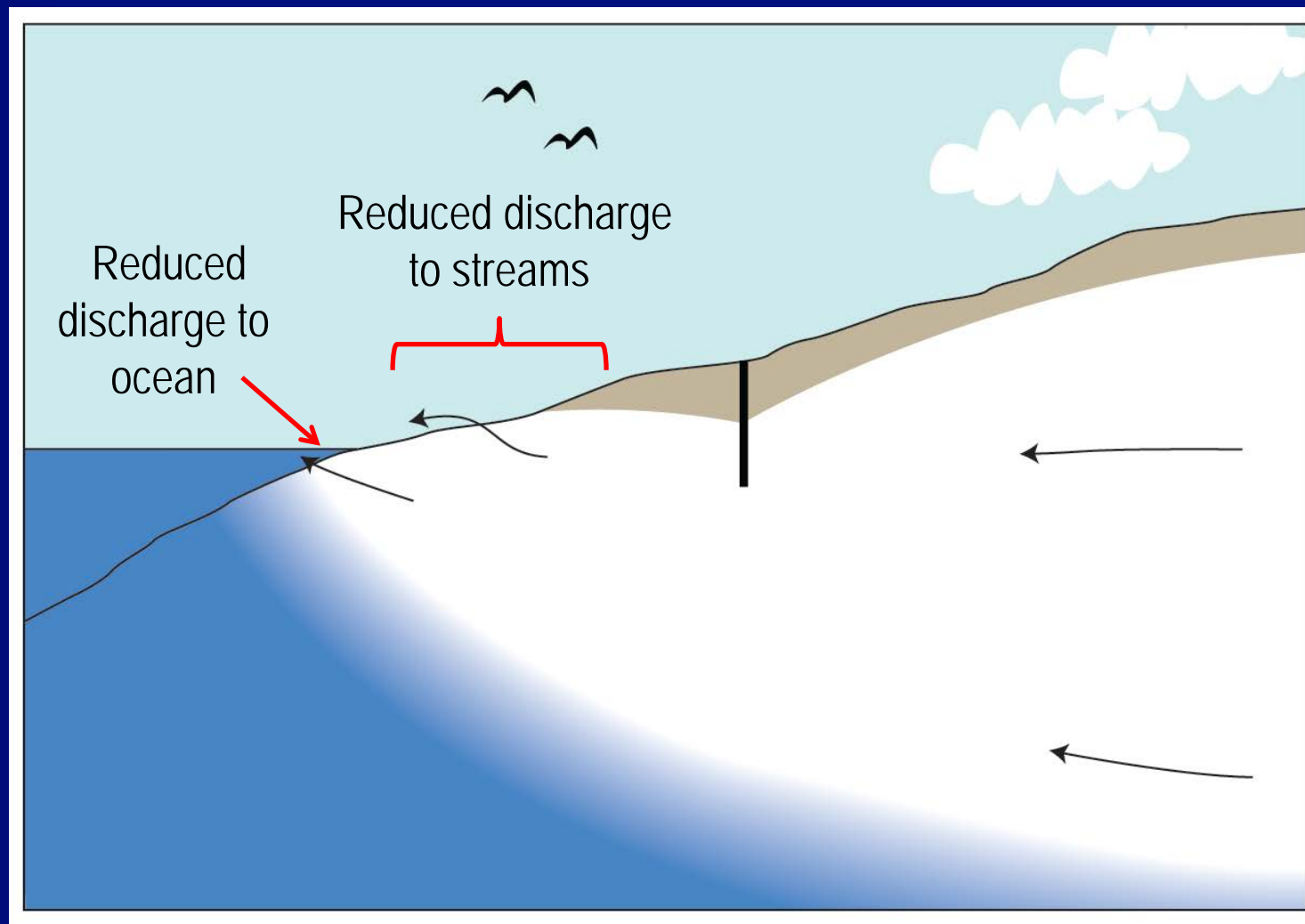
Pumping from Freshwater Lens with Caprock



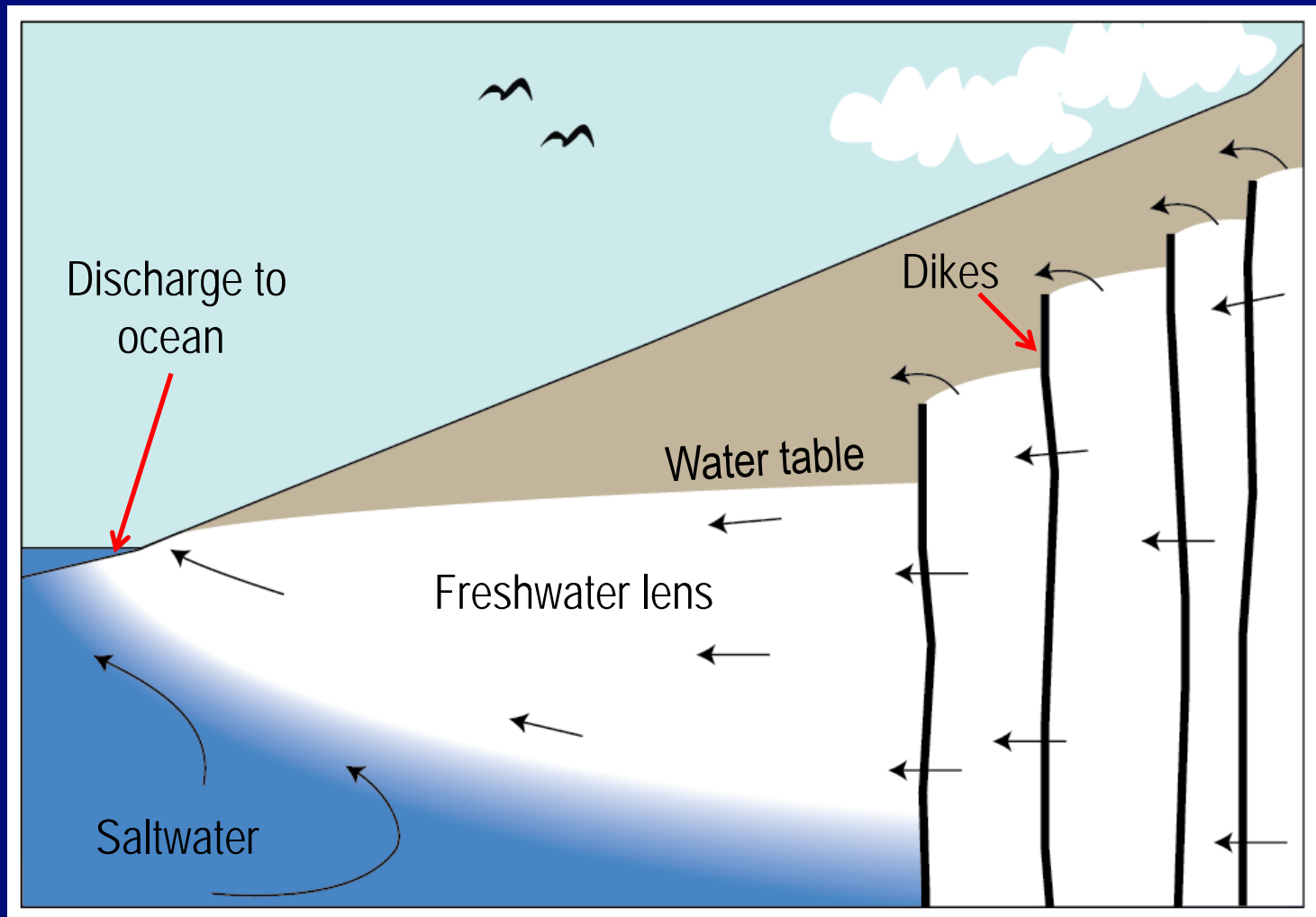
Freshwater Lens in Low-Permeability Aquifer



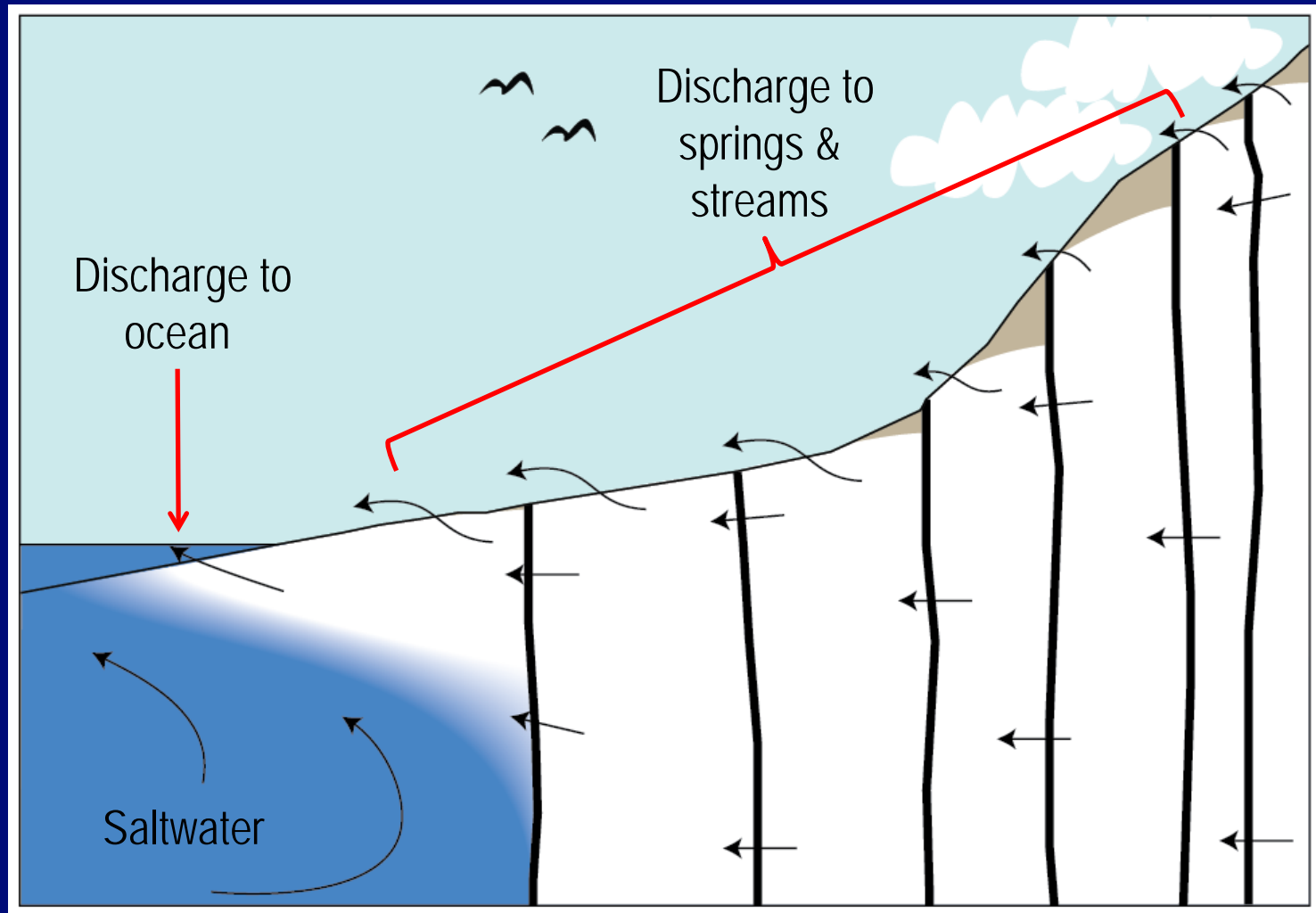
Pumping from Low-Permeability Aquifer



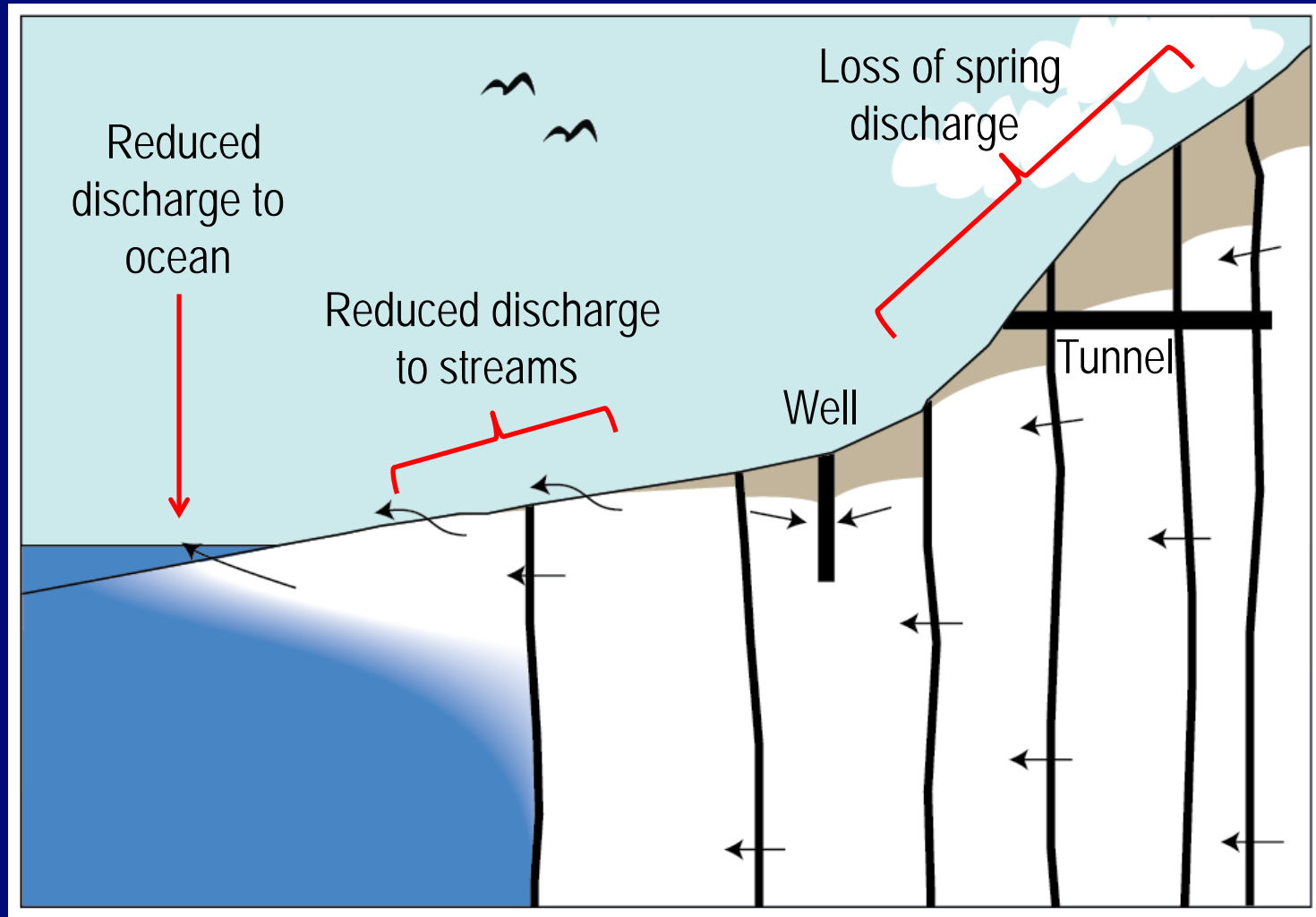
Dike-Impounded Groundwater



Dike-Impounded Groundwater



Withdrawing Dike-Impounded Groundwater



Approaches to Quantifying Consequences

GEOHYDROLOGY AND NUMERICAL SIMULATION OF THE GROUND-WATER FLOW SYSTEM OF MOLOKAI, HAWAII

By Delwyn S. Oki

U.S. GEOLOGICAL SURVEY
Water-Resources Investigations

Prepared in cooperation with
STATE OF HAWAII
DEPARTMENT OF HAWAIIAN AFFAIRS

U.S. Department of the Interior

Numerical Simulation of Ground-Water Withdrawals in the Southern Lihue Basin, Kauai, Hawaii

U.S. GEOLOGICAL SURVEY
Water-Resources Investigations

Prepared in cooperation with
COUNTY OF KAUAI DEPARTMENT OF PUBLIC WORKS



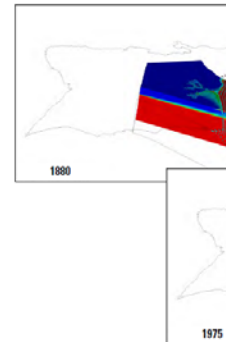
Reassessment of Ground-Water Recharge and Simulated Ground-Water Availability for the Hawi Area of North Kohala, Hawaii

U.S. Department of the Interior
U.S. Geological Survey
Water-Resources Investigations Report 02-4006



Prepared in cooperation with the Honolulu Board of Water Supply

Numerical Simulation of the Valley-Fill Barriers and the Effects of Withdrawals in the Pearl Harbor Area



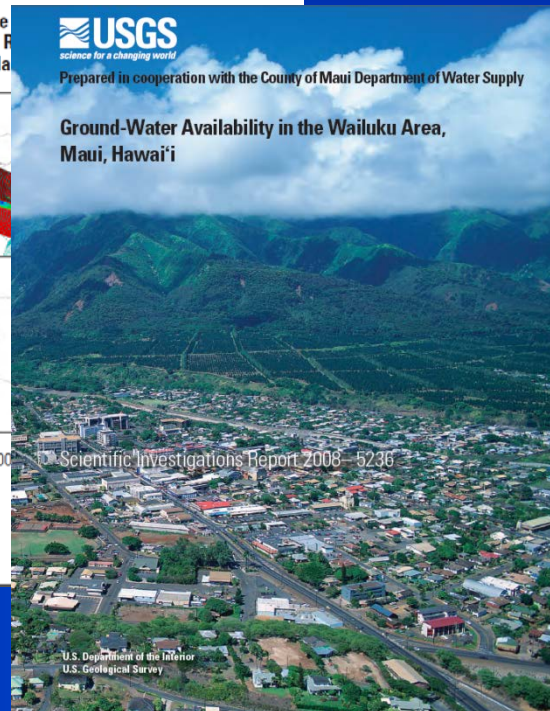
Scientific Investigations Report 2008-5236

U.S. Department of the Interior
U.S. Geological Survey



Prepared in cooperation with the County of Maui Department of Water Supply

Ground-Water Availability in the Wailuku Area, Maui, Hawai'i

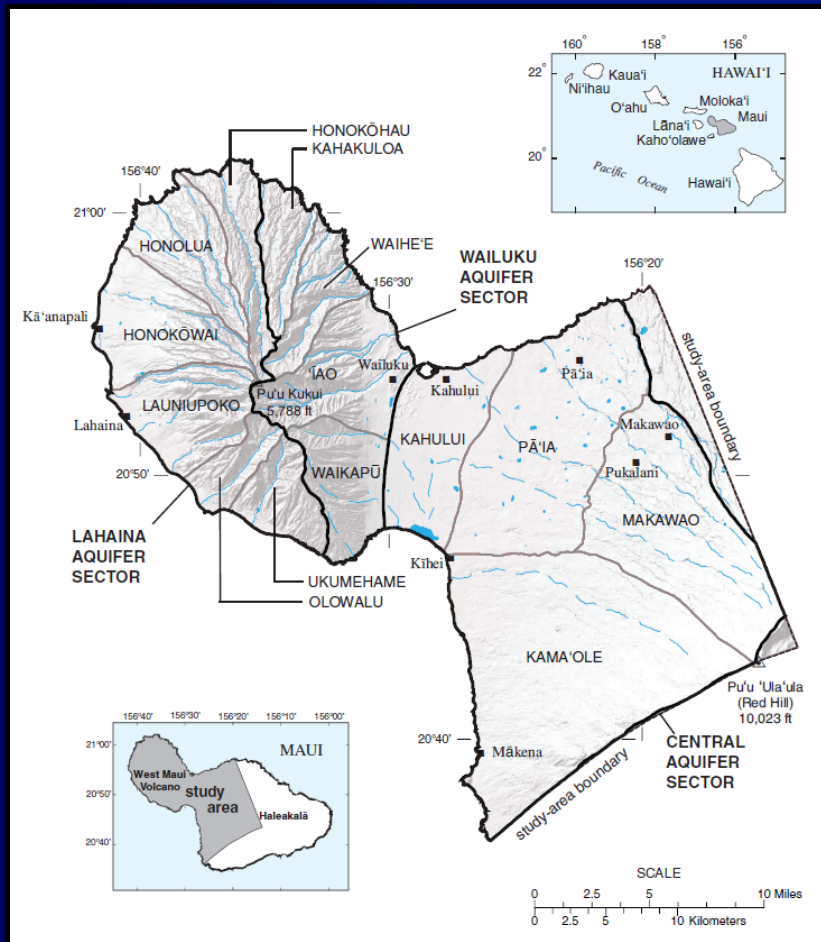


Scientific Investigations Report 2008-5236

U.S. Department of the Interior
U.S. Geological Survey

Wailuku, Maui—Freshwater Lens

(Gingerich, 2008, USGS SIR 2008-5236)



Acceptable Consequence

- Salinity 1% that of seawater or better

Approach

- Numerical groundwater model
- Solute-transport capable

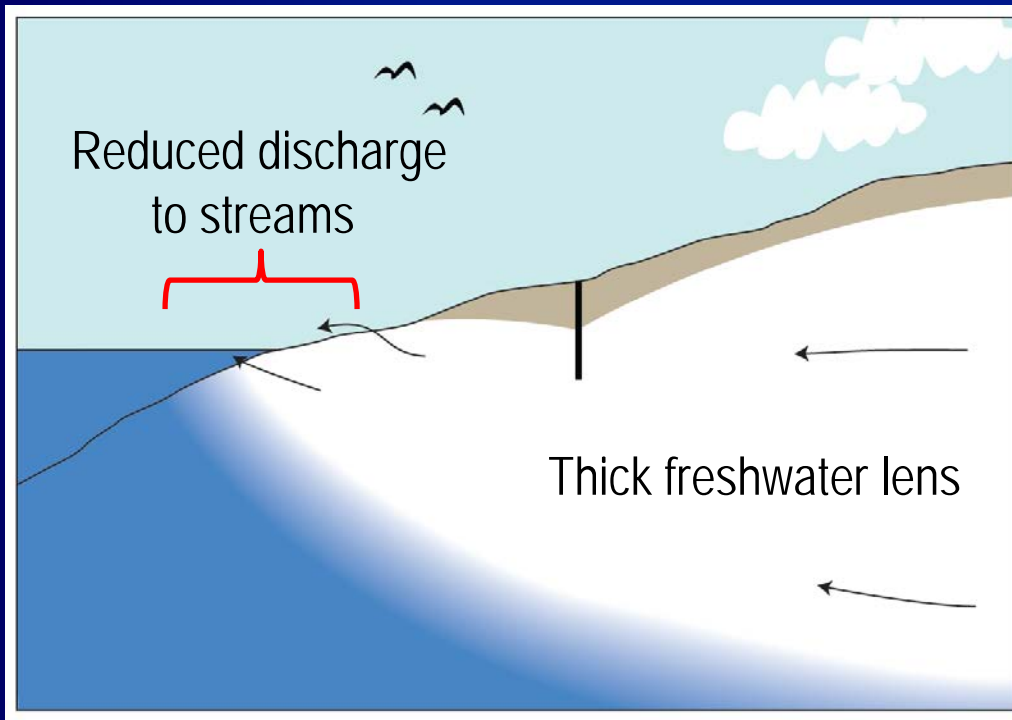
Wailuku, Maui—Freshwater Lens

(Gingerich, 2008, USGS SIR 2008-5236)

Pumping rate (Mgal/d)	Number of well fields	Percentage of yield meeting acceptable criterion
20.1	4	23%
27.1	14	89%

Līhu'e, Kaua'i—Thick Lens, Low Permeability

(Izuka and Oki, 2002, USGS WRI 01-4200)



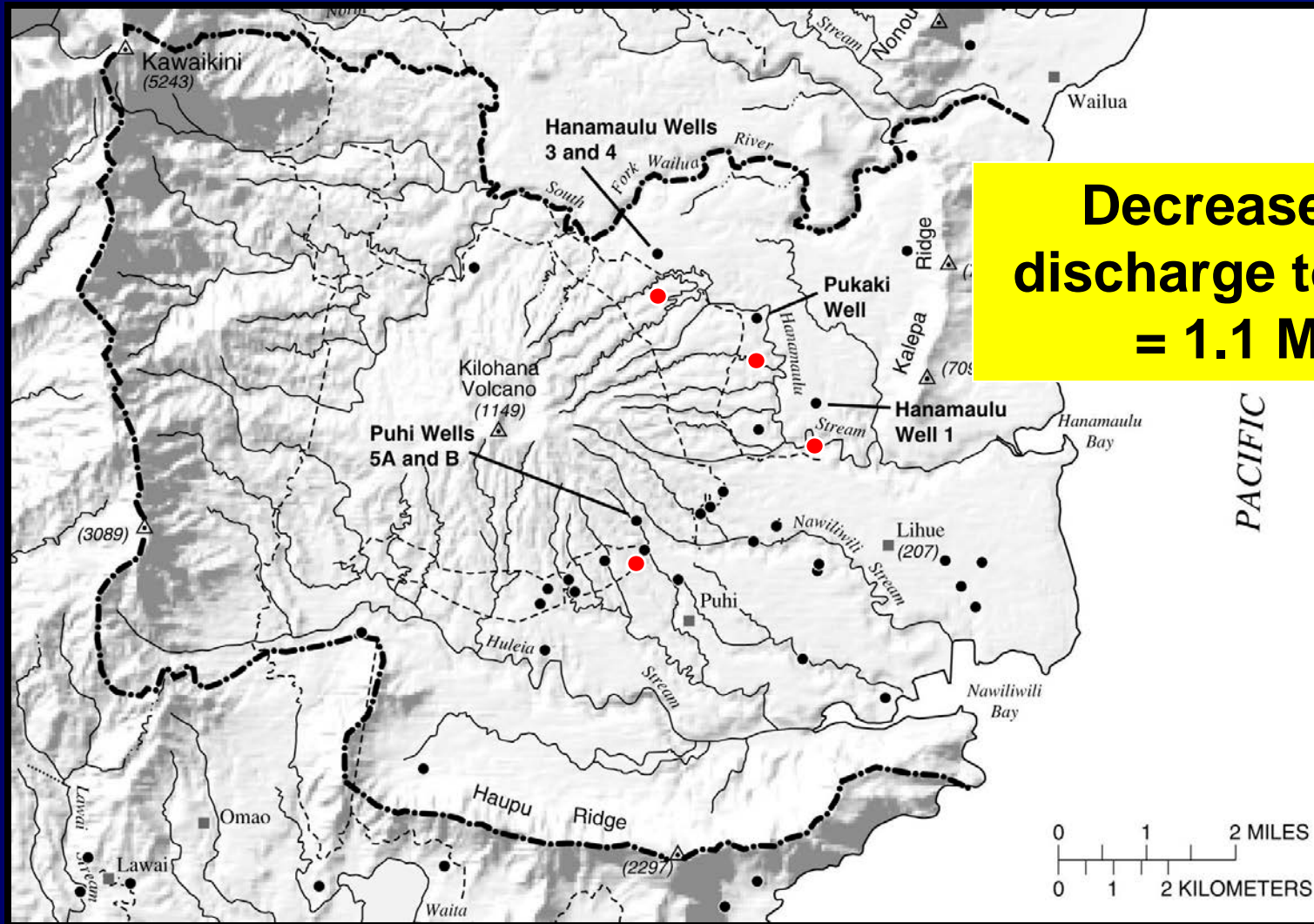
Acceptable Consequence

- Not specified

Approach

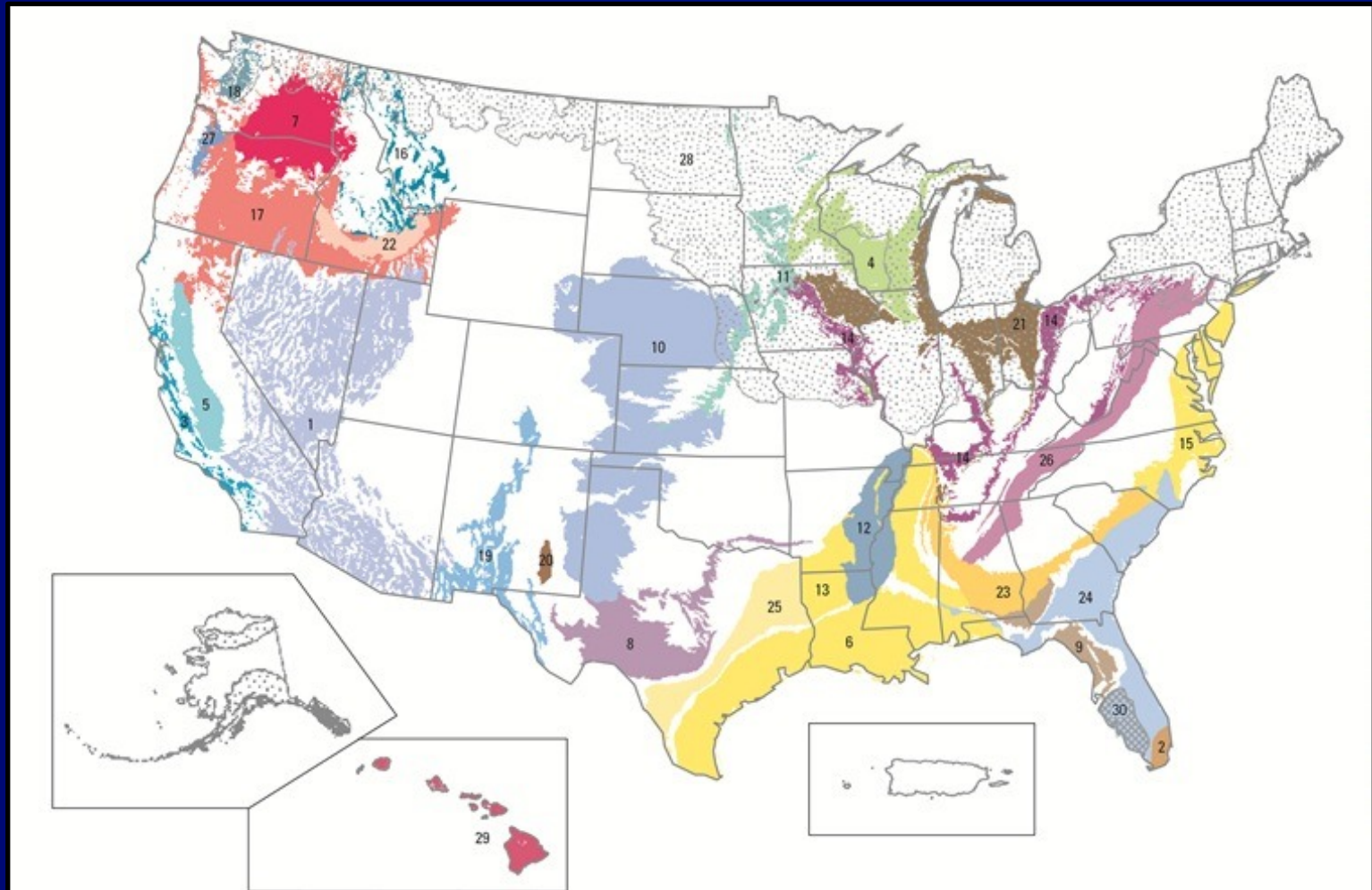
- Numerical groundwater model
- Capable of assessing streamflow depletion

Effects of Pumping Additional 1.2 Mgal/d from Līhu'e



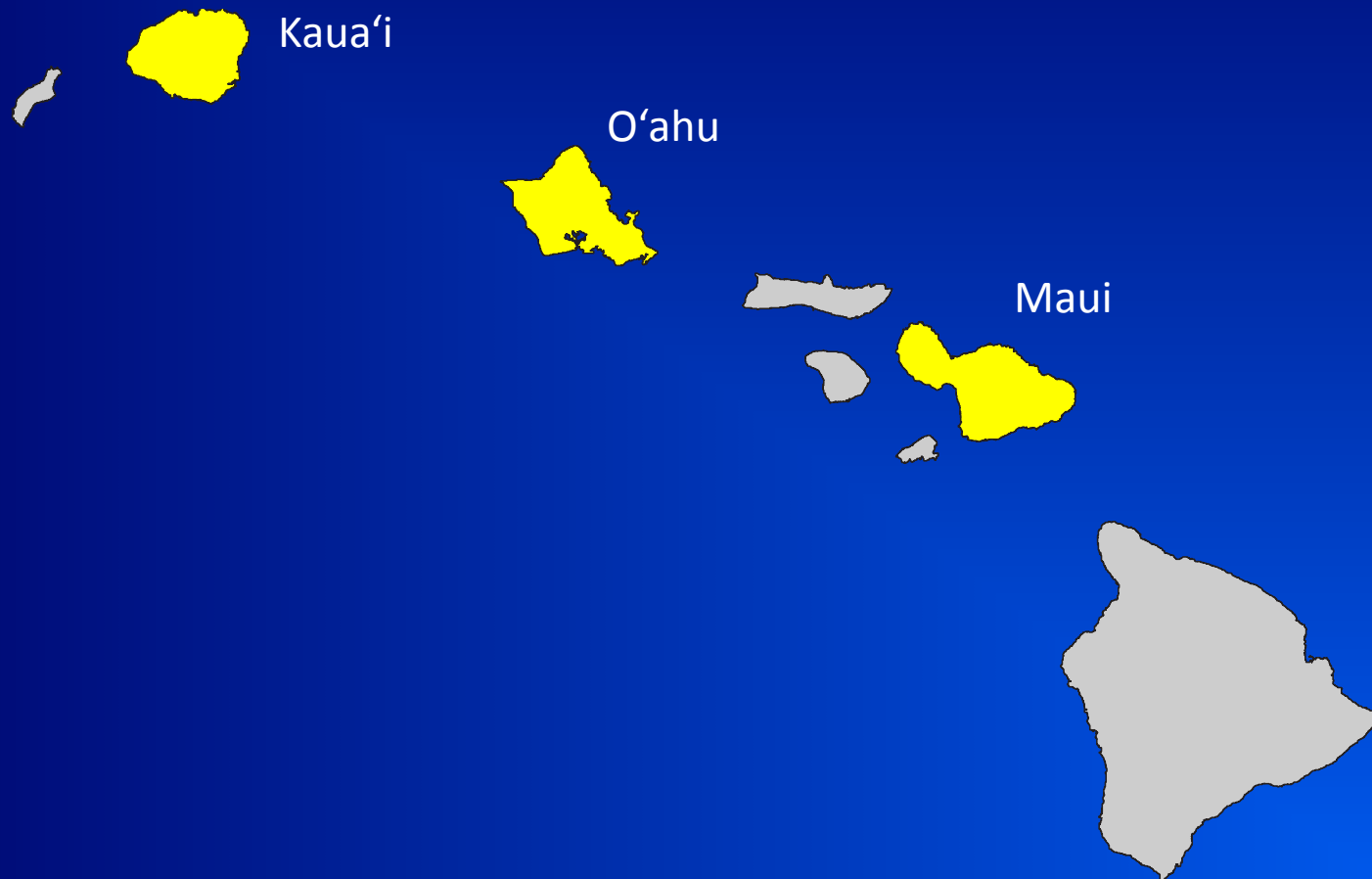
**Decrease in GW
discharge to streams
= 1.1 Mgal/d**

USGS Groundwater-Availability Assessments



USGS Groundwater Availability Study in Hawai'i

Numerical Models



Summary

- Groundwater availability limited by consequences community is willing to accept
- Hawai'i—diverse hydrogeologic settings, each with its own set of pumping-related consequences
- Assessing groundwater availability in Hawai'i requires:
 - Identifying hydrogeologic setting and associated consequences of groundwater withdrawal
 - Setting acceptable limits for those consequences
 - Using approaches that quantify consequences for the desired pumping