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# Groundwater Availability, Molokaʻi, Hawaiʻi

## Commission on Water Resource Management
## September 15, 2020

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

# Outline

1. Background
2. Motivation for study
3. USGS groundwater study

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# Published Report

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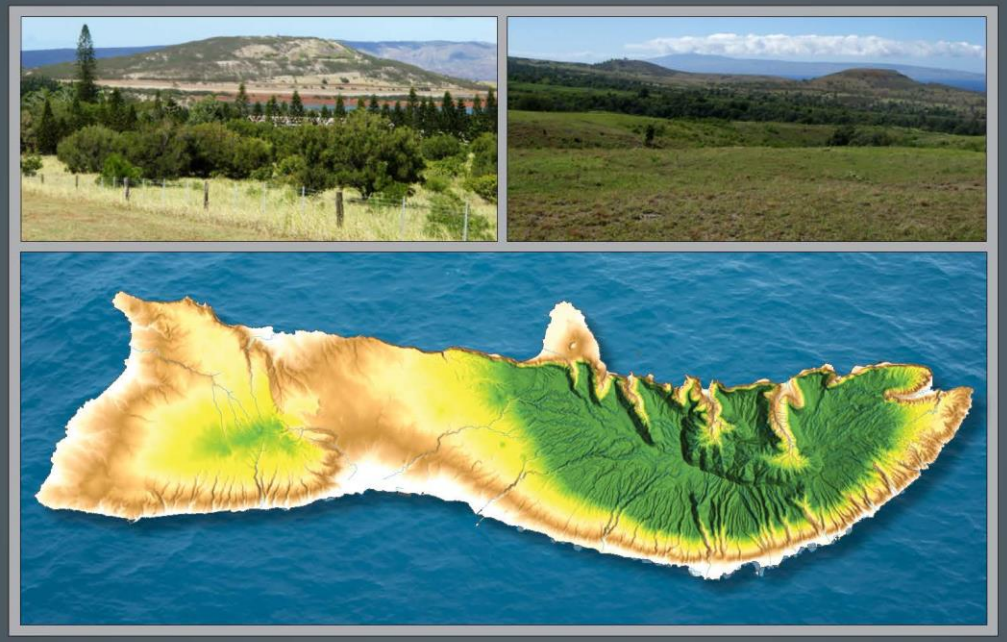
Prepared in cooperation with the State of Hawai‘i Department of Hawaiian Home Lands, State of Hawai‘i Office of Hawaiian Affairs, and County of Maui Department of Water Supply

## Numerical Simulation of Groundwater Availability in Central Moloka‘i, Hawai‘i



Scientific Investigations Report 2019–5150

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# Generalized Geology


0 5 MILES
0 5 KILOMETERS

West Moloka‘i volcano
Rift zone
Rift zone
Kualapu‘u Reservoir
Caldera area
East Moloka‘i volcano
Hālawa Bay

**EXPLANATION**

- Sedimentary deposits
- Kalaupapa Volcanics
- East Moloka‘i Volcanics
- West Moloka‘i Volcanics
- Volcanic vent
- Dike
- Kualapu‘u aquifer-system boundary
- Well in the Kualapu‘u aquifer system

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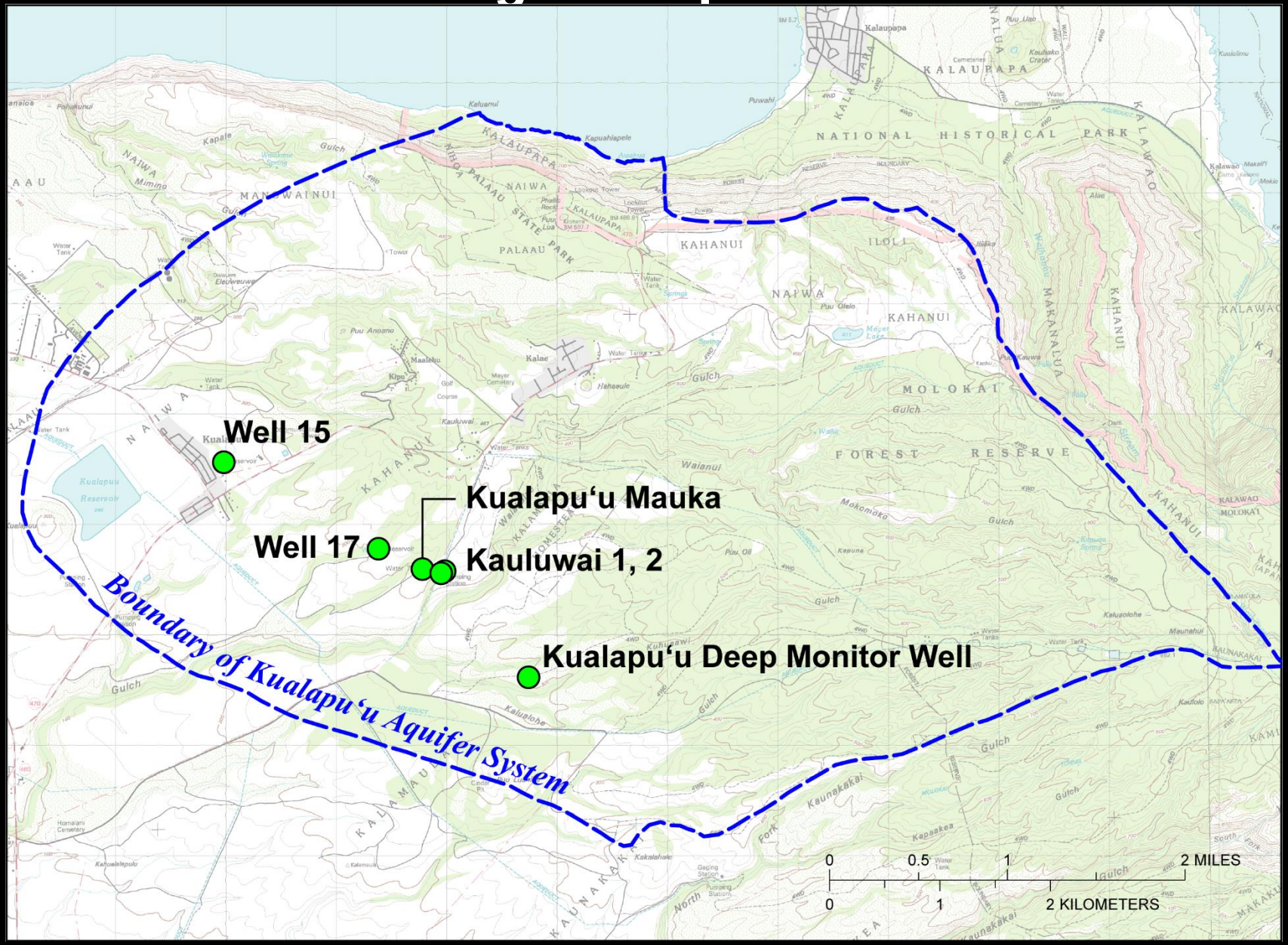
(modified from Sherrod and others, 2007; Langenheim and Clague, 1987)

# Existing Kualapu‘u Wells

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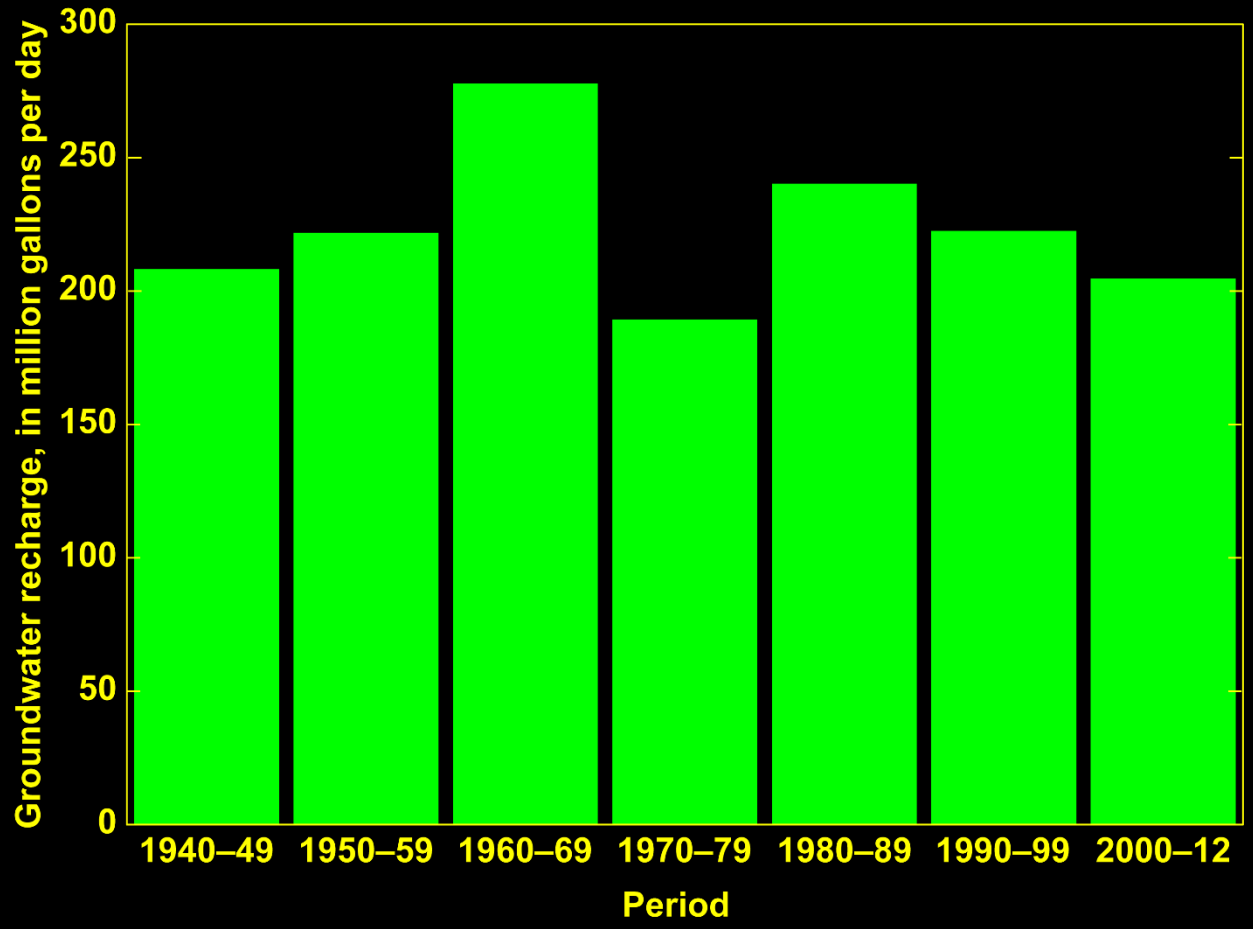
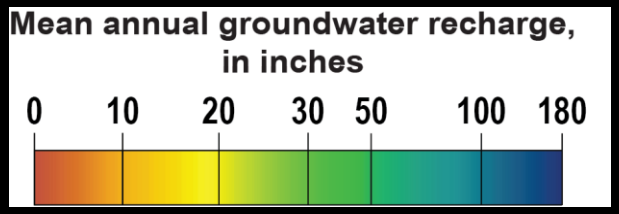
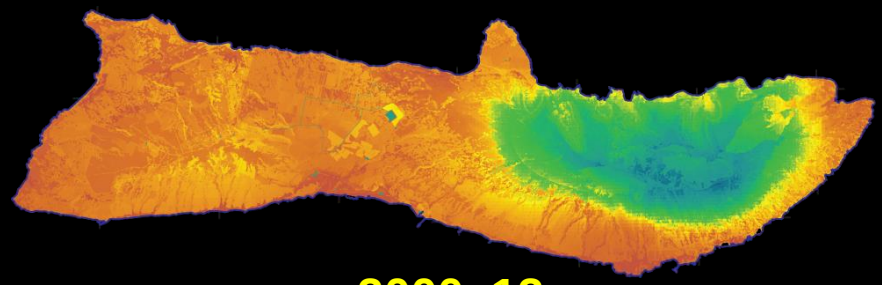
# Recharge By Decade



2000–12

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# Motivation for Understanding Groundwater Availability

1. Groundwater is the main source of drinking water

2. Demand for groundwater is expected to increase

3. Groundwater resources are limited
   - Limited rainfall and recharge in developed areas
   - Salinity increased in some wells

4. Effects of additional groundwater withdrawal are uncertain
   - Will proposed withdrawals affect salinity of other wells?
   - Will reduction in freshwater discharge to nearshore ecosystems be acceptable?

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# USGS Study

- Overall objective is to evaluate groundwater availability in central Molokaʻi
- Objective met by developing a numerical groundwater model capable of quantifying changes in salinity and flow to nearshore areas
- Numerical model used to simulate selected withdrawal scenarios developed with input from State and County agencies

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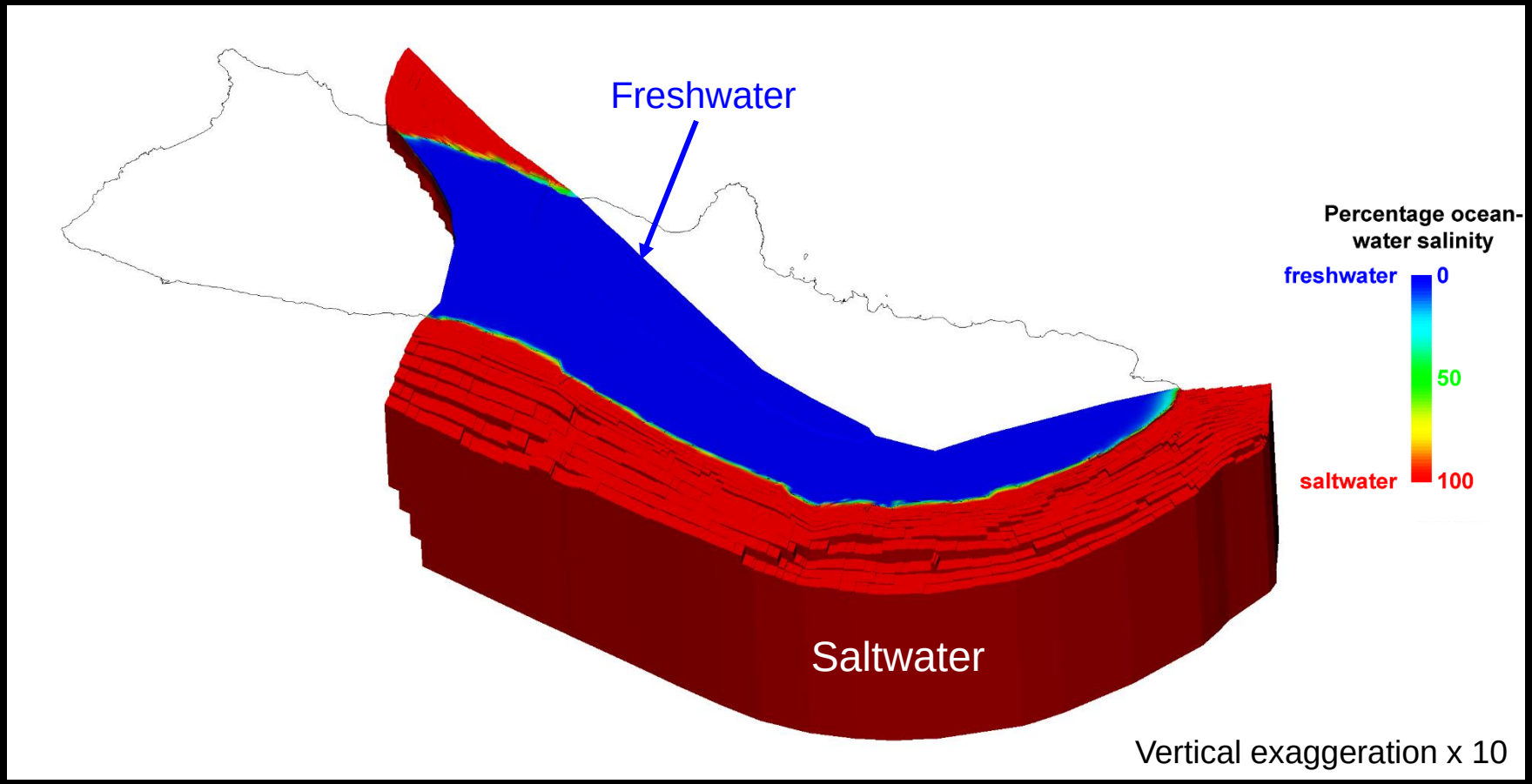
# Study Area 3-D Model—Oblique View




3-D computer model:

- Integrates available geologic and hydrologic information
- Simulates flow and salinity in aquifer and discharge to nearshore areas

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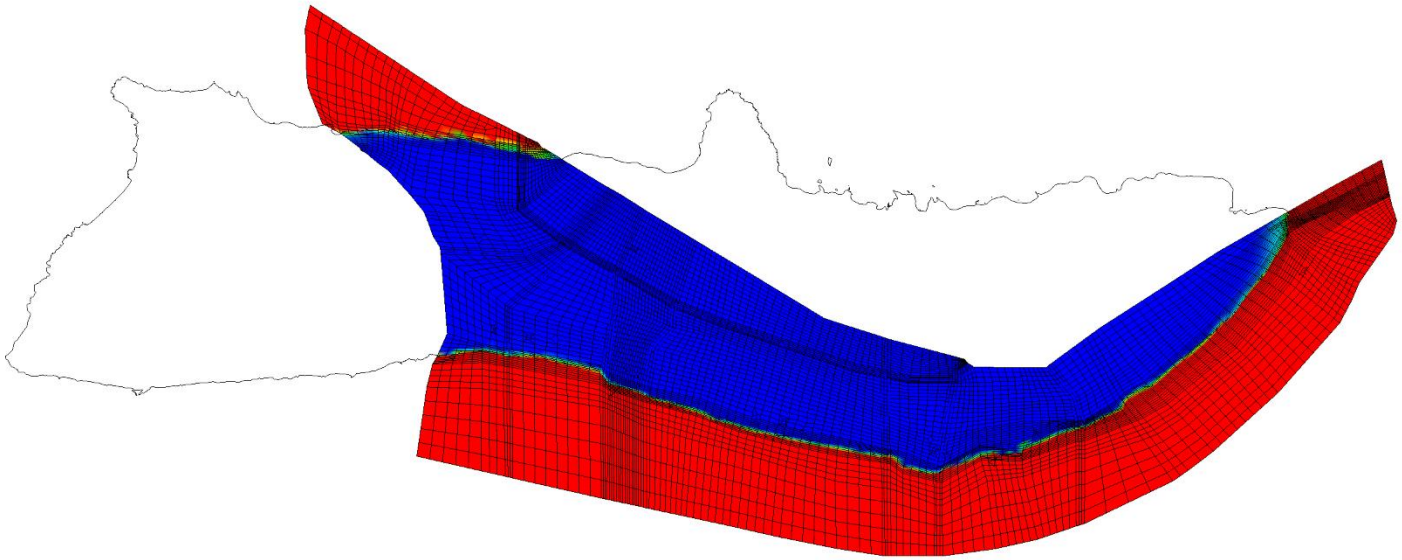
# 1940–2012 Animation of Freshwater Volume



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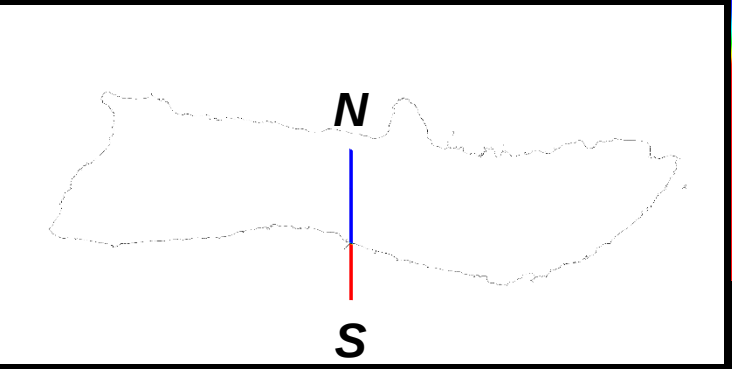
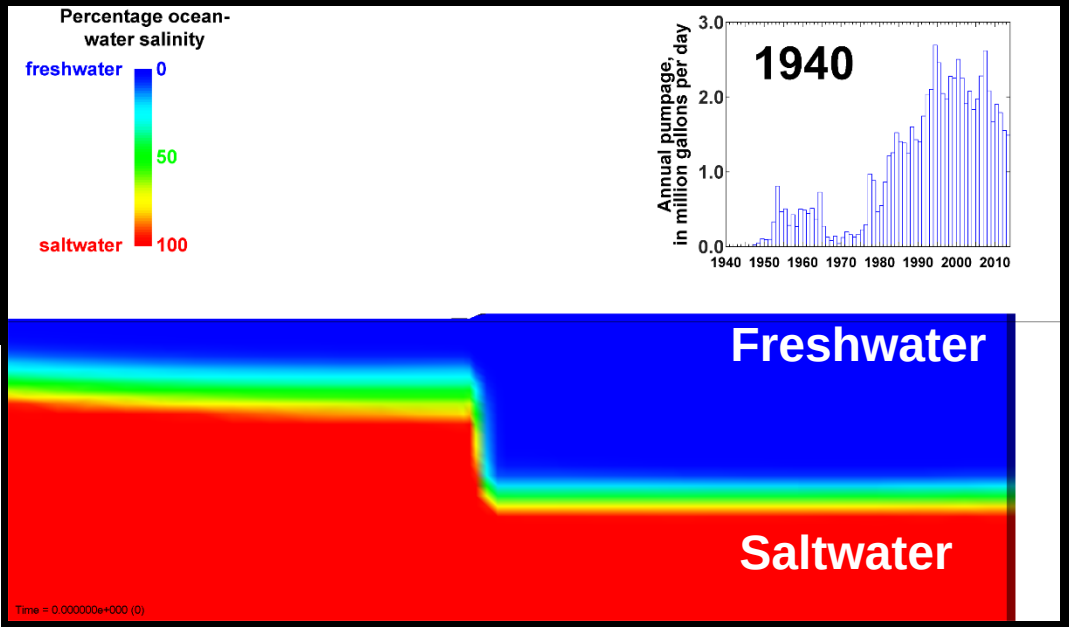
# 1940–2012 Animation Explanation

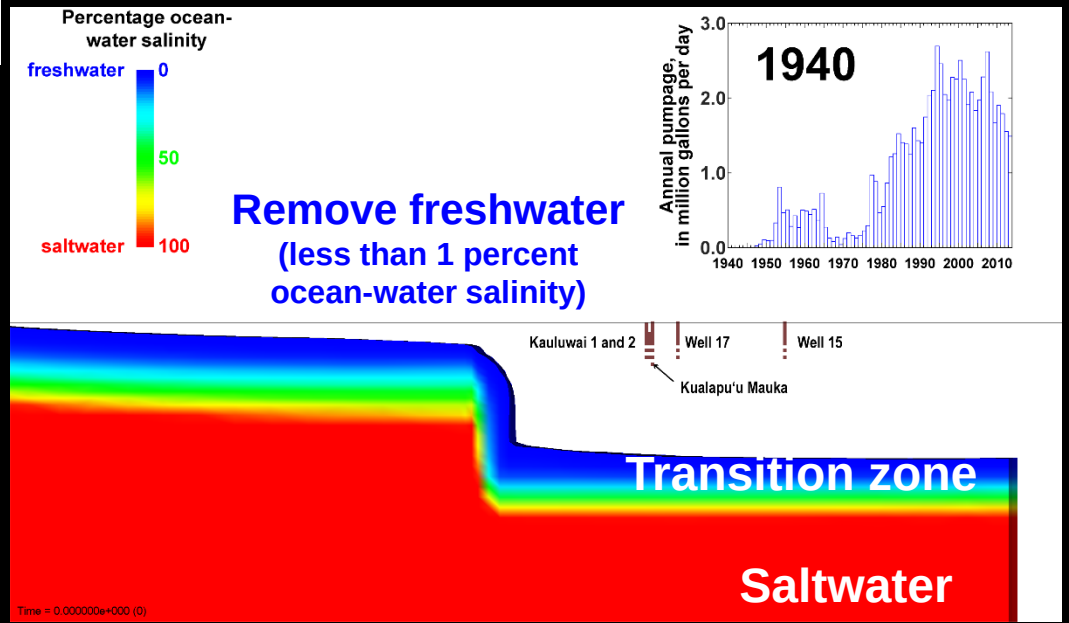



Cross section (slice of aquifer) view from top

*South* *North*

Cross section—view from side (east to west)

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# 1940–2012 Animation of Freshwater Volume

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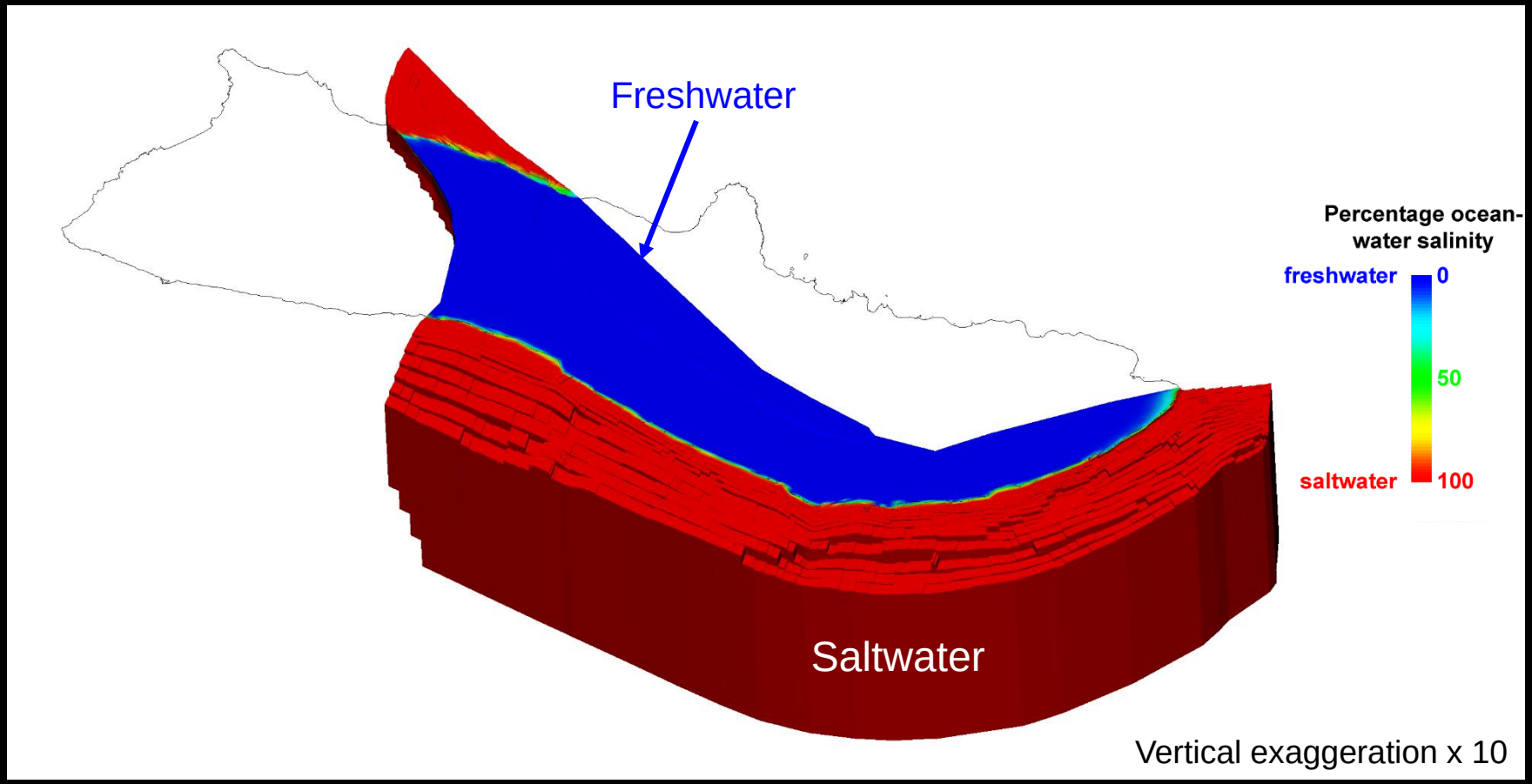
# Application of Model




- Quantify changes in salinity
- Quantify changes in discharge to nearshore areas

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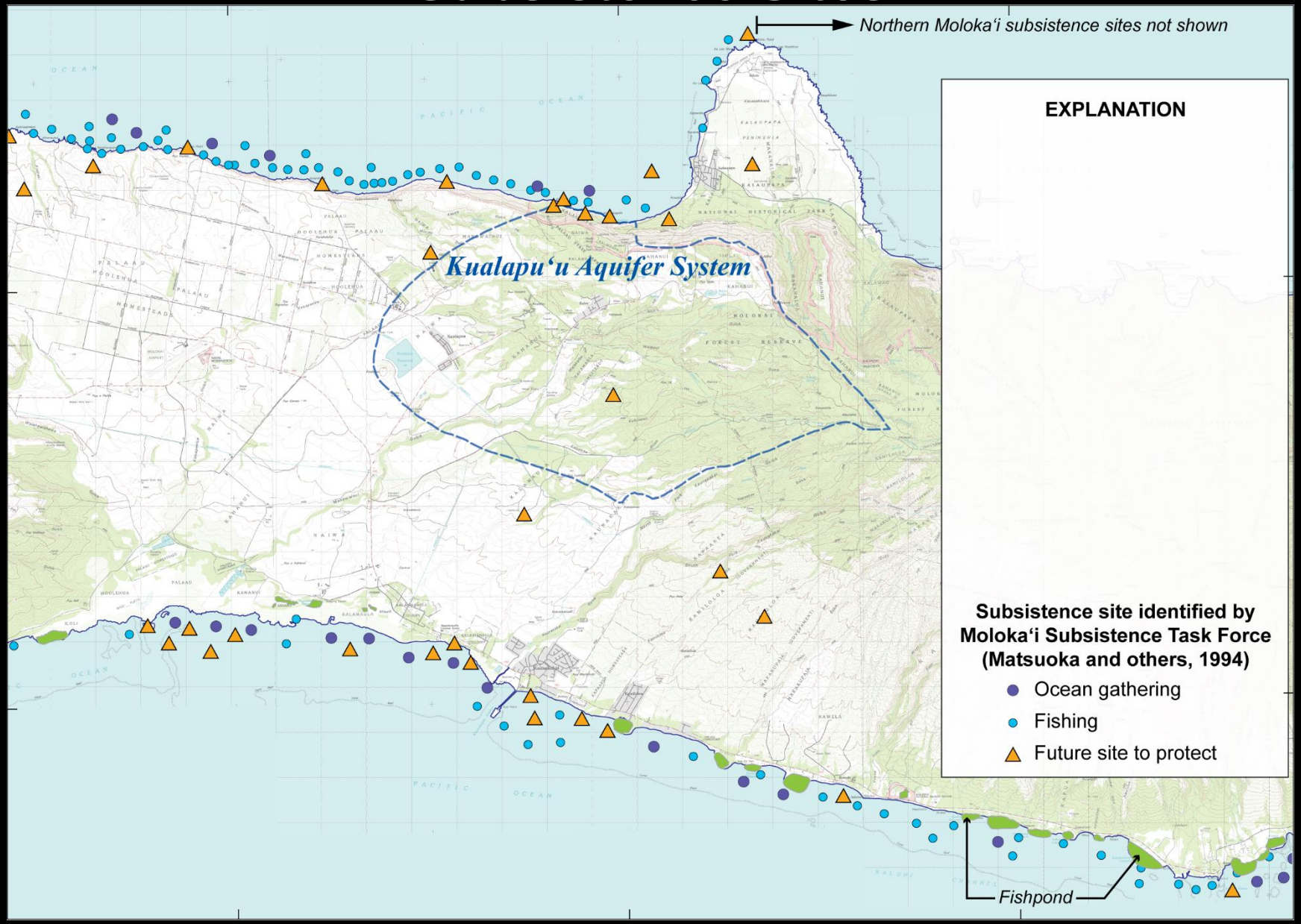
# Subsistence Sites

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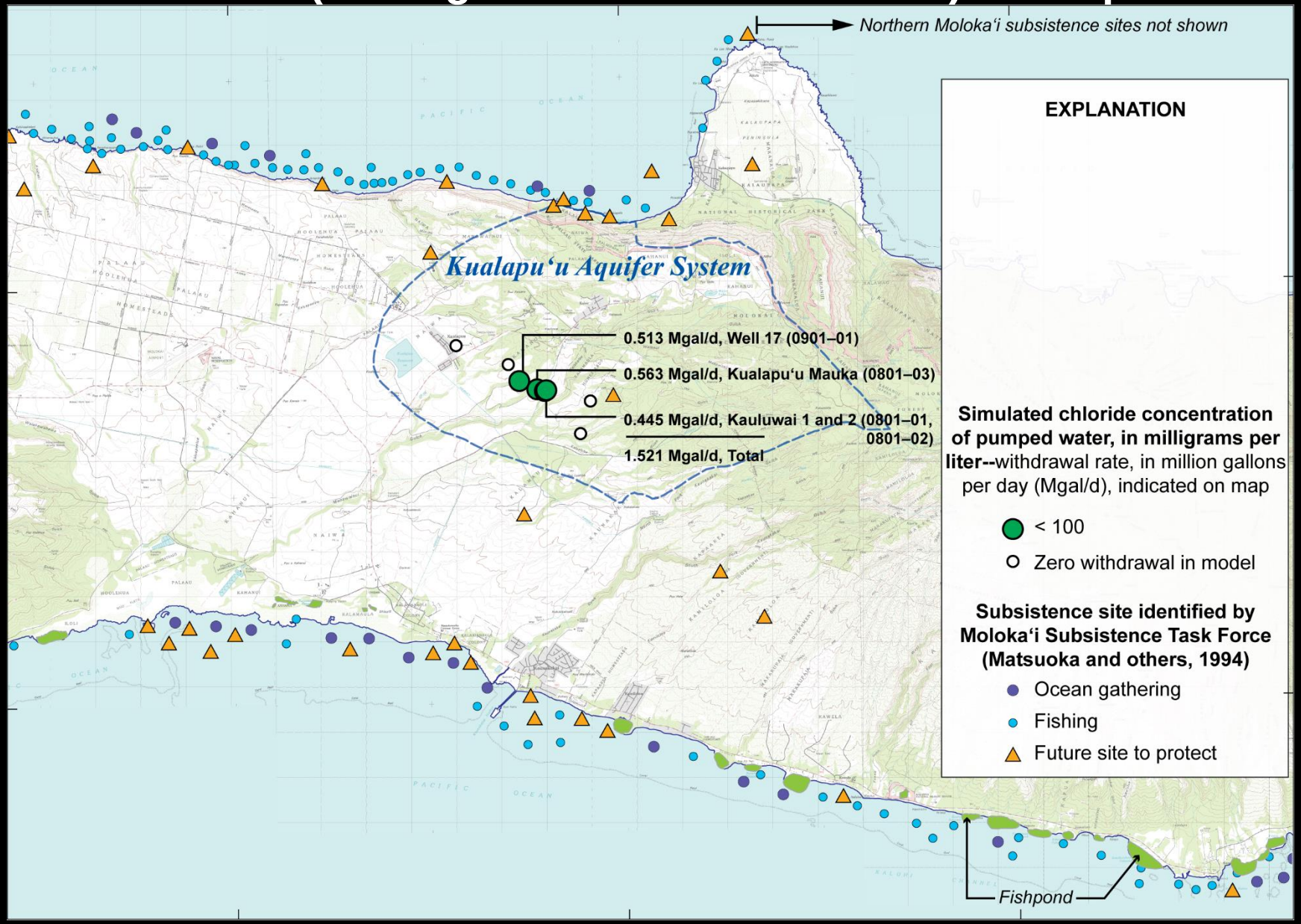
# Base Scenario (Average 2016–17 Withdrawals)—Pumped Wells

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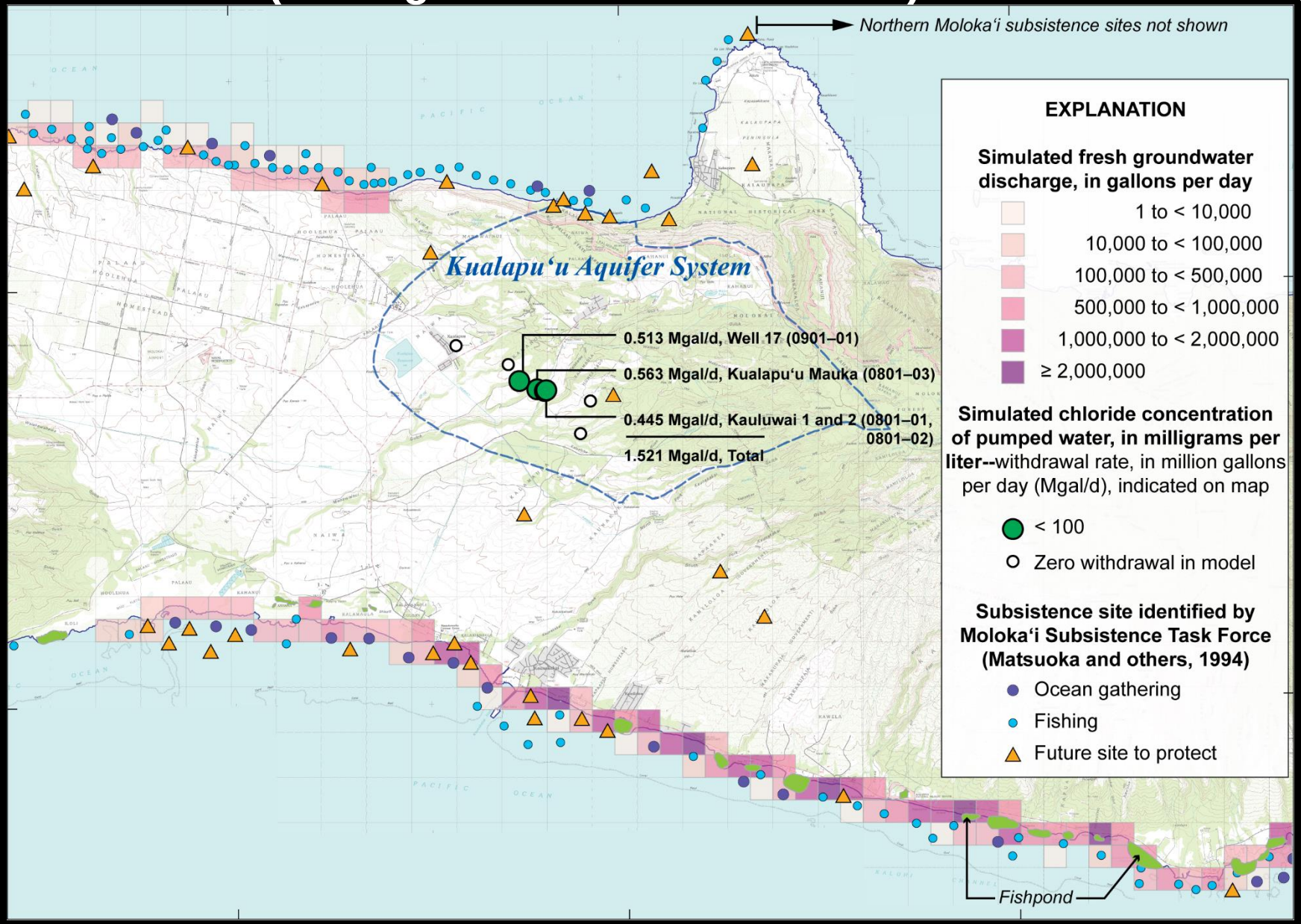
# Base Scenario (Average 2016–17 Withdrawals)—Coastal Discharge

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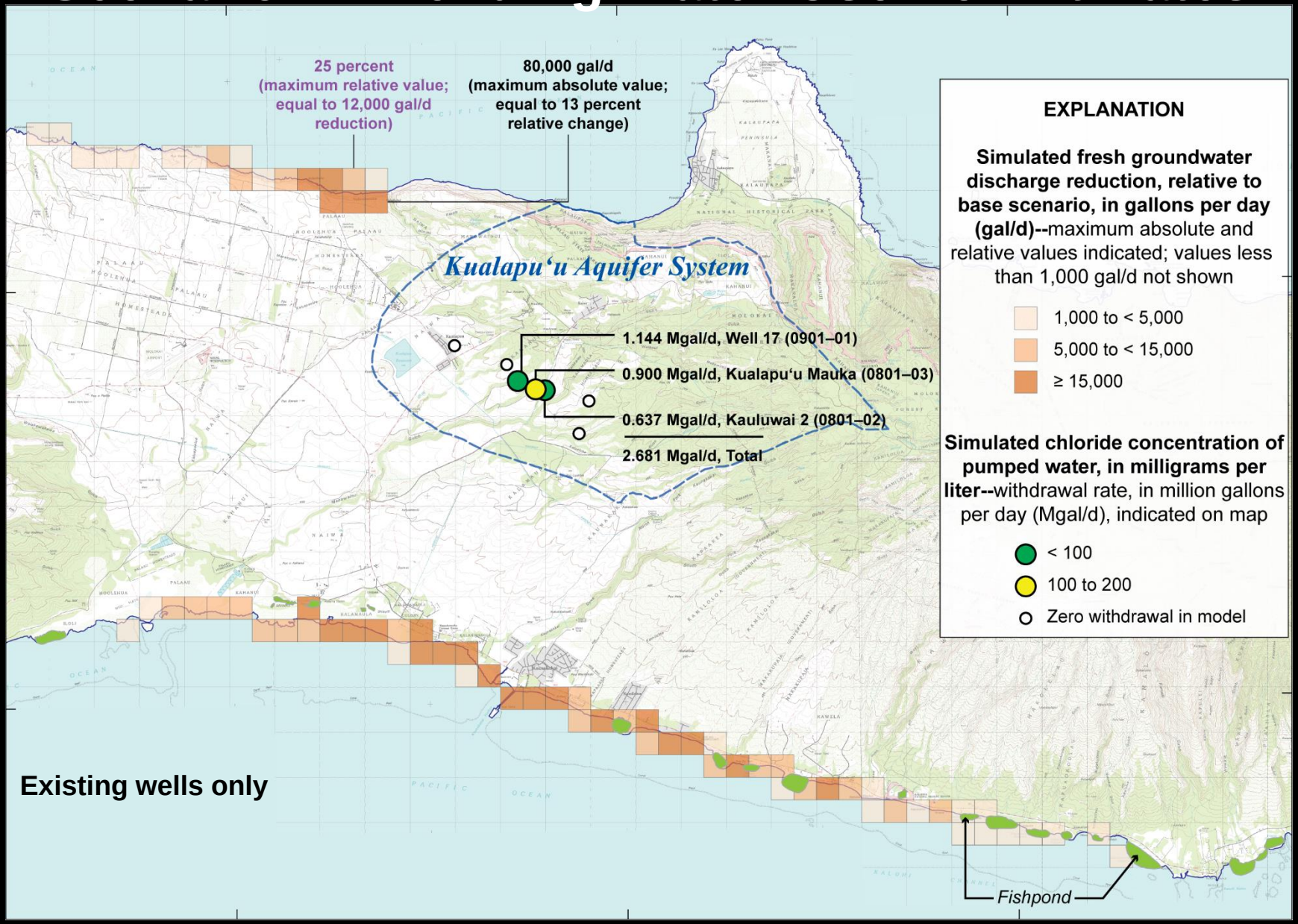
# Scenario 2—Pending Water-Use Permit Rates

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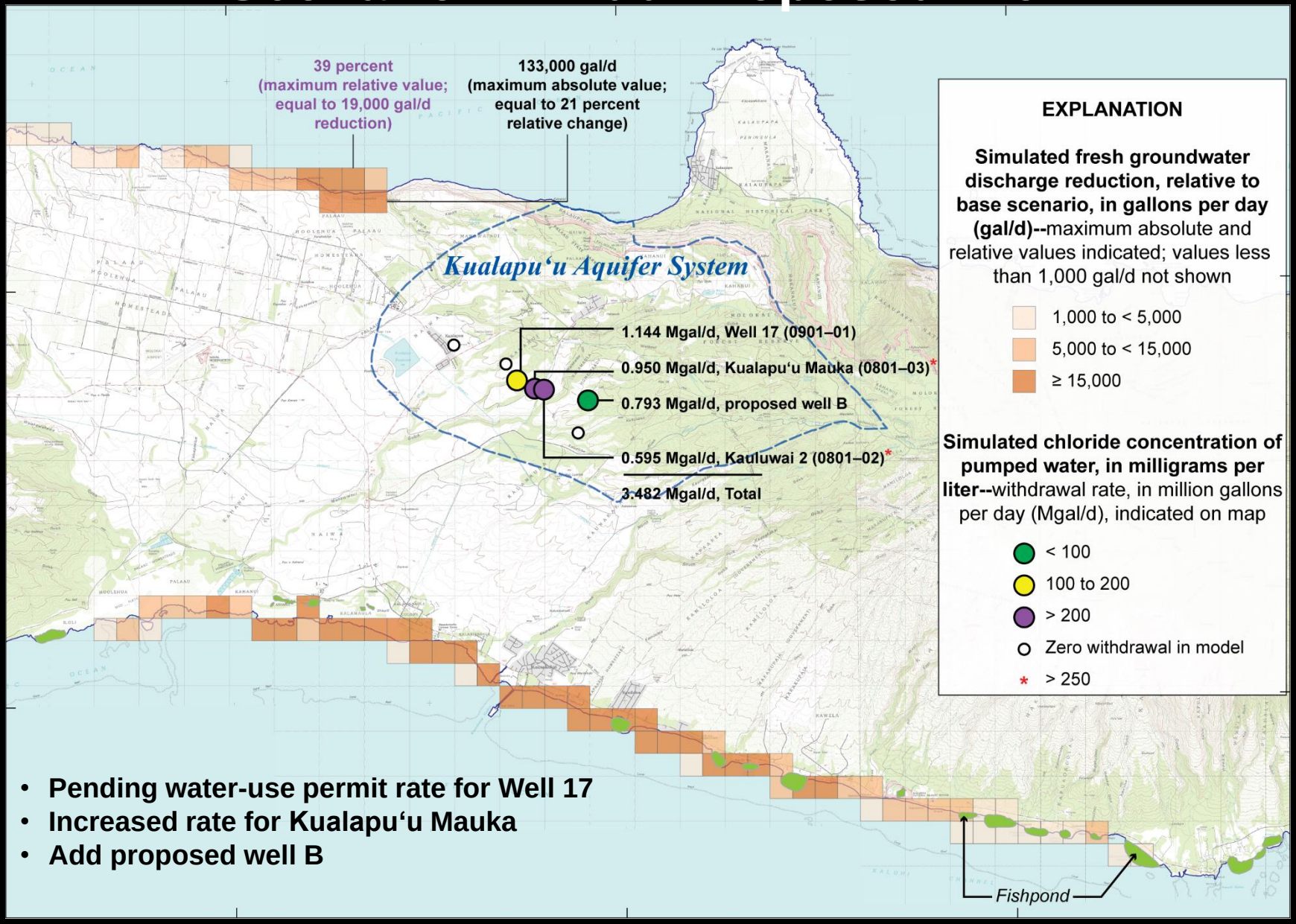
# Scenario 4—Add Proposed Well




- Pending water-use permit rate for Well 17
- Increased rate for Kualapu‘u Mauka
- Add proposed well B

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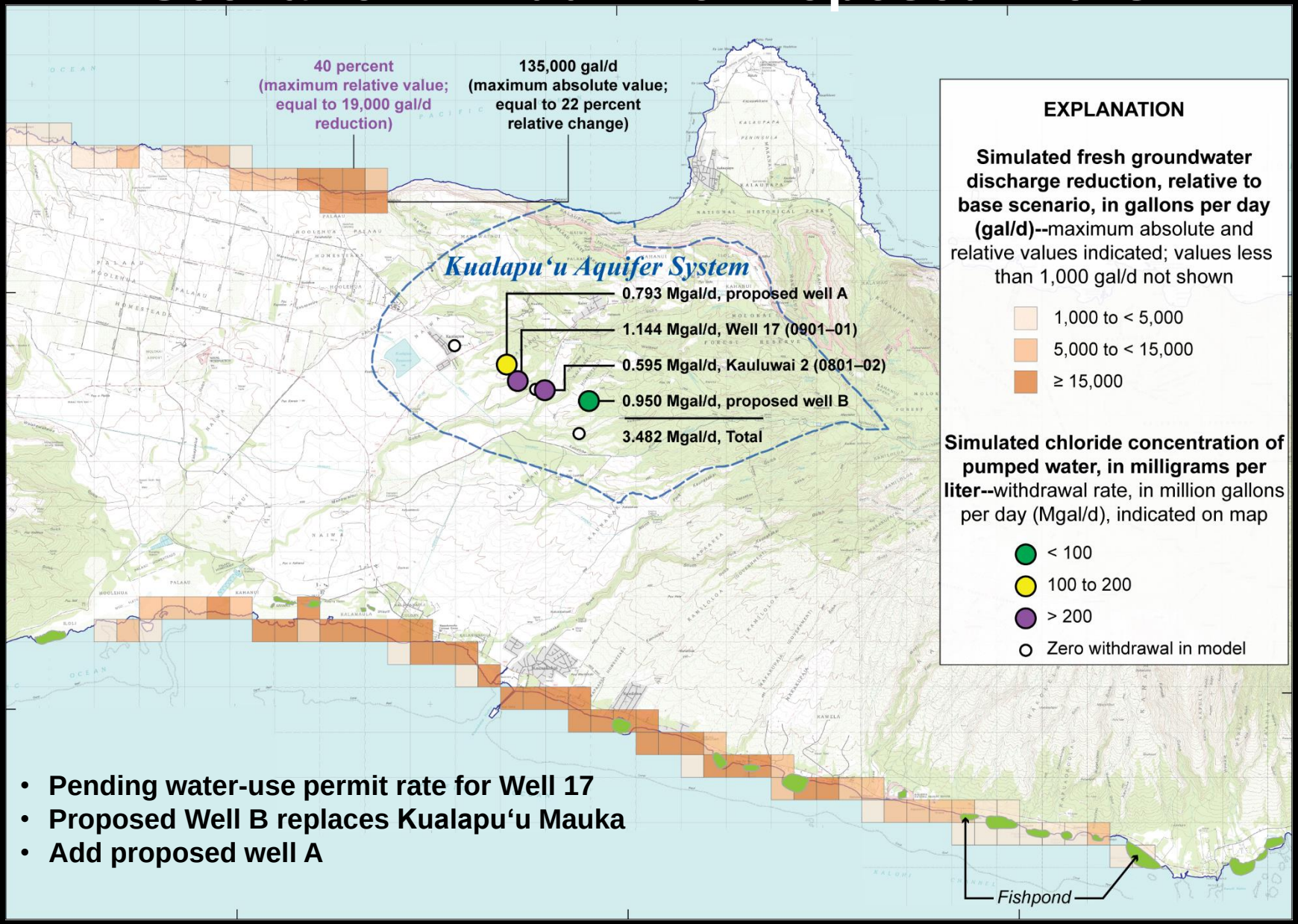
# Scenario 7—Add Two Proposed Wells




- Pending water-use permit rate for Well 17
- Proposed Well B replaces Kualapu‘u Mauka
- Add proposed well A

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# Summary

1. Groundwater model developed to evaluate withdrawal scenarios

2. Model results indicate additional groundwater in the Kualapuʻu area may be available

3. The distribution and rate of withdrawals are important factors controlling groundwater availability

4. Additional withdrawals will have an impact—managers and stakeholders must evaluate whether the impacts are acceptable

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# Study Limitations

1. Groundwater model is regional in scale and may not accurately represent local conditions

2. Groundwater model contains uncertainty
   A. subsurface geology poorly known
   B. additional data from wells would help to constrain model
   C. water-budget components uncertain
   D. model can be updated as information becomes available

3. No wells available in parts of the Kualapuʻu aquifer system

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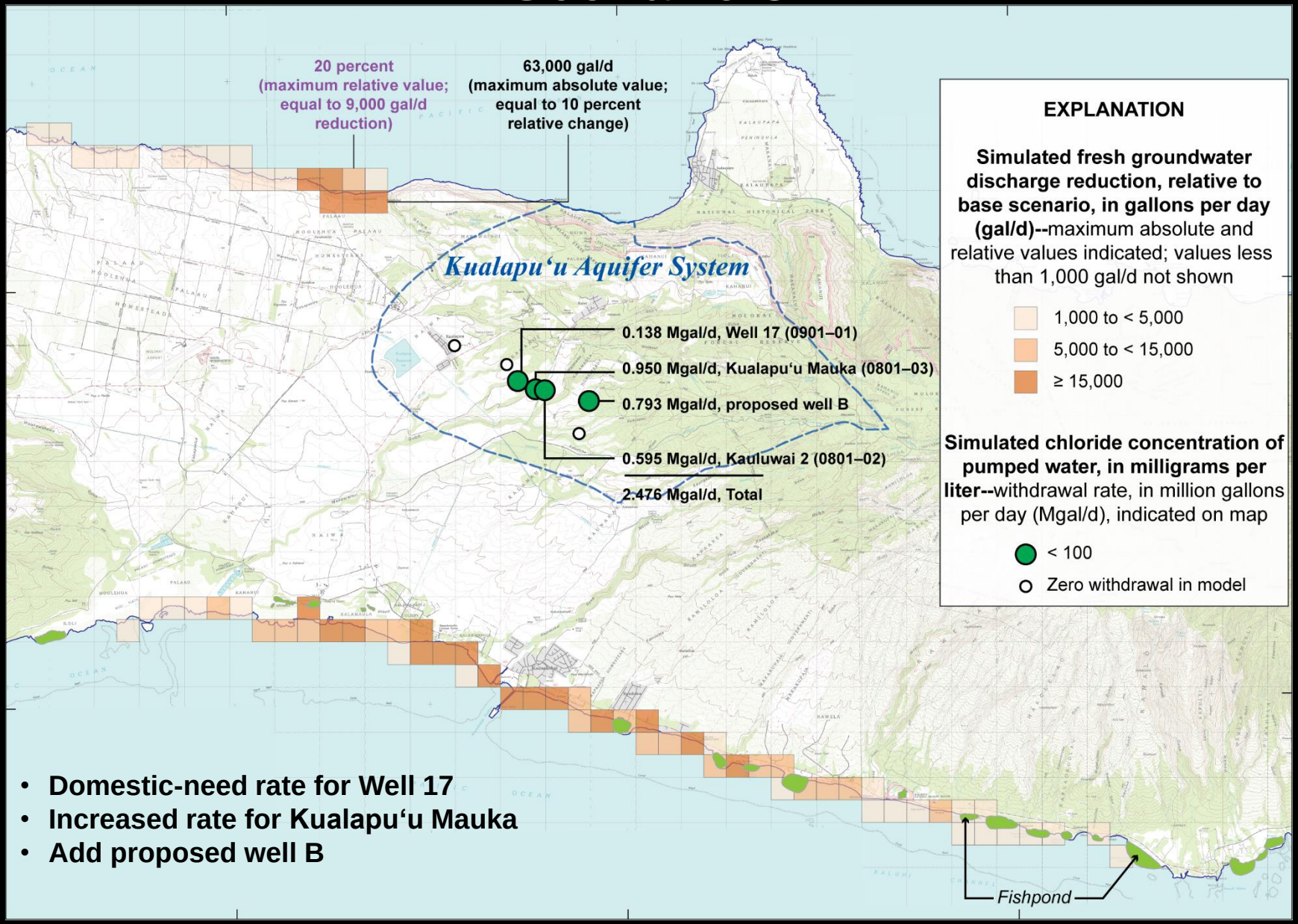
Questions?

# Scenario 3




- Domestic-need rate for Well 17
- Increased rate for Kualapu‘u Mauka
- Add proposed well B

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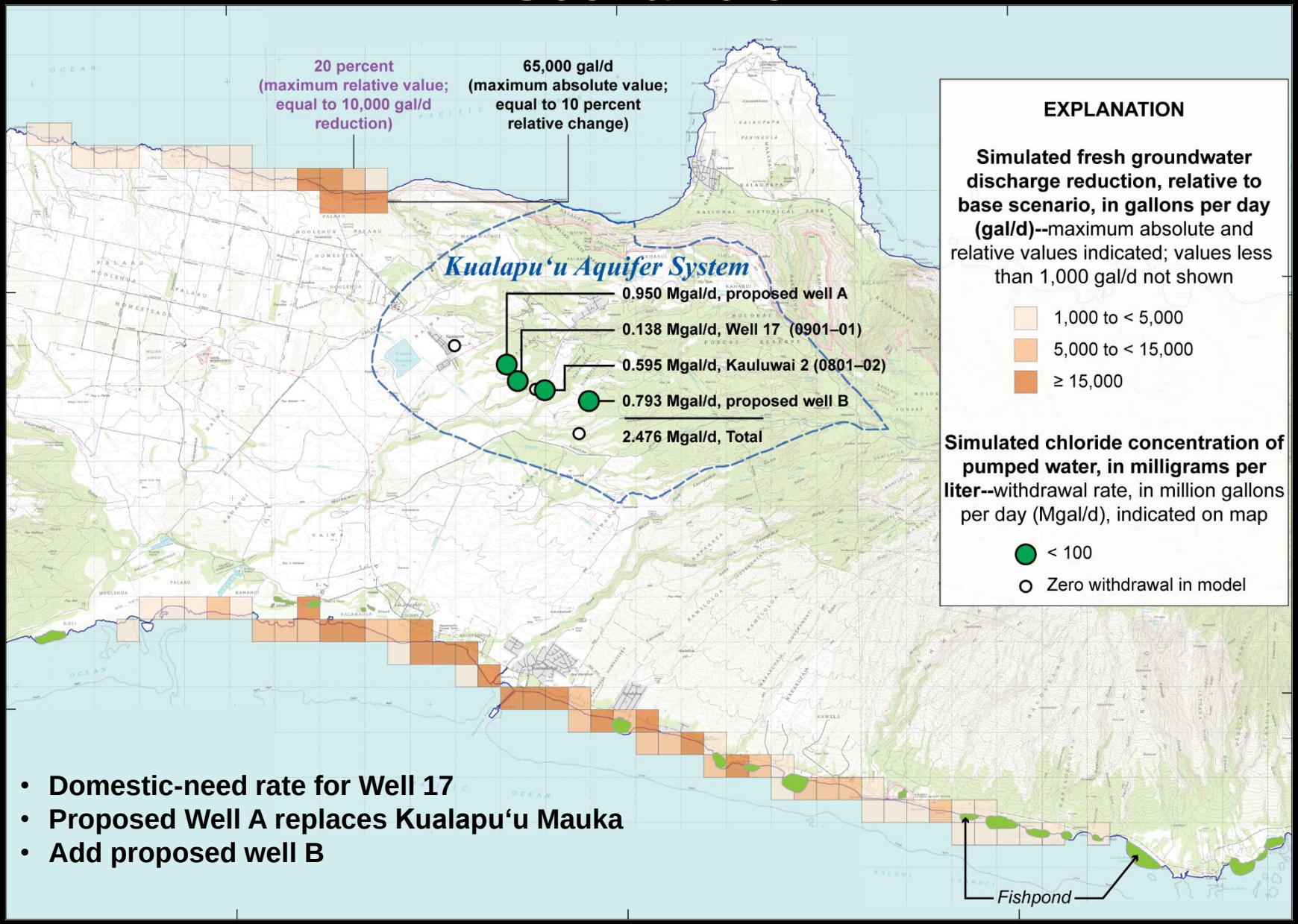
# Scenario 5




- Domestic-need rate for Well 17
- Proposed Well A replaces Kualapu‘u Mauka
- Add proposed well B

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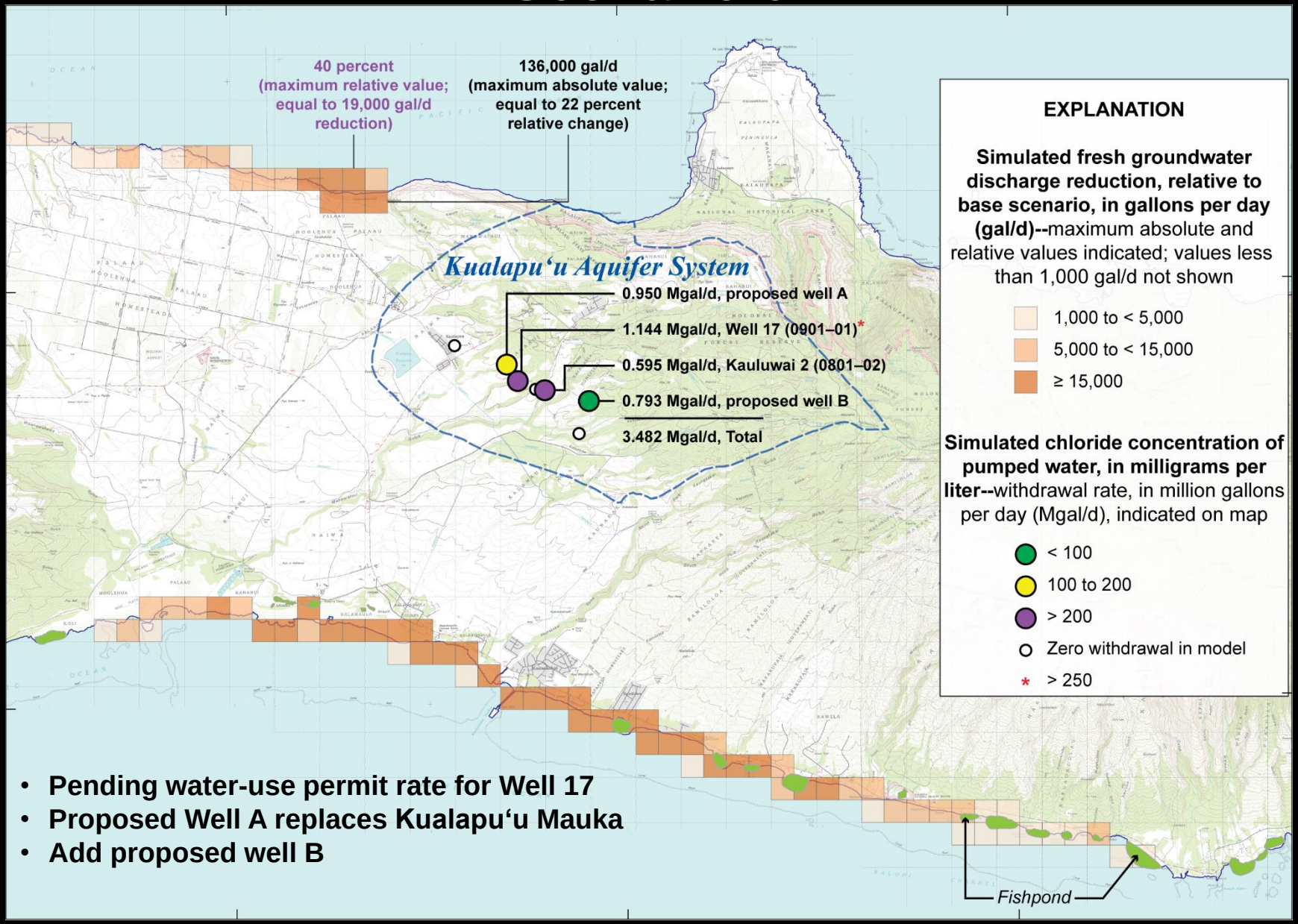
# Scenario 6




- **Pending water-use permit rate for Well 17**
- **Proposed Well A replaces Kualapu‘u Mauka**
- **Add proposed well B**

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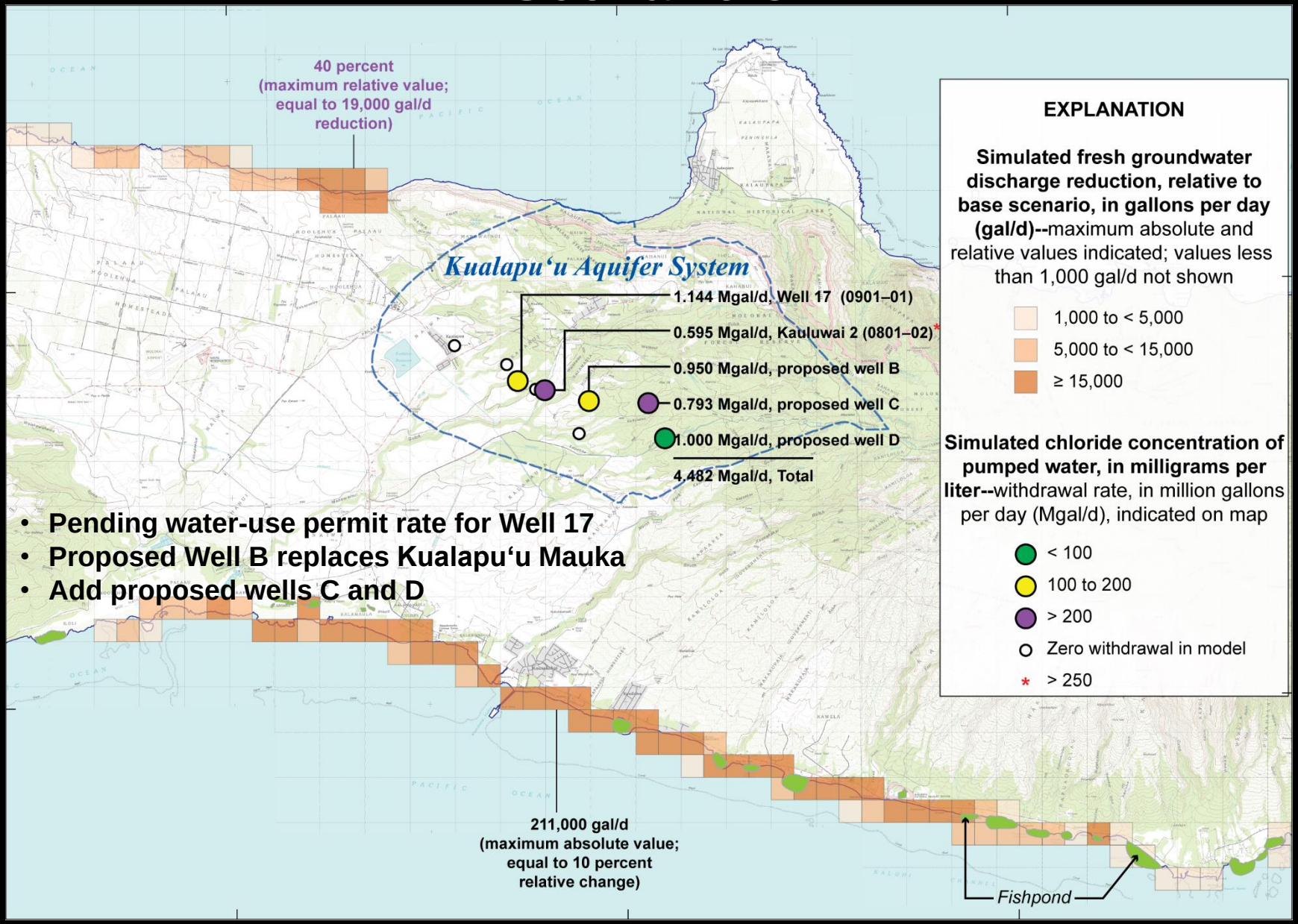
# Scenario 8

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