

The background of the slide is a light gray gradient with several realistic water droplets of various sizes scattered across it. The droplets have highlights and shadows, giving them a three-dimensional appearance.

# **NEW INSIGHTS INTO GROUNDWATER FLOW IN THE PEARL HARBOR BASIN**

FUEL TANK ADVISORY COMMITTEE MEETING

OCTOBER 9, 2024

# TAKE-AWAY MESSAGES

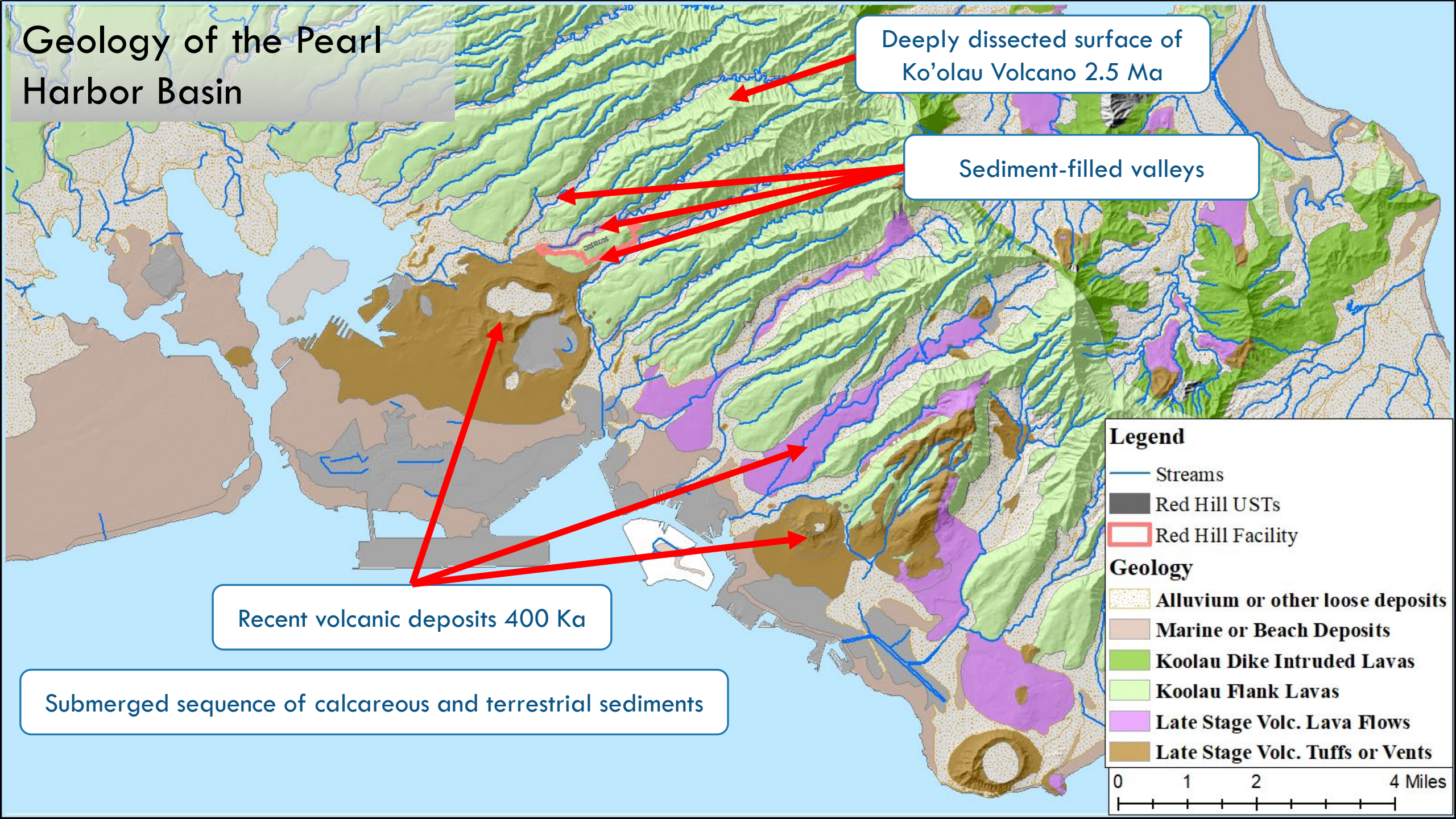
- GROUNDWATER FLOW IS CONTROLLED BY THE GEOLOGIC STRUCTURES WITH WHICH IT COMES IN CONTACT: TO UNDERSTAND THE HYDROLOGY, WE NEED TO UNDERSTAND THE GEOLOGY
- THE PEARL HARBOR BASIN IS AMONG THE MOST GEOLOGICALLY COMPLEX REGIONS OF HAWAII
- THE CONCEPTUAL GROUNDWATER FLOW MODEL SELECTED BY THE NAVY AS THE BASIS OF THEIR NUMERICAL MODEL DOES NOT CORRECTLY INCORPORATE IMPORTANT GEOLOGIC FEATURES PRESENT IN THE REGION: HENCE, THE COMPUTED WATER FLOW TRAJECTORIES CONFLICT WITH THOSE INDICATED BY OUR RESEARCH
- THE CONVENTIONAL PICTURE THAT WE HAVE OF GROUNDWATER STORAGE AND FLOW IN HAWAII (AND OAHU) NEEDS TO BE REVISED

# UNIVERSITY OF HAWAII RESEARCH OBJECTIVES

- USE MODERN TOOLS AND METHODS TO:
- DEVELOP A BETTER UNDERSTANDING OF THE REGIONAL GEOLOGY
- DOCUMENT GROUNDWATER FLOW RATES AND DIRECTIONS
- VALIDATE THOSE FINDINGS THROUGH THE EXECUTION OF ONE OR MORE DYE TRACER TESTS

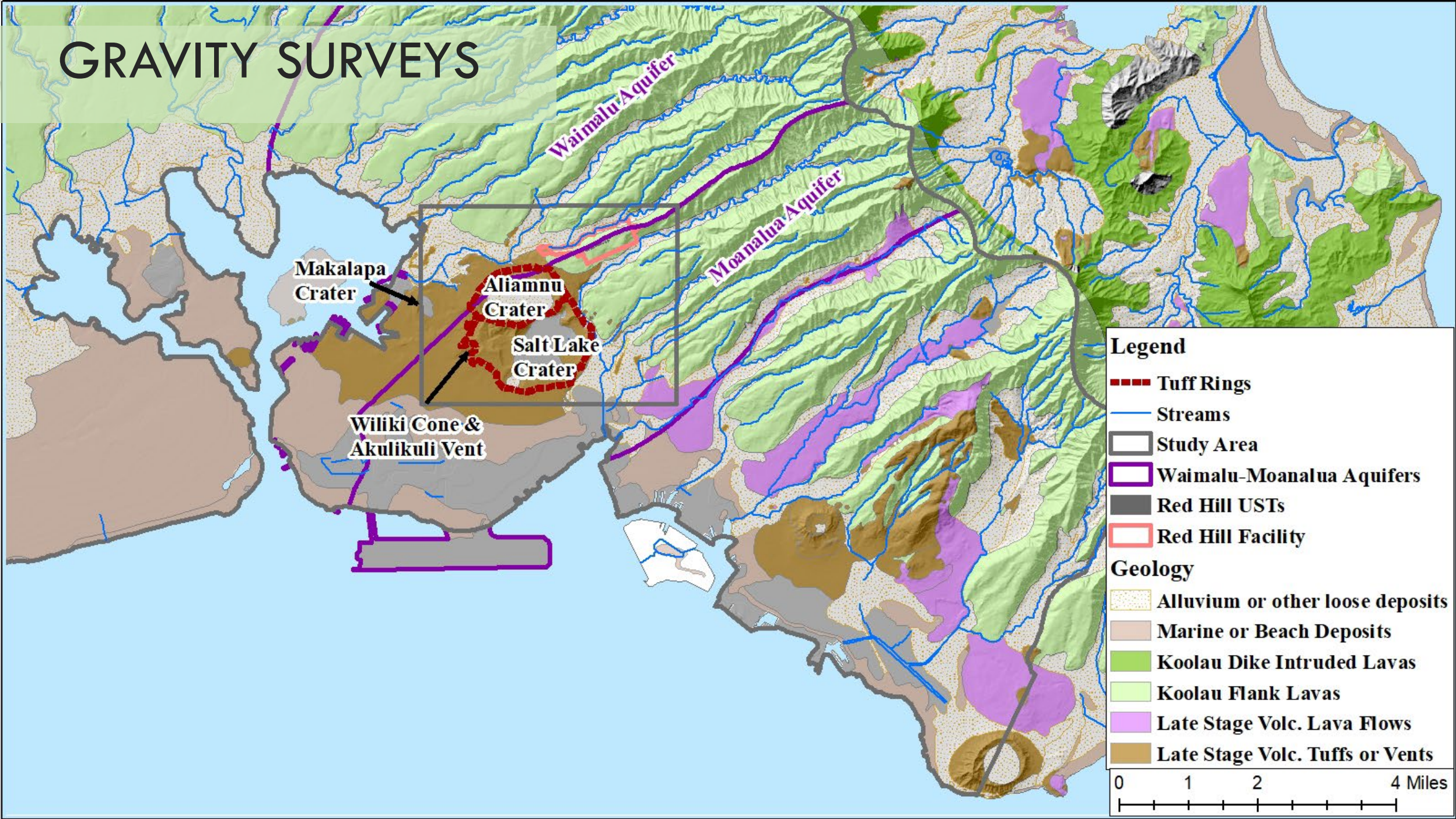


# Geology of the Pearl Harbor Basin





# GRAVITY SURVEYS

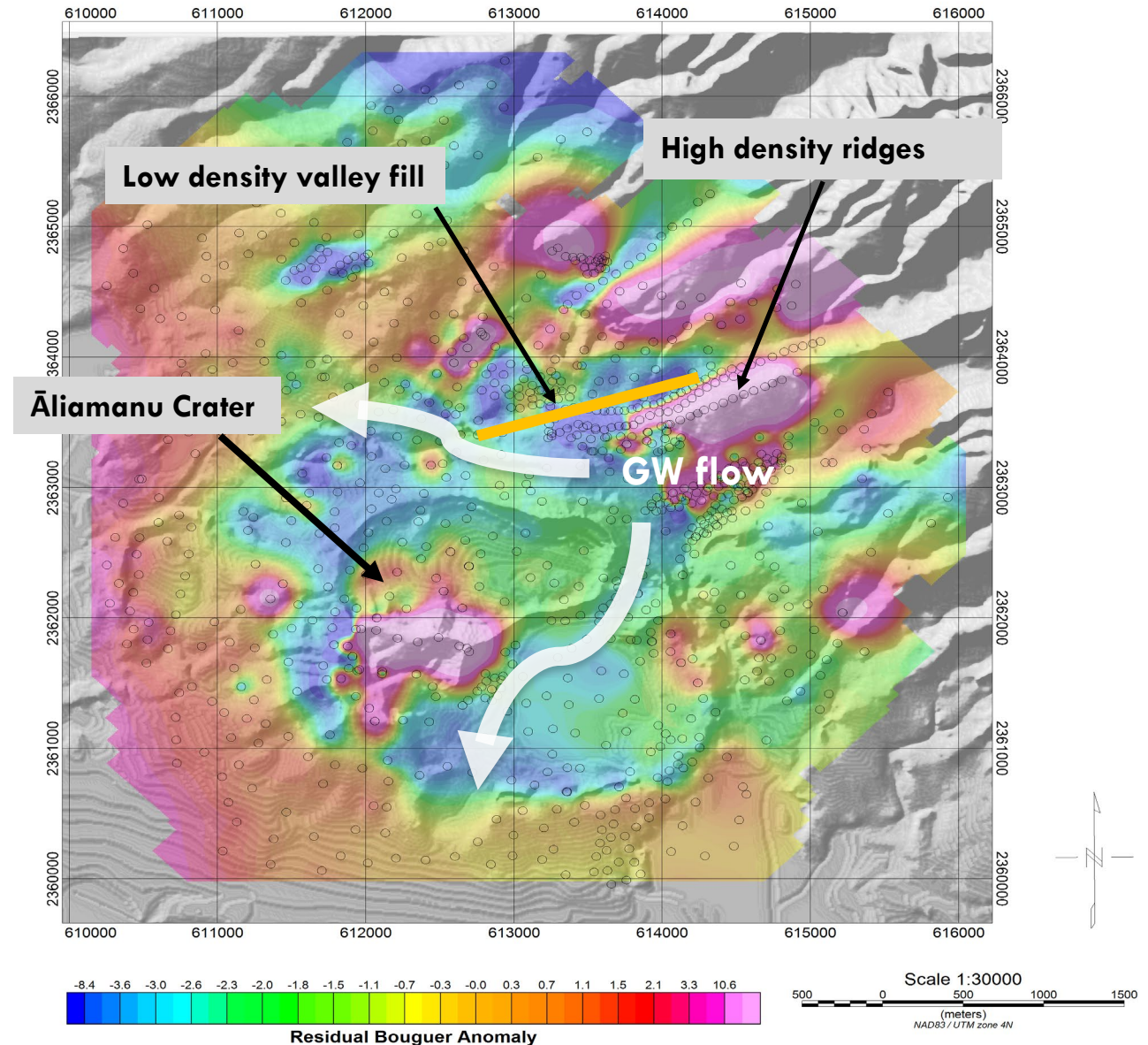




# RESIDUAL BOUGUER GRAVITY ANALYSIS

**Direction of groundwater flow is controlled by permeability of geologic structures:**

*Changes in density imply a change in the buried geologic structures. In some cases high density is associated with dikes or other intrusive structures – low permeability structures - but may also be associated with fractured basalt with higher permeability. Low density structures can be associated with clays and sediment layers – which are lower permeability structures. Āliamanu Crater may have underlying intrusive basalt which could impede water flow. Lower density valley fill (sediments) are thought to impede water flow to the NW where that fill extends down into the water table.*

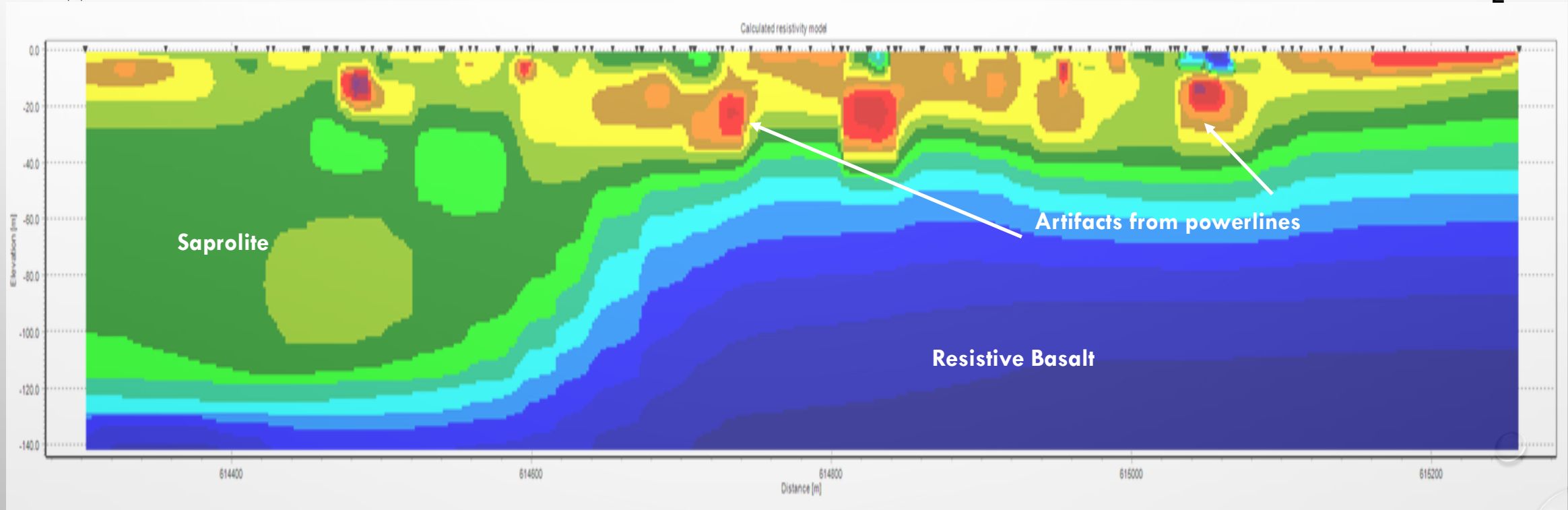


# Electrical Resistivity South Halawa Valley:

Saprolite begins where South Halawa Valley becomes wider near HCCC. These are preliminary and will benefit from sharp boundary or metallic infrastructure inversions. Saprolite is a boundary to groundwater flow.

W

E



Ohmm

0.1

5

200

5557.5



# GROUNDWATER FLOW MEASUREMENTS

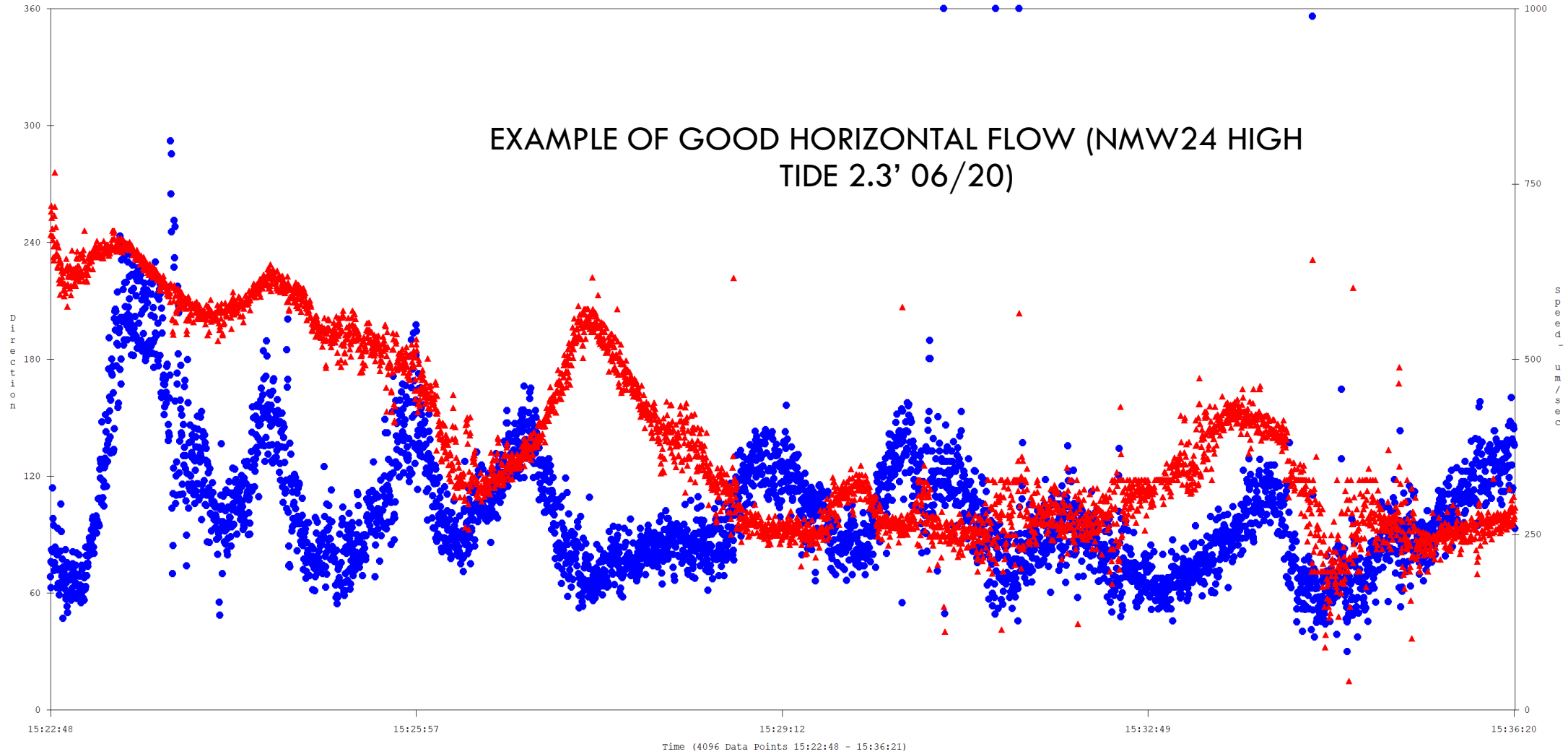




# Borescope Investigation NMW24

NMW24\_062024\_15P5  
Date: Jun 20, 2024 - Depth 15.5

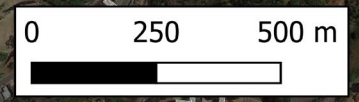
▲ Direction ● Velocity







- Borescope Groups**
- ◆ 1: Completed
  - ◆ 2: Completed
  - ◆ 3: Completed
  - ◆ 4: Started
  - ▲ Production

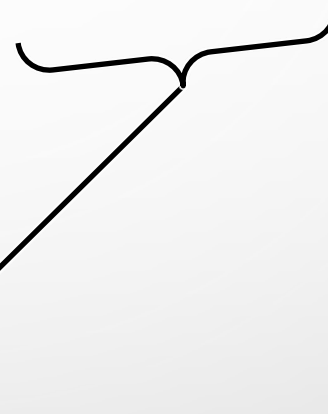
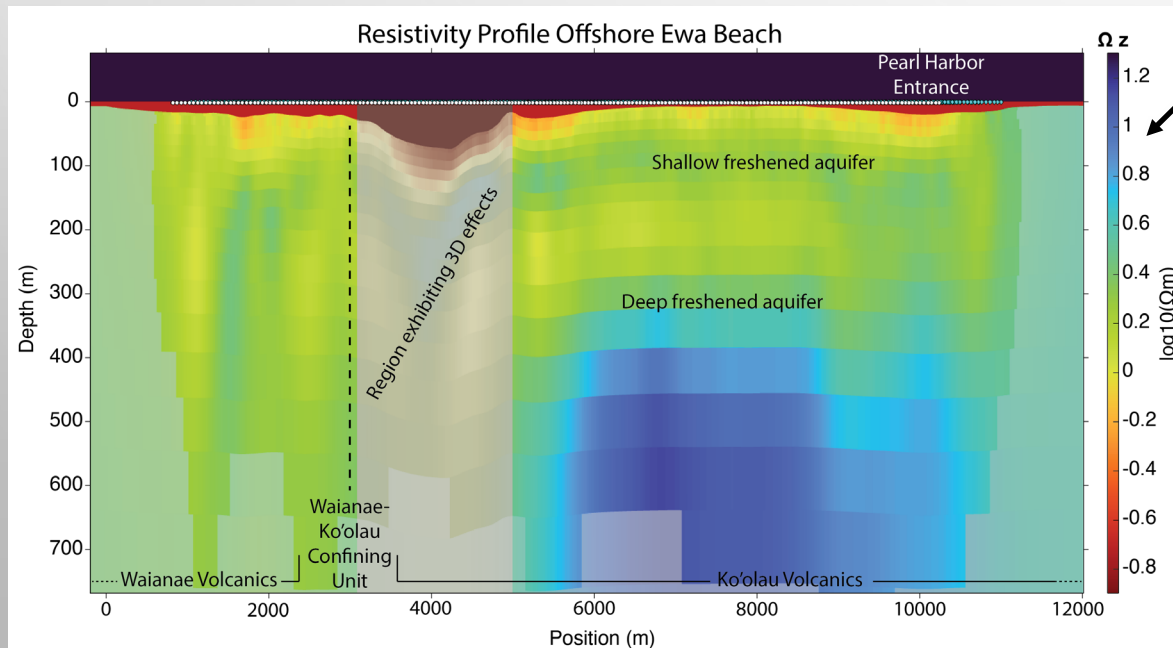




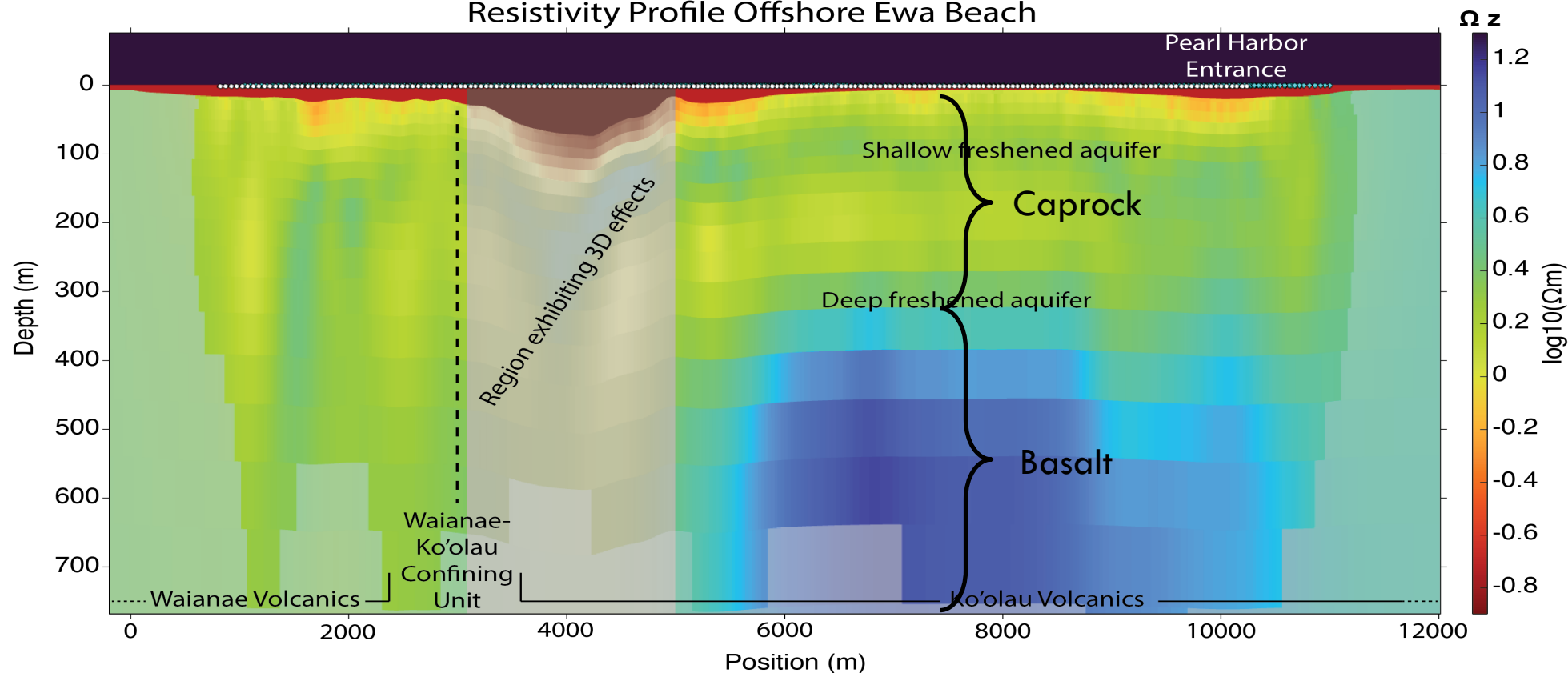
# SHALLOW OFFSHORE RESISTIVITY SURVEYS

In October 2023 we surveyed the southern coast of Oahu and within Pearl Harbor.

Shown below are two lines, one offshore Ewa Beach on the southwest side of Oahu, and the other in Maunalua Bay, to the southeast. Both exhibit increased resistivity that we interpret as offshore freshened groundwater.







## Resistivity Profile Offshore Ewa Beach







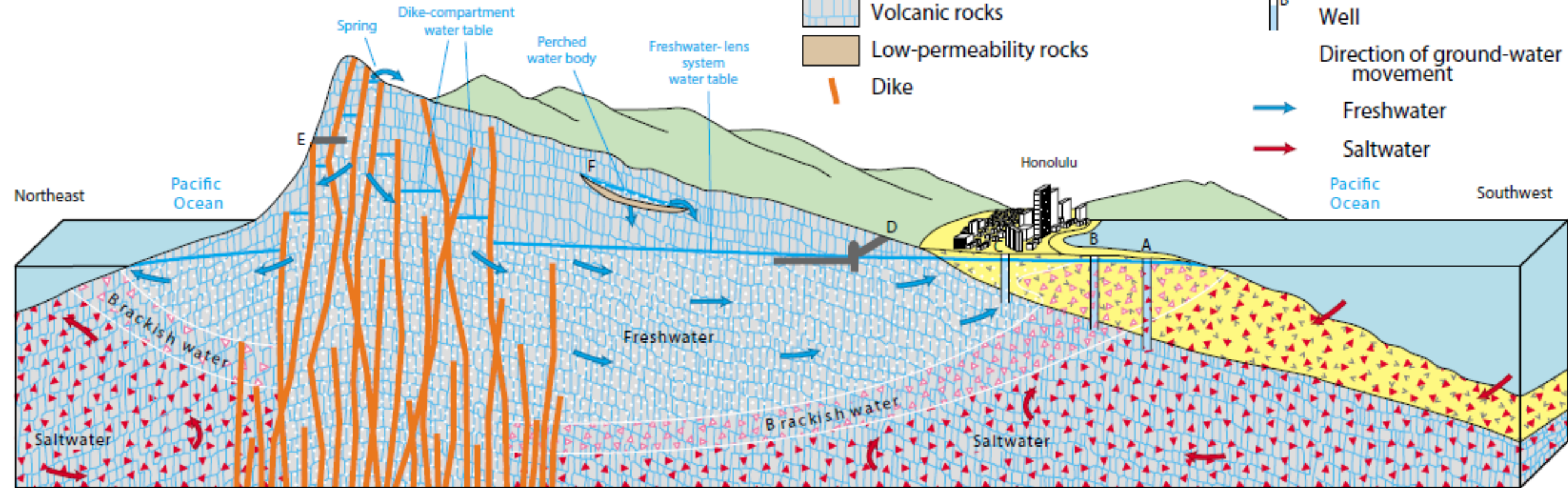
- Deep freshened groundwater at depths of ~350 meters below sea floor
- This depth is consistent with the extrapolated base of the caprock from onshore wells.
- We also see a shallower resistor that may be another freshened aquifer.
- The western extent of the offshore freshened groundwater is coincident with the surface expression of the transition from the Ko'olau to the Waianae volcanics, suggesting that the two volcanic systems are not hydraulically connected.



# EXPLANATION

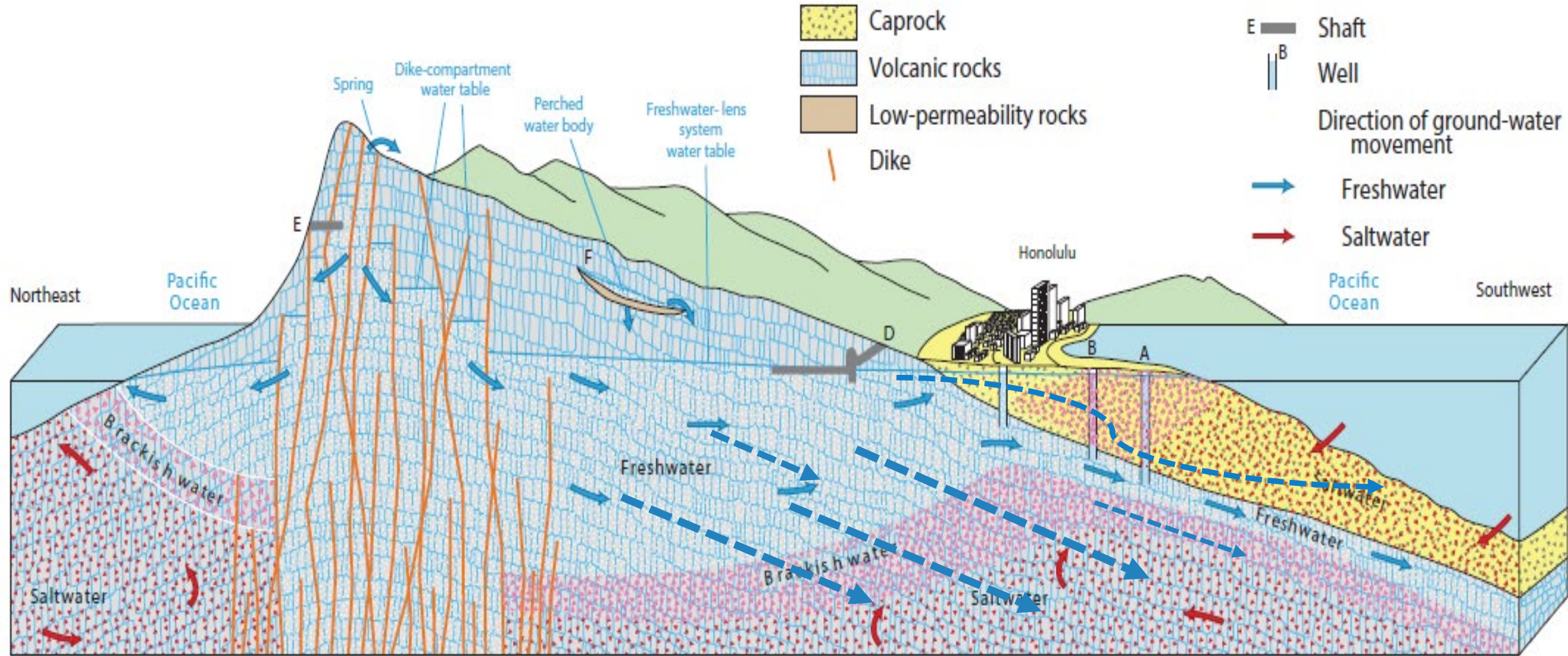
-  Sedimentary deposits (caprock)
-  Volcanic rocks
-  Low-permeability rocks
-  Dike

-  Shaft
  -  Well
  -  Freshwater
  -  Saltwater
- Direction of ground-water movement



NOT TO SCALE







**Geology and Ground-water Resources  
of the  
Honolulu-Pearl Harbor Area  
Oahu, Hawaii**

**CHESTER K. WENTWORTH**

BOARD OF WATER SUPPLY  
CITY AND COUNTY OF HONOLULU  
HONOLULU, HAWAII

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