



BRIEFING C1

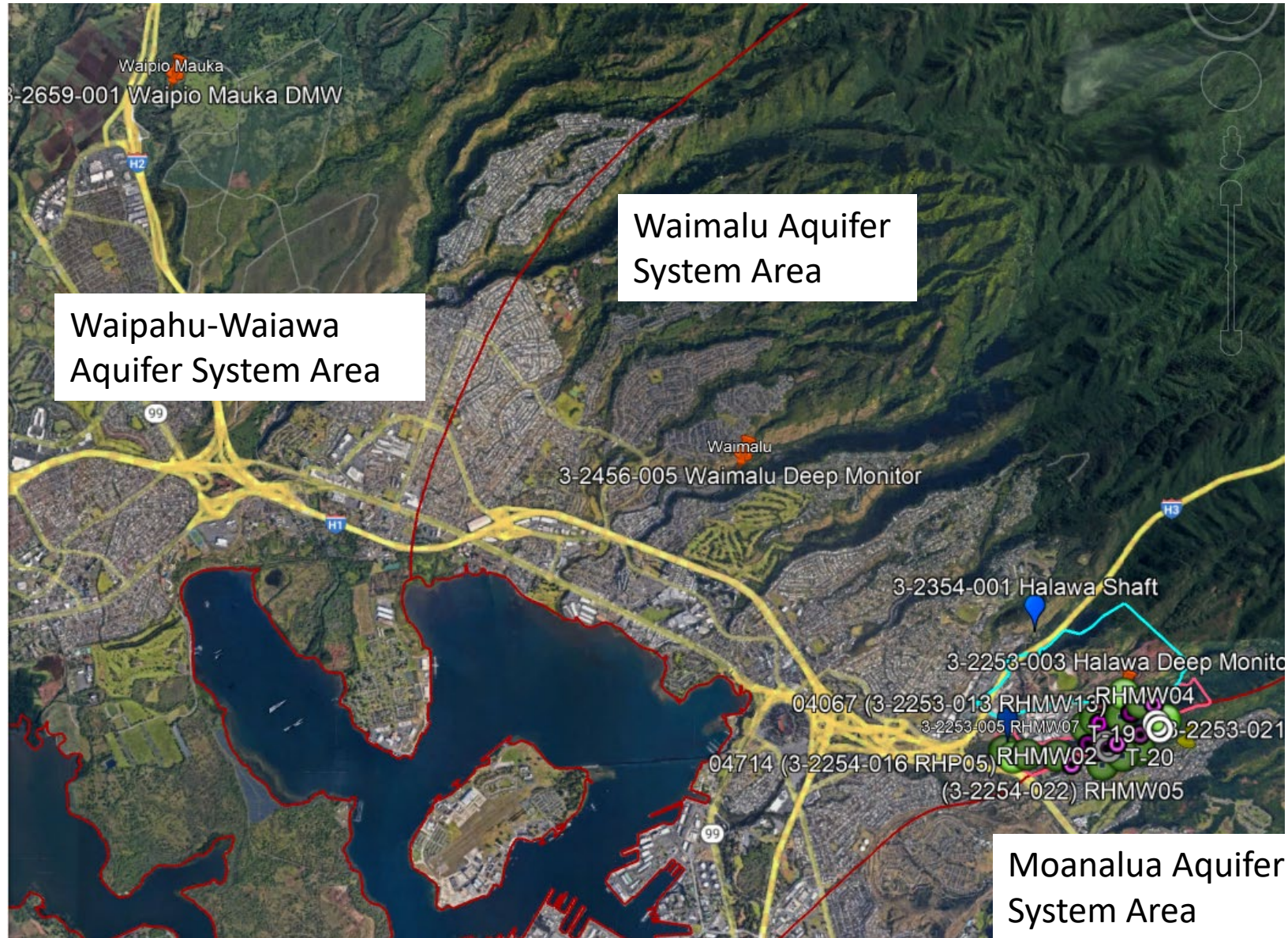
CWRM Data on Wells Related to Red Hill Crisis, Oahu

June 20, 2023

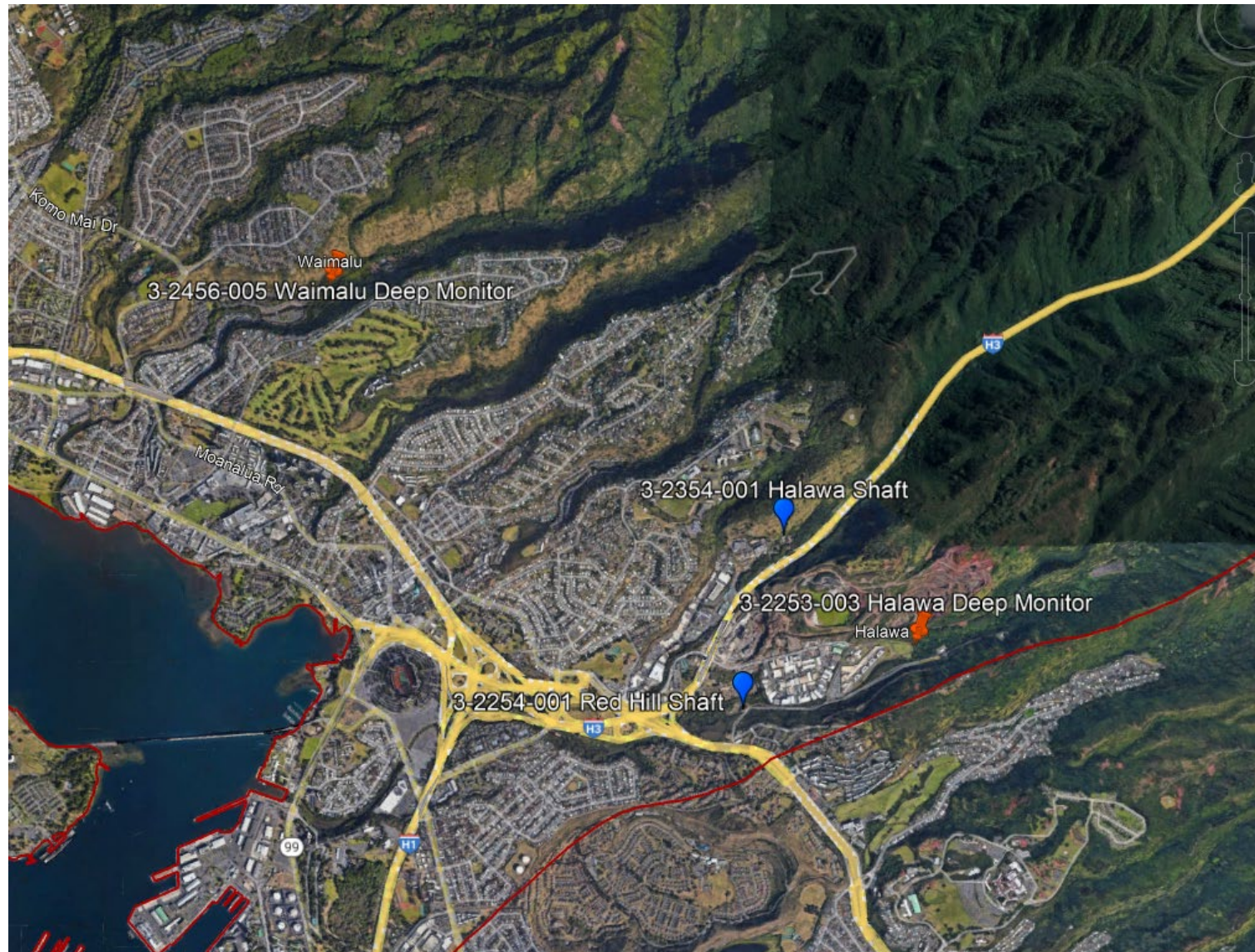
OVERVIEW OF PRESENTATION

- CWRM Deep Monitor Well Data
 - Aquifers are robust and relatively healthy
- Navy System Well Pumpage
 - Navy wells are pumped within allocation and chlorides are stable
- Navy Monitor Wells
 - 35 monitor wells, both drilled and proposed

CWRM Deep Monitor Well (DMW) Locations relative to Red Hill Facility



Halawa and Waimalu DMW locations relative to Halawa and Red Hill Shafts

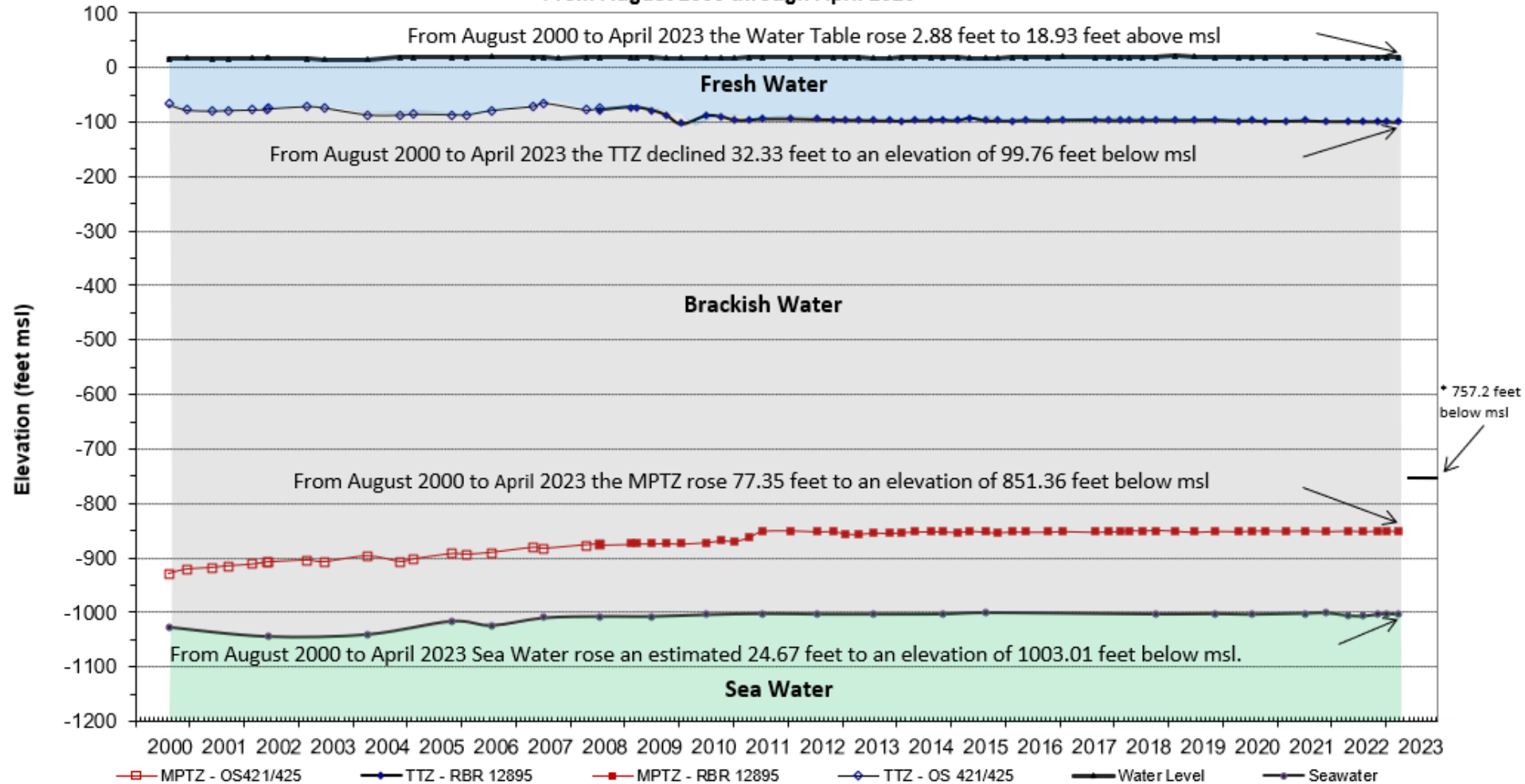


Aquifer Health in DMWs nearest RHBFSF

- General aquifer health can be assessed by plotting the historic elevations of the water levels, the Top (TTZ), and Midpoint (MPTZ) of the transition zones. Below are graphs compiled from data gathered from the CWRM DMWs nearest the Red Hill Facility, and are presented as time series.
- **Halawa DMW**
- The thickness of the freshwater lens proximal to the Halawa DMW is obscured by an upflow of brackish water in this well.
- The elevations of the TTZ, MPTZ, and Sea Water indicate relatively stable conditions in this region of the aquifer.

Halawa Deep Monitor Well, Oahu (3-2253-003)

Fluctuations in the Water Table, Top of Transition Zone (TTZ), and Midpoint of Transition Zone (MPTZ) From August 2000 through April 2023



Notes : (1) TTZ = 1,000 $\mu\text{S}/\text{cm}$ ($\sim 220 \text{ mg/L Cl}^-$); MPTZ = 25,000 $\mu\text{S}/\text{cm}$ ($\sim 8,500 \text{ mg/L Cl}^-$) (2) Fresh Water $< 220 \text{ mg/L Cl}^-$, Brackish Water 220 mg/L Cl^- to 18,999 mg/L Cl^- , Sea Water $\geq 19,000 \text{ mg/L Cl}^-$; (3) OS 421/425 = Ocean Sensors CTD (absolute conductivity); (4) RBR 12895 = RBR Global CTD (Specific Conductivity); (5) msl = mean sea level.

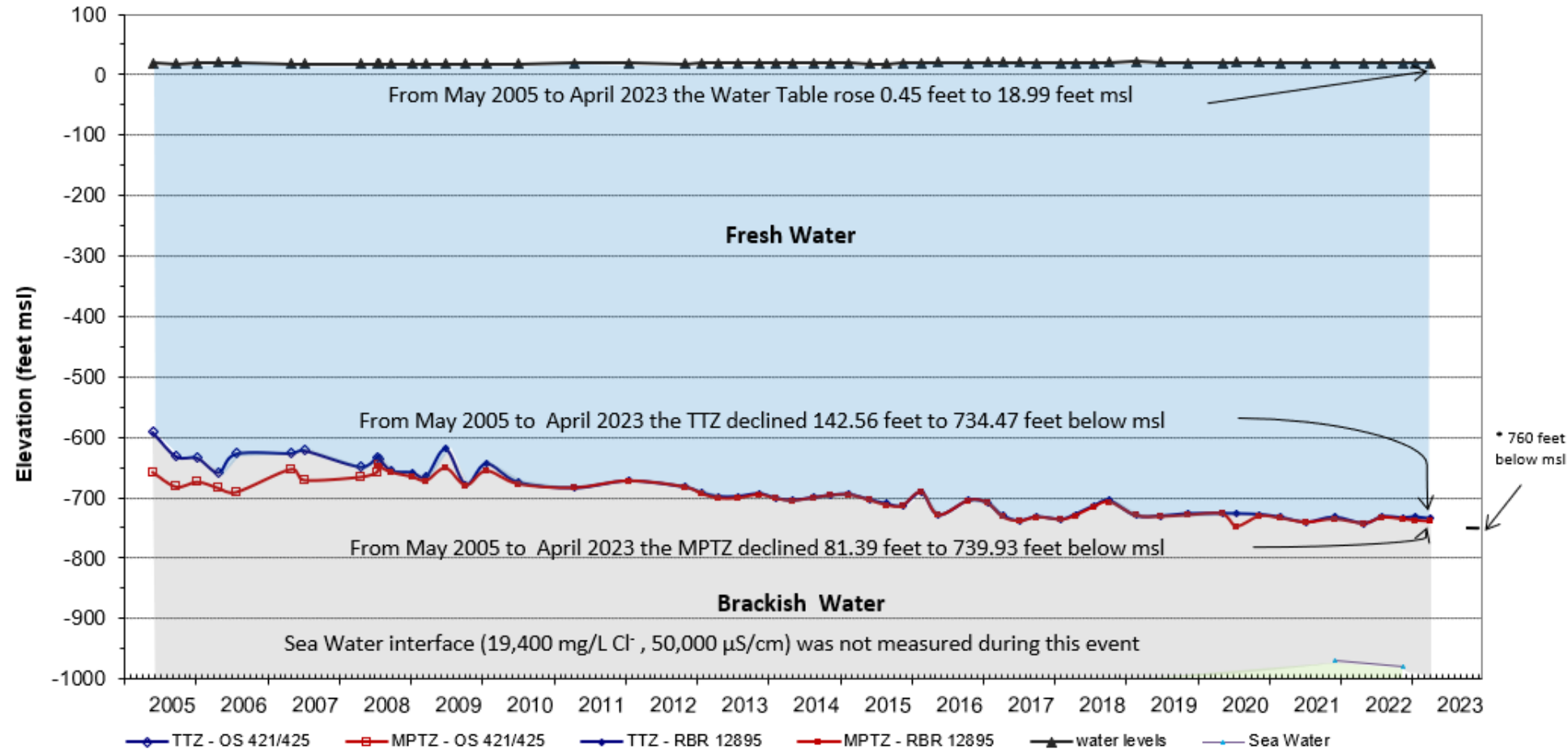
* Since the year 2000, the MPTZ has risen 77.35 feet, rising toward a calculated Ghyben-Herzberg equilibrium elevation of approximately 757.2 feet below msl (relative to the Water Table, measured at 18.93 feet above msl). Note the relatively thick mixing zone, resulting from upward borehole flow of an influx of brackish water.

- **Waimalu DMW**

- The freshwater lens in the Waimalu DMW continues to thicken, indicating a long-term influx of fresh water from the Koolaus.
- The presence of an increasing thickness of fresh water in this well makes it a possibility that there is a hydraulic buffer for the Halawa Shaft that deflects releases migrating northwest across Halawa Valley from the Red Hill facility.

Waimalu Deep Monitor Well, Oahu (3-2456-005)

Fluctuations in the Water Table, Top of Transition Zone (TTZ), and Midpoint of Transition Zone (MPTZ)
from May 2005 through April 2023



Notes: (1) TTZ = 1,000 μS/cm (~ 220 mg/L Cl⁻); MPTZ = 25,000 μS/cm (~ 8,500 mg/L Cl⁻) (2) Fresh Water < 220 mg/L Cl⁻, Brackish Water 220 mg/L Cl⁻ to 19,399 mg/L Cl⁻, Sea Water ≥ 19,400 mg/L Cl⁻; (3) OS 421/425 = Ocean Sensors CTD (absolute conductivity); (4) RBR 12895 = RBR Global CTD (Specific Conductivity); (5) msl = mean sea level.

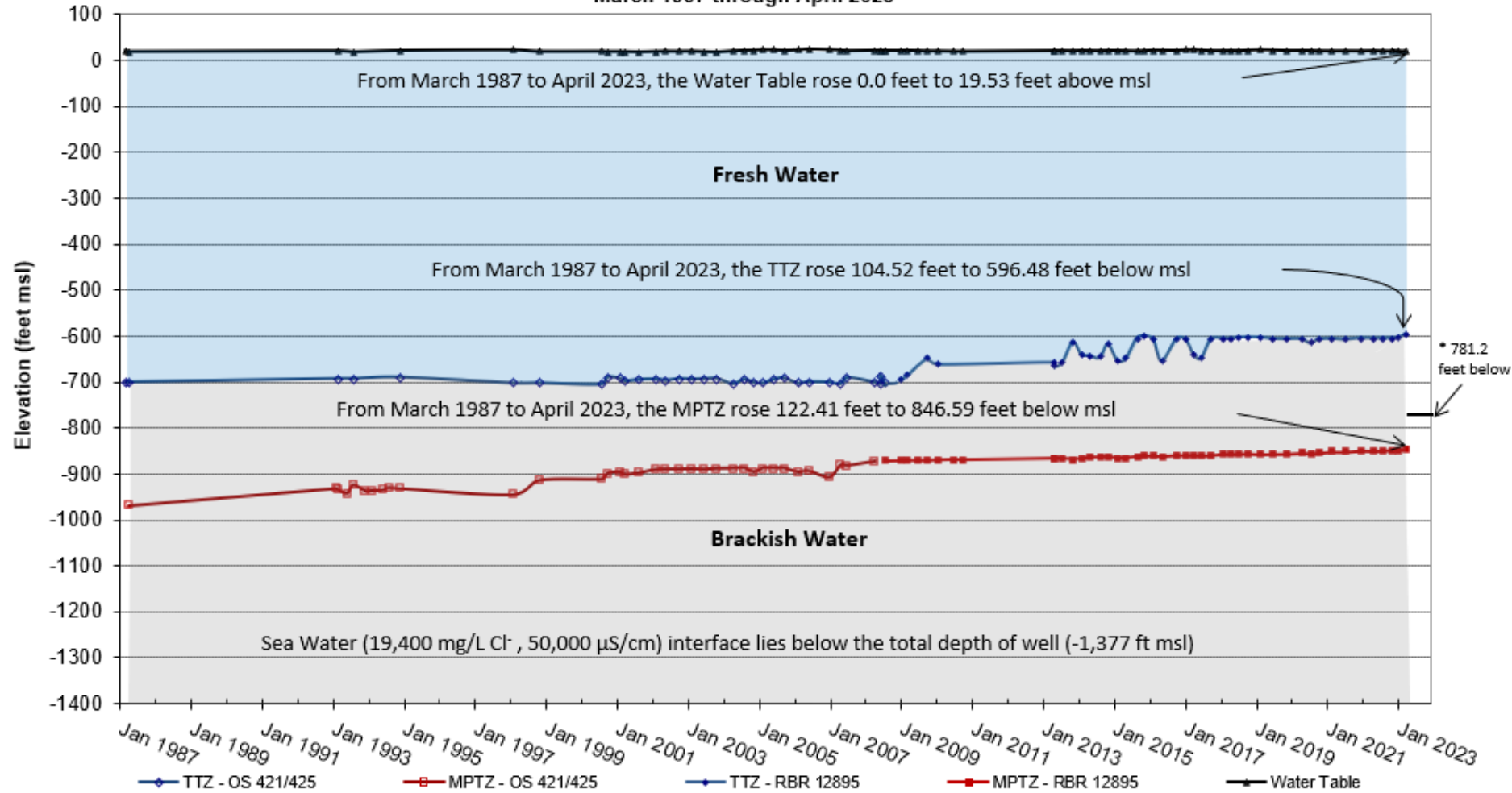
* Since the year 2005, the MPTZ has declined 81.39 feet toward a calculated Ghyben-Herzberg equilibrium elevation of approximately 760 feet below msl, relative to the Water Table measured at 18.99 feet above msl.

- **Waipio Mauka DMW**

- The freshwater lens in the Waipio Mauka DMW continues to slowly thin, from 700 feet thick to about 600 feet thick since this well was installed 37 years ago.
- The elevation of the Mid Point (MPTZ) also shows a gentle rise. The current elevation is still below the calculated Ghyben-Herzberg elevation, indicating the current thickness is greater than expected from the theoretical aquifer Mid Point calculation.

Waipio Mauka Deep Monitor Well, Oahu (3-2659-001)

Fluctuations in the Water Table, Top of Transition Zone (TTZ), and Midpoint of Transition Zone (MPTZ)
March 1987 through April 2023



Notes: (1) TTZ = 1,000 $\mu\text{S/cm}$ (~ 220 mg/L Cl^-); MPTZ = 25,000 $\mu\text{S/cm}$ (~ 8,500 mg/L Cl^-) (2) Fresh Water < 220 mg/L Cl^- , Brackish Water 220 mg/L Cl^- to 19,399 mg/L Cl^- , Sea Water \geq 19,400 mg/L Cl^- ; (3) OS 421/425 = Ocean Sensors CTD (absolute conductivity); (4) RBR 12895 = RBR Global CTD (Specific Conductivity); (5) msl = mean sea level

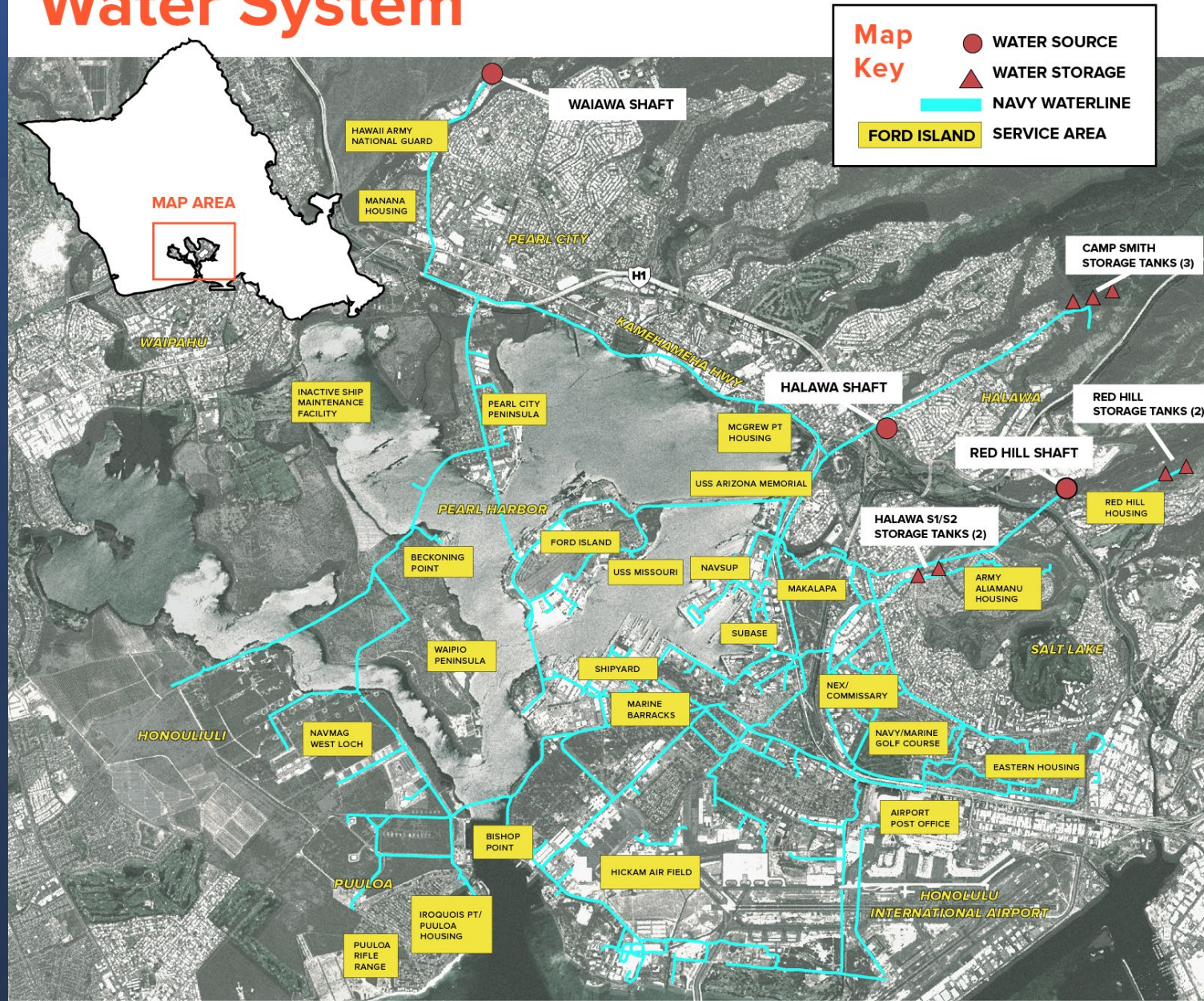
* Since the year 1987, the MPTZ has risen 122 feet, to below a calculated Ghyben-Herzberg equilibrium elevation of approximately 781 feet below msl, relative to the Water Table measured at 19.53 feet above msl.

Navy System Pumping Centers

Navy operates three Shafts within the area surrounding the Red Hill Tank Farm:

- **Aiea Halawa Shaft (3-2255-032)** drilled in 1937, located within the Waimalu Aquifer System, Water Use Permit 00086 with an Allocation of **0.697** mgd.
 - **Red Hill Shaft (3-2254-001)** drilled in 1943, located within the Moanalua Aquifer System, Water Use Permit 00085 with an Allocation of **4.659** mgd.
 - **Waiawa Shaft (3-2558-010)** drilled in 1951, located within the Waipahu-Waiawa Aquifer System, Water Use Permit 00111 with an Allocation of **14.977** mgd.
- All Shafts operate under the Public Water System ID of **PWC HI0000360** with the DOH Safe Drinking Water Branch

Joint Base Pearl Harbor - Hickam Water System



Map showing the location of the three Navy Shafts



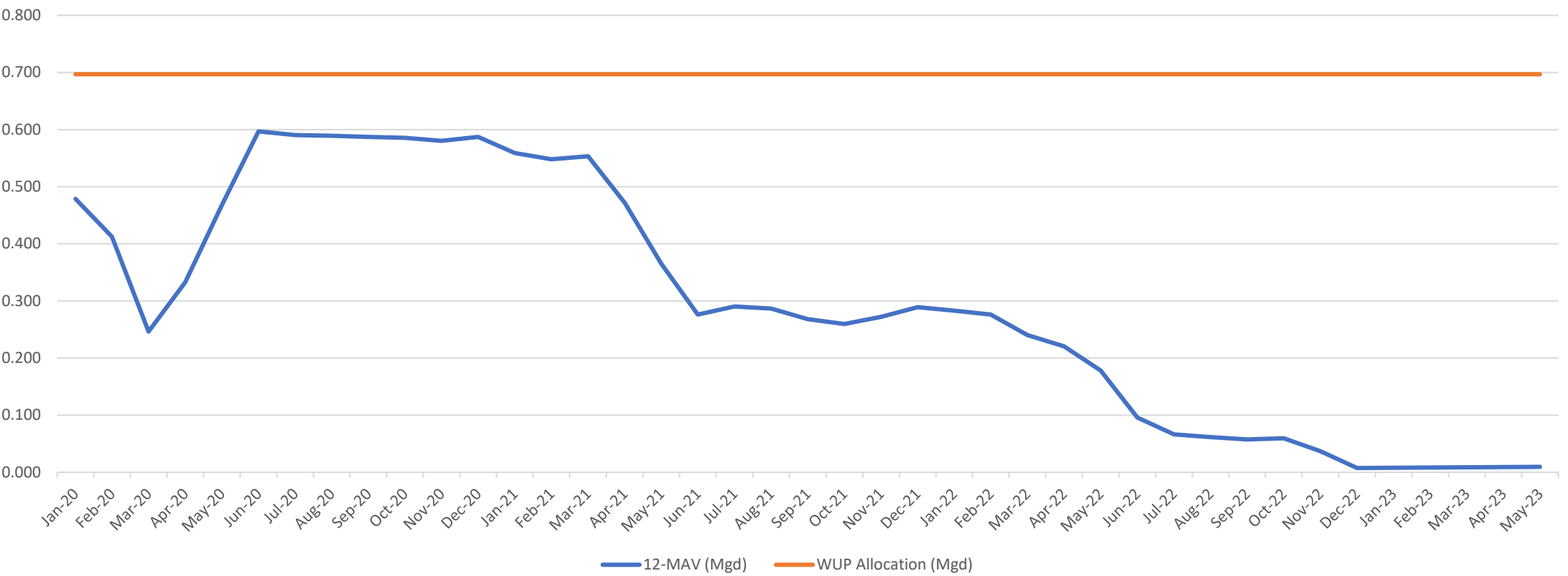
Pumpage prior to the release at Red Hill and the resulting change in Pumping in response:

November 2021 12-MAV Pumping

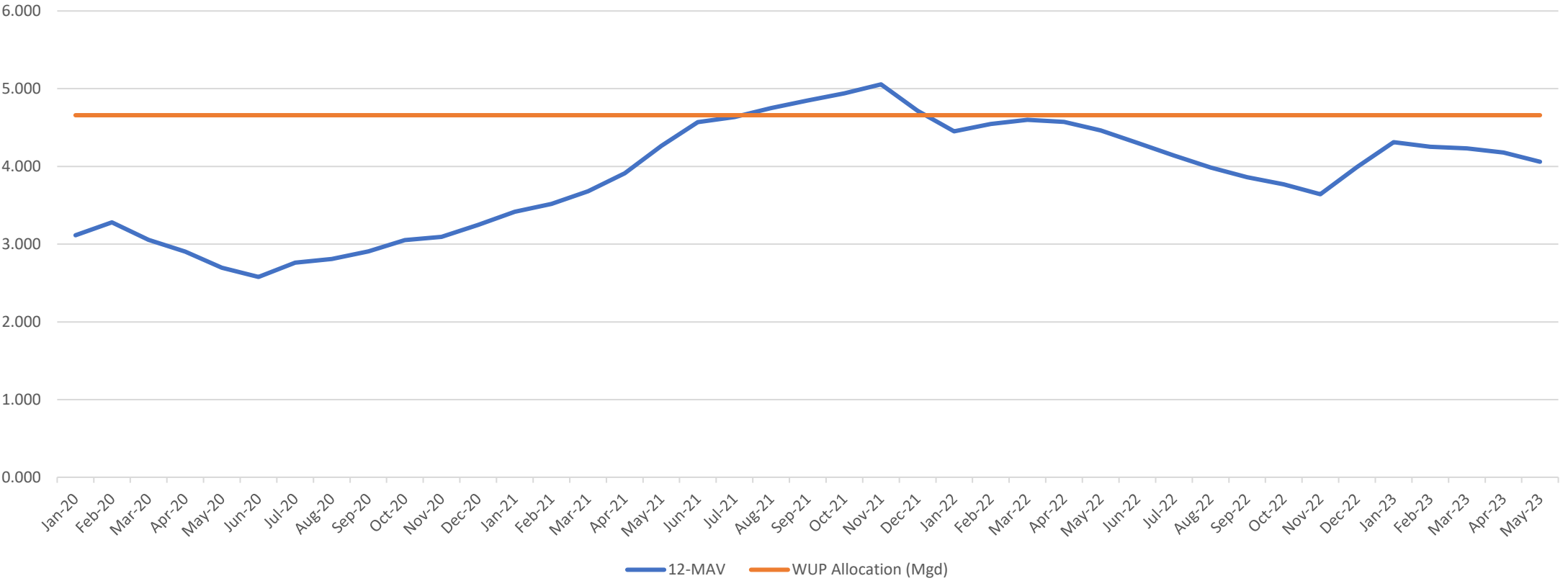
- Aiea-Hālawa Shaft **0.272 Mgd** with an allocation of 0.697 Mgd
- Waiawa Shaft **15.009 Mgd** with an allocation of 14.977 Mgd
- Red Hill Shaft **5.055 Mgd** with an allocation of 4.659 Mgd

Combined 12-MAV 20.363 Mgd

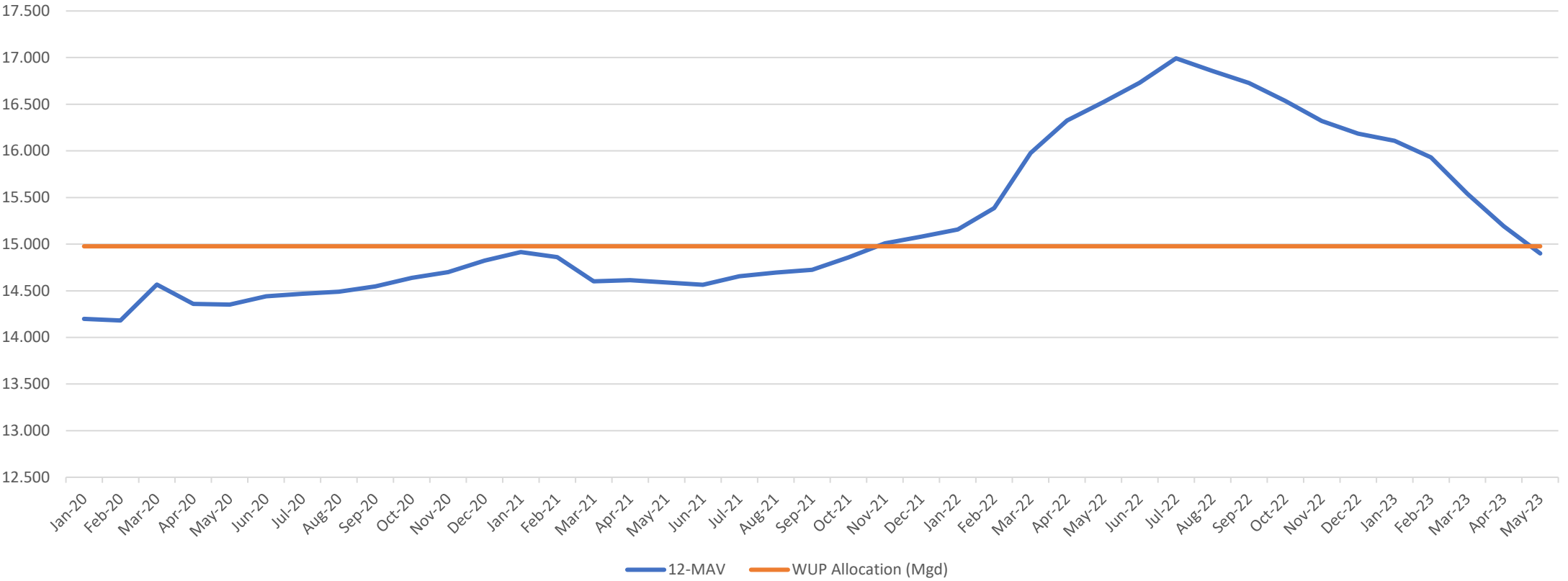
Aiea Halawa Shaft (3-2255-032) 12-MAV vs. WUP Allocation (Mgd)



Red Hill Shaft (3-2254-001) 12-MAV vs. WUP Allocation (Mgd)



Waiawa Shaft (3-2558-010) 12-MAV vs. WUP Allocation (Mgd)



The change in pumping in response to the release at Red Hill Tank Farm:

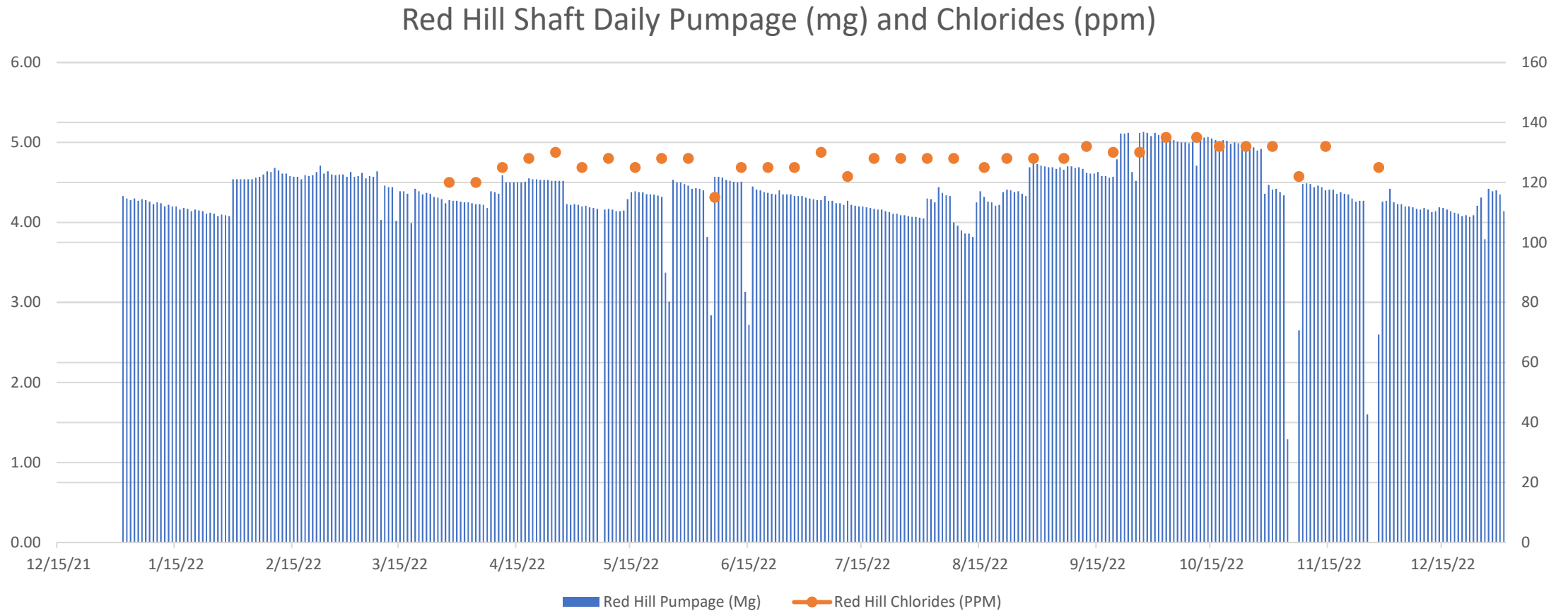
- Pumping ceased at Red Hill Shaft in December 2021, resuming on January 29, 2022. Since then, Red Hill Shaft has been pumping an average of 4,220,000 gallons per day.
- Pumping ceased at Aiea Halawa Shaft in December 2021. Pumps started at September 23, 2022, then the pumps run periodically a couple days each month typically pumping just over 100,000 gallons a month with a maximum of 2,430,000 gallons per day in October 2022.
- Pumping at Waiawa Shaft always continued, with a maximum 12-MAV of 16.993 mgd. Since that time pumping rates have continued to decline to the May 2023 12-MAV of 14.901 mgd.

Current Pumping:

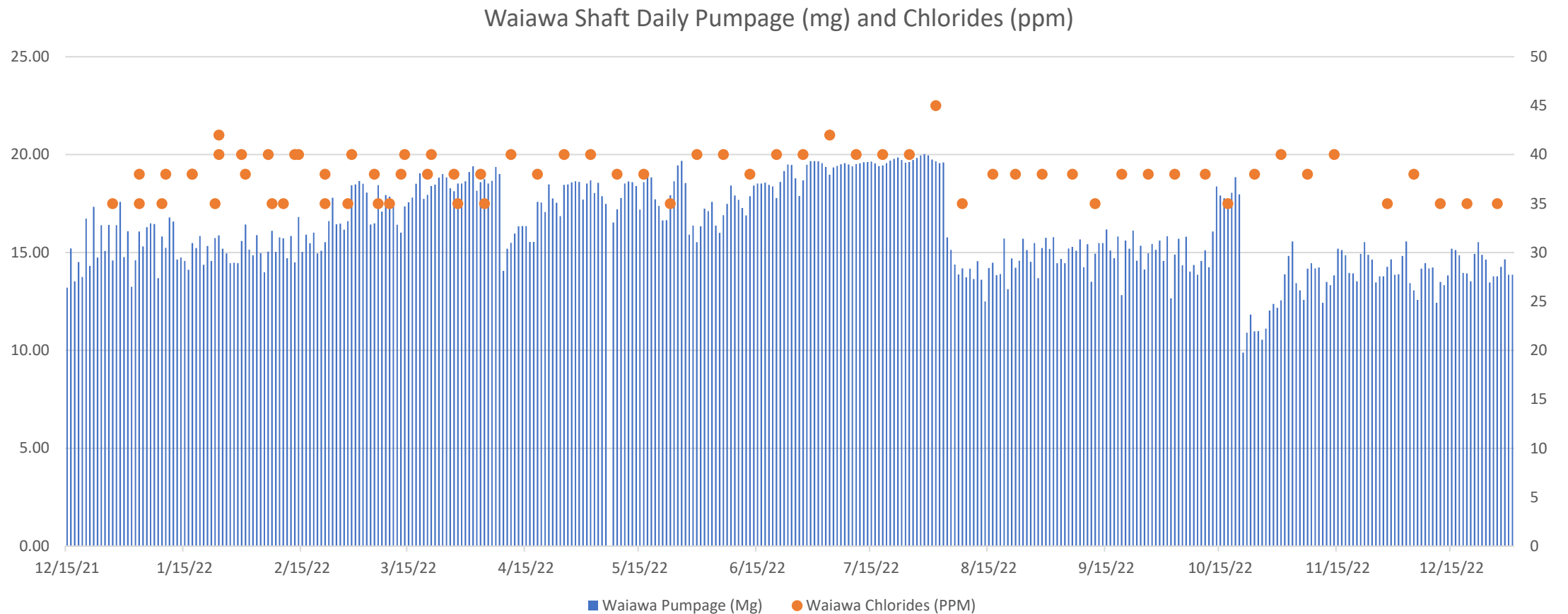
May 2023 12-MAV Pumping

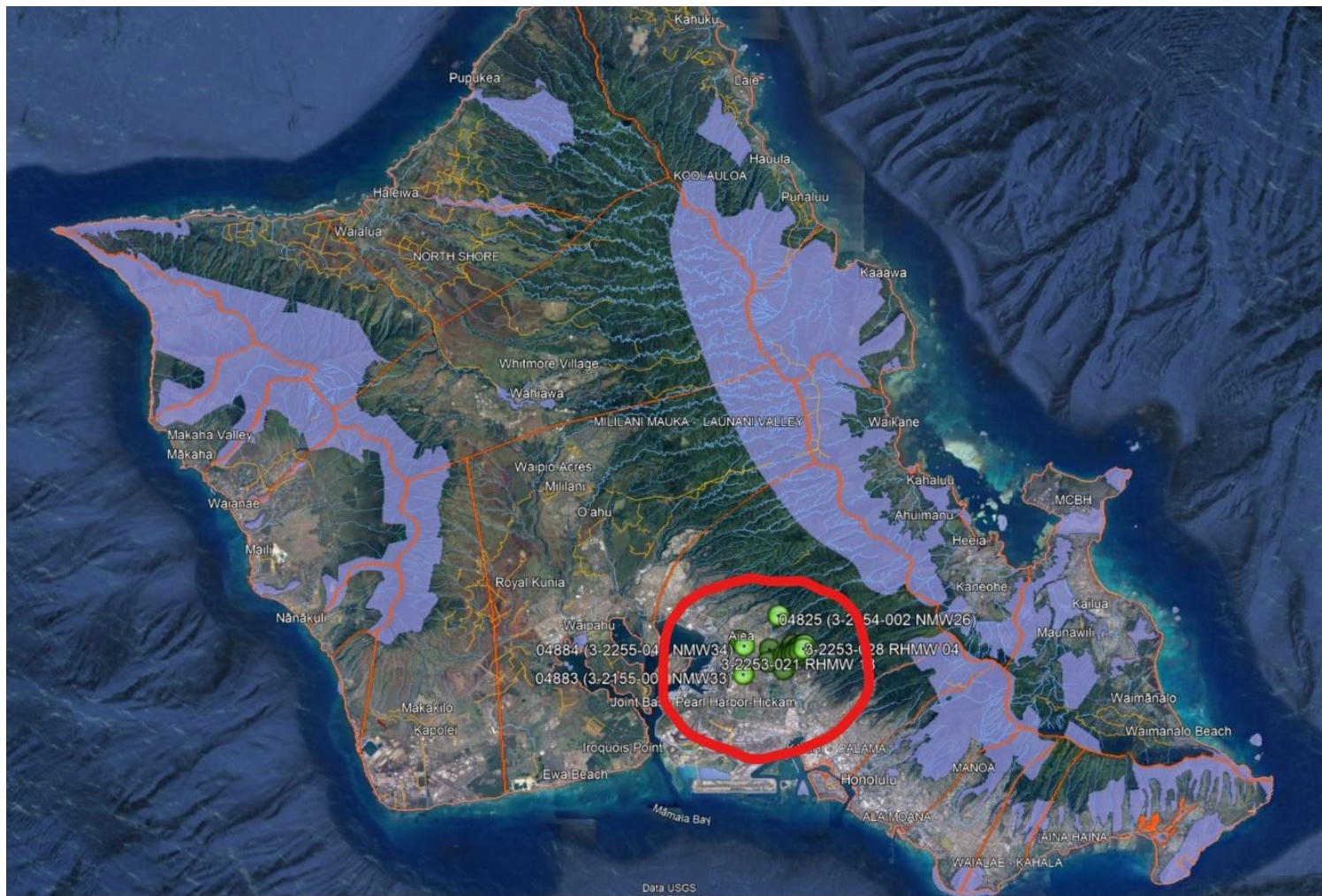
- Aiea-Hālawā Shaft **0.010 Mgd** with an allocation of 0.697 Mgd
- Waiawa Shaft **14.901 Mgd** with an allocation of 14.977 Mgd
- Red Hill Shaft **4.061 Mgd** with an allocation of 4.659 Mgd
- Combined 12-MAV **18.972 Mgd** (vs. 20.363 Mgd 12-MAV as of November 2021)

Chlorides have remained steady during the increased and decreased pumping



Chlorides have remained steady during the increased and decreased pumping



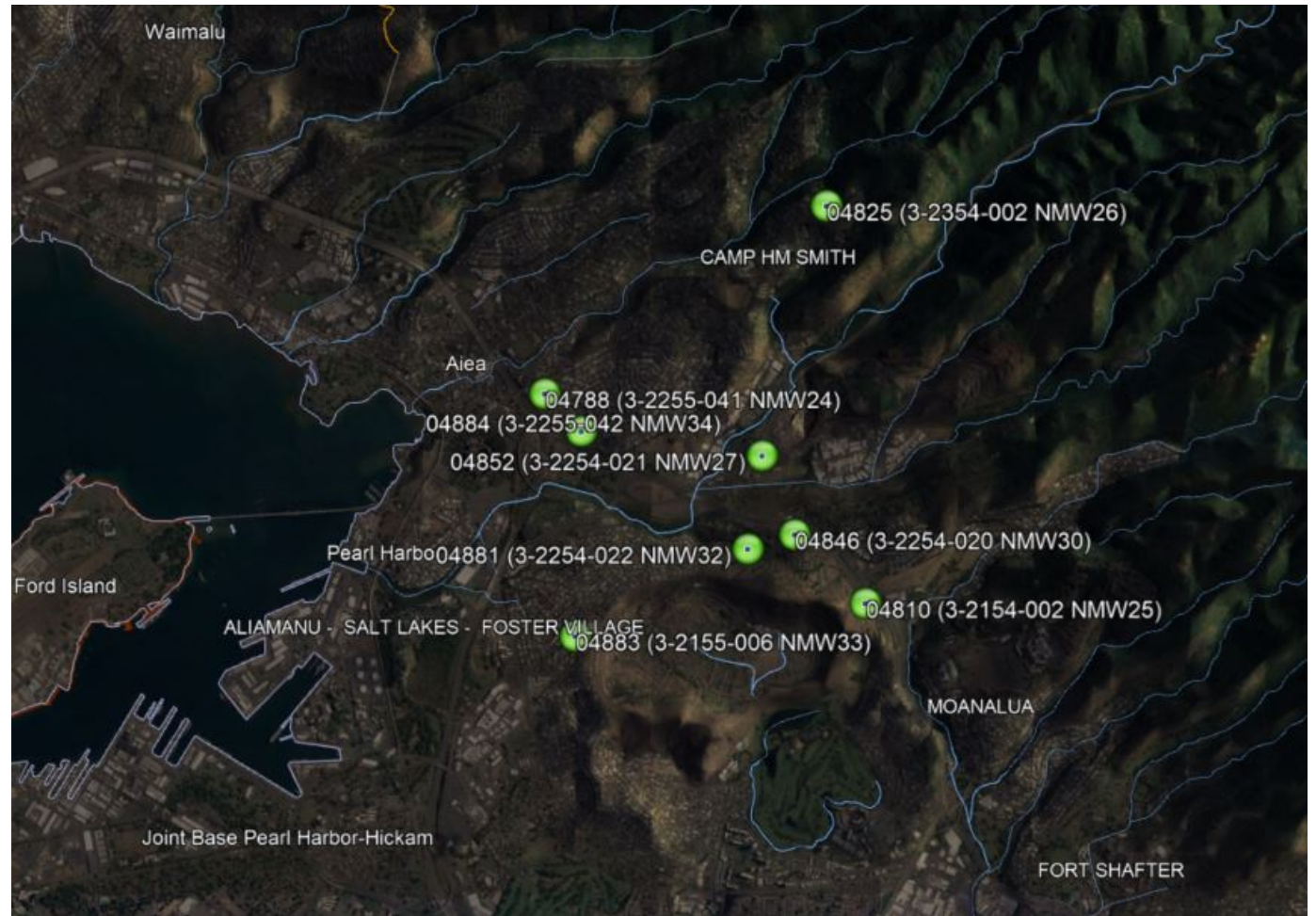


Navy Monitor Well Permits


Twenty- Three Existing Navy Monitor Wells




Eight New Proposed Navy Monitor Wells




Legend

 Fuel_Tanks


 NAVFAC Production Wells

Well Construction Permit Applications (1996-Jun2023)

 BWS


 NAVFAC


Well Construction Permits Issued (1996-Jun2023)


 BWS


 NAVFAC

Well Construction Complete (as of Jun 2023)

 BWS

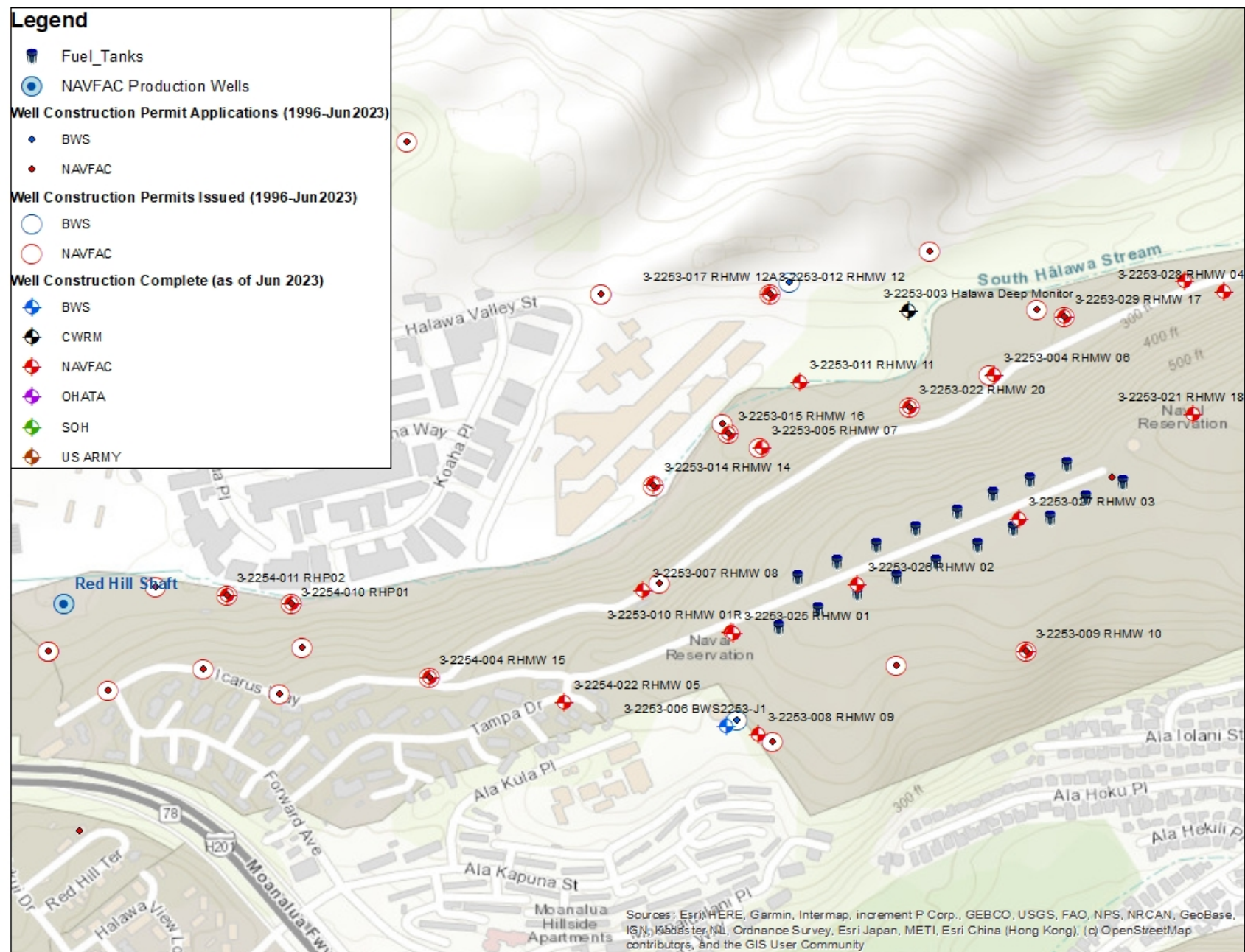
 CWRM

 NAVFAC

 OHATA

 SOH

 US ARMY



WATER QUALITY DATA FROM MONITOR WELLS

The DOH's Red Hill Water Information website - <https://health.hawaii.gov/about/red-hill-water-information/> includes links to data in the **Aquifer Monitoring and Recovery** portion of the "Ongoing issues" table.

The EPA's Groundwater Results Application - <https://www.epa.gov/red-hill/groundwater-results-application>

The Navy's JBPHH Red Hill Environmental website - https://jbphh-safewaters.org/public/framework/bannerhtml.aspx?idhtml=10769&banner=jbphh_environmental.png&title=JBPHH%20Red%20Hill%20Environmental&Domain=env.jbphh-safewaters.org&idMenu=90120&ddlDSN=SYSTM&DSN=SYSTM