



*Ke Kahawai Pono*

*"The trustee who oversees the rightful sharing of water."*

# Kona Ground Water Monitoring Update

Hawaii Department of Health and  
Commission On Water Resources Management Conference

Keauhou Beach Resort, Kona, Hawaii

January 17, 2013



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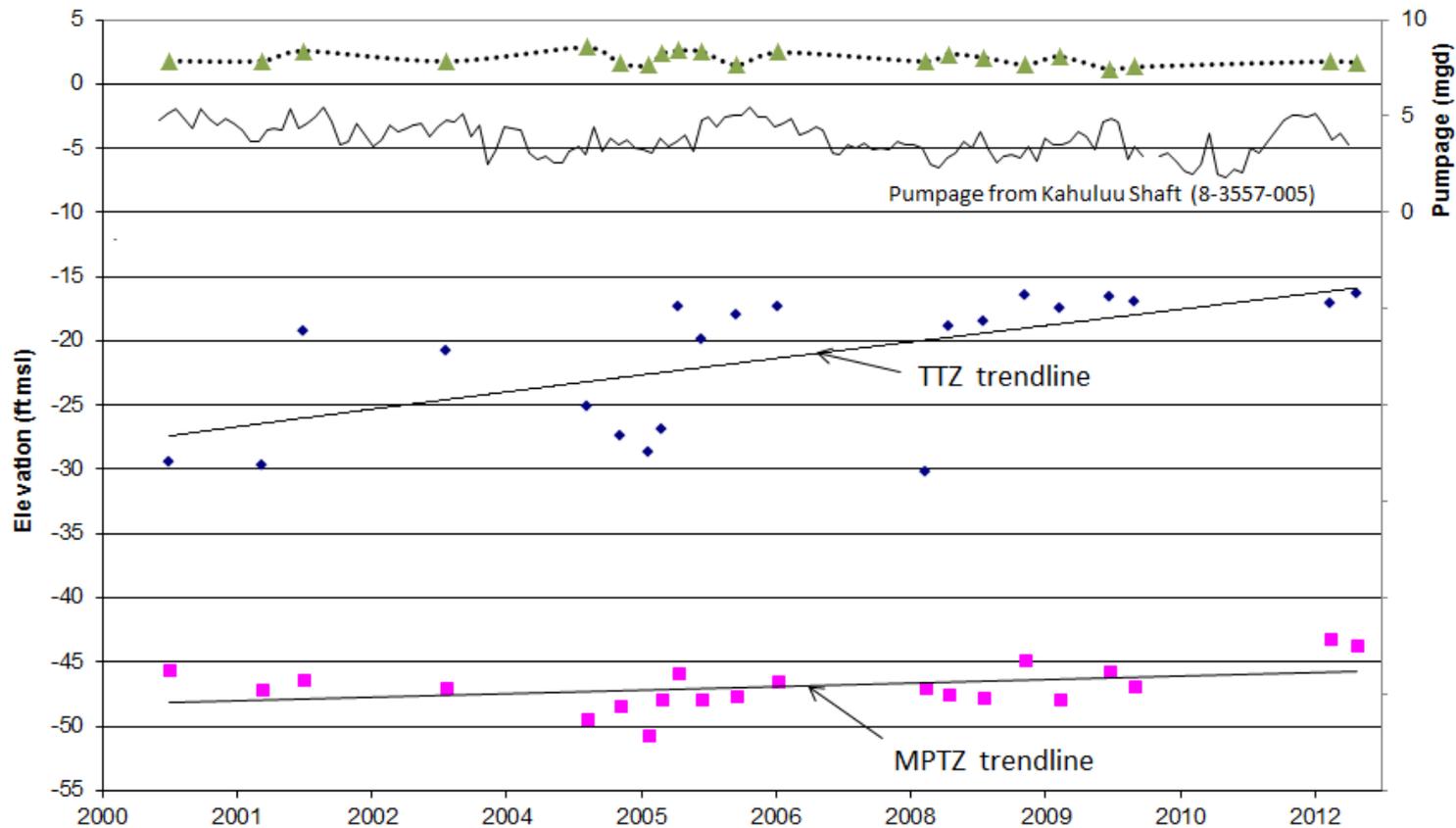
# Kona Ground Water Monitoring Update



Map Courtesy of USGS

# Kona Ground Water Monitoring Update

**Kahaluu Deep Monitor Well, Hawaii (8-3457-004)**  
**Elevations of the Water Level, Top (TTZ), and Midpoint (MPTZ) of the Transition Zone Over Time**



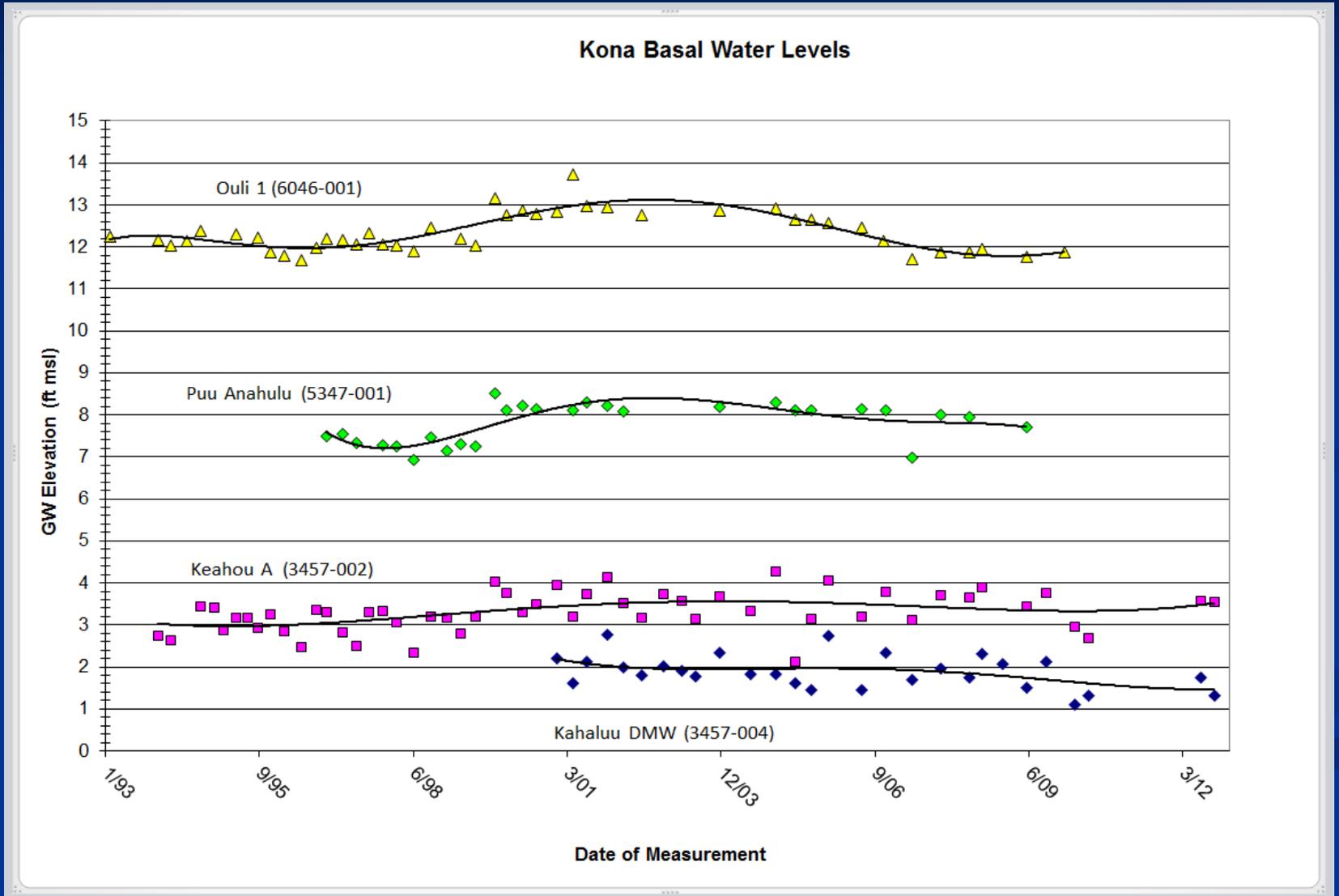
**LEGEND**

- ◆ TTZ - 5,000  $\mu\text{S}/\text{cm}$
- ◆ MPTZ - 25,000  $\mu\text{S}/\text{cm}$
- Water Levels (msl)
- Kahaluu Shaft Pumpage

**Notes:**

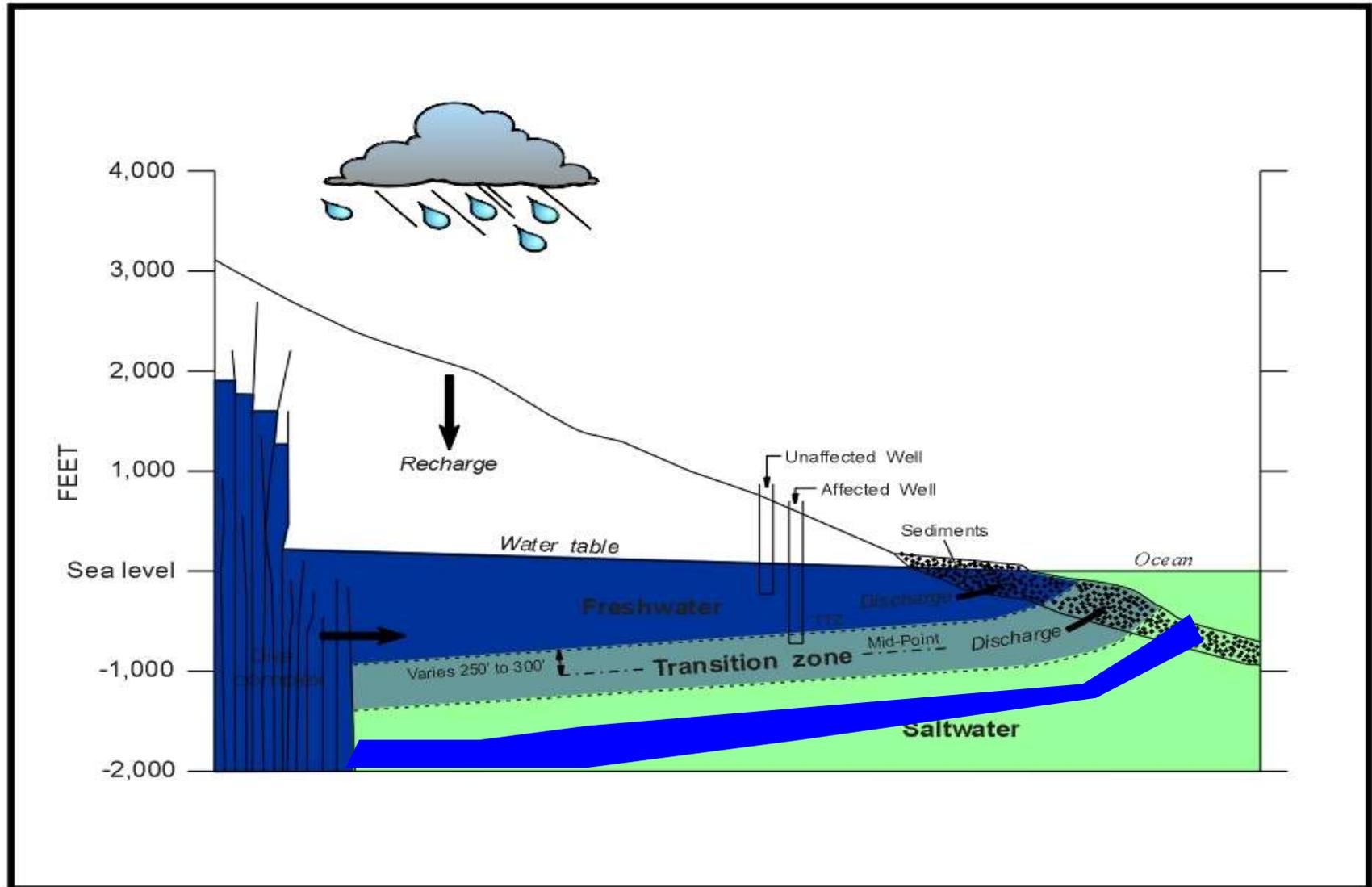
Minimum conductivity in this well is greater than 1,000  $\mu\text{S}/\text{cm}$  Top of Transition Zone (TTZ). Therefore, 5,000  $\mu\text{S}/\text{cm}$  is used as the TTZ monitoring point

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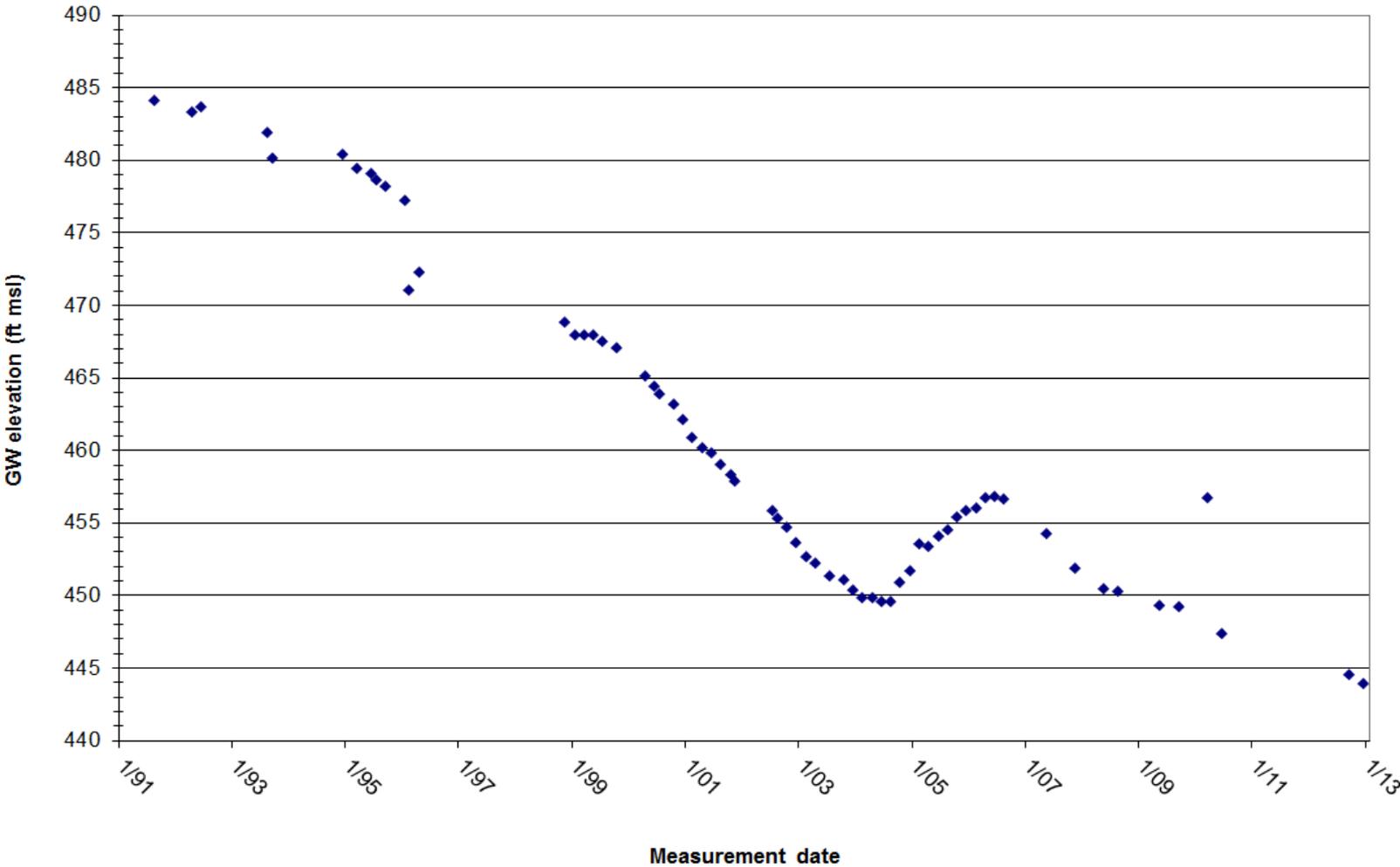


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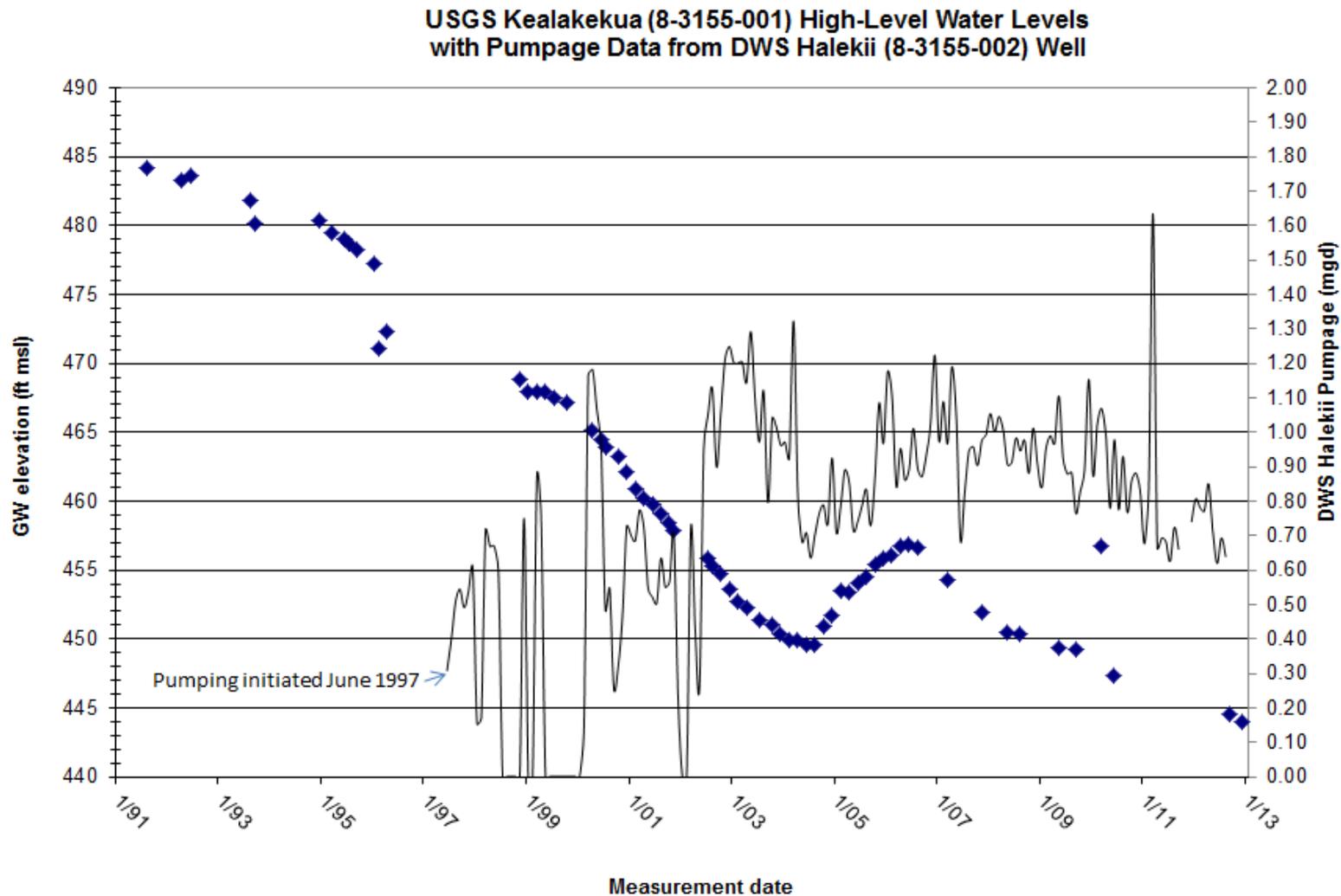


# Kona Ground Water Monitoring Update

USGS Kealakekua (8-3155-001) High-Level Water Levels

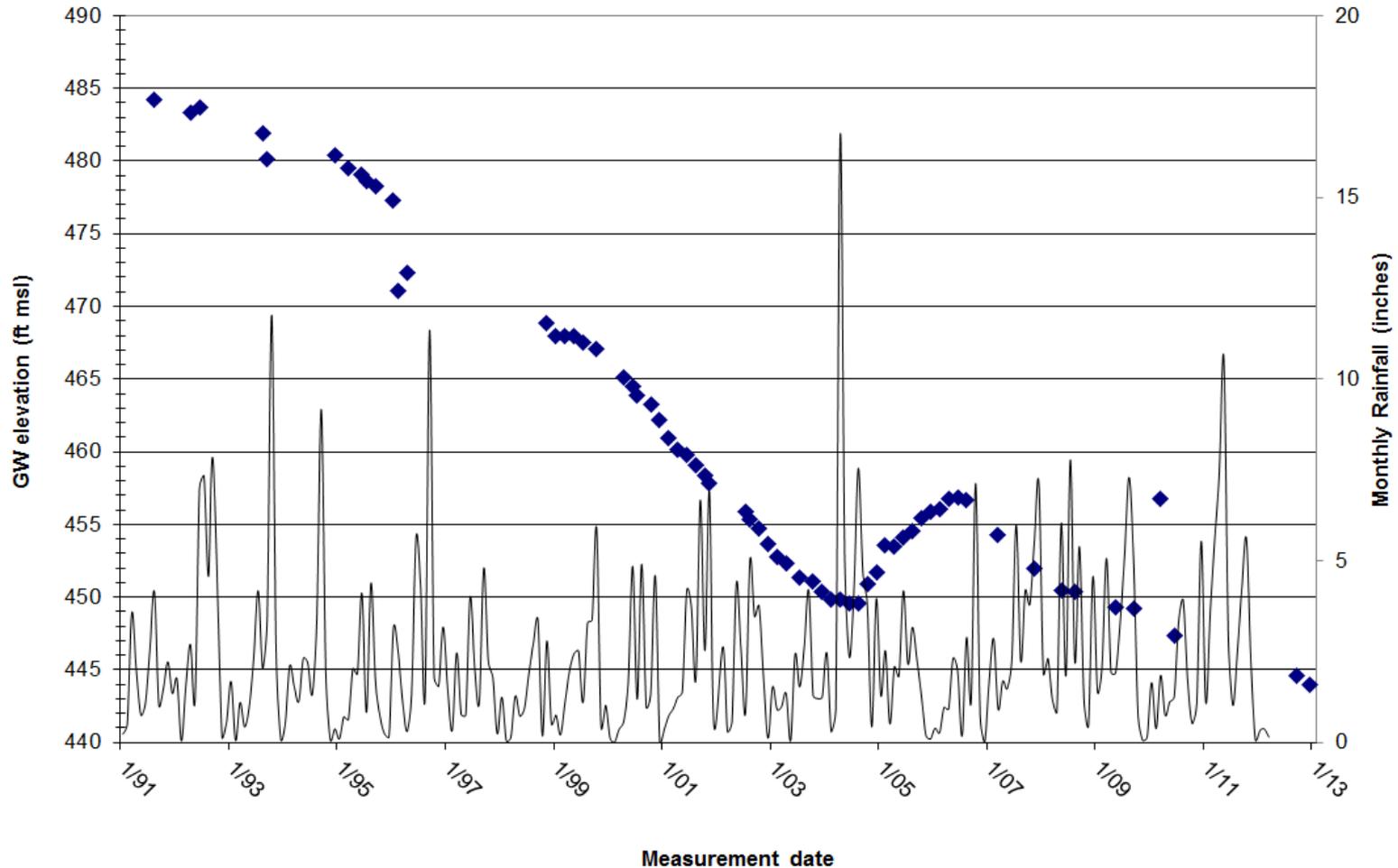


# Kona Ground Water Monitoring Update



# Kona Ground Water Monitoring Update

USGS Kealakekua (8-3155-001) High-Level Water Levels  
with Monthly Rainfall at Kainaliu NWS Station





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## 1. PRESENTION TITLE SLIDE

Good morning and welcome to the conference. I'm Patrick Casey, a geologist with the Survey Branch of the State's Commission on Water Resource Management.

First, I'd like to thank Dan Chang and the Safe Drinking Water Branch of the HDOH for coordinating this event- I'd also like to thank all of you for being here today, and more specifically, I want to express my thanks for your cooperation and contributions that are a vital component to managing Hawaii's fresh water resources, not only in the Kona area, but State wide. Effective water resource management is a collaborative effort.

## 2. ISLANDS FROM SPACE STATION SLIDE

You have no doubt seen this photo many times, I think it is a graphic illustration of our situation: a chain of small volcanic islands, surrounded by a LOT of sea water.

As most of you know, beginning in 2008, the Commission had its staff reduced by 50%, eliminating the Survey Branch, and as a consequence, many of our ground water monitoring efforts here in Kona, as well as on the other islands, were either curtailed, or terminated. I'm pleased to report that as of last summer, the Commission has begun staffing back up, and resuming the State-wide monitoring programs. I'm one of the new kids on the block- not quite fresh-off-the-boat, Windward Oahu has been my home since the mid-90s, and before joining the Commission last August, I worked in the environmental consulting arena for some 27 years, including projects on 6 of our islands. In the last few months I've met several of you, and look forward to getting to know you and working with you all as we move forward. Working together, managing the State's water resources for the benefit of all is a big undertaking. I would like thank you in advance for your patience and your input as I get up to speed in doing my part in this effort.

As we staffed up, the Survey Branch's primary focus has been on processing the book shelves (and I'm not kidding-) of water use reports, and bringing our water use database current. We have also been working to get our new WRIMS (Water Resources Information Management System) up and functional. You will hear from Paul Eyre in much more detail later today, as we are rolling out our on-line water use reporting- this will enable water use reporters across the state to go online and submit their monthly water use reports. Once the on-line water use reporting has been implemented, the survey branch can refocus on resuming and expanding the ground water monitoring programs that were curtailed.

My talk today is to provide an update on our current ground water monitoring efforts in Kona, and what has taken place over the last few years. In 2003, Glen Bauer, formerly with the Commission, presented a comprehensive Study of the Ground-Water Conditions in the North and South Kona and South Kahala Districts. In that study Glenn provided an analysis of the results of 800+ measurements over 11 years in a network of up to 40 monitoring wells. I won't

retell Glenn's story here, but he identified a number of concerns- including an apparent relationship between climate changes and decline in high-level water, and also what influences long-term trends in basal water. Equally important, Glenn identified a need for additional studies and monitoring to gain a better understanding of the hydrologic relationship between high-level and basal water aquifers, and the effects of climate change, including changes to precipitation and recharge.

In the interim, additional GW data was collected from selected wells, however, due to our staff cutbacks in 2008, a significant portion of the data collection effort was reduced, along with the manpower to process the data. With our new staff, the Commission has been reviewing and processing the data that was collected and stored. We have processed most of the deep monitoring well data, and have generated some time-line graphs depicting the trends in Top of Transition Zone (TTZ) and the MidPoint Transition Zones (MPTZ) in the profiled wells on Oahu, Maui, and Big Island.

### 3. CROSS SECTION

This cross section depicts the transition zones at the interface between the fresh and underlying saline water and illustrates the top and midpoints of the transition zone.

### 4. WELL LOCATON SLIDE WITH BLUE current and ORANGE to be added DOTS

Currently, on the leeward side of Hawaii, on a quarterly basis, we are collecting conductivity profiles in the Kahului Deep Monitoring Well, and water levels in the Keahou A, Kainaliu, and Kealakekua monitoring wells (BLUE DOTS). We would also like to renovate the Komo well, which currently fouled with a cable extending above the water level. We will be resuming the collection of water level data in several other wells, including Puu Anahulu (ORANGE DOTS), and Ouli 1 and Waiaka Tank Site near Wiamea. Yesterday we collected water level from the WaiakaTank site and Kaehoa Monitoring wells.

Since 2003 in the Kona area, according to our database, 34 additional wells have been installed in the Keauhou aquifer system, 22 of them are coded as observation wells, principally in the Kohanaiki area, and near the airport. 32 of the 34 new wells are basal, and 2 were installed in the high-level zone. Additionally, 24 new wells have been installed in the Kiholo aquifer system, and two in the Kealakekua system since 2003, although none are coded as observations wells.

I understand that later today folks from the National Park Service and others will present talks on their monitoring efforts at Kaloko- Honokohau National Historic Park.

## Basal aquifers

We are continuing to process the ground water data collected over the last few years to assess the conditions and trends in the monitored wells. The next couple of slides show some trends and identify some potential concerns in the basal aquifers beneath Kona and to the north.

### 5. KAHULUU DEEP MONITORING WELL SLIDE

One basal aquifer deep monitoring well, Kahaluu, located about 1 ½ miles north of here, has been profiled with a Conductivity/Temperature/Depth probe from 2000 through the present. As you can see at the top of the slide, the water levels in the well have remained fairly stable over the 12 years of monitoring. The fresh water lens (using the water level to MidPoint Transition Zone parameter) in this well has fluctuated by several feet during the monitoring period, and currently it is about 45 feet thick, slightly less than the 47 feet measured in 2000. The trend line of the TTZ however, suggests that the mixing zone between the TTZ and the MPTZ has increased in thickness over the same period from 16 feet to 27 feet. Pumpage from the nearby DWS Kahaluu Shaft is shown for comparison.

### 6. KONA BASAL WATER LEVELS SLIDE

This slide shows the water levels in four selected basal wells from 1993 through 2012. Notable is the slight rise in water levels in the three wells measured in the fall of 1999. The Ouli 1 and Pua Anahulu wells are 1.5 to 3 miles from any pumped well, and unlikely to be influenced by pumping. The water levels in the basal aquifers in the proximity of these wells have remained fairly stable over the nearly 20 years of water level monitoring. Although the thickness of the thin freshwater lens in the basal aquifers can be approximated by using measured water levels and Ghyben-Herzberg, the profile in the Kahaluu well illustrates the concern to be considered here: although water levels remain stable, the thickness of the freshwater lens below may be in transition, and thinning. I think the concern here is not to assume that stable water levels means a stable lens- they may be stable, but CTD profiles should be conducted periodically in deep wells to confirm top and midpoints of the transition zone.

## **Deep monitoring wells in basal aquifers**

### 7. KONA WELL MAPSHOWING KEOPU AND KAMAKANA RED DOTS

A deep basal well, Kamakana, was installed in 2010 and 2011 near Palani, and tapped a freshwater-bearing zone beneath the saline water at around 1,050 feet below water level, similar to that discovered in the Keopu deep monitoring well, approximately 2 mile to the southeast. The freshwater zone exhibited artesian conditions with a strong up-boring flow.

## 8. CROSS SECTION FIGURE SHOWING LOWER FRESHWATER ZONE

Despite significant efforts to complete the Kamakana well as a nested well, so the freshwater zone could be more closely studied, it was subsequently grouted from the bottom up to 450' below water level, to seal off the vertical flow of fresh water.

We are planning to renovate the deep Keopu well, and hopefully convert it into a two level, nested well to better study the deep fresh water zone and its hydrologic relationship with the shallow zones.

The discovery of this deep freshwater zone in two wells, approximately 2 miles apart, highlights the need for additional exploration and studies of this potential freshwater resource.

### **High-Level water**

We are also processing and assessing the data collected from high –level wells. The data collected during the monitoring of the Kealakekua USGS monitoring well, four miles southeast from here, may present another cautionary tale:

#### 9. KEALAKEKUAMAP with BLUE DOT

I've plotted the water level data for this well from 1991 through last fall.

#### 10. KEALAKEKUA WLs

From the installation in 1991, through the summer of 2004, the water levels show a steady decline from 484' above sea level to 450' above sea level, seemingly irrespective of pumping of the Halekii well, (some 35 feet away) that began in 1997,

#### 11. KEALAKEKUA WLs WITH PUMPING

or of potential recharge from precipitation, as seen in this slide with data from nearby Kainaliu weather station.

#### 12. KEALAKEKUA WLs WITH RAINFALL

While this overall decline may be attributable to climate change, I think the caution here is when drilling into high-level compartments, there is a potential risk to puncture the compartment and cause a decline in water levels in that compartment. The decline also highlights the need for further studies into the sustainability of the high-level aquifers- the application of current hydrologic models may not provide an accurate explanation of the behaviors of these high-level aquifers.

### 13. ISLANDS SLIDE

#### CONCLUSION

I realize this presentation is a quick look at a only a few points of concern. There is more data to process and incorporate into our assessment of aquifer conditions, here, and on the other islands. Going forward, the Commission is focusing on not only processing the data we have accumulated, but to expand the network of monitored wells in the basal and high-level aquifers in the Kona, and south Kahala areas. As I mentioned earlier, we will be resuming the data collection from previously monitoring wells so have more long-term data. We will be preparing a set of recommendations for improving existing wells, as well as identifying potential locations for future monitoring wells, as changing conditions generate the need for more data.

As we continue to assess ground water conditions, and disseminate the information, we will be asking for your help- we will be requesting non-pumping water level data from the DWS wells to be submitted with their water use reports. Another very significant contribution will be for the owners of some of the existing, and unused, wells to grant the Commission access to their wells for quarterly water level and conductivity profile measurements, and to allow the installation of a few recording transducers. We are working to compile a list of wells we would like to monitor, and I hope to contact a few well owners with our requests in the upcoming months. I believe the goal in our combined efforts is to develop an effective water resource management process.

I look forward to discussing the data and concerns I have voiced here today with you. I'll be attending the round table this afternoon and look forward to hearing your presentations and discussions

Any questions?

Thank you!