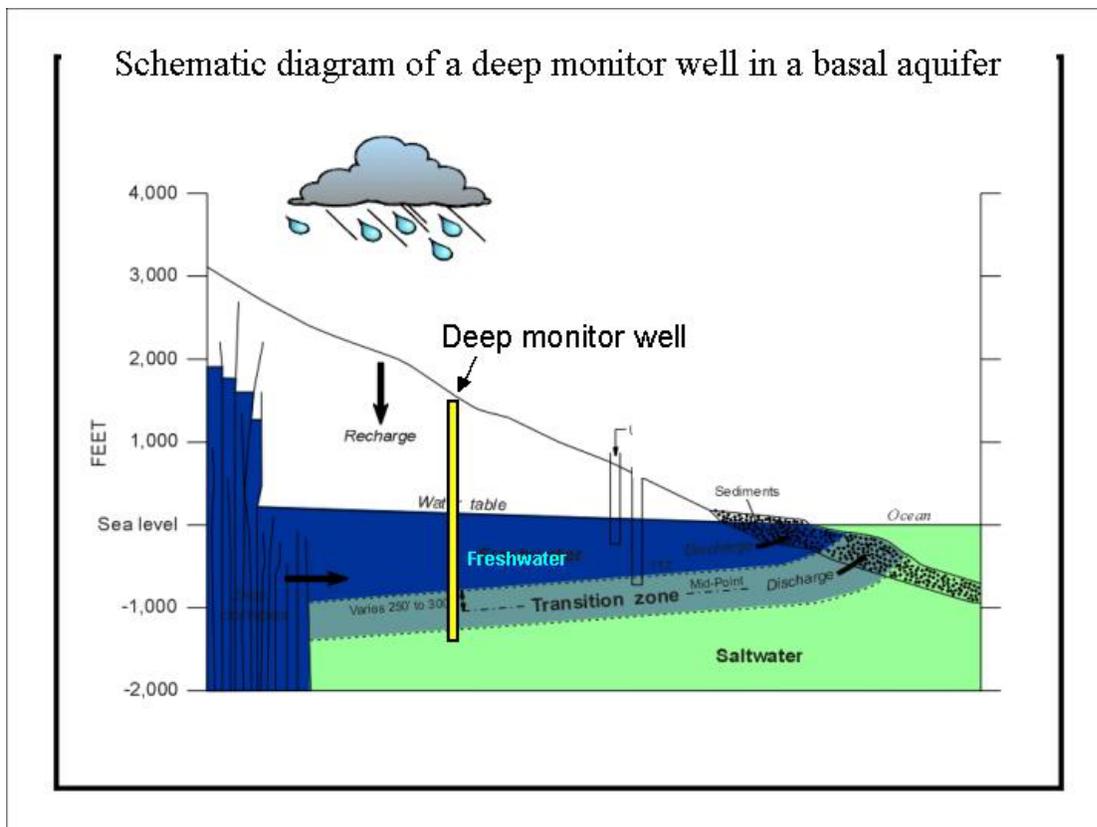


COMMISSION ON WATER RESOURCE MANAGEMENT  
DEEP MONITOR WELL PROGRAM

Introduction

Hawaii's unique volcanic geology provides for large aquifers (water bearing rock) that are able to support the State's population by supplying potable ground water as well as water for agricultural and other purposes. These aquifers are replenished by rainfall. Because fresh ground water is slightly less dense than seawater, it floats on top of the saline water forming what is known as a Ghyben-Herzberg lens, which is referred to as a "basal" aquifer. Theoretically, for every foot of fresh water above sea level, there is 40 feet of fresh water below sea level. Between the freshwater and salt-water portions of the lens is a zone of mixing, known as the "Transition Zone."

In Hawaii, the chloride ion concentration (milligrams per liter or mg/L) is used to determine the freshness or saltiness of ground water. It is also listed as a contaminant in the EPA Secondary Drinking Water Regulations. Chloride in small concentrations is not harmful to humans, but in concentrations above 250 mg/L, or 2 percent that of seawater, it imparts a salty taste in water that is objectionable to many people. By definition, the Transition Zone is water greater than 250 mg/L chloride (TTZ) to the mid-point concentration of 9,500 mg/L chloride (MPTZ), which is 50 percent of seawater. Below the mid-point, concentration increases to sea water at 19,000 mg/L chloride. Because the amount of water that can be developed from a freshwater lens for potable use is constrained by the salinity of the water, the altitude of the top of the transition zone (where chloride concentration is 2 percent that of seawater) and the thickness of the transition zone are important. The transition zone is in constant flux, responding to changes caused by variations in pumping and rainfall.



## What is a Deep Monitor Well?

A deep monitor well penetrates the entire water column from fresh water into the salt water. Data collected from the well are used to track the change and movement of the Transition Zone over time. This can be accomplished either by direct sampling at discrete elevations (below mean sea level) or by lowering a Conductivity-Temperature-Depth (CTD) probe that measures changes in the electrical conductance, temperature, and depth of the water as it is lowered to the bottom of the well. The saltier the water, the more conductive it is. As one travels inland, the water levels increase; therefore, the elevation of the mid-point below mean sea level would decrease accordingly. Ideally there should be three deep monitor wells in each aquifer system, situated in a way as to provide a mountain to seaward (mauka to makai) line or cross-section through the basal aquifer. Given there are 118 aquifer system areas in the state, this means that ideally there should be a minimum of 354 deep monitor wells to fully assess the status of our ground water resources.

## CWRM Deep Monitor Wells

The Commission is responsible for twelve (12) deep monitor wells, eleven (11) which are active.

Commission staff monitors and logs six (6) deep monitor wells on Oahu on a quarterly schedule. All of the Oahu wells are located within the Pearl Harbor Aquifer Sector, which encompasses the Waimalu, Waipahu-Waiawa, and Ewa-Kunia Aquifer System Areas. The Pearl Harbor Aquifer Sector Area is the most important potable aquifer in the State of Hawaii, supplying the majority of the drinking water for the island of Oahu. The Halawa Deep Monitor Well, located above Halawa Medium Security Prison, and the Waimalu Deep Monitor Well, located in Waimalu Valley, are located in the Waimalu Aquifer System Area. The Waipio-Mauka Deep Monitor Well, near Mililani Cemetery, and the Waipahu Deep Monitor Well, below the old sugar mill; are located in the Waipahu-Waiawa Aquifer System Area. The Kunia-Middle Deep Monitor Well, located west of Kunia Road, and the Kunia-Mauka Deep Monitor Well, situated about 1.6 miles north of the Kunia-Middle Deep Monitor Well, are located in the Ewa-Kunia Aquifer System Area.

On Maui, Commission staff currently conducts CTD profiles in four (4) deep monitor wells on a quarterly schedule. The Mahinahina Deep Monitor Well is located in the Honokowai Aquifer System Area near Lahaina, an important and expanding tourist destination on the dry, leeward side of the island. The Waiehu Deep Monitor Well and the Iao Deep Monitoring Well are located in the Iao Aquifer System Area, which is heavily pumped and may be showing signs of overpumpage. The Commission recently completed the installation of the new Waihee Deep Monitor Well, located in the Waihee Aquifer System Area, which is adjacent to and in hydraulic communication with the Iao Aquifer System Area.

The Commission staff also currently conducts a quarterly CTD profile in one (1) deep monitor well on the island of Hawaii, near Kailua-Kona within the Keauhou Aquifer System Area. The Kahaluu Deep Monitor Well is located seaward of the Kahaluu Shaft and reflects conditions in the basal aquifer where no caprock exists. One (1) additional deep well, the Keopu Deep Monitor Well, located mauka of Kailua-Kona, is not currently monitored due to caving and well completion difficulties; however, efforts are underway to repair this well and resume CTD profiling. The Keopu Deep Monitor Well is unusual in that a deep lens of fresh water was encountered below the seawater profiled under the basal fresh water lens during drilling. Water levels rose in the Keopu well when the deep fresh water lens was encountered, indicating artesian conditions in the fresh water lens. Plans to drill additional deep monitor wells in the Kona are of the island of Hawaii are currently being considered to provide additional, and much needed, potable water resource data.

## Other Deep Monitor Wells

Other deep monitor wells in the state are monitored by the following entities: 1) Honolulu Board of Water Supply (twenty-nine (29) near their pumping sources on Oahu), 2) U.S. Geological Survey (one (1) in the Kualapuu Aquifer System Area, Molokai), 3) Ewa Plain Water Development Co. (one (1) in Ewa-Kunia Aquifer System Area, Oahu); 4) Forest City Hawaii Kona, LLC (one (1) in Keauhou Aquifer System Area, Island of Hawaii).