From:	Mike Reimer
To:	WPCtestimony
Subject:	testimony for General Plan 2045
Date:	Tuesday, January 7, 2025 6:12:45 AM
Attachments:	TESTIMONY Hawaii General Plan 2025 to be sent January 7 with cover letter.docx

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To: Windward Planning Commission
Hawaii County Government

From: Michael Reimer, Ph.D.

Re: Testimony for Planning Commission January 16-17, 2025 Special General Plan Meeting

I am submitting testimony as an attachment for the Planning Commission January 16-17, 2025 Special General Plan Meeting.

Respectfully yours,

/s/

Michael Reimer, Ph.D.
Geologist
Denver, CO
GeoMike5@att.net
January 7, 2025

The concern that the Hawai`i County 2045 General Plan does not include sufficient discussion of subsurface issues has been presented in public forums and has considerable merit because, in Hawai`i, there is a strong connection of subsurface environment and the surface ecosystem.

Perhaps the best way to state concern about this omission is to mention a statement by Dr. Nicole Deziel, lead author of an article addressing subsurface environmental manipulation. In an overview of her article, she cautioned, *"Researchers and policymakers tend to focus on only one domain, when they really are interconnected."* (*Synergies and Trade-Offs in Reducing Impacts of Unconventional Oil and Gas Development on Wildlife and Human Health in Bioscience 72: 472-480, March 2022*).

Because of this robust surface and subsurface domain connection on Hawai`i Island, I strongly concur with the concern to have the 2045 General Plan include subsurface issues and I provide commentary on some issues that have been previously mentioned.

The issue of the subsurface environment with emphasis on hydraulic fracturing (or fracking) has been addressed as a need for inclusion in the 2045 Hawai`i County General Plan (Brenda Ford, Letter to Editor, West Hawai`i Today, December 6, 2024). When fracking is mentioned, most people think of it being employed for enhanced oil and gas extraction from tight rock formations underground. That may not seem to have any application in Hawai`i but fracking can be used for much more than oil and gas extraction and for situations that are common in Hawai`i. For example, hydraulic fracturing can be used for: Stimulating groundwater wells; Mining; Waste remediation and disposal; Measuring Earth stress; Electricity generation for geothermal resources; Geological sequestration of CO_2; Pumped storage hydroelectricity (for non oil and gas issues, see https://en.wikipedia.org/wiki/Fracking).

Because the impact of fracking extends beyond underground rocks and fluids, and influences both surface and atmospheric characteristics, fracking, and indeed, other subsurface activities that may be implemented, are reasonable items for discussion and inclusion in the General Plan. Fracking exclusion was added in 2013 to the Hawai`i County Code (Chapter 14), Article 21, Section 14-120 through 14-127. There will most likely be requests for exceptions to this exclusion. There was a plan in 2015 to evaluate the possibility of a geothermal resource on Hualālai but it was canceled. (https://www.thinkgeoenergy.com/university-of-Hawai`i-cancels-planned-geothermal-exploration-work-at-hualalai/).

In 2023, Hawai`ian Home Lands was seeking to evaluate the development of geothermal resources under its lands. (https://www.higp.Hawai`i.edu/hggrc/Hawai`ian-home-lands-seeks-6m-to-test-for-geothermal-power/). Therefore, including a discussion of subsurface development in the County Plan is merited.

There is a long history of fracturing rock as a means to increase its permeability. Increasing permeability was first used in the 1860s to increase the amount of water available to wells. Explosives were lowered into the drilled or dug well. This practice was given a name and called ”shooting the well,” and had a very localized effect. This practice of increasing permeability of rocks on a large scale was then applied to oil recovery and recently to gas recovery as a means of extracting more energy resources from underground areas where rock permeability is so low as to prevent free flow of those fluids. Perhaps the largest use of fracking was a project to use atomic bombs to cause “fracking” over vast areas. This was done in the 1950s as part of Project Plowshare, when the concept of using atomic weapons to create great canals was proposed, perhaps to form competition to the Panama Canal. It was also thought to be applicable to enhance the flow of natural gas by increasing permeability of tight rock. In 1969, an atomic bomb was set off underground near Rulison, Colorado to see if it could enhance flow in natural gas by fracturing the fine-grained, low-permeability sandstone of the Williams Fork Formation of the Mesaverde Group. It did, but the gas was radioactive and not really useful for commercial use. (https://www.energy.gov/sites/prod/files/2020/04/f74/RulisonFactSheet.pdf).

Although this seemed an extreme fracking approach, today’s hydraulic fracking activities are not without their own pollution problems. Hawai`i government agencies are no stranger to pollution effects from various activities in the state, including disposal of public sewage wastewater and pollution created by military activities, the most recent of the latter being the Red Hill fuel releases into potable groundwater supplies and the use of radioactive materials in training exercises on Oahu and Hawai`i Island.

Hydraulic fracturing (fracking) is a drilling technology that involves pumping large quantities of fluids at high pressure into a wellbore and into the target rock formation. The fluid typically contains water, a proppant (a material like spherical sand particles to keep the fractures open), and chemical additives. A large fracking operation can require millions of gallons of water pumped underground. The chemicals, in large part used to reduce the viscosity of water so the proppant flows readily into the fractures, are often stored in surface holding ponds that are unlined and can leach into the ground and become part of the natural groundwater. The hydraulic fracturing operation itself, with

its above ground equipment and chemical mixing ponds, is a major source of pollution and, it is not necessarily the fracturing of rock that causes large-scale introduction of pollutants into the groundwater, but the leaching from the surface chemical holding ponds into the subsurface that pollutes potable water sources. (https://www.nrdc.org/stories/fracking-101#work).

One point I will make is that the impacts of hydraulic fracturing are still being studied. Many of the chemicals injected to force fracture have not been evaluated to know their potential toxicity. They have no EPA guidelines for a level of concern. It is a complex system and pros and cons can be found to argue any individual point. It is not sufficient to say that analyses for contaminants only for which EPA has guidelines have been conducted and none are above the EPA thresholds levels of concern. There are thousands of chemicals that EPA has not studied for their toxicity that end up in potable groundwater supplies. But a rule of thumb can be applied. Those chemicals at any level used in fracking should not be there. There is little doubt that fracking operations do pose risks to human health and not just for oil and gas resource enhancement (https://www.urmc.rochester.edu/news/story/study-links-fracking-drinking-water-pollution-and-infant-heath: see *Hill, Elaine L. and Lala Ma, 2022, Drinking water, fracking, and infant health, J. Health Econ., 102595*).

I note that there had been some discussion in the public forum (Bobby Camara, Letter to Editor, West Hawai`i Today, December 21, 2024) about the issue of fracking and contamination of the main island system of freshwater lying above the oceanic salt water in the same aquifer of the island. The letter postulated that there would be no mixing of the two waters (i.e., contamination) because the lower density of the freshwater would always keep it above the denser saline water. The Ghyben-Herzberg groundwater system was referenced. That model is useful only in static conditions, and not the real-world dynamic system where stacked aquifer systems are always forced into a mixing scenario. Tidal forces, differential concentration diffusion, recharge of freshwater, removal of the freshwater through well pumping are some examples of how the system is constantly mixed. (*Wentworth, C.K., 1947. Factors in the behavior of groundwater in a Ghyben-Herzberg system. Pac Sci 1(3): 172-184*). Fracking can increase the interchange between those two systems.

On Hawai`i Island, there are occurrences of perched water reservoirs where there is an impermeable layer between that perched freshwater reservoir and lower freshwater/saline water reservoir. An example of one such perched reservoir was found from drilling at Pōhakuloa Training Area Training Area (PTA) as the Army was trying to find a local potable water source so they did not have to transport water.

Freshwater is provided to PTA by trucking, a major operation that requires about 4,000 trucks a year with 5,000 gallons each of potable water. The cost is over three million dollars a year. The Army entered into a cooperative project in 2013 to drill at PTA to see if freshwater could be found to provide supply for PTA. The plan was to drill a hole over 6,000 feet deep to encounter the saline level at sea level and hope that freshwater reservoirs were found above this saline level. Surprisingly, the drill hole encountered a perched freshwater reservoir at a 600-foot depth. (https://www.dvidshub.net/news/229643/army-taps-consortium-find-water-training-area-high-up-hawaiian-volcano).

Any near-surface reservoir could easily become contaminated from the toxins used during training exercises, just as the unlined ponds for fracking development have leached through the porous overburden into groundwater. The freshwater perched reservoir found was never developed. This drilling occurred in 2013 and it is unknown if the contamination from the PTA surface operations contaminated that shallow freshwater reservoir. Such a potential pollution source is described below but it is not the only one that could provide contaminants for underground water sources.

A major concern of groundwater pollution today is “forever chemicals”, those per- and polyfluoroalkyl substances (PFAS), commonly used in fire-fighting foams, which do not breakdown in the environment contribute greatly to health risks. The U.S. Army has been analyzing for those “forever chemicals” that have been part of the releases into the environment from their training activities at PTA and Kilauea Military Reservation. (https://aec.army.mil/aec/6616/9869/7418/PTA-KMR_PFAS_PASI.pdf).

The analyses so far seem to have been only conducted in soils and not groundwater. This 2023 report states that, for PTA, historical reports place ground water levels several hundred to 1,000 feet or more below the surface and so they were not sampled. It is incongruous that this 2023 report ignored the perched groundwater table found at 600 feet below the surface as it was being considered for a potable water source. Testing it would have provided important information on the rate of movement of contaminants below the surface. The Army has established their own risk-based screening concentration levels above which they would conduct further studies for remedial action. That level was set at 70 parts per trillion. In a report of July 2023, concentrations in soils were found at PTA above those levels (Table ES-1 in https://aec.army.mil/aec/6616/9869/7418/PTA-KMR_PFAS_PASI.pdf).

The Army states "*While not an enforceable regulatory standard, this represents a concentration in drinking water that is not expected to produce adverse health effects if the water is consumed over an entire lifetime."* (https://aec.army.mil/PFAS/HI/PTA). No reference to support that claim is given in that notice.

However, this is now in conflict with recent U.S. EPA levels. In April of 2024, the U.S. EPA set levels for drinking water, depending on the type of forever chemical, at 4-10 parts per trillion. (https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas).

"*EPA expects that over many years the final rule will prevent PFAS exposure in drinking water for approximately 100 million people, prevent thousands of deaths, and reduce tens of thousands of serious PFAS-attributable illnesses.*" Ibid.) This statement from EPA about PFAS contamination foretells a tremendous health benefit with the elimination of this toxin in the environment.

Why would fracking be done at PTA? Perhaps for several reasons, not only to increase water flow from the perched water reservoir but to include underground waste disposal and energy production. It was noted that when this perched water was found at PTA, lower levels of that groundwater were found to be at higher temperatures, up to 250 degrees Fahrenheit. It was suggested at the time of that finding, the warmer water could be used as a source of steam to run electricity-generating turbines. (https://eos.org/articles/underground-water-reserves-found-hawaiis-high-country).

The contamination risk could be exacerbated with fracking operations, opening flow paths from a larger volume for water migration. Another potential source of contamination is injecting waste underground. In 2005, when the EPA began enforcing elimination of cesspools containing human excreta, it provided the U.S. Army at PTA with minimum regulations to prevent the contamination of groundwater that could be used for drinking purposes by underground injections of that waste. Fracking is a means to increase underground storage reservoirs for fluids and gases. The U.S. Army operated six large capacity cesspools at that time. (https://www.epa.gov/sites/default/files/2015-09/documents/cafo-pohakuloa05.pdf).

A study conducted by the University of Hawai`i showed how injecting wastewater into a saline underlying reservoir would contaminate a freshwater reservoir above it (*Duane L. Heutmaker, Frank L. Peterson, and Stephen W. Wheatcraft, March 1977, Technical Report No. 107, A laboratory study of waste injection into a Ghyben-Herzberg groundwater system under dynamic conditions*). Fracking would increase the pollution potential.

The larger picture is one of critical interest. Because fracking and other technologies that impact the subsurface can influence the surface and atmospheric environment it is worthwhile to address it as a concern in the General Plan. Hawai`i's social, cultural, economic, health, safety, and quality of life domains among others depend on sustainability of the environment. There is a chance to minimize additional negative impacts in the future. And that needs to be addressed now.

Respectfully submitted,

Michael Reimer, Ph.D.
Geologist
Denver, CO
GeoMike5@att.net
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