BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843
www.boardofwatersupply.com

January 19, 2021

Ms. Suzanne D. Case, Chairperson and Members
State of Hawaii
Department of Land and Natural Resources
Commission on Water Resource Management
1151 Punchbowl Street, Board Room 132
Honolulu, Hawaii 96813

Dear Ms. Case and Members:

Subject: Testimony on Draft Amended Interim Instream Flow Standards in the Surface Water Hydrologic Unit of He`eia (3028): He`eia Stream, O`ahu

The Board of Water Supply (BWS) recognizes the importance of setting an Amended Interim Instream Flow Standard (IIFS) for He`eia Stream. We appreciate the Commission's informational meeting to gather stakeholder input on the proposed IIFS of 1.77 million gallons per day (MGD) for He`eia Stream. However, we have questions on the methodology and implementation and request sufficient time be allowed to ensure a comprehensive evaluation prior to the Commission taking action on setting the IIFS. We request consideration of the following comments.

Methodology for Setting Amended Interim Instream Flow Standard (IIFS)

In our previous testimony on this subject, dated November 23, 2020, we presented detailed comments regarding the analyses shown in the Draft Instream Flow Standard Assessment Report for the Hydrologic Unit of He`eia (3028). Our November 23, 2020 testimony is attached for reference. Our testimony outlined numerous questions and concerns related to the analyses and the associated, limited data behind the estimated hydrologic relationship of historic rainfall to streamflow, streamflow measurement locations and available data, and the understanding of the hydrogeology of Ha`ikū Tunnel, Ha`ikū Well and `Ioleka`a Well. To date, BWS has not yet received a response from the Commission regarding these questions and concerns.

Subsequently, the draft the Commission on Water Resource Management (CWRM) Staff Submittal for the CWRM Board Meeting of January 19, 2021, Draft Recommendation section states that the 1.77 MGD represents "natural baseflow under current climate conditions". Yet this number is not reflected in the Surface Flow section; for example, it does not match the numbers shown in Table 2 or Figure 3. Furthermore, it is not clear what "under current climate conditions" implies; although the Climate Change section appears to continue the previous CWRM staff assertion that rainfall has not changed in the He`eia area and therefore is not a consideration in establishing an Amended IIFS.

At this time, BWS does not understand the methodology, particularly the mathematical analyses, used by CWRM staff to arrive at the proposed Amended IIFS of 1.77 MGD. We recommend that the U.S. Geological Survey (USGS) be involved in the hydrogeological evaluation and we are open to entering into a cooperative agreement with USGS as they have expressed interest. We look forward to participating in the evaluation with USGS, CWRM and the He`eia Stream users.

Implementation of Amended IIFS

The draft CWRM Staff Submittal, Implementation section directs BWS to "construct a pipeline from the transmission pipe out of Ha`ikū Tunnel to be able to discharge water to He`eia Stream", with the purpose of maintaining a proposed Amended IIFS of 1.77 MGD. A median base flow of 0.96 MGD 1989-2019, would result in a release of approximately 0.8 MGD of the 1.0 MGD production of Ha`ikū Tunnel into He`eia Stream; i.e., an 80 percent reduction. We note that BWS has already reduced source production by almost 1 MGD among the three BWS sources (Ha`ikū Tunnel, Ha`ikū Well and `Ioleka`a Well) compared to their total Permitted Use of 1.95 MGD. The Permitted Use was established by CWRM based on existing use during the Windward sector designation process.

There is a potential economic impact of such a large Amended IIFS on BWS's ability to provide adequate water supply within the Windward 500' water system, especially in a drought. The consequence of this impact was inadequately addressed in the draft CWRM Staff Submittal along with an incomplete understanding of the extent and operations of the BWS water system and requires more time for comprehensive evaluation and data sharing.

We believe the artificial method of direct pipe discharge is inefficient, provides a conduit for drinking water supply contamination and is subject to seepage losses and evaporation as the stream water flows to He`eia wetland and fishpond, where restoration efforts are occurring. We would like to explore a more natural solution to stream restoration by reducing source production of all three of BWS water sources, in a holistic watershed approach. By increasing dike water levels, water would naturally migrate into He`eia and `Ioleka`a Streams and not just at a single point.

We envision working with CWRM and USGS on piloting operational changes to determine an optimal solution that balances all public trust uses (water in its natural state, traditional and customary practices, domestic use and water for the Department of Hawaiian Home Lands (DHHL), with the consideration of directed water conservation and water loss control within the Windward 500' system. The majority of the 500' system consists of residential homes above the 172' elevation located mauka of Kahekili Highway, upper Kaneohe Bay Drive, Kamehameha Highway around Mokulele Drive and in Maunawili Valley and the Kamakau School in Ha`ikū Valley is on DHHL lands. We understand and consider residential water use and water for individual personal needs, including in non-residential developments, as vital domestic public trust uses, and among the highest uses of water resources.

Additional items in the proposed USGS study could include the following:

1. Water system operational adjustments with pumping scenarios with Ha`ikū Tunnel, Ha`ikū Well, and `Ioleka`a Well;
2. Recommendations for reductions in BWS permitted use for unused water;
3. Installation of a stream gauge downstream of the confluence of He`eia and `Ioleka`a Streams;
4. Updated seepage runs along He`eia and `Ioleka`a Streams;
5. Flow measurements of stream diversions; and
6. Re-evaluation of the Draft CWRM Instream Flow Standard Assessment Report and Amended IIFS.

BWS is prepared to reduce source production to test stream restoration flows as a key component of the study. Finally, we would like to analyze the economic impacts of the various alternatives of the restriction of non-instream use in terms of costs to our customers who will ultimately have to bear the burden of those costs.

The study scope of work could be completed within 180 days pending discussions and a timeframe to complete the study will be dependent on the scope. Given the many competing needs for limited water resources in this area, BWS respectfully requests your favorable consideration to ensure that the foregoing issues are adequately considered and addressed before this Commission issues a decision.

If you have any questions, please contact me at 748-5061.

Very truly yours,

ERNEST Y. W. LAU, P.E.
Manager and Chief Engineer

Attachment

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843
www.boardofwatersupply.com

November 23, 2020

Ms. Suzanne D. Case, Chairperson and Members
State Department of Land and Natural Resources
Commission on Water Resource Management
1151 Punchbowl Street, Board Room 132
Honolulu, Hawaii 96813

Dear Ms. Case and Members:

Subject: Testimony on Draft Instream Flow Standard Assessment Report for the Hydrologic Unit of He`eia (3028)

The Board of Water Supply (BWS) requests consideration of the following comments, related to the Commission on Water Resource Management (CWRM) Draft Instream Flow Standard Assessment Report for the Hydrologic Unit of He`eia (3028), the related informational briefing during the CWRM Board Meeting of September 15, 2020, and the related CWRM/BWS meeting of October 12, 2020.

Background

On September 15, 2020, BWS attended the virtual CWRM Board Meeting, which included an Informational Briefing on Developing an Amended Interim Instream Flow Standard for He`eia Stream, by CWRM staff. At the conclusion of this briefing, "next steps" were listed (consultation with BWS, consultation with Aha Moku representatives, site visit with Papahana Kuaola, etc.) but specific dates were not provided.

On October 12, 2020, CWRM staff held a virtual meeting with BWS staff to obtain information on BWS' Haiku Tunnel and groundwater production and use in the Koolaupoko region. During the course of the meeting, CWRM notified BWS of the existence of the Draft Instream Flow Standard Assessment Report for the Hydrologic Unit of He`eia (3028) (Draft Heeia IFS Report), and of the Public Fact Gathering Meeting scheduled for October 21, 2020. As the Draft Heeia IFS Report had been completed in June 2020, posted on September 24, 2020, and identified to BWS on October 12, 2020, BWS was obligated to review and provide comments within a timeframe of less than nine days.

Accordingly, BWS reviewed the September 15, 2020 Informational Briefing, meeting notes from the October 12, 2020 CWRM/BWS meeting, and the Draft He'eia IFS Report and compiled the following testimony for your consideration.

Rainfall Contribution to Historic He`eia Streamflow

During the CWRM/BWS meeting, CWRM staff stated that CWRM has "rainfall data...specific for He`eia, that shows a zero to 1 percent decrease in rainfall, maybe even a 1 percent increase", since approximately the 1920s through 2010s, and suggested that rainfall was not a significant factor to consider when evaluating historic He`eia streamflow.

However, subsequent BWS research with the National Weather Service and the University of Hawaii confirmed that there were no rain gauges in He`eia with that duration of historic rainfall data. Instead, as shown on Figure 3-10 in the Draft Heeia IFS Report, CWRM referenced interpolated islandwide rainfall trends related to the University of Hawaii's Rainfall Atlas of Hawaii program. These interpolated trends indicate a zero to 1 percent rainfall decrease in the He`eia area per decade.

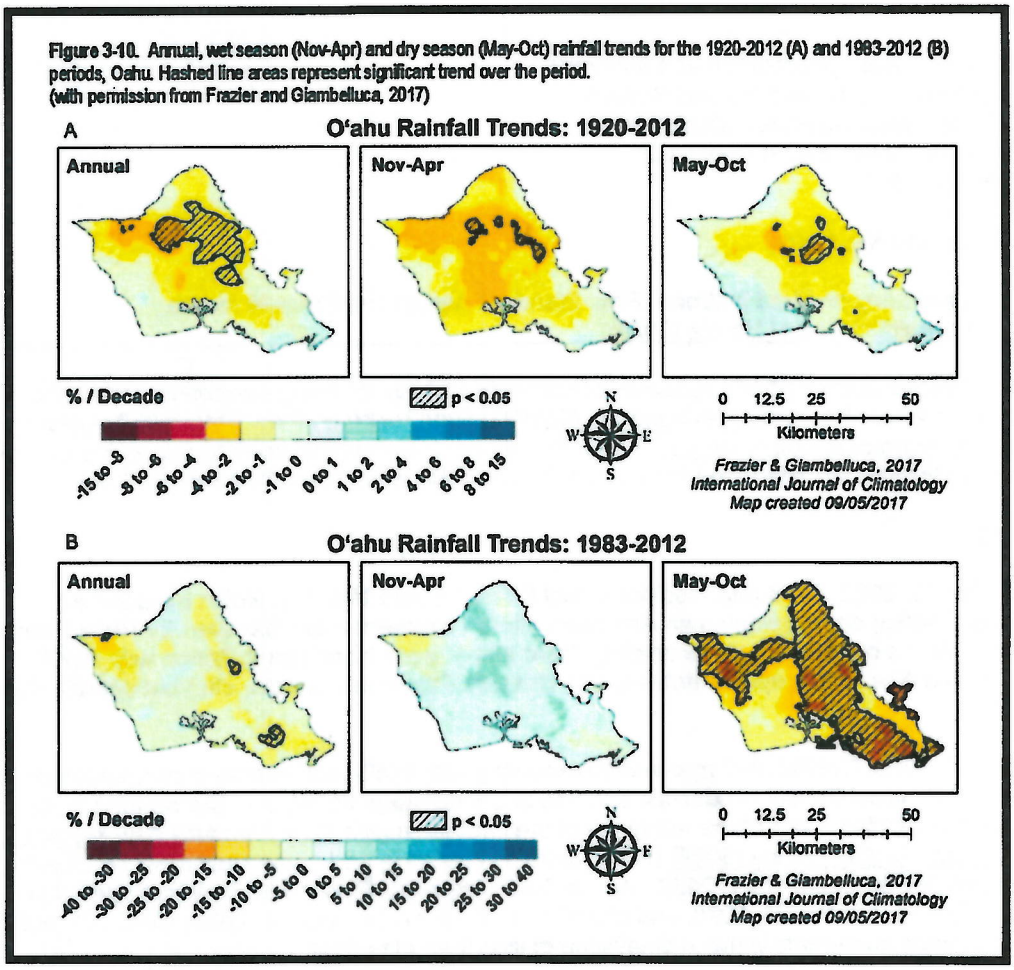
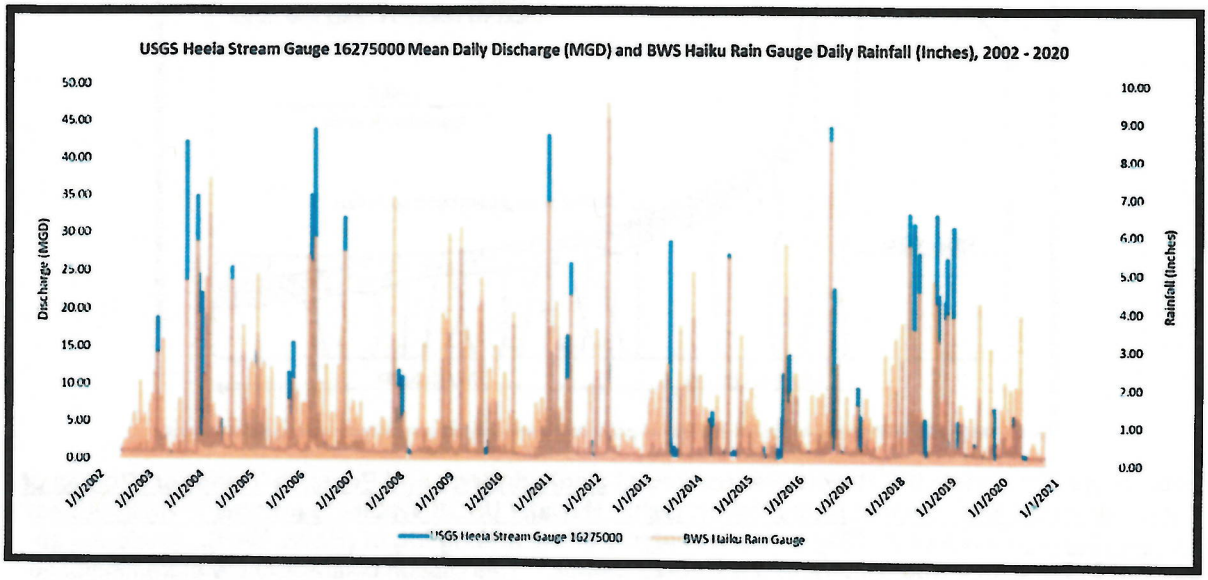


Figure 3-10. Annual, wet season (Nov-Apr) and dry season (May-Oct) rainfall trends for the 1920-2012 (A) and 1983-2012 (B) periods, Oahu. Hashed line areas represent significant trend over the period.
(with permission from Frazier and Giambelluca, 2017)

This in fact may present a significant effect on He`eia streamflow. If rainfall decline is closer to 1 percent per decade, over the period of 1920 - 2012 this translates to a decrease of approximately 9 percent.

Furthermore, the timing of the apparent He`eia streamflow decline should be compared to the timing of historic increases and decreases in rainfall, rather than relying solely on interpolated islandwide trends. Since 1920, there have been major swings in rainfall, with decades of relatively wet and relatively dry weather. Streamflow should be compared to these rainfall time series for those historic timeframes that have data for both parameters, to improve the understanding of factors affecting streamflow.

Accordingly, BWS compared U.S. Geological Survey (USGS) Stream Gauge 16275000 streamflow data, to rainfall data from BWS Haiku Rain Gauge (until mid-2019, located about 0.4 mile upstream of USGS 16275000, near Haiku Well; due to vandalism, relocated approximately 0.25 mile downstream of USGS 16275000, near Papahana Kuaola), for the shared historic time period of June 2002 through September 2020. The rainfall data are graphed with streamflow data below, in semitransparent color, to allow the common historical increases and decreases in rainfall and streamflow to display over the time period. **These data, spanning almost the past two decades, indicate there is a clear relationship between rainfall and streamflow in He`eia, and that historic and projected rainfall patterns should be considered as factors in assessing He`eia streamflow.**



Finally, as noted in the Draft Heeia IFS Report and as a general trend for most watersheds on Oahu, the presence of non-native vegetation in the He`eia watershed has increased over the past century. **Non-native vegetation is associated with higher evapotranspiration characteristics, which may also divert overland flow and groundwater discharge that would otherwise contribute to He`eia streamflow; therefore, this factor should also be considered when evaluating streamflow.**

Groundwater Contribution to Historic He`eia Streamflow

During the CWRM Informational Briefing and the CWRM/BWS meeting, CWRM staff theorized that the BWS Haiku Tunnel was the sole factor in the apparent streamflow decrease of He`eia Stream since the tunnel's construction, c.1940. CWRM staff stated that the nearby BWS Haiku and Iolekaa Wells were thought to have no effect on streamflow, as they were "not in the same high-level dike complex as Haiku Tunnel".

BWS disagrees with this understanding. First, text from Page 33 of the Draft Heeia IFS Report describing the regional hydrogeology states, "...Where a dike complex exists, 100 or more dikes per mile, occupying 5% or more of the rock, is not uncommon and can hold substantial quantities of water in the permeable layers between the dikes". **This statement suggests an incomplete understanding of dike complexes and marginal dike zones. The marginal dike zone, with fewer than 100 dikes per mile and dikes constituting less than 5% of total rock volume, is more favorable than the dike complex for the occurrence of dike-impounded water** (Takasaki, K.J. and J.F. Mink, 1985, Evaluation of Major Dike-Impounded Ground-Water Reservoirs, Island of Oahu, U.S. Geological Survey Water-Supply Paper 2217). Figure 3-2 of the Draft Heeia IFS Report further illustrates this concept.

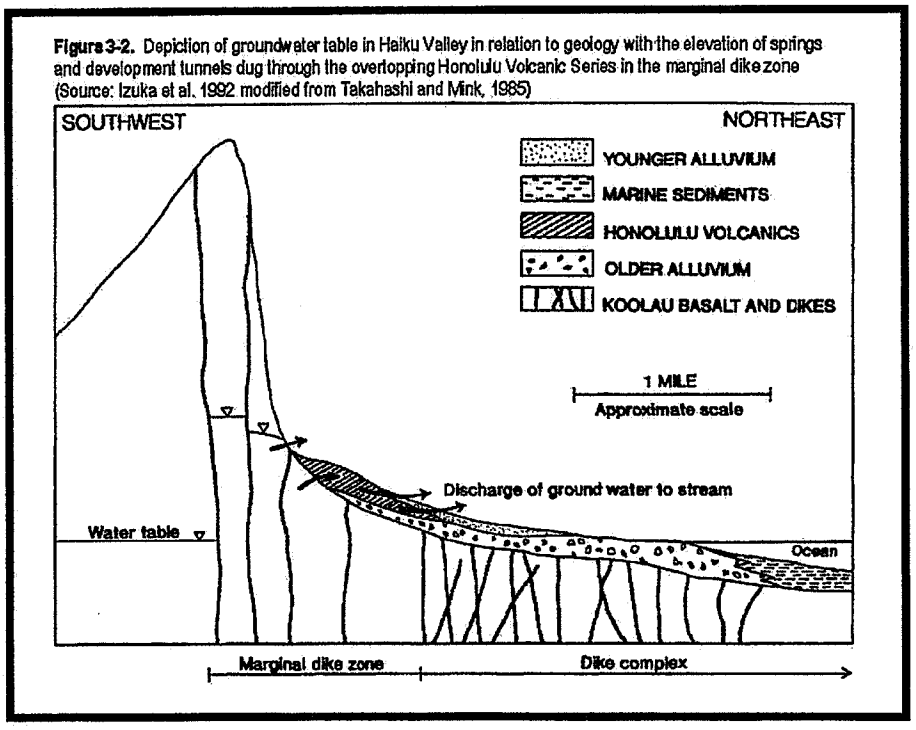


Figure 3-2. Depiction of groundwater table in Haiku Valley in relation to geology with the elevation of springs and development tunnels dug through the overlopping Honolulu Volcanic Series in the marginal dike zone (Source: Izuka et al. 1992 modified from Takahashi and Mink, 1985)

Second, the Draft Heeia IFS Report cites portions of **Geohydrology and Possible Transport Routes of Polychlorinated Biphenyls in Haiku Valley, Oahu, Hawaii / USGS Water-Resources Investigations Report 92-4168 (Izuka et al, 1993): "...an analysis of the drilling log of (Haiku Well)...(includes an aquifer) in the dike compartment of the Koolau Basalt."** This citation contradicts the aforementioned CWRM staff statements. Furthermore, the **Izuka et al, 1993 report goes on to comment, "The difference in water levels between Haiku Tunnel and (Haiku) Well indicate that they penetrate different dike compartments, but water may be exchanged between compartments".**

Third, the **Iolekaa Well Environmental Impact Statement (EIS)**, as commented on c.1983 by the University of Hawaii (UH), U.S. Geological Survey (USGS), and State of Hawaii Department of Land and Natural Resources (DLNR), notes **"both the Iolekaa Well and the Haiku Well tap dike aquifers".**

Fourth, historical reports and agency comments as noted above, demonstrate that the relationships between Haiku Tunnel, Haiku Well, Iolekaa Well and He`eia streamflow have not yet been fully investigated nor resolved. Izuka et al, 1993 states:

> *The flow-duration curves indicate that the base flow of Heeia Stream decreased after 1940 when Haiku water-tunnel withdrawals began and increased in 1989 when withdrawals from well 2450-2 began. Whether water-tunnel and well withdrawals have caused the changes in base flow, or whether the changes are the result of climatic variations, is unclear.* ***The Lower Luakaha rain gage (State number 782) located 6 mi to the southeast of Haiku Valley, is one of the few rain gages with a record long enough to compare with the Heeia stream-discharge record at station 16275000. During the 6 years of stream-discharge record prior to the development of the Haiku water tunnel, rainfall averaged 153 in/yr at the Lower Luakaha gage, but between 1940 and 1988, rainfall averaged only 116 in/yr, a decrease of approximately 24 percent. The decrease in base flow may thus be due to a decrease in rainfall. Even though base flow is sustained by ground-water discharge, a decrease in rainfall would decrease recharge and storage, which in turn decreases spring discharge and base flow.*** *The recorded magnitude of the stream-discharge decrease is large, however:*

> *base flow after tunnel development was only about one third of the base flow before tunnel development. A change of this magnitude indicates that the tunnel is at least partly responsible for the decrease in base flow of the stream*
>
> *In 1980, the withdrawal from the tunnel decreased from about 1.9 Mgal/d to 1.7 Mgal/d.* ***The increase in streamflow in the period from 1989 to 1990 may be due to this decrease in tunnel withdrawal, but rainfall in this period also increased to 128 in/yr. Interpretation of the effects of ground-water withdrawals on base flow for a short 2-year record is tenuous, however. Additional analyses and an extended stream-discharge record are needed to establish the connection between base flow and ground-water development.***

Izuka et al, 1993 also described four seepage runs conducted by the USGS between November and December 1991. The report notes "The stream gains water along all of the reaches measured in the seepage runs". However, **these seepage runs were conducted along the upper reach of He`eia Stream only, above the confluence with Iolekaa Stream; therefore, the influence of Iolekaa Stream was not considered. It is also not clear whether Haiku Tunnel, Haiku Well or Iolekaa Well production was considered during the period of these seepage runs.** Instead, the report provides a general comment on this and prior seepage runs from the same measurement locations:

> *Seepage runs from this study are compared...with seepage runs done in 1938 prior to the construction of the Haiku Tunnel, in 1961 after construction of the tunnel and prior to construction of (Haiku) Well, and in 1981, before and during aquifer testing of (Haiku) Well. Locations of measuring sites of the earlier seepage runs correspond closely to the site locations of this study.* ***The earlier seepage runs show that the large gain between sites 2 and 3 has been a persistent feature in the seepage of Heeia Stream, despite the withdrawal of water from the nearby well and water tunnel.***

In an August 20, 1981 comment letter to BWS concerning the Draft EIS for Iolekaa Well, the USGS stated:

> *Paragraph (regarding Iolekaa Well short-term pumping test; probably referring to the 3-hour pumping test and stream gauging conducted during well installation, January 1966) is an oversimplification of a complex hydrologic system.* ***Short-term test pumping results of the Iolekaa Well cannot be used as criteria to indicate that the pumping has no effect on the baseflow of Iolekaa Stream and probably no effect on Haiku and Heeia Streams...Drawdown during a pumping test will be excessive in the well bore and in the immediate vicinity of the well. Drawdown will be small and slow in spreading away from the well. Thus, unless the channels intersect groundwater in close proximity to the well, its flow will not be noticeably affected, especially in the short term.***

In a September 1, 1981 comment letter to BWS concerning the Draft EIS for Iolekaa Well, the DLNR provided a similar comment:

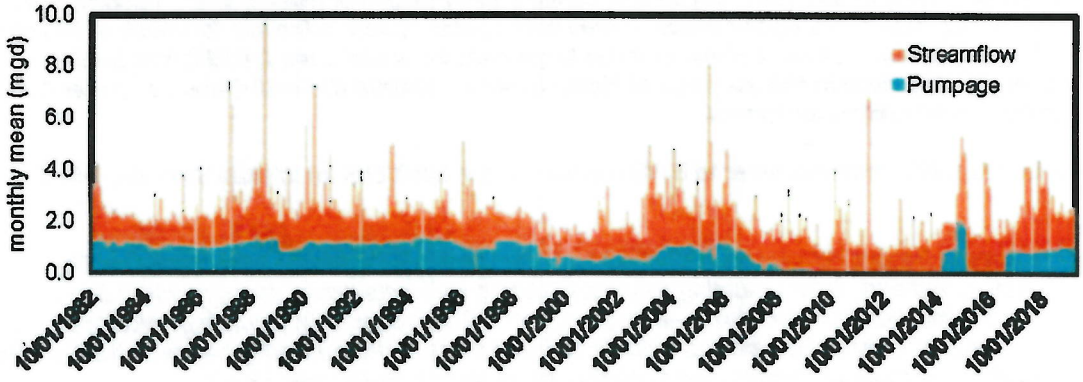
> ***The question of whether pumping of the Iolekaa Well will adversely affect streamflow's has not been satisfactorily discussed in the document. The EIS should address means by which a determination will be made as to whether pumping of the well will affect adjacent streamflow's. This would require gauging of streams over a period of time, and in particular, during low flows.***

At that time, BWS replied to these comments by noting that BWS was "working with USGS to establish permanent gauging stations along Haiku, Heeia, and Iolekaa Streams" to improve the understanding of the flow system. Unfortunately, this effort does not appear to have been achieved to that degree. As reflected in the Draft Heeia IFS Report, only USGS Stream Gauge 16275000 has remained as a permanent gauge. This gauge is located a short distance downstream of Haiku Tunnel and Haiku Well, along the upper reach of He`eia Stream.

Finally, Figure 3-7 of the Draft Heeia IFS Report reflects the incomplete understanding of relationships between Haiku Tunnel, Haiku Well, Iolekaa Well and He`eia streamflow. **If, as previously suggested by CWRM staff, Haiku Tunnel is the sole factor influencing Heeia streamflow relative to Haiku Well, Iolekaa Well, or historic rainfall, then the lack of increase in streamflow between c.2010 - 2014 does not make sense. Haiku Tunnel was out of service during this period.**

If rainfall were taken into account, the period c.2010 - 2014 at the BWS Haiku Rain Gauge was not characterized by unusually low rainfall. Consideration should therefore be given to Haiku Well (and by association, Iolekaa Well), both of which were in service during the period c.2010 – 2014.

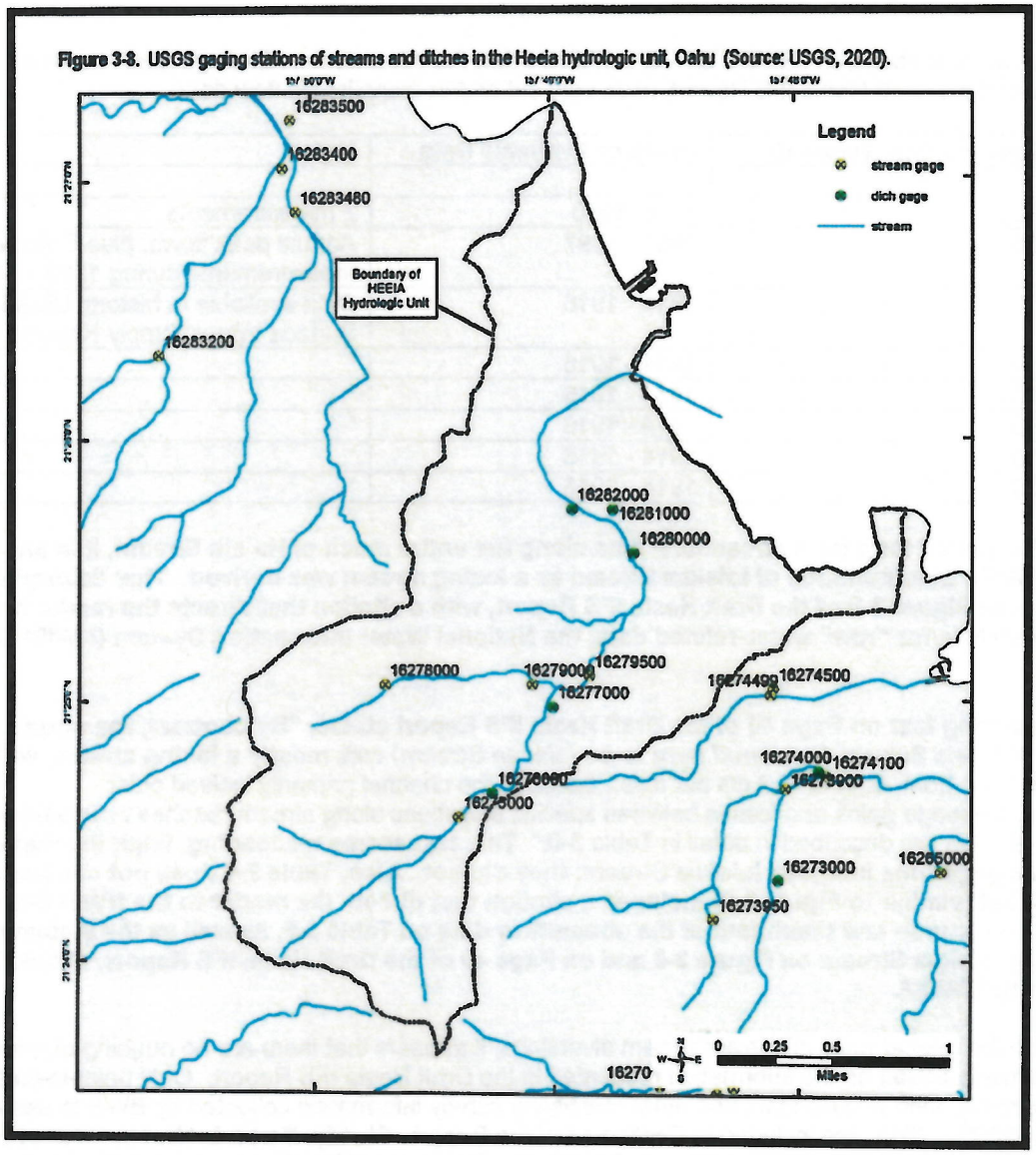
Figure 3-7. Monthly mean daily flow in Heeia Stream at (USGS station 16275000) and the total daily flow in Heeia hydrologic unit, Oahu. (Source: USGS, 2020)



Historic Measurement of He`eia Streamflow

Page 31 of the Draft Heeia IFS Report notes limited long-term streamflow data along the entire reach of He`eia Stream. The only permanent stream gauge is USGS Stream Gauge 16275000. As noted above, this gauge is located a short distance downstream of Haiku Tunnel and Haiku Well, along the upper reach of He`eia Stream and above the confluence with Iolekaa Stream. One other stream gauge had more than a few years of historic data; USGS Stream Gauge 16278000, collected data between c.1940 – 1970 along the upper reach of Iolekaa Stream.

Figure 3-8. USGS gaging stations of streams and ditches in the Heeia hydrologic unit, Oahu (Source: USGS, 2020).



Subsequent BWS research with the USGS confirmed that the other stream/ditch gauges shown on Figure 3-8 of the Draft Heeia IFS Report, have very old and/or inapplicable flow data:

USGS Stream/Ditch Gauge ID	Dates of Available Data	Notes
16277000	1939, 1940	2 measurements
16279500	1965 - 1997	Annual peak flows, plus 6 discharge measurements during 1960 – 1963
16279000	1914 - 1916	Data available in historic USGS Surface Water Supply Reports
16270000	1914 - 1916	"
16277000	1914 - 1916	"
16280000	1914 - 1916	"
16281000	1914 - 1916	"
16282000	1914 - 1916	"

Given the limited long-term streamflow data along the entire reach of He`eia Stream, it is unclear how CWRM's determination of Iolekaa Stream as a losing stream was derived. This determination is shown on Figure 3-9 of the Draft Heeia IFS Report, with a citation that directs the reader to the USGS Web Site for "raw" water-related data, the National Water Information System (NWIS) Data Portal.

Accompanying text on Page 40 of the Draft Heeia IFS Report states, "By contrast, the north branch of Heeia Stream *(assumed here to be Iolekaa Stream)* was mostly a losing stream, with losses ranging from -0.34 to -3.2 cfs per mile...because the channel primarily incised older alluvium...Seepage gains and losses between specific elevations along stream reaches estimated from Izuka et al 1993 are described in detail in Table 3-6." **This text seems misleading, implying that the USGS seepage runs included Iolekaa Stream; they did not. Also, Table 3-6 does not cite Izuka et al, 1993, but (similar to Figure 3-9) includes a citation that directs the reader to the NWIS Data Portal. The source and timeframe of the streamflow data on Table 3-6, as well as the statements regarding Iolekaa Stream on Figure 3-9 and on Page 40 of the Draft Heeia IFS Report, should be clarified by CWRM.**

Turning to the related topic of current stream diversions, it appears that there are no ongoing diversion measurements based on the information presented in the Draft Heeia IFS Report. Only point-in-time measurements, field photographs and other identifying survey information collected by BWS to assist CWRM c.2009 – 2011, are included in Section 14 of the Report. Clearly, **if non-instream uses of He`eia Stream are to be assessed, such stream diversions should be subject to long-term measurement.**

Figure 3-9. Seepage run results from near simultaneous point measurements in Heeia hydrologic unit, Oahu. (Source: USGS, 2020).

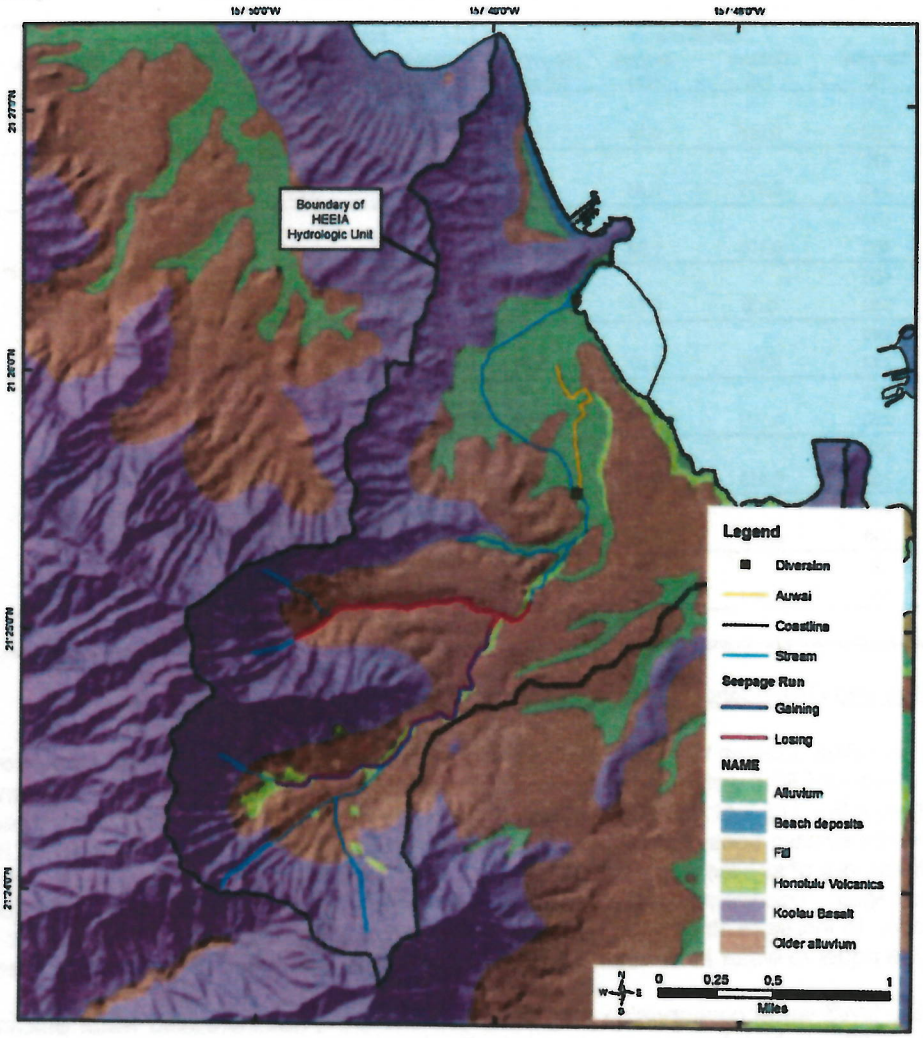


Table 3-6. Distance between elevations (miles, mi), total mean gain/loss in flow (cubic feet per second, cfs), and mean seepage rate change (cfs per mi) for specific streams in the Heeia hydrologic unit, Oahu. (Source: USGS, 2020)

Heeia Stream				North Branch Heeia Stream/Iolekaa Stream			
Elevation (ft)	Distance (mi)	Seepage (cfs)	Seepage rate (cfs per mi)	Elevation (ft)	Distance (mi)	Seepage (cfs)	Seepage rate (cfs per mi)
570				430			
500	0.056	0.74	13.21	360	0.115	-0.04	-0.35
470				360			
430	0.077	0.86	11.11	320	0.237	-0.64	-2.70
430				320			
400	0.101	1.02	10.10	140	0.625	-0.21	-0.34
400							
340	0.06	0.36	6.00				
340							
272	0.299	0.07	0.23				
272							
240	0.293	0.75	2.56				
240							
160	0.413	1.26	3.05				
160							
150	0.799	1.99	2.49				
150							
95	0.263	-0.10	-0.37				

BWS Production and Operational Considerations with Respect to He`eia Streamflow

Haiku Tunnel and Well, Iolekaa Well and Luluku Tunnel and Well are essential sources that provide water supply to the Windward 500' water system extending from Haiku Valley to Maunawili Valley serving properties between the 172 foot and 400-foot elevations. The Kahaluu Tunnel and Well has been separated from the system because a connecting 16-inch water line across the Heeia wetland has been permanently taken out of service due to pipe corrosion, leakage and potential main breaks that would be inaccessible to repair. This water system change results in less flexibility to accommodate reductions in source production to increase streamflow while still meeting system water demands. Domestic use is a Public Trust Use equal to water in its natural state, traditional and customary use and DHHL use.

We note that the BWS water conservation program created in 1990, has increased water efficiency in the windward water system which has resulted in a reduction in source production compared to State permitted use. The water conservation savings in these dike sources equates to more groundwater storage for drought mitigation and stream restoration.

Thank you for the opportunity to provide testimony on the Draft Instream Flow Standard Assessment Report for the Hydrologic Unit of He`eia (3028). If you have questions, please contact Barry Usagawa, Water Resources Program Administrator at 748-5900 or Nancy Matsumoto, Hydrology-Geology Branch of our Water Resources Division, at 748-5938.

Very truly yours,

ERNEST Y. W. LAU, P.E.
Manager and Chief Engineer

cc: B. Usagawa
N. Matsumoto

No Log #