

# North Shore Hydrological Services

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Matt Rosener, MS, PE, Principal

November 7, 2019

Mr. Ian Hirokawa  
State of Hawaii – Department of Land and Natural Resources – Land Division  
1151 Punchbowl Street – Room 220  
Honolulu, HI 96813

Dear Mr. Hirokawa,

I am hydrologist and professional water resource engineer who has been working on stream and watershed management issues on Kaua'i for 15 years now. I am presently leading a watershed restoration program at Waipa, on the north shore of Kaua'i, and I am involved in hydrologic studies related to streamflow restoration campaigns on Kauai and Maui. In the past, I have worked as a hydrologist for the U.S. Geological Survey (USGS) and under a research appointment through the University of Hawai'i, and I have worked as a water resource engineer for the USDA Natural Resources Conservation Service as well as private engineering firms. I now operate my own business, consulting on various water and watershed management projects and studies. This letter is intended to express professional opinions and submit specific questions that I have related to the Waiahi Hydropower Long-Term Water Lease Draft Environmental Assessment (DEA), dated October 2019. I appreciate the opportunity to review the subject document, and I respectfully present the following comments, questions, and concerns.

First, and foremost, I strongly object to any possible scenario that involves the issuance of a long-term lease for waters of the North Fork Wailua River (aka Wai'ale'ale Stream) and Wai koko Stream (tributary to the South Fork Wailua River) before new Instream Flow Standards (IFS) are set for these streams by the Commission on Water Resource Management (CWRM). As you know, CWRM proposed new Interim Instream Flow Standards (IIFS) for these streams, and the Kauai Electric Utility Cooperative (KIUC) requested a contested case hearing in response. There is also the matter of the ongoing USGS low-flow characterization study for Southeast Kaua'i, which includes these streams, that is projected to be complete by 2020. There is a logical sequence to the process of issuing a long-term water lease in this situation: 1. Completion of the USGS hydrology study, 2. Establishment of the IIFS for the streams by CWRM, and 3. Issuance of a water lease based on results and findings of the previous tasks.

There are additional steps which should also be completed prior to lease issuance, including the adoption by the State of a cost-share formula for implementation of a watershed management plan, developed through the water lease process. Also, fair market water lease rent rates should be established by the State so that water diverters can accurately evaluate the anticipated costs and benefits of new or continued water diversions in Hawai'i. In this case, KIUC cannot reasonably assess the economics of continued long-term operation of the Waiahi Hydropower system without first knowing the impacts and costs of the following important factors:

# North Shore Hydrological Services

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Matt Rosener, MS, PE, Principal

1. IFS requirements for not only the Wai'ale'ale and Waikoko Streams, but also for the Ili'ili'ula and Waiahi Streams that are substantially diverted as part of the Waiahi hydropower scheme
2. KIUC's portion of the cost-share arrangement for eventual implementation of the watershed management plan associated with a long-term water lease
3. Water lease rent costs for all water diverted from State lands, to be determined by fair market value analysis

While I believe that hydropower should play a role in reducing our islands' dependency on fossil fuel-based energy sources in general, not every hydropower scheme is alike. The proposed pumped-storage project being considered by KIUC for the west side of Kauai is a great conceptual example of how a combination of renewable energy resources can be utilized without the extensive collateral damage to the environment caused by more conventional hydropower designs. The long-term water leasing process provides an opportunity to address the significant and dramatic paradigm shift from traditional water management that emphasized conservation and watershed management units (i.e. ahupua'a) to the current model of full resource consumption and regular inter-basin water transfer as core elements. I am not arguing that we need to go back to traditional management completely, but the State should be looking for ways to opportunistically incorporate elements of the ahupua'a system into modern water resource management, particularly in cases where waters can be restored to their basin of origin.

The Waiahi Hydropower system with its associated stream diversion intakes and transmission ditches effectively transfers enormous volumes of water from the North Fork to the South Fork of the Wailua River basin. In doing so, not only is the hydrology of the diverted streams substantially altered, but the flow regimes of receiving waters (e.g. Waiahi Stream) are significantly disrupted as well. In some cases, natural stream channels are being used as ditches where water from other streams is discharged only to be diverted again quickly a short distance downstream. According to the Instream Flow Council (2002), "the objective of an instream flow prescription should be to mimic the natural flow regime as closely as possible", but currently inter-basin water transfer is drastically altering the natural flow regimes in most of the stream network in the Wailua River basin, and this would continue with the Proposed Action described in the DEA. To reiterate, the Instream Flow Standards for Wai'ale'ale and Waikoko Streams must be established by CWRM prior to any long-term lease for water diversion from these streams.

Considering that the water currently diverted from these streams by KIUC has many other downstream uses and users (e.g. irrigation for agriculture, irrigation for aesthetics, domestic water supply, industrial water supply, recreational activities, etc.), there is an important need to develop an accurate water budget that accounts for the ultimate end use of the water diverted at the Wai'ale'ale and Waikoko Stream intakes. There is no doubt that much of this water leaves the Wailua River basin, through the Upper Lihue and Hanamaulu Ditches, and there are many questions about how the various off-stream beneficial uses of the diverted waters are being prioritized. Neither the State Agricultural Water Use and Development Plan or the Kauai Water Use and Development Plan adequately address this topic, and it may be that a regional water management plan needs to be produced to form the basis of sound water management of a resource that originates in the Wailua River basin but is ultimately "shared" between several adjacent stream basins.

# North Shore Hydrological Services

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Matt Rosener, MS, PE, Principal

While the previous comments are related to my general resource management concerns for the waters of the Wailua River watershed, the following comments and questions are specifically related to the DEA document, and I would appreciate thoughtful and thorough responses to them. First, there is a fundamental problem with the analyses presented in the DEA in the selection of a severely degraded baseline (resulting from excessive current water diversion rates) instead of evaluating the impacts of the Proposed Action on the natural hydrology of the Wai'ale'ale and Waikoko Stream systems which has never been done due to these water diversions pre-dating most modern environmental laws and regulations. While the anticipated Finding of No Significant Impact (p. 53) for this project may technically meet the requirements for an EA document, it would be pretty hard to argue that the continued diversion of water anywhere near historical amounts at these sites will not continue to have significant negative impacts to the downstream environment in this system. Please consider the following questions and comments on the DEA and provide appropriate responses.

1. What is the upper limit of flow that would be allowed to be diverted from these streams if the Proposed Action and associated long-term water lease are approved? The DEA assumes a minimum IFS for the streams in the analyses, but it seems that the water lease request is for all water in the streams in excess of the IFS set by CWRM. This seems irresponsible, and a maximum diversion flow should be established for each of the streams.
2. Why are environmental impacts to other streams diverted by the Wai'ahi Hydropower scheme ignored in this assessment (e.g. Ili'ili'ula)? It seems the system should be evaluated completely in order for the real impacts of this project to be properly evaluated.
3. Why are downstream water diversions allowed to take water diverted from Wai'ale'ale and Waikoko Streams without water permits or leases? Why is a private company profiting from a public trust resource without a permit to use the water they treat and sell to the County of Kaua'i?
4. I requested data for the flow gaging stations in the Ili'ili'ula – North Wailua Ditch from KIUC for my analyses, but was not granted access to this data. Why is this information not shared with the public so that they can effectively evaluate potential impacts from the proposed long-term water lease?
5. Why are the highest 12-month moving average values for ditch flows highest in the last few years of KIUC ditch flow monitoring (see Figures 6 & 7 on p. 15-16)? Are the increased peak diversion flow rates associated with water availability? Is it affected by the equipment upgrades at the Upper Wai'ahi Hydro plant in 2015 (e.g. turbine replacement)?
6. How was the KIUC ditch flow data quality accounted for when new gage ratings were developed in 2017 (p. 16), and how did the new ratings compare to the (12-year) old ratings?
7. Table 4 on p. 17 shows the maximum flow measured in the ditch at the Wai'ale'ale Stream intake during the Jan. 2017 – Apr. 2019 period as 56.0 MGD, but since the ditch hydraulic capacity is only 30 MGD (p. 24), where does the "excess" water go in these situations? (There are several

# North Shore Hydrological Services

---

Matt Rosener, MS, PE, Principal

peak ditch flows > 30 MGD in the Figure 9 hydrograph for the Wai'ale'ale Stream intake and fewer instances of ditch flow > 30 MGD in the Figure 10 hydrograph for the Waikoko Stream intake, suggesting that "excess" water from the North Fork is sometimes dumped into the South Fork drainage via Waikoko Stream).

8. Figure 8 on p. 17 shows rating curves for the KIUC gages in the ditch at Wai'ale'ale and Waikoko Stream intakes, and Figures 9 & 10 show hydrographs for these gages with many peaks beyond the upper limits of the ratings. Given this limitation, how does KIUC really know how much water moves through the ditch during high flow periods (i.e. beyond the rating limits)?
9. Section 1.6.5 of the DEA (p. 19) suggests that the combined water diversion from the two subject streams has decreased from the plantation era to the present. If true, this could be attributed to differences in rainfall/runoff and water availability between the two time periods of monitoring, not in differences in diversion practices. However, the most recent KIUC ditch diversion records (2017-2019) for the Wai'ale'ale Stream intake show a 5% increase in average flow diverted when compared to the full, long-term USGS record for the same location (1965-2002). How do we account for this discrepancy?
10. The DEA refers to hydropower as "clean" energy (p. 22), but is it really that clean if it severely degrades downstream ecosystems? One can easily argue that this energy source is locally-sourced and renewable, but using the word "clean" is debatable. Over the past decade, many ill-conceived hydropower projects have been decommissioned and removed from streams across the country because their negative environmental and social impacts were analyzed to be greater than their economic benefits. Given the significant impacts to the downstream ecosystems, can we really consider this type of hydropower a "clean" energy source?
11. The DEA also states that hydropower projects that return water to the same stream are considered non-consumptive (p. 22), but that is not the case here. Waters diverted from Wai'ale'ale and Waikoko Streams do not return to those streams under the current scheme. While they are discharged within the same river basin, much of this water ends up leaving the basin through other diversion ditches. Are the authors of the DEA making the statement that water diverted from the Wai'ale'ale and Waikoko Streams for the Upper and Lower Waiahi Hydropower plants is actually a non-consumptive use?
12. The assumption that the USGS station 16061000 "ditch flow records roughly represent natural streamflow during low flow periods" for Wai'ale'ale Stream (p. 23-24) may be true, but 125 days of zero flow and 429 days of < 1 cfs flow in this ditch record tell us that there were times when the ditch flow and streamflow were significantly different, even at low flow levels. As such, the 97% exceedance estimate for the CWRM proposed IIFS value of 3.5 MGD would likely be > 99% on the flow-duration curve if a true streamflow record was available for analysis. Please comment on the applicability of this assumption.
13. On p. 25, the DEA refers to Table 10 and compares the mean flows for 2 USGS ditch gage stations, but the periods of record for these stations are significantly different. In order to use

# North Shore Hydrological Services

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Matt Rosener, MS, PE, Principal

these records for calculation of the Waikoko Stream contribution to the ditch, only records for overlapping time periods should be used. Please correct this.

14. What is KIUC's estimate of baseflow conditions in Wai'ale'ale and Waikoko Streams? Please provide an appropriate flow metric (e.g. BFO<sub>50</sub>) or a range of baseflow values.
15. The DEA mentions a 1987 IIFS for Ili'ili'ula Stream (p. 33), but if that stream was fully diverted at the time of diversion registration, doesn't that make the IIFS = zero? The CWRM seepage run along the ditch, presented in Figure 13-4 of the Instream Flow Standard Assessment Report (IFSAR), showed 97% diversion of Ili'ili'ula Stream during the flow measurements.
16. The analysis of the impact of reduced ditch flows on power production on p. 34 is flawed. While the assumed combined IIFS reservation (4.3 MGD) is subtracted from the 2017-2019 Average Operational Flows (AOF) at the hydro plants for the power production analysis, the IIFS was generally being met during this period (at least at Wai'ale'ale Stream), so one would not need to subtract the IIFS amount from the AOF at the power plants. Please explain this discrepancy.
17. Another discrepancy was found on p. 36 where the DEA says that a minimum of 15.3 cfs is needed in the ditch below the Waikoko intake in order to meet the minimum 11.6 cfs "operating limit cliff" at the upper hydro forebay. But if Ili'ili'ula contributes 33% of the ditch flow at the forebay (on average), then its contribution would be expected to be 7.5 cfs to the ditch when ditch flow below the Waikoko intake is 15.3 cfs. Summing these amounts and subtracting 1.5 cfs for seepage losses yields a ditch flow value at the upper hydro forebay of 21.3 cfs which is much higher than the 11.6 cfs "operating limit cliff." My calculations show that the minimum ditch flow below the Waikoko Stream intake would be 8.8 cfs in order to stay above the critical flow value at the upper hydro forebay. Please explain this discrepancy.
18. The power production factor of ~ 10% used for the final analysis of reduced ditch flows on power production seems completely arbitrary (p. 36). Please provide a reference or justification for selection and use of this adjustment.
19. The V-notch of the low-flow weir in the conceptual design for new diversion dam/intake structures (p. 42, Fig. 23) could be a barrier to passage of native stream animals as flows through it may be too concentrated with velocities too high for passable conditions. This comment does not require a response, but I submit it for consideration with regards to intake design criteria, in the case that the Proposed Action is ultimately approved.
20. The DEA states that the Proposed Action is expected to have "positive effects on the environment" by increasing the amount of water left in the streams (p. 53), but this is contingent upon good IIFSs being set by CWRM for these streams. Until this happens, the potential remains for a 'net negative' effect to occur, especially if the Wai'ale'ale Stream diversion dam is "improved" to capture more water than it does under current conditions. Please comment on this scenario.

# North Shore Hydrological Services

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Matt Rosener, MS, PE, Principal

21. The statement in the DEA on p. 59 that, "hydroelectric power production does not create noxious emissions" is false. While there is a broad range of emission levels from different types of hydropower systems in different climates, recent scientific research has shown that some hydroelectric schemes can produce carbon emissions on a scale similar to those from a fossil fuel-based power plant. Granted, these examples are mainly associated with methane emissions from large reservoirs formed behind hydropower dams in tropical regions, but the statement from the DEA is still false and should be corrected or clarified.
22. According to the DEA, the project sites at the Wai'ale'ale and Waikoko Stream intakes are located outside of the 500-year floodplain limits (p. 67). While this is only true because FEMA's Flood Insurance Rate Maps do not extend to the far mauka areas where these sites are located, this section seems deceptive in suggesting that the project sites are not in active floodplains. Not only are they in floodplains, they are located in stream channels. Please update this section accordingly.
23. The section of the DEA on p. 72 about Downstream Water Users is helpful, but a much more in-depth evaluation of this associated issue (e.g. Secondary Impacts?) should be carried out before any long-term water lease is approved. It is difficult to separate downstream water uses from this evaluation because without them, it would make more sense to keep more of the North Fork water in the North Fork. If other areas outside the Wailua River basin really depend on this water from Wai'ale'ale Stream, then a more balanced approach to water appropriation would be pursued, ideally. This gets back to the need for an accurate accounting of the water diverted from Wai'ale'ale and Waikoko Streams through a water budget analysis and the possible need for a regional water management plan (e.g. moku-scale).
24. In the section on Downstream Water Users (p. 72), the DEA says that Grove Farm has 65 tenants farming 3,800 acres of land in the Lihue area. How much water do they use that might be sourced from Wai'ale'ale and/or Waikoko Stream? If some of this water is sourced from the stream diversions on state property, how much does Grove Farm pay for this water and is their water diversion covered under a separate permit than KIUC's?
25. What is the ultimate fate of the water discharged from the Lower Wai'ahi Hydro Plant tailrace? If it is dumped into Wai'ahi Stream and then diverted again into the Upper Lihue Ditch and/or the Hanamaulu Ditch, is some of this water delivered all the way to Waita Reservoir and the Poipu/Koloa area?
26. If the Wai'ale'ale and Waikoko Stream diversions are eventually abandoned by KIUC, as a result of an IIFS they deem too high or other factors, will this lead to higher rates of water diversion from the South Fork Wailua River to satisfy the existing and future water demand outside the Wailua River basin?
27. The DEA states that, "water used by the hydro plants is returned to Wai'ahi Stream" (p. 78), but since much of the water going through the hydro plants is sourced from other streams, how can it be "returned" to a different stream?

# North Shore Hydrological Services

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Matt Rosener, MS, PE, Principal

28. The DEA states that no water pollution impacts are expected from the Proposed Action, but what about impacts to water temperature and dissolved oxygen levels below the diversion dam intakes when diversion amounts are 80–90% of upstream flow as would be allowed in the (IIFS) scenario described in the document? Do we really expect no impacts? We should not be comparing water quality conditions below the dams now to future conditions there for this analysis. Instead, we should be comparing conditions upstream and downstream of the dam for the Proposed Action scenario if we truly want to evaluate the impact of the water diversions on downstream water quality.
29. The determination that construction impacts on stream biota will be less than significant (p. 87) seems questionable, especially in light of the recent fish kill in Wailuku Stream on Maui due to the construction of a fish ladder for native fish passage. Please describe how this scenario will be avoided.
30. The Proposed Action does not seem to include any improvements to the Ili'ili'ula – North Wailua Ditch other than the required improvements to the diversion dams and water intake and control structures. Why are ditch improvements to increase the transfer efficiency and reduce leakage not addressed in this project? The seepage run performed by CWRM and documented in the IFSAR (Figure 13–4) show substantial seepage losses between the Waikoko Stream intake and Diversion #9971 and again between the Ili'ili'ula Stream intake and the Upper Hydro forebay. With the significant demand for limited water resources in this area, it would seem that leakage from the ditch is an important issue that should be addressed through this project, but no solutions are presented. Please explain why this important component was omitted.

I'd also like to question the claims that the Proposed Action will have no impacts to most climbing 'o'opu species in the diverted streams because most of their habitat is located far downstream of the project sites (p. 88). I would argue that there could be good habitat for some of these species right below the diversion dams if a more natural flow regime was restored to Wai'ale'ale and Waikoko Streams. I read Dr. Parham's Stream Habitat Assessment report included as Appendix D to the DEA, and I understand that non-native predatory bass currently limit the potential for increasing native fish populations in the Wailua River system. I also understand that this limiting factor could potentially be addressed through future stream restoration efforts, but if significant streamflow is not returned to these streams through the IFS and water lease processes, then the flow regime could become the limiting factor to the productivity of the native stream ecosystem at some point in the future. KIUC is applying for a 65-year water lease, and a lot can change in 65 years. We should not assume that because the presence of non-native species in the streams now limits the health of the native biota, that this will always be the case.

The Stream Habitat Assessment report (Appendix D) says that the upper-middle reaches of the Wai'ale'ale and Waikoko Stream channels had intermittent flows during the stream surveys performed in 2018. The author describes braided channels that, "appeared to flow into and up from the substrate making some areas dry or only containing disconnected pools" (p. 120). It is unclear if the proposed

# North Shore Hydrological Services

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Matt Rosener, MS, PE, Principal

IIFSs were being met at the upstream points of diversion during these surveys, but if so, more flow release is apparently needed to provide critical connectivity in these stream reaches. It is important to think of minimum instream flows in the context of downstream channel dimensions and substrate type. This is especially true in steep, boulder-dominated streambeds where greatly reduced flows may end up translating downslope mainly as hyporheic flow (i.e. through the rocks instead of over them). Do we really expect our native stream life to migrate upstream underground? In some cases, they may be adapted to this intermittent flow regime, but in stream segments dewatered by upstream diversion, we may be causing significant barriers to upstream migration. Of course, natural barriers to upstream migration may exist in the streambeds, even for some of our strongest climbing aquatic species. The Stream Habitat Assessment report points out that Wailua Falls on the South Fork and Kaholalele Falls on the North Fork of the Wailua River may act as these types of natural barriers. But, the presence of opae kalaole in the vicinity of the project area shows that they can pass these falls somehow. Also, in Section 4 of the IFSAR, maps were presented that seemed to indicate previous observations of multiple 'o'opu species in the South Fork above Wailua Falls, so I don't think we should consider these barriers impassable to our native stream life. In short, several other factors, both natural and anthropogenic, play into the potential health of the native biota in the Wailua River system, but the dramatically altered hydrology of this basin is the one limiting factor that can be addressed through this water lease application and the associated, ongoing process to set appropriate IIFSs for these streams.

In Section 4 of the DEA, Relationship to State and County Land Use Plans and Policies, Section 226-11 of the Hawaii State Plan is addressed. This section states that, "To achieve the land-based, shoreline, and marine resources objectives, it shall be the policy of this State to: (1) Exercise an overall conservation ethic in the use of Hawai'i's natural resources." The history of these water diversions at Wai'ale'ale and Waikoko Streams has been the exact opposite of this mandate in that the diversions were designed for full extraction of the water resource most of the time. This is the antithesis to the conservation ethic which promotes wise and balanced use of natural resources to allow for continued use of the resource in the future. While the Proposed Action does allow for some return of water to the dry streambeds during low-flow conditions, it still does not exercise an overall conservation ethic as it will likely still result in high levels of water diversion at both streams in the future.

Using the streamflow record from the CWRM gage station on Wai'ale'ale Stream below the diversion dam<sup>1</sup>, I simulated instream flows and ditch diversion flows, assuming the proposed IIFS value of 4.0 MGD at the gage site with flows above that diverted into the ditch up to its hydraulic capacity of 30 MGD. I calculated the resulting diversion percentages for each time step in the record, ranked them, and assigned exceedance percentage values, very similar to the process of developing a flow-duration curve. The results indicate that the diversion percentage at this intake could be as high as 88.1%, and the median diversion percentage would be 66.7%. This means that 2/3 of the streamflow or greater could still be diverted half the time, with 1/3 or less of the streamflow diverted half the time. While this is certainly better than nothing (which is how much flow the stream got for much of the last 100 years),

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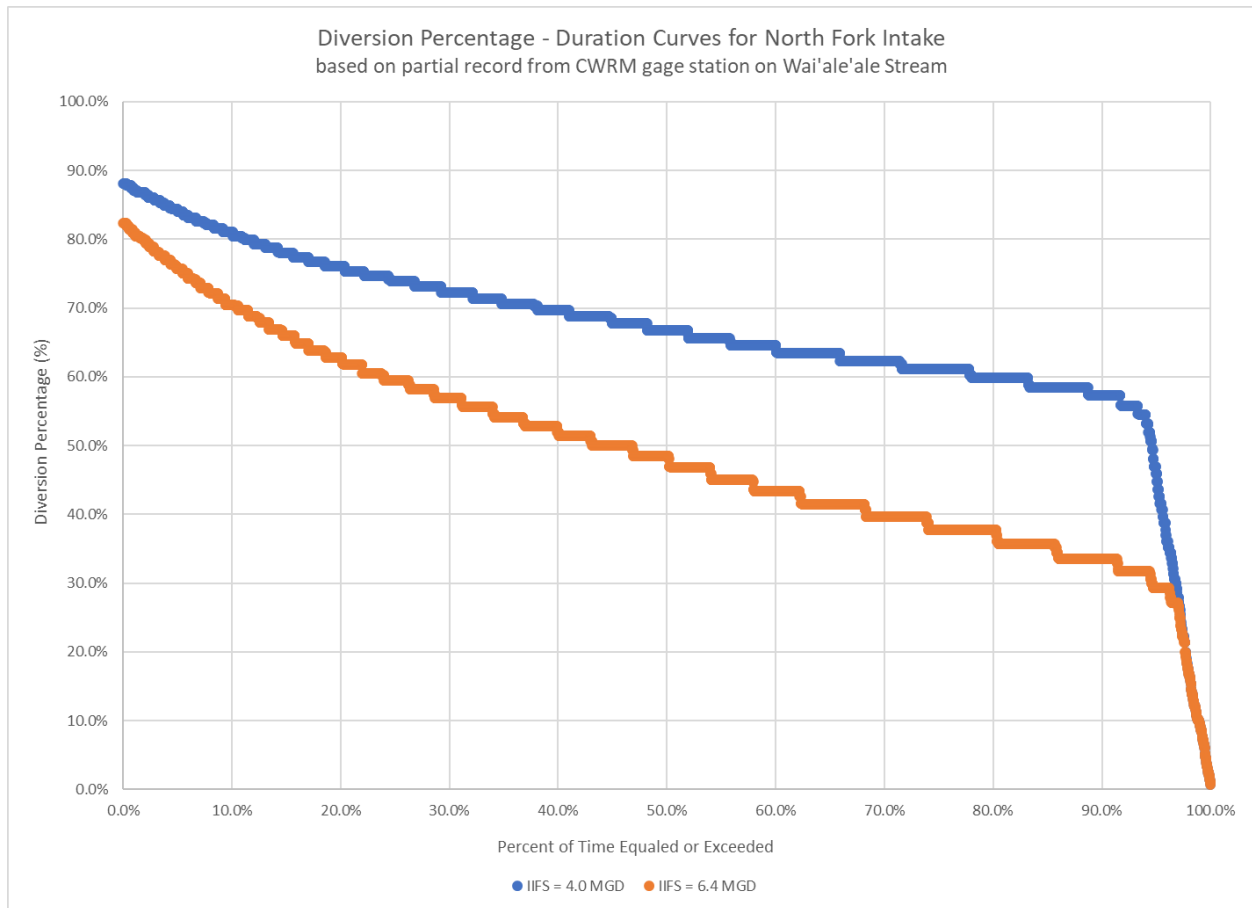
<sup>1</sup> Only a portion of the record was used, beginning with 5/8/19 when water withdrawal by the ditch seems to have ceased. This allows for analysis of a flow record that represents all outflow from the upper basin of Wai'ale'ale Stream above the Ili'ili'ula - North Wailua Ditch diversion.



# North Shore Hydrological Services

Matt Rosener, MS, PE, Principal

it begs the question of if this is really in line with the conservation ethic that we're supposed to be following.



I realize that many of the questions and concerns raised here will be better addressed through the IFS-setting process for these streams, but again I think it's important to restate that there is no reason that a long-term water lease should be approved for these streams without first establishing the Instream Flow Standards. Depending on the results of the IFS process, much of the information and results of several of the analyses presented in this draft Environmental Assessment would need to be revised to reflect the IFS decisions. For this reason, and others outlined here, it seems premature to accept or approve the findings of this DEA, and it definitely doesn't make sense to issue any long-term water lease for these waterways until several other steps are completed (e.g. USGS low-flow study, IFS process, watershed management cost-share formula, update to water lease rent rates). Given the fact that the applicant is requesting a 65-year lease, they are essentially looking to lock up this resource for the rest of our lifetimes. Again, a lot can happen in 65 years. A lot can happen in 10 years. Who knows what major advances in power production technology might happen during these timeframes? I strongly encourage you to consider the input from the Kaua'i community and all other information available to make a wise decision regarding this matter.

# North Shore Hydrological Services

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Matt Rosener, MS, PE, Principal

Respectfully,

A handwritten signature in black ink that reads "Matt Rosener" with a long horizontal flourish extending to the right.

Matt Rosener, P.E.

Hydrologist/Water Resources Engineer

References Cited:

Instream Flow Council, 2002. Instream Flows for Riverine Resource Stewardship.