FIRST CIRCUIT COURT
STATE OF HAWAII
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Attorneys for Defendants
ALEXANDER & BALDWIN, INC. ,
EAST MAUI IRRIGATION CO., LTD. and
HAWAIIAN COMMERCIAL AND SUGAR CO.

IN THE CIRCUIT COURT OF THE FIRST CIRCUIT

STATE OF HAWAII

HEALOHA CARMICHAEL, LEZLEY JACINTHO, and NĀ MOKU AUPUNI O KO`OLAU HUI,

Plaintiffs,

v.

BOARD OF LAND AND NATURAL RESOURCES, SUZANNE CASE, in her official capacity as Chairperson of the Board of Land and Natural Resources, the DEPARTMENT OF LAND AND NATURAL RESOURCES, ALEXANDER & BALDWIN, INC., EAST MAUI IRRIGATION CO., LTD., HAWAIIAN COMMERCIAL AND SUGAR, CO., and COUNTY OF MAUI, DEPARTMENT OF WATER SUPPLY,

Defendants.

CIVIL NO. 15-1-0650-04 RAN
(Environment; Declaratory Judgment)

DEFENDANTS ALEXANDER & BALDWIN, INC., EAST MAUI IRRIGATION CO., LTD. AND HAWAIIAN COMMERCIAL AND SUGAR, CO.'S **REPLY MEMORANDUM IN SUPPORT** OF THEIR SUBSTANTIVE JOINDER IN DEFENDANT COUNTY OF MAUI, DEPARTMENT OF WATER SUPPLY'S APPLICATION FOR LEAVE TO TAKE INTERLOCUTORY APPEAL OF THE ORDER GRANTING PLAINTIFFS' MOTION FOR PARTIAL SUMMARY JUDGMENT, FILED JANUARY 13, 2016; DECLARATION OF ELIJAH YIP; EXHIBITS "1" – "5"; CERTIFICATE OF SERVICE

HEARING
DATE: February 1, 2016
TIME: 9:30 a.m.
JUDGE: RHONDA A. NISHIMURA

TRIAL EXHIBIT AB-169

DEFENDANTS ALEXANDER & BALDWIN, INC., EAST MAUI IRRIGATION CO., LTD. AND HAWAIIAN COMMERCIAL AND SUGAR, CO.'S REPLY MEMORANDUM IN SUPPORT OF THEIR SUBSTANTIVE JOINDER IN DEFENDANT COUNTY OF MAUI, DEPARTMENT OF WATER SUPPLY'S APPLICATION FOR LEAVE TO TAKE INTERLOCUTORY APPEAL OF THE ORDER GRANTING PLAINTIFFS' MOTION FOR PARTIAL SUMMARY JUDGMENT, FILED JANUARY 13, 2016

I. ARGUMENT

Defendants Alexander & Baldwin, Inc., East Maui Irrigation Co., Ltd. ("***EMI***") and Hawaiian Commercial and Sugar, Co. ("***HC&S***"; collectively, the "***A&B Defendants***") join in the arguments in the reply memoranda in support of Defendants County of Maui, Department of Water Supply's ("***County***") Application for Leave to Take Interlocutory Appeal of The Order Granting Plaintiffs' Motion for Partial Summary Judgment, filed October 21, 2015 and Motion for Stay of Proceedings and/or Enforcement of the Order Pending Appeal filed on January 13, 2016 (the "***Application***") filed by the County and Defendants Board of Land and Natural Resources, Suzanne Case, and Department of Land and Natural Resources (collectively, the "***State Defendants***"). In addition, the A&B Defendants file this reply memorandum to correct certain factual misstatements in Plaintiffs' memorandum in opposition to the Application ("***Plaintiffs' Opp Memo***").

A. Plaintiffs Are Incorrect in Asserting That "One Third of the Water Currently Flowing Through the EMI Ditch Would Continue to Flow" If All Diversions Within the License Areas Were Ordered to Be Shut Down.

At the bottom of page 4, continuing at the top of page of 5 of Plaintiffs' Opp Memo, Plaintiffs assert:

> According to A&B, however, one-third of the water flowing through the EMI ditch system does not originate from state lands. . . . In other words, if all the diversions of all the streams within the areas covered by revocable permit numbers 7263, 7264, 7265 and 7266, were ordered to be shut down, one third of the water currently flowing through the EMI ditch would continue to flow.

This statement ignores the physical realities of the EMI ditch system.

The EMI system is an integrated system of ditches, tunnels, diversions and reservoirs that extends across lands owned by both the State and by EMI. While it has been estimated that approximately 30% of the water historically collected in the portions of the system situated east of Honopou stream (which marks the western boundary of the State license areas) emanates from land owned by EMI, it is not true that, "if all the diversions of all the streams within the areas

covered by revocable permit numbers 7263, 7264, 7265 and 7266, were ordered to be shut down, one third of the water currently flowing through the EMI ditch would continue to flow." *See* Declaration of Garret Hew, attached hereto as Ex. 1 ("***Hew Decl.***"), at ¶ 4. This is because the vast majority of the diversions in the EMI system east of Honopou Stream are located in the areas covered by the revocable permits. The water in the streams at the points where they are diverted consists of water emanating from State lands that has been naturally commingled in the streams with water emanating from EMI lands. Thus, if all of the diversions located within the license areas were to be "shut down," none of the water emanating from EMI land located above the diversions would be diverted and therefore none of this water would "continue to flow" in the EMI ditch system. *See id.* at ¶ 5.

Taking the Huelo license area as an example, the EMI Ditch System map (attached as Exhibit C-1 to Exhibit 5 attached hereto[1]) shows that most of the ditches and intakes are located in the yellow area that depicts State-owned land. Below the yellow area is a large green area showing higher elevation watershed land owned by EMI. The map reflects an estimate that 35.51% of the water collected in the combined State and EMI-owned watersheds in the Huelo area emanated from EMI land. However, the EMI Ditch System has no intakes in this high elevation EMI-owned watershed. The water emanating from EMI land has to flow downstream into the State-owned license areas where it commingles with water that emanates from the State-owned watersheds. Only then is it diverted into the EMI Ditch System via diversion structures that are located, for the most part, in the State-owned license areas. *See id.* at ¶ 6.

This is even more clearly illustrated in the Honomanu license area, where the green EMI-owned watershed lands are located far above the diversion points in the yellow areas. The estimate for the Honomanu license area is that 52.61% of the water collected originates on EMI-owned land. If the diversions located on State-owned lands in the Honomanu license area were to be "shut down," none of the water emanating from the EMI-owned land above would be diverted and therefore would not "continue to flow" in the EMI ditch system. *See id.* at ¶ 7.

Viewing the four license areas as a whole, the estimated 30% of EMI Ditch system water arising on EMI-owned watershed lands east of Honopou Stream will not "continue to flow" in

[1] Exhibit 5 is the Hearings Officer's Recommended Findings of Fact, Conclusions of Law and Decision and Order filed on January 15, 2016 in the contested case before the Commission on Water Resource Management ("***CWRM***") regarding the 27 petitions to amend the interim instream flow standards ("***IIFS***") for certain East Maui streams, Case No. CCH-MA13-01.

the EMI Ditch unless EMI is allowed to continue to have access to and to operate all of the diversions located in the State-owned license areas. EMI has the right to access and operate these diversions, even in the absence of the revocable permits, by reason of the "right and easement" it acquired to do so in its March 18, 1938 agreement (the "***1938 Agreement***") with the Territory of Hawai'i (attached hereto as Ex. 3). *See* Hew Decl. at ¶ 8.

Even utilizing the easements in favor of EMI provided for in the 1938 Agreement, it would be operationally impossible, on a day by day basis, to accurately separate out the water that originates on EMI-owned watershed lands from the water it commingles with upon entering State land. The 30% estimate is simply a long-term average that was derived from rainfall records and was used to calculate license fees so as to exclude any payment by EMI for water emanating from its own lands. It was only developed and used for accounting purposes. It would be a massive and time-consuming undertaking to devise a system of diversion modifications, on a diversion by diversion basis, to physically implement an apportionment of the water in the streams that emanates from EMI-owned watersheds versus State-owned watersheds. *See id.* at ¶ 9.

Even if, in theory, EMI could engineer, obtain permits for, and construct diversion modifications so as to implement operating systems that would only divert water in amounts equivalent to the amounts that originate on EMI-owned watershed lands, there would still be no assurance that this amount of water would be sufficient to reliably supply the County with its needs for its Upcountry users. *See id.* at ¶ 10. Due to gravity flow considerations, only water that is collected in the highest elevation ditch in the EMI Ditch System, the Wailoa Ditch, can be physically delivered to the County. Accordingly, when estimating the amount of water that might still be flowing in the EMI System if EMI were only to divert water originating on its own lands, water that is collected in the lower elevation ditches must be excluded. *See id.* at ¶ 11.

Based on daily ditch flow data in the Wailoa Ditch at Honopou from 2005 to 2015, if the daily flows in the Wailoa Ditch at Honopou were to have been reduced to 30% of what they were over the last ten years, and the County's needs were assumed to be 7 million gallons per day ("***mgd***") at the Kamole Weir, and 3 mgd at the Kula Ag Park, the County would have had less than 10 mgd for 523 days, or 14.32% of this time period, and less than 7 mgd for 130 days or 3.56% of this time period. *See* Ex. 4 attached hereto; Hew Decl. at ¶¶ 12-13. To be clear, during

these periods, the County would not have had enough water even if no water was delivered to HC&S at all. *See* Hew Decl. at ¶ 13.

The amount that may actually be available in the Wailoa Ditch in the future will likely be less than reflected in this analysis, however, given the recommended amendments to the IIFS for the East Maui streams recently issued by the Hearings Officer in the pending contested case hearing before CWRM. *See* Ex. 5 attached hereto; Hew Decl. at ¶ 14. The impending IIFS amendments make it even less certain that EMI could reliably supply the County with sufficient water for its Upcountry users even if EMI were able to divert all of the water estimated to emanate from its owned lands and directed 100% of such water collected in the Wailoa Ditch to the County, and none to HC&S. *See* Hew Decl. at ¶ 15.

B. A 70% Reduction in EMI's Diversions Would Be Devastating to HC&S' Final Harvest, Transition Plans, and Future Agricultural Use of Its Central Maui Lands Currently Irrigated with EMI Ditch Water.

A 70% reduction in EMI's diversions would not only jeopardize the County's ability to supply its Upcountry users, but devastate the viability of HC&S' final harvest along with any future agricultural use of the Central Maui lands currently irrigated with EMI Ditch water. *See id.* at ¶ 16. Exhibit A to Plaintiffs' Opp Memo is a copy of a January 19, 2016 article published in the *Maui News*. In the second column from the right as replicated in Exhibit A, there is a reference to A&B's announcement that it plans to end sugar production by the end of this year, and then the following statement is attributed to counsel for Plaintiffs:

> Given the plans to shut down the plantation, A&B may be able to obtain enough water from land it currently owns. One-third of the water comes from A&B land, Sylva said, meaning that even if the state revoked all permits it still would have one-third of its current take. It's enough to supply the county's needs, and "they arguably have enough to satisfy their transition into a different crop for the time being," she said.

Ex. A to Plaintiffs' Opp Memo.

The quoted statement erroneously asserts that the continuing needs of HC&S for this year, in addition to those of the County, could be met with 30% of the water currently diverted from East Maui. *See* Declaration of Rick W. Volner, Jr., attached hereto as Ex. 2 ("***Volner Decl.***"), at ¶ 7. Thirty percent of the available water would be insufficient to sustain and ripen the 16,000 – 17,000 acres of sugarcane planned to be harvested this year. Maintaining yields and financial viability of this last harvest is critical to funding HC&S' employee benefits and transition services. *See id.* at ¶ 7A. Nor would the available water be sufficient to maintain

cover crops and other soil conservation measures as required by National Resources Conservation Service approved conservation plans. *See id.* at ¶ 7B. The available water also would be insufficient to accelerate and expand diversification crop test efforts. *See id.* at ¶ 7C.

In addition, 30% of historic EMI Ditch System deliveries would not nearly be enough to both supply the needs of the County and sustain the long-term cultivation of agricultural crops in the central plain of Maui. Based on readily available estimates for water usage among various agricultural crops that could be grown in the central valley of Maui, 30% of currently available water falls wells short of any productive and financially viable diversified agricultural uses. *See id.* at ¶ 8.

In sum, Plaintiffs' assertion that the County's Upcountry users and HC&S' short-term and long-term water needs would be adequately met with 30% of the water delivered by the EMI Ditch System has no factual basis.

II. CONCLUSION

Based on the foregoing reasons and the arguments presented in the memoranda filed by County and the State Defendants in support of the Application, it is clear that a stay of the Court's orders issued on January 8, 2016 and leave to appeal the same should be granted. Accordingly, the Court should grant the Application.

DATED: Honolulu, Hawaii, January 28, 2016.

CADES SCHUTTE LLP

DAVID SCHULMEISTER
ELIJAH YIP
Attorneys for Defendants
ALEXANDER & BALDWIN, INC., EAST MAUI IRRIGATION CO., LTD. and HAWAIIAN COMMERCIAL AND SUGAR CO.

IN THE CIRCUIT COURT OF THE FIRST CIRCUIT

STATE OF HAWAII

HEALOHA CARMICHAEL, LEZLEY JACINTHO, and NĀ MOKU AUPUNI O KO`OLAU HUI, Plaintiffs, v. BOARD OF LAND AND NATURAL RESOURCES, SUZANNE CASE, in her official capacity as Chairperson of the Board of Land and Natural Resources, the DEPARTMENT OF LAND AND NATURAL RESOURCES, ALEXANDER & BALDWIN, INC., EAST MAUI IRRIGATION CO., LTD., HAWAIIAN COMMERCIAL AND SUGAR, CO., and COUNTY OF MAUI, DEPARTMENT OF WATER SUPPLY, Defendants.	CIVIL NO. 15-1-0650-04 RAN (Environment; Declaratory Judgment) DECLARATION OF ELIJAH YIP

DECLARATION OF ELIJAH YIP

I, ELIJAH YIP, declare as follows:

1. I am an attorney with the law firm of Cades Schutte LLP, attorneys for Defendants Alexander & Baldwin, Inc. and East Maui Irrigation Company, Ltd. and Hawaiian Commercial and Sugar Company in the above-captioned action, and am authorized and competent to make this declaration based on personal knowledge except as otherwise stated below.

2. Attached hereto as Exhibit "1" is a true and correct PDF copy of the signed declaration of Garret Hew dated January 28, 2016. The original declaration will be submitted to the Court upon receipt of the same by my office.

3. Attached hereto as Exhibit "2" is a true and correct PDF copy of the signed declaration of Rick W. Volner, Jr. dated January 28, 2016. The original declaration will be submitted to the Court upon receipt of the same by my office.

I, ELIJAH YIP, declare, verify, certify, and state under penalty of perjury that the foregoing is true and correct.

DATED: Honolulu, Hawaii, January 28, 2016.

ELIJAH YIP

IN THE CIRCUIT COURT OF THE FIRST CIRCUIT

STATE OF HAWAII

HEALOHA CARMICHAEL, LEZLEY JACINTHO, and NĀ MOKU AUPUNI O KO'OLAU HUI, Plaintiffs, v. BOARD OF LAND AND NATURAL RESOURCES, SUZANNE CASE, in her official capacity as Chairperson of the Board of Land and Natural Resources, the DEPARTMENT OF LAND AND NATURAL RESOURCES, ALEXANDER & BALDWIN, INC., EAST MAUI IRRIGATION CO., LTD., HAWAIIAN COMMERCIAL AND SUGAR, CO., and COUNTY OF MAUI, DEPARTMENT OF WATER SUPPLY, Defendants.	CIVIL NO. 15-1-0650-04 RAN (Environment; Declaratory Judgment) DECLARATION OF GARRET HEW

DECLARATION OF GARRET HEW

I, GARRET HEW, declare as follows:

1. I am the President of East Maui Irrigation Co., Ltd. ("***EMI***"), a subsidiary of Alexander & Baldwin, LLC. ("***A&B***"). I have been employed by EMI since 1985. I am authorized and competent to make this declaration based on personal knowledge.

2. This declaration is submitted to correct certain factual misstatements in contained in Plaintiffs' January 22, 2016 Memorandum in Opposition to Defendant County of Maui, Department of Water Supply's Application for Leave to Take Interlocutory Appeal of the Order Granting Plaintiff's Motion For Partial Summary Judgment, filed October 21, 2015 and Motion

EXHIBIT 1

for Stay of Proceedings and/or Enforcement of the Order Pending Appeal ("***Plaintiffs' Opp Memo***").

3. At the bottom of page 4, continuing at the top of page 5 of Plaintiffs' Opp Memo, Plaintiffs incorrectly assert:

> According to A&B, however, one-third of the water flowing through the EMI ditch system does not originate from state lands.... In other words, if all the diversions of all the streams within the areas covered by revocable permit numbers 7263, 7264, 7265 and 7266, were ordered to be shut down, one third of the water currently flowing through the EMI ditch would continue to flow.

4. The EMI system is an integrated system of ditches, tunnels, diversions and reservoirs that extends across lands owned by both the State and by EMI. While it has been estimated that approximately 30% of the water historically collected in the portions of the system situated east of Honopou stream (which marks the western boundary of the State license areas) emanates from land owned by EMI, it is not true that, "if all the diversions of all the streams within the areas covered by revocable permit numbers 7263, 7264, 7265 and 7266, were ordered to be shut down, one third of the water currently flowing through the EMI ditch would continue to flow."

5. The reason the foregoing statement is not true is that the vast majority of the diversions in the EMI system east of Honopou Stream are located in the areas covered by the revocable permits. The water in the streams at the points where they are diverted consists of water emanating from State lands that has been naturally commingled in the streams with water emanating from EMI lands. Thus, if all of the diversions located within the license areas were to be "shut down," none of the water emanating from EMI land located above the diversions would be diverted and therefore none of this water would "continue to flow" in the EMI ditch system.

6. Taking the Huelo license area as an example, the EMI Ditch System map (attached as Exhibit C-1 to Exhibit 5 attached hereto) shows that most of the ditches and intakes are located in the yellow area that depicts State-owned land. But below the yellow area is a large green area showing higher elevation watershed land owned by EMI. The map reflects an estimate that 35.51% of the water collected in the combined State and EMI-owned watersheds in the Huelo area emanated from EMI land. But the EMI Ditch System has no intakes in this high elevation EMI-owned watershed. The water emanating from EMI land has to flow downstream into the State-owned license areas where it commingles with water that emanates from the State-owned watersheds. Only then is it diverted into the EMI Ditch System via diversion structures that are located, for the most part, in the State-owned license areas.

7. This is even more clearly illustrated in the Honomanu license area, where the green EMI-owned watershed lands are located far above the diversion points in the yellow areas. The estimate for the Honomanu license area is that 52.61% of the water collected originates on EMI-owned land. If the diversions located on State-owned lands in the Honomanu license area were to be "shut down," however, none of the water emanating from the EMI-owned land above would be diverted and therefore would not "continue to flow" in the EMI ditch system.

8. Viewing the four license areas as a whole, the estimated 30% of EMI Ditch system water arising on EMI-owned watershed lands east of Honopou Stream will not "continue to flow" in the EMI Ditch unless EMI is allowed to continue to have access to and to operate all of the diversions located in the State-owned license areas. EMI has the right to access and operate these diversions, even in the absence of the revocable permits, by reason of the "right and easement" it acquired to do so in its March 18, 1938 agreement (the "***1938 Agreement***") with the Territory of Hawaii, a copy of which is attached hereto as Exhibit 3.

9. Even utilizing the easements in favor of EMI provided for in the 1938 Agreement, it would be operationally impossible, on a day by day basis, to accurately separate out the water that originates on EMI-owned watershed lands from the water it commingles with upon entering State land. The 30% estimate is simply a long-term average that was derived from rainfall records and was used to calculate license fees so as to exclude any payment by EMI for water emanating from its own lands. It was only developed and used, in other words, for accounting purposes. It would be a massive and time-consuming undertaking to devise a system of diversion modifications, on a diversion by diversion basis, to physically implement an apportionment of the water in the streams that emanates from EMI-owned watersheds versus State-owned watersheds.

10. Even if, in theory, EMI could engineer, obtain permits for, and construct diversion modifications so as to implement operating systems that would only divert water in amounts equivalent to the amounts that originate on EMI-owned watershed lands, there would still be no assurance that this amount of water would be sufficient to reliably supply the County of Maui with its needs for its Upcountry users.

11. Due to gravity flow considerations, only water that is collected in the highest elevation ditch in the EMI Ditch System, the Wailoa Ditch, can be physically delivered to the County. Accordingly, when estimating the amount of water that might still be flowing in the EMI System if EMI were only to divert water originating on its own lands, water that is collected in the lower elevation ditches must be excluded.

12. To develop a rough estimate of how reliably there would be enough water in the Wailoa Ditch to supply the County of Maui, I created the spreadsheet attached hereto Exhibit 4. The first two columns of Exhibit 4 show the daily ditch flows in the Wailoa Ditch at Honopou

for the last ten years sorted in order by volume of flow from low to high. The third column multiplies the volume reflected in the second column by thirty percent (30%) to represent the amount of water collected by EMI on that day that would emanate from EMI-owned lands. The fourth column is a running tally of the number of days for which ditch delivery data is available.

13. Exhibit 4 demonstrates that if the daily flows in the Wailoa Ditch at Honopou were to have been reduced to 30% of what they were over the last ten years, and the County's needs were assumed to be 7 million gallons per day ("***mgd***") at the Kamole Weir, and 3 mgd at the Kula Ag Park, the County would have had less than 10 mgd for 523 days, or 14.32% of this time period, and less than 7 mgd for 130 days or 3.56% of this time period. To be clear, during these periods, the County would not have had enough water even if no water was delivered to HC&S at all.

14. The amount that may actually be available in the Wailoa Ditch in the future will likely be less than reflected in this analysis, however, given the recommended amendments to the Interim Instream Flow Standards ("***IIFS***") for the East Maui streams recently issued by the Hearings Officer in the pending contested case hearing before the Commission on Water Resource Management. A true and correct copy of the Hearings Officer's Recommended Findings of Fact, Conclusions of Law and Decision and Order is attached hereto as Exhibit 5.

15. The impending IIFS amendments make it even less certain that EMI could reliably supply the County with sufficient water for its Upcountry users even if EMI were able to divert all of the water estimated to emanate from its owned lands and directed 100% of such water collected in the Wailoa Ditch to the County, and none to HC&S.

16. This declaration has been primarily focused on responding to Plaintiffs' misstatements regarding the immediate impacts to the County of a shutdown of the EMI

diversions in the State-owned license areas. If EMI had to reduce its diversions by 70%, however, not only would the County's ability to supply its Upcountry users be jeopardized, the viability of HC&S' final harvest would be devastated along with any future agricultural use of the Central Maui lands currently irrigated with EMI Ditch water.

I, GARRET HEW, declare, verify, certify, and state under penalty of perjury that the foregoing is true and correct.

DATED: Maui, Hawaii, January 28, 2016.

GARRET HEW

ImanageDB:3361540.2

IN THE CIRCUIT COURT OF THE FIRST CIRCUIT

STATE OF HAWAII

HEALOHA CARMICHAEL, LEZLEY JACINTHO, and NĀ MOKU AUPUNI O KO`OLAU HUI, Plaintiffs, v. BOARD OF LAND AND NATURAL RESOURCES, SUZANNE CASE, in her official capacity as Chairperson of the Board of Land and Natural Resources, the DEPARTMENT OF LAND AND NATURAL RESOURCES, ALEXANDER & BALDWIN, INC., EAST MAUI IRRIGATION CO., LTD., HAWAIIAN COMMERCIAL AND SUGAR, CO., and COUNTY OF MAUI, DEPARTMENT OF WATER SUPPLY, Defendants.	CIVIL NO. 15-1-0650-04 RAN (Environment; Declaratory Judgment) DECLARATION OF RICK W. VOLNER, JR.

DECLARATION OF RICK W. VOLNER, JR.

I, RICK W. VOLNER, JR., declare as follows:

1. I am the General Manager of Hawaiian Commercial and Sugar Company ("***HC&S***"), which is the division of Alexander & Baldwin, LLC ("***A&B***") that operates A&B's sugar operations on Maui. I have served as General Manager of HC&S since April 1, 2011. I am authorized and competent to make this declaration based on personal knowledge.

2. I was born and raised in Maui, Hawai'i. I attended the University of Hawai'i at Mānoa, where I obtained a B.S. in Mechanical Engineering in 1997. Upon graduation I returned to Maui to work for HC&S as an Agricultural Engineer. I have worked in various supervisory positions including wastewater operations manager, Lowrie and Mā'alaea Farm Manager, Vice President of Farming Operations, and Senior-Vice President of Agricultural Operations.

EXHIBIT 2

3. I currently oversee all of the operations of HC&S, which include the cultivation of approximately 35,000 acres of sugarcane and the operation of the Pu'unēnē mill and power plant.

4. This declaration is submitted to correct certain factual misstatements contained in Exhibit A to Plaintiffs' January 22, 2016 Memorandum in Opposition to Defendant County of Maui, Department of Water Supply's Application for Leave to Take Interlocutory Appeal of the Order Granting Plaintiff's Motion For Partial Summary Judgment, filed October 21, 2015 and Motion for Stay of Proceedings and/or Enforcement of the Order Pending Appeal ("***Plaintiffs' Opp Memo***").

5. Exhibit A to Plaintiffs' Opp Memo is a copy of a January 19, 2016 article published in The Maui News. In the second column from the right as replicated in Exhibit A, there is a reference to A&B's announcement that it plans to end sugar production by the end of this year, and then the following statement is attributed to counsel for Plaintiffs:

> Given the plans to shut down the plantation, A&B may be able to obtain enough water from land it currently owns. One-third of the water comes from A&B land, Sylva said, meaning that even if the state revoked all permits it still would have one-third of its current take. It's enough to supply the county's needs, and "they arguably have enough to satisfy their transition into a different crop for the time being," she said.

6. The Declaration of Garret Hew separately addresses the physical challenges to the operation of the EMI Ditch System so as to only divert the estimated 30% of the water collected in the system that originates on watershed lands owned by EMI and the lack of any assurance that, even if it were possible, that this would be adequate to supply the needs of the County of Maui.

7. The quoted statement is also incorrect with regard to whether the continuing needs of HC&S for this year, in addition to those of the County, could be met with 30% of the water currently diverted from East Maui. The reasons are principally as follows:

A. 30% of available water would be insufficient to sustain and ripen the 16,000 – 17,000 acres of sugarcane planned to be harvested this year. Maintaining

yields and financial viability of this last harvest is critical to funding employee benefits and transition services.

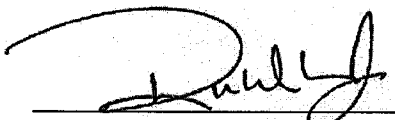
B. The available water would be insufficient to maintain cover crops and other soil conservation measures as required by National Resources Conservation Service approved conservation plans.

C. The available water would be insufficient to accelerate and expand diversification crop test efforts.

8. In addition, 30% of historic EMI Ditch System deliveries could not come close to both supplying the needs of the County of Maui and sustaining the long term cultivation of agricultural crops in the central plain of Maui. Based on readily available estimates for water usage among various agricultural crops that could be grown in the central valley of Maui, 30% of currently available water falls wells short of any productive and financially viable diversified agricultural uses.

I, RICK W. VOLNER, JR., declare, verify, certify, and state under penalty of perjury that the foregoing is true and correct.

DATED: Maui, Hawaii, January 28, 2016.



RICK W. VOLNER, JR.

EMWA

LIBER 1485 PAGE 1

THIS INDENTURE, made this 15th day of March, 1938, by and between the TERRITORY OF HAWAII, acting by and through L. M. Whitehouse, Commissioner of Public Lands for the Territory of Hawaii, with the consent and approval of the Governor and of the Land Board of said Territory, hereinafter called the "Territory", and the EAST MAUI IRRIGATION COMPANY, LIMITED, an Hawaiian corporation, hereinafter called the "Company",

W I T N E S S E T H T H A T :

WHEREAS it is the desire of the Territory to have competitive bidding on licenses to divert water from government lands situated in East Maui; and

WHEREAS the joint use by any future Licensees of the Territory and by the Company of the aqueduct system on East Maui, Territory of Hawaii, extending from Nahiku to Honopou inclusive, which system is partly on government land and partly on Company land, will make competitive bidding possible,

NOW THEREFORE:

I.

THE TERRITORY, in consideration of the easements hereinafter granted to it by the Company and of the covenants and agreements herein contained to be observed and performed by the Company, does hereby grant to the Company a perpetual (except as to cancellation as hereinafter provided) right and easement:

(1) To convey all water now or hereafter owned by the Company and all water covered by any water license now held by the Company or which in the future may be granted to it, jointly with the Territory, without charge, through any or all aqueducts now or hereafter crossing government lands situated in East Maui

STANLEY, VITOUSEK, PRATT & WISE
ATTORNEYS AT LAW
HONOLULU, HAWAII

extending from Nahiku to Honopou inclusive; and

(2) To divert such water thus conveyed, after due allowance has been made for evaporation, leakage and seepage losses at a point or points designated by the Company, which have been or will be equipped at the Company's expense with suitable turnout and water measurement devices, provided however, that such right and easement to convey and divert such water shall be subject to the following restrictions, to-wit:

(a) During times when the total water contributory to these jointly used aqueducts does not exceed the capacity thereof, that portion of the flow therein, which shall be considered the Company's water, is to equal the quantity of water contributed thereto from sources owned in fee and from those held under license by the Company, and the remaining water shall be considered the Territory's water;

(b) During times when the total water contributory to these jointly used aqueducts exceeds the capacity thereof, that portion of the flow therein which shall be considered the Company's water shall bear the same ratio to the total capacity thereof as the long term average water yield (as hereinafter defined) contributory thereto from sources owned in fee and held under license by the Company bears to the total long term average water yield contributory to these jointly used aqueducts, and the remaining water shall be considered the Territory's water.

II.

THE COMPANY, in consideration of the foregoing grant and of the covenants and agreements to be observed and performed by the Territory, herein contained, does hereby grant to the Territory a perpetual (except as to cancellation as hereinafter provided) right and easement:

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HONOLULU, HAWAII

(1) To convey water jointly with the Company, without charge, through aqueducts crossing the Company's lands situated in East Maui extending from Nahiku to Honomou inclusive; and

(2) To divert water thus conveyed - after due allowance has been made for evaporation, leakage and seepage losses at points in said area designated by the Territory which have been equipped or will be equipped at the Territory's expense with suitable turn-outs and water measuring devices; the portion of the flow which shall be considered the Territory's water to be that specified above;

(3) To use reservoirs which are owned by the Company and are situated East of Honopou on East Maui, jointly with the Company, without charge, to the end that:

(a) Water in excess of the maximum capacity of, and otherwise contributory to, that portion of the aqueduct system crossing the drainage areas on which these reservoirs are situated, is to be conveyed jointly by the Territory and the Company into these reservoirs, in so far as this can be done by gravity using the existing aqueduct system (natural and artificial);

(b) Water in these reservoirs shall be drawn therefrom and put into that portion of the aqueduct system, which can thus be served by gravity, at a maximum rate limited either by the capacity of the reservoir outlets or the capacity of that portion of the aqueduct system into which the reservoir water is being put, so as to keep the aqueduct system flowing as nearly full as possible; the portion of the water thus drawn from the reservoirs which shall be considered the Territory's water shall bear the same ratio to the total water drawn therefrom as the long term average water yield (as hereinafter defined) contributory to that portion of the aqueduct system located on the drainage areas on

which these reservoirs are situated and derived from sources owned by the government not then under license to the Company, bears to the total long term average water yield contributory to said portion of the aqueduct system, and the remaining portion thus drawn from the reservoirs shall be considered the Company's water.

III.

THE COMPANY, for the consideration aforesaid, does hereby agree that, in order to supplement the stream flows, it will endeavor to develop existing ground water on the Government and Company lands at Nahiku and Keanae above the existing aqueduct system by means of tunneling if in its opinion there are locations where it is feasible to develop water economically.

development of grd. water

IV.

IT IS MUTUALLY COVENANTED AND AGREED by and between the parties hereto that:

(1) Each of the existing five licenses now held by the Company to use and convey water from government lands on East Maui shall be cancelled, and/or extended, as the case may be, so that they shall terminate on that June thirtieth nearest to the date stipulated in each respective license as the otherwise normal expiration date; and the final rental on each of these licenses shall be adjusted according to the resulting proportionate curtailment or extension of time, as the case may be;

(2) Licenses 267-B and 974 (two of the said five licenses) which overlap and have no definite line separating them shall be combined and considered under one license on and after the day following the above agreed termination by cancellation, namely on and after the first day of July, 1938.

V.

IT IS FURTHER AGREED that if the Territory, after due legal notice thereof, shall put up at public auction at least sixty days previous to its termination by the above agreed cancellation, and

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ATTORNEYS AT LAW
HONOLULU, HAWAII

thereafter at least sixty (60) days previous to its stipulated expiration, each of the aforementioned licenses (reduced to four in number) for a term of thirty (30) years, the Company agrees to bid on such licenses and offer to purchase the right to the water to be granted by any given license, providing the annual sums required to be paid by the licensee thereunder (i.e. the upset price) do not exceed the annual sums which would be required to be paid if the upset price were determined in the manner hereinafter set forth in subsections (a), (b) and (c) hereof and further providing such licenses contain provisions substantially similar to the provisions of subsections (d), (e), (f) and (g) hereof:

(a) When the average price per pound of raw sugar for a given annual payment period, July 1st to the following June 30th, inclusive, is three cents (3¢) or less, the price per million gallons of water diverted from the licensed area under consideration during the given payment period shall be that given in the price list hereinafter set forth;

(b) When the average price per pound of raw sugar for a given annual payment period, July 1st to the following June 30th, inclusive, is greater than three cents (3¢) and not more than four cents (4¢) the price per million gallons of water diverted from the licensed area under consideration during such given payment period shall be that resulting from the price given in the said price list being increased at a rate of three per cent. (3%) for every one-tenth (1/10th) of a cent the said average price of raw sugar exceeds three cents (3¢) per pound;

(c) When the average price per pound of raw sugar for a given annual payment period, July 1st to the following June 30th, inclusive, is greater than four cents (4¢) the price per million gallons of water diverted from the licensed area under consideration during the given payment period shall be that determined as above

for an average price per pound of raw sugar of four cents (4¢).

PRICE LIST FOR WATER DIVERTED FROM EAST MAUI LICENSED AREAS

LICENSE	AREA COVERED	PRICE PER MILLION GALLONS WHEN RAW SUGAR IS THREE CENTS OR LESS PER POUND
Nahiku	From Hana-Koolau boundary to Waiaaka Stream	$ .9539
Keanae	From and including Waiaaka Stream to Nuaailua Stream	1.5009
Honomanu	From and including Nuaailua Stream to Puohakumoa Stream	2.1043
Huelo	From and including Puohakumoa Stream to and including Honopou Stream	2.0980

(d) In the event the Company is the successful bidder on any license it shall, from March to November inclusive of each year, take all of the available East Maui water to which it has acquired a right by license and by ownership in fee, up to that portion of the capacity of the aqueduct system to which it has a right under this agreement; provided, however, if the sugar cane area irrigated by the Company's water is reduced by governmental restrictions this required minimum quantity of water to be taken by the Company may, if the Company desires, be reduced proportionately. During January, February and December of each year the Company shall take only such water as it desires. The curtailed quantity of water, resulting from either of the two foregoing reductions of water, shall be considered as having been taken proportionately from drainage areas, irrespective of whether owned by the Territory or by the Company, according to the long term average yield of each such area and such curtailed quantity of water deemed to be taken from a licensed area shall be the quantity

constructively (according to the above proportionate plan) diverted from that area.

(e) The rental payments required to be made for each of said licenses, in the event the Company is the successful bidder therefor, shall be made semi-annually in advance on or before July 10th and January 10th of each license year, and the amount thereof shall be determined as follows:

(f) The estimated rental shall be determined for the ensuing six months on the basis of the successful bid and upon the assumption that the average price of raw sugar for said six months will be three and one-half cents (3½¢) per pound, and that the quantity of water diverted from the licensed area under consideration will be the long term average quantity for six (6) months diverted therefrom;

(g) Adjustment of rental shall be made within six (6) months after the expiration of the license year, June 30th, so that the resulting rental paid by the Licensee to the Territory will conform to the successful bid, average price of raw sugar for the license year under consideration and the quantity of water actually and constructively diverted during this license year from the licensed area under consideration; refunds or additional payments as the case may be will be made accordingly.

VI.

IT IS ALSO AGREED that:

(1) Failure to bid, by the Company, on any of the said licenses under the specified conditions shall not automatically operate as a cancellation of this agreement but such failure shall give the Territory the option of cancelling the same;

(2) Failure to put up at auction any of the said licenses at the specified time, or failure to fix the upset price in the manner herein required shall not automatically operate as a cancella-

tion of this agreement but such failure shall give the ~~Territory~~ Company the option of cancelling the same.

VII.

The cost of operation and maintenance of said aqueduct system shall be borne by the Territory and the Company in direct proportion to the use made thereof; that is to say, so long as the Territory has not granted a license to any one other than the Company to take and use water from any of said land or otherwise made use of any of said water, the Company shall be deemed to be the sole user of said aqueduct system and the total cost of operation and maintenance of said aqueduct system shall be borne by the Company. If, however, one other than the Company should become the purchaser of one or more of the licenses, or otherwise become the user of any of said water, then, and in that event the cost of operation and maintenance shall be borne by the Territory and the Company in direct proportion to the product of the water conveyed, and the distance through which it is conveyed through the artificial channels of said aqueduct system by each party respectively.

VIII.

WORDS AND PHRASES appearing herein shall have the following additional special meanings in so far as they apply:

(1) "Territory" shall include its duly appointed representatives, successors, assigns, licensees and lessees;.

(2) "Company" shall include its duly appointed representatives, successors and assigns;

(3) "Aqueduct" or "aqueduct system" shall include open ditches, tunnels, flumes, pipe lines, natural and artificial channels, reservoirs, diverting dams, gravel and sand traps, intake structures, together with regulating gates, spillway structures and water measuring devices, and shall also include roads, trails, bridges, etc., used in connection therewith;

(4) "Long term average water yield" shall be the arithmetical average annual water yield which would have been diverted from any given drainage area under consideration had the aqueduct system, at the time of the determination, been in existence during the entire period in which water records are available for such area, and shall be determined jointly by the Territory's and the Company's hydrographers based on all available applicable water measurements and long term rainfall records;

(5) "Average price per pound of raw sugar", shall mean the average of the daily full New York market price, Hawaiian basis, of ninety-six degree (96°) centrifugal raw sugar (at present officially reported from time to time by the Hawaiian Sugar Planters' Association) or its equivalent. In case there is more than one quotation of such market price during any day the arithmetical average of the quotations shall be the market price for such day. In case there is no quotation of such market price for any day then the market price for the last previous day shall be taken as the market price of any such day for which there is no quotation. The average market price for the license year, July 1st to June 30th inclusive, shall be determined by taking the arithmetical average of the daily market prices for each and every day, including Sundays and holidays, for said license year.

IX.

All matters of disagreement that may arise under this agreement which cannot be adjusted by the parties hereto to their mutual satisfaction, as well as any matter herein left to future mutual agreement at the option of either the Territory or Company, shall be submitted to and determined by three arbitrators in the manner prescribed in Chapter 116 of the Revised Laws of Hawaii 1935, as amended from time to time. In any such case either

party may give to the other written notice of the desire to so arbitrate the matter in difference and shall appoint one arbitrator in such notice, whereupon the other party shall, within ten (10) days after receipt of such notice, appoint a second arbitrator, and in case of failure so to do, the arbitrator first named shall appoint such second arbitrator, and the two arbitrators so appointed (in either manner) shall select and appoint a third arbitrator; in the event that the two arbitrators so appointed shall fail to select and appoint a third arbitrator within ten (10) days after the appointment of the second arbitrator, either party may request the appointment of such third arbitrator by the person then holding the position of First Judge of the Circuit Court of the First Judicial Circuit in the Territory of Hawaii at that time; the three arbitrators so appointed shall thereupon proceed to determine the matter in question, difference or disagreement to be determined, and the decision of any two of them, including the disposition of the costs of arbitration, shall be final, conclusive and binding upon both parties unless vacated, set aside or modified as provided by the statutes aforesaid. The arbitrators shall have the powers and duties prescribed by said statutes and judgment may be entered upon such award by said Circuit Court of the First Judicial Circuit.

X.

Nothing herein contained shall be construed to in any way affect any easement or right of way heretofore granted by the Territory to the Company.

IN WITNESS WHEREOF the parties hereto have duly executed

STANLEY HUMUKER PRATT & WINN
ATTORNEYS AT LAW
HONOLULU, HAWAII

this instrument, in duplicate, the day and year first above written.

TERRITORY OF HAWAII,

By _____
Commissioner of Public Lands.

EAST MAUI IRRIGATION COMPANY, LIMITED,

By _____
Its Vice-President

By _____
Its Treasurer.

APPROVED:

_____
Governor of the Territory of Hawaii.

APPROVED:

_____
Member of the Land Board, Territory of Hawaii.

APPROVED AS TO FORM:

_____
W. B. Kemp, Attorney General, Territory of Hawaii.

STANLEY, DITOUSSEL, PRATT & WISE
ATTORNEYS AT LAW
HONOLULU, HAWAII

LIBER 1435 PAGE 12

CORPORATION

TERRITORY OF HAWAII,
City and County of Honolulu } ss.

On this 18th *day of* March *A. D. 1938, before me appeared* J.Waterhouse and Jas.F.Morgan, *to me personally known, who, being by me duly sworn, did say that they are the* Vice-President and Treasurer, *respectively of* East Maui Irrigation Company, Limited, *and that the seal affixed to the foregoing instrument is the corporate seal of said corporation and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors, and the said* J.Waterhouse and Jas. F. Morgan, *acknowledged said instrument to be the free act and deed of said corporation.*

NOTARY PUBLIC

Notary Public, First Judicial Circuit, Territory of Hawaii.

-TERRITORY OF HAWAII-)
: Ss
-CITY AND COUNTY OF HONOLULU-)

On this 21st day of March, A.D. 1938, before me personally appeared L. M. WHITEHOUSE, Commissioner of Public Lands of the Territory of Hawaii, to me known to be the person who executed the foregoing instrument, under his official seal, and acknowledged that he executed the same as his free act and deed as such Commissioner of Public Lands, on behalf of the Territory of Hawaii.

NOTARY PUBLIC

Abbie C. Servat
Notary Public, First Judicial Circuit, Territory of Hawaii.

-TERRITORY OF HAWAII-)
: Ss
-CITY AND COUNTY OF HONOLULU-)

On this 21st day of March, A.D. 1938, before me personally appeared J. B. POINDEXTER, Governor of Hawaii, to me known to be the person who executed the same as his free act and deed as such Governor, on behalf of the Territory of Hawaii.

NOTARY PUBLIC

Abbie C. Servat
Notary Public, First Judicial Circuit, Territory of Hawaii.

Entered of Record this 22nd day of March A. D. 1938 at 9:26 o'clock A.M. and compared. Mark H. Huckestein, Registrar of Conveyances.

By _____ Clerk

CORRECTION AGREEMENT LIBER 1435 PAGE 269

This indenture made this 24th day of March, 1938, by and between THE TERRITORY OF HAWAII, acting by and through L. M. Whitehouse, Commissioner of Public Lands for the Territory of Hawaii, with the consent and approval of the Governor and of the Land Board of said Territory, hereinafter called the "Territory" and the EAST MAUI IRRIGATION COMPANY, LTD., an Hawaiian corporation, hereinafter called the "Company".

W I T N E S S E T H T H A T:

Whereas, through inadvertence, the word "Territory" appears on page 8 in the fourth line of paragraph VI sub-paragraph (2) of that certain agreement dated March 18, 1938 by and between the above mentioned parties which agreement is recorded in the office of the Bureau of Conveyances, Honolulu, City and County of Honolulu said Territory and in Book 1435, pages 1 to 12, and

Whereas the parties desire to correct such error by deleting the word "Territory" and substituting in lieu thereof the word "Company".

NOW, THEREFORE:

It is agreed by and between the parties hereto that the word "Territory" appearing on page 8 in the fourth line of paragraph VI, sub-paragraph (2) of that certain agreement dated March 18, 1938, recorded in the office of the Bureau of Conveyances said Honolulu in Book 1435, pages 1 to 12 be deleted and the word "Company" be inserted in lieu thereof.

IN WITNESS whereof the parties hereto have duly executed this instrument, in duplicate, the day and year first

above written.

TERRITORY OF HAWAII

By _____
Commissioner of Public Lands

EAST MAUI IRRIGATION COMPANY, LTD.

By _____
Its _____

By _____
Its _____

APPROVED:

_____
Governor of the Territory
of Hawaii.

_____
Member of the Land Board,
Territory of Hawaii.

APPROVED AS TO FORM:

_____
Attorney General of said Territory.

CORPORATION

TERRITORY OF HAWAII, }
City and County of Honolulu } ss.

LIBER 1435 PAGE 271

On this [illegible] *day of* [illegible] *A. D. 193*[illegible]*, before me appeared* [illegible] and [illegible] *to me personally known, who, being by me duly sworn, did say that they are the* [illegible] and [illegible] *respectively of* [illegible], LTD., a Hawaiian corporation *and that the seal affixed to the foregoing instrument is the corporate seal of said corporation and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors, and the said* [illegible] and [illegible] *acknowledged said instrument to be the free act and deed of said corporation.*

[signature]
Notary Public, First Judicial Circuit, Territory of Hawaii.

-TERRITORY OF HAWAII-)
: Ss
-CITY AND COUNTY OF HONOLULU-)

On this 11th day of April, A.D. 1938, before me personally appeared L. M. WHITEHOUSE, Commissioner of Public Lands of the Territory of Hawaii, to me known to be the person who executed the foregoing instrument under his official seal, and acknowledged that he executed the same as his free act and deed as such Commissioner of Public Lands, on behalf of the Territory of Hawaii.

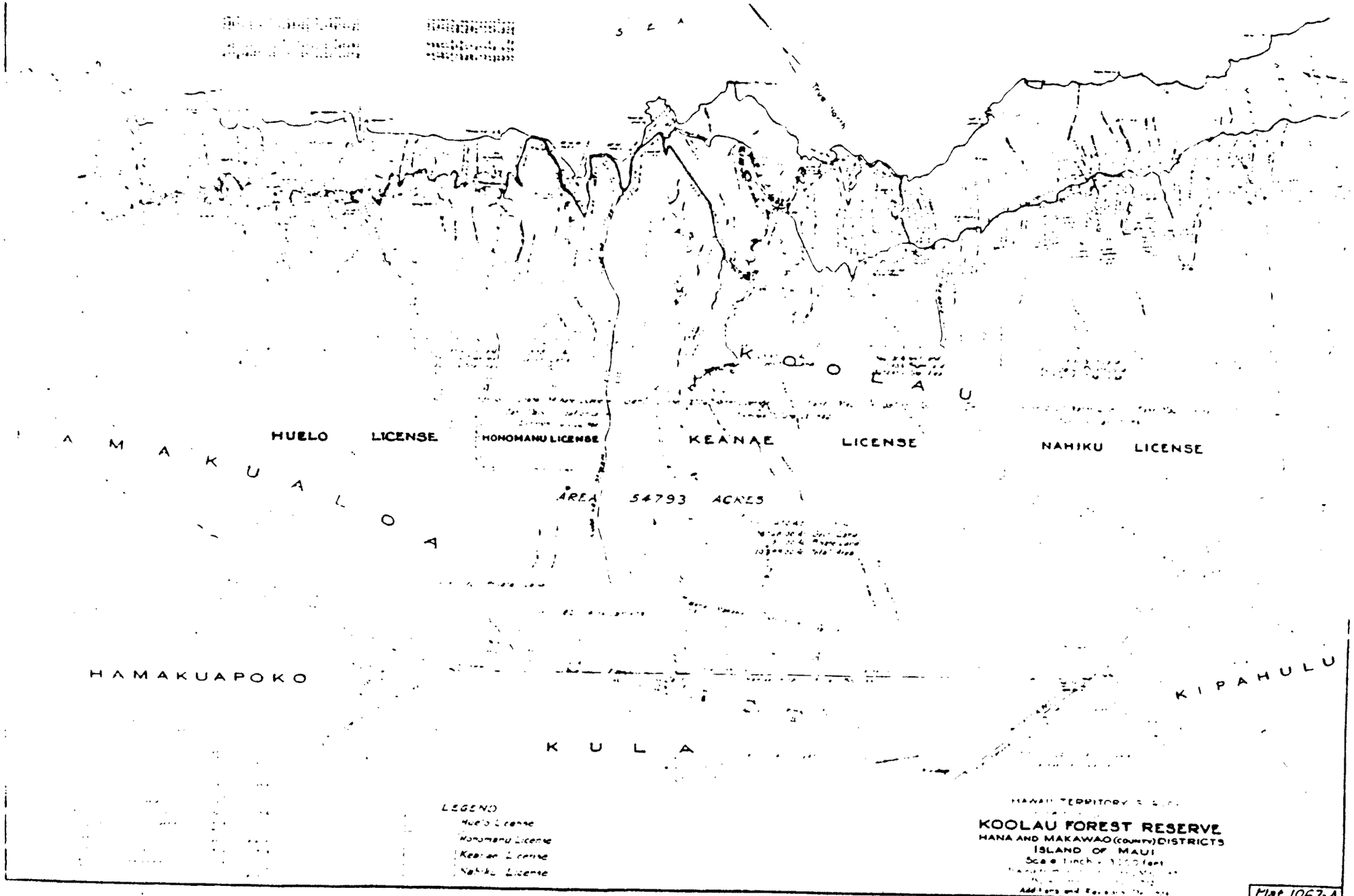
Abbie C. Sproat
Notary Public, First Judicial Circuit, Territory of Hawaii.

-TERRITORY OF HAWAII-)
: Ss
-CITY AND COUNTY OF HONOLULU-)

On this 11th day of April, A.D. 1938, before me personally appeared J. B. POINDEXTER, Governor of Hawaii, to me known to be the person who executed the foregoing instrument and acknowledged that he executed the same as his free act and deed as such Governor, on behalf of the Territory of Hawaii.

Abbie C. Sproat
Notary Public, First Judicial Circuit, Territory of Hawaii.

Entered of Record this 13th day of April A. D. 1938 at 9:04 o'clock A.M. and compared. Mark N. Huckestein, Registrar of Conveyances.
By ______ Clerk


S E A
K O O L A U
HUELO LICENSE
HONOMANU LICENSE
KEANAE LICENSE
NAHIKU LICENSE
AREA 54793 ACRES
HAMAKUAPOKO
KULA
KIPAHULU
LEGEND
Huelo License
Honomanu License
Keanae License
Nahiku License
HAWAII TERRITORY
KOOLAU FOREST RESERVE
HANA AND MAKAWAO (county) DISTRICTS
ISLAND OF MAUI
Map 1067-A

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
4/3/2011	1.80	0.54	1
4/2/2011	2.86	0.86	2
7/16/2008	11.15	3.35	3
5/23/2007	11.28	3.38	4
7/9/2008	11.68	3.50	5
7/15/2008	11.96	3.59	6
7/11/2008	12.05	3.62	7
12/17/2008	12.22	3.67	8
7/10/2008	12.50	3.75	9
7/8/2008	12.74	3.82	10
7/7/2008	13.34	4.00	11
7/14/2008	13.90	4.17	12
7/3/2008	14.44	4.33	13
7/4/2008	14.57	4.37	14
6/30/2008	14.63	4.39	15
7/6/2008	15.07	4.52	16
6/29/2008	15.11	4.53	17
6/18/2008	15.31	4.59	18
7/1/2008	15.33	4.60	19
8/9/2014	15.53	4.66	20
6/17/2008	15.70	4.71	21
6/28/2008	15.87	4.76	22
7/2/2008	16.18	4.85	23
6/9/2008	16.60	4.98	24
6/19/2008	16.78	5.03	25
6/16/2008	17.06	5.12	26
6/27/2008	17.11	5.13	27
6/8/2008	17.31	5.19	28
5/24/2007	17.43	5.23	29
6/14/2008	17.58	5.27	30
6/7/2008	17.69	5.31	31
6/26/2008	17.84	5.35	32
11/25/2008	17.87	5.36	33
12/19/2013	17.89	5.37	34
12/18/2013	18.08	5.42	35
12/17/2013	18.18	5.45	36
12/10/2009	18.35	5.51	37
12/9/2009	18.36	5.51	38
12/16/2013	18.40	5.52	39
12/8/2009	18.70	5.61	40
6/15/2008	18.71	5.61	41
12/15/2013	18.85	5.66	42

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
12/7/2009	18.87	5.66	43
6/6/2008	18.89	5.67	44
7/12/2008	19.19	5.76	45
12/13/2013	19.31	5.79	46
12/14/2013	19.31	5.79	47
12/10/2008	19.63	5.89	48
6/4/2008	19.75	5.93	49
12/11/2013	19.80	5.94	50
6/16/2009	19.91	5.97	51
12/10/2013	20.01	6.00	52
2/15/2012	20.02	6.01	53
10/28/2008	20.11	6.03	54
12/9/2008	20.15	6.05	55
6/25/2008	20.17	6.05	56
10/29/2008	20.18	6.05	57
2/16/2012	20.18	6.05	58
12/12/2013	20.31	6.09	59
12/9/2013	20.33	6.10	60
6/15/2009	20.38	6.11	61
6/13/2008	20.45	6.14	62
6/1/2008	20.50	6.15	63
7/30/2013	20.67	6.20	64
12/8/2013	20.67	6.20	65
9/25/2014	20.78	6.23	66
11/5/2012	20.83	6.25	67
10/30/2008	20.86	6.26	68
6/14/2009	20.87	6.26	69
6/17/2009	20.89	6.27	70
6/2/2008	20.96	6.29	71
6/3/2008	20.99	6.30	72
10/27/2008	21.02	6.31	73
11/15/2008	21.03	6.31	74
12/7/2013	21.03	6.31	75
10/14/2008	21.09	6.33	76
5/30/2008	21.21	6.36	77
5/31/2008	21.36	6.41	78
6/5/2008	21.36	6.41	79
11/4/2012	21.38	6.41	80
9/24/2014	21.39	6.42	81
7/13/2008	21.49	6.45	82
12/6/2013	21.50	6.45	83
6/13/2009	21.52	6.46	84

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
2/9/2012	21.63	6.49	85
9/23/2014	21.73	6.52	86
11/3/2012	21.76	6.53	87
12/7/2008	21.82	6.55	88
12/12/2012	21.87	6.56	89
7/5/2008	21.90	6.57	90
12/5/2013	21.93	6.58	91
11/6/2012	22.00	6.60	92
12/3/2013	22.00	6.60	93
9/9/2010	22.02	6.61	94
10/30/2013	22.02	6.61	95
12/8/2008	22.05	6.62	96
5/29/2008	22.07	6.62	97
11/14/2008	22.12	6.64	98
5/6/2013	22.13	6.64	99
5/1/2013	22.34	6.70	100
9/10/2010	22.38	6.71	101
12/4/2013	22.40	6.72	102
10/26/2008	22.48	6.74	103
2/11/2012	22.48	6.74	104
5/5/2013	22.49	6.75	105
10/29/2013	22.49	6.75	106
11/9/2013	22.51	6.75	107
6/12/2009	22.52	6.76	108
12/6/2008	22.54	6.76	109
2/14/2012	22.56	6.77	110
5/2/2013	22.57	6.77	111
12/22/2008	22.60	6.78	112
10/31/2013	22.66	6.80	113
9/22/2014	22.67	6.80	114
5/1/2011	22.70	6.81	115
2/8/2012	22.73	6.82	116
4/30/2013	22.77	6.83	117
12/11/2012	22.89	6.87	118
10/13/2008	22.92	6.88	119
5/28/2008	22.94	6.88	120
5/4/2013	22.94	6.88	121
10/9/2008	22.98	6.89	122
2/10/2012	23.02	6.91	123
10/28/2013	23.02	6.91	124
4/29/2013	23.06	6.92	125
11/1/2013	23.06	6.92	126

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
2/7/2012	23.07	6.92	127
5/9/2013	23.12	6.94	128
12/9/2012	23.13	6.94	129
5/2/2011	23.18	6.95	130
4/30/2011	23.33	7.00	131
5/3/2011	23.39	7.02	132
9/17/2013	23.40	7.02	133
6/11/2008	23.44	7.03	134
12/19/2008	23.45	7.04	135
9/19/2014	23.45	7.04	136
1/26/2014	23.46	7.04	137
9/16/2013	23.51	7.05	138
11/13/2008	23.52	7.06	139
6/11/2009	23.53	7.06	140
4/28/2013	23.55	7.07	141
3/7/2014	23.56	7.07	142
12/8/2012	23.59	7.08	143
5/3/2013	23.60	7.08	144
9/18/2014	23.62	7.09	145
12/13/2012	23.63	7.09	146
12/2/2013	23.64	7.09	147
10/27/2013	23.71	7.11	148
10/11/2014	23.71	7.11	149
12/4/2008	23.72	7.12	150
11/2/2012	23.75	7.13	151
5/8/2013	23.86	7.16	152
12/5/2008	23.87	7.16	153
7/29/2013	23.87	7.16	154
5/7/2013	23.95	7.19	155
1/27/2014	23.98	7.19	156
9/17/2014	23.98	7.19	157
9/13/2013	24.02	7.21	158
9/7/2013	24.05	7.22	159
5/27/2008	24.09	7.23	160
11/12/2008	24.15	7.25	161
10/8/2008	24.18	7.25	162
9/29/2008	24.24	7.27	163
12/21/2008	24.27	7.28	164
12/7/2012	24.28	7.28	165
11/9/2008	24.34	7.30	166
12/1/2013	24.35	7.31	167
10/12/2014	24.35	7.31	168

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
10/26/2013	24.36	7.31	169
4/27/2013	24.38	7.31	170
9/20/2014	24.46	7.34	171
4/27/2011	24.49	7.35	172
6/10/2009	24.52	7.36	173
12/23/2008	24.54	7.36	174
2/25/2015	24.54	7.36	175
4/28/2011	24.61	7.38	176
2/10/2011	24.62	7.39	177
10/9/2014	24.63	7.39	178
12/18/2008	24.65	7.40	179
10/29/2012	24.65	7.40	180
9/6/2013	24.66	7.40	181
2/20/2015	24.66	7.40	182
10/25/2008	24.67	7.40	183
10/24/2008	24.69	7.41	184
12/3/2008	24.70	7.41	185
7/28/2013	24.71	7.41	186
11/8/2013	24.74	7.42	187
2/5/2012	24.80	7.44	188
9/13/2006	24.84	7.45	189
1/25/2014	24.84	7.45	190
9/15/2014	24.84	7.45	191
10/28/2012	24.85	7.46	192
9/21/2014	24.85	7.46	193
10/25/2013	24.87	7.46	194
10/15/2006	24.90	7.47	195
3/6/2014	24.90	7.47	196
2/24/2014	24.93	7.48	197
9/18/2010	24.98	7.49	198
4/26/2013	25.00	7.50	199
9/16/2014	25.00	7.50	200
7/27/2013	25.11	7.53	201
2/9/2011	25.15	7.55	202
6/9/2009	25.16	7.55	203
10/13/2014	25.17	7.55	204
10/10/2014	25.20	7.56	205
1/22/2014	25.24	7.57	206
9/14/2006	25.31	7.59	207
2/26/2015	25.31	7.59	208
10/13/2011	25.33	7.60	209
12/6/2012	25.33	7.60	210

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
2/24/2015	25.33	7.60	211
6/24/2008	25.37	7.61	212
11/13/2012	25.38	7.61	213
4/1/2011	25.42	7.63	214
10/14/2006	25.43	7.63	215
2/19/2015	25.43	7.63	216
5/26/2008	25.47	7.64	217
4/26/2011	25.48	7.64	218
2/6/2012	25.48	7.64	219
10/23/2008	25.53	7.66	220
11/30/2013	25.53	7.66	221
6/6/2007	25.54	7.66	222
10/27/2011	25.54	7.66	223
11/16/2008	25.55	7.67	224
9/12/2013	25.55	7.67	225
10/8/2014	25.61	7.68	226
6/5/2009	25.62	7.69	227
12/10/2012	25.63	7.69	228
2/4/2012	25.64	7.69	229
10/27/2012	25.65	7.70	230
9/28/2008	25.66	7.70	231
10/23/2013	25.66	7.70	232
9/4/2013	25.69	7.71	233
9/21/2008	25.70	7.71	234
7/26/2013	25.72	7.72	235
3/2/2014	25.74	7.72	236
5/10/2013	25.76	7.73	237
2/23/2014	25.81	7.74	238
11/29/2013	25.89	7.77	239
9/12/2006	25.99	7.80	240
9/15/2013	25.99	7.80	241
2/8/2011	26.02	7.81	242
10/28/2011	26.02	7.81	243
4/25/2013	26.07	7.82	244
9/14/2014	26.08	7.82	245
6/3/2009	26.09	7.83	246
12/21/2013	26.12	7.84	247
12/5/2012	26.14	7.84	248
11/2/2013	26.18	7.85	249
1/21/2014	26.18	7.85	250
11/7/2008	26.19	7.86	251
5/22/2007	26.24	7.87	252

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
9/5/2013	26.24	7.87	253
12/2/2008	26.33	7.90	254
5/24/2008	26.35	7.91	255
6/5/2007	26.37	7.91	256
10/3/2014	26.37	7.91	257
9/11/2013	26.41	7.92	258
12/29/2012	26.42	7.93	259
10/21/2013	26.43	7.93	260
9/29/2010	26.44	7.93	261
10/13/2006	26.45	7.94	262
5/25/2008	26.45	7.94	263
4/25/2011	26.45	7.94	264
9/13/2014	26.45	7.94	265
11/8/2008	26.50	7.95	266
2/2/2012	26.50	7.95	267
10/26/2012	26.50	7.95	268
10/30/2012	26.50	7.95	269
6/21/2009	26.56	7.97	270
9/17/2010	26.57	7.97	271
2/18/2015	26.57	7.97	272
11/6/2008	26.58	7.97	273
8/10/2014	26.62	7.99	274
10/26/2011	26.74	8.02	275
10/7/2008	26.75	8.03	276
11/28/2013	26.81	8.04	277
2/22/2014	26.82	8.05	278
2/22/2011	26.90	8.07	279
2/27/2010	26.94	8.08	280
4/24/2013	26.98	8.09	281
6/4/2009	27.02	8.11	282
11/1/2012	27.02	8.11	283
6/12/2008	27.04	8.11	284
10/31/2012	27.05	8.12	285
9/10/2013	27.06	8.12	286
12/4/2012	27.07	8.12	287
9/20/2008	27.10	8.13	288
10/24/2013	27.14	8.14	289
1/20/2014	27.16	8.15	290
2/7/2011	27.19	8.16	291
9/22/2008	27.20	8.16	292
6/2/2009	27.21	8.16	293
7/25/2013	27.21	8.16	294

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
1/24/2015	27.28	8.18	295
10/12/2011	27.30	8.19	296
10/20/2013	27.31	8.19	297
10/8/2011	27.33	8.20	298
6/4/2007	27.36	8.21	299
1/28/2012	27.38	8.21	300
5/23/2008	27.44	8.23	301
6/20/2008	27.44	8.23	302
6/12/2007	27.51	8.25	303
9/28/2010	27.52	8.26	304
10/7/2011	27.61	8.28	305
9/12/2014	27.65	8.30	306
10/10/2008	27.66	8.30	307
10/12/2006	27.70	8.31	308
4/23/2011	27.88	8.36	309
9/3/2013	27.89	8.37	310
11/28/2008	27.90	8.37	311
9/11/2006	27.92	8.38	312
2/17/2015	27.96	8.39	313
4/29/2011	27.99	8.40	314
11/8/2012	27.99	8.40	315
6/11/2007	28.03	8.41	316
9/27/2008	28.04	8.41	317
10/22/2013	28.06	8.42	318
6/3/2007	28.09	8.43	319
11/12/2012	28.10	8.43	320
9/1/2013	28.14	8.44	321
9/2/2013	28.14	8.44	322
12/28/2012	28.21	8.46	323
10/3/2011	28.23	8.47	324
7/6/2009	28.24	8.47	325
6/17/2010	28.25	8.48	326
2/21/2014	28.25	8.48	327
8/4/2013	28.26	8.48	328
10/11/2011	28.28	8.48	329
9/30/2010	28.29	8.49	330
2/1/2012	28.29	8.49	331
12/16/2008	28.30	8.49	332
10/19/2013	28.30	8.49	333
4/23/2013	28.31	8.49	334
2/21/2011	28.34	8.50	335
1/27/2012	28.37	8.51	336

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
2/6/2011	28.38	8.51	337
1/19/2014	28.38	8.51	338
12/3/2012	28.45	8.54	339
2/26/2010	28.48	8.54	340
2/21/2015	28.49	8.55	341
10/25/2012	28.50	8.55	342
4/22/2011	28.60	8.58	343
10/22/2008	28.62	8.59	344
5/22/2008	28.64	8.59	345
11/27/2013	28.65	8.60	346
10/25/2011	28.67	8.60	347
3/5/2014	28.72	8.62	348
10/6/2011	28.79	8.64	349
7/24/2013	28.84	8.65	350
1/23/2015	28.87	8.66	351
6/1/2009	28.91	8.67	352
9/11/2014	28.92	8.68	353
8/31/2013	28.93	8.68	354
9/27/2014	28.96	8.69	355
6/13/2007	28.98	8.69	356
9/27/2010	28.98	8.69	357
8/25/2010	28.99	8.70	358
10/11/2006	29.05	8.72	359
11/5/2008	29.05	8.72	360
2/25/2014	29.06	8.72	361
4/24/2011	29.11	8.73	362
10/11/2008	29.12	8.74	363
12/1/2008	29.18	8.75	364
6/2/2007	29.21	8.76	365
10/12/2008	29.21	8.76	366
2/3/2011	29.24	8.77	367
3/1/2014	29.27	8.78	368
2/15/2011	29.32	8.80	369
7/22/2013	29.37	8.81	370
10/24/2012	29.40	8.82	371
10/18/2013	29.40	8.82	372
10/5/2011	29.41	8.82	373
2/25/2010	29.46	8.84	374
1/26/2012	29.47	8.84	375
10/3/2008	29.55	8.87	376
10/6/2008	29.56	8.87	377
2/7/2007	29.60	8.88	378

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
4/21/2011	29.66	8.90	379
1/18/2014	29.72	8.92	380
10/2/2011	29.73	8.92	381
2/15/2015	29.76	8.93	382
10/21/2008	29.83	8.95	383
5/21/2008	29.88	8.96	384
9/14/2010	29.91	8.97	385
4/22/2013	29.92	8.98	386
6/16/2010	29.93	8.98	387
10/2/2014	29.93	8.98	388
10/23/2012	29.95	8.99	389
11/26/2012	29.96	8.99	390
12/2/2012	29.96	8.99	391
9/17/2008	29.99	9.00	392
2/28/2015	29.99	9.00	393
7/31/2013	30.04	9.01	394
9/21/2013	30.05	9.02	395
1/22/2015	30.06	9.02	396
11/21/2006	30.07	9.02	397
11/23/2013	30.07	9.02	398
2/6/2007	30.17	9.05	399
2/4/2011	30.22	9.07	400
6/1/2007	30.24	9.07	401
7/23/2013	30.27	9.08	402
8/30/2013	30.27	9.08	403
2/20/2014	30.27	9.08	404
7/21/2013	30.29	9.09	405
2/24/2010	30.35	9.11	406
7/5/2009	30.36	9.11	407
7/7/2009	30.37	9.11	408
9/26/2014	30.39	9.12	409
10/24/2011	30.40	9.12	410
11/26/2013	30.41	9.12	411
5/31/2009	30.46	9.14	412
2/14/2015	30.53	9.16	413
10/10/2006	30.55	9.17	414
8/3/2013	30.62	9.19	415
2/10/2007	30.65	9.20	416
2/20/2011	30.66	9.20	417
9/19/2008	30.67	9.20	418
11/27/2008	30.72	9.22	419
9/16/2010	30.72	9.22	420

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
2/2/2011	30.75	9.23	421
10/10/2011	30.78	9.23	422
8/24/2010	30.85	9.26	423
11/20/2006	30.86	9.26	424
2/3/2012	30.90	9.27	425
9/12/2010	30.92	9.28	426
2/5/2011	30.92	9.28	427
4/20/2011	30.96	9.29	428
9/11/2010	30.98	9.29	429
9/15/2008	30.99	9.30	430
9/13/2010	31.00	9.30	431
9/5/2006	31.04	9.31	432
1/21/2015	31.11	9.33	433
9/6/2014	31.12	9.34	434
9/26/2010	31.13	9.34	435
1/25/2012	31.14	9.34	436
10/22/2012	31.15	9.35	437
5/20/2011	31.18	9.35	438
5/31/2007	31.23	9.37	439
9/5/2014	31.23	9.37	440
6/6/2009	31.25	9.38	441
5/11/2013	31.32	9.40	442
1/17/2014	31.32	9.40	443
9/16/2008	31.37	9.41	444
2/5/2007	31.38	9.41	445
8/29/2013	31.42	9.43	446
6/8/2009	31.47	9.44	447
4/18/2013	31.47	9.44	448
12/15/2008	31.50	9.45	449
2/23/2015	31.52	9.46	450
9/18/2008	31.58	9.47	451
10/5/2013	31.58	9.47	452
11/25/2012	31.64	9.49	453
10/14/2011	31.67	9.50	454
11/22/2013	31.69	9.51	455
11/19/2006	31.71	9.51	456
2/13/2015	31.72	9.52	457
2/16/2015	31.75	9.53	458
6/23/2007	31.76	9.53	459
1/24/2012	31.76	9.53	460
10/4/2013	31.77	9.53	461
10/17/2013	31.77	9.53	462

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
9/4/2006	31.82	9.55	463
7/4/2009	31.83	9.55	464
2/17/2012	31.85	9.56	465
6/20/2010	31.86	9.56	466
5/19/2011	31.86	9.56	467
5/20/2008	31.87	9.56	468
9/17/2006	31.88	9.56	469
6/10/2007	31.88	9.56	470
10/16/2013	31.89	9.57	471
6/9/2010	31.92	9.58	472
8/23/2010	31.92	9.58	473
7/18/2013	32.01	9.60	474
4/17/2013	32.03	9.61	475
1/24/2014	32.04	9.61	476
2/10/2010	32.07	9.62	477
1/20/2015	32.08	9.62	478
10/21/2012	32.15	9.65	479
12/20/2008	32.19	9.66	480
10/9/2006	32.22	9.67	481
4/19/2011	32.22	9.67	482
6/15/2010	32.24	9.67	483
12/1/2012	32.25	9.68	484
9/27/2011	32.26	9.68	485
7/17/2013	32.33	9.70	486
7/8/2009	32.37	9.71	487
6/12/2010	32.42	9.73	488
1/30/2011	32.48	9.74	489
8/11/2014	32.48	9.74	490
2/19/2014	32.49	9.75	491
11/11/2012	32.54	9.76	492
5/21/2011	32.56	9.77	493
2/23/2010	32.57	9.77	494
9/10/2006	32.59	9.78	495
10/23/2011	32.64	9.79	496
5/3/2008	32.66	9.80	497
5/30/2009	32.67	9.80	498
9/26/2011	32.73	9.82	499
2/14/2007	32.74	9.82	500
1/19/2015	32.78	9.83	501
6/10/2008	32.80	9.84	502
7/17/2008	32.82	9.85	503
2/4/2007	32.83	9.85	504

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
5/19/2008	32.84	9.85	505
9/10/2014	32.86	9.86	506
11/25/2006	32.87	9.86	507
11/11/2008	32.87	9.86	508
6/29/2010	32.87	9.86	509
11/17/2008	32.89	9.87	510
10/15/2013	32.89	9.87	511
9/14/2008	32.90	9.87	512
3/8/2014	32.93	9.88	513
1/23/2012	33.06	9.92	514
7/14/2007	33.10	9.93	515
11/18/2006	33.13	9.94	516
1/29/2011	33.13	9.94	517
8/2/2013	33.18	9.95	518
7/16/2013	33.20	9.96	519
6/20/2009	33.21	9.96	520
2/11/2010	33.26	9.98	521
10/3/2013	33.26	9.98	522
2/12/2015	33.29	9.99	523
2/12/2012	33.34	10.00	524
3/13/2008	33.35	10.01	525
5/2/2008	33.35	10.01	526
2/9/2010	33.37	10.01	527
8/28/2013	33.37	10.01	528
5/30/2007	33.39	10.02	529
6/8/2010	33.40	10.02	530
1/1/2006	33.42	10.03	531
11/21/2013	33.44	10.03	532
11/4/2008	33.47	10.04	533
2/18/2010	33.48	10.04	534
4/16/2013	33.49	10.05	535
2/12/2010	33.51	10.05	536
10/20/2012	33.55	10.07	537
9/4/2014	33.56	10.07	538
10/5/2008	33.60	10.08	539
9/7/2014	33.64	10.09	540
10/7/2014	33.66	10.10	541
5/1/2008	33.67	10.10	542
5/28/2009	33.71	10.11	543
9/6/2006	33.72	10.12	544
2/26/2014	33.74	10.12	545
8/21/2010	33.75	10.13	546

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
3/12/2008	33.78	10.13	547
2/1/2011	33.81	10.14	548
10/2/2008	33.82	10.15	549
1/6/2010	33.85	10.16	550
1/6/2011	33.85	10.16	551
6/22/2010	33.90	10.17	552
1/16/2014	33.91	10.17	553
9/25/2010	33.93	10.18	554
11/9/2012	33.95	10.19	555
1/22/2012	33.96	10.19	556
9/30/2011	33.99	10.20	557
1/18/2015	33.99	10.20	558
10/16/2008	34.00	10.20	559
9/14/2013	34.02	10.21	560
8/22/2010	34.06	10.22	561
4/18/2011	34.07	10.22	562
5/26/2009	34.08	10.22	563
12/31/2005	34.14	10.24	564
9/29/2011	34.20	10.26	565
8/5/2013	34.23	10.27	566
8/9/2013	34.23	10.27	567
9/3/2014	34.24	10.27	568
2/15/2014	34.25	10.28	569
7/15/2013	34.28	10.28	570
5/27/2009	34.30	10.29	571
9/2/2010	34.31	10.29	572
1/28/2011	34.31	10.29	573
9/13/2008	34.34	10.30	574
10/8/2006	34.37	10.31	575
2/14/2011	34.40	10.32	576
1/31/2012	34.40	10.32	577
9/26/2008	34.44	10.33	578
11/7/2013	34.44	10.33	579
2/9/2007	34.45	10.34	580
1/27/2011	34.51	10.35	581
9/3/2010	34.52	10.36	582
4/19/2013	34.54	10.36	583
6/21/2010	34.59	10.38	584
9/23/2006	34.61	10.38	585
2/14/2014	34.75	10.43	586
5/18/2008	34.80	10.44	587
11/24/2012	34.80	10.44	588

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
3/11/2008	34.84	10.45	589
11/17/2006	34.88	10.46	590
5/29/2007	34.88	10.46	591
2/8/2010	34.91	10.47	592
5/29/2009	34.93	10.48	593
7/16/2010	34.93	10.48	594
6/7/2010	34.95	10.49	595
6/22/2007	35.00	10.50	596
11/26/2008	35.02	10.51	597
10/14/2013	35.04	10.51	598
1/31/2007	35.06	10.52	599
4/15/2013	35.06	10.52	600
2/16/2011	35.09	10.53	601
11/3/2008	35.13	10.54	602
10/22/2011	35.13	10.54	603
6/24/2007	35.14	10.54	604
10/29/2006	35.24	10.57	605
6/28/2010	35.27	10.58	606
1/5/2010	35.31	10.59	607
1/5/2011	35.31	10.59	608
9/3/2006	35.34	10.60	609
12/14/2008	35.36	10.61	610
4/30/2008	35.37	10.61	611
6/7/2009	35.42	10.63	612
9/25/2011	35.46	10.64	613
5/25/2009	35.47	10.64	614
12/30/2005	35.49	10.65	615
2/11/2015	35.49	10.65	616
6/14/2010	35.52	10.66	617
7/13/2007	35.56	10.67	618
1/19/2010	35.57	10.67	619
1/19/2011	35.57	10.67	620
1/17/2015	35.57	10.67	621
7/3/2006	35.58	10.67	622
10/20/2008	35.60	10.68	623
3/18/2011	35.62	10.69	624
5/16/2011	35.62	10.69	625
7/15/2010	35.67	10.70	626
4/21/2013	35.68	10.70	627
2/27/2014	35.68	10.70	628
4/17/2011	35.71	10.71	629
7/28/2010	35.74	10.72	630

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
1/26/2010	35.75	10.73	631
1/26/2011	35.75	10.73	632
1/21/2012	35.80	10.74	633
10/19/2012	35.85	10.76	634
3/10/2008	35.91	10.77	635
9/20/2011	35.92	10.78	636
5/17/2011	35.99	10.80	637
9/12/2008	36.02	10.81	638
6/5/2010	36.08	10.82	639
10/18/2012	36.20	10.86	640
11/20/2013	36.20	10.86	641
7/20/2013	36.29	10.89	642
2/17/2014	36.30	10.89	643
5/27/2007	36.31	10.89	644
10/20/2011	36.33	10.90	645
2/13/2012	36.33	10.90	646
6/18/2007	36.37	10.91	647
1/20/2012	36.37	10.91	648
8/8/2013	36.40	10.92	649
2/15/2007	36.47	10.94	650
2/22/2010	36.50	10.95	651
7/2/2006	36.52	10.96	652
7/25/2010	36.53	10.96	653
8/20/2010	36.53	10.96	654
2/7/2010	36.54	10.96	655
2/17/2010	36.56	10.97	656
9/22/2013	36.58	10.97	657
12/29/2005	36.60	10.98	658
11/25/2013	36.62	10.99	659
2/13/2014	36.62	10.99	660
2/18/2014	36.63	10.99	661
2/10/2015	36.65	11.00	662
11/24/2008	36.67	11.00	663
1/4/2010	36.67	11.00	664
6/30/2010	36.67	11.00	665
1/4/2011	36.67	11.00	666
9/25/2013	36.67	11.00	667
2/1/2007	36.69	11.01	668
11/30/2012	36.88	11.06	669
1/30/2007	36.90	11.07	670
7/1/2010	36.95	11.09	671
10/1/2011	36.96	11.09	672

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
9/1/2010	36.98	11.09	673
10/2/2013	36.98	11.09	674
3/23/2013	37.05	11.12	675
1/16/2015	37.08	11.12	676
9/28/2013	37.10	11.13	677
6/4/2010	37.11	11.13	678
3/9/2008	37.13	11.14	679
9/18/2006	37.14	11.14	680
2/13/2007	37.14	11.14	681
9/2/2006	37.17	11.15	682
3/14/2008	37.17	11.15	683
5/24/2009	37.19	11.16	684
7/10/2013	37.19	11.16	685
2/19/2010	37.20	11.16	686
5/15/2011	37.21	11.16	687
4/29/2008	37.24	11.17	688
5/17/2008	37.29	11.19	689
4/14/2013	37.32	11.20	690
10/7/2006	37.33	11.20	691
7/2/2009	37.34	11.20	692
10/28/2006	37.35	11.21	693
9/24/2010	37.36	11.21	694
8/26/2010	37.37	11.21	695
5/25/2007	37.45	11.24	696
11/16/2006	37.46	11.24	697
1/25/2010	37.48	11.24	698
1/25/2011	37.48	11.24	699
9/2/2014	37.59	11.28	700
4/16/2011	37.63	11.29	701
2/3/2007	37.71	11.31	702
5/28/2007	37.73	11.32	703
9/19/2011	37.73	11.32	704
1/17/2010	37.74	11.32	705
1/17/2011	37.74	11.32	706
7/26/2010	37.78	11.33	707
10/9/2010	37.81	11.34	708
12/28/2005	37.86	11.36	709
1/19/2012	37.90	11.37	710
7/1/2006	37.94	11.38	711
10/13/2013	37.95	11.39	712
1/30/2012	38.00	11.40	713
10/1/2014	38.03	11.41	714

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
1/16/2010	38.06	11.42	715
1/16/2011	38.06	11.42	716
9/1/2014	38.09	11.43	717
7/8/2010	38.18	11.45	718
12/23/2013	38.19	11.46	719
1/3/2010	38.28	11.48	720
1/3/2011	38.28	11.48	721
11/29/2008	38.30	11.49	722
6/19/2010	38.30	11.49	723
12/22/2013	38.32	11.50	724
12/30/2010	38.33	11.50	725
9/20/2013	38.33	11.50	726
3/4/2011	38.38	11.51	727
1/29/2007	38.47	11.54	728
9/4/2010	38.47	11.54	729
4/28/2008	38.48	11.54	730
8/17/2010	38.54	11.56	731
7/14/2013	38.54	11.56	732
8/25/2013	38.56	11.57	733
5/7/2008	38.57	11.57	734
7/6/2006	38.59	11.58	735
2/9/2015	38.60	11.58	736
3/15/2011	38.61	11.58	737
10/4/2008	38.62	11.59	738
3/20/2015	38.62	11.59	739
10/17/2012	38.65	11.60	740
9/1/2006	38.69	11.61	741
1/15/2015	38.69	11.61	742
6/21/2008	38.70	11.61	743
5/18/2011	38.70	11.61	744
9/15/2010	38.75	11.63	745
2/6/2010	38.79	11.64	746
6/3/2010	38.80	11.64	747
9/19/2010	38.83	11.65	748
9/8/2006	38.88	11.66	749
3/8/2008	38.88	11.66	750
10/18/2010	38.92	11.68	751
7/9/2013	39.05	11.72	752
7/1/2009	39.06	11.72	753
2/12/2014	39.08	11.72	754
2/23/2011	39.09	11.73	755
1/30/2013	39.11	11.73	756

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
10/5/2006	39.12	11.74	757
1/13/2014	39.13	11.74	758
3/21/2013	39.19	11.76	759
12/27/2005	39.22	11.77	760
5/23/2009	39.23	11.77	761
8/27/2013	39.23	11.77	762
7/4/2006	39.30	11.79	763
3/31/2008	39.31	11.79	764
11/10/2008	39.35	11.81	765
9/23/2010	39.42	11.83	766
4/13/2013	39.46	11.84	767
1/26/2009	39.47	11.84	768
1/12/2014	39.52	11.86	769
2/8/2007	39.56	11.87	770
3/16/2011	39.63	11.89	771
9/23/2009	39.66	11.90	772
3/7/2008	39.67	11.90	773
1/18/2012	39.70	11.91	774
6/30/2006	39.72	11.92	775
1/24/2010	39.74	11.92	776
1/24/2011	39.74	11.92	777
8/31/2014	39.77	11.93	778
4/27/2008	39.80	11.94	779
3/30/2008	39.81	11.94	780
11/19/2013	39.81	11.94	781
10/27/2006	39.84	11.95	782
7/27/2010	39.84	11.95	783
4/15/2011	39.90	11.97	784
6/26/2010	39.92	11.98	785
6/6/2010	39.93	11.98	786
12/29/2010	40.04	12.01	787
1/18/2010	40.06	12.02	788
6/27/2010	40.06	12.02	789
1/18/2011	40.06	12.02	790
2/25/2011	40.06	12.02	791
10/21/2011	40.07	12.02	792
5/16/2008	40.10	12.03	793
10/8/2010	40.11	12.03	794
9/10/2008	40.14	12.04	795
1/28/2007	40.17	12.05	796
6/2/2010	40.25	12.08	797
10/19/2011	40.28	12.08	798

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
7/24/2010	40.31	12.09	799
7/14/2010	40.32	12.10	800
3/15/2008	40.33	12.10	801
5/12/2011	40.34	12.10	802
1/14/2015	40.34	12.10	803
5/26/2007	40.38	12.11	804
8/30/2006	40.39	12.12	805
1/28/2013	40.41	12.12	806
8/24/2013	40.42	12.13	807
7/31/2010	40.44	12.13	808
10/17/2014	40.49	12.15	809
1/15/2010	40.52	12.16	810
1/15/2011	40.52	12.16	811
8/15/2010	40.63	12.19	812
3/19/2015	40.63	12.19	813
3/22/2013	40.67	12.20	814
12/26/2005	40.69	12.21	815
7/7/2010	40.70	12.21	816
1/17/2012	40.80	12.24	817
6/11/2010	40.82	12.25	818
3/14/2011	40.82	12.25	819
8/19/2010	40.83	12.25	820
11/23/2012	40.93	12.28	821
7/9/2009	40.99	12.30	822
3/20/2013	40.99	12.30	823
5/14/2011	41.01	12.30	824
5/6/2008	41.02	12.31	825
1/2/2010	41.04	12.31	826
1/2/2011	41.04	12.31	827
10/15/2012	41.05	12.32	828
9/19/2006	41.09	12.33	829
9/7/2006	41.10	12.33	830
3/6/2008	41.11	12.33	831
7/21/2008	41.11	12.33	832
6/28/2009	41.12	12.34	833
1/22/2011	41.15	12.35	834
2/8/2015	41.17	12.35	835
1/15/2014	41.18	12.35	836
2/16/2010	41.21	12.36	837
1/1/2010	41.23	12.37	838
1/1/2011	41.23	12.37	839
2/19/2011	41.24	12.37	840

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
5/20/2010	41.31	12.39	841
1/16/2012	41.35	12.41	842
11/5/2013	41.40	12.42	843
7/12/2007	41.42	12.43	844
5/21/2007	41.44	12.43	845
5/20/2009	41.47	12.44	846
7/3/2009	41.49	12.45	847
10/13/2012	41.50	12.45	848
3/16/2008	41.53	12.46	849
7/13/2010	41.54	12.46	850
8/12/2014	41.54	12.46	851
2/5/2010	41.56	12.47	852
11/2/2008	41.60	12.48	853
10/4/2011	41.63	12.49	854
2/1/2015	41.63	12.49	855
9/18/2011	41.64	12.49	856
1/31/2011	41.66	12.50	857
8/29/2006	41.67	12.50	858
6/29/2006	41.72	12.52	859
9/9/2013	41.84	12.55	860
9/20/2006	41.87	12.56	861
1/27/2007	41.87	12.56	862
6/23/2014	41.91	12.57	863
4/14/2011	41.96	12.59	864
11/2/2009	42.01	12.60	865
8/30/2014	42.01	12.60	866
1/31/2013	42.02	12.61	867
9/22/2009	42.03	12.61	868
4/26/2008	42.04	12.61	869
4/12/2013	42.06	12.62	870
9/8/2010	42.08	12.62	871
12/25/2005	42.11	12.63	872
6/25/2007	42.14	12.64	873
5/29/2011	42.19	12.66	874
8/1/2013	42.20	12.66	875
7/27/2008	42.22	12.67	876
6/30/2009	42.22	12.67	877
2/1/2009	42.26	12.68	878
3/3/2014	42.27	12.68	879
8/31/2010	42.31	12.69	880
1/29/2013	42.35	12.71	881
5/18/2010	42.36	12.71	882

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
12/28/2010	42.36	12.71	883
1/13/2015	42.36	12.71	884
1/27/2013	42.37	12.71	885
12/31/2009	42.48	12.74	886
9/11/2008	42.50	12.75	887
7/8/2013	42.50	12.75	888
11/14/2006	42.52	12.76	889
10/4/2006	42.58	12.77	890
1/9/2011	42.62	12.79	891
7/26/2006	42.66	12.80	892
11/23/2008	42.73	12.82	893
8/16/2010	42.78	12.83	894
6/23/2008	42.87	12.86	895
2/11/2014	42.96	12.89	896
9/17/2011	42.97	12.89	897
2/11/2011	42.98	12.89	898
1/26/2007	42.99	12.90	899
10/14/2012	43.00	12.90	900
1/21/2011	43.01	12.90	901
1/25/2009	43.05	12.92	902
3/5/2008	43.19	12.96	903
12/27/2006	43.21	12.96	904
11/19/2014	43.21	12.96	905
10/12/2013	43.24	12.97	906
10/14/2010	43.34	13.00	907
10/17/2008	43.40	13.02	908
3/13/2011	43.40	13.02	909
8/23/2013	43.42	13.03	910
5/20/2007	43.43	13.03	911
3/26/2008	43.46	13.04	912
11/3/2009	43.47	13.04	913
1/15/2012	43.47	13.04	914
10/19/2008	43.53	13.06	915
1/29/2012	43.53	13.06	916
6/1/2010	43.62	13.09	917
1/4/2006	43.64	13.09	918
2/18/2011	43.64	13.09	919
9/16/2009	43.70	13.11	920
3/18/2015	43.71	13.11	921
8/17/2006	43.76	13.13	922
7/8/2007	43.78	13.13	923
12/13/2008	43.82	13.15	924

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
12/24/2005	43.84	13.15	925
1/23/2010	43.86	13.16	926
1/23/2011	43.86	13.16	927
5/15/2008	43.92	13.18	928
10/26/2006	43.93	13.18	929
4/13/2011	43.96	13.19	930
9/24/2011	43.96	13.19	931
10/12/2012	44.00	13.20	932
9/9/2008	44.04	13.21	933
5/19/2010	44.06	13.22	934
6/9/2007	44.09	13.23	935
10/4/2014	44.09	13.23	936
10/31/2009	44.11	13.23	937
2/24/2011	44.11	13.23	938
6/28/2006	44.14	13.24	939
3/27/2008	44.16	13.25	940
10/17/2010	44.20	13.26	941
3/19/2013	44.22	13.27	942
2/22/2015	44.23	13.27	943
11/15/2006	44.26	13.28	944
5/4/2008	44.30	13.29	945
7/27/2006	44.33	13.30	946
5/17/2009	44.40	13.32	947
11/16/2014	44.41	13.32	948
1/31/2015	44.46	13.34	949
9/28/2011	44.47	13.34	950
12/30/2009	44.53	13.36	951
3/4/2008	44.59	13.38	952
11/18/2013	44.60	13.38	953
1/14/2010	44.63	13.39	954
1/14/2011	44.63	13.39	955
4/25/2008	44.64	13.39	956
8/26/2013	44.70	13.41	957
6/17/2007	44.73	13.42	958
1/25/2007	44.75	13.43	959
7/10/2007	44.75	13.43	960
1/12/2015	44.83	13.45	961
7/25/2006	44.91	13.47	962
4/14/2007	44.92	13.48	963
9/21/2011	44.96	13.49	964
2/7/2015	44.97	13.49	965
1/12/2011	44.99	13.50	966

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
5/11/2011	45.02	13.51	967
8/26/2006	45.05	13.52	968
1/31/2009	45.17	13.55	969
11/20/2012	45.18	13.55	970
2/28/2011	45.27	13.58	971
1/3/2006	45.32	13.60	972
4/9/2013	45.34	13.60	973
1/26/2013	45.37	13.61	974
10/30/2009	45.52	13.66	975
8/29/2014	45.57	13.67	976
11/29/2006	45.66	13.70	977
7/19/2007	45.67	13.70	978
11/13/2006	45.68	13.70	979
11/4/2013	45.74	13.72	980
9/21/2009	45.79	13.74	981
12/24/2006	45.81	13.74	982
7/6/2010	45.81	13.74	983
6/22/2014	45.83	13.75	984
9/22/2006	45.84	13.75	985
1/14/2012	45.88	13.76	986
8/16/2006	45.91	13.77	987
3/17/2011	45.91	13.77	988
7/13/2013	45.92	13.78	989
5/14/2010	45.94	13.78	990
7/11/2007	45.95	13.79	991
8/14/2010	46.04	13.81	992
1/10/2010	46.05	13.82	993
1/10/2011	46.05	13.82	994
5/13/2011	46.14	13.84	995
8/13/2010	46.15	13.85	996
11/9/2009	46.16	13.85	997
10/9/2011	46.24	13.87	998
11/22/2012	46.25	13.88	999
2/2/2010	46.27	13.88	1,000
7/11/2013	46.27	13.88	1,001
12/30/2012	46.30	13.89	1,002
3/3/2015	46.36	13.91	1,003
12/27/2010	46.38	13.91	1,004
3/3/2008	46.43	13.93	1,005
5/15/2010	46.43	13.93	1,006
10/3/2006	46.49	13.95	1,007
10/10/2012	46.50	13.95	1,008

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
10/1/2013	46.52	13.96	1,009
5/30/2011	46.54	13.96	1,010
9/8/2014	46.60	13.98	1,011
2/2/2007	46.62	13.99	1,012
11/30/2008	46.64	13.99	1,013
5/17/2010	46.71	14.01	1,014
12/29/2009	46.72	14.02	1,015
6/20/2007	46.73	14.02	1,016
3/3/2011	46.76	14.03	1,017
5/19/2007	46.77	14.03	1,018
2/5/2013	46.78	14.03	1,019
8/5/2008	46.85	14.06	1,020
9/15/2009	46.86	14.06	1,021
10/6/2014	46.88	14.06	1,022
9/6/2008	46.92	14.08	1,023
5/16/2009	46.95	14.09	1,024
4/12/2011	46.96	14.09	1,025
1/20/2011	46.97	14.09	1,026
12/23/2005	46.98	14.09	1,027
3/29/2008	46.98	14.09	1,028
1/24/2007	47.03	14.11	1,029
5/19/2009	47.03	14.11	1,030
9/25/2008	47.04	14.11	1,031
2/4/2013	47.04	14.11	1,032
1/24/2009	47.05	14.12	1,033
11/12/2006	47.06	14.12	1,034
5/22/2009	47.06	14.12	1,035
7/21/2010	47.11	14.13	1,036
2/4/2010	47.16	14.15	1,037
11/10/2012	47.16	14.15	1,038
9/14/2011	47.19	14.16	1,039
3/16/2013	47.24	14.17	1,040
8/22/2013	47.30	14.19	1,041
11/1/2009	47.36	14.21	1,042
4/15/2007	47.41	14.22	1,043
1/11/2015	47.49	14.25	1,044
10/11/2012	47.50	14.25	1,045
8/31/2006	47.51	14.25	1,046
11/24/2006	47.63	14.29	1,047
4/11/2013	47.63	14.29	1,048
6/18/2009	47.65	14.30	1,049
6/19/2007	47.70	14.31	1,050

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
1/21/2009	47.70	14.31	1,051
3/17/2015	47.79	14.34	1,052
5/31/2010	47.85	14.36	1,053
10/15/2010	47.93	14.38	1,054
10/18/2008	48.00	14.40	1,055
10/16/2012	48.00	14.40	1,056
4/24/2008	48.01	14.40	1,057
6/15/2007	48.08	14.42	1,058
1/1/2007	48.15	14.45	1,059
3/26/2015	48.15	14.45	1,060
10/29/2009	48.19	14.46	1,061
1/25/2013	48.22	14.47	1,062
12/23/2006	48.24	14.47	1,063
1/1/2013	48.29	14.49	1,064
3/2/2008	48.31	14.49	1,065
9/24/2013	48.33	14.50	1,066
3/28/2008	48.36	14.51	1,067
8/20/2014	48.43	14.53	1,068
12/20/2013	48.46	14.54	1,069
5/17/2007	48.47	14.54	1,070
3/25/2008	48.48	14.54	1,071
7/30/2010	48.50	14.55	1,072
1/8/2011	48.50	14.55	1,073
9/5/2008	48.62	14.59	1,074
1/11/2014	48.64	14.59	1,075
8/29/2007	48.68	14.60	1,076
3/12/2011	48.68	14.60	1,077
1/7/2010	48.72	14.62	1,078
8/12/2010	48.72	14.62	1,079
1/7/2011	48.72	14.62	1,080
7/7/2007	48.73	14.62	1,081
7/4/2011	48.77	14.63	1,082
1/13/2012	48.78	14.63	1,083
11/15/2014	48.87	14.66	1,084
9/12/2011	48.89	14.67	1,085
6/12/2006	48.91	14.67	1,086
12/22/2005	48.96	14.69	1,087
10/5/2014	48.98	14.69	1,088
10/9/2012	49.00	14.70	1,089
8/30/2009	49.10	14.73	1,090
1/27/2010	49.13	14.74	1,091
7/22/2010	49.16	14.75	1,092

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
6/18/2012	49.18	14.75	1,093
1/22/2009	49.19	14.76	1,094
1/2/2013	49.23	14.77	1,095
4/13/2007	49.28	14.78	1,096
9/15/2011	49.30	14.79	1,097
11/29/2012	49.39	14.82	1,098
12/28/2009	49.40	14.82	1,099
8/9/2007	49.47	14.84	1,100
5/21/2009	49.52	14.86	1,101
8/28/2010	49.55	14.87	1,102
1/10/2015	49.55	14.87	1,103
8/18/2014	49.57	14.87	1,104
12/21/2005	49.58	14.87	1,105
6/13/2006	49.68	14.90	1,106
1/24/2013	49.71	14.91	1,107
8/7/2014	49.71	14.91	1,108
5/13/2010	49.83	14.95	1,109
3/15/2013	49.83	14.95	1,110
7/24/2006	49.89	14.97	1,111
10/1/2008	49.89	14.97	1,112
11/4/2009	49.94	14.98	1,113
4/8/2013	49.97	14.99	1,114
9/4/2008	49.98	14.99	1,115
6/10/2010	49.99	15.00	1,116
10/7/2010	50.10	15.03	1,117
7/7/2013	50.10	15.03	1,118
1/23/2007	50.12	15.04	1,119
5/14/2009	50.13	15.04	1,120
7/2/2013	50.17	15.05	1,121
2/1/2010	50.19	15.06	1,122
8/15/2006	50.31	15.09	1,123
5/16/2010	50.32	15.10	1,124
3/1/2008	50.33	15.10	1,125
12/11/2009	50.37	15.11	1,126
1/30/2015	50.37	15.11	1,127
6/21/2013	50.41	15.12	1,128
9/11/2011	50.48	15.14	1,129
2/10/2014	50.48	15.14	1,130
6/21/2014	50.50	15.15	1,131
7/9/2007	50.57	15.17	1,132
5/12/2010	50.59	15.18	1,133
1/20/2009	50.62	15.19	1,134

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
6/11/2006	50.68	15.20	1,135
9/5/2009	50.68	15.20	1,136
5/18/2009	50.72	15.22	1,137
10/18/2011	50.72	15.22	1,138
10/6/2013	50.80	15.24	1,139
12/31/2012	50.82	15.25	1,140
10/16/2010	50.83	15.25	1,141
8/17/2014	50.83	15.25	1,142
4/20/2013	50.92	15.28	1,143
11/10/2009	50.96	15.29	1,144
10/28/2009	50.97	15.29	1,145
11/13/2014	51.02	15.31	1,146
2/12/2007	51.03	15.31	1,147
5/16/2007	51.04	15.31	1,148
2/6/2015	51.12	15.34	1,149
1/23/2009	51.13	15.34	1,150
4/5/2008	51.14	15.34	1,151
12/20/2010	51.19	15.36	1,152
5/14/2008	51.20	15.36	1,153
12/19/2010	51.21	15.36	1,154
12/27/2009	51.24	15.37	1,155
7/5/2011	51.27	15.38	1,156
8/21/2014	51.29	15.39	1,157
1/30/2009	51.36	15.41	1,158
11/3/2013	51.36	15.41	1,159
4/11/2011	51.37	15.41	1,160
3/18/2013	51.37	15.41	1,161
8/24/2006	51.38	15.41	1,162
9/4/2009	51.39	15.42	1,163
4/6/2008	51.49	15.45	1,164
10/30/2006	51.50	15.45	1,165
5/13/2009	51.60	15.48	1,166
1/2/2006	51.63	15.49	1,167
3/25/2015	51.65	15.50	1,168
7/17/2010	51.70	15.51	1,169
12/15/2012	51.70	15.51	1,170
12/22/2006	51.77	15.53	1,171
1/27/2009	51.77	15.53	1,172
4/6/2011	51.81	15.54	1,173
1/15/2009	51.84	15.55	1,174
6/26/2006	51.86	15.56	1,175
7/26/2008	51.94	15.58	1,176

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
1/10/2014	51.95	15.59	1,177
10/8/2012	52.00	15.60	1,178
12/20/2005	52.01	15.60	1,179
6/21/2007	52.04	15.61	1,180
5/29/2010	52.08	15.62	1,181
9/20/2009	52.13	15.64	1,182
11/11/2006	52.14	15.64	1,183
11/22/2008	52.14	15.64	1,184
1/23/2013	52.19	15.66	1,185
5/15/2009	52.22	15.67	1,186
7/19/2013	52.22	15.67	1,187
8/28/2007	52.31	15.69	1,188
8/18/2012	52.37	15.71	1,189
1/16/2009	52.38	15.71	1,190
1/9/2015	52.42	15.73	1,191
8/6/2014	52.43	15.73	1,192
6/16/2007	52.51	15.75	1,193
9/22/2010	52.52	15.76	1,194
8/28/2006	52.60	15.78	1,195
2/29/2008	52.61	15.78	1,196
3/11/2011	52.63	15.79	1,197
10/16/2014	52.63	15.79	1,198
8/4/2006	52.64	15.79	1,199
11/17/2007	52.71	15.81	1,200
10/1/2010	52.84	15.85	1,201
8/25/2006	52.95	15.89	1,202
9/9/2006	52.97	15.89	1,203
10/25/2006	52.97	15.89	1,204
6/10/2006	52.98	15.89	1,205
12/18/2010	52.98	15.89	1,206
7/6/2013	53.09	15.93	1,207
11/17/2013	53.09	15.93	1,208
9/10/2011	53.10	15.93	1,209
6/20/2014	53.24	15.97	1,210
4/18/2008	53.28	15.98	1,211
4/18/2012	53.28	15.98	1,212
8/23/2006	53.29	15.99	1,213
8/16/2014	53.35	16.01	1,214
8/29/2009	53.36	16.01	1,215
9/16/2011	53.37	16.01	1,216
7/18/2007	53.46	16.04	1,217
5/25/2013	53.46	16.04	1,218

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
7/1/2007	53.47	16.04	1,219
6/24/2006	53.49	16.05	1,220
8/8/2007	53.50	16.05	1,221
7/12/2010	53.55	16.07	1,222
5/15/2007	53.57	16.07	1,223
10/30/2011	53.57	16.07	1,224
6/27/2006	53.58	16.07	1,225
6/15/2012	53.62	16.09	1,226
9/8/2008	53.65	16.10	1,227
1/22/2010	53.66	16.10	1,228
7/27/2009	53.70	16.11	1,229
3/14/2013	53.73	16.12	1,230
5/22/2012	53.81	16.14	1,231
1/12/2012	53.85	16.16	1,232
8/19/2014	53.85	16.16	1,233
7/23/2010	53.86	16.16	1,234
6/20/2013	53.91	16.17	1,235
9/3/2008	53.92	16.18	1,236
9/14/2009	53.92	16.18	1,237
9/13/2011	53.93	16.18	1,238
12/25/2010	53.95	16.19	1,239
5/30/2010	53.96	16.19	1,240
1/23/2014	54.01	16.20	1,241
11/8/2009	54.02	16.21	1,242
12/17/2009	54.13	16.24	1,243
12/26/2009	54.15	16.25	1,244
10/13/2010	54.15	16.25	1,245
12/31/2006	54.20	16.26	1,246
10/27/2009	54.24	16.27	1,247
4/22/2012	54.28	16.28	1,248
3/16/2015	54.29	16.29	1,249
4/10/2007	54.36	16.31	1,250
12/19/2005	54.42	16.33	1,251
6/14/2007	54.46	16.34	1,252
1/20/2010	54.52	16.36	1,253
9/11/2009	54.59	16.38	1,254
11/16/2007	54.65	16.40	1,255
6/6/2013	54.67	16.40	1,256
8/10/2010	54.69	16.41	1,257
7/3/2011	54.73	16.42	1,258
10/24/2010	54.77	16.43	1,259
11/14/2014	54.77	16.43	1,260

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
4/19/2008	54.80	16.44	1,261
8/28/2009	54.82	16.45	1,262
5/24/2013	54.82	16.45	1,263
1/13/2010	54.87	16.46	1,264
1/13/2011	54.87	16.46	1,265
9/9/2014	54.88	16.46	1,266
5/12/2009	54.98	16.49	1,267
12/26/2006	55.04	16.51	1,268
8/5/2014	55.14	16.54	1,269
1/22/2007	55.17	16.55	1,270
4/23/2008	55.19	16.56	1,271
5/10/2011	55.22	16.57	1,272
3/16/2007	55.23	16.57	1,273
9/24/2009	55.25	16.58	1,274
6/22/2008	55.27	16.58	1,275
1/14/2009	55.30	16.59	1,276
10/7/2012	55.30	16.59	1,277
3/17/2013	55.35	16.61	1,278
6/9/2006	55.36	16.61	1,279
7/5/2006	55.41	16.62	1,280
10/2/2006	55.42	16.63	1,281
7/1/2011	55.42	16.63	1,282
4/11/2007	55.45	16.64	1,283
4/17/2012	55.48	16.64	1,284
2/28/2008	55.49	16.65	1,285
11/23/2010	55.52	16.66	1,286
2/27/2012	55.55	16.67	1,287
2/21/2010	55.57	16.67	1,288
3/5/2011	55.64	16.69	1,289
12/21/2006	55.67	16.70	1,290
1/19/2009	55.67	16.70	1,291
1/14/2014	55.72	16.72	1,292
3/9/2014	55.72	16.72	1,293
11/23/2006	55.75	16.73	1,294
7/28/2011	55.75	16.73	1,295
8/3/2006	55.78	16.73	1,296
7/5/2010	55.78	16.73	1,297
9/2/2009	55.82	16.75	1,298
8/18/2010	55.85	16.76	1,299
9/15/2006	55.89	16.77	1,300
4/4/2015	55.90	16.77	1,301
6/25/2014	55.91	16.77	1,302

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
8/25/2014	55.92	16.78	1,303
9/19/2009	55.94	16.78	1,304
7/23/2006	55.95	16.79	1,305
8/14/2006	55.95	16.79	1,306
10/8/2013	55.97	16.79	1,307
9/12/2007	56.02	16.81	1,308
1/22/2013	56.02	16.81	1,309
10/22/2014	56.06	16.82	1,310
7/9/2010	56.13	16.84	1,311
11/12/2014	56.15	16.85	1,312
1/10/2012	56.19	16.86	1,313
11/7/2006	56.25	16.88	1,314
12/24/2010	56.25	16.88	1,315
9/21/2010	56.30	16.89	1,316
5/28/2010	56.43	16.93	1,317
1/21/2007	56.48	16.94	1,318
5/11/2010	56.48	16.94	1,319
1/8/2015	56.48	16.94	1,320
8/26/2014	56.49	16.95	1,321
5/13/2008	56.50	16.95	1,322
8/30/2010	56.55	16.97	1,323
6/29/2013	56.60	16.98	1,324
12/17/2010	56.61	16.98	1,325
1/31/2010	56.69	17.01	1,326
8/12/2006	56.70	17.01	1,327
2/11/2009	56.73	17.02	1,328
6/8/2011	56.74	17.02	1,329
6/16/2012	56.77	17.03	1,330
12/26/2013	56.78	17.03	1,331
9/9/2011	56.81	17.04	1,332
7/26/2009	56.82	17.05	1,333
12/18/2005	56.85	17.06	1,334
8/31/2005	56.87	17.06	1,335
3/2/2011	56.90	17.07	1,336
8/7/2007	56.93	17.08	1,337
10/26/2009	56.95	17.09	1,338
11/28/2006	57.05	17.12	1,339
12/16/2009	57.12	17.14	1,340
4/19/2012	57.12	17.14	1,341
1/8/2014	57.16	17.15	1,342
9/24/2006	57.19	17.16	1,343
3/15/2007	57.24	17.17	1,344

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
9/3/2009	57.24	17.17	1,345
12/6/2005	57.29	17.19	1,346
4/22/2008	57.29	17.19	1,347
6/14/2012	57.30	17.19	1,348
3/4/2014	57.30	17.19	1,349
6/5/2013	57.43	17.23	1,350
6/10/2011	57.48	17.24	1,351
5/27/2010	57.49	17.25	1,352
9/12/2009	57.55	17.27	1,353
10/6/2006	57.57	17.27	1,354
4/9/2007	57.57	17.27	1,355
4/12/2007	57.57	17.27	1,356
6/27/2009	57.63	17.29	1,357
3/13/2013	57.68	17.30	1,358
2/27/2011	57.69	17.31	1,359
6/30/2011	57.74	17.32	1,360
4/10/2011	57.78	17.33	1,361
7/20/2010	57.79	17.34	1,362
9/29/2013	57.82	17.35	1,363
9/11/2007	57.83	17.35	1,364
10/26/2014	57.86	17.36	1,365
2/27/2008	57.88	17.36	1,366
12/3/2005	57.92	17.38	1,367
6/13/2013	57.96	17.39	1,368
9/16/2006	57.97	17.39	1,369
12/20/2006	57.98	17.39	1,370
9/7/2008	58.04	17.41	1,371
12/25/2009	58.08	17.42	1,372
11/6/2013	58.08	17.42	1,373
6/25/2006	58.17	17.45	1,374
1/3/2015	58.17	17.45	1,375
11/22/2010	58.22	17.47	1,376
4/17/2008	58.24	17.47	1,377
6/8/2006	58.26	17.48	1,378
3/13/2007	58.27	17.48	1,379
8/2/2007	58.28	17.48	1,380
6/5/2014	58.28	17.48	1,381
6/14/2015	58.30	17.49	1,382
5/11/2009	58.42	17.53	1,383
8/11/2010	58.44	17.53	1,384
10/6/2012	58.45	17.54	1,385
6/29/2009	58.49	17.55	1,386

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
6/17/2012	58.50	17.55	1,387
2/18/2009	58.53	17.56	1,388
7/27/2011	58.67	17.60	1,389
9/17/2009	58.68	17.60	1,390
6/25/2010	58.70	17.61	1,391
1/9/2012	58.72	17.62	1,392
12/21/2010	58.82	17.65	1,393
8/4/2008	58.89	17.67	1,394
4/5/2011	58.93	17.68	1,395
11/1/2008	59.04	17.71	1,396
7/20/2008	59.10	17.73	1,397
10/11/2013	59.15	17.75	1,398
8/20/2008	59.25	17.78	1,399
8/11/2006	59.26	17.78	1,400
6/7/2007	59.27	17.78	1,401
6/15/2011	59.28	17.78	1,402
10/23/2006	59.30	17.79	1,403
3/28/2013	59.47	17.84	1,404
6/19/2013	59.50	17.85	1,405
3/24/2008	59.51	17.85	1,406
8/15/2012	59.54	17.86	1,407
6/20/2006	59.59	17.88	1,408
7/2/2011	59.60	17.88	1,409
8/1/2010	59.62	17.89	1,410
1/25/2015	59.62	17.89	1,411
8/14/2014	59.67	17.90	1,412
8/27/2009	59.71	17.91	1,413
7/21/2009	59.75	17.93	1,414
11/24/2014	59.75	17.93	1,415
8/7/2013	59.81	17.94	1,416
3/21/2008	59.83	17.95	1,417
12/27/2013	59.83	17.95	1,418
5/5/2010	59.85	17.96	1,419
8/2/2006	59.86	17.96	1,420
1/13/2009	59.95	17.99	1,421
9/26/2013	60.00	18.00	1,422
5/14/2007	60.05	18.02	1,423
4/5/2012	60.09	18.03	1,424
5/4/2010	60.20	18.06	1,425
12/15/2009	60.23	18.07	1,426
1/9/2014	60.25	18.08	1,427
7/29/2007	60.30	18.09	1,428

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
8/10/2013	60.31	18.09	1,429
3/12/2013	60.35	18.11	1,430
7/10/2009	60.37	18.11	1,431
11/21/2008	60.40	18.12	1,432
3/9/2007	60.41	18.12	1,433
4/8/2007	60.48	18.14	1,434
11/13/2007	60.48	18.14	1,435
6/14/2011	60.50	18.15	1,436
1/20/2007	60.51	18.15	1,437
7/17/2009	60.56	18.17	1,438
7/22/2006	60.59	18.18	1,439
2/8/2014	60.59	18.18	1,440
11/19/2007	60.67	18.20	1,441
4/16/2012	60.79	18.24	1,442
10/23/2010	60.82	18.25	1,443
12/16/2010	60.83	18.25	1,444
10/25/2009	60.84	18.25	1,445
7/20/2007	60.97	18.29	1,446
1/21/2013	60.99	18.30	1,447
12/2/2005	61.00	18.30	1,448
9/23/2011	61.00	18.30	1,449
12/17/2005	61.02	18.31	1,450
8/30/2005	61.05	18.32	1,451
12/31/2010	61.08	18.32	1,452
5/10/2010	61.11	18.33	1,453
10/17/2011	61.12	18.34	1,454
9/8/2011	61.17	18.35	1,455
6/9/2011	61.22	18.37	1,456
5/18/2012	61.30	18.39	1,457
5/6/2007	61.34	18.40	1,458
9/7/2007	61.34	18.40	1,459
2/12/2011	61.38	18.41	1,460
3/14/2007	61.40	18.42	1,461
6/30/2014	61.40	18.42	1,462
8/21/2008	61.43	18.43	1,463
2/13/2011	61.50	18.45	1,464
8/27/2007	61.52	18.46	1,465
2/28/2012	61.57	18.47	1,466
2/5/2015	61.62	18.49	1,467
12/30/2006	61.67	18.50	1,468
8/24/2007	61.67	18.50	1,469
1/8/2012	61.68	18.50	1,470

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
11/14/2007	61.70	18.51	1,471
6/19/2014	61.77	18.53	1,472
3/11/2013	61.80	18.54	1,473
12/13/2006	61.84	18.55	1,474
10/5/2012	61.85	18.56	1,475
8/17/2012	61.86	18.56	1,476
6/6/2014	61.97	18.59	1,477
7/15/2009	62.01	18.60	1,478
1/9/2010	62.01	18.60	1,479
8/21/2013	62.05	18.62	1,480
8/22/2006	62.07	18.62	1,481
2/26/2008	62.07	18.62	1,482
11/18/2007	62.11	18.63	1,483
2/10/2009	62.11	18.63	1,484
7/1/2014	62.15	18.65	1,485
3/24/2015	62.26	18.68	1,486
3/1/2011	62.28	18.68	1,487
8/20/2013	62.30	18.69	1,488
4/1/2008	62.31	18.69	1,489
3/1/2015	62.31	18.69	1,490
3/24/2013	62.34	18.70	1,491
10/15/2008	62.36	18.71	1,492
8/6/2007	62.38	18.71	1,493
7/5/2013	62.40	18.72	1,494
8/9/2010	62.44	18.73	1,495
8/19/2013	62.50	18.75	1,496
2/3/2010	62.54	18.76	1,497
9/5/2010	62.56	18.77	1,498
7/6/2011	62.57	18.77	1,499
5/17/2012	62.61	18.78	1,500
8/1/2008	62.64	18.79	1,501
6/7/2006	62.70	18.81	1,502
1/11/2011	62.70	18.81	1,503
8/6/2008	62.79	18.84	1,504
2/26/2012	62.80	18.84	1,505
2/17/2009	62.81	18.84	1,506
3/10/2011	62.87	18.86	1,507
7/7/2014	62.89	18.87	1,508
12/2/2007	62.90	18.87	1,509
7/30/2007	62.93	18.88	1,510
6/4/2014	62.94	18.88	1,511
1/7/2015	63.01	18.90	1,512

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
7/17/2007	63.04	18.91	1,513
8/13/2014	63.04	18.91	1,514
12/24/2009	63.05	18.92	1,515
6/29/2011	63.10	18.93	1,516
8/10/2007	63.14	18.94	1,517
11/10/2013	63.15	18.95	1,518
11/6/2006	63.16	18.95	1,519
7/6/2014	63.16	18.95	1,520
9/2/2008	63.17	18.95	1,521
6/30/2007	63.22	18.97	1,522
5/27/2014	63.37	19.01	1,523
7/19/2006	63.38	19.01	1,524
6/25/2013	63.38	19.01	1,525
9/16/2007	63.42	19.03	1,526
3/12/2007	63.56	19.07	1,527
3/4/2015	63.56	19.07	1,528
12/9/2010	63.66	19.10	1,529
1/2/2015	63.66	19.10	1,530
12/14/2009	63.74	19.12	1,531
11/27/2012	63.76	19.13	1,532
6/6/2006	63.78	19.13	1,533
5/3/2010	63.85	19.16	1,534
8/3/2008	63.86	19.16	1,535
4/4/2011	63.89	19.17	1,536
8/13/2006	63.92	19.18	1,537
8/15/2014	63.95	19.19	1,538
9/10/2009	63.99	19.20	1,539
11/11/2014	63.99	19.20	1,540
8/30/2007	64.02	19.21	1,541
8/1/2014	64.02	19.21	1,542
12/11/2008	64.03	19.21	1,543
2/3/2014	64.03	19.21	1,544
1/29/2015	64.14	19.24	1,545
8/4/2014	64.15	19.25	1,546
5/21/2012	64.19	19.26	1,547
12/25/2006	64.23	19.27	1,548
10/12/2010	64.25	19.28	1,549
11/15/2007	64.30	19.29	1,550
7/3/2013	64.33	19.30	1,551
4/4/2012	64.34	19.30	1,552
9/22/2011	64.37	19.31	1,553
3/8/2007	64.38	19.31	1,554

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
8/2/2008	64.38	19.31	1,555
5/8/2009	64.47	19.34	1,556
7/11/2010	64.55	19.37	1,557
11/19/2010	64.58	19.37	1,558
11/19/2012	64.62	19.39	1,559
7/6/2007	64.65	19.40	1,560
4/7/2011	64.66	19.40	1,561
6/6/2011	64.70	19.41	1,562
12/1/2005	64.72	19.42	1,563
8/4/2011	64.73	19.42	1,564
8/13/2012	64.74	19.42	1,565
12/14/2006	64.77	19.43	1,566
2/3/2013	64.81	19.44	1,567
5/6/2010	64.83	19.45	1,568
8/26/2009	64.87	19.46	1,569
7/28/2007	64.92	19.48	1,570
6/17/2015	64.92	19.48	1,571
7/26/2011	64.97	19.49	1,572
4/6/2013	65.04	19.51	1,573
8/24/2014	65.07	19.52	1,574
10/31/2011	65.08	19.52	1,575
6/11/2012	65.08	19.52	1,576
4/7/2007	65.10	19.53	1,577
6/15/2014	65.17	19.55	1,578
6/8/2007	65.21	19.56	1,579
2/15/2010	65.21	19.56	1,580
1/7/2012	65.26	19.58	1,581
8/27/2006	65.27	19.58	1,582
9/4/2012	65.30	19.59	1,583
12/16/2005	65.31	19.59	1,584
9/10/2007	65.49	19.65	1,585
10/24/2009	65.51	19.65	1,586
12/19/2006	65.54	19.66	1,587
10/24/2007	65.58	19.67	1,588
6/8/2014	65.58	19.67	1,589
4/16/2008	65.60	19.68	1,590
7/25/2009	65.74	19.72	1,591
11/18/2014	65.81	19.74	1,592
4/3/2015	65.81	19.74	1,593
11/18/2011	65.82	19.75	1,594
2/7/2014	65.84	19.75	1,595
8/10/2006	65.89	19.77	1,596

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
6/13/2012	65.89	19.77	1,597
8/28/2014	65.90	19.77	1,598
8/1/2007	65.91	19.77	1,599
9/13/2007	65.92	19.78	1,600
8/16/2012	65.94	19.78	1,601
5/5/2007	65.97	19.79	1,602
9/2/2011	65.98	19.79	1,603
7/3/2007	66.00	19.80	1,604
8/16/2013	66.00	19.80	1,605
7/29/2010	66.01	19.80	1,606
9/8/2013	66.13	19.84	1,607
6/19/2006	66.23	19.87	1,608
8/5/2006	66.29	19.89	1,609
12/27/2012	66.34	19.90	1,610
3/21/2011	66.35	19.91	1,611
5/31/2011	66.36	19.91	1,612
2/16/2014	66.39	19.92	1,613
1/19/2007	66.43	19.93	1,614
6/12/2013	66.45	19.94	1,615
3/10/2013	66.46	19.94	1,616
12/12/2006	66.49	19.95	1,617
2/25/2008	66.49	19.95	1,618
9/27/2013	66.49	19.95	1,619
2/9/2014	66.50	19.95	1,620
5/16/2012	66.56	19.97	1,621
9/28/2006	66.61	19.98	1,622
9/6/2010	66.63	19.99	1,623
9/24/2008	66.65	20.00	1,624
11/8/2006	66.70	20.01	1,625
11/7/2009	66.75	20.03	1,626
10/23/2014	66.78	20.03	1,627
10/4/2012	66.90	20.07	1,628
11/7/2011	66.93	20.08	1,629
6/18/2010	67.03	20.11	1,630
11/12/2007	67.15	20.15	1,631
6/17/2013	67.16	20.15	1,632
12/5/2006	67.18	20.15	1,633
8/29/2008	67.18	20.15	1,634
8/11/2012	67.19	20.16	1,635
7/31/2014	67.23	20.17	1,636
8/26/2012	67.29	20.19	1,637
6/5/2006	67.32	20.20	1,638

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
6/7/2011	67.36	20.21	1,639
6/30/2015	67.48	20.24	1,640
6/13/2010	67.52	20.26	1,641
9/3/2007	67.56	20.27	1,642
10/3/2010	67.61	20.28	1,643
5/9/2010	67.66	20.30	1,644
5/28/2011	67.67	20.30	1,645
8/6/2009	67.71	20.31	1,646
8/27/2010	67.77	20.33	1,647
6/16/2014	67.79	20.34	1,648
2/9/2009	67.88	20.36	1,649
10/23/2007	67.89	20.37	1,650
12/15/2010	67.90	20.37	1,651
6/13/2015	67.90	20.37	1,652
11/7/2012	67.93	20.38	1,653
12/13/2009	67.94	20.38	1,654
1/20/2013	67.97	20.39	1,655
8/23/2007	67.98	20.39	1,656
5/26/2010	68.01	20.40	1,657
3/22/2008	68.07	20.42	1,658
3/15/2015	68.08	20.42	1,659
5/2/2010	68.16	20.45	1,660
12/4/2005	68.17	20.45	1,661
12/8/2010	68.19	20.46	1,662
11/8/2014	68.22	20.47	1,663
7/25/2008	68.23	20.47	1,664
10/18/2006	68.25	20.48	1,665
5/19/2012	68.26	20.48	1,666
6/17/2014	68.30	20.49	1,667
8/1/2006	68.36	20.51	1,668
4/15/2012	68.38	20.51	1,669
1/18/2009	68.42	20.53	1,670
9/7/2011	68.44	20.53	1,671
12/1/2007	68.50	20.55	1,672
6/4/2013	68.53	20.56	1,673
12/31/2014	68.57	20.57	1,674
2/24/2008	68.59	20.58	1,675
6/18/2013	68.60	20.58	1,676
1/10/2009	68.66	20.60	1,677
7/14/2011	68.66	20.60	1,678
11/18/2010	68.69	20.61	1,679
6/14/2014	68.71	20.61	1,680

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
6/23/2006	68.72	20.62	1,681
12/26/2010	68.90	20.67	1,682
5/18/2007	69.02	20.71	1,683
4/4/2013	69.13	20.74	1,684
6/27/2007	69.19	20.76	1,685
5/22/2011	69.20	20.76	1,686
11/14/2012	69.27	20.78	1,687
4/3/2012	69.29	20.79	1,688
10/10/2009	69.31	20.79	1,689
9/30/2008	69.34	20.80	1,690
9/29/2006	69.38	20.81	1,691
7/20/2009	69.40	20.82	1,692
1/18/2007	69.41	20.82	1,693
1/6/2012	69.44	20.83	1,694
4/11/2008	69.52	20.86	1,695
8/25/2009	69.60	20.88	1,696
8/12/2007	69.67	20.90	1,697
8/24/2009	69.69	20.91	1,698
4/28/2012	69.69	20.91	1,699
8/19/2008	69.73	20.92	1,700
1/7/2014	69.78	20.93	1,701
10/22/2006	69.80	20.94	1,702
5/13/2007	69.86	20.96	1,703
7/13/2014	69.94	20.98	1,704
1/12/2009	69.96	20.99	1,705
12/11/2014	69.99	21.00	1,706
6/26/2007	70.00	21.00	1,707
11/20/2010	70.00	21.00	1,708
9/7/2010	70.10	21.03	1,709
1/6/2015	70.18	21.05	1,710
7/7/2006	70.20	21.06	1,711
12/6/2009	70.20	21.06	1,712
1/30/2010	70.20	21.06	1,713
6/15/2006	70.40	21.12	1,714
9/29/2009	70.40	21.12	1,715
2/23/2008	70.54	21.16	1,716
11/30/2005	70.60	21.18	1,717
12/6/2006	70.60	21.18	1,718
3/21/2015	70.60	21.18	1,719
9/29/2014	70.64	21.19	1,720
12/4/2006	70.70	21.21	1,721
4/6/2007	70.70	21.21	1,722

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
8/31/2009	70.70	21.21	1,723
6/28/2011	70.70	21.21	1,724
4/21/2012	70.70	21.21	1,725
4/27/2012	70.70	21.21	1,726
2/27/2015	70.70	21.21	1,727
6/2/2013	70.72	21.22	1,728
6/16/2015	70.75	21.23	1,729
11/10/2006	70.80	21.24	1,730
11/26/2007	70.90	21.27	1,731
8/29/2010	70.90	21.27	1,732
12/15/2005	71.00	21.30	1,733
6/12/2012	71.00	21.30	1,734
3/23/2009	71.10	21.33	1,735
10/23/2009	71.10	21.33	1,736
11/17/2011	71.10	21.33	1,737
6/4/2006	71.20	21.36	1,738
6/12/2015	71.20	21.36	1,739
6/18/2014	71.24	21.37	1,740
2/28/2014	71.26	21.38	1,741
5/4/2007	71.28	21.38	1,742
3/10/2007	71.40	21.42	1,743
8/3/2011	71.40	21.42	1,744
8/14/2012	71.50	21.45	1,745
9/14/2007	71.70	21.51	1,746
5/15/2012	71.70	21.51	1,747
8/23/2014	71.76	21.53	1,748
8/8/2014	71.79	21.54	1,749
12/12/2009	71.80	21.54	1,750
12/4/2011	71.80	21.54	1,751
3/27/2013	71.88	21.56	1,752
5/9/2009	72.10	21.63	1,753
10/3/2012	72.10	21.63	1,754
6/11/2013	72.11	21.63	1,755
10/22/2007	72.20	21.66	1,756
5/1/2010	72.20	21.66	1,757
5/28/2014	72.30	21.69	1,758
8/25/2012	72.30	21.69	1,759
2/22/2008	72.34	21.70	1,760
5/7/2009	72.40	21.72	1,761
7/16/2009	72.40	21.72	1,762
2/13/2010	72.40	21.72	1,763
10/17/2009	72.50	21.75	1,764

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
9/1/2011	72.50	21.75	1,765
6/28/2013	72.50	21.75	1,766
7/12/2014	72.51	21.75	1,767
12/3/2006	72.60	21.78	1,768
9/30/2009	72.60	21.78	1,769
7/16/2011	72.60	21.78	1,770
9/1/2012	72.60	21.78	1,771
5/26/2014	72.63	21.79	1,772
8/29/2005	72.70	21.81	1,773
12/23/2009	72.70	21.81	1,774
4/14/2012	72.70	21.81	1,775
10/24/2014	72.79	21.84	1,776
11/9/2006	72.80	21.84	1,777
12/11/2006	72.80	21.84	1,778
9/6/2007	72.80	21.84	1,779
11/8/2007	72.90	21.87	1,780
12/30/2014	72.97	21.89	1,781
6/13/2011	73.00	21.90	1,782
4/3/2013	73.04	21.91	1,783
8/25/2007	73.20	21.96	1,784
8/5/2009	73.20	21.96	1,785
5/29/2014	73.27	21.98	1,786
11/9/2007	73.30	21.99	1,787
2/25/2012	73.30	21.99	1,788
12/7/2010	73.40	22.02	1,789
7/15/2006	73.50	22.05	1,790
6/30/2013	73.54	22.06	1,791
11/5/2006	73.70	22.11	1,792
8/24/2008	73.80	22.14	1,793
10/22/2010	73.80	22.14	1,794
7/30/2014	73.87	22.16	1,795
7/21/2006	73.90	22.17	1,796
7/18/2006	74.00	22.20	1,797
9/6/2011	74.00	22.20	1,798
2/20/2010	74.10	22.23	1,799
5/7/2010	74.10	22.23	1,800
11/17/2010	74.10	22.23	1,801
11/21/2010	74.10	22.23	1,802
7/12/2011	74.10	22.23	1,803
10/7/2013	74.23	22.27	1,804
3/12/2015	74.28	22.28	1,805
8/18/2005	74.30	22.29	1,806

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
1/11/2012	74.30	22.29	1,807
8/7/2012	74.40	22.32	1,808
4/2/2015	74.40	22.32	1,809
5/11/2007	74.49	22.35	1,810
11/29/2005	74.50	22.35	1,811
8/20/2006	74.50	22.35	1,812
1/2/2007	74.50	22.35	1,813
8/18/2008	74.50	22.35	1,814
10/6/2010	74.50	22.35	1,815
6/14/2013	74.51	22.35	1,816
7/10/2014	74.51	22.35	1,817
9/23/2013	74.53	22.36	1,818
7/7/2005	74.70	22.41	1,819
5/24/2014	74.70	22.41	1,820
5/6/2009	74.80	22.44	1,821
6/10/2012	74.80	22.44	1,822
4/5/2015	74.82	22.45	1,823
7/2/2010	74.90	22.47	1,824
7/15/2011	75.00	22.50	1,825
10/9/2013	75.08	22.52	1,826
8/19/2007	75.10	22.53	1,827
5/10/2009	75.10	22.53	1,828
8/6/2010	75.10	22.53	1,829
12/23/2010	75.10	22.53	1,830
3/20/2012	75.10	22.53	1,831
5/23/2013	75.19	22.56	1,832
4/7/2013	75.40	22.62	1,833
8/5/2007	75.50	22.65	1,834
2/2/2014	75.62	22.69	1,835
7/1/2013	75.69	22.71	1,836
7/5/2014	75.70	22.71	1,837
11/27/2007	75.80	22.74	1,838
9/7/2009	75.80	22.74	1,839
8/24/2005	75.90	22.77	1,840
6/3/2006	75.90	22.77	1,841
6/29/2015	75.93	22.78	1,842
6/26/2013	75.95	22.79	1,843
3/9/2013	75.96	22.79	1,844
3/11/2007	76.00	22.80	1,845
10/9/2009	76.00	22.80	1,846
4/2/2012	76.00	22.80	1,847
8/9/2006	76.10	22.83	1,848

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
12/28/2006	76.10	22.83	1,849
7/27/2007	76.10	22.83	1,850
3/7/2007	76.20	22.86	1,851
9/1/2008	76.20	22.86	1,852
6/23/2010	76.30	22.89	1,853
11/26/2005	76.40	22.92	1,854
10/19/2009	76.40	22.92	1,855
2/16/2009	76.46	22.94	1,856
8/27/2005	76.50	22.95	1,857
8/26/2007	76.60	22.98	1,858
11/10/2007	76.60	22.98	1,859
1/5/2012	76.60	22.98	1,860
5/25/2014	76.68	23.00	1,861
9/28/2014	76.84	23.05	1,862
11/16/2013	76.87	23.06	1,863
10/29/2011	76.90	23.07	1,864
4/8/2012	77.00	23.10	1,865
2/4/2015	77.01	23.10	1,866
5/26/2011	77.10	23.13	1,867
9/5/2011	77.20	23.16	1,868
11/24/2013	77.22	23.17	1,869
5/21/2010	77.30	23.19	1,870
8/26/2011	77.30	23.19	1,871
3/20/2008	77.37	23.21	1,872
1/13/2007	77.40	23.22	1,873
11/22/2006	77.60	23.28	1,874
7/25/2011	77.60	23.28	1,875
12/10/2014	77.67	23.30	1,876
7/13/2011	77.70	23.31	1,877
6/9/2012	77.70	23.31	1,878
2/15/2013	77.84	23.35	1,879
11/7/2007	77.90	23.37	1,880
7/14/2006	78.10	23.43	1,881
4/5/2007	78.10	23.43	1,882
9/30/2013	78.13	23.44	1,883
11/7/2014	78.13	23.44	1,884
10/24/2006	78.20	23.46	1,885
10/19/2010	78.20	23.46	1,886
12/14/2010	78.20	23.46	1,887
3/13/2014	78.25	23.48	1,888
10/21/2007	78.30	23.49	1,889
2/21/2008	78.31	23.49	1,890

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
8/27/2011	78.40	23.52	1,891
1/17/2008	78.48	23.54	1,892
9/30/2014	78.53	23.56	1,893
5/14/2012	78.60	23.58	1,894
8/21/2006	78.70	23.61	1,895
8/22/2007	78.70	23.61	1,896
4/30/2010	78.70	23.61	1,897
5/21/2013	78.74	23.62	1,898
12/16/2012	78.77	23.63	1,899
11/21/2012	78.78	23.63	1,900
1/9/2009	78.80	23.64	1,901
6/7/2013	78.85	23.66	1,902
8/2/2014	78.91	23.67	1,903
4/15/2008	78.98	23.69	1,904
7/31/2006	79.00	23.70	1,905
9/2/2007	79.00	23.70	1,906
6/3/2014	79.07	23.72	1,907
5/23/2012	79.10	23.73	1,908
8/17/2005	79.20	23.76	1,909
6/18/2006	79.30	23.79	1,910
6/29/2014	79.30	23.79	1,911
6/11/2015	79.30	23.79	1,912
11/30/2007	79.40	23.82	1,913
12/10/2006	79.50	23.85	1,914
6/15/2015	79.64	23.89	1,915
8/6/2013	79.77	23.93	1,916
3/17/2008	79.85	23.96	1,917
5/12/2007	79.88	23.96	1,918
5/3/2007	79.98	23.99	1,919
10/16/2009	80.00	24.00	1,920
10/25/2010	80.00	24.00	1,921
8/12/2012	80.00	24.00	1,922
3/19/2011	80.10	24.03	1,923
9/4/2005	80.20	24.06	1,924
12/14/2005	80.20	24.06	1,925
5/4/2009	80.20	24.06	1,926
11/25/2014	80.20	24.06	1,927
2/8/2009	80.25	24.08	1,928
5/5/2009	80.30	24.09	1,929
12/29/2014	80.30	24.09	1,930
4/8/2008	80.36	24.11	1,931
1/17/2007	80.40	24.12	1,932

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
8/10/2012	80.40	24.12	1,933
1/19/2013	80.40	24.12	1,934
7/12/2013	80.40	24.12	1,935
9/21/2006	80.50	24.15	1,936
6/14/2006	80.60	24.18	1,937
9/9/2009	80.60	24.18	1,938
11/16/2011	80.60	24.18	1,939
12/24/2013	80.60	24.18	1,940
6/7/2014	80.60	24.18	1,941
6/26/2011	80.70	24.21	1,942
12/18/2006	80.80	24.24	1,943
6/1/2014	80.80	24.24	1,944
1/15/2006	80.90	24.27	1,945
8/9/2008	80.90	24.27	1,946
2/12/2006	81.00	24.30	1,947
2/24/2009	81.05	24.32	1,948
12/5/2005	81.10	24.33	1,949
5/12/2008	81.10	24.33	1,950
3/2/2012	81.10	24.33	1,951
10/2/2012	81.10	24.33	1,952
11/16/2010	81.20	24.36	1,953
10/22/2009	81.40	24.42	1,954
7/14/2014	81.40	24.42	1,955
3/31/2007	81.50	24.45	1,956
7/12/2009	81.50	24.45	1,957
3/22/2009	81.60	24.48	1,958
1/18/2013	81.60	24.48	1,959
12/11/2007	81.70	24.51	1,960
5/10/2007	81.79	24.54	1,961
6/2/2006	81.80	24.54	1,962
12/6/2010	81.80	24.54	1,963
6/23/2015	81.80	24.54	1,964
2/7/2009	81.86	24.56	1,965
7/6/2005	81.90	24.57	1,966
8/23/2009	82.00	24.60	1,967
8/31/2011	82.20	24.66	1,968
6/10/2015	82.20	24.66	1,969
4/9/2011	82.40	24.72	1,970
6/1/2013	82.40	24.72	1,971
7/29/2014	82.40	24.72	1,972
11/26/2006	82.60	24.78	1,973
2/16/2013	82.60	24.78	1,974

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
12/25/2013	82.70	24.81	1,975
2/20/2008	82.74	24.82	1,976
11/25/2007	82.80	24.84	1,977
8/4/2009	82.80	24.84	1,978
8/11/2007	82.90	24.87	1,979
6/3/2013	82.90	24.87	1,980
4/6/2012	83.00	24.90	1,981
7/4/2007	83.10	24.93	1,982
7/26/2012	83.10	24.93	1,983
8/23/2005	83.20	24.96	1,984
11/6/2011	83.20	24.96	1,985
7/6/2012	83.25	24.98	1,986
9/28/2009	83.30	24.99	1,987
1/3/2012	83.30	24.99	1,988
2/1/2006	83.40	25.02	1,989
6/16/2013	83.40	25.02	1,990
7/24/2009	83.50	25.05	1,991
6/2/2011	83.60	25.08	1,992
6/22/2006	83.80	25.14	1,993
8/8/2008	83.80	25.14	1,994
11/28/2005	83.90	25.17	1,995
6/10/2013	83.90	25.17	1,996
8/17/2013	83.90	25.17	1,997
1/12/2007	84.00	25.20	1,998
8/25/2008	84.00	25.20	1,999
8/30/2008	84.00	25.20	2,000
3/17/2012	84.00	25.20	2,001
6/27/2015	84.00	25.20	2,002
9/2/2005	84.10	25.23	2,003
3/29/2007	84.20	25.26	2,004
6/3/2011	84.20	25.26	2,005
6/27/2011	84.20	25.26	2,006
8/15/2005	84.30	25.29	2,007
8/22/2009	84.30	25.29	2,008
6/13/2014	84.30	25.29	2,009
12/14/2012	84.40	25.32	2,010
1/8/2006	84.50	25.35	2,011
6/7/2012	84.50	25.35	2,012
8/17/2007	84.60	25.38	2,013
11/25/2011	84.60	25.38	2,014
1/28/2014	84.60	25.38	2,015
12/25/2012	84.70	25.41	2,016

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
10/19/2006	84.90	25.47	2,017
4/26/2012	84.90	25.47	2,018
8/27/2014	84.90	25.47	2,019
10/21/2005	85.10	25.53	2,020
11/30/2011	85.10	25.53	2,021
5/27/2011	85.40	25.62	2,022
4/1/2012	85.50	25.65	2,023
8/4/2012	85.50	25.65	2,024
8/24/2012	85.50	25.65	2,025
3/14/2014	85.60	25.68	2,026
5/12/2014	85.60	25.68	2,027
4/28/2010	85.70	25.71	2,028
5/22/2010	85.70	25.71	2,029
5/25/2011	85.80	25.74	2,030
8/2/2011	85.80	25.74	2,031
11/1/2011	85.80	25.74	2,032
11/17/2014	85.80	25.74	2,033
2/8/2006	86.10	25.83	2,034
6/1/2006	86.10	25.83	2,035
4/5/2013	86.10	25.83	2,036
1/3/2014	86.10	25.83	2,037
9/3/2005	86.20	25.86	2,038
10/8/2009	86.30	25.89	2,039
1/16/2006	86.60	25.98	2,040
1/11/2010	86.60	25.98	2,041
4/13/2012	86.60	25.98	2,042
11/27/2005	86.80	26.04	2,043
11/6/2007	86.80	26.04	2,044
3/9/2011	86.90	26.07	2,045
7/9/2014	86.90	26.07	2,046
7/26/2007	87.00	26.10	2,047
7/28/2008	87.00	26.10	2,048
10/21/2014	87.00	26.10	2,049
4/3/2008	87.16	26.15	2,050
11/25/2005	87.20	26.16	2,051
6/28/2007	87.20	26.16	2,052
10/20/2007	87.30	26.19	2,053
12/10/2007	87.30	26.19	2,054
3/31/2011	87.30	26.19	2,055
5/13/2012	87.30	26.19	2,056
5/9/2007	87.46	26.24	2,057
3/7/2013	87.50	26.25	2,058

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
2/19/2008	87.61	26.28	2,059
7/31/2008	87.67	26.30	2,060
9/25/2005	87.70	26.31	2,061
8/25/2011	87.70	26.31	2,062
11/20/2014	87.70	26.31	2,063
4/1/2007	87.80	26.34	2,064
8/21/2009	87.90	26.37	2,065
12/22/2009	87.90	26.37	2,066
8/18/2013	87.90	26.37	2,067
9/23/2008	87.94	26.38	2,068
9/30/2006	88.00	26.40	2,069
10/14/2014	88.00	26.40	2,070
8/15/2013	88.12	26.44	2,071
4/21/2008	88.13	26.44	2,072
11/11/2007	88.20	26.46	2,073
3/6/2013	88.20	26.46	2,074
8/14/2013	88.30	26.49	2,075
5/23/2014	88.40	26.52	2,076
3/6/2007	88.50	26.55	2,077
8/26/2005	88.60	26.58	2,078
5/9/2011	88.60	26.58	2,079
12/9/2014	88.60	26.58	2,080
8/28/2005	88.80	26.64	2,081
3/8/2013	88.80	26.64	2,082
10/1/2012	88.85	26.66	2,083
9/1/2009	88.90	26.67	2,084
2/28/2010	88.90	26.67	2,085
8/5/2012	88.90	26.67	2,086
8/31/2012	88.90	26.67	2,087
10/27/2014	88.90	26.67	2,088
3/13/2015	88.90	26.67	2,089
8/8/2009	89.00	26.70	2,090
8/9/2012	89.00	26.70	2,091
9/3/2012	89.00	26.70	2,092
5/11/2014	89.00	26.70	2,093
8/20/2011	89.20	26.76	2,094
8/28/2008	89.30	26.79	2,095
8/7/2009	89.30	26.79	2,096
8/31/2008	89.40	26.82	2,097
1/12/2010	89.40	26.82	2,098
2/17/2011	89.40	26.82	2,099
11/23/2014	89.60	26.88	2,100

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
11/23/2005	89.80	26.94	2,101
2/2/2006	89.80	26.94	2,102
8/22/2005	89.90	26.97	2,103
1/29/2009	89.91	26.97	2,104
3/12/2012	90.00	27.00	2,105
4/2/2008	90.27	27.08	2,106
4/27/2010	90.30	27.09	2,107
8/6/2012	90.30	27.09	2,108
7/5/2007	90.40	27.12	2,109
6/21/2006	90.50	27.15	2,110
1/16/2008	90.50	27.15	2,111
6/26/2009	90.60	27.18	2,112
6/26/2014	90.60	27.18	2,113
8/14/2005	90.70	27.21	2,114
1/11/2007	90.80	27.24	2,115
8/1/2011	90.80	27.24	2,116
3/26/2006	91.00	27.30	2,117
5/30/2012	91.00	27.30	2,118
11/15/2012	91.20	27.36	2,119
2/2/2009	91.40	27.42	2,120
3/30/2015	91.40	27.42	2,121
11/8/2011	91.50	27.45	2,122
3/11/2015	91.60	27.48	2,123
4/4/2007	91.70	27.51	2,124
7/28/2009	91.70	27.51	2,125
11/17/2012	91.80	27.54	2,126
11/28/2012	91.80	27.54	2,127
5/5/2008	91.83	27.55	2,128
11/22/2005	91.90	27.57	2,129
9/13/2009	92.10	27.63	2,130
7/23/2011	92.10	27.63	2,131
11/19/2011	92.10	27.63	2,132
5/20/2012	92.10	27.63	2,133
12/28/2014	92.10	27.63	2,134
6/28/2015	92.10	27.63	2,135
9/15/2007	92.20	27.66	2,136
6/22/2013	92.40	27.72	2,137
11/12/2009	92.50	27.75	2,138
5/8/2011	92.50	27.75	2,139
5/31/2006	92.60	27.78	2,140
5/3/2009	92.60	27.78	2,141
11/10/2014	92.60	27.78	2,142

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
8/8/2012	92.70	27.81	2,143
1/15/2008	92.90	27.87	2,144
5/25/2010	92.90	27.87	2,145
11/14/2013	92.90	27.87	2,146
3/30/2007	93.00	27.90	2,147
9/21/2012	93.00	27.90	2,148
5/22/2013	93.00	27.90	2,149
12/9/2006	93.20	27.96	2,150
3/28/2007	93.30	27.99	2,151
8/8/2010	93.40	28.02	2,152
2/9/2006	93.50	28.05	2,153
9/14/2012	93.50	28.05	2,154
1/5/2015	93.50	28.05	2,155
10/20/2005	93.60	28.08	2,156
3/31/2012	93.70	28.11	2,157
10/15/2009	93.80	28.14	2,158
1/2/2012	93.90	28.17	2,159
8/7/2010	94.00	28.20	2,160
2/18/2008	94.06	28.22	2,161
1/6/2009	94.10	28.23	2,162
8/17/2009	94.10	28.23	2,163
10/10/2010	94.10	28.23	2,164
1/31/2006	94.20	28.26	2,165
8/3/2009	94.20	28.26	2,166
7/28/2014	94.30	28.29	2,167
10/18/2014	94.30	28.29	2,168
5/8/2008	94.39	28.32	2,169
8/18/2009	94.40	28.32	2,170
9/19/2013	94.50	28.35	2,171
6/5/2011	94.60	28.38	2,172
10/25/2014	94.60	28.38	2,173
3/6/2011	94.70	28.41	2,174
8/13/2013	94.70	28.41	2,175
10/15/2014	94.70	28.41	2,176
1/14/2007	94.80	28.44	2,177
10/2/2009	94.80	28.44	2,178
11/29/2011	94.80	28.44	2,179
5/25/2012	95.10	28.53	2,180
11/18/2012	95.10	28.53	2,181
11/13/2009	95.30	28.59	2,182
11/6/2014	95.40	28.62	2,183
3/2/2015	95.40	28.62	2,184

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
9/9/2007	95.50	28.65	2,185
8/16/2008	95.60	28.68	2,186
11/28/2014	95.70	28.71	2,187
3/23/2015	95.80	28.74	2,188
8/6/2011	95.90	28.77	2,189
4/2/2013	96.00	28.80	2,190
1/8/2009	96.20	28.86	2,191
11/24/2010	96.30	28.89	2,192
2/7/2006	96.50	28.95	2,193
8/3/2012	96.50	28.95	2,194
9/19/2012	96.50	28.95	2,195
12/15/2006	96.70	29.01	2,196
1/14/2008	96.70	29.01	2,197
6/19/2009	96.90	29.07	2,198
3/18/2006	97.10	29.13	2,199
6/24/2009	97.20	29.16	2,200
11/15/2011	97.30	29.19	2,201
7/29/2011	97.40	29.22	2,202
11/22/2014	97.50	29.25	2,203
1/28/2015	97.50	29.25	2,204
1/19/2006	97.60	29.28	2,205
10/25/2007	97.60	29.28	2,206
4/10/2013	97.60	29.28	2,207
5/2/2007	97.64	29.29	2,208
6/24/2013	97.70	29.31	2,209
5/10/2014	97.70	29.31	2,210
12/5/2010	97.80	29.34	2,211
8/10/2009	97.90	29.37	2,212
11/4/2006	98.00	29.40	2,213
12/12/2008	98.00	29.40	2,214
12/7/2006	98.10	29.43	2,215
7/5/2012	98.10	29.43	2,216
7/27/2012	98.10	29.43	2,217
2/14/2013	98.10	29.43	2,218
5/20/2013	98.10	29.43	2,219
8/16/2005	98.20	29.46	2,220
1/12/2008	98.20	29.46	2,221
1/2/2014	98.20	29.46	2,222
4/4/2008	98.28	29.48	2,223
9/27/2006	98.30	29.49	2,224
4/20/2009	98.40	29.52	2,225
6/17/2006	98.50	29.55	2,226

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
3/16/2012	98.50	29.55	2,227
4/29/2012	98.50	29.55	2,228
10/1/2006	98.60	29.58	2,229
12/2/2011	98.70	29.61	2,230
11/14/2010	98.80	29.64	2,231
12/9/2005	98.90	29.67	2,232
7/10/2010	98.90	29.67	2,233
9/22/2012	98.90	29.67	2,234
3/5/2013	98.90	29.67	2,235
2/11/2006	99.00	29.70	2,236
8/13/2007	99.00	29.70	2,237
12/1/2011	99.00	29.70	2,238
11/16/2012	99.00	29.70	2,239
2/19/2006	99.10	29.73	2,240
3/25/2009	99.10	29.73	2,241
3/7/2011	99.20	29.76	2,242
4/26/2015	99.20	29.76	2,243
6/25/2011	99.30	29.79	2,244
7/4/2005	99.40	29.82	2,245
7/17/2011	99.40	29.82	2,246
3/18/2012	99.40	29.82	2,247
5/12/2012	99.60	29.88	2,248
10/19/2007	99.70	29.91	2,249
12/7/2007	99.80	29.94	2,250
12/22/2010	99.80	29.94	2,251
4/20/2012	99.80	29.94	2,252
10/16/2006	99.90	29.97	2,253
9/5/2005	100.10	30.03	2,254
8/19/2011	100.10	30.03	2,255
2/4/2014	100.10	30.03	2,256
7/23/2012	100.20	30.06	2,257
7/24/2012	100.20	30.06	2,258
12/13/2005	100.30	30.09	2,259
4/16/2007	100.30	30.09	2,260
4/26/2010	100.40	30.12	2,261
8/15/2011	100.40	30.12	2,262
2/17/2008	100.59	30.18	2,263
12/21/2009	100.60	30.18	2,264
4/27/2015	100.60	30.18	2,265
11/21/2005	100.70	30.21	2,266
1/11/2008	100.70	30.21	2,267
5/23/2011	100.70	30.21	2,268

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
6/24/2014	100.70	30.21	2,269
12/22/2014	100.70	30.21	2,270
1/17/2013	100.80	30.24	2,271
5/30/2006	101.00	30.30	2,272
8/11/2009	101.00	30.30	2,273
7/18/2011	101.00	30.30	2,274
5/24/2011	101.10	30.33	2,275
8/24/2011	101.20	30.36	2,276
2/6/2009	101.29	30.39	2,277
2/23/2009	101.48	30.44	2,278
10/18/2007	101.50	30.45	2,279
6/24/2015	101.50	30.45	2,280
9/30/2012	101.60	30.48	2,281
7/16/2006	101.70	30.51	2,282
7/19/2011	101.80	30.54	2,283
7/24/2011	101.90	30.57	2,284
8/12/2013	102.00	30.60	2,285
7/27/2005	102.20	30.66	2,286
1/23/2006	102.20	30.66	2,287
3/23/2006	102.20	30.66	2,288
8/27/2008	102.30	30.69	2,289
1/1/2015	102.30	30.69	2,290
12/6/2007	102.40	30.72	2,291
11/27/2010	102.40	30.72	2,292
4/10/2008	102.49	30.75	2,293
12/7/2005	102.50	30.75	2,294
8/13/2005	102.60	30.78	2,295
11/15/2010	102.60	30.78	2,296
5/18/2014	102.60	30.78	2,297
7/25/2007	102.70	30.81	2,298
5/28/2015	102.90	30.87	2,299
3/25/2006	103.00	30.90	2,300
3/11/2012	103.00	30.90	2,301
5/1/2007	103.10	30.93	2,302
6/27/2014	103.10	30.93	2,303
7/4/2014	103.10	30.93	2,304
1/10/2007	103.30	30.99	2,305
3/2/2010	103.40	31.02	2,306
5/24/2012	103.40	31.02	2,307
10/19/2014	103.40	31.02	2,308
9/11/2005	103.50	31.05	2,309
8/15/2008	103.50	31.05	2,310

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
4/19/2009	103.50	31.05	2,311
9/13/2012	103.50	31.05	2,312
7/5/2005	103.60	31.08	2,313
2/26/2011	103.60	31.08	2,314
11/26/2014	103.70	31.11	2,315
3/24/2006	103.80	31.14	2,316
5/19/2013	104.00	31.20	2,317
1/15/2007	104.10	31.23	2,318
1/11/2009	104.10	31.23	2,319
6/22/2009	104.10	31.23	2,320
6/28/2014	104.20	31.26	2,321
7/3/2014	104.20	31.26	2,322
3/23/2007	104.40	31.32	2,323
8/27/2012	104.60	31.38	2,324
9/18/2013	104.60	31.38	2,325
5/8/2010	104.70	31.41	2,326
7/22/2012	104.70	31.41	2,327
9/2/2012	104.80	31.44	2,328
1/30/2006	104.90	31.47	2,329
1/1/2012	104.90	31.47	2,330
5/26/2013	104.90	31.47	2,331
4/1/2015	104.90	31.47	2,332
10/7/2009	105.00	31.50	2,333
12/3/2007	105.10	31.53	2,334
5/21/2014	105.10	31.53	2,335
7/11/2014	105.10	31.53	2,336
7/22/2008	105.15	31.55	2,337
1/5/2009	105.40	31.62	2,338
12/17/2006	105.50	31.65	2,339
8/17/2008	105.60	31.68	2,340
7/16/2007	105.80	31.74	2,341
8/30/2012	105.80	31.74	2,342
12/20/2014	105.80	31.74	2,343
9/26/2005	105.90	31.77	2,344
6/7/2015	105.90	31.77	2,345
8/18/2007	106.10	31.83	2,346
5/31/2013	106.10	31.83	2,347
5/22/2014	106.10	31.83	2,348
5/27/2015	106.10	31.83	2,349
7/10/2011	106.30	31.89	2,350
3/29/2013	106.30	31.89	2,351
2/6/2014	106.30	31.89	2,352

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
8/9/2009	106.40	31.92	2,353
11/27/2014	106.40	31.92	2,354
12/24/2012	106.50	31.95	2,355
7/2/2014	106.50	31.95	2,356
3/5/2007	106.60	31.98	2,357
7/11/2011	106.80	32.04	2,358
9/8/2012	106.80	32.04	2,359
6/6/2015	106.80	32.04	2,360
9/7/2012	106.90	32.07	2,361
2/1/2014	106.90	32.07	2,362
9/8/2007	107.00	32.10	2,363
6/6/2012	107.00	32.10	2,364
5/2/2009	107.10	32.13	2,365
4/29/2009	107.30	32.19	2,366
7/8/2011	107.30	32.19	2,367
6/9/2014	107.30	32.19	2,368
7/18/2010	107.50	32.25	2,369
6/8/2012	107.50	32.25	2,370
1/11/2006	107.70	32.31	2,371
3/25/2011	107.70	32.31	2,372
12/27/2014	107.70	32.31	2,373
12/12/2007	107.80	32.34	2,374
1/10/2008	107.80	32.34	2,375
12/8/2006	108.00	32.40	2,376
7/21/2011	108.00	32.40	2,377
5/9/2014	108.10	32.43	2,378
1/13/2008	108.20	32.46	2,379
9/4/2011	108.30	32.49	2,380
9/5/2012	108.30	32.49	2,381
9/16/2012	108.30	32.49	2,382
8/8/2006	108.40	32.52	2,383
5/5/2011	108.50	32.55	2,384
11/29/2014	108.50	32.55	2,385
8/14/2011	108.60	32.58	2,386
2/24/2012	108.60	32.58	2,387
2/16/2008	108.69	32.61	2,388
4/24/2014	108.80	32.64	2,389
11/29/2010	108.90	32.67	2,390
11/30/2010	108.90	32.67	2,391
10/14/2007	109.00	32.70	2,392
11/28/2011	109.00	32.70	2,393
7/4/2010	109.10	32.73	2,394

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
4/25/2012	109.10	32.73	2,395
11/6/2009	109.30	32.79	2,396
8/11/2013	109.40	32.82	2,397
9/6/2009	109.50	32.85	2,398
3/30/2012	109.50	32.85	2,399
1/4/2012	109.60	32.88	2,400
5/30/2014	109.60	32.88	2,401
8/2/2012	109.70	32.91	2,402
1/28/2009	109.76	32.93	2,403
7/2/2007	109.80	32.94	2,404
1/7/2009	109.80	32.94	2,405
8/16/2009	109.80	32.94	2,406
3/29/2011	109.80	32.94	2,407
7/20/2011	109.80	32.94	2,408
3/1/2012	109.80	32.94	2,409
10/21/2010	109.90	32.97	2,410
7/30/2011	110.20	33.06	2,411
3/26/2013	110.40	33.12	2,412
7/18/2008	110.43	33.13	2,413
3/17/2007	110.50	33.15	2,414
9/18/2009	110.50	33.15	2,415
11/12/2010	110.50	33.15	2,416
8/21/2005	110.60	33.18	2,417
2/18/2006	110.60	33.18	2,418
9/20/2010	110.60	33.18	2,419
11/22/2011	110.60	33.18	2,420
11/5/2007	110.80	33.24	2,421
7/30/2009	110.80	33.24	2,422
3/5/2012	110.82	33.25	2,423
4/14/2008	110.83	33.25	2,424
12/31/2011	111.00	33.30	2,425
10/16/2011	111.10	33.33	2,426
12/8/2014	111.10	33.33	2,427
1/26/2008	111.11	33.33	2,428
12/9/2007	111.20	33.36	2,429
7/19/2009	111.20	33.36	2,430
4/12/2012	111.20	33.36	2,431
1/27/2008	111.31	33.39	2,432
8/26/2008	111.40	33.42	2,433
5/29/2015	111.40	33.42	2,434
9/27/2005	111.60	33.48	2,435
4/22/2007	111.60	33.48	2,436

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
7/22/2009	111.60	33.48	2,437
8/10/2011	111.60	33.48	2,438
8/13/2008	111.70	33.51	2,439
5/4/2011	111.70	33.51	2,440
7/27/2014	111.70	33.51	2,441
8/7/2005	112.00	33.60	2,442
8/3/2014	112.00	33.60	2,443
2/29/2012	112.20	33.66	2,444
7/21/2012	112.30	33.69	2,445
12/23/2014	112.30	33.69	2,446
7/19/2008	112.38	33.71	2,447
4/1/2010	112.40	33.72	2,448
5/17/2014	112.40	33.72	2,449
10/18/2009	112.50	33.75	2,450
9/18/2012	112.50	33.75	2,451
10/2/2010	112.60	33.78	2,452
6/1/2011	112.60	33.78	2,453
11/26/2011	112.60	33.78	2,454
12/6/2011	112.60	33.78	2,455
7/26/2005	112.70	33.81	2,456
6/12/2014	112.70	33.81	2,457
11/29/2007	112.90	33.87	2,458
7/14/2009	112.90	33.87	2,459
8/16/2007	113.10	33.93	2,460
6/25/2009	113.10	33.93	2,461
8/23/2011	113.10	33.93	2,462
8/19/2012	113.20	33.96	2,463
12/26/2012	113.20	33.96	2,464
7/19/2010	113.30	33.99	2,465
6/23/2011	113.40	34.02	2,466
4/2/2006	113.50	34.05	2,467
6/23/2009	113.50	34.05	2,468
3/17/2006	113.60	34.08	2,469
8/21/2007	113.60	34.08	2,470
9/17/2012	113.60	34.08	2,471
4/12/2008	113.64	34.09	2,472
9/21/2005	113.70	34.11	2,473
6/11/2011	113.70	34.11	2,474
1/25/2008	113.79	34.14	2,475
12/29/2006	114.00	34.20	2,476
11/9/2014	114.00	34.20	2,477
5/10/2008	114.09	34.23	2,478

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
12/18/2009	114.10	34.23	2,479
5/26/2012	114.20	34.26	2,480
5/29/2006	114.30	34.29	2,481
7/9/2011	114.40	34.32	2,482
5/23/2010	114.50	34.35	2,483
6/21/2015	114.60	34.38	2,484
9/6/2012	114.70	34.41	2,485
10/1/2009	115.00	34.50	2,486
12/3/2011	115.00	34.50	2,487
4/20/2008	115.03	34.51	2,488
3/16/2009	115.20	34.56	2,489
7/28/2012	115.40	34.62	2,490
11/20/2005	115.50	34.65	2,491
2/6/2006	115.50	34.65	2,492
10/19/2005	115.60	34.68	2,493
11/3/2007	115.60	34.68	2,494
12/16/2006	115.70	34.71	2,495
1/3/2007	115.70	34.71	2,496
4/20/2007	115.80	34.74	2,497
4/18/2009	115.80	34.74	2,498
3/30/2011	115.80	34.74	2,499
1/15/2013	115.80	34.74	2,500
10/21/2009	116.00	34.80	2,501
7/31/2007	116.10	34.83	2,502
1/22/2006	116.30	34.89	2,503
3/3/2010	116.30	34.89	2,504
10/11/2010	116.30	34.89	2,505
3/27/2007	116.40	34.92	2,506
4/25/2014	116.60	34.98	2,507
10/17/2005	116.70	35.01	2,508
3/29/2015	116.70	35.01	2,509
11/24/2007	116.80	35.04	2,510
1/29/2010	116.80	35.04	2,511
4/27/2007	116.90	35.07	2,512
1/9/2008	117.00	35.10	2,513
8/22/2014	117.00	35.10	2,514
8/12/2005	117.10	35.13	2,515
7/25/2012	117.10	35.13	2,516
1/19/2008	117.12	35.14	2,517
1/6/2014	117.20	35.16	2,518
3/22/2006	117.30	35.19	2,519
11/24/2011	117.30	35.19	2,520

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
12/14/2014	117.30	35.19	2,521
8/5/2005	117.60	35.28	2,522
3/23/2011	117.60	35.28	2,523
5/8/2007	117.67	35.30	2,524
10/4/2010	117.70	35.31	2,525
6/12/2011	117.70	35.31	2,526
5/16/2013	117.70	35.31	2,527
3/20/2009	117.80	35.34	2,528
7/31/2011	117.80	35.34	2,529
11/17/2005	117.90	35.37	2,530
11/4/2007	117.90	35.37	2,531
4/13/2008	117.92	35.38	2,532
1/18/2006	118.10	35.43	2,533
3/15/2012	118.10	35.43	2,534
5/31/2014	118.30	35.49	2,535
10/16/2007	118.40	35.52	2,536
4/25/2015	118.40	35.52	2,537
8/2/2010	118.50	35.55	2,538
2/25/2006	118.60	35.58	2,539
7/30/2006	118.60	35.58	2,540
6/24/2010	118.60	35.58	2,541
6/26/2015	118.60	35.58	2,542
7/7/2012	118.65	35.60	2,543
3/24/2009	118.80	35.64	2,544
10/29/2014	118.80	35.64	2,545
5/24/2010	118.90	35.67	2,546
3/22/2011	118.90	35.67	2,547
2/14/2010	119.00	35.70	2,548
11/5/2011	119.00	35.70	2,549
10/18/2005	119.10	35.73	2,550
4/25/2010	119.10	35.73	2,551
6/16/2011	119.10	35.73	2,552
7/20/2014	119.10	35.73	2,553
10/27/2007	119.20	35.76	2,554
6/8/2015	119.30	35.79	2,555
10/31/2006	119.40	35.82	2,556
3/4/2013	119.50	35.85	2,557
5/29/2012	119.60	35.88	2,558
5/16/2014	119.60	35.88	2,559
4/28/2009	119.80	35.94	2,560
7/29/2009	119.80	35.94	2,561
8/28/2012	119.90	35.97	2,562

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
11/20/2008	119.99	36.00	2,563
4/29/2010	120.00	36.00	2,564
2/15/2008	120.15	36.05	2,565
1/29/2006	120.20	36.06	2,566
11/2/2011	120.20	36.06	2,567
10/10/2013	120.30	36.09	2,568
10/26/2010	120.40	36.12	2,569
9/12/2005	120.60	36.18	2,570
5/20/2014	120.60	36.18	2,571
11/20/2007	120.70	36.21	2,572
5/11/2012	120.80	36.24	2,573
2/10/2013	120.80	36.24	2,574
5/4/2006	121.00	36.30	2,575
3/25/2013	121.00	36.30	2,576
5/8/2014	121.10	36.33	2,577
6/19/2012	121.20	36.36	2,578
11/27/2006	121.30	36.39	2,579
11/11/2010	121.50	36.45	2,580
10/31/2008	121.67	36.50	2,581
5/7/2007	121.73	36.52	2,582
12/13/2010	121.80	36.54	2,583
11/21/2011	121.80	36.54	2,584
2/25/2007	121.90	36.57	2,585
3/24/2014	121.90	36.57	2,586
8/31/2007	122.00	36.60	2,587
1/21/2010	122.00	36.60	2,588
3/14/2015	122.30	36.69	2,589
10/30/2007	122.40	36.72	2,590
2/17/2006	122.50	36.75	2,591
3/17/2009	122.60	36.78	2,592
3/28/2006	122.80	36.84	2,593
9/5/2007	122.80	36.84	2,594
12/8/2007	122.90	36.87	2,595
3/31/2010	122.90	36.87	2,596
7/22/2011	122.90	36.87	2,597
6/2/2014	122.90	36.87	2,598
3/23/2008	122.99	36.90	2,599
3/10/2012	123.00	36.90	2,600
3/19/2012	123.00	36.90	2,601
6/3/2012	123.20	36.96	2,602
6/4/2011	123.30	36.99	2,603
9/6/2005	123.40	37.02	2,604

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
7/17/2006	123.40	37.02	2,605
11/3/2010	123.40	37.02	2,606
7/8/2014	123.40	37.02	2,607
8/28/2011	123.50	37.05	2,608
3/21/2014	123.50	37.05	2,609
6/22/2015	123.50	37.05	2,610
8/1/2005	123.90	37.17	2,611
8/2/2005	123.90	37.17	2,612
8/20/2009	123.90	37.17	2,613
3/14/2010	124.10	37.23	2,614
3/16/2006	124.20	37.26	2,615
1/16/2013	124.20	37.26	2,616
3/21/2006	124.30	37.29	2,617
8/18/2011	124.30	37.29	2,618
2/16/2007	124.40	37.32	2,619
9/1/2007	124.40	37.32	2,620
12/10/2010	124.40	37.32	2,621
9/29/2012	124.50	37.35	2,622
7/16/2014	124.50	37.35	2,623
7/30/2008	124.58	37.37	2,624
7/13/2006	124.60	37.38	2,625
11/24/2009	124.60	37.38	2,626
5/30/2015	124.90	37.47	2,627
11/28/2007	125.20	37.56	2,628
8/7/2008	125.20	37.56	2,629
9/9/2012	125.20	37.56	2,630
4/7/2008	125.25	37.58	2,631
12/11/2010	125.30	37.59	2,632
12/21/2014	125.30	37.59	2,633
11/25/2009	125.40	37.62	2,634
9/10/2012	125.50	37.65	2,635
12/5/2007	125.60	37.68	2,636
10/20/2014	125.60	37.68	2,637
7/4/2013	125.80	37.74	2,638
5/15/2014	125.80	37.74	2,639
9/27/2009	125.90	37.77	2,640
7/20/2012	125.90	37.77	2,641
7/19/2014	125.90	37.77	2,642
7/20/2006	126.00	37.80	2,643
9/24/2005	126.10	37.83	2,644
5/3/2006	126.10	37.83	2,645
10/31/2007	126.20	37.86	2,646

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
4/2/2010	126.30	37.89	2,647
4/6/2015	126.30	37.89	2,648
9/25/2009	126.40	37.92	2,649
3/10/2015	126.50	37.95	2,650
10/14/2009	126.80	38.04	2,651
6/8/2013	126.80	38.04	2,652
10/21/2006	126.90	38.07	2,653
9/29/2007	126.90	38.07	2,654
12/2/2010	126.90	38.07	2,655
4/30/2009	127.00	38.10	2,656
2/14/2008	127.04	38.11	2,657
11/14/2011	127.10	38.13	2,658
11/5/2014	127.10	38.13	2,659
11/16/2005	127.20	38.16	2,660
9/3/2011	127.20	38.16	2,661
12/30/2011	127.20	38.16	2,662
5/31/2012	127.30	38.19	2,663
12/24/2008	127.40	38.22	2,664
7/25/2005	127.50	38.25	2,665
5/17/2013	127.80	38.34	2,666
7/28/2006	127.90	38.37	2,667
10/17/2006	128.00	38.40	2,668
7/15/2014	128.20	38.46	2,669
1/14/2006	128.40	38.52	2,670
3/30/2010	128.40	38.52	2,671
12/12/2010	128.50	38.55	2,672
6/4/2012	128.50	38.55	2,673
8/3/2005	128.60	38.58	2,674
1/8/2008	128.60	38.58	2,675
6/25/2015	128.60	38.58	2,676
10/13/2007	128.70	38.61	2,677
2/26/2006	128.80	38.64	2,678
11/21/2014	128.80	38.64	2,679
12/26/2014	128.80	38.64	2,680
7/11/2009	128.90	38.67	2,681
11/15/2013	129.00	38.70	2,682
8/12/2011	129.10	38.73	2,683
7/31/2009	129.20	38.76	2,684
7/26/2014	129.20	38.76	2,685
7/1/2005	129.30	38.79	2,686
8/6/2005	129.30	38.79	2,687
8/21/2012	129.30	38.79	2,688

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
4/3/2007	129.60	38.88	2,689
1/4/2009	129.60	38.88	2,690
12/16/2011	129.80	38.94	2,691
1/20/2006	130.10	39.03	2,692
6/29/2007	130.10	39.03	2,693
3/19/2008	130.20	39.06	2,694
5/1/2009	130.20	39.06	2,695
10/20/2010	130.20	39.06	2,696
11/13/2010	130.30	39.09	2,697
7/15/2007	130.40	39.12	2,698
5/2/2012	130.40	39.12	2,699
11/3/2011	130.50	39.15	2,700
6/18/2015	130.60	39.18	2,701
4/29/2007	130.70	39.21	2,702
6/23/2013	130.70	39.21	2,703
10/5/2010	131.10	39.33	2,704
2/26/2007	131.20	39.36	2,705
4/20/2010	131.30	39.39	2,706
7/18/2014	131.30	39.39	2,707
8/5/2011	131.40	39.42	2,708
8/1/2012	131.40	39.42	2,709
2/19/2007	131.50	39.45	2,710
7/2/2005	131.60	39.48	2,711
1/9/2007	131.60	39.48	2,712
8/30/2011	131.60	39.48	2,713
7/17/2014	131.60	39.48	2,714
2/14/2009	131.76	39.53	2,715
8/4/2007	131.80	39.54	2,716
4/17/2009	131.90	39.57	2,717
6/24/2011	131.90	39.57	2,718
3/12/2014	131.90	39.57	2,719
5/27/2006	132.10	39.63	2,720
11/21/2007	132.10	39.63	2,721
7/8/2006	132.20	39.66	2,722
6/5/2012	132.20	39.66	2,723
10/16/2005	132.30	39.69	2,724
3/25/2007	132.30	39.69	2,725
2/20/2012	132.50	39.75	2,726
3/29/2012	132.80	39.84	2,727
4/1/2006	133.20	39.96	2,728
2/12/2009	133.31	39.99	2,729
1/4/2014	133.40	40.02	2,730

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
10/1/2005	133.50	40.05	2,731
4/6/2006	133.50	40.05	2,732
3/24/2007	133.50	40.05	2,733
9/4/2007	133.60	40.08	2,734
8/10/2008	133.70	40.11	2,735
8/22/2012	133.80	40.14	2,736
10/11/2009	134.10	40.23	2,737
8/5/2010	134.10	40.23	2,738
9/20/2005	134.20	40.26	2,739
2/18/2007	134.20	40.26	2,740
10/22/2005	134.40	40.32	2,741
8/19/2006	134.40	40.32	2,742
8/23/2008	134.40	40.32	2,743
12/4/2010	134.50	40.35	2,744
4/19/2010	134.60	40.38	2,745
8/23/2012	134.60	40.38	2,746
12/19/2012	134.60	40.38	2,747
3/25/2014	134.60	40.38	2,748
1/23/2008	134.67	40.40	2,749
4/3/2006	134.70	40.41	2,750
3/15/2009	134.80	40.44	2,751
4/7/2015	135.00	40.50	2,752
9/23/2005	135.40	40.62	2,753
5/2/2006	135.40	40.62	2,754
12/4/2007	135.40	40.62	2,755
5/7/2014	135.40	40.62	2,756
5/13/2014	135.40	40.62	2,757
3/17/2010	135.70	40.71	2,758
5/1/2012	135.80	40.74	2,759
2/13/2009	135.99	40.80	2,760
3/18/2009	136.10	40.83	2,761
2/22/2009	136.12	40.84	2,762
9/12/2012	136.20	40.86	2,763
6/19/2015	136.30	40.89	2,764
4/3/2014	136.40	40.92	2,765
12/3/2009	136.50	40.95	2,766
4/2/2014	136.50	40.95	2,767
1/16/2007	136.60	40.98	2,768
7/13/2009	136.60	40.98	2,769
2/11/2007	136.70	41.01	2,770
6/22/2011	136.70	41.01	2,771
5/19/2014	136.70	41.01	2,772

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
2/15/2009	136.82	41.05	2,773
4/24/2010	136.90	41.07	2,774
3/3/2013	136.90	41.07	2,775
3/22/2007	137.10	41.13	2,776
6/17/2011	137.20	41.16	2,777
10/12/2007	137.30	41.19	2,778
1/10/2006	137.50	41.25	2,779
4/5/2006	137.60	41.28	2,780
11/10/2010	137.60	41.28	2,781
9/30/2005	137.70	41.31	2,782
11/20/2011	137.70	41.31	2,783
2/17/2007	137.80	41.34	2,784
6/9/2013	137.90	41.37	2,785
7/21/2014	137.90	41.37	2,786
9/8/2009	138.00	41.40	2,787
11/2/2010	138.10	41.43	2,788
1/18/2008	138.17	41.45	2,789
7/2/2012	138.20	41.46	2,790
5/28/2006	138.30	41.49	2,791
2/11/2013	138.50	41.55	2,792
6/9/2015	138.50	41.55	2,793
4/21/2010	138.60	41.58	2,794
2/3/2015	138.60	41.58	2,795
10/27/2005	138.80	41.64	2,796
2/13/2008	138.94	41.68	2,797
12/7/2014	139.00	41.70	2,798
4/4/2006	139.10	41.73	2,799
7/23/2009	139.10	41.73	2,800
12/25/2014	139.20	41.76	2,801
5/9/2008	139.24	41.77	2,802
10/28/2014	139.30	41.79	2,803
7/3/2005	139.40	41.82	2,804
5/26/2006	139.40	41.82	2,805
2/21/2007	139.50	41.85	2,806
8/29/2011	139.80	41.94	2,807
12/11/2005	139.90	41.97	2,808
9/9/2005	140.20	42.06	2,809
2/1/2013	140.20	42.06	2,810
12/6/2014	140.30	42.09	2,811
4/27/2009	140.50	42.15	2,812
9/26/2009	140.50	42.15	2,813
8/22/2008	140.70	42.21	2,814

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
5/27/2012	140.70	42.21	2,815
6/27/2013	140.70	42.21	2,816
10/6/2009	140.80	42.24	2,817
6/15/2013	141.00	42.30	2,818
10/26/2007	141.30	42.39	2,819
12/7/2011	141.40	42.42	2,820
1/21/2008	141.41	42.42	2,821
7/28/2005	141.50	42.45	2,822
8/14/2007	141.50	42.45	2,823
8/15/2009	141.60	42.48	2,824
11/13/2013	141.60	42.48	2,825
3/4/2012	142.10	42.63	2,826
7/24/2007	142.30	42.69	2,827
5/6/2014	142.30	42.69	2,828
8/12/2009	142.70	42.81	2,829
1/17/2009	142.80	42.84	2,830
3/23/2014	142.80	42.84	2,831
3/11/2006	142.90	42.87	2,832
3/18/2008	143.05	42.92	2,833
10/20/2006	143.10	42.93	2,834
1/7/2008	143.10	42.93	2,835
11/1/2014	143.20	42.96	2,836
10/17/2007	143.40	43.02	2,837
3/26/2011	143.40	43.02	2,838
10/15/2011	143.40	43.02	2,839
7/11/2006	143.50	43.05	2,840
12/15/2014	143.50	43.05	2,841
8/25/2005	143.70	43.11	2,842
8/3/2010	143.70	43.11	2,843
1/9/2006	143.80	43.14	2,844
3/28/2009	143.80	43.14	2,845
2/21/2012	143.90	43.17	2,846
4/24/2015	144.50	43.35	2,847
2/5/2009	144.69	43.41	2,848
1/5/2014	144.80	43.44	2,849
5/23/2015	144.80	43.44	2,850
11/24/2005	144.90	43.47	2,851
8/11/2005	145.00	43.50	2,852
3/15/2006	145.30	43.59	2,853
2/27/2007	145.30	43.59	2,854
7/7/2011	145.40	43.62	2,855
8/4/2010	146.00	43.80	2,856

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
4/8/2011	146.00	43.80	2,857
3/27/2006	146.20	43.86	2,858
11/14/2005	146.30	43.89	2,859
5/5/2014	146.50	43.95	2,860
7/24/2008	146.61	43.98	2,861
2/10/2006	146.80	44.04	2,862
2/20/2007	146.80	44.04	2,863
3/3/2007	146.80	44.04	2,864
2/23/2006	146.90	44.07	2,865
8/3/2007	146.90	44.07	2,866
1/24/2006	147.10	44.13	2,867
4/1/2013	147.10	44.13	2,868
5/12/2013	147.10	44.13	2,869
4/9/2008	147.16	44.15	2,870
5/4/2014	147.40	44.22	2,871
4/30/2006	147.50	44.25	2,872
1/7/2006	147.60	44.28	2,873
4/27/2006	147.60	44.28	2,874
9/23/2007	147.70	44.31	2,875
11/11/2009	147.70	44.31	2,876
3/24/2010	147.70	44.31	2,877
4/8/2015	147.70	44.31	2,878
3/31/2006	147.80	44.34	2,879
4/29/2014	147.80	44.34	2,880
5/14/2014	147.80	44.34	2,881
3/20/2011	147.90	44.37	2,882
11/18/2008	147.99	44.40	2,883
8/2/2009	148.00	44.40	2,884
8/18/2006	148.10	44.43	2,885
4/30/2014	148.10	44.43	2,886
3/8/2011	148.20	44.46	2,887
4/26/2014	148.20	44.46	2,888
4/9/2006	148.30	44.49	2,889
7/3/2010	148.30	44.49	2,890
4/27/2014	148.40	44.52	2,891
10/4/2005	148.50	44.55	2,892
10/15/2007	148.50	44.55	2,893
4/28/2014	148.50	44.55	2,894
5/3/2014	148.50	44.55	2,895
12/12/2014	148.50	44.55	2,896
12/5/2011	148.60	44.58	2,897
8/29/2012	148.60	44.58	2,898

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
2/12/2008	148.63	44.59	2,899
7/10/2006	148.70	44.61	2,900
11/3/2006	149.00	44.70	2,901
3/2/2007	149.20	44.76	2,902
5/1/2014	149.20	44.76	2,903
3/19/2009	149.50	44.85	2,904
12/19/2014	149.50	44.85	2,905
5/25/2015	149.50	44.85	2,906
2/18/2012	149.60	44.88	2,907
3/13/2010	149.70	44.91	2,908
7/24/2005	149.80	44.94	2,909
5/2/2014	149.80	44.94	2,910
7/19/2012	149.90	44.97	2,911
12/18/2007	150.20	45.06	2,912
4/18/2010	150.20	45.06	2,913
8/22/2011	150.20	45.06	2,914
9/20/2012	150.20	45.06	2,915
11/11/2013	150.20	45.06	2,916
5/31/2015	150.20	45.06	2,917
12/19/2007	150.30	45.09	2,918
12/20/2007	150.40	45.12	2,919
8/7/2006	150.70	45.21	2,920
12/8/2011	150.70	45.21	2,921
4/7/2014	150.90	45.27	2,922
2/11/2008	150.91	45.27	2,923
9/15/2012	151.00	45.30	2,924
5/10/2012	151.10	45.33	2,925
6/16/2006	151.50	45.45	2,926
12/21/2007	151.50	45.45	2,927
11/4/2011	151.50	45.45	2,928
2/5/2006	151.60	45.48	2,929
12/17/2007	151.70	45.51	2,930
12/15/2007	151.80	45.54	2,931
12/16/2007	151.80	45.54	2,932
11/2/2014	151.90	45.57	2,933
2/2/2015	151.90	45.57	2,934
12/2/2006	152.10	45.63	2,935
12/14/2007	152.10	45.63	2,936
12/16/2014	152.10	45.63	2,937
5/26/2015	152.10	45.63	2,938
2/10/2008	152.15	45.65	2,939
12/22/2007	152.20	45.66	2,940

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
12/26/2007	152.20	45.66	2,941
1/14/2013	152.30	45.69	2,942
1/4/2013	152.40	45.72	2,943
9/19/2005	152.60	45.78	2,944
11/2/2006	152.60	45.78	2,945
2/6/2008	152.65	45.80	2,946
9/17/2007	152.70	45.81	2,947
12/24/2007	152.70	45.81	2,948
5/2/2015	152.80	45.84	2,949
12/23/2007	152.90	45.87	2,950
11/14/2009	152.90	45.87	2,951
3/29/2014	152.90	45.87	2,952
9/22/2005	153.00	45.90	2,953
3/9/2012	153.00	45.90	2,954
2/8/2008	153.05	45.92	2,955
7/14/2012	153.10	45.93	2,956
5/24/2015	153.10	45.93	2,957
12/25/2007	153.30	45.99	2,958
12/15/2011	153.30	45.99	2,959
1/1/2014	153.40	46.02	2,960
2/4/2008	153.45	46.04	2,961
10/15/2005	153.50	46.05	2,962
3/1/2010	153.50	46.05	2,963
9/28/2007	153.60	46.08	2,964
2/9/2008	153.60	46.08	2,965
2/25/2013	153.60	46.08	2,966
8/13/2011	153.80	46.14	2,967
3/31/2013	153.80	46.14	2,968
3/9/2015	153.80	46.14	2,969
2/24/2007	153.90	46.17	2,970
10/11/2007	153.90	46.17	2,971
6/10/2014	154.00	46.20	2,972
2/3/2008	154.01	46.20	2,973
3/26/2014	154.10	46.23	2,974
1/13/2006	154.20	46.26	2,975
2/9/2013	154.20	46.26	2,976
2/27/2009	154.22	46.27	2,977
2/5/2008	154.30	46.29	2,978
2/7/2008	154.30	46.29	2,979
7/15/2012	154.40	46.32	2,980
4/16/2009	154.50	46.35	2,981
4/29/2006	154.60	46.38	2,982

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
4/28/2007	154.60	46.38	2,983
12/13/2007	154.60	46.38	2,984
2/22/2007	154.70	46.41	2,985
4/30/2012	154.70	46.41	2,986
2/13/2013	154.70	46.41	2,987
4/12/2014	154.70	46.41	2,988
3/21/2007	154.80	46.44	2,989
8/20/2007	154.80	46.44	2,990
11/25/2010	154.80	46.44	2,991
2/24/2013	154.80	46.44	2,992
5/28/2012	154.90	46.47	2,993
3/2/2013	154.90	46.47	2,994
11/13/2005	155.00	46.50	2,995
5/25/2006	155.20	46.56	2,996
1/4/2007	155.40	46.62	2,997
8/12/2008	155.40	46.62	2,998
2/2/2013	155.40	46.62	2,999
8/19/2005	155.50	46.65	3,000
11/18/2005	155.50	46.65	3,001
8/20/2012	155.50	46.65	3,002
12/17/2012	155.50	46.65	3,003
2/23/2007	155.80	46.74	3,004
1/3/2009	155.80	46.74	3,005
11/22/2009	156.10	46.83	3,006
1/28/2006	156.20	46.86	3,007
11/23/2007	156.20	46.86	3,008
10/30/2014	156.20	46.86	3,009
1/8/2010	156.50	46.95	3,010
6/18/2011	156.50	46.95	3,011
10/31/2014	156.50	46.95	3,012
4/8/2006	156.60	46.98	3,013
7/31/2005	156.70	47.01	3,014
4/28/2006	156.70	47.01	3,015
9/1/2005	156.80	47.04	3,016
6/20/2015	156.80	47.04	3,017
3/27/2009	156.90	47.07	3,018
8/9/2011	156.90	47.07	3,019
2/6/2013	156.90	47.07	3,020
9/28/2005	157.00	47.10	3,021
10/13/2009	157.20	47.16	3,022
5/22/2015	157.20	47.16	3,023
11/26/2009	157.30	47.19	3,024

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
7/23/2008	157.43	47.23	3,025
1/8/2007	157.50	47.25	3,026
3/28/2014	157.50	47.25	3,027
8/4/2005	157.60	47.28	3,028
5/5/2015	157.60	47.28	3,029
10/3/2005	157.70	47.31	3,030
3/31/2015	157.70	47.31	3,031
3/4/2007	157.80	47.34	3,032
1/6/2008	157.80	47.34	3,033
11/4/2014	157.80	47.34	3,034
1/4/2015	157.80	47.34	3,035
10/27/2010	157.90	47.37	3,036
5/7/2015	157.90	47.37	3,037
12/1/2014	158.00	47.40	3,038
11/3/2014	158.10	47.43	3,039
11/19/2005	158.20	47.46	3,040
7/4/2012	158.20	47.46	3,041
12/3/2014	158.20	47.46	3,042
12/4/2014	158.20	47.46	3,043
3/14/2012	158.30	47.49	3,044
3/30/2006	158.40	47.52	3,045
5/3/2015	158.40	47.52	3,046
5/4/2015	158.40	47.52	3,047
5/8/2015	158.40	47.52	3,048
4/30/2015	158.50	47.55	3,049
5/1/2015	158.50	47.55	3,050
5/6/2015	158.60	47.58	3,051
12/27/2007	158.70	47.61	3,052
12/5/2014	158.70	47.61	3,053
7/29/2012	158.80	47.64	3,054
4/9/2015	158.80	47.64	3,055
7/12/2012	159.00	47.70	3,056
2/23/2013	159.00	47.70	3,057
12/2/2014	159.00	47.70	3,058
12/25/2008	159.10	47.73	3,059
4/26/2006	159.20	47.76	3,060
11/30/2014	159.20	47.76	3,061
4/7/2012	159.30	47.79	3,062
3/21/2012	159.40	47.82	3,063
6/3/2015	159.50	47.85	3,064
1/5/2006	159.60	47.88	3,065
5/19/2015	159.60	47.88	3,066

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
5/20/2015	159.60	47.88	3,067
12/29/2008	159.70	47.91	3,068
3/30/2014	159.70	47.91	3,069
5/12/2015	159.70	47.91	3,070
5/16/2015	159.70	47.91	3,071
5/17/2015	159.70	47.91	3,072
1/26/2015	159.80	47.94	3,073
5/9/2015	159.80	47.94	3,074
5/10/2015	159.80	47.94	3,075
1/1/2009	159.90	47.97	3,076
1/2/2009	159.90	47.97	3,077
5/11/2015	159.90	47.97	3,078
4/30/2007	160.00	48.00	3,079
4/23/2007	160.10	48.03	3,080
3/14/2009	160.10	48.03	3,081
5/14/2015	160.10	48.03	3,082
5/15/2015	160.10	48.03	3,083
9/29/2005	160.20	48.06	3,084
3/1/2006	160.20	48.06	3,085
5/8/2006	160.20	48.06	3,086
5/9/2006	160.20	48.06	3,087
3/4/2010	160.20	48.06	3,088
5/13/2015	160.20	48.06	3,089
5/21/2015	160.20	48.06	3,090
12/24/2014	160.30	48.09	3,091
7/18/2009	160.40	48.12	3,092
6/5/2015	160.40	48.12	3,093
5/18/2015	160.50	48.15	3,094
6/1/2015	160.50	48.15	3,095
6/2/2015	160.50	48.15	3,096
12/28/2008	160.60	48.18	3,097
6/4/2015	160.60	48.18	3,098
11/5/2009	160.70	48.21	3,099
5/1/2006	160.80	48.24	3,100
12/27/2008	160.80	48.24	3,101
12/20/2009	160.80	48.24	3,102
2/16/2006	160.90	48.27	3,103
5/7/2006	160.90	48.27	3,104
12/30/2008	160.90	48.27	3,105
12/31/2008	161.10	48.33	3,106
8/13/2009	161.10	48.33	3,107
9/28/2012	161.30	48.39	3,108

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
5/18/2013	161.40	48.42	3,109
4/10/2006	161.50	48.45	3,110
5/24/2006	161.50	48.45	3,111
1/4/2008	161.50	48.45	3,112
4/24/2006	161.60	48.48	3,113
12/30/2007	161.60	48.48	3,114
4/14/2006	161.70	48.51	3,115
1/5/2008	161.70	48.51	3,116
4/22/2006	161.80	48.54	3,117
4/24/2012	161.80	48.54	3,118
2/4/2009	161.89	48.57	3,119
5/6/2006	161.90	48.57	3,120
12/29/2007	161.90	48.57	3,121
1/1/2008	161.90	48.57	3,122
1/2/2008	161.90	48.57	3,123
1/3/2008	161.90	48.57	3,124
5/5/2006	162.00	48.60	3,125
12/17/2011	162.00	48.60	3,126
3/29/2006	162.10	48.63	3,127
4/23/2006	162.10	48.63	3,128
12/31/2007	162.10	48.63	3,129
5/13/2006	162.20	48.66	3,130
3/21/2009	162.20	48.66	3,131
4/17/2010	162.20	48.66	3,132
9/11/2012	162.20	48.66	3,133
3/31/2014	162.20	48.66	3,134
4/20/2006	162.30	48.69	3,135
3/27/2014	162.40	48.72	3,136
5/11/2006	162.50	48.75	3,137
5/16/2006	162.50	48.75	3,138
1/12/2006	162.60	48.78	3,139
4/19/2006	162.60	48.78	3,140
8/14/2009	162.60	48.78	3,141
8/16/2011	162.60	48.78	3,142
11/12/2013	162.60	48.78	3,143
4/17/2006	162.70	48.81	3,144
4/25/2006	162.70	48.81	3,145
5/12/2006	162.70	48.81	3,146
11/1/2006	162.70	48.81	3,147
12/28/2007	162.70	48.81	3,148
4/23/2010	162.70	48.81	3,149
11/9/2010	162.70	48.81	3,150

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
10/2/2005	162.80	48.84	3,151
4/21/2006	162.80	48.84	3,152
12/9/2011	162.80	48.84	3,153
9/25/2012	162.80	48.84	3,154
5/15/2013	162.80	48.84	3,155
4/18/2006	162.90	48.87	3,156
5/10/2006	163.00	48.90	3,157
10/5/2009	163.00	48.90	3,158
4/1/2014	163.00	48.90	3,159
4/4/2014	163.00	48.90	3,160
9/10/2005	163.10	48.93	3,161
5/13/2013	163.10	48.93	3,162
4/7/2006	163.20	48.96	3,163
5/23/2006	163.20	48.96	3,164
9/24/2007	163.20	48.96	3,165
3/10/2006	163.30	48.99	3,166
4/15/2006	163.40	49.02	3,167
5/14/2006	163.40	49.02	3,168
5/17/2006	163.40	49.02	3,169
8/6/2006	163.50	49.05	3,170
4/11/2009	163.50	49.05	3,171
4/16/2006	163.60	49.08	3,172
5/20/2006	163.60	49.08	3,173
3/28/2011	163.60	49.08	3,174
5/22/2006	163.70	49.11	3,175
5/30/2013	163.80	49.14	3,176
5/15/2006	163.90	49.17	3,177
5/19/2006	163.90	49.17	3,178
7/22/2014	163.90	49.17	3,179
2/2/2008	163.92	49.18	3,180
11/22/2007	164.00	49.20	3,181
12/19/2009	164.00	49.20	3,182
5/21/2006	164.10	49.23	3,183
12/26/2008	164.20	49.26	3,184
2/24/2006	164.40	49.32	3,185
10/20/2009	164.40	49.32	3,186
5/18/2006	164.70	49.41	3,187
11/21/2009	164.70	49.41	3,188
12/23/2012	164.90	49.47	3,189
8/10/2005	165.00	49.50	3,190
6/22/2012	165.00	49.50	3,191
3/12/2006	165.10	49.53	3,192

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
9/23/2012	165.20	49.56	3,193
4/11/2006	165.30	49.59	3,194
11/2/2007	165.30	49.59	3,195
9/26/2012	165.30	49.59	3,196
4/13/2006	165.40	49.62	3,197
3/30/2013	165.40	49.62	3,198
12/8/2005	165.50	49.65	3,199
7/29/2008	165.78	49.73	3,200
9/30/2007	165.80	49.74	3,201
9/27/2012	165.80	49.74	3,202
3/19/2006	166.00	49.80	3,203
4/11/2015	166.00	49.80	3,204
7/29/2006	166.10	49.83	3,205
7/1/2012	166.10	49.83	3,206
4/12/2006	166.20	49.86	3,207
4/22/2010	166.20	49.86	3,208
5/11/2008	166.30	49.89	3,209
7/12/2006	166.60	49.98	3,210
9/25/2006	166.60	49.98	3,211
10/3/2009	166.70	50.01	3,212
11/19/2008	166.89	50.07	3,213
12/17/2014	167.00	50.10	3,214
9/24/2012	167.10	50.13	3,215
3/20/2006	167.20	50.16	3,216
12/29/2011	167.30	50.19	3,217
5/28/2013	167.30	50.19	3,218
7/30/2005	167.40	50.22	3,219
6/21/2011	167.40	50.22	3,220
7/8/2005	167.50	50.25	3,221
8/1/2009	167.80	50.34	3,222
6/20/2011	167.80	50.34	3,223
4/14/2015	168.10	50.43	3,224
3/7/2006	168.30	50.49	3,225
8/17/2011	168.30	50.49	3,226
2/3/2009	168.49	50.55	3,227
3/1/2013	168.50	50.55	3,228
1/24/2008	168.53	50.56	3,229
4/29/2015	168.60	50.58	3,230
7/9/2006	168.80	50.64	3,231
1/27/2015	168.80	50.64	3,232
9/8/2005	168.90	50.67	3,233
1/9/2013	168.90	50.67	3,234

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
3/20/2014	169.40	50.82	3,235
8/19/2009	169.60	50.88	3,236
6/11/2014	169.90	50.97	3,237
10/4/2009	170.00	51.00	3,238
8/7/2011	170.00	51.00	3,239
10/28/2007	170.30	51.09	3,240
4/26/2007	170.40	51.12	3,241
4/16/2010	170.40	51.12	3,242
12/2/2009	170.50	51.15	3,243
8/11/2011	170.50	51.15	3,244
10/10/2005	170.60	51.18	3,245
12/10/2005	170.60	51.18	3,246
12/12/2005	170.60	51.18	3,247
3/22/2015	170.90	51.27	3,248
3/8/2012	171.00	51.30	3,249
8/20/2005	171.10	51.33	3,250
2/5/2014	171.10	51.33	3,251
2/28/2009	171.37	51.41	3,252
9/26/2006	171.40	51.42	3,253
4/13/2015	171.40	51.42	3,254
8/11/2008	171.50	51.45	3,255
10/5/2005	171.70	51.51	3,256
3/14/2006	171.70	51.51	3,257
4/12/2009	172.00	51.60	3,258
12/28/2011	172.00	51.60	3,259
8/15/2007	172.10	51.63	3,260
11/28/2010	172.10	51.63	3,261
1/6/2006	172.30	51.69	3,262
4/15/2015	172.30	51.69	3,263
8/14/2008	172.70	51.81	3,264
3/28/2012	172.80	51.84	3,265
12/13/2014	172.80	51.84	3,266
2/26/2013	173.30	51.99	3,267
4/6/2014	173.30	51.99	3,268
5/3/2012	173.40	52.02	3,269
1/3/2013	173.40	52.02	3,270
4/16/2015	173.40	52.02	3,271
4/26/2009	173.60	52.08	3,272
5/6/2012	173.60	52.08	3,273
4/10/2015	173.70	52.11	3,274
11/13/2011	173.80	52.14	3,275
9/7/2005	174.00	52.20	3,276

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
10/29/2007	174.10	52.23	3,277
9/13/2005	174.20	52.26	3,278
4/25/2007	174.30	52.29	3,279
9/21/2007	174.40	52.32	3,280
4/23/2012	174.40	52.32	3,281
3/5/2015	174.40	52.32	3,282
2/22/2012	174.70	52.41	3,283
3/3/2006	174.80	52.44	3,284
4/11/2012	174.80	52.44	3,285
7/21/2007	174.90	52.47	3,286
2/17/2013	174.90	52.47	3,287
11/30/2006	175.00	52.50	3,288
2/28/2007	175.00	52.50	3,289
3/18/2007	175.10	52.53	3,290
12/18/2012	175.10	52.53	3,291
3/24/2011	175.20	52.56	3,292
12/18/2014	175.20	52.56	3,293
3/26/2007	175.30	52.59	3,294
3/2/2006	175.40	52.62	3,295
5/27/2013	175.40	52.62	3,296
11/15/2005	175.50	52.65	3,297
4/19/2007	175.50	52.65	3,298
8/8/2011	175.50	52.65	3,299
7/23/2005	175.70	52.71	3,300
1/31/2014	175.70	52.71	3,301
11/6/2005	175.80	52.74	3,302
3/4/2006	176.00	52.80	3,303
3/8/2006	176.30	52.89	3,304
6/20/2012	176.30	52.89	3,305
7/25/2014	176.50	52.95	3,306
1/21/2006	176.60	52.98	3,307
2/13/2006	176.60	52.98	3,308
12/18/2011	176.60	52.98	3,309
3/29/2010	176.70	53.01	3,310
10/26/2005	176.80	53.04	3,311
11/23/2009	176.80	53.04	3,312
3/16/2010	176.80	53.04	3,313
1/13/2013	177.12	53.14	3,314
5/9/2012	177.20	53.16	3,315
5/14/2013	177.20	53.16	3,316
11/12/2005	177.40	53.22	3,317
4/5/2014	177.40	53.22	3,318

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
3/19/2007	177.50	53.25	3,319
11/5/2005	177.60	53.28	3,320
1/7/2007	177.60	53.28	3,321
11/26/2010	177.60	53.28	3,322
12/14/2011	177.90	53.37	3,323
3/23/2010	178.10	53.43	3,324
1/12/2013	178.10	53.43	3,325
4/19/2015	178.10	53.43	3,326
6/19/2011	178.30	53.49	3,327
7/11/2012	178.30	53.49	3,328
4/23/2015	178.30	53.49	3,329
12/1/2010	178.40	53.52	3,330
5/29/2013	178.50	53.55	3,331
4/11/2014	178.50	53.55	3,332
7/24/2014	178.50	53.55	3,333
11/27/2011	178.80	53.64	3,334
4/21/2007	178.90	53.67	3,335
9/27/2007	179.00	53.70	3,336
1/22/2008	179.07	53.72	3,337
10/31/2010	179.10	53.73	3,338
7/23/2007	179.20	53.76	3,339
2/20/2006	179.60	53.88	3,340
4/8/2010	179.60	53.88	3,341
10/12/2009	179.70	53.91	3,342
3/9/2006	180.10	54.03	3,343
9/20/2007	180.10	54.03	3,344
3/27/2011	180.10	54.03	3,345
1/7/2013	180.10	54.03	3,346
3/1/2007	180.20	54.06	3,347
2/28/2013	180.40	54.12	3,348
1/28/2010	180.50	54.15	3,349
1/5/2007	180.60	54.18	3,350
1/8/2013	180.60	54.18	3,351
3/28/2010	180.80	54.24	3,352
1/11/2013	180.80	54.24	3,353
4/17/2015	180.80	54.24	3,354
10/10/2007	180.90	54.27	3,355
2/12/2013	180.90	54.27	3,356
12/28/2013	181.05	54.32	3,357
3/9/2009	181.20	54.36	3,358
6/2/2012	181.20	54.36	3,359
2/22/2006	181.30	54.39	3,360

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
9/18/2007	181.40	54.42	3,361
11/16/2009	181.40	54.42	3,362
4/23/2009	181.50	54.45	3,363
4/15/2009	181.70	54.51	3,364
2/27/2013	181.70	54.51	3,365
4/20/2015	181.70	54.51	3,366
2/1/2008	181.71	54.51	3,367
7/20/2005	182.10	54.63	3,368
10/25/2005	182.10	54.63	3,369
4/12/2010	182.10	54.63	3,370
10/29/2010	182.10	54.63	3,371
3/3/2012	182.10	54.63	3,372
7/31/2012	182.20	54.66	3,373
12/29/2013	182.25	54.68	3,374
3/1/2009	182.43	54.73	3,375
3/5/2010	182.50	54.75	3,376
7/16/2012	182.60	54.78	3,377
12/27/2011	182.70	54.81	3,378
1/10/2013	182.70	54.81	3,379
2/28/2006	182.80	54.84	3,380
4/10/2009	182.80	54.84	3,381
4/9/2010	182.80	54.84	3,382
9/15/2005	182.90	54.87	3,383
3/10/2014	183.30	54.99	3,384
4/2/2007	183.40	55.02	3,385
12/4/2009	183.40	55.02	3,386
3/23/2012	183.40	55.02	3,387
4/17/2007	183.50	55.05	3,388
4/22/2009	183.60	55.08	3,389
3/28/2015	183.80	55.14	3,390
10/14/2005	183.90	55.17	3,391
2/23/2012	184.10	55.23	3,392
3/6/2006	184.30	55.29	3,393
3/11/2009	184.30	55.29	3,394
4/15/2010	184.30	55.29	3,395
1/6/2013	184.30	55.29	3,396
8/21/2011	184.40	55.32	3,397
6/27/2012	184.40	55.32	3,398
3/12/2009	184.50	55.35	3,399
7/18/2012	184.80	55.44	3,400
3/13/2006	184.90	55.47	3,401
6/1/2012	184.90	55.47	3,402

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
10/9/2005	185.00	55.50	3,403
1/17/2006	185.00	55.50	3,404
3/12/2010	185.00	55.50	3,405
3/2/2009	185.01	55.50	3,406
10/5/2007	185.10	55.53	3,407
4/6/2009	185.10	55.53	3,408
9/25/2007	185.60	55.68	3,409
7/30/2012	185.60	55.68	3,410
10/11/2005	185.70	55.71	3,411
6/30/2012	185.70	55.71	3,412
4/3/2010	185.90	55.77	3,413
11/9/2011	185.90	55.77	3,414
11/10/2011	186.10	55.83	3,415
4/21/2009	186.20	55.86	3,416
9/14/2005	186.30	55.89	3,417
4/10/2010	186.50	55.95	3,418
12/30/2013	186.50	55.95	3,419
3/13/2012	186.70	56.01	3,420
7/23/2014	186.70	56.01	3,421
1/6/2007	186.90	56.07	3,422
9/18/2005	187.00	56.10	3,423
3/29/2009	187.00	56.10	3,424
6/26/2012	187.00	56.10	3,425
12/20/2012	187.00	56.10	3,426
3/15/2010	187.10	56.13	3,427
1/5/2013	187.40	56.22	3,428
4/13/2014	187.40	56.22	3,429
3/8/2015	187.40	56.22	3,430
7/22/2005	187.60	56.28	3,431
11/7/2005	187.70	56.31	3,432
10/6/2007	187.70	56.31	3,433
2/22/2013	187.70	56.31	3,434
8/9/2005	187.80	56.34	3,435
3/30/2009	187.80	56.34	3,436
2/19/2009	187.89	56.37	3,437
3/4/2009	187.90	56.37	3,438
11/15/2009	187.90	56.37	3,439
4/14/2010	187.90	56.37	3,440
11/1/2010	187.90	56.37	3,441
2/21/2009	187.97	56.39	3,442
3/8/2009	188.00	56.40	3,443
11/23/2011	188.00	56.40	3,444

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
9/22/2007	188.10	56.43	3,445
6/24/2012	188.10	56.43	3,446
3/3/2009	188.13	56.44	3,447
7/14/2005	188.20	56.46	3,448
11/11/2005	188.20	56.46	3,449
7/11/2005	188.30	56.49	3,450
7/19/2005	188.30	56.49	3,451
1/27/2006	188.40	56.52	3,452
2/4/2006	188.40	56.52	3,453
4/18/2007	188.40	56.52	3,454
10/4/2007	188.40	56.52	3,455
7/3/2012	188.50	56.55	3,456
2/20/2009	188.55	56.57	3,457
3/13/2009	188.60	56.58	3,458
2/26/2009	188.72	56.62	3,459
9/19/2007	188.80	56.64	3,460
12/22/2012	188.80	56.64	3,461
3/25/2010	188.90	56.67	3,462
3/6/2015	188.90	56.67	3,463
6/21/2012	189.00	56.70	3,464
7/21/2005	189.10	56.73	3,465
3/7/2010	189.10	56.73	3,466
3/9/2010	189.10	56.73	3,467
5/7/2012	189.10	56.73	3,468
4/4/2009	189.20	56.76	3,469
3/5/2009	189.30	56.79	3,470
12/31/2013	189.30	56.79	3,471
10/29/2005	189.40	56.82	3,472
10/3/2007	189.40	56.82	3,473
4/10/2012	189.50	56.85	3,474
10/2/2007	189.60	56.88	3,475
3/21/2010	189.60	56.88	3,476
7/17/2012	189.70	56.91	3,477
4/12/2015	189.70	56.91	3,478
3/7/2009	189.80	56.94	3,479
10/13/2005	189.90	56.97	3,480
10/9/2007	189.90	56.97	3,481
3/6/2009	189.90	56.97	3,482
3/27/2010	189.90	56.97	3,483
4/7/2010	189.90	56.97	3,484
10/30/2010	189.90	56.97	3,485
5/7/2011	189.90	56.97	3,486

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
2/25/2009	189.99	57.00	3,487
7/17/2005	190.00	57.00	3,488
10/31/2005	190.00	57.00	3,489
2/15/2006	190.00	57.00	3,490
3/26/2009	190.00	57.00	3,491
7/29/2005	190.10	57.03	3,492
3/20/2010	190.10	57.03	3,493
12/26/2011	190.10	57.03	3,494
3/22/2012	190.10	57.03	3,495
4/5/2009	190.40	57.12	3,496
4/9/2009	190.40	57.12	3,497
12/13/2011	190.40	57.12	3,498
3/11/2010	190.60	57.18	3,499
9/17/2005	190.70	57.21	3,500
1/26/2006	190.70	57.21	3,501
3/19/2010	190.70	57.21	3,502
7/10/2012	190.70	57.21	3,503
4/22/2015	190.80	57.24	3,504
10/30/2005	190.90	57.27	3,505
3/8/2010	190.90	57.27	3,506
4/4/2010	190.90	57.27	3,507
4/6/2010	190.90	57.27	3,508
3/15/2014	190.90	57.27	3,509
3/26/2010	191.00	57.30	3,510
6/25/2012	191.00	57.30	3,511
11/4/2005	191.10	57.33	3,512
3/31/2009	191.10	57.33	3,513
6/23/2012	191.10	57.33	3,514
3/22/2010	191.20	57.36	3,515
4/11/2010	191.20	57.36	3,516
10/7/2007	191.30	57.39	3,517
11/28/2009	191.30	57.39	3,518
7/13/2012	191.30	57.39	3,519
4/18/2015	191.30	57.39	3,520
4/1/2009	191.40	57.42	3,521
4/25/2009	191.40	57.42	3,522
11/17/2009	191.40	57.42	3,523
4/5/2010	191.50	57.45	3,524
4/10/2014	191.50	57.45	3,525
3/10/2009	191.60	57.48	3,526
4/8/2009	191.60	57.48	3,527
12/22/2011	191.60	57.48	3,528

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
4/2/2009	191.80	57.54	3,529
4/3/2009	191.80	57.54	3,530
10/28/2010	191.80	57.54	3,531
7/10/2005	191.90	57.57	3,532
10/8/2007	191.90	57.57	3,533
11/5/2010	191.90	57.57	3,534
12/23/2011	191.90	57.57	3,535
2/21/2006	192.10	57.63	3,536
11/1/2007	192.10	57.63	3,537
12/12/2011	192.10	57.63	3,538
1/28/2008	192.16	57.65	3,539
1/25/2006	192.20	57.66	3,540
2/7/2013	192.20	57.66	3,541
12/19/2011	192.30	57.69	3,542
8/8/2005	192.40	57.72	3,543
10/1/2007	192.40	57.72	3,544
1/20/2008	192.40	57.72	3,545
11/12/2011	192.40	57.72	3,546
4/21/2015	192.50	57.75	3,547
7/22/2007	192.60	57.78	3,548
3/10/2010	192.60	57.78	3,549
4/7/2009	192.70	57.81	3,550
5/8/2012	192.70	57.81	3,551
10/8/2005	192.80	57.84	3,552
11/10/2005	192.80	57.84	3,553
2/14/2006	192.80	57.84	3,554
12/25/2011	192.80	57.84	3,555
2/19/2012	192.90	57.87	3,556
12/1/2006	193.00	57.90	3,557
3/20/2007	193.00	57.90	3,558
12/5/2009	193.00	57.90	3,559
3/18/2010	193.00	57.90	3,560
4/13/2010	193.00	57.90	3,561
3/19/2014	193.00	57.90	3,562
7/13/2005	193.10	57.93	3,563
3/11/2014	193.10	57.93	3,564
3/27/2015	193.10	57.93	3,565
4/13/2009	193.20	57.96	3,566
12/3/2010	193.20	57.96	3,567
4/9/2012	193.20	57.96	3,568
12/21/2012	193.20	57.96	3,569
2/3/2006	193.30	57.99	3,570

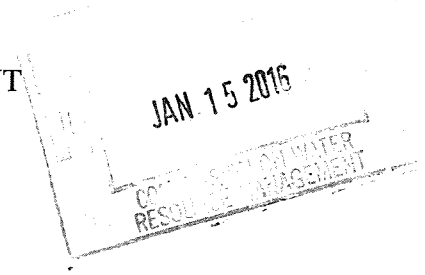
WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
7/16/2005	193.40	58.02	3,571
3/6/2010	193.40	58.02	3,572
12/24/2011	193.40	58.02	3,573
7/9/2012	193.40	58.02	3,574
9/26/2007	193.50	58.05	3,575
6/29/2012	193.50	58.05	3,576
12/21/2011	193.60	58.08	3,577
2/20/2013	193.60	58.08	3,578
3/5/2006	193.70	58.11	3,579
2/18/2013	193.70	58.11	3,580
4/20/2014	193.70	58.11	3,581
5/6/2011	193.80	58.14	3,582
3/22/2014	193.80	58.14	3,583
12/1/2009	193.90	58.17	3,584
4/24/2007	194.10	58.23	3,585
4/21/2014	194.12	58.24	3,586
10/24/2005	194.20	58.26	3,587
11/3/2005	194.20	58.26	3,588
5/5/2012	194.20	58.26	3,589
4/23/2014	194.20	58.26	3,590
7/12/2005	194.30	58.29	3,591
4/24/2009	194.40	58.32	3,592
12/10/2011	194.40	58.32	3,593
3/7/2015	194.40	58.32	3,594
4/14/2009	194.50	58.35	3,595
12/11/2011	194.60	58.38	3,596
7/9/2005	194.70	58.41	3,597
2/27/2006	194.70	58.41	3,598
10/7/2005	194.90	58.47	3,599
10/12/2005	194.90	58.47	3,600
7/8/2012	194.90	58.47	3,601
7/18/2005	195.00	58.50	3,602
10/28/2005	195.00	58.50	3,603
11/9/2005	195.00	58.50	3,604
11/20/2009	195.00	58.50	3,605
7/15/2005	195.10	58.53	3,606
11/6/2010	195.10	58.53	3,607
4/19/2014	195.10	58.53	3,608
4/28/2015	195.10	58.53	3,609
1/29/2008	195.15	58.55	3,610
11/11/2011	195.20	58.56	3,611
4/9/2014	195.30	58.59	3,612

WAILOA DITCH FLOWS AT HONOPOU 2005-2015

Date	Wailoa Ditch at Honopou - MGD	Wailoa Ditch at Honopou EMI 30% MGD	Days
12/20/2011	195.40	58.62	3,613
3/18/2014	195.50	58.65	3,614
4/15/2014	195.50	58.65	3,615
4/16/2014	195.50	58.65	3,616
3/25/2012	195.60	58.68	3,617
6/28/2012	195.70	58.71	3,618
2/8/2013	195.70	58.71	3,619
4/18/2014	195.70	58.71	3,620
11/29/2009	195.80	58.74	3,621
11/8/2010	195.80	58.74	3,622
3/24/2012	195.80	58.74	3,623
3/27/2012	195.90	58.77	3,624
1/30/2008	195.94	58.78	3,625
4/17/2014	196.10	58.83	3,626
11/2/2005	196.20	58.86	3,627
1/29/2014	196.30	58.89	3,628
10/6/2005	196.50	58.95	3,629
1/30/2014	196.50	58.95	3,630
11/1/2005	196.60	58.98	3,631
11/27/2009	196.60	58.98	3,632
11/19/2009	196.80	59.04	3,633
1/31/2008	196.81	59.04	3,634
2/19/2013	196.90	59.07	3,635
11/30/2009	197.00	59.10	3,636
3/7/2012	197.00	59.10	3,637
5/4/2012	197.00	59.10	3,638
3/17/2014	197.00	59.10	3,639
4/22/2014	197.00	59.10	3,640
3/26/2012	197.10	59.13	3,641
3/16/2014	197.10	59.13	3,642
11/8/2005	197.20	59.16	3,643
2/21/2013	197.20	59.16	3,644
11/4/2010	197.30	59.19	3,645
11/18/2009	197.70	59.31	3,646
4/14/2014	197.80	59.34	3,647
9/16/2005	197.90	59.37	3,648
4/8/2014	197.90	59.37	3,649
3/6/2012	198.00	59.40	3,650
10/23/2005	198.70	59.61	3,651
11/7/2010	198.90	59.67	3,652

COMMISSION ON WATER RESOURCE MANAGEMENT



STATE OF HAWAII

PETITION TO AMEND INTERIM INSTREAM FLOW STANDARDS FOR HONOPOU, HUELO (PUOLUA), HANEHOI, WAIKAMOI, ALO, WAHINEPEE, PUOHOKAMOA, HAIPUAENA, PUNALAU/KOLEA, HONOMANU, NUAAILUA, PIINAAU, PALAUHULU, OHIA (WAIANU), WAIOKAMILO, KUALANI, WAILUANUI, WEST WAILUAIKI, EAST WAILUAIKI, KOPILIULA, PUAKAA, WAIOHUE, PAAKEA, WAIAAKA, KAPAULA, HANAWI, AND MAKIPIPI STREAMS	)	Case No.. CCH-MA13-01

MINUTE ORDER 16

HEARINGS OFFICER'S PROPOSED FINDINGS OF FACT, CONCLUSIONS OF LAW, & DECISION AND ORDER

Attached are the Hearings Officer's Proposed Findings of Fact, Conclusions of Law, and Decision and Order.

The Commission on Water Resource Management ("Commission") is providing the opportunity for any party in this case to file written exceptions to the Proposed Findings of Fact, Conclusions of Law, and Decision and Order. The deadline to file written exceptions is Close of Business, **February 12, 2016**. Any party wishing to present oral arguments on the written exceptions must submit written exceptions by the deadline.

Please address your written exceptions to the Commission.

The Commission will hear oral arguments on the written exceptions at a date, time, and place to be announced.

DATED: Honolulu, Hawai`i January 15, 2016

LAWRENCE H. MIIKE, Hearings Officer
Commission on Water Resource Management

COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII

FILED
JAN 15 2016
COMMISSION ON WATER RESOURCE MANAGEMENT

PETITION TO AMEND INTERIM INSTREAM FLOW STANDARDS FOR HONOPOU, HANEHOI/PUOLUA (HUELO), WAIKAMOI, ALO, WAHINEPEE, PUOHOKAMOA, HAIPUAENA, PUNALAU/KOLEA, HONOMANU, NUAAILUA, PIINAU, PALAUHULU, OHIA (WAIANU), WAIOKAMILO, KUALANI (HAMAU), WAILUANUI, WAIKANI, WEST WAILUAIKI, EAST WAILUAIKI, KOPILIULA, PUAKAA, WAIOHUE, PAAKEA, WAIAAKA, KAPAULA, HANAWI, AND MAKAPIPI STREAMS	)	Case No. CCH-MA13-01

HEARINGS OFFICER'S

PROPOSED FINDINGS OF FACT, CONCLUSIONS OF LAW, &

DECISION AND ORDER

TABLE OF CONTENTS

Hearings Officer's Proposed Findings of Fact, Conclusions of Law, and Decision and Order

The Hearings Officer makes the following Findings of Fact ("FOF"), Conclusions of Law ("COL"), and Decision and Order ("D&O"), based on the records maintained by the Commission on Water Resource Management, Department of Land and Natural Resources ("Commission") on contested case number CCH-MA13-01, Petition to Amend Interim Instream Flow Standards for Honopou, Hanehoi/Puolua (Huelo), Waikamoi, Alo, Wahinepee, Puohokamoa, Haipuaena, Punalau/Kolea, Honomanu, Nuaailua, Piinau, Palauhulu, Ohia (Waianu), Waiokamilo, Kualani (Hamau), Wailuanui, Waikani, West Wailuaiki, East Wailuaiki, Kopiliula, Puakaa, Waiohue, Paakea, Waiaaka, Kapaula, Hanawi, and Makapipi Streams, and the witness testimonies and exhibits presented and accepted into evidence.

If any statement denominated a COL is more properly considered a FOF, then it should be treated as an FOF; and conversely, if any statement denominated as a FOF is more properly considered a COL, then it should be treated as a COL.

Proposed FOF not incorporated in this D&Or have been excluded because they may be duplicative, not relevant, not material, taken out of context, contrary (in whole or in part) to the found facts, an opinion (in whole or in part), contradicted by other evidence, or contrary to law. Proposed FOF that have been incorporated may have minor modifications or corrections that do not substantially alter the meaning of the original findings.

I. FINDINGS OF FACT[1]

A. Sequence of Events Leading to the Contested Case

1. On May 24, 2001, the Native Hawaiian Legal Corporation ("NHLC") filed 27 Petitions to Amend the IIFS for 27 East Maui streams on behalf of Nā Moku `Aupuni `O Ko`olau Hui

[1] References to the record are enclosed in parentheses, followed by a party's proposed Finding of Fact ("FOF"), if accepted. "Exh." refers to exhibits accompanying written or oral testimony, followed by the exhibit number and page or table number, if necessary. Written testimony is referred to as follows: name of the witness, the type of written testimony, and the page number or paragraph of that testimony. "WDT" means written direct testimony or witness statement; and "WRT" means written responsive testimony or the written rebuttal testimony to the written responsive testimony. Oral testimony is referred to as follows: name of the witness, the date of the transcript ("Tr."), and the page number.

("Nā Moku"), Beatrice Kepani Kekahuna, Marjorie Wallett, and Elizabeth Lehua Lapenia[2]. The petitions were accepted on July 13, 2001. (Commission meeting of August 28, 2008, p. 1.)

2. By a letter dated July 26, 2001, NHLC memorialized its conversation with Commission staff and reiterated its request for the Commission to focus its efforts to restore streamflow to Honopou, Hanehoi, Kualani, Piinau, Palauhulu, Waiokamilo, and Wailuanui streams. (*Id.*)

3. Including the addition of Puolua (Huelo) Stream, these eight streams were eventually organized into five surface water hydrologic units: 1) Honopou (6034) surface water hydrologic unit contains Honopou Stream; 2) Hanehoi (6037) contains Hanehoi and Puolua (Huelo) Streams; 3) Piinaau (6053) contains Piinaau and Palauhulu Streams; 4) Waiokamilo (6055) contains Waiokamilo and Kualani Streams; and 5) Wailuanui (6056) contains Wailuanui Stream.[3] (Exh. C-85, pp. 1-2.)

4. From July 2001, there were meetings, site visits, and discussions among the interested parties regarding the possibility of a collaborative effort to carry out stream studies for the area. On March 20, 2002, the Commission approved a cooperative agreement between the United States Geological Survey ("USGS") and the Commission for the Water Resources Investigations for Northeast Maui streams. The Study was to run from October 2, 2002 to September 30, 2005. The study was completed in January 2006. (*Id.*)

5. On May 29, 2008, NHLC filed a complaint on behalf of Nā Moku, Beatrice Kekahuna, Marjorie Wallet, and Maui Tomorrow Foundation, Inc. ("MTF"), alleging that HC&S was wasting water, based on testimony of an HC&S employee who testified at the Board of Land and Natural Resources ("BLNR") contested case hearing on November 15, 2005. The waste complaint was resolved after staff corresponded with the parties. (Staff Submittal to Clarify the Scope of the Proceedings for the Contested Case Hearing on Remand from the Intermediate Court of Appeals No. CAAP-10-0000161, August 20, 2014, p. 2.)

6. On August 18, 2008, HC&S filed a Motion to Consolidate Petitions to Amend Interim Instream Flow Standards for East Maui Streams and Complaint Relating Thereto Filed May 29, 2008. In the motion, HC&S requested that the Commission consolidate all 27 previously filed petitions into one and to consider amending the IIFS for all 27 streams in one unified proceeding. (Staff submittal, August 28, 2008, p. 2.)

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[2] The Commission was notified by letter on May 10, 2007, that NHLC no longer represented Ms. Lapenia.

[3] The petition to amend the IIFS for Waikani Waterfall (Stream) was consolidated with and addressed as part of the petition to amend the IIFS for East and West Wailuanui Streams, hereinafter referred to as "Wailuanui Stream." (Staff submittal, September 24, 2008, p. 2.)

7. On September 24, 2008, the Commission denied HC&S's motion . (Exh. C-89, p. 9.)

8. On September 25, 2008, the Commission voted to accept staff's recommendation to accept the Petition to Amend the Interim Instream Flow Standards for the Surface Water Hydrologic Units of Honopou (6034), Hanehoi (6037), Piinaau (6053), Waiokamilo (6055), and Wailuanui (6056), Maui. (*Ibid.*, p. 30.)

9. Six of the eight streams in these five surface water hydrologic units had some diverted water restored, for a total of 4.5 mgd (7 cfs)[4]: 1) Honopou Stream; 2) Hanehoi Stream; 3) Puolua (Huelo) Stream; 4) Palauhulu Stream; 5) Waiokamilo Stream; and 6) Wailuanui Stream. Two streams, Piinaau and Kualani Streams, were not restored. (Exh. C-85, pp. 60-62; Exh. C-103, p. 4.)

10. In accepting staff's recommendation, the Commission added three amendments, the first of which was that "(m)oving forward on the staff's recommendation is the first step in (an) integrated approach to all 27 (twenty-seven) streams that are the subject of these petitions." Then Chair Thielen had stated in the preceding discussion that "if people are not happy at the end of the year, when the Commission makes any decisions, they would have the ability to request a contested case hearing at that time. Cooperation now is not a waiver of any body's rights to contest that at a later date." After the vote to accept staff's recommendation with amendments, Chair Thielen stated that "the main thing that was passed today is setting minimum instream flow standards that require some infrastructure change, require some evaluation, cooperation and then coming back to the Commission and making final recommendations for the entire 27 stream units." (Exhs. C-89, pp. 27, 30-31.)

11. On December 16-17, 2009, the Commission met to consider staff's recommendations for the remaining 19 streams. Additional information was requested before the Commission would make its decision, including a focus on seasonal IIFS—i.e., different IIFS for wet versus dry seasons. (Exhs. C-90, C-106.)

12. On May 25, 2010, the Commission voted to amend the IIFS through a seasonal approach to address habitat availability for native stream animals for six of the remaining 19 streams, with winter total restorative amounts of 9.45 mgd, and summer restoration reduced to 1.11 mgd. (Exh. HO-1.).)

13. Together with the additions for the first eight streams (six of which were amended) that totaled 4.5 mgd (*supra,*FOF 9), total stream restorations for the 27 streams were as follows: 12 of

[4] But see FOF 183, *infra,* where the total is 4.65 mgd.

27 streams restored by a total of 13.95 mgd in the wet season, reduced to 5.61 mgd in the dry season.

14. Commission staff had estimated total diversions by East Maui Irrigation (EMI) as ranging from 134 mgd in the winter months to 268 mgd in the summer months, averaging about 167 mgd. (Exh. C-85, p. 22; Exh. C-103, p. 18, table 4.)

15. Increasing the IIFS for 12 of the 27 streams by 13.95 mgd in the wet (winter) season, and reducing the total for these 12 streams to 5.61 mgd in the dry (summer) season, resulted in: 1) winter months: 13.95 mgd returned to the streams, leaving 120.05 (134 – 13.95) mgd to continue to be diverted; and 2) summer months: 5.61 mgd returned to the streams, leaving 262.39 (268 – 5.61) mgd to continue to be diverted. Thus, in the winter months, 10.4 (13.95/134) percent of diversions would be returned to the streams, and in the summer months, 2.1 (5.61/268) percent would be returned.

16. HC&S had submitted a consultant's paper on September 12, 2008, *Importance of the Hawaiian Commercial & Sugar Company to the Hawaii Economy and Conditions for Its Survival: A consultant Paper by Leroy O. Laney, Ph.D.* Commission staff stated that "HC&S plays an important role in Maui's economy...however, the paper fails to provide any data with regards to water usage by HC&S or any data that demonstrates the impacts of specific reductions in water availability." (Exh. C-85, p.4.)

17. HC&S had calculated its water usage as 5,064 gallons per acre per day (gad) in the winter months and 10,128 gad in the summer months, but Commission staff found this to be high and had calculated average irrigation needs for sugarcane to range from 1,400 to 6, 000 gad. (Exh. C-85, p. 8.)

18. Despite these earlier conclusions by Commission staff (*supra*, COL 16-17), in its May 25, 2010 submittal, staff stated the following, based on additional information provided by HC&S: "On average, streamflow provides 167 mgd of water to the plantation with an additional 72 mgd from ground water sources. Evidently, the plantation's water needs greatly exceed surface water sources otherwise HC&S would not expend the cost to pump water from its brackish water wells to supplement surface water sources. Pumping costs can range from $32 to $290 per million gallons (*citation omitted*). With decreasing trends in streamflow, east Maui streams will continue to be an insufficient supply of surface water needs for the plantation regardless of interim IFS adoption (*footnote omitted*). (Exh. C-103, p. 14-15.)

19. Staff did not attempt to reconcile its May 25, 2010 opinion with its earlier September 24, 2008 opinion, nor did the Commission discuss this issue before reaching its decision on the remaining 19 streams. (Exhs. C-91, E-60.)

20. At the end of the May 25, 2010 meeting, petitioners requested a contested case. (Exhs. C-91, E-60, p. 50.)

21. On June 3, 2010, Nā Moku filed a Petition for a Contested Case for "(p)etitioners right to sufficient stream flow to support the exercise of their traditional and customary native Hawaiian rights to growing kalo and gathering in, among, and around East Maui streams and estuaries and the exercise of other rights for religious, cultural and subsistence purposes. Specifically, the rights of members to engage in such practices in, on, and near Waikamoi, Puohokamoa, Haipuaena, Punalau/Kolea, Honomanu, West Wailuaiki, East Wailuaiki, Kopiliula and Puakaa, Waiohue, Paakea, Kapaula, Hanawi streams from HRS § 1-1 and HRS § 7-1 and protected under HRS § 174-101." (Exh. C-92, p. 3.)

22. Petitioner's request for a contested case identified five of the six streams that had their IIFS amended, and eight of the 13 streams that had been left at their status quo IIFS in the Commission's May 25, 2010 decision. (Staff Submittal on the request for a contested case hearing, October 18, 2010, p. 4, table 1.)

23. On June 3, 2010, County of Maui, Department of Water Supply ("MDWS"), also had filed a contested case petition, citing as its reasons that: 1) "any decision will directly affect MDWS's ability to provide water to homes, farms, schools, hospitals, churches, and businesses in Upcountry Maui, as MDWS's Upcountry System relies heavily on surface water"; and 2) "MDWS is the public water supplier for the County. MDWS is in the best position to represent the public's interest in continued use of these resources for the Upcountry Maui public water supply." (Application to be a Party in a Contested Case Hearing Before the Commission on Water Resource Management, June3, 2010, p. 2.)

24. On October 18, 2010, the Commission voted to deny the petition on the basis that "(n)either petitioner has a property interest in the determination of the public's interest in stream flows," and "(t)he amendment of the interim IFS for the subject streams was couched in terms of flows required at a particular point in the stream. The Commission's decision did not give any party any rights or privileges in the stream flows." Therefore, "it is clear there was no requirement for the Commission to hold a contested case hearing prior to making a decision on

the amendment of interim IFS for the 16 hydrologic units in east Maui." (Exh. C-93, p. 5, pp. 3-4.)

25. On November 17, 2010, Nā Moku filed a timely notice of appeal, contending that the Commission erred in: 1) concluding that Nā Moku had no right to a contested case hearing; and 2) reaching its underlying decision regarding IIFS amendment for the nineteen streams at issue. (*In Re Petition to Amend Interim Instream Flow Standardsfor Waikamoi, Puohokamoa, Haipuaena, Punalau/Kolea, Honomanu, West Wailuaiki, East Wailuaiki, Kopiliula, Puakaa, Waiohue, Paakea, Kapaula and Hanawi Streams*, Hawai`i Intermediate Court of Appeals, CAAP-10-0000161, November 30, 2012, pp. 2-3.)

26. On November 30, 2012, the Intermediate Court of Appeals vacated the Commission's October 18, 2010 denial of Nā Moku's Petition for Hearing and remanded the matter to the Commission with instructions to grant Nā Moku's Petition for Hearing and to conduct a contested case hearing pursuant to HRS Chapter 91 and in accordance with state law. (*Ibid.*, p. 8.)

27. In its ruling, the Intermediate Court Appeals concluded that "(t)he May 25, 2010 meeting, at which the Commission reached an IIFS determination for the nineteen streams, did not comply with the adjudicatory procedures of HAPA (Hawai`i Administrative Procedures Act). Among other things, the Commission did not produce a written decision accompanied by findings of fact and conclusions of law. We consequently decline Nā Moku's invitation to address the merits of whether the Commission erred in reaching its determination on the petitions to amend the IIFS for the nineteen streams, as argued in the parties' briefs. This matter is to be properly presented, argued, and decided pursuant to an HRS chapter 91 contested case hearing conducted by the Commission, the body statutorily empowered to make this determination." (*Ibid.*, pp. 7-8.)

28. On January 29, 2014, Lawrence Miike was appointed Hearings Officer.[5]

29. On March 4, 2014, a prehearing conference was held to establish timetables for the contested case proceedings. (Minute Order #1, February 25, 2014.)

30. On April 21, 2014, Nā Moku, MDWS, HC&S,[6] Hawaii Farm Bureau Federation, and MTF, were granted standing. (Minute Order #2, April 21, 2014.)

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[5] Dr. Miike was a member of the Commission from 1994 to 1998 and from 2004 to 2012. He was a member of the Commission at the time of its September 24, 2008 decision on the first eight streams, the May 25, 2010 decision on the remaining 19 streams, and the October 18, 2010 decision to deny standing to Nā Moku. Dr. Miike voted to approve the staff recommendation (with amendments) on the first eight streams, dissented from the majority's approval of the remaining 19 streams, and did not attend the meeting where the Commission denied standing to Nā Moku.

31. On May 13, 2014, MTF withdrew as a party to the contested case, without prejudice to the ability of its supporters, Neola Caveny and Ernest Shupp, to continue as parties. (Letter of May 13, 2014, from Isaac Hall, attorney for Maui Tomorrow Foundation, Inc.; Minute Order #6, May 28, 2014.)

32. On June 6, 2014, MTF requested that it be reinstated as a party to the contested case, and the request was granted on June 9, 2014. (Minute Order #8, June 9, 2014.)

33. On June 30, 2014, a hearing was held to address the Hearings Officer's proposal that the contested case must address all 27 streams in an integrative approach and not just the thirteen streams named in the request for the contested case. (Minute Order #7, May 30, 2014; Transcript of due process hearing, June 30, 2014.)

34. At the June 30, 2014 hearing, the Hearings Officer ruled that all 27 streams would be addressed in the contested case, because:

a. the Commission's decision on the first eight streams amended the staff recommendation to state that "(m)oving forward on the staff's recommendation is the first step in (an) integrated approach to all 27 (twenty-seven) streams that are the subject of these petitions," FOF 10, *supra*;

b. the Intermediate Court of Appeals had ruled that "(t)he May 25, 2010 meeting, at which the Commission reached an IIFS determination for the nineteen streams, did not comply with the adjudicatory procedures of HAPA (Hawai`i Administrative Procedures Act). Among other things, the Commission did not produce a written decision accompanied by findings of fact and conclusions of law. We consequently decline Nā Moku's invitation to address the merits of whether the Commission erred in reaching its determination on the petitions to amend the IIFS for the nineteen streams, as argued in the parties' briefs. This matter is to be properly presented, argued, and decided pursuant to an HRS chapter 91 contested case hearing conducted by the Commission, the body statutorily empowered to make this determination," FOF 27, *supra*;

c. neither the Commission's decision on the first eight streams nor its decision on the remaining 19 streams met the legal requirements for establishing IIFS, as those decisions did not "weigh the importance of the present or potential instream values with the importance of the present or potential uses of water for noninstream purposes, including the economic impact of restricting such uses," H.R.S. § 174C-71(2)(D); and

[6] Alexander and Baldwin, Inc./EMI/HC&S.

d. the Commission cannot evaluate the cumulative impact of existing and proposed diversions on trust purposes without assessing the impacts of diversions on all 27 streams. (Transcript of due process hearing, June 30, 2013, pp. 28-41.)

35. On July 16, 2014, the Commission met to discuss a Proposed Procedural Order to conduct a Contested Case Hearing for all twenty-seven (27) streams. (Proposed Procedural Order to clarify the scope of the proceeding and Contested Case Hearing, July 16, 2014.)

36. On August 20, 2014, the Commission voted to authorize, order, delegate, and direct the Hearings Officer to conduct a Contested Case Hearing on Petitions to Amend the Interim Instream Flow Standards for all twenty seven (27) Petitions and streams filed by NHLC. (Minutes of the Commission Meeting of August 20, 2014, pp. 9-10.)

37. On September 9, 2014, the Hearings Officer issued a revised schedule for the Contested Case Hearing. (Minute Order # 9, September 9, 2014.)

38. On September 8, 2014, a notice was published, announcing that the Contested Case Hearing would address all twenty seven (27) petitions. (Maui News, September 8, 2014.)

39. On November 13, 2014, a standing hearing was held to address three applications to be additional parties in the Contested Case Hearing. (Minute Order # 10, October 28, 2014.)

40. At the standing hearing, Jeffrey Paisner was granted standing. John Blumer-Buell and Nikhilananda were denied standing but could testify at the hearing. (Minute Order # 11, December 4, 2014.)

41. On January 7, 2015, a minute order was issued, standardizing the captions for the contested case hearing, because differing versions had been used by the parties and the Commission staff. (Minute Order # 13, January 7, 2015.)

42. On February 19, 2015, a prehearing conference was held to discuss the order of witnesses. (Minute Order # 14, February 9, 2015.)

43. Between March 2, 2015 and April 2, 2015, 15 days of hearings were held, during which 36 witnesses testified and an additional 16 witness statements and approximately 550 exhibits were introduced into evidence.

44. On October 2, 2015, Nā Moku and MTF jointly, HC&S, and MDWS submitted their FOF, COL, and D&O to the hearings officer. Jeffrey Paisner and Hawaii Farm Bureau Federation did not submit any FOF, COL, and D&O.

45. On January 15, 2016, the hearings officer submitted his FOF, COL, and D&O to the Commission and the parties.

B. The EMI-State Watershed Leases

46. "Since the 1930s, the Territory and then the State issued water permits to Alexander & Baldwin, Inc., Hawaiian Commercial & Sugar Co, and East Maui Irrigation Company, Ltd. (EMI) for the diversion of water from streams in East Maui. The collection system consist(ed) of 388 separate intakes, 24 miles of ditches, and fifty miles of tunnels, as well as numerous small dams, intakes, pipes, and flumes (*citation omitted*). With few exceptions, the diversions capture all of the base flow, which represents the ground-water contribution to total stream flow, and an unknown percentage of total stream flow[7] at each crossing...The source of diverted water is a watershed with an area of about 56,000 acres, about two-thirds of which is owned by the State (*citation omitted*) and managed by the State Department of Land and Natural Resources." (Gingerich, S.B., 2005, "Median and Low-Flow Characteristics for Streams under Natural and Diverted Conditions, Northeast Maui, Hawaii: Honolulu, HI, U.S. Geological Survey, Scientific Investigation Report 2004-5262, 72 pp., at p. 1, referenced by Stephen B. Gingerich, Transcript, March 3, 2015, p. 49 [*hereinafter*, "2005 Flow Study"].)

47. The leases cover four watersheds of approximately 50,000 acres, of which 33,000 acres are owned by the State, and 17,000 acres are owned by EMI. (Garrett Hew, WDT, ¶ 4.)

48. The lease between the State and EMI traces back to a September 13, 1876 agreement. Construction of the ditch system began in the 1870's. (Exh. C-2; Garrett Hew, WDT, ¶ 5.)

49. Since 1938, the leases have been governed by an agreement dated March 18, 1938 between the Territory of Hawaii and EMI. The last long-term licenses were issued in the 1950s and 1960s, and following their expiration, annual revocable licenses were issued by the Board of Land and Natural Resources ("BLNR"). The licenses are currently in holdover status due to the contested case hearing that is pending before BLNR. (Exhs. C-3 to C-11; Garrett Hew, WDT, ¶¶ 6, 8-11.)

50. Prior to 1985-86, the State contracted with the U.S. Geological Survey ("USGS.") to operate gaging stations in various locations in the Ditch system to measure the volume of water collected in each license area from State lands. Beginning with fiscal year 1985-1986, the State no longer contracted with USGS for this service, and EMI took over the operation of the ditch gages and reports the license yields directly to the State. Since 1988 EMI reports a single annual yield to the State, aggregating the readings at the western end of the license areas at Honopou Stream and applying a single factor of 70 percent, based on a comparison of average yields

[7] ground water, plus freshet ("normal" rainfall) and storm waters.

reported by USGS in prior years and a series of studies from 1949 to 1985. (Garrett Hew, WDT, ¶ 12, 13, 15; Exh. C-16.)

51. EMI pays the State $160,000 a year for the right to divert stream waters from the approximately 33,000 acres it leases. (Garrett Hew, Tr., March 17, 2015, pp. 198-200.)

52. From east to west, the watersheds are:

a. Nahiku: between the Nahiku Homesteads and the easterly boundary of the Keanae license area. (Exh. C-10, p. 2.)

b. Keanae: between and including the easterly watershed of Waiaaka Stream and the westerly watershed of Piinau Stream. (Exh. C-8, p. 2.)

c. Honomanu: between and including Nuaailua and Haipuena Streams and tributaries. (Exh. C-6, ¶ 4.)

d. Huelo: between and including Puohokamoa and Honopou Streams and their tributaries. (Exh. C-4, p. 2.)

53. From east to west, the State leases begin at Nahiku and end at Honopou Stream, and the East Maui Ditch System continues to collect stream waters between Honopou Stream and Maliko Gulch on EMI's and other private landowners' lands. The sugar cane fields of HC&S begin west of Maliko Gulch. (*See* Exh. C-1, attached.)

54. Streams in the lands leased from the State not only traverse EMI lands on their way to the ocean, but also traverse other private landowners' lands, particularly as the streams near the ocean. (*See* Exh. C-1, attached.)

55. The 1876 agreement between the State and EMI recognized the existence of other property owners, stating that "existing rights or present tenants of said lands or occupiers along said streams shall in no wise be lessened or affected injuriously by reason of anything hereinbefore granted or covenanted." (Exhibit C-2, pp. 2-3; Garrett Hew, Tr., March 17, 2015, pp, 161-169.)

56. Each of the four leases continues to recognize the rights of other property owners "for domestic purposes and the irrigation of kuleanas entitled to the same." (Exh. C-4, ¶ 6; Exh. C-6, ¶ 6; Exh. C-8, p. 2; Exh. C-10, p. 2.)

C. The East Maui Streams

57. There are 25, not 27, streams that are the subject of this contested case:

a) Waikani is not a stream but a waterfall on Wailuanui Stream. (Garrett Hew, WDT, ¶ 36.)

b) Alo is a tributary of Waikamoi Stream. (*See* Exh. C-1, attached.)

58. EMI and MDWS have diverted 23 of these 25 streams:

a) Kualani (also known as "Hamau") and Ohia (also known as "Waianu") Streams are both below the EMI ditch system and have never been diverted. (Garrett Hew, WDT, ¶ 36.)

59. EMI's and MDWS's ditches divert more streams than these 23 streams. (*See* Exhs. C-1 and C-33, attached.) From east to west, the streams that are in each of the state watershed leases are as follows. Streams subject to this contested case are underlined and identified with an asterisk:

a) Nahiku lease area:

1. Makapipi Stream*
2. Hanawi Stream*
3. Kapaula Stream*

b) Keanae lease area:

4. Waiaaka Stream*
5. Paakea Stream*
6. Waiohue Stream*
7. Puakaa Stream*[8]
8. Kopiliula Stream*
9. East Wailuaiki Stream*
10. West Wailuaiki Stream*
11. Wailuanui Stream* (Waikani waterfall, *supra*, FOF 57)
12. Kualani (or Hamau) Stream* (below ditch system, *supra*, FOF 58)
13. Waiokamilo Stream*
14. Ohia (or Waianu) Stream* (below ditch system, *supra*, FOF 58)
15. Palauhulu Stream* (Hauoli Wahine and Kano tributaries)
16. Piinau Stream*

c) Honomanu lease area:

17. Nuaailua Stream*

[8] Puakaa Stream is listed as a independent stream in the Petition, but on the map (*see* Exh. C-1, attached), it is a tributary of Kopiliula Stream.

18. Honomanu Stream*

19. Punalau Stream* (Kolea and Ulunui tributaries)

20. Haipuaena Stream*

d) Huelo lease area:

21. Puohokamoa Stream*

22. Wahinepee Stream*

23. Waikamoi Stream* (Alo tributary)

24. Kolea Stream

25. Punaluu Stream

26. Kaaiea Stream

27. Oopuola Stream (Makanali tributary)

28. Puehu Stream

29. Nailiilihaele Stream

30. Kailua Stream

31. Hanahana Stream (Ohanui tributary)

32. Hoalua Stream

33. Hanehoi Stream* (Huelo [also known as Puolua] tributary)

34. Waipio Stream

35. Mokupapa Stream

36. Hoolawa Stream (Hoolawa ili and Hoolawa nui tributaries)

37. Honopou Stream* (Puniawa tributary)

60. Additional streams between Honopou Stream and Maliko Gulch (*See* Exhs. C-1 and C-33, attached) include:

38. Kapalaalaea Stream (Piilo`i tributary)

39. Halehaku Stream (Waihee, Makaa, Kaulu, Palama, Opana tributaries)

40. Keali Stream

41. Manawaiianu Stream

42. Opaepilau Gulch (labeled as a stream in Exh. C-33)

43. Lilikoi Gulch (labeled as a stream in Exh. C-33)

61. Exhibit C-33 needs explanation in that:

a) In the Nahiku lease area, Kapaula Stream is not depicted.

b) In the Keanae lease area, Paakea, Waiohue, Puakaa, East Wailuaiki, West Wailuaiki, Wailuanui, Waiakamilo, and Palauhulu Streams are not depicted. Of these, EMI has stated that it no longer diverts Waiakamilo. (Garrett Hew, WDT, ¶ 33; Garrett Hew, Tr., March 17, 2015, pp. 125, 128.)

c) In the Honomanu lease area, Kolea Stream is a branch of Punalau Stream, *supra*, FOF 59 (stream # 19).

d. In the Huelo lease area:

1. Alo Stream is a tributary of Waikamoi Stream.
2. Ohanui Stream is a tributary of Hanahana Stream.
3. Huelo Stream is a tributary of Hanehoi Stream.
4. Kolea Stream is not depicted, but there is a Kolea reservoir.
5. Wahinepee, Punaluu, Puehu, and Mokupapa Streams are not depicted.
6. Hoolawa ili and Hoolawa nui are tributaries of Hoolawa Stream.

e. In the area between Honopou Stream and Maliko Gulch:

1. There is no Kapalaalaea Stream, but an unidentified stream flows into Kapalaalaea Reservoir.
2. Opana Stream is one of the tributaries of Halehaku Stream.
3. EMI states that Opana, Opaepilau, and Lilikoi Streams are not diverted at the Wailoa Ditch (but are diverted at the lower ditches). (Garrett Hew, Tr., March 18, 2015, p. 176.)
4. Keali and Manawaiianu Streams are below the Wailoa Ditch and not depicted, *see* Exh. C-1, attached.

D. Stream Diversions

1. EMI's Ditch System

62. The Ditch system was constructed in phases, beginning in the 1870s and extending to the completion of the current system in 1923. (Garrett Hew, WDT, ¶ 5.)

63. From mauka to makai, the major ditches that cross Honopou Stream (the western boundary of the state lease areas) are the Wailoa Ditch, the New Hamakua Ditch, the Lowrie Ditch, and the Haiku Ditch. The major ditches that cross Maliko Gulch, the border between EMI's ditch system and HC&S's sugarcane fields, are the Wailoa Ditch, the Kauhikoa Ditch, the Lowrie Ditch, and the Haiku Ditch. (*See* Exh. C-33, attached.)

64. Water sold to MDWS from EMI's Haiku Uka watershed (collected through MDWS's Waikamoi Upper Flume and Waikamoi Lower Pipeline, *see* Exh. C-33, and described, *infra*, at FOF 71, is removed east of Honopou Stream and is therefore not captured by the gages at Honopou and need to be added to the amounts measured at Honopou for total license area yields. (Garrett Hew, WDT, ¶ 12.)

65. EMI records the amount of water delivered to HC&S at gages in the four ditches that cross Maliko Gulch. Most of the recorded flows are from the four license areas, which end at Honopou Stream, but some water is collected in streams between Honopou Stream and Maliko Gulch. (Garrett Hew, WDT, ¶ 24.)

66. The delivery capacity of the EMI system is 450 mgd. The long-term average delivery by EMI to HC&S has been 165 mgd, but since 1999, deliveries have decreased significantly, and in the ten year period from 2004-2013, the average delivery was 126 mgd. (Garrett Hew, WDT, ¶ 23, 30.)

67. The HC&S irrigation system is designed to operate at the maximum extent possible on gravity flow from higher to lower elevations, so it is critical that the maximum amount of water possible is taken into the HC&S system at the Wailoa Ditch, the ditch at the highest elevation, which has a capacity of 195 mgd. (Garrett Hew, WDT, ¶ 28.)

68. When the Wailoa Ditch is filled to capacity, it overflows into the New Hamakua Ditch via the streams. Once the New Hamakua has reached capacity, it overflows via the streams into the Lowrie Ditch. And if the Lowrie is filled to capacity, it overflows into the Haiku Ditch via the streams. (Garrett Hew, Tr., March 18, 2015, p. 144.)

69. Surface water flows from East Maui can fluctuate tremendously from day to day and cannot be relied on at times to meet the irrigation requirements of HC&S. When the Wailoa ditch flow is extremely low, the lower ditches have little or no water. (Garrett Hew, WDT, ¶ 29.)

70. At Honopou:

a. for the Wailoa Ditch from 1922 to 1987, daily flows ranged from 1.8 to 328 cubic feet per second (cfs), or 1.16 to 212 mgd,[9] averaging 108.8 mgd, with flows less than 42.46 mgd for five days out of a year;

b. for the New Hamakua Ditch from 1918 to 1985, daily flows ranged from zero to 120.2 mgd, averaging 2.89 mgd, with flows less than 0.27 mgd for four days out of a year;

[9] 1 cfs equals 0.6463 mgd.

c. for the Old Hamakua Ditch from 1918 to 1965, daily flows ranged from zero to 39.43 mgd, averaging 0.05 mgd, with flows lowest in June and averaging 0.03 mgd;

d. for the Lowrie Ditch from 1910 to 1985, daily flows ranged from zero to 74.97 mgd, averaging 16.23 mgd, with flows less than 2.72 mgd for five days out of a year; and

e. for the Haiku Ditch from 1910-1985, daily flows ranged from zero to135.1 mgd, averaging 2.84 mgd, with flows less than 0.36 mgd three days out of a year.(Exh. C-101, pp. 74-77.)

2. MDWS

71. MDWS receives water from EMI through:

a. groundwater from a development tunnel in the Ko`olau Ditch for the Nahiku community;

b. streams in EMI's Haiku Uka watershed through the upper and lower Waikamoi flumes that MDWS maintains to serve its Olinda/Upper Kula and Piiholo water treatment plants;

c. water from the Wailoa Ditch after it enters HC&S's lands to serve its Kamole water treatment plant; and

d. non-potable water from HC&S's Hamakua Ditch[10] at Reservoir 40 to serve the Kula Agricultural Park. (Garrett Hew, WDT, ¶ 20;Garrett Hew, Tr., March 18, 2015, pp. 192-193; David Taylor, WDT, ¶ 7; Exh. C-33.)

72. MDWS diverts stream water directly through its upper and lower Waikamoi flumes, and receives stream waters from EMI's Wailoa Ditch and its continuation as HC&S's Hamakua Ditch, *see* Exh. C-33, attached.

73. The upper Waikamoi flume diverts water from the Waikamoi, Puohokamoa, and Haipuena Streams to the Olinda/Upper Kula water treatment facility. Water for this facility is stored in the 30-million gallon Waikamoi reservoirs and the 100-million gallon Kahakapao reservoirs, *see* Exh. C-33, attached. The Olinda facility's average daily production is 1.6 mgd, with a capacity of 2 mgd. (David Taylor, WDT, ¶ 11; Exh. B-3, p. 25; David Taylor, Tr., March 11, 2015, pp. 47, 140.) [MDWS FOF 25.]

[10] The source for the Hamakua Ditch is the Wailoa Ditch. *See* Exh. C-33, attached.

74. The lower Waikamoi flume diverts water from the Waikamoi, Puohokamoa, Haipuaena and Honomanu Streams to the Piiholo water treatment facility. Water for this facility is store in the 50-million gallon Piiholo Reservoir, *see* Exh. C-33, attached. The Piiholo facility's average daily production is 2.5 mgd, with a capacity of 5 mgd. (David Taylor, WDT, ¶ 10; Eh. B-3, p. 25; David Taylor, Tr., March 11, 2015, p. 47.) [MDWS FOF 24.]

75. The stream flows are variable, so the reservoirs provide storage so that there is a relatively constant amount of water available to the treatment facilities, regardless of streamflow. (David Taylor, Tr., March 11, 2015, p. 49.)

76. There are no gages on the Waikamoi flumes, so there is no way to measure the amount of water being diverted from the streams. Because the new upper Waikamoi flume isn't going to be leaking, MDWS assumes that everything that goes in will come out. MDWS measures the reservoir levels every day, so once the new flume is functional, MDWS will be able to calculate how much water is coming from the flume on days when the main intake from the dam is dry, which is most of the days. All of the water coming in will be from the flume. (David Taylor, Tr.,March 11, 2015, pp. 59-60.)

77. EMI's Wailoa ditch, which diverts multiple streams (*see* Exh. C-33 and FOF 61, *supra*), is the source of water for MDWS's Kamole water treatment facility. The Kamole facility's average daily production is 3.6 mgd, with a capacity of 6 mgd. (David Taylor, WDT, ¶ 9; Exh. B-3, p. 24; David Taylor, Tr., March 11, 2015, p. 47.) [MDWS FOF 23.]

78. MDWS owns the upper and lower Waikamoi flumes and has a contract with EMI to service the diversions to keep them clear. MDWS takes water directly from the Wailoa ditch. (David Taylor, Tr., March 11, 2015, p. 53.)

79. HC&S's Hamakua ditch (the western extension of the Wailoa ditch), at reservoir 40 (*see* Exh. C-33, attached), is the source of water for Kula Agricultural Park, where two reservoirs have a total capacity of 5.4 million gallons. The Park consists of 31 farm lots which range in size from 7 to 29 acres, and which are owned by the County of Maui. Individual lots are metered and billed by MDWS. (David Taylor, WDT, ¶ 13; Exh. B-4.) [MDWS FOF 27.]

80. MDWS pays EMI $0.06 per thousand gallons ($60/million gallons). (Garrett Hew, WDT, ¶ 21.)

81. The original contract between MDWS and EMI was entered into in 1961, which was replaced by a 1973 "Memorandum of Understanding" with a term of 20 years. Since its expiration, there have been a total of 8 extensions. After the lapse of the most recent extension,

EMI has continued to provide water to MDWS through a memorandum dated April 13, 2000. (David Taylor, WDT, ¶ 15; Exhs. B-5-15.) [MDWS FOF 29.]

82. The memorandum provides that MDWS will receive 12 mgd from the Wailoa ditch with an option for an additional 4 mgd. During periods of low flow, no water will be diverted to lower-elevation ditches, and MDWS will receive a minimum allotment of 8.2 mgd and HC&S will also receive 8.2 mgd. If these minimum amounts cannot be delivered, MDWS and HC&S will receive prorated shares of the water available. (David Taylor, WDT, ¶ 15; Exh. B-5; David Taylor, Tr., March 11, 2015, pp. 53-54; Garrett Hew, Tr., March 18, 2015, pp. 146-147.) [MDWS FOF 30.]

83. Average daily use by MDWS from the Wailoa ditch is 7.1 mgd, which includes water for the Kamole facility, averaging 3.6 mgd (*see* FOF 77, *supra*), and the Kula Agricultural Park. (David Taylor, Tr., March 11, 2015, pp. 81-83.)

E. Estimates of Stream Flows

84. Prior to the partial restorations of twelve streams in 2008 and 2010, *supra*, FOF 9, 11, and subsequent installation of gages in these streams, there were only four active gages, one each in Hanawi Stream, West Wailuaiki Stream, Waiokamilo Stream, and Honopou Stream (which is outside the study area to be described, *infra*). (2005 Flow Study, p.4 and Table 1; Exh. C-101, p. 28; Exh. C-85, 47.)

85. Gages had been previously installed on a number of streams for various periods of time and for various years. For example, Makapipi Stream had a gage at 920 feet elevation between 1932-1945; Hanawi Stream had gages at 500 feet elevation between 1932-1947 and again between 1992-1995, and at 1,318 feet elevation between 1914-1915 and again between 1921-Present; and West Wailuaiki Stream had a gage at 1343 feet elevation between 1914-1917 and again between 1921-Present. (2005 Flow Study, Table 1.)

86. In 2002 to 2005, USGS conducted studies to: 1) assess the effects of existing diversions on flows of perennial streams in northeast Maui, 2) characterize the effects of diversions on instream temperature variations, and 3) estimate the effects that streamflow restoration (full or partial) would have on the availability of habitat for native stream fauna (fish, shrimp and mollusks) in northeast Maui. The study area contained 22 named streams from the drainage basins of Makapipi Stream in the east to Kolea Stream to the west (Streams # 1 and #24 in FOF

59, *supra*). (2005 Flow Study, p. 3.) The first study is summarized in this section. The second and third studies are summarized in the next section.

87. Stream flows under natural (undiverted) and diverted conditions were estimated for 21[11] streams, using a combination of continuous-record gaging-station data, low-flow measurements, and values determined from regression equations developed for the study. For the drainage basin for each continuous-record gaged site and selected ungaged sites, morphometric, geologic, soil, and rainfall characteristics were quantified. Regression equations relating the non-diverted streamflow statistics to basin characteristics of the gaged basins were developed. Regression equations were also used to estimate stream flow at selected ungaged diverted and undiverted sites. (2005 Flow Study, p. 1.)

88. Estimates were made for 50 percent and 95 percent duration total flow (TFQ) and base flow (BFQ).[12] (2005 Flow Study, p. 1.)

89. A 50 percent duration flow (median streamflow; Q_{50}) means that, for a specific period of time, half of the measured stream flow was greater than the Q_{50} value, and half was less. For example, for measurements of total flows in a particular stream for the specified period of time: 1) if TFQ_{50} = 25 mgd, then total stream flow was above 25 mgd half of the time and below 25 mgd half of the time,; and 2) if TFQ_{95} = 2 mgd, total stream flow was above 2 mgd 95 percent of the time and below 2 mgd 5 percent of the time. (2004 Flow Study, p. 4.) [HC&S FOF 2.]

90. Relative errors between observed and estimated flows ranged from 10 to 20 percent for the 50-percent duration total flow and base flow, and from 29 to 56 percent for the 95-percent duration total flow and base flow. (2004 Flow Study, p. 1.) Errors are higher for lower flows because, for the same absolute error in flow, the relative error in percent increases as the actual flow decreases. (2005 Flow Study, p. 43.) [HC&S FOF 11.]

91. East of Keanae Valley, the 95-percent duration discharge equation generally underestimated total flow (TFQ_{95}), due to gains in flow from groundwater discharge, and within and west of Keanae Valley, the equation generally overestimated total flow, due to loss of water at lower elevations. (2005 Flow Study, pp. 1, 58.) [HC&S FOF 6.B.]

92. An extreme example of the limitations of the model is Piinau Stream:

> Estimates of flow-duration statistics for Piinau Stream determined from the regression equations are the highest of any sites in the study area...yet the flow observations,

[11] No estimates were made for Piinau Stream because the regression equations were not valid for this stream and reliable flow measurements were lacking (2004 Flow Study, p. 63.)

[12] Base flow is the groundwater contribution to flow; total flow includes all sources; i.e., ground, freshet ("normal" rainfall) and storm waters.

> although scarce, indicate that flows are much lower than estimated. The stream channel was dry between 1,200 ft and 600 ft altitude...and only a trickle of flow was observed upstream of the 1,300-ft diversion. A recent (2001) large landslide, which covered the stream at about 1,000 ft altitude and filled most of the stream channel downstream to 600 ft altitude with gravel, cobbles, and boulders, complicates flow in the stream. This basin has the highest rainfall and MAXELEV (maximum elevation) in the study area and both are above the range of characteristics used to develop the flow-duration equations. Because the regression equations are not valid for this stream and reliable flow measurements are lacking, no estimates of stream statistics were made for Piinau Stream. (2005 Flow Study, p. 63.)

93. Reduction in 50- and 95-percent flows in stream reaches affected by the diversions throughout the study area averaged 58-60 percent. (2005 Flow Study, p. 1.) Average reduction in the low flow of streams due to diversions ranged from 55 to 60 percent. (2005 Flow Study, p. 70; Stephen B. Gingerich, WDT, p. 2.) [Nā Moku/MTF FOF 235.]

F. Restoration Potential

1. The 2005 Habitat Study

94. The purposes of the second and third studies in 2002 to 2005, *supra*, FOF 86, were to characterize the effects of diversions on instream temperature variations, and to estimate the effects that streamflow restoration (full or partial) would have on the availability of habitat for native stream fauna (fish, shrimp and mollusks). (Exh. E-69: Gingerich, S.B. and Wolff, R.H., 2005, "Effects of Surface-Water Diversions on Habitat Availability for Native Macro-Fauna, Northeast Maui," Hawaii: U.S. Geological Survey Scientific Investigations Report 2005-5213, 93 pp., referenced by Stephen B. Gingerich, Transcript, March 3, 2015, p. 49 [*hereinafter*, "2005 Habitat Study"].)

95. In general, the stream temperatures measured at any of the monitoring sites were not elevated enough to adversely affect the growth or mortality of native fish, shrimp, and mollusks or to cause wetland taro to be susceptible to fungi and associated rotting diseases. (2005 Habitat Study, p. 1.)

96. The Physical Habitat Simulation System (PHABSIM), which incorporates hydrology, stream morphology and microhabitat preferences, was used to simulate habitat/discharge relations for various species and life stages, and to provide quantitative habitat comparisons at different streamflows of interest. Estimates were made of the availability of aquatic habitat for diverted and undiverted conditions and to produce a relation between discharge and habitat availability. Habitat-duration curves show the percentage of time that indicated habitat

conditions would be equaled or exceeded and are based on the available estimates of flow duration at each stream reach developed in the 2005 Flow Study for Q_{50} and Q_{95} of total and base flows. (2005 Habitat Study, pp. 1, 51-52.)

97. The area of usable bed habitat was estimated over a range of streamflows that includes the diverted and natural base-flow estimates. The results are also presented as habitat relative to natural conditions with 100 percent of natural habitat at natural median base flow (BFQ_{50}) and 0 percent of habitat at 0 streamflow. In general, the models show a decrease in habitat for all species as streamflow is decreased from natural conditions. (2005 Habitat Study, pp. 51-52.) [Nā Moku/MTF FOF 250.]

98. The relative amount of expected natural habitat (H) expected at 50 percent of natural median base flow ranges from 70 to 92 percent (H_{70-92}), and maintaining 90 percent of natural median base flow results in 94 to 101 percent of expected natural habitat (H_{94-101}) in the stream reaches. (2005 Habitat Study, p. 52.)

99. For East Maui streams, it is estimated that 64 percent of natural median base flow ($0.64xBFQ_{50}$) is required to provide 90 percent of the natural habitat (H_{90}). The flow requirements for each stream reach were provided by the USGS in terms of cubic feet per second (cfs) for all petitioned streams except for Piinaau, Honopou, and Hanehoi streams. (Stephen B. Gingerich, WDT, Summary Table.) [Nā Moku/MTF FOF 258.]

100. Many factors that affect the presence of native aquatic species in northeast Maui were beyond the scope of the USGS study and were not addressed, including:

a. What is the effect of alien species on the migration and living conditions of the native species?

b. What is the fate of animals upon reaching a dry stream reach during upstream migration?

c. At what rate and at what locations will native species populations return to natural levels if diversions were removed?

d. Why were opae seen in abundance above the major diversions but oopu alamoo were not observed at all?

e. To what extent do native and alien species use the diversion ditches and tunnels for migration between streams?

f. What is the effect of taro lo`i on the migration and life cycles of native species?

g. What are the effects of stream diversions on native aquatic insect species?

(Stephen B. Gingerich, WDT, pp. 4-5.) [Nā Moku/MTF FOF 256.]

2. The 2009 Habitat Availability Study

101. After release of the two USGS reports, USGS provided Commission staff with relative estimates of the change in aquatic habitat due to surface-water diversions. (Stephen B. Gingerich, WDT, October 31, 2014, p. 4.)

102. The resulting "2009 Habitat Availability Study" (Glenn R. Higashi, WDT, Appendix A: Parham, J.E. *et al.*, "The Use of Hawaiian Stream Habitat Evaluation Procedure to Provide Biological Resource Assessment in Support of Instream Flow Standards for East Maui Streams," Bishop Museum and Division of Aquatic Resources, Department of Land and Natural Resources, November 20, 2009) had four goals:

1. explain the influence of stream diversions on the distribution and habitat availability of native stream animals;
2. provide documentation of the model's design, underlying data structure, and application;
3. show changes in habitat availability for native amphidromous animals on a stream-by-stream basis; and
4. prioritize habitat and passage restoration actions among the streams of concern in East Maui. (Glen R. Higashi, WDT, ¶ 3.) [Nā Moku/MTF FOF 269.]

103. Of the 27 streams that were the subject of this contested case, the 2009 Habitat Availability Study addressed only the 19 streams remaining after the Commission's September 25, 2008 order amending the IIFS for 6 of 8 streams, where instream flow for taro cultivation was the main concern, *supra*, FOF 9. (Glen R. Higashi, WDT, ¶ 19.) [Nā Moku/MTF FOF 271.]

104. The Study stated that the 19 streams comprised 16 distinct streams and their tributaries, but only explained that Waiaaka Stream was left out because it was not in DAR's stream codes, database, or GIS coverages. Puakaa Stream is a tributary of Kopiliula Stream, *supra*, FOF 59. Wahinepee Stream was left out without explanation. (2009 Habitat Availability Study, Table 1.)

105. Minimum viable habitat flow (H_{min}) for the maintenance of suitable instream habitat was defined as 64% of Median Base Flow ($0.64xBFQ_{50}$) (also defined as H_{90} by USGS studies, *supra*, FOF 99), which was expected to produce suitable conditions for growth, reproduction, and recruitment of native stream animals. (Glen R. Higashi, WDT, Appendix D, p. 4.)

106. Habitat less than H_{90} was not expected to result in viable flow rates for the protection of native aquatic biota. There is no linear relationship between the amount of habitat and the number of animals. H_{70}, or twenty percent less habitat than H_{90}, would not result in only 20 percent less animals; nor would H_{50}, which is twenty percent less than H_{70}, result in only an additional 20 percent less animals. (Glen R. Higashi, WDT, Appendix D, p. 2.)

107. The 16 streams in the study, with their corresponding numbers in FOF 59, *supra*, were:

a. Makapipi Stream,[1]

b. Hanawi Stream,[2]

c. Kapaula Stream,[3]

d. Paakea Stream,[5]

e. Waiohue Stream,[6]

f. Kopiliula Stream[8] (and its tributary, Puakaa Stream[7])

g. East Wailuaiki Stream,[9]

h. West Wailuaiki Stream,[10]

i. Ohia Stream,[14]

j. Nuaailua Stream,[17]

k. Honomanu Stream,[18]

l. Punalau Stream,[19]

m. Haipuaena Stream,[20]

n. Puohokamoa Stream,[21]

o. Waikamoi Stream,[23]

p. Kolea Stream.[24] (Glen R. Higashi, WDT, Appendix A, Table 1.)

108. The Division of Aquatic Resources ("DAR"), recommended the restoration of the following eight streams, in descending order of habitat units restored:

a. Honomanu Stream: 11.6 kilometers (km) of Habitat Units;

b. Puohokamoa Stream: 7.6 km of Habitat Units;

c. Waikamoi Stream: 5.8 km of Habitat Units;

d. Kopiliula Stream (and its tributary, Puakaa Stream): 5.1 km of Habitat Units;

e. East Wailuaiki Stream: 4.4 km of Habitat Units;

f. West Wailuaiki Stream: 4.0 km of Habitat Units;

g. Makapipi Stream: 3.8 km of Habitat Units; and

h. Hanawi Stream: 3.5 km of Habitat Units.

(Glen R. Higashi, WDT, Appendix B, pp. 3-4.)

109. Flow restoration for these eight streams would result in 45.8 km out of a total of 67.3 km, or 68 percent of the 16 streams. (Glen R. Higashi, WDT, Appendix B, p. 4.)

110. Restoration of fish passage and restoration of suitable habitat forming flows at a small number of key locations can result in large amounts of potential habitat to become available for native animals. (Glen R. Higashi, WDT, Appendix A, p. 77.)

111. Restoration of an upstream diversion is not useful without first improving diversions downstream. (*Ibid.*)

112. DAR recommended that all existing diversions on these eight streams be modified to increase suitable instream habitat, minimize the entrainment of larvae, and to allow for animal passage for the recruiting post-larvae. (Glen R. Higashi, WDT, ¶ 8.) [Na Moku, FOF 278.]

113. DAR also commented that:

a. The restoration of suitable flows to a single stream is more appropriate than the return of inadequate flows to multiple streams.

b. Restoration of streams should be spread out in a geographic sense. This will provide greater protection against localized habitat disruptions, a wider benefit to estuarine and nursery habitat for nearshore marine species, and result in more comprehensive ecosystem function across the entire east Maui sector. (Glen R. Higashi, WDT, Appendix D, p. 3.)

114. DAR later reconsidered its initial list of 8 streams on the basis of:

a. the amount of habitat currently lost to diversions;

b. seasonality (wet versus dry seasons) was considered by setting minimum connectivity flows in the dry season and minimum habitat flow in the wet season;

c. issues relating to losing reaches, which eliminated Honomanu and Makapipi streams;

d. streams most biologically impacted by dewatering;

e. the number and difficulty of modifying diversions;

f. the efficient use of water in terms of habitat units restored per cfs of water returned;

g. whether restoration of stream flow along a given segment of a stream involved the comingling of stream and ditch waters; and

h. to geographically distribute the streams proposed for restoration across the entire East Maui ecosystem. (Glen R. Higashi, WDT, Appendix C, p. 2.)

115. Honomanu and Makapipi streams were eliminated after consultation with CWRM, USGS and Bishop Museum on the basis of concerns over losing reaches and replaced with Waiohue and Haipuena streams. DAR's estimates of the undiverted BFQ_{50} flows and 64 percent of BFQ_{50} (H_{90}) flows for the revised list of eight streams were as follows, in order of DAR's priority ranking:[13]

	Median undiverted base stream flow below lower most diversion (Undiverted BFQ_{50})	64 percent of BFQ_{50}, or H_{90} flows
East Wailuaiki Stream	4.52 mgd (7.0 cfs)	2.91 mgd (4.5 cfs)
West Wailuaiki Stream	4.52 mgd (7.0 cfs)	2.91 mgd (4.5 cfs)
Puohokamoa Stream	6.79 mgd (10.5 cfs)	4.33 mgd (6.7 cfs)
Waikamoi Stream	4.46 mgd (6.9 cfs)	2.84 mgd (4.4 cfs)
Kopiliula Stream	5.17 mgd (8.0 cfs)	3.30 mgd (5.1 cfs)
Haipuaena Stream	3.36 mgd (5.2 cfs)	2.13 mgd (3.3 cfs)
Waiohue Stream	4.39 mgd (6.8 cfs)	2.78 mgd (4.3 cfs)
Hanawi Stream	no flow recommended, only modification of diversion for passage	

(Glen R. Higashi, WDT, Appendix D, p. 5.)

116. For these eight streams, the amounts that would be needed to bring stream flows under diverted conditions to 64 percent of BFQ_{50}, or the minimum habitat needed for growth, reproduction, and recruitment of native stream animals, were as follows:

East Wailuaiki Stream:	2.07 mgd (3.2 cfs)
West Wailuiki Stream:	2.26 mgd (3.5 cfs)
Puohokamoa Stream:	3.49 mgd (5.4 cfs)
Waikamoi Stream:	1.68 mgd (2.6 cfs)
Kopiliula Stream:	1.94 mgd (3.0 cfs)
Haipuaena Stream:	1.62 mgd (2.5 cfs)
Waiohue Stream:	1.75 mgd (2.7 cfs)
Hanawi Stream:	modification only of diversion for passage
Total:	14.81 mgd (22.9 cfs)

[13] cfs converted to mgd: 1 cfs = 0.6463 mgd.

(Glenn R. Higashi, WDT, Appendix C, Table 1.)

G. The September 25, 2008 Commission Order

117. On September 25, 2008, the Commission voted to accept staff's recommendation to restore six of eight streams for a total of 4.5 mgd: 1) Honopou Stream; 2) Hanehoi Stream; 3) Puolua (Huelo) Stream; 4) Palauhulu Stream; 5) Waiokamilo Stream; and 6) Wailuanui Stream. Two streams, Piinaau and Kualani Streams, were not restored, *supra*, FOF 8-9.

1. Honopou Stream

118. The Wailoa, New Hamakua, Lowrie, and Haiku ditches diverted water from Honopou Stream. There is one active gaging station above the Wailoa ditch, and there were three other now-inactive stations below the New Hamakua, Lowrie, and Haiku ditches, respectively. Data from these gages were used instead of the estimates from the 2004 Stream Flow study. Furthermore, Honopou Stream is outside the study area, which would have made the use of the 2005 Stream Flow study for Honopou Stream questionable. (Exh. C-85, pp. 10, 16.)

119. Honopou is a gaining stream, and the average annual groundwater contribution from the stretch from the Wailoa ditch to the Haiku ditch (1.78 cfs, or 1.15 mgd) equals the groundwater (base flow) contribution above the Wailoa ditch (1.78 cfs, or 1.15 mgd), so under undiverted conditions, the base flow below the Haiku ditch would be twice that above the Wailoa ditch. Despite this doubling of base flow as measured by gages above the Wailoa ditch and below the Haiku ditch, the four ditches reduce total stream flow (Q_{50}) by 50 percent, from 2.4 cfs (1.55 mgd) above the Wailoa ditch to 1.2 cfs (0.775 mgd). below the Haiku ditch. (Exh. C-85, pp. 10, 16.)

120. The 2005 Flow Study had comparable percentages of reduced stream flows due to the diversions: 1) reduction in 50- and 95-percent flows in stream reaches affected by the diversions throughout the study area averaged 58-60 percent; and 2) average reduction in the low flow of streams due to diversions ranged from 55 to 60 percent, *supra*, FOF 93.

121. The 2008 Commission decision allowed the continued diversion at Wailoa ditch but minimal or no diversions of low flows (base flows) at the lower ditches; leaving an estimated 1.78 cfs (1.15 mgd) just below the Haiku ditch. Since Honopou Stream continues to gain an unknown amount of water below the Haiku ditch, the IIFS just below the Haiku ditch was set at 2.00 cfs, or 1.29 mgd. (Exh. C-85, pp. 14, 16.)

122. A second IIFS was established downstream of taro and domestic diversions below the Haiku ditch, to prevent drying of the stream and increase the continuity of flow to enhance biological integrity in the stream. This IIFS was established at the Q_{90} above the Wailoa ditch, or 0.47mgd (0.72 cfs). This resulted in 0.82 mgd (1.29 - 0.47 mgd) available to the taro and domestic diversions, and 0.47 mgd to increase continuity of flow to the ocean. There was no explanation of why 0.82 mgd would meet the needs of domestic and taro users, nor why the downstream IIFS of 0.47 mgd was for only continuity of flow to establish biological connectivity instead of a larger IIFS to increase stream habitat to enable reproduction. (Exh. C-85, pp. 14-16.)

123. Even though both total and base flows were reduced by about 50 percent by the diversions, using base flow to amend the IIFS was justified by the conclusion that "(g)round water contribution estimates instead of total flow estimates are used because major diversion structures are generally assumed to capture the majority of the base flow, which is assumed to be mostly ground water flow." (Exh. C-85, p. 14.)

124. In setting the first IIFS at 2.00 cfs, the amendment added 0.22 cfs to 1.78 cfs to account for an unknown gain in the amount of water below the Haiku ditch, *supra*, FOF 121. But base flows below the Haiku ditch were available, with Q_{90} at 0.51 cfs, so the amended IIFS should have been increased to 2.29 instead of to 2.00 cfs, or 1.48 mgd instead of 1.29 mgd. (Exh. C-85, p. 16.)

125. This would have increased the available water for domestic and taro users from 0.82 mgd to 1.01 mgd.

126. Base flow was defined as the Q_{70} to Q_{90} flows. In using the base flows instead of total flows, the amended IIFS also chose the lower number of base flow, while recognizing that "the median base flow could also be as high as Q_{70} or 70 percent of total flow." (Exh. C-85, p. 14.)

127. Using Q_{90}, the first IIFS was increased from 0.51 cfs to 2.00 cfs. Using Q_{70}, the increase would have added 0.87 to 1.78 cfs, or 2.65 cfs (1.71 mgd), compared with 1.48 mgd for Q_{90}, *supra*, FOF 124. (C-85, pp. 14-16.)

128. Using Q_{90}, the second IIFS was established at 0.72 cfs (0.47 mgd), the Q_{90} above the Wailoa ditch, *supra*, FOF 122, replacing the measured Q_{90} of 0.51 cfs at the site. Using Q_{70}, the measurement at the site was 0.87 cfs, and would have been replaced by the Q_{70} above the Wailoa ditch, or 1.4 cfs (0.90 mgd). (C-85, p. 16.)

129. Therefore, adding the measured Q_{90} and Q_{70} values at the first IIFS site instead of hypothesizing what those numbers might be, and using Q_{70} instead of Q_{90} values for base flow:

a. The IIFS at the first site could have been 1.71 mgd instead of 1.48 mgd or 1.29 mgd, *supra*, FOF 124, 127; and

b. The IIFS at the second site could have been 0.90 mgd instead of 0.47 mgd, *supra*, FOF 128.

130. Under the assumptions underlying FOF 129, *supra*, the amount of water available to domestic and taro users below the Haiku ditch would have increased from 0.82 (1.29 - 0.47) mgd to 1.01 (1.48 - 0.47) mgd under the Q_{90} flows, and would have decreased slightly from 0.82 mgd to 0.81 (1.71 - 0.9) mgd under the Q_{70} flows; however, under the Q_{70} flows, water at the second IIFS site to increase stream flow to enhance biological integrity would have increased from 0.47 mgd to 0.90 mgd.

131. The total flow restored to Honopou Stream was 1.29 mgd, with 0.82 mgd available to the taro and domestic diversions, and 0.47 mgd for enhancing continuity of flow to the ocean, *supra*, FOF 121-122.

132. Commission staff noted that there was an estimated 35 acres cultivable for taro, and that Honopou residents do not receive water from a county water system. (Exh. C-85, pp. 11, 13.) There was no explanation on how the 0.82 mgd for taro and domestic diversions would meet these needs.

133. Nā Moku members claim 6.17 acres for taro cultivation and an additional 17.82 acres for cultivable agriculture, for a total of 23.99 acres fed by Honopou Stream, claiming either appurtenant or traditional and customary native Hawaiian rights to a sufficient amount of stream water to irrigate the taro lo`i contained within this acreage. (Exh. A-173.) [Nā Moku FOF 554-556.]

134. Teri Gomes, Nā Moku's expert witness, was not able to quantify the portion of a parcel that was actually farmed in taro nor the percentage of each parcel actually contained in lo`i or farmed in taro at the time of the Mahele and put the entire parcel in taro when she couldn't tell what portion was in taro. (Teri Gomes, Tr., March 4, 2015, p. 137; Tr., April 1, 2015, pp. 18, 40.)

135. Gomes also placed the parcel in the cultivable agriculture category when land was awarded without specificity of use. (Teri Gomes, Tr., April 1, 2015, pp. 19, 32.)

136. On the other hand, HC&S contends that specific locations for properties currently being used or planned to be used for taro cultivation amounts to only two acres . The total of 23.99 acres that Nā Moku members claim is simply the parcels that Lurlyn Scott describes in her

Declaration as parcels in which her family has an interest, and are the same properties that her cousins referenced in their Declarations. (Lurlyn Scott, WDT, ¶ 30; Tr., March 4, 2015, p. 193.) [HC&S FOF 111-112.]

2. Hanehoi Stream and its tributary Puolua (also known as "Huelo")

137. The Wailoa, New Hamakua, Lowrie, and Haiku Ditches divert water from Hanehoi Stream, and the Lowrie and Haiku Ditches divert water from the Puolua tributary. Measured stream flow data are limited for Hanehoi/Puolua Streams, so flow statistics were estimated with regression equations. Furthermore, Hanehoi/Puolua are outside the 2005 Flow Study area in which the regression equations were developed, so the estimated flow statistics may not be representative of the flow conditions in Hanehoi and Puolua (Huelo) Streams. (Exh. C-85, p. 20, 26.)

138. There are no data on whether Hanehoi and Puolua Streams are losing or gaining flow from groundwater. There is currently very little flow in Hanehoi Stream, but residents reported that the streams had continuously flow before the 1960s except in times of drought, and archaeological evidence of extensive taro lo`i along the lower reaches of the streams suggests that water was once readily available . Streamflow data from long-term gaging stations around the islands indicate that monthly mean total and base flows have generally decreased from the 1940s to 2002, which is consistent with decreasing rainfall trends statewide. (C-85, p. 20.)

139. A diversion for domestic purposes serves approximately 30 families, or approximately 100 people in the Huelo community. There is rarely water available in residents' sections of the streams under present conditions, so they are not using stream water for their crops. (Exh. C-85, pp. 21-22.)

140. As in the case of Honopou Stream, base flow was defined as the Q_{70} to Q_{90} flows. For Honopou Stream, the lower flow of Q_{90} was used instead of the Q_{70}, *supra*, FOF 126-127. For Hanehoi and Puolua Streams, the regression equation estimates were made for TFQ_{50} and TFQ_{95} and BFQ_{50} and BFQ_{95} (TF is total flow, and BF is base flow). TFQ is the same as Q. For Hanehoi Stream, the lower flow (BFQ_{95} instead of the BFQ_{50}) was again used, as it had been for Honopou Stream. But note that TFQ_{95} is lower than the definition of base flow (Q_{70} to Q_{90} flows), and BFQ_{95} is lower than TFQ_{95}. For example, between the Lowrie and Haiku Ditches, for Hanehoi Stream, the estimated TFQ_{95} was 0.81 mgd (1.26 cfs) and BFQ_{95} was 0.74 mgd (1.15 cfs).(Exh. C-85, pp. 24, 26.)

141. Two IIFS were established below the Haiku Ditch and above the confluence of the two streams: 1) for Hanehoi Stream, 0.41 mgd (0.63 cfs); and 2) for the Puolua Stream tributary, 0.57 mgd (0.89 cfs). (C-85, p. 24.)

142. Theses two IIFS were arrived at in the following way:

a. The natural, undiverted BFQ_{95} just above the terminal waterfall at the mouth of Hanehoi Stream was estimated at 1.96 mgd (3.04 cfs). Half, or 0.98 mgd (1.52 cfs), was assumed to maintain biological integrity of the stream. (In the 2005 Habitat Availability Study, when 50 percent of natural base flow [BFQ_{50}, not the smaller BFQ_{95} as used for these two streams] is present in the stream, potentially 80 to 90 percent of the natural habitat for selected native aquatic species is available. Although Hanehoi Stream was not part of the study area, the Study was the best information available.)

b. Since there is no information available on whether Hanehoi Stream is losing or gaining groundwater, the assumption was made that Hanehoi Stream and its tributary, Puolua Stream, contribute to the natural, undiverted flow just above the terminal waterfall. (Exh. C-85, p. 24.)

143. For the Puolua tributary, the IIFS was set at 0.57 mgd (0.89 cfs), the estimated, natural, undiverted flow at that site. For Hanehoi Stream, the IIFS would be 0.41 mgd (0.63 cfs, the remainder after subtracting 0.57 mgd (0.89 cfs) from 0.98 mgd (1.52 cfs). (Exh. C-85, p. 24.)

144. A third IIFS of 0.74 mgd (1.15 cfs) was established further upstream on Hanehoi Stream above the Lowrie Ditch, the estimated undiverted BFQ_{95} below the Lowrie Ditch. (Exh. C-85, p. 25.)

145. No IIFS was proposed for the stream mouth because of the small number of registered surface water users below the confluence of the streams, and because of the terminal waterfall. (Exh. C-85, p. 25.)

146. The purpose of the first two IIFS, *supra*, FOF 141, was to ensure that an adequate amount of surface water reaches users downstream of the Haiku Ditch. (Exh. C-85, p. 24.)

147. The purpose of the third IIFS was to provide adequate surface water for domestic use of the Huelo community. (Exh. C-85, p. 25.)

148. Note that there is a conflict between how the first two IIFS were arrived at and the stated purpose of those IIFS. The sum of the two IIFS, 0.98 mgd (1.52 cfs), *supra*, FOF 143, was based on maintaining the biological integrity of the stream, but the purpose of those IIFS was to ensure that an adequate amount of surface water reaches users downstream of the Haiku Ditch, *supra*,

FOF 146. Moreover, no IIFS was proposed for the stream mouth, which means that all of the water at the IIFS on Hanehoi Stream and its Puolua tributary could be diverted from the streams below those locations, so there would be no improvement in the biological integrity of the stream.

149. As a consequence, although the sum of the first two IIFS was to improve the biological integrity of the stream, operatively, the flows could be completely diverted for offstream uses, leading to no biological enhancement of the streams. Furthermore, as with Honopou Stream, *supra*, FOF 122, there is no explanation on how the quantities chosen would provide an adequate amount of surface water for users downstream of the Haiku Ditch, *supra*, FOF 146.

150. While not identifying specific acres, Nā Moku contends that insufficient water and lands that have either appurtenant or riparian rights require that both Hanehoi and Puolua Streams be returned to their natural base flows (BFQ_{50}): 1) for Hanehoi Stream, 1.64 mgd (2.54 cfs) at the selected ungaged site between the Lowrie and Haiku Ditch; and 2) 0.95 mgd (1.47 cfs) at the selected ungaged site below the Haiku Ditch for Puolua Stream. This would increase the IIFS for Hanehoi Stream from 0.74 mgd to 1.64 mgd, and for Puolua Stream, from 0.57 mgd to 0.95 mgd. (Exh. C-85, p. 26.) [Nā Moku/MTF FOF 783-784, 806, 810, 819, 840.]

151. On the other hand, HC&S noted that CWRM identified an estimated cultivable area of 2.3 acres, and identified two parties who are or who would like to cultivate taro on four acres, as well as one person who has a parcel adjacent to Hanehoi Stream and would like to exercise her riparian rights. (Exh. C-85, p. 21; Ernest Schupp, WDT, ¶¶ 3, 9, 13; *see generally,* Neola Caveny, WDT; *see generally*, Solomon Lee, WDT.) [HC&S FOF 154-161.]

3. Piinaau and Palauhulu Streams

152. Piinaau and Palauhulu Streams are diverted by the Ko`olau Ditch (east of and flowing into the Wailoa Ditch; *see* Exhs. C-1 and C-33, attached:

a. Piinaau Stream is dry immediately downstream of the Koolau Ditch, possibly from infiltration losses and diversions at the Ditch. Actual flow measurements are not available because of geographic inaccessibility and a major landslide in 2001.

b. Palauhulu Stream gains flow (averaging 2.7 mgd) from Plunkett Spring below the Ditch. The lower reach is dry from infiltration losses above Store Spring, below which the stream gains an unknown amount of flow from the spring.

c. There was one now-inactive gaging station on Palauhulu Stream just before its confluence with Piinaau Stream. Streamflow statistics were estimated with regression equations from the 2005 Flow Study and low-flow (diverted conditions) measurements. (Exh. C-85, pp. 30, 36.)

153. For Piinaau Stream, the Commission kept the status quo IIFS at its lower reach at 40 feet elevation, upstream from its confluence with Palauhulu Stream. A flow value could not be determined due to the large uncertainty in the hydrological data. Moreover, with the current flow, the stream exhibited a rich native species diversity, offered a variety of recreational and aesthetic opportunities, and the two registered diversions had not indicated a lack of water availability. (Exh. C-85, p. 33.)

154. For Palauhulu Stream, a IIFS was established at 3.56 mgd (5.50 cfs) near 80 feet elevation, upstream of its confluence with Piinaau Stream, to ensure that the proposed flow reaches downstream users in Keanae peninsula. This was half of the estimated undiverted base flow at the site. Since estimated diverted flow was 3.10 mgd (11 cfs), there was a net addition of 0.46 mgd (0.71 cfs). A second IIFS was not proposed at the stream mouth, because the amount of water flowing from both streams into the estuary, Waialohe Pond, was deemed adequate. (Exh. C-85, pp. 34-35, 36.)

155. Median base flow (BFQ_{50}) was used to establish the IIFS, in contrast with Honopou Stream, where Q_{90} was used, *supra*, FOF 126, 127, and Hanehoi and Puolua Streams, where BFQ_{95} was used, *supra*, FOF 140. (Exh. C-85, p. 34.) Part of the reason was that "(m)edian base flow is used as a standard to determine the relative native species habitat availability in a USGS study, which will be important for future comparisons," and that "(i)f flow is restored to 50 percent of natural base flow, potentially 80 to 90 percent of native habitat is available in Palauhulu Stream upstream of the confluence." (Exh. C-85, p. 34.) It was not explained why BFQ_{50} was not used for the previously described streams, nor why habitat availability was the basis for the amended IIFS, when taro cultivation was the focus.

156. Commission staff identified eight diversions for domestic use, irrigation of taro and other crops and for livestock, for an estimated cultivable area of 106 acres. The Keanae complex, with about 107 lo`i, which has decreased by half since 1903, is fed by Palauhulu Stream. The Keanae Arboretum complex, with 14 lo`i, is fed by Piinaau Stream. (Exh. C-85, p. 31.)

157. Nā Moku claimed that Palauhulu Stream was the water source for 27.195 acres, 24.595 for taro in Keanae, and an addditional 2.6 acres in cultivable acreage. (Exh. A-173, Teri Gomes, Tr., April 1, 2015, p. 7.) [Na Moku/MTF FOF 571-573.]

158. HC&S contends that no person came forth to assert a claim for water from Piinaau Stream, and that the entire Keanae lo`i complex comprises only 10.53 acres. (Garret Hew, WDT, ¶ 29; Exh. C-108, figure 3, p. 57.; Exh. C-109; Exh. C-110.) [HC&S FOF 318-320.]

4. Waiokamilo Stream

159. Waiokamilo Stream is diverted by the Ko`olau Ditch. It is generally a losing stream. The 2005 Flow Study indicated that it is dry immediately downstream of the Ditch, then gains about 3.8 mgd from Akeke (Banana) Spring. Thereafter, the stream loses flow to ground water, minor diversions, and a known losing reach near Dams 2 and 3. (Exh. C-85, p. 40.)

160. In March 2007, the Board of Land and Natural Resources' ("BLNR") issued an interim order to release 6 mgd into Waiokamilo Stream below Dam 3. (Exh. C-83, p. 46.)

161. In July 2007, as a result of the interim order, a USGS gaging station was installed near Dam 3. Streamflow statistics at ungaged sites were estimated with regression equations and low-flow measurements. (Exh. C-85, pp. 40, 47.)

162. In the September 25, 2008 Commission order, an IIFS of 3.17 mgd (4.9 cfs) was established near Dam 3 at the site of the USGS gage. This was the median total flow (T_{50}, also described as TFQ_{50}), or the total flow in the stream without diversions at the Ko`olau Ditch. The estimate of the total undiverted flow: 1) just below the Ko`olau Ditch was TFQ_{50} = 4.52 mgd (7 cfs); 2) below Akeke (Banana) Spring, TFQ_{50} was estimated at 6.46 mgd (10 cfs); but 3) TFQ_{50} was measured at the USGS gaging station at 3.17 mgd (4.9 cfs), likely due to losing reaches between the Spring and Dam 3, *supra*, FOF 159. (Exh. C-85, pp. 43-44, 47.)

163. Below the IIFS established at 3.17 mgd (4.9 cfs) near Dam 3 at the site of the USGS gage, Waiokamilo Stream gains flows at 250 feet elevation from what was thought was Kualani Stream and at 240 feet from an unnamed spring, so that just above the terminal waterfall, TFQ_{50} without diversions was estimated at 5.62 mgd (8.7 cfs). (Exh. C-85, p. 47.)

164. What was thought to be Kualani Stream served as a conduit for the Lakini auwai system. Water from Waiokamilo Stream was diverted into the Lakini system and joined Kualani Stream before reaching Dam 1, after which it is diverted for taro cultivation in the Lakini taro patches and in Wailua Valley further downstream. (Exh. C-85, pp. 45, 47.)

165. After investigation, what was thought to be Kualani Stream was actually the most eastern tributary of Waiokamilo Stream. (Garrett Hew, Tr., April 1, 2015, p. 126; Dean Ueno, Tr. March 2, 2015, p. 43.).)

166. The IIFS at Dam 3 was the total flow in the stream without diversions at the Ko`olau Ditch, yet the TFQ_{50} of 3.17 mgd was only half of the 6 mgd that BLNR had ordered released at the same point in March 2007, *supra*, FOF 160.

167. EMI claimed that it had sealed up all its diversions on Waiokamilo Stream, including the intake on what was thought was Kualani Stream, and thereby was no longer diverting any water from Waiokamilo Stream. Dean Uyeno of the Commission staff also stated that what was thought was Kualani Stream, but now is known as East Waiokamilo Stream, was not being diverted. (Garrett Hew, Tr., March 17, 2015, pp. 125, 128-129; Dean Uyeno, Tr., March 2, 2015, pp. 41-43.)

168. Commission staff estimated that there were 515 cultivable acres with Waiokamilo Stream as its source. (Exh. C-85, p. 41.)

169. The Wailuanui lo`i complex relies on three different sources of water, two of which are associated with Waiokamilo Stream and one with Wailuanui Stream. (Exh. cC-85, p. 52.)

170. Nā Moku claimed that 60.767 acres, 44.474 acres in taro and 16.293 cultivable acres, are fed by Waiokamilo and Kualani Streams, 22.448 cultivable taro acres are fed by Wailuanui and Kualani Streams, and 5 acres in Waianu Valley, between Wailuanui and Keanae, are fed by Waiokamilo Stream. (Exh. A-173; Isaac Kanoa, WDT, ¶ 6.) [Nā Moku/MTF FOF 595, 606.]

171. Because what was thought was Kualani Stream is actually the east branch of Waiokamilo Stream, Nā Moku's revised claim is that 65.767 acres are fed by Waiokamilo Stream, and 22.448 acres are fed by Wailuanui and Waiokamilo Streams.

172. HC&S states that EMI is no longer diverting Waiokamilo Stream. (Garrett Hew, WDT, ¶ 35; Tr., March 17, 2015, pp. 128-129; Exh. C-52, pp. 56-67; Exh. C-147, pp. 84-96.) [HC&S FOF 365.]

5. Wailuanui Stream

173. Streamflow statistics were estimated by regression equations, estimating that Wailuanui Stream gains flow from the lower reaches of its tributaries to the coast. Average annual groundwater gains upstream of Ko`olau Ditch for East and West Wailuanui are 1.7 mgd and 2.2 mgd, respectively. Between the Ditch and the lowest USGS ungaged site, Wailuanui Stream gains an average of 0.8 mgd. (Exh. C-85, p. 51.)

174. Ko`olau Ditch is the only diversion capturing base flow and could reduce natural total flow by 84 percent. A number of other diversions between the lowest stream gage and the coast could reduce natural total flow by 85 percent. (Exh. C-85, p. 51.)

175. The IIFS was established at 1.97 mgd (3.05 cfs) at 620 feet elevation, downstream of the Ko`olau Ditch and below the confluence of East and West Wailuanui Streams. Estimated diverted flow at this site was 0.65 mgd (1.0 cfs), so there would be a net addition of 1.32 mgd (2.05 cfs). (Exh. C-85, pp. 54, 56.)

176. The IIFS is half of the BFQ_{50} of 3.94 mgd (6.1 cfs) and was established on the rationale that with half of median base flow, potentially 80 to 90 percent of natural habitat will be available, as well as providing more surface water to the downstream users, the majority of whom are downstream of the IIFS location. (Exh. C-85, p. 55.)

177. The IIFS of 0.71 mgd (1.1 cfs), BFQ_{50} of diverted flow, was kept at the status quo further downstream below Waikani Falls. At this location, BFQ_{50} of undiverted flow is 4.33 mgd (6.7 cfs), and 64 percent of BFQ_{50}, or H_{90}, would be 2.77mgd (4.33 cfs). Therefore, the status quo IIFS would be less than that needed for growth, reproduction, and recruitment of native stream animals. (Exh. C-85, p. 56.)

178. There are two declared diversions for taro cultivation with an estimated cultivable area of 350 acres, but the Wailuanui lo`i complex relies on water from both Waiokamilo and Wailuanui Streams, and Commission staff had estimated that there were 515 cultivable acres with Waiokamilo Stream as its source, *supra*, FOF 168. Therefore, these two areas have undetermined overlaps, and the total would be less than the sum of the two. (Exh. C-85, p. 52.)

179. As noted earlier, *supra*, FOF 170, Nā Moku contends that 22.448 acres are fed by Wailuanui and Waiokamilo Streams.

180. HC&S contends that "the Wailua (Waikani) complex" is the lo`i system that is irrigated solely with water from Wailuanui Stream, and as of the summer of 2006, it comprised 2.80 acres. Furthermore, HC&S contends that it is now substantially, if not entirely, removed from taro production despite an increased, consistent flow of 2 to 3 mgd since the Commission's 2008 decision. (Garret Hew, WDT, ¶¶ 36-38; Exh. C-108; Norman "Bush" Martin, Tr., March 9, 2015, pp. 185-189; Dan Clark, Tr., March 10, 2015, pp. 113-117; Uyeno, December 18, 2014 written report, p. 30.) [HC&S FOF 387-389, 393.]

181. HC&S further contends that the record does not include an adequate breakdown of the parcels and acreage that Nā Moku has identified as owned by its members in the vicinity of

Wailuanui Stream that may have been previously irrigated with Wailuanui Stream water. [HC&S FOF 391.]

6. Summary and Analysis

a. Use of Different Reference Flows

182. The September 25, 2008 Commission order was said to have restored 4.5 mgd (7 cfs) to six of the eight streams, *supra*, FOF 9. If there were estimated diverted flows at the IIFS sites, those would be subtracted from the IIFS to compute net restorations. If there were only estimated undiverted flows at the IIFS sites, then the IIFS were assumed to be the net restorations:

Honopou Stream:	1.29 - 0.14 =	1.15 mgd	(based on TFQ_{90} flows)
Hanehoi Stream:		0.74 mgd	(based on BFQ_{95} flows)
		0.41 mgd	(based on BFQ_{95} flows)
Puolua Stream:		0.57 mgd	(based on BFQ_{95} flows)
Palauhulu Stream:	3.56 - 3.10 =	0.46 mgd	(based on BFQ_{50} flows)
Waiokamilo Stream:		3.17 mgd	(based on TFQ_{50} flows)
Wailuanui Stream:	1.97 - 0.65 =	1.32 mgd	(based on BFQ_{50} flows)
Total:		7.82 mgd	

183. If the 3.17 mgd for Waiokamilo Stream is left out because BLNR had previously ordered that the flow be increased to 6 mgd at the IIFS site, *supra*, FOF 160, the total restorations would be 4.65 mgd (7.19 cfs).

184. The summary table provided by Commission staff are nearly identical to the numbers (without Waiokamilo Stream) in FOF 182, *supra*, except that Honopou is listed at 1.21 mgd instead of 1.15 mgd, and Palauhulu Stream is listed at 0.45 mgd instead of 0.46 mgd. That table summarizes the restoration amounts at 4.7 mgd instead of 4.65 mgd. This discrepancy may be due to the Commission staff's use of BFQ_{50} or TFQ_{70} in arriving at their numbers. (Exh. HO-1, footnote 1.) Commission staff also stated that the restoration amounts did not consider Honopou, Hanehoi, and Puolua Streams, but they are in fact included, with the IIFS assumed to be the net restoration, *supra*, FOF 182. (Exh. HO-1, footnote 2 and column titled "Restoration Amount, Wet Season.")

185. There was also no uniformity in that four different reference flows (TFQ_{90}, BFQ_{95}, BFQ_{50}, and TFQ_{50}) were used to calculate restoration amounts, *supra*, FOF 182. Commission staff had defined base flow (BFQ) as the Q_{70} to Q_{90} flows, *supra*, FOF 126; but for Honopou

Stream, they had chosen the low end (Q_{90}), and for Hanehoi and Puolua Streams, had chosen an even smaller reference flow, BFQ_{95}. Furthermore, in the summary table, staff "assumed that Q_{70} and BFQ_{50} represent median base flow in the streams." (Exh. HO-1, footnote 1.)

186. Therefore, for Honopou, Hanehoi and Puolua Streams, less than median base flows formed the basis for restoration amounts, *supra*, FOF 182, and for Palauhulu and Wailuanui Streams, *supra*, FOF 155, 176, only half of the median base flows were restored.

187. The choice of reference flows makes a significant difference in the amount of flow restored. For example, restorations for both Hanehoi and Puolua Streams used BFQ_{95} instead of BFQ_{50} flows, *supra*, FOF 182. Had BFQ_{50} been used, the restoration amounts for Hanehoi Stream would have increased from 0.74 mgd to 1.64 mgd, and from 0.41 mgd to 0.78 mgd, respectively; and for Puolua Stream, the restoration would have increased from 0.57 mgd to 0.95 mgd. (Exh. C-85, pp. 24-26.)

188. Finally, the use of TFQ_{50} flows for Waiokamilo Stream is explained by the fact that it was no longer being diverted, *supra*, FOF 167, and TFQ_{50} should represent median undiverted total flow. However, the TFQ_{50} of 3.17 mgd, which represents all of the total flow, is substantially less than the 6 mgd that BLNR had ordered in March 2007 to be restored, *supra*, FOF 160.

189. In the 2007 BLNR order, it had conservatively estimated that the flow above Dams 2 and 3 was 3 mgd, and that EMI had measured it at 3.57 mgd and 3.85 mgd on July 26, 2005, comparable to flows measured by EMI in 1981. It ordered that current diversions be decreased so that flows below Dam 3 increased to 6 mgd on a monthly moving average on an annual basis. (Exh. C-83, pp. 28, 31, 46.)

190. However, total flows after diversions were sealed only averaged 3.17 mgd (4.9 cfs) over 8 months of measurements beginning on September 1, 2007. (Exh. C-85, p. 44.)

b. Taro Water Requirements

191. Paul Reppun, a taro farmer who testified as an expert on taro cultivation in the Nā Wai `Ehā proceeding as well as in the instant proceeding, had opined that the water requirements of kalo lo`i ranges from 100,000 to 300,000 gad. (Paul Reppun, WDT, Exh. A, p. 5; Tr., March 4, 2015, p. 43.) [HC&S FOF 84.]

192. In the contested case hearing on petitions to amend the IIFS for Nā Wai `Ehā streams, the Commission had concluded that on kuleana lands, 130,000 to 150,000 gad of flow-through

water was sufficient for proper kalo cultivation, with 15,000 to 40,000 gad of net loss between lo`i inflow and outflow from evaporation, transpiration, and percolation through the bottoms and leakage through the banks, with most of the loss through percolation and leakage. (Exh. C-120, p. 120, COL 54-56; p. 168, COL 219 (citations omitted).) [HC&S FOF 83.]

193. The Commission's estimate was based on its finding that the kuleana lands in the Nā Wai `Ehā case receive more than 130,000 to 150,000 gad for their kalo lo`i, including the 50 percent of time that no water is needed to flow into the lo`i. This would be equivalent to 260,000 to 300,000 gad for the 50 percent of the time that water is flowing, amounts that would be sufficient to meet even Reppun's estimate of 100,000 to 300,000 gad for sufficient flow. (Exh. C-120, p. 120, COL 56.)

194. In the instant proceeding, Reppun stated that his estimate of 100,000 to 300,000 gad took into account the 50 percent of time that no water is needed (but *see* FOF 196, 271, *infra*) and that any figure can be assumed to be an average resulting from such parameters as percolation rates, weather, season, location on the stream relative to other diversions, initial water temperature, and rate of dilution of used water. (Paul Reppun, Tr., March 4, 2015, p. 43; WDT, Exh. A, p. 6.)

195. However, the utility of using a general water requirement is questionable, as even Reppun opined, "there is no one definitive answer." (Paul Reppun, Tr., March 4, 2015, p.19.)

196. Reppun's use of the 100,000 to 300,000 gad figure is predicated on when the taro needs the most water, not an average over the course of the entire crop cycle, which he had claimed: "but the important thing is that when it does need the most water, it can be severely--the crop can be severely damaged if it doesn't get that. And so it's that peak period of time, which during the summer months, during the hottest times, the longest days, also happens to be the time that everybody else needs the most water, and also the stream needs the most water." (Paul Reppun, Tr., March 4, 2015, p. 19.)

197. The temperature of 27^0C (80.6^0F) is the threshold point at which wetland kalo becomes more susceptible to fungi and rotting diseases. (Paul Reppun, Tr., March 4, 2015, p. 27; Exh. C-108, p. 1.) [HC&S FOF 86.]

198. Water temperature in a lo`i complex is dependent on variables such as the amount and temperature of the inflow, the amount of foliage cover, and the size of the complex, and different factors in a lo`i can contribute to how soon and how quickly taro rot occurs. (Paul Reppun, Tr., March 4, 2015, pp. 31-33.) [HC&S FOF 88-89.]

199. Reppun participated in a 2007 USGS study designed to collect baseline flow--what the farmers were actually using--and temperature data from kalo cultivation areas on Kauai, Oahu, Maui, and Hawaii. "All we did was look at quantities of water and correlate that to temperature." (Paul Reppun, Tr., March 4, 2015, p. 26; Exh. C-108.)

200. The area of a lo`i complex included the cultivated and fallow lo`i banks, pathways, and auwai inside the perimeter of each complex. (Exh. C-108, pp. 5-6.)

201. Water need for kalo cultivation depends on the crop stage, and in order to assure consistency of the data collected at the various sites, only lo`i with crops near the harvesting stage (continuous flooding of the mature crop) were selected for water-temperature data collection. Data was collected in the dry season (June - October), when water requirements for cooling kalo approach upper limits. Flow measurements generally were made during the warmest part of the day, and temperature measurements were made every 15 minutes at each site for about a 2-month period. (Exh. C-108, p. 1.)

202. The Maui part of the study measured three areas, all on the windward side: 1) Waihee, 2) Wailua, and 3) Keanae. (Exh. C-108, p. 43.)

203. Three lo`i complexes in Wailua were studied: Lakini, Wailua, and Waikani. Lakini and Wailua receive diverted water from Waiokamilo Stream, and Waikani receives diverted water from Wailuanui Stream. All the active lo`i in Keanae were treated as one complex, which receives diverted water from Palauhulu Stream. (Exh. C-108, p. 43.)

204. The acreage for these complexes were:

Lakini: 0.74 acres

Wailua: 3.32 acres

Waikani: 2.80 acres

Keanae: 10.53 acres (Exh. C-108, p. 44, Table 5.)

205. The average inflow value for the 19 lo`i complexes across the four islands that were studied was 260,000 gad, and the median inflow value was 150,000 gad. The average inflow value for the 17 windward lo`i complexes was 270,000 gad, and the median inflow value was 150,000 gad. (Exh. C-108, p. 1.)

206. Inflow measurements on July 30, 2006 and on September 21, 2006 were:

Lakini: 750,000 gad and 550,000 gad (for 0.74 acres)

Wailua: 180,000 gad and 140,000 gad (for 3.32 acres)

Waikani: 190,000 and 93,000 gad (for 2.80 acres)

Keanae: 180,000 gad and 150,000 gad (for 10.53 acres) (Exh. C-108, p. 44.)

207. Of the 17 (of 19) lo`i complexes where water inflow values were measured, only three had inflow temperatures that rose above 27^0C. (Exh. C-108, pp. 1.)

208. Lakini, Wailua, Waikani, and Keanae had inflow temperatures well below 27^0C, with Keanae having the lowest inflow temperature of all lo`i complexes in the study at 20.0^0C. (Exh. C-108, pp. 1, 51, 53, 56, 58.)

209. Outflow temperature was not measured for Wailua, and there was an equipment malfunction at Keanae. For Lakini, temperatures exceeded 27^0C 16.9 percent of the time, with the earliest time of day at 1015 hours and the latest, at 1800 hours; peak temperatures occurred between 1300 and 1815 hours. For Waikani, temperatures exceeded 27^0C 29.1 percent of the time, with the earliest time of day at 0000 hours and the latest, at 2345 hours; peak temperatures occurred between 1400 and 2045 hours. (Exh. C-108, p. 45.)

210. The time that 27^0C was exceeded did not occur every day. Although the study did not summarize these data, the graphs indicate that one-half to two-thirds of the time, temperatures exceeded 27^0C for several hours a day. (Exh. C-108, pp. 51, 56.)

211. Reppun is of the opinion that 77^0F is the point at which rot begins to accelerate, and as rot begins to accelerate, it doesn't necessarily reach unacceptable levels until a little bit higher temperature, and he is of the opinion that 27^0C (80.6^0F) is about that point where it starts to really climb. (Paul Reppun, Tr., March 4, 2015, pp. 27-28.)

212. Reppun is of the opinion that the percent of the time that outflows exceed 27^0C is the most important factor. (Paul Reppun, Tr., March 4, 2015, p. 69.)

213. Reppun also opines that the cooler the water that comes into the lo`i, the better, and the water flowing out of the lo`i should be 77^0F or less. (Paul Reppun, Tr., March 4, 2015, pp. 51, 62.)

214. Aside from such things as the stage of the crop, temperature of the inflows, the amount of sunlight, etc., there are management practices that the farmer can engage in to maximize the cooling effect of the water. The main one is to increase the depth of the water, which would increase the cooling capacity of the water. That takes more water. (Paul Reppun, Tr., March 4, 2015, p. 59.)

215. If you begin to have rot, then you rest your field and change it from a wetland ecosystem to a dry land ecosystem. (Paul Reppun, Tr., March 4, 2015, p. 33.)

216. Questioned on the 0.74-acre Lakini lo`i complex using 550,000 to 750,000 gad, *supra*, FOF 204, 206, Reppun was of the opinion that the capacity of that amount of water was enormous relative to the size of the area, that the water was not going to heat up very much at all, and that the amount was more than adequate. (Paul Reppun, Tr., March 4, 2015, p. 73.)

217. Reppun's opinion that taro water requirements are approximately 100,000 to 300,000 gad does not mean that these amounts are daily averages during a crop cycle, but an approximation of the amount required when maximum inflow is required to prevent rot. Nor is 100,000 to 300,000 gad the maximum of the amount so required. Reppun's principal point is that when lo`i waters are most susceptible to reach temperatures that accelerate rot, sufficient inflow waters need to be available to keep water temperatures below the threshold for rot.

c. Acreage in Taro

218. In total, the acreage claimed by Nā Moku as being either in taro or cultivable agriculture was 136.18 acres for Honopou, Palauhulu, Waiokamilo, and Wailuanui Streams, *supra*, FOF 133, 157, 170, 171.[14] (Teri Gomes, Tr., April 1, 2015, p. 11, 13.)

219. Nā Moku identified no acreage for Hanehoi and Puolua Streams, but contended that insufficient water and lands that have either appurtenant or riparian rights require that both Hanehoi and Puolua Streams be returned to their natural base flows (BFQ_{50}), *supra*, FOF 150; while HC&S noted that the Commission identified an estimated cultivable area of 2.3 acres, and identified two parties who are or who would like to cultivate taro on four acres, as well as one person who has a parcel adjacent to Hanehoi Stream and would like to exercise her riparian rights, *supra*, FOF 151.

220. Teri Gomes, Na Moku's expert witness, put the entire parcel in taro when she couldn't tell what portion was in taro. In her previous testimony before BLNR, she had reduced the acreage by 10 percent, but was not instructed to do so in the present contested case. (Teri Gomes, Tr., April 1, 2015, pp. 14, 18, 40.)

221. Gomes also placed the parcel in the cultivable agriculture category when land was awarded without specificity of use, because most parcels awarded at the time of the Mahele were used for agricultural purposes and she had already eliminated house lots, cemeteries, and churches. (Teri Gomes, Tr., April 1, 2015, pp. 19, 32.)

[14] The total acreage under FOF 133, 157, 170, and 171 is 139.4 acres, but there is some overlap because some acres are fed by both Waokamilo and Wailuanui Streams, *supra*, FOF 170-171.

222. Therefore, Na Moku's own expert witness conceded that these acreages are overstated by an unknown amount for taro cultivation and cultivable agriculture.

d. Revised IIFS to Meet Taro Water Needs

223. The Commission's order identified the acreage of taro for each stream through the undocumented declarations of registered diverters, with a total of 1006 acres plus water for domestic needs, *supra*, FOF 132, 139, 156, 168, 178, but did not attempt to evaluate these claims nor relate these acres to the amount of water added to the streams in the revised IIFS.

224. It has further been noted that different reference flows were used to amend the IIFS, *supra*, FOF 182-189.

225. Commission staff stated that their efforts were based on looking at the lower Q values, the low flow values, in order to make sure that it would always be met, to make sure that the downstream users would always have a set amount of water, and conceded that such an approach could amend the IIFS lower than what taro farmers might need. (Dean Uyeno, Tr., March 2, 2015, p. 122.)

e. Habitat Improvement

226. For East Maui streams, it is estimated that 64 percent of natural median base flow ($0.64xBFQ_{50}$) would be required to provide 90 percent of the natural habitat (H_{90}), *supra*, FOF 99, which is expected to produce suitable conditions for growth, reproduction, and recruitment of native stream animals, *supra*, FOF 105.

227. Habitat less than H_{90} would not result in viable flow rates for the protection of native aquatic biota. There is no linear relationship between the amount of habitat and the number of animals. H_{70}, or twenty percent less habitat than H_{90}, would not result in only 20 percent less animals; nor would H_{50}, which is twenty percent less than H_{70}, result in only an additional 20 percent less animals, *supra*, FOF 106.

228. The 2008 Commission decision restored only enough water to Honopou Stream for continuity of flow, not growth, reproduction, and recruitment of native stream animals, *supra*, FOF 122.

229. For Hanehoi Stream, half of the BFQ_{95} (not the much larger BFQ_{50}) flow, or $0.50xBFQ_{95}$ was restored, *supra*, FOF 142. Thus, not only was the smaller base flow used as a reference, but the percent of such flow was only 50 percent, not 64 percent. Furthermore, although the amended

IIFS was to improve the biological integrity of the stream, operatively, the flows could be completely diverted for offstream uses, *supra*, FOF 149.

230. For Palauhulu Stream, restoration was for half of BFQ_{50}, or $0.50xBFQ_{50}$, less than the $0.64xBFQ_{50}$, and flow at the mouth was deemed adequate, although it is unclear if that flow met the $0.64BFQ_{50}$ requirement, *supra*, FOF 154-155.

231. For Waiokamilo Stream, the total flow of 3.17 mgd was restored (TFQ_{50}), which cannot meet the BLNR order to have a total of 6 mgd flowing in the stream, supra, FOF 162, 166. If this total flow is really equivalent to H_{100}, however, the principal purpose of BLNR's order and the cessation of diversions were to increase the availability of stream water for taro growing. So how much of the stream water is used by the taro farmers will determine whether habitat restoration takes place.

232. Finally, for Wailuanui Stream, restoration was for half of BFQ_{50}, or $0.50xBFQ_{50}$, less than the $0.64xBFQ_{50}$ needed for habitat restoration, *supra*, FOF 176. Furthermore, the increased flows can be diverted by downstream users, further compromising habitat improvement, *supra*, FOF 177.

H. The May 25, 2010 Commission Order

233. On May 25, 2010, the Commission voted to amend the IIFS through a seasonal approach for six of the remaining 19 streams, with winter total restorative amounts of 9.45 mgd, and summer restoration reduced to 1.11 mgd, *supra*, FOF 12.

234. Winter restorative flows were established at 64 percent of BFQ_{50} (H_{90} or $H_{minimum}$) to maintain minimum viable habitat for native stream animals, while summer restorative flows were established at 20 percent of BFQ_{50} ($C_{minimum}$) to maintain minimum connectivity for animals to survive in shallow pools without suitable long-term growth or reproduction of native stream animals. (Exh. C-103, pp. 9, 11.)

235. A comparison between annual and seasonal approaches is summarized as follows:

	Annual approach	Seasonal approach
Instream uses	helps restore streams to their natural flow pattern for the full year	helps restore streams to their natural flow pattern for part of the year
	greater biological benefit as the higher flows support annual growth and reproduction of native stream animals	results in semi-annual growth and reproduction with recruitment and survival during the alternate six months

noninstream uses	less stream water available for agricultural and domestic needs in the summer when demands are high	streamflows provide more water for agricultural and domestic needs in the summer season when demands are higher than in winter
	one-time diversion modification needed for stable IIFS	more complex diversion modification needed for flexible IIFS and oversight of semi-annual modifications required

(Exh. C-103, p. 14.)

236. Together with the additions for the first eight streams (six of which were amended) that totaled 4.5 mgd (*supra,*FOF 9), total stream restorations for the 27 streams were as follows: 12 of 27 streams restored by a total of 13.76 mgd in the wet season, reduced to 5.61 mgd in the dry season, *supra*, FOF 13.

237. By comparison, Commission staff had estimated total diversions by East Maui Irrigation (EMI) as ranging from 134 mgd in the winter months to 268 mgd in the summer months, averaging about 167 mgd, *supra*, FOF 14.

238. Of the eight (nine, counting Puakaa Stream as separate from Kopiliula Stream, *supra*, FOF 108) streams recommended by DAR for restoration, *supra*, FOF 115, Commission staff recommended five--Waikamoi, East Wailuaiki, West Wailuaiki, Waiohue, and Hanawi Streams--and added one, Makapipi Stream. (Exh. C-103. p. 19.)

239. The flow rates for H_{90} or $H_{minimum}$ calculated by Commission staff were similar but not the same as DAR's recommended flows in the wet season, because DAR calculated IIFS for the lower and middle reaches of the streams, while Commission staff calculated IIFS near potential monitoring stations. (Exh. C-103, p. 17.)

240. Commission staff's recommendations, which were accepted by the Commission, were as follows:

a. Waikamoi Stream: "supports DAR's position of a geographic approach to flow restoration. A geographic approach means restoring flow to streams both east and west of Keanae Valley. Benefits of this approach include biological diversity in the East Maui area, and regional diversity in traditional gathering opportunities...(I)t is the only stream out of the three recommended DAR streams located west of Keanae Valley that is not used for conveyance along its main reach. Many area residents also expressed interests in gathering native animals from this stream." (Exh. C-103, p. 19.)

b. West Wailuaiki and East Wailuaiki Streams: flow restoration in these streams "will result in the most biological return from additional flow. The presence of an estuary in both streams further enhances the biological diversity of the stream. In addition, flow restoration provides increased opportunities for traditional gathering that area residents currently want to practice." (Exh. C-103, p. 19.)

c. Waiohue Stream: "is also proposed for flow restoration for similar reasons that East and West Wailuaiki Streams were selected. The presence of an estuary further enhances the biological diversity of the stream...(R)esidents testified to gathering vegetation and stream animals in Waiohue Stream." (Exh. C-103, p. 19.)

d. Hanawi Stream: "minimal flow is needed to achieve the desired biological diversity and impacts to HC&S would be negligible. Modification of the diversion would serve mainly to create a wetted pathway for stream animal connectivity from the diversion to the ocean. The interim IFS for Hanawi Stream is an exception to the staff"s approach to calculating the interim IFS because the stream has adequate flow to sustain a viable biota population. As recommended by DAR, the biological health of the stream could be further improved simply by providing connectivity in the dry reach immediately below the diversion. For this reason, staff established the monitoring site directly below the ditch at an interim IFS of 0.1 cfs to ensure a wetted pathway." (Exh. C-103, p. 19.)

e. Makapipi Stream: "Apart from DAR's priority streams, staff recommends restoration for Makapipi Stream because the Nahiku community relies heavily on the stream for cultural practices, recreation, and other instream uses. With the uncertainty of gaining and losing reaches along most of the stream's course to the ocean, it is not known whether restored flow will result in continuous stream flow from the headwaters to the stream mouth. A coordinated study of a short-term release of water past the one major EMI diversion should be sufficient to determine the sustainability of the proposed standard (0.60 mgd [0.93 cfs], which is TFQ_{70}, or BFQ_{50}, just upstream of Hana Highway)." (Exh. C-103, pp. 19-20.)

241. Commission staff did not recommend DAR's selection of Puohokamoa, Haipuaena, and Kopiliula Streams, reasoning that these streams are used for conveyance, more water may exist in the portion of the stream used for conveyance than would naturally occur, and any interim IFS should be based on the surface water available within the given hydrological unit. (Exh. C-103, p. 20.)

a. For Kopiliula Stream, conveyance was described as "ditch," and DAR had recommended bypassing the area of commingling of the ditch and stream water with a box flume. (Glenn Higashi, Tr., March 16, 2015, p. 171. [Nā Moku/MTF FOF 362.]

b. For Puohokamoa Stream, conveyance was described as "overflow" at the Spreckels Ditch and "??" at the Manuel Luis Ditch. (Exh. C-103, p. 1-5.)

c. For Haipuaena Stream, conveyance was described as "S-7, Punalau" at the Spreckels Ditch. ("S-7, Punalau" refers to the Spreckels Ditch intake on Punalau Stream, which is immediately east of Haipuaena Stream. S-8 is the Spreckels Ditch intake for Haipuaena Stream.) (Exh. C-103, p. 1-7.)

242. However, during the contested case hearing, Garrett Hew of EMI agreed that there's no identification of particular conveyance streams. If storm waters overflow a ditch, the water goes into the stream and then hits the next ditch downstream. There are no actual conveyance ditches or designated conveyance streams in the system. (Garrett Hew, Tr., March 18, 2015, pp. 144-145.)

243. For Puakaa Stream, minimum connectivity as for Hanawi Stream, *supra*, FOF 240(d), was not recommended, because the habitat unit gain would be only 300 meters compared to over 1300 meters for Hanawi Stream, and the cost and effort to modify the diversion to allow for connectivity was better spent in Hanawi Stream. (Exh. C-103, p. 20.)

244. For the remaining nine streams--Alo (a tributary of Waikamoi Stream), Wahinepee, Punalau, Honomanu, Nuaailua, Ohia, Paakea, Waiaaka, and Kapaula Streams--flow restoration was not recommended because these streams would not result in significant biological return from additional flow. Instead, staff recommended establishing measurable status quo flows at specific locations along each stream." (Exh. C-103, p. 20.)

245. The revised IIFS for these six streams were as follows:

	Wet season (winter)	Dry season (summer)
Waikamoi Stream	1.81 mgd (2.80 cfs)	0
West Wailuaiki Stream	2.46 mgd (3.80 cfs)	0.26 mgd (0.40 cfs)
East Wailuaiki Stream	2.39 mgd (3.70 cfs)	0.13 mgd (0.20 cfs)
Waiohue Stream	2.07 mgd (3.20 cfs)	0.06 mgd (0.10 cfs)
Hanawi Stream (annual)	0.06 mgd (0.10 cfs)	0.06 mgd (0.10 cfs)
Makapipi Stream (annual)	0.60 mgd (0.93 cfs)	0.60 mgd (0.93 cfs)
Total:	9.39 mgd (14.53 cfs)	0.57 mgd (1.73 cfs)

246. The total restoration amounts for the wet season are slightly less than the sum of the IIFS by 0.13 mgd (0.20 cfs), because Waikamoi Stream was restored by 1.68 mgd (2.60 cfs) to bring its IIFS to 1.81 mgd (2.80 cfs), while the other streams' revised IIFS are equal to the restoration amounts. (Exh. HO-1.)

247. Thus, total wet season restoration for these six streams was 9.26 mgd (14.33 cfs), and total dry season restoration was 0.57 mgd (1.73 cfs).

248. Together with the six streams whose IIFS were increased 4.7 mgd (7.27 cfs) on an annual basis in September 2008 primarily for taro growing and domestic uses, *supra*, FOF 184, total wet season and dry season restorations for these twelve streams were:

Wet season: 13.96 mgd (21.60 cfs)

Dry season: 5.27 mgd (8.15 cfs)

249. There are small inconsistencies in the totals for the first six streams in 2008 and for the six streams in 2010, *supra*, FOF 9, 12, 13, 15, 184, as well in the summary table provided by Commission staff at the contested case hearing (Exh. HO-1). For example, the summary table prepared by Commission staff identified wet season total restoration as 13.97 mgd (21.62 cfs), and dry season total restoration of 5.83 mgd (9.02 cfs). (Exh. HO-1.) However, these differences are insignificant when contrasted to the total amounts diverted for offstream uses by East Maui Irrigation (EMI); namely, from 134 mgd in the winter months to 268 mgd in the summer months, averaging about 167 mgd, *supra*, FOF 14, 237.

I. Impact of the Commission's Orders

1. Adequacy of Increased Flows from the 2008 Order for Taro Growing and Domestic Uses

250. In amending the IIFS, different reference flows were used, and the choice of reference flow significantly affected the amount of water restored, *supra*, FOF 186-187.

251. At the contested case hearing, Commission staff confirmed that the intent of the IIFS meant there would always be that amount of flow in the stream, and that "(w)hat we're trying to do is in using the low flow BF values was to insure that there would always be (that) amount of water in the stream;" "our efforts were based on looking at the lower Q values, the low flow values, in order to make sure that it would always be met;" "we wanted to go with the lower number to assure that the amount would be there for the majority of the time." (Dean Uyeno, Tr., March 2, 2015, pp. 91, 121-122, 128-129, 153.)

252. Staff also confirmed that complaints of taro farmers that they were not getting enough water was not material to whether or not they would have changed their decision to recommend higher releases into the stream: "No. The point was to make sure that the IFS was being met at the IFS point." (Dean Uyeno, Tr., March 2, 2015, p. 64.)

253. Nā Moku didn't provide data on their needs for water, and the documentation for the amended IIFS were addressed by Commission staff. (Exchange between the Hearings Officer and Alan Murakami, attorney for Nā Moku, Tr., March 2, 2015, pp. 45-48.)

254. However, at the conclusion of the Commission's meeting on the September 25, 2008 order, then Chair Thielen stated that: "We recognize that the numbers for the minimum amount of stream flow standard that is in the staff's recommendations for each of the streams(s) may not be the number that the taro farmers and the community want, but on the other hand you've been taking after the diversion. Under this transition the stream would get that amount first and it may be found over the course of the year some requirements may be met or not." (Exh. C-89, p. 31.)

255. The recommended IIFS were for increased water for taro growing and domestic use, and improving habitat for native stream animals, *supra*, FOF 122, 131, 142, 146, 147, 154, 155, 160, 176.

256. In the implementation, among other things, Commission staff has learned that: 1) the regression estimates used for flows had, in many cases, overstated what those flows would be, so if the sluice gates on the ditches are opened, there still may not be enough flow to meet the amended IIFS; and 2) in Wailuanui and Keanae, the Ko`olau Ditch has only been taking, for the most part, water generated by rainfall, and spring water below the Ditch is what the taro farmers have access to. (Dean Ueno, Tr., March 2, 2015, pp. 30-31.)

257. Whatever basis is used to amend the IIFS, there is a natural variability in stream flow which may dip below the IIFS, generally due to periods of low rainfall, so guaranteeing that a specific flow is always in the stream and still meet the objective of the IIFS is not possible. (Dean Ueno, Tr., March 2, 2015, p. 87, 92-94.)

258. At the time of the 2008 Commission Order, the 2005 Habitat Study was available, but the 2009 Habitat Availability Study was not. (FOF 94-116.) Therefore, Commission staff did not know that the minimum flow level necessary for suitable habitat availability (H_{90}) for growth, reproduction, and recruitment of native stream animals was 64 percent of BFQ_{50}.

2. Adequacy of Increased Flows from the 2010 Order for Increases in Native Stream Animals

a. Impact of Seasonal Flows

259. To detect if seasonal flow changes mandated by the 2010 Commission resulted in positive changes in a stream over time, monitoring stations were established in three of the four streams for which seasonal IIFS (winter versus summer flows) had been established--East Wailuaiki, West Wailuaiki, and Waiohue Streams, *supra*, FOF 245. Surveys began prior to the water restoration and continued for two years after flow restoration commenced.(Glenn Higashi, WDT, Appendix E, pp. 5, 7.)

260. The monitoring effort did not include an assessment of whether or not the winter flows, based on 64 percent of estimated BFQ_{50}, had in fact achieved the minimum habitat of H_{90} necessary for growth, reproduction, and recruitment of native stream animals. (*Ibid.*, pp. 4-49.) Moreover, it is possible that the 64 percent level set by USGS may not be sufficient. (Glenn Higashi, Tr., March 16, 2015, pp. 223-224.)

261. The focus of the monitoring effort was to determine if the return of water had an effect on the habitat and abundance of stream animals and focused on three broad areas: 1) changes in the quantity of physical habitat; 2) changes to the population structure of native stream animals; and 3) changes in connectivity between the lower and upper stream areas. (*Ibid.*, pp. 1, 4, 11.)

262. The correlation between return flows, habitat, and biota was weak. This may have been due to a number of factors including: changing environmental conditions (e.g., rainfall, drought, flash flooding), short monitoring period (< 4 years), and/or that summer flows were detrimental to gains in habitat and biota from the winter flows. (*Ibid.*, p. 2.)

263. While not definitive, some general conclusions were suggested by the study:

> Some changes to instream habitat at the upper survey stations were observed in response to the higher wintertime flow releases. In general, dry, disconnected or slow-water habitats were replaced by more connected swift-water habitats. These improvements to instream habitat reflected a change to a more stream-like environment. Based on our knowledge of stream animals found in mid to upper stream reaches, these changes should result in more suitable instream habitat. In contrast to the improvements observed at upper stations during the wintertime flow releases, the lower summer flows showed little or no habitat improvement.
>
> In the upper stations of all streams, stream animal assemblages did not show the healthy characteristics. In general, we did not see consistent patterns of occurrence, growth in numbers, or increases in size classes of the animals. As expected based on its

habitat and range distribution, *Atyoida bisulcata*[15] was the most common species and some recruitment and growth were observed in East and West Wailua Iki streams.While conditions may have been suitable for *A. bisulcata*, few *Lentipes concolor*, *Sicyopterus stimpsoni*, and *Neritina granosa*[16] were observed in the upper stations suggesting poor quality habitat for these species over time.

At the lower monitoring stations, little change was observed to instream habitat with respect to either winter or summer flow releases. This was not an unexpected result. The lower stations were just upstream from the stream mouth and had perennial flow prior to the flow restorations. In the lower stations of all streams, the stream animal assemblages appear healthy and diverse with good recruitment from the ocean and display composition structure typical of Hawaiian streams. A range of size classes for most stream animals were observed and this pattern likely reflects that suitable conditions existed for feeding, growth, courtship and reproduction.

In our assessment of connectivity, we only observed consistent recruitment of small individuals for *Atyoida bisulcata* to the upper stations over time suggesting that adequate connectivity flows were present. While the upper sites showed some connectivity for *A. bisulcata*, we did not observe increases in recruitment numbers comparing post-release periods to pre-release periods for *Lentipes concolor*, *Sicyopterus stimpsoni*, or *Neritina granosa*. This result suggests that flows for connectivity may have been insufficient for these species. (*Ibid.*, pp. 1-2.)

264. There is no evidence that the summertime flows were advantageous to the animals. The concept of varying flow over times is well supported in fisheries, but in this case it was not. For example, if the wintertime flows had been returned during the summer and complete flow restoration had been done in the winter, that would have been a seasonal flow approach, and we might have seen completely different results. (James Parham, Tr., March 16, 2015, pp. 62-63.)

265. "Overall, the seasonal flow hypothesis (higher winter flows and lower summer flows) was conceptually coherent, yet not supported by the data. The lack of support for the seasonal flow hypothesis may reflect that the prescribed flow amounts were insufficient (i.e. needed higher flows in summer) or that a year round minimum flow is more appropriate for East Maui streams." (Glenn Higashi, WDT, Appendix E, p. 2.)

b. Makapipi Stream

266. The other three streams whose IIFS were amended were Waikamoi, Hanawi, and Makapipi. Waikamoi Stream's IIFS was amended for seasonal flows but was not selected for the evaluation. Hanawi Stream's IIFS was amended to provide connectivity to the ocean, because the

[15] A small shrimp or opae.
[16] two fish or o'opu, and a mollusk or hihiwai.

stream has adequate flow to sustain a viable biota population, and only minimal flow was needed to create a wetted pathway for stream animal connectivity from the diversion to the ocean, *supra*, FOF 240(d).

267. Makapipi Stream was preliminarily selected for restoration, because the Nahiku community relies heavily on the stream for cultural practices, recreation, and other instream uses. However, with the uncertainty of gaining and losing reaches along most of the stream's course to the ocean, it is not known whether restored flow will result in continuous stream flow from the headwaters to the stream mouth. Therefore, a short-term release of water past the one major EMI diversion was ordered to determine the sustainability of the proposed standard of 0.60 mgd (0.93 cfs), TFQ_{70} or BFQ_{50}, just upstream of Hana Highway, *supra*, FOF 240(e).

268. When the sluice gates on the Koolau Ditch were partially opened to allow the majority of the water in Makapipi Stream to flow downstream of the diversion, flows ranged from 0.87 mgd (1.35 cfs) on September 14, 2010 to 0.76 mgd (1.18 cfs) on September 17, 2010. Daily site visits during September 13-17, 2010, indicated zero flow at the Hana Highway Bridge, located about two-thirds of a mile downstream of the diversion. A 1,000-foot reach upstream of the Hana Highway Bridge was dry, with the exception of a few isolated pools of water, and there was no indication of recent streamflow. The precise location where the stream went dry farther upstream was not determined, because it could not be safely accessed on foot. Much of the lower sections of the stream below the highway was largely dry, with isolated reaches with pools of water. (Exh. C-54, p. 1; Dean Uyeno, Tr., March 3, 2015, p. 48.) [HC&S FOF 573.]

J. Neither the 2008 nor 2010 Commission Orders Balanced Instream versus Noninstream Uses

1. The 2008 Order was Intended to be Provisional

269. The 2008 Order addressing eight streams was intended to be provisional and revisited for a final determine for these eight streams when the IIFS for the remaining nineteen streams were addressed:

> In accepting staff's recommendation, the Commission added three amendments, the first of which was that "(m)oving forward on the staff's recommendation is the first step in (an) integrated approach to all 27 (twenty-seven) streams that are the subject of these petitions." Then Chair Thielen had stated in the preceding discussion that "if people are not happy at the end of the year, when the Commission makes any decisions, they would have the ability to request a contested case hearing at that time. Cooperation now is not a waiver of any body's rights to contest that at a later date." After the vote to accept staff's recommendation with amendments, Chair Thielen stated that "the main thing that

was passed today is setting minimum instream flow standards that require some infrastructure change, require some evaluation, cooperation and then coming back to the Commission and making final recommendations for the entire 27 stream units," *supra*, FOF 10.

270. However, Commission staff operated on the premise that complaints of taro farmers that they were not getting enough water was not material to whether or not they would have recommended higher releases into the stream, *supra*, FOF 253.

271. Thus, there was no evaluation on which to base an integrated approach to make final recommendations for all 27 streams.

2. The 2010 Order Did not Revisit the 2008 Order nor Balance Instream versus Noninstream Uses

272. The 2010 order focused only on amending the IIFS for the remaining 19 streams, *supra*, FOF 12.

273. More specifically, the Commission focused only on native stream animals and did not balance instream versus noninstream uses, *supra*, FOF 12, 19, 233.

274. On Nā Moku's appeal of the Commission's denial of its request for a contested case hearing, the Intermediate Court of Appeals vacated the Commission's denial and remanded the matter to the Commission with instructions to grant Nā Moku's Petition for Hearing and to conduct a contested case hearing pursuant to HRS Chapter 91 and in accordance with state law, *supra*, FOF 26.

275. The Intermediate Court of Appeals declined to address the merits of whether the Commission erred in reaching its determination on the petitions to amend the IIFS for the nineteen streams and stated that the matter would be properly presented, argued, and decided pursuant to an HRS chapter 91 contested case hearing conducted by the Commission, *supra*, FOF 27.

276. The Hearings Officer subsequently proposed, and the Commission accepted and so ordered, that the Contested Case Hearing address all twenty-seven petitions and streams filed by Nā Moku, *supra*, FOF 33-36.

K. Instream Uses

277. Beneficial instream uses for significant purposes are <u>located in the stream</u> and achieved by leaving the water in the stream. They include, but are not limited to:

a. maintenance of fish and wildlife habitats

b. outdoor recreational activities;

c. maintenance of ecosystems such as estuaries, wetlands, and stream vegetation;

d. aesthetic values such as waterfalls and scenic waterways;

e. navigation;

f. instream hydropower generation;

g. maintenance of water quality;

h. the conveyance of irrigation and domestic water supplies to downstream points of diversion; and

i. the protection of traditional and customary Hawaiian rights. (HRS § 174C-3.)

278. "Navigation" and "instream hydropower generation (*emphasis added*)" are not relevant to the East Maui streams.

279. "Maintenance of fish and wildlife habitats" has been addressed, *supra*, in section I.F, habitat restoration potential; section I.H, the Commission's 2010 order; and section I.I, the impact of that order. Further analysis on stream habitat is provided, *infra*, on the exercise of traditional and customary Hawaiian rights.

280. That portion of stream flows to satisfy appurtenant rights is included in "the conveyance of irrigation and domestic water supplies to downstream points of diversion," and is an instream use. The exercise of appurtenant rights is a noninstream use, because it is carried out on appurtenant lands and not within the streams from which those appurtenant rights are derived.

281. The adequacy of the increased flows to meet taro grower and domestic uses was addressed in section I.I.i, *supra*. Further analysis on taro growing and domestic uses is provided, *infra*, on the exercise of traditional and customary Hawaiian rights.

282. "Outdoor Recreational Activities":

From east to west, Makapipi, Hanawi, Waiohue, East Wailuaiki, West Wailuaiki, Wailuanui, Waiokamilo, Ohia, Honomanu, Waikamoi, Hanehoi, and Honopou streams have significant outdoor recreational activities, including in some cases swimming and/or fishing, and nearly all including scenic views for recreational and sometimes for educational purposes. (Makapipi IFSAR § 5.0, p. 50; Exh. A-1; Hanawi IFSAR § 5.0, p. 54; Lucien De Naie, WDT; East Wailuaiki IFSAR § 5.0, p. 52; West Wailuaiki IFSAR § 7.0, p. 56; Wailuanui IFSAR § 5.0, pp. 43-44; Waiokamilo IFSAR § 5.0, p. 40; Ohia IFSAR § 5.0, p. 43; Honomanu IFSAR § 5.0, p. 56; Camp, WDT; Exh. E-71; Neola Caveny, WDT; Exh. E-24; Lurlyn Scott, WDT, ¶¶ 24-25;

Julien P. Allen Jaccintho, WDT ¶ 9. [HC&S FOF 264, 334, 354, 378, 406, 427, 553, 576; Na Moku FOF 387, 396, 404, 405, 414, 416, 420-423, 428, 435, 438, 440.]

283. "Maintenance of Ecosystems Such as Estuaries, Wetlands, and Stream Vegetation":

From east to west, all of the streams except Waiaaka and Ohia Streams have seasonal, non-tidal palustrine wetlands, in the upper watershed of the hydrologic unit. East Wailuaiki, West Wailuaiki, and Waiohue Streams also have estuaries. (Waiaaka IFSAR § 6.0, pp. 51-53; Ohia IFSAR § 6.0, pp. 46-48; Exh. C-103, p. 19.) [HC&S FOF 421, 433, 466, 513.)

284. "Aesthetic Values Such as Waterfalls and Scenic Waterways":

Waterfalls, some including plunge pools at their base, and to a lesser extent, springs, constitute the principal aesthetic values in the East Maui streams. From east to west, the streams include Makapipi, Hanawi, Kapaula, Waiaaka, Paakea, Waiohue, Kopiliula, West Wailuaiki, East Wailuaiki, Wailuanui, Waiokamilo, Palauhulu, Piinaau, Honomanu, Punalau, Haipuaena, Puohokamoa, Waikamoi, and Honopou. (Makapipi IFSAR § 7.0, p. 62; Hanawi IFSAR § 7.0, p. 61; Kapaula IFSAR § 7.0, p. 62; Waiaaka IFSAR § 7.0, p. 59; Paakea IFSAR § 7.0, p.64; Waiohue IFSAR § 7.0, p. 64; Kopiliula IFSAR § 7.0, p. 67; East Wailuaiki IFSAR § 7.0, p. 64; West Wailuaiki IFSAR § 7.0, p. 63; Wailuanui IFSAR § 7.0, p. 56; Waiokamil59;o IFSAR § 7.0, p. 52; Palauhulu IFSAR § 7.0, p. 55; Honomanu IFSAR § 7.0, p. 69; Punalau IFSAR § 7.0, p. 59; Haipuaena IFSAR § 7.0, p. 65; Puohokamoa IFSAR § 7.0, p. 66; Waikamoi IFSAR § 7.0, p. 72; Exh. C-101, p. 48.) [HC&S FOF 103, 182, 203, 226, 246, 266, 309, 356, 380, 408, 429, 453, 474, 494, 514, 535, 555, 578.]

285. "Maintenance of Water Quality":

Streams that appear on the 2006 List of Impaired Waters in Hawaii, Clean Water Act § 303(d), include, from east to west, Hanawi, Puakaa, East Wailuaiki, West Wailuaiki, Ohia, Honomanu, Punalau, Haipuaena, Puohokamoa, and Waikamoi streams. (Hanawi IFSAR § 10.0, pp. 74-75; Puakaa IFSAR § 10.0, pp. 75-76; East Wailuaiki IFSAR § 10.0, pp. 71-72;West Wailuaiki IFSAR § 10.0,pp. 70-71; Ohia IFSAR § 10.0, pp. 57-58; Honomanu IFSAR § 10.0, pp. 76-78; Punalau IFSAR § 10.0, pp. 65-66, 74; Haipuaena IFSAR § 10.0, pp. 72-74; Puohokamoa IFSAR § 10.0, p. 4; Waikamoi IFSAR § 10, pp. 80-81.) [HC&S FOF 185, 206, 229, 249, 269, 339, 411, 432, 456, 558.]

1. Protection of Traditional and Customary Hawaiian Rights

286. Maintenance of fish and wildlife habitats to enable gathering of stream animals and increased flows to enable the exercise of appurtenant rights constitute the instream exercise of "traditional and customary Hawaiian rights."

a. Gathering of Stream Animals

287. Both the 2008 and 2010 Commission orders did not result in increased populations of stream animals, nor any signs of growth, reproduction, and recruitment.

288. In the 2008 Commission order, except for Waiokamilo Stream, which had been returned to full natural flow by a previous order of BLNR, all of the other streams' flow levels were established below 64 percent of BFQ_{50}, the minimum flow level necessary for suitable habitat availability (H_{90}) for growth, reproduction, and recruitment of native stream animals, *supra*, FOF 258.

289. In the 2010 Commission order, evaluation of the seasonal flows ordered for four of the six streams resulted in: 1) no evidence that the summertime flows were advantageous to the animals, *supra*, FOF 264; 2) the lack of support for the seasonal flow hypothesis may reflect that the prescribed flow amounts were insufficient (i.e. needed higher flows in summer) or that a year round minimum flow is more appropriate for East Maui streams, *supra*, FOF 265; and 3) the monitoring effort did not include an assessment of whether or not the winter flows, based on 64 percent of estimated BFQ_{50}, had in fact achieved the minimum habitat of H_{90} necessary for growth, reproduction, and recruitment of native stream animals; moreover, it is possible that the 64 percent level set by USGS may not be sufficient, *supra*, FOF 260.

290. In the 2010 Commission order, Hanawi Stream was only modified to provide connectivity in the dry reach immediately below the diversion, because it had been concluded that the stream had adequate flow to sustain a viable biota population, *supra*, FOF 240.d. No evaluation was conducted to confirm that the expected results had been achieved in both connectivity and sustaining viable stream animal populations.

b. Exercise of Appurtenant Rights

291. In total, the acreage claimed by Nā Moku as being either in taro or cultivable agriculture was 136.18 acres for Honopou, Palauhulu, Waiokamilo, and Wailuanui Streams, *supra*, FOF 218.

292. Nā Moku identified no acreage for Hanehoi and Puolua Streams, but contended that insufficient water and lands that have either appurtenant or riparian rights require that both Hanehoi and Puolua Streams be returned to their natural base flows (BFQ_{50}), *supra*, FOF 219.

293. Teri Gomes, Nā Moku's expert witness, conceded that these acreages are overstated by an unknown amount for taro cultivation and cultivable agriculture, *supra*, FOF 222. She put the entire parcel in taro when she couldn't tell what portion was in taro. In her previous testimony before BLNR, she had reduced the acreage by 10 percent, but was not instructed to do so in the present contested case, *supra*, FOF 220. She also placed the parcel in the cultivable agriculture category when land was awarded without specificity of use, because most parcels awarded at the time of the Mahele were used for agricultural purposes and she had already eliminated house lots, cemeteries, and churches, *supra*, FOF 221.

294. The 136.18 acres claimed by Nā Moku for Honopou, Palauhulu, Waiokamilo, and Wailuanui Streams were comprised of the following areas:

a.	Keanae (Palauhulu Stream):		27.195 acres;
b.	Wailua: (Waiokamilo and		27.73 acres
		Wailuanui Streams)	33.035 acres
			24.227 acres
c.	Honopou: (Honopou Stream)		23.99 acres
		Total:	136.18 acres

(Teri Gomes, WDT, pp. 3-36, 38-39.)

295. Nā Moku had claimed that 60.767 acres, 44.474 acres in taro and 16.293 cultivable acres, are fed by Waiokamilo and Kualani Streams, 22.448 cultivable taro acres are fed by Wailuanui and Kualani Streams, and 5 acres in Waianu Valley, between Wailuanui and Keanae, are fed by Waiokamilo Stream. *supra*, FOF 170. Because what was thought was Kualani Stream is actually the east branch of Waiokamilo Stream, Nā Moku's revised claim is that 65.767 acres are fed by Waiokamilo Stream, and 22.448 acres are fed by Wailuanui and Waiokamilo Streams, *supra*, FOF 171. The total of 88.22 acres (65.767 plus 22.448 acres) is slightly larger than the total of the three Wailua areas of 84.99 acres (27.73 + 33.035 + 24.227), *supra*, FOF 294, which is likely due to some overlap of acres ascribed to both Wailuanui and Waiokamilo Streams.

296. The breakdown of each of the four groups in FOF 294, *supra*, is:

Keanae: 22 taro lots: 13.475 acres (0.07 to 2.27[17] acres in size)

[17] described as a poalima, or chief's terraced plantation, with 6 lo`i.

		4 agriculture lots	7.00 acres	
		5 ili (land area)	5.49 acres	
		1 conservation	0.18 acres	
		1 wetland	1.05 acres	
	Total	33 parcels	27.195 acres	
	Wailua:	10 taro lots:	8.02 acres	(0.125 to 2.75[18] acres in size)
		7 agriculture lots	11.86 acres	
		1 ili (land area)	0.42 acres	
		4 mo`o (narrow strip of land)	7.43 acres	
	Total	22 parcels	27.73 acres	
	Wailua:	10 taro lots	9.22 acres	(0.162 to 2.67[19] acres)
		9 agriculture lots	11.23 acres	
		5 mo`o (narrow strip of land)	12.03 acres	
		1 kula (plain) and home lot	0.216 acres	
		1 pond	0.338 acres	
	Total:	26 parcels	33.035 acres	
	Wailua:	24 taro lots	12.92 acres	(0.08 to 0.83[20] acres in size)
		9 agriculture lots	5.006 acres	
		4 mo`o (narrow strip of land)	4.98 acres	
		1 ili (land area)	1.32 acres	
	Total:	38 parcels	24.227 acres	
	Honopou:	1 lot, consisting of 22.81 acres that included:		
		taro lot	3.32 acres	
		unspecified	8 acres	
		poalima (chief's terraced plantation)	1.67 acres[21]	

[18] described s containing 26 lo`i.
[19] described as containing 10 lo`i.
[20] described as a taro lot.

	land along three streams	9.82 acres
	poalima (chief's terraced plantation)	0.08 acres
	taro lot and kula	1.10 acres
Total:	3 parcels	23.99 acres

(Teri Gomes, WDT, pp. 3-36, 38-39.)

297. The lots, whether for taro, agriculture, ili, or mo`o, are relatively small. The largest of the taro lots was 3.32 acres, and the great majority of the taro lots were less than one acre in size.

298. Teri Gomes, Nā Moku's expert witness, had placed the entire parcel in taro when she couldn't tell what portion was in taro. In her previous testimony before BLNR, she had reduced the acreage by 10 percent, but was not instructed to do so in the present contested case, *supra*, FOF 220, 293.

299. Counting only the taro lots and the poalima:

Keanae:	13.475 out of 27.195 acres	less 10%:	12.13 acres
Wailua:	8.02 out of 27.73 acres	less 10%:	7.22 acres
Wailua:	9.22 out of 33.035 acres	less 10%:	8.30 acres
Wailua:	12.92 out of 24.227 acres	less 10%:	11.63 acres
Honopou:	6.17 out of 23.99 acres	less 10%:	5.55 acres

300. However, all except one of these 69 parcels were identified as only taro lots, with the exception being 1.10 acres in Honopou, described as a taro lot and kula, *supra*, FOF 296.

301. Gomes also placed the parcel in the cultivable agriculture category when land was awarded without specificity of use, because most parcels awarded at the time of the Mahele were used for agricultural purposes and she had already eliminated house lots, cemeteries, and churches, *supra*, FOF 221, 293.

302. However, cultivable agriculture is not equivalent to wetland taro: 1) taro lots were specified as so; and 2) there were other types of agriculture at the time of the Mahele, which used much less water for growing crops. Therefore, while the cultivable agriculture category was entitled to water from the time of the Mahele, that amount would be much less than for taro.

303. Counting the agricultural lots:

Keanae:	7.00 acres
Wailua:	11.86 acres

[21] quantity arrived at as being the remainder, because lot sizes were identified for only 3 of the 4 lots in the grant.

Wailua: 11.23 acres

Wailua: 5.006 acres

304. The Honopou acreage of 23.99 acres also included 9.82 acres along three streams, *supra*, FOF 296, which were probably agricultural, as it ran along streams (*See, infra*, FOF 305).

305. Nā Moku also submitted other exhibits for:

Keanae, consisting of 397.41 acres:

Taro and house lot along Hamau (Kualani) Stream: 9.20 acres

Agricultural lot running along Palauhulu Stream: 13.70 acres

Agricultural lot running along Wailua(nui) Stream: 103.82 acres

Agricultural lot running along the Ditch of Wailua: 151.65 acres

Waianu, consisting of 160.50 acres:

Agricultural lot running from the mountain to the sea: 107 acres

Agricultural lot running from the government road to the sea: 53.50 acres

Honopou, consisting of 2.07 acres, although the total of the parcels is 0.624 acres:

Taro and pasture: 0.154 acres

Taro and pasture: 0.47 acres

Makapipi, consisting of 4.17 acres:

Agricultural lot running along Haiha Stream: 4.17 acres

(Teri Gomes, WDT, pp. 36-40.)

306. For Keanae, HC&S contends that there are only 10.53 acres, supra, FOF 158, referring to the USGS study, *supra*, FOF 204, compared to the 13.475 acres as estimated in FOF 299, *supra*.

307. For Wailua, HC&S contends that it no longer diverts Waiokamilo Stream, *supra*, FOF 172, that Wailuanui Stream is the sole water source for only 2.80 acres, *supra*, FOF 180, but does not address the acreage that is watered by both streams.

308. For Honopou, HC&S contends that there are only 2 acres in taro, *supra*, FOF 136, compared to 6.17 acres as estimated in FOF 299, *supra*.

309. Nā Moku had identified no acreage for Hanehoi and Puolua Streams, but contended that insufficient water and lands that have either appurtenant or riparian rights require that both Hanehoi and Puolua Streams be returned to their natural base flows (BFQ_{50}), *supra*, FOF 219. HC&S noted that CWRM identified an estimated cultivable area of 2.3 acres, and identified two parties who are or who would like to cultivate taro on four acres, as well as one person who has a

parcel adjacent to Hanehoi Stream and would like to exercise her riparian rights, *supra*, FOF 151.

310. Nā Moku submitted one exhibit for Makapipi Stream on a 4.17-acre lot for agricultural purposes running along Haiha Stream, *supra*, FOF 305. HC&S noted that CWRM had records for two diversions for taro cultivation, and that Jeffrey Paisner owns property that abuts Makapipi Stream but has no firsthand knowledge that taro was cultivated on his property. (Makapipi IFSAR § 12.0, p. 84; Jeffrey Paisner, WDT, §§ 5-6.) [HC&S FOF 584-586.]

L. Noninstream Uses

1. HC&S

a. Irrigation Requirements

311. Approximately 30,000 acres (the "East Maui Fields") of HC&S's 35,000-acre sugarcane plantation can be serviced by surface water from EMI or brackish groundwater pumped from within the boundaries of the plantation, but not water from the West Maui ditch system. From 2008-2013, HC&S actively cultivated sugarcane on an average of 28,941 acres of its East Maui Fields. (Rick Volner, WDT, ¶ 2; Garret Hew, WDT, ¶ 25; Rick Volner, Tr., March 23, 2015, p. 27; Exhs. C-35 and C-137.) [HC&S FOF 590-592.]

312. From 2008 to 2013, HC&S received 113.71mgd[22] from surface water deliveries and 69.90 mgd in pumped groundwater for a combined total of 183.61 mgd, 62 percent from surface water and 38 percent from groundwater. (Exh. C-137, columns B and C.) [HC&S FOF 629.A.]

313. The use of those waters as reported by HC&S were as follows:

a.	Sugarcane irrigation:	132.45 mgd
b.	MDWS:	2.83 mgd
c.	HC&S Industrial:	6.25 mgd
d.	Other:	0.41 mgd
	Total:	141.94 mgd
	Remainder:	41.67 mgd (183.61 - 141.94 mgd)

(Exh. C-137; Rich Volner, Tr., March 23, 2015, pp. 23-30.)

314. MDWS's usage is at the Kamole Weir and Kula Agricultural Park. Industrial usage at HC&S is used in the factory, power plant, mixing fertilizer solutions, and anything else to

[22] HC&S reports its water deliveries and usage in millions of gallons per year, and those numbers have been divided by 365 to arrive at daily totals. For example, the 113.71 mgd in surface water deliveries was reported as 41,505 million gallons per year.

support the farming and factory operations, one of the largest uses being cane cleaning. "Other" is water for tenants that are on the HC&S property, such as Ameron and for a period of time, Monsanto. (Rich Volner, Tr., March 23, 2015, pp. 23-26.))

315. After these three user categories, all of the remaining water is used for sugarcane irrigation. The unaccounted remainder is ascribed to system losses, consisting of seepage, evaporation, and miscellaneous losses, such as back-flushing of filters, drip tube ruptures or breaks, animal damage, pipeline breaks, misreported irrigation (if they are not applying the correct hours to the amount that they ran), testing of systems prior to planting, or where water is taken out of the system but not accounted for in daily irrigation. (Rick Volner,Tr., March 23, 2015, pp. 26, 30-31, 140.) [HC&S FOF 637.]

316. The 132.45 mgd for sugarcane irrigation, divided by the 28,941 irrigated acres, *supra*, FOF 311, is the gallons per acre per day, or 4,577 gad. (Exh. C-137.)

317. Compared to the actual irrigation of 4,577 gad that HC&S was able to deliver to its fields, it contends that irrigation requirements were 5,146 gpad, resulting in 89 percent of irrigation requirements being met from 2008 to 2013. (Exh. C-137.)

318. HC&S determines its irrigation requirements of each field on a day-to-day basis employing a computerized water balance model, which essentially calculates a water budget that accounts for "deposits" of water in the form of rainfall and irrigation and "withdrawals" in the form of evapotranspiration (losses from evaporation and transpiration from the sugarcane plant). HC&S uses the water balance model as a managerial tool to determine what fields need to be irrigated. The model prioritizes field needs, indicating which field should receive water next, based on the estimated soil moisture status of each field. (Exh. C-67, pp. 5-6.) [HC&S FOF 626.]

319. HC&S does not include rainfall data in the calculation of water availability, because it contends that light rains lower evapotranspiration by raising humidity and lowering exposure to sunlight, and that during heavy rains, surface runoff is not taken up by the plants. Therefore, HC&S contends that while sometimes rain does fall in sufficient amounts over a period of time to be effective for plant and soil absorption, dividing total annual rainfall by 365 days and assuming that this amount was applied on a daily basis is erroneous. (Rick Volner, WDT, ¶ 60.)

320. However, by totally excluding rainfall data from its calculation of water availability, it also ignores its own description of a water balance model that accounts for "deposits" in the form of rainfall and irrigation, *supra*, FOF 318, therefore overestimating by an unknown amount the amount needed from irrigation with surface water.

321. Under the foregoing assumptions, HC&S calculates its percent actual irrigation of required irrigation as 89 percent from 2008 to 2013, *supra*, FOF 317.

322. HC&S also introduced data on average water need and availability from 1986, the year HC&S converted from furrow irrigation to drip irrigation, to 2009, and from 1986 to 2013:

a. 1986 to 2009: HC&S contends that 85 percent of total water requirements[23] were met; and average total requirements were 270 mgd versus available water of 230 mgd, with requirements not met 10 months of the year and only the winter months of November and December in which requirements were met. Total requirements were estimated at 9,019 gad, which included system losses, irrigation inefficiencies, and industry (factory) needs. (Exh. C-71, Appendix G, p. G-3; Exh. C-103, pp. 14-15.) [HC&S FOF 624, 628.]

b. 1986 to 2013: HC&S contends that 89 percent of total requirements[24] were met; and average total requirements were 251 mgd versus available water of 224 mgd, with requirements not met 10 months of the year and only the winter months of November and December in which requirements were met. Irrigation requirements were estimated at 7,396 gad. (Exh. C-74.)

323. HC&S's figures for 2008 to 2013 addressed irrigation, not total requirements, with irrigation requirements of 5,146 gad versus available water of 4,577 gad; and average irrigation requirements of 149 mgd versus available water of 132.15 mgd, with 89 percent of irrigation requirements met, *supra*, FOF 313, 316-317. Assuming the total 51.16 mgd for other uses, including 41.67 mgd of seepage and evaporation losses, *supra*, FOF 312-315, were required, then 92 percent of total requirements were met.

324. To summarized the data from these three time periods:

a. 1986 to 2009:

i. 230 mgd of available water, meeting 85 percent of total requirements of 270 mgd;

ii. no specific number for irrigation requirements separated from other uses;

b. 1986-2013:

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[23] includes system losses, irrigation efficiencies, and industry (factory) needs. MDWS usage not mentioned. (Exh. C-71. p. G-3.)

[24] includes boiler and factory operations and seepage and evaporation in transportation and storage systems. MDWS usage not mentioned. (Exh. C-74.)

i. 224 mgd of available water, meeting 89 percent of total requirements of 251 mgd;

ii. 7,396 gad irrigation requirements;

c. 2008-2013:

i. 184 mgd of available water, meeting 92 percent of total requirements of 200 mgd;

ii. 4,577 gad of irrigation water available, meeting 89 percent of 5,146 gad irrigation requirements.

From HC&S's own data, from1986-2009 to 2008-2013, average available water decreased from 230 mgd to 184 mgd, or by 20 percent, but irrigation requirements decreased from 9,019 gad to 5,146 gad, or by 43 percent, thereby increasing the percent of irrigation requirements met from 85 percent to 89 percent.

325. HC&S observed that the water requirements of 5,146 gad for the East Maui fields are less than that which CWRM found to be reasonable in the Nā Wai `Ehā contested case hearing: 5,958 gad for the Waihee-Hopoi Fields and 5,408 gad for the `Īao-Waikapū Fields. (Exh. C-120, p. 128 [COL 91].) [HC&S FOF 630.]

326. The West Maui fields have less rainfall, lower elevation, higher winds, and higher evapotranspiration, so on average, irrigation requirements are lower for the East Maui than for the West Maui fields. (Rick Volner, Tr., March 23, 2015, p. 154.)

327. However, for 1986-2013, HC&S had calculated its water requirements for 30,000 acres (versus 28,941 irrigated acres in its calculations for 2008 to 2013) as 7,396 gad; not only significantly higher than the 5,146 gad it had calculated for 2008 to 2013, but also significantly higher than the 5,958 gad and 5,408 gad for the two West Maui fields. (Exh. C-74.)

328. Morever, in the Nā Wai `Ehā contested case hearing, HC&S had used an 80 percent efficiency factor, while the method adopted by the Commission used an 85 percent efficiency factor. (Exh. C-120, p. 126 [COL 83].)

329. For the period 1986 to 2013, HC&S had used an 80 percent efficiency factor to arrive at its water requirement of 7,396 gad--the same efficiency factor used by HC&S in the Nā Wai `Ehā contested case hearing, where the Commission adopted an 85 percent efficiency factor. (Exh. C-74.)

330. Applying an efficiency factor of 85 instead of 80 percent, water requirements for 1986 to 2013 would have decreased to 7,251 gad from 7,396 gad, but still much higher than the West Maui Fields, *supra*, FOF 327. (Exh. C-74.)

331. For the period 2008 to 2013, no "gross water needed" is provided, nor an explanation of how the 5,146 mgd requirement was derived, nor why the 5,146 mgd requirement was much lower than the 7,251 gad or 7,396 gad requirements for 1986 to 2013. (Exh. C-137.)

332. Assuming that the 5,146 mgd requirement was derived in the same way that the 1986 to 2013 requirement of 7,396 gad was derived, the 5,146 gad requirement must have applied an efficiency factor of 80 percent, with irrigation requirements of 4,117 gad plus system losses of 1,029 gad. Applying an efficiency factor of 85 percent, the revised irrigation requirement would be 4,117 gad plus system losses of 727 gad, or a requirement of 4,844 gad, including system losses.

333. Given that the East Maui fields were expected to use less water than the West Maui fields and that the 1986 to 2013 requirement would be much higher at 7,251 gad than the 5,958 gad and 5,408 gad requirements for the West Maui fields, the 2008 to 2013 revised estimate of 4,844 gad, using an 85 percent instead of 80 percent efficiency factor, is more in line with those expectations.

334. Commission staff had estimated irrigation requirements to be 1,400 gad to 6,000 gad, based on a newly developed Irrigation Water Requirement Estimation Decision Support System (IWREDSS) model. (Exh. C-85, p. 9.) [Na Moku FOF 1019.]

335. The Commission staff's estimated requirements did not explain how the model was applied and what the range from 1,400 gad to 6,000 gad represented, although it might be inferred that the range represented winter versus summer requirements. (Exh. C-5, p. 9.)

336. On the other hand, the expert who developed the model adopted by the Commission in the Nā Wai `Ehā contested case had concluded that the principal difference that resulted in his model calculating lower optimal irrigation requirements than HC&S's was the choice of irrigation efficiency. He had selected 85 percent because it is the irrigation industry standard and the minimum efficiency for which drip irrigation systems are designed. HC&S's use of 80 percent had been used before either of HC&S's two experts started with HC&S and neither were aware of any actual measurements or studies conducted by HC&S to verify that assumption. (Exh. C-120, FOF 488-489, pp. 82-83.)

337. Thus, 4,844 gad, the irrigation requirement calculated by HC&S for the years 2008 to 2013, adjusted for 85 percent efficiency instead of 80 percent, is a reasonable estimate of irrigation requirements for HC&S's East Maui fields.

338. Therefore, for 2008 to 2013, total irrigation requirements would have been 140.19 mgd (4,844 gad x 28,941 irrigated acres) versus 132.45 mgd of actual irrigation, *supra*, FOF 311-312, or 94 percent of irrigation requirements having been met.

339. Left unexplained, however, is the drastic difference in both available irrigation and requirements between 1986-2013 and the subset years of 2008-2013. For 1986 to 2013, HC&S contends that 6,163 gad was the irrigation requirement, increased to 7,396 gad when applying their 80 percent efficiency factor. Multiplying 7,396 gad by the 30,000 acres HC&S used as its irrigated acres, the total irrigation requirement would be 221.9 mgd.[25] ((Exh. C-74.)

340. Adjusting H&S's 7,396 gad for 85 percent instead of 80 percent efficiency would result in 7,250 gad, or a total irrigation requirement for 30,000 acres of 217.9 mgd.

341. Comparable data for 2008-2013 were 5,146 gad adjusted to 4,844 gad for irrigation requirements, and a total irrigation requirement for 28,941 acres of 140.19 mgd. Adjusting the 1986-2013 data from 30,000 acres to 28,941 acres would reduce 217.9 mgd to 209.82 mgd, still 50 percent higher than the 140.19 mgd for 2008-2013.

342. For 1986-2013, there was 223.6 mgd available, 152.6 mgd from surface water and 71 mgd from ground water. 6.5 mgd was for industrial usage and an allocation of 22.4 mgd (10 percent for seepage and evaporation losses), leaving 194.7 mgd for irrigation. (Exh. C-74.)

343. If HC&S's irrigation water requirements for 1986-2013, adjusted for 85 percent instead of 80 percent efficiency, were 7,250 gad or a total irrigation requirement of 217.9 mgd for 30,000 acres, *supra*, FOF 340, then 89 percent of irrigation requirements would have been met. Applied to 28,941 acres, irrigation requirements would be reduced from 217.9 mgd to 209.82 mgd, *supra*, FOF 341, and 93 percent of irrigation requirements would have been met.

344. If HC&S's irrigation water requirements for 1986-2013 were 4,844 gad or 140.19 mgd, the total for 2008-2013, HC&S's irrigation requirements would have been more than met by the 194.7 mgd available for irrigation. Even using an 80 percent efficiency factor, or 5,146 gad, as HC&S did, over 28,941 acres, the total requirement would have been 148.93 mgd, and over 30,000 acres, the total requirement would have been 154.38 mgd. In either scenario, the total irrigation requirement would have been more than met by the 194.7 mgd available for irrigation.

[25] There is a small error in HC&S's calculations, because 6,163 gad is 83 percent of 7,396 gad, so 7,396 gad should have been 7,703 gad. Multiplying 7,703 gad by 30,000 acres is 231.1 mgd.

345. Similar conclusions could probably be made for 1986-2009, with even more "surplus" water, because the available water was 230 mgd for 1986-2009 versus 224 for 1986-2013, *supra*, FOF 324.

346. Given the expected lower irrigation requirements for HC&S's East Maui versus West Maui fields and the use of an 85 percent versus 80 percent efficiency factor, it is reasonable to conclude that HC&S's irrigation requirements for its East Maui fields should be 4,844 gad, *supra*, FOF 333, 337.

347. Based on this irrigation requirement of 4,844 gad, between 1986 and 2013, HC&S's irrigation requirements would not only have been met, but also would have left a surplus, *supra*, FOF 343. For 2008 to 2013, with its lower water deliveries than for the overall 1986 to 2013 period, 94 percent of irrigation requirements would have been met, supra, FOF 338.

348. HC&S states that the sugarcane plant can survive, but not thrive, with less than optimal water. Sugar yields increase as water application to the cane plant increases. The determination of HC&S's water needs for sugarcane cultivation is thus based on the amount of water required to produce yields at levels that enable HC&S to remain economically viable. (Rich Volner, WDT, ¶ 55; Exh. C-71, Appendix G, p. G-3.) [HC&S FOF 631.]

349. Sugar production is influenced by two main variables: yield per acre and acreage harvested. Of the two, yield per acre, measured in Tons of Sugar per Acre ("TSA"), is more critical than acreage harvested. The single most important variable affecting yields per acre is the amount of irrigation water available. (Rick Volner, WDT, ¶ 7, 17; Rick Volner, Tr., March 23, 2015, pp. 58, 66; Exh. C-65, Appendix I, p. 20.) [HC&S FOF 672-674.]

350. HC&S has determined that, on a long-term basis, sustainable yields should be between 12 and 14 TSA per crop cycle, which translates into over 200,000 tons of sugar per year given the acreage that HC&S has in cultivation. Yields in this range generate sufficient revenues to carry its fixed and variable costs and return a reasonable profit to its shareholders. (Rick Volner, WDT, ¶ 17; Rick Volner, Tr., March 23, 2015, p. 58.) [HC&S FOF 673.]

351. The market price of commodity sugar is a direct factor influencing sugar revenues. However, HC&S has no control over the sugar market and at most can attempt to time the market well and take advantages of spikes in sugar pricing. (Rick Volner, Tr. March 23, 2015, p. 66; Exh. C-65, Appendix I, p. 20.) [HC&S FOF 675.]

352. From 2008 to 2013, production improvements accounted for about half of the increases in revenues, with dramatically improved sugar prices accounting for the other half. (Rick Volner, WDT, ¶ 22.) [HC&S FOF 690.]

353. HC&S implemented various measures to improve its agronomic practices in an effort to reverse the declining sugar yields experienced from 2006 through 2009, with severe drought in 2007 and 2008 and reduced water deliveries resulting from the amended IIFS determinations previously issued by the Commission in this proceeding and in the separate Nā Wai `Ehā proceeding. The measures included a one-time harvest delay in 2009 to increase average crop age, increased deep tilling of fields before planting, improved fertilization, and improved ripening practices. HC&S also shifted some of its available power generation capacity from power sales to increased well pumping for irrigation. (Rick Volner, WDT, ¶ 20.) [HC&S FOF 688-689.]

354. HC&S reported the following improvements, following the severe drought years of 2007 and 2008:

	Sugar Production	TSA	Agribusiness Profit
2008	145,000 tons	8.6	(-)$12.9 million
2009	126,000 tons	8.4	(-)$27.8 million
2010	171,800 tons	11.1	(+)$6.1 million[26]
2011	182,800 tons	12.1	(+) $22.2 million
2012	178,300 tons	11.3	(+)$20.8 million
2013	191,500 tons	12.4	(+)$10.7 million
2014	162,100 tons	11.4	(-)$11.8 million

(Rick Volner, WDT, ¶¶ 12-17; Rick Volner, Tr., March 23, 2015, p. 9; Exh. C-57, pp. 4, 13; Exh. C-58, pp. 6,7, 17; Exh. C-59, pp. 6, 17; Exh. C-60, pp. 6, 17; Exh. C-61, pp. 6, 15; Exh. C-62, pp. 4, 10; Exh. C-150, p. 2.) [HC&S FOF 680-686.]

355. The September 25, 2008 Commission order restored 4.5 mgd to five East Maui streams, *supra*, FOF 117, and the May 25, 2010 order restored an additional 9.45 mgd in the winter and 1.11 mgd in the summer for six more streams, *supra*, FOF 233, for a reduction of stream waters to HC&S of 13.95 mgd in the winter and 5.61 mgd in the summer.

356. From 2008 to 2013, HC&S received an average of 183.61 mgd, 113.71 mgd from East Maui streams and 69.90 mgd from ground water, *supra*, FOF 312, compared to a reduction

[26] included $4.9 million in disaster relief funds.

beginning in late 2008 of 4.5 mgd and in mid-2010 of 13.95 mgd in the winter and 5.61 mgd in the summer, *supra*, FOF 355. Thus, from late 2008, water for the East Maui fields was reduced by 2.5 percent, and from mid-2010 reduced by 7.6 percent in the winter and 3.1 percent in the summer.

357. Thus, from late 2008, assuming these reductions all had to be absorbed by crop irrigation, irrigation requirements would have been 140.19 mgd, *supra*, FOF 338, while available irrigation water would have been reduced from 132.45 mgd to 127.95 mgd, and from mid-2010, available irrigation water would have been 118.5 mgd in the winter and 126.84 mgd in the summer. These reductions would have resulted in 94 percent of irrigation requirements met decreasing to 91 percent, starting in late 2008, and to 85 to 90 percent, beginning in mid-2010, *supra*, FOF 356.

358. For the West Maui fields, the Commission order of June 10, 2010 restored 12.5 mgd to the Nā Wai `Ehā streams but also found that ground water could offset 9.5 mgd, for a net reduction of 3 mgd. On remand from the Hawai`i Supreme Court, the April 17, 2014 Commission-approved Mediated Agreement restored an additional 12.9 mgd to the streams, for a total of 25.4 mgd. The ground water source was increased from 9.5 mgd to 18.5 mgd, the increase of 9 mgd resulting in a net reduction of water to HC&S of 3.9 mgd. (Iao Ground Water Management Area High-Level Source Water Use Permit Applications and Petition to Amend Interim Instream Flow Standards of Waihe`e, Waiehu, `Īao, and Waikapū Streams Contested Case Hearing No. CCH-MA06-01, "Commission on Water Resource Management Order Adopting: 1) Hearings Officer's Recommendation on the Mediated Agreement between the Parties; and 2) Stipulation Re Mediator's Report of Joint Proposed Findings of Fact, Conclusions of Law, Decision and Order," April 17, 2014, pp.1-3 ("2014 Mediated Agreement".)

359. To summarize, for HC&S's West Maui (Nā Wai `Ehā) fields, stream water sources were reduced by 25.4 mgd, but ground water sources was increased by 18.5 mgd, for a net reduction of 6.9 mgd, 3 mgd in 2010 and a further 3.9 mgd in 2014, *supra*, FOF 358.

360. Prior to the restoration order of June 10, 2010, HC&S used 50.09 mgd in 2005 and 41.92 mgd in 2006 from the Nā Wai `Ehā streams, averaging 46.01 mgd. (`Iao Ground Water Management Area High-Level Source Water Use Permit Applications and Petition to Amend Interim Instream Flow Standards of Waihe`e, Waiehu, `Iao, and Waikapū Streams Contested Case Hearing No. CCH-MA06-01, "Findings of Fact, Conclusions of Law, and Decision and Order," June 10, 2010, p. 210, table 7.)

361. Thus, for its West Maui fields, the 2010 Commission order reduced HC&S's water by 6.5 percent, increasing reductions in 2014 to 15 percent. Based on the 2005-2006 use rates, *supra*, FOF 360, available water after 2010 would have been reduced from 46.01 mgd to 43.01 mgd, and reduced to 39.11 mgd after 2014.

362. Compared to East Maui's 28,941 irrigated acres, *supra*, FOF 311, West Maui has only 4,770 acres in irrigation. Water requirements for these 4,770 acres had been found to be 27.81 mgd, and system losses to be 2.15-4.20 mgd by the Commission. ("2014 Mediated Agreement," p. 3 and Exhibit 1, p. 13.) Thus, even with the 15 percent reduction in water for its West Maui fields, supplies were still greater than irrigation requirements and reasonable losses, 39.11 mgd versus 29.96 mgd to 32.01 mgd.

363. To summarize, for the 28,941 irrigated acres in the East Maui fields, water available as a percent of irrigation requirements decreased from 94 percent to 91 percent in 2008, and to 85-90 percent in 2010, *supra*, FOF 357. For the 4,770 irrigated acres in West Maui, more water was available both before and after the Commission's actions in 2010 and 2014, *supra*, FOF 362.

364. Comparing these reductions of irrigation water to HC&S's East Maui and West Maui fields with sugar production and agribusiness profits from 2008 to 2014, *supra*, FOF 354, there does not appear to be any relationship between the two. The rebound from the severe drought years of 2007 and 2008 has been ascribed by HC&S to production improvements, *supra*, FOF 353, which accounted for about half of the increases in revenues, with dramatically improved sugar prices accounting for the other half, *supra*, FOF 352.

365. HC&S has also contended that, on a long-term basis, sustainable yields should be between 12 and 14 TSA per crop cycle, which translates into over 200,000 tons of sugar per year given the acreage that HC&S has in cultivation. Yields in this range generate sufficient revenues to carry its fixed and variable costs and return a reasonable profit to its shareholders, *supra*, FOF 350.

366. However, HC&S met that level of production only once between 2003 and 2013, when in 2003 it generated 205,700 tons of sugar, and conceded that it did not have a minimum sugar production number to remain viable, because its bottom line is dependent on many variables contribute to economic success, including sugar pricing, other revenue streams including specialty sugar, energy, molasses, and other things like that. (Exh. C-77; Rick Volner, Tr., March 23, 2015, pp. 59-60, 67-69.) [Nā Moku/MTF FOF 1037, 1043.]

367. HC&S also conceded that 200,000 tons of sugar a year is a production goal, not a minimum water need to remain viable. (Rick Volner, Tr., March 23, 2015, p. 68.) [Na Moku/MTF FOF1044.]

368. Between 2008 and 2014, only 2011 and 2013 had TSAs over 12, and the higher profit resulted from a smaller production: $22.2 million on a production of 12.1 TSA (182,800 tons) and $10.7 million on a production of 12.4 TSA (191,500 tons), *supra*, FOF 354.

369. HC&S states that the sugarcane plant can survive, but not thrive, with less than optimal water. Sugar yields increase as water application to the cane plant increases, *supra*, FOF 348.

370. Because of the Commission's 2008 and 2010 orders, for the 28,941 irrigated acres in the East Maui fields, water available as a percent of irrigation requirements decreased from 94 percent to 91 percent in 2008, and to 85-90 percent in 2010, *supra*, FOF 357, 363. For the 4,770 irrigated acres in West Maui, more water was available both before and after the Commission's actions in 2010 and 2014, *supra*, FOF 362.

371. In the Nā Wai `Ehā contested case hearing, the Commission had found that reasonable irrigation requirements were 5,958 gad for the Waihee-Hopoi Fields and 5,408 gad for the Iao-Waikapu Fields, *supra*, FOF 325. (Exh. C-120, p. 128 [COL 91].) [HC&S FOF 630.]

372. The estimates adopted by the Commission in the Nā Wai `Ehā contested case hearing adopted an 80 percent probability for satisfying the crop's irrigation requirements (80% of the time, or four out of five years), because it is the industry standard for calculating crop water duties in both the government and private sectors, including the Hawai`i Natural Resource Conservation Service of USDA. (Exh. C-120, COL 457, pp. 73-74.)

373. Irrigation requirements (gad) in Nā Wai `Ehā were as follows, with the 80 percent probability in bold:

	Median	Minimum	50%	**80%**	90%	95%	Maximum
Waihe`e-Hopoi	5589	4422	5583	**5958**	6126	6251	6305
`Īao-Waikapū	4993	3830	4990	**5408**	5597	5739	5836

(Exh. C-120, Table 11, p. 214.)

374. For the Waihe`e-Hopoi fields, 5958 gad would satisfy irrigation requirements 80 percent of the time. At 5583 gad, irrigation requirements would be satisfied 50 percent of the time. So 5958 gad at the 80 percent rate would be at least 375 gad or more than needed for 50 percent of the time. Similarly, 6305 gad would satisfy irrigation requirements 100 percent of the time, and at the 80 percent rate of 5958 gad, up to 347 gad would be needed to satisfy the irrigation

requirements for the remaining 20 percent of the time. Finally, at the 100 percent rate, even though all acres would receive sufficient water all of the time, more water than needed would be applied nearly all the time. The Commission monitors water use on a 12-month moving average (12-MAV), and at an average rate of 5958 gad, daily irrigation requirements of 6305 gad could be applied and be offset by days when the requirements were less than 5958 gad, as long as the 12-MAV stays within the range of 5958 gad. (Exh. C-120, footnote 5, p. 74.)

375. After the Commission's 2008 and 2010 orders, for the 28,941 irrigated acres in the East Maui fields, water available as a percent of irrigation requirements decreased from 94 percent to 91 percent in 2008, and to 85-90 percent in 2010. For the 4,770 irrigated acres in West Maui, more water was available both before and after the Commission's actions in 2010 and 2014, *supra*, FOF 370.

376. At 85-90 percent of irrigation requirements, water available for irrigation for the East Maui fields would be greater than the 80 percent probability for satisfying irrigation requirements that the Commission had adopted in the Nā Wai `Ehā contested case hearing for the West Maui fields.

b. Losses

1. EMI

377. From March to October 2011, USGS conducted a field study of the EMI ditch system to document the location of tunnels and open-ditch sections and to determine seepage losses and gains along selected reaches. (Cheng, C.L., 2012, "Measurements of Seepage Losses and Gains, East Maui Irrigation Diversion System, Maui, Hawaii," US Geological Survey Open-File Report 2012-1115, 23 p. ("USGS 2012 Seepage Report"), presented at the CWRM meeting of January 23, 2013. ("USGS 2013 Presentation") [Nā Moku/MTF FOF 1064.]

378. The EMI diversion system begins at Makapipi Stream in the east and ends at Maliko Gulch in the west. It consists of four primary ditches known as the Wailoa, New Hamakua, Lowrie, and Haiku ditches. Additional ditches that connect to the four primary ditches include the Ko`olau, Spreckels, Kauhikoa, Spreckels at Papaaea, Manuel Luis, and Center ditches. (USGS 2012 Seepage Report, p. 1.)

379. Ditch characteristics for about 63 miles of the EMI system, excluding abandoned ditches and stream conveyances, were characterized. About 46 miles (73%) of the surveyed diversion

system are tunnels, and 17 miles (27%) are open ditches, of which 3.5 miles (6%)are lined, 2.5 miles (4%) are partially lined(4%), and 11 miles (17%) are unlined. (*Id.*)

380. Tunnels, covered and/or underground, include culverts, siphons and pipes. Lined ditches have concrete ditch bottom and walls, steel ditch bottoms and walls, or concrete ditch bottoms and armored cut-stone walls. Partially lined ditches have earthen material on the ditch bottom and one wall and lined on the other wall; earthen material on the ditch bottom and lined on both walls; or a lined ditch bottom and earthen material on both walls. Unlined ditches have earthen material on bottom and both walls. (USGS 2013 Presentation.)

381. The Wailoa, Kauhikoa, and Haiku ditches have greater than 96 percent of their total length as tunnels, whereas more than half of the Lowrie ditch and Spreckels ditch at Papaaea are open ditches. About 70 percent of the total length of lined open ditches in the EMI diversion system is located along the Ko`olau ditch, whereas about 67 percent of the total length of unlined open ditches is located along the Lowrie ditch. Less than 4 percent is partially lined open ditches, and about half is in the Spreckels ditch. (USGS 2012 Seepage Report, p. 1.)

382. Discharge measurements were made along 26 seepage-run measurement reaches that are about a total of 15 miles in length. The seepage run measurement reaches represent 23 percent of the total length of ditches in the EMI system. (*Id.*)

383. The results were as follows:

Range of ditch flows (mgd)	seepage losses and gains (mgd)	seepage losses and gains, in percentage of ditch flows
>19	-0.39 to 2	-1.6% to 4%
9.7 to 19	-0.26 to 1.4	-3.7% to 11%
1.3 to 5.2	-0.78 to 0.17	-20% to 8%
0 to 1.3	-0.13 to 0.21	-71% to 41%

Measurement reach lengths range from 0.15 to 2.23 miles. (USGS 2013 Presentation.)

384. Ko`olau and Spreckels ditches generally had seepage losses. Wailoa, Kauhikoa, and New Hamakua ditches had seepage gains. The Manuel Luis, Center, Lowrie, and Haiku ditches had variable seepage losses and gains. Open ditch measurement reaches generally had seepage losses that ranged from 0.1 cfs (0.06 mgd) per mile at the Lowrie ditch to 3.0 cfs (1.94 mgd) per mile at the Ko`olau ditch. Tunnel measurement reaches generally had seepage gains that ranged from 0.1 cfs (0.06 mgd) per mile at the Manuel Luis ditch to 5.2 cfs (3.36 mgd) per mile at the Wailoa ditch. (USGS 2012 Seepage Report, p. 1.)

385. Thus, because both open ditches and tunnels in the EMI diversion system not only incur seepage losses but also gains from groundwater, especially in the tunnels, it is not clear whether net seepage losses even occur in the EMI diversion system. At low flows, the USGS study results show that losses are greater than gains, but at higher flows, gains are greater than losses, *supra*, FOF 383.

2. HC&S

386. For 1986 to 2013, HC&S accounted for "system inefficiencies, installation, and terrain inconsistencies" separately from "system losses due to seepage and evaporation of transportation and storage system." "System inefficiencies, etc." assumed that "effective water needed" was 80 percent of "gross water needed" and were incorporated into HC&S's irrigation requirements, which uses a 80 percent efficiency factor in calculating its water requirements. (Exh. C-74.) The preceding analysis had concluded that, for purposes of estimating HC&S's irrigation needs, an 85 percent efficiency factor should be used instead, *supra*, FOF 328-337. "System losses, etc." was estimated at 10 percent of the water needed to irrigate 30,000 acres, but no analysis was provided for this estimate. (Exh. C-74.)

387. Based on this information, *supra*, FOF 386, system losses would be 10 percent of the water required to irrigate 28,941 acres, or 4,844 gad x 28,941 acres x 0.1 = 14.02 mgd. (The information provided by HC&S identified water requirements as 7,396 gad and acreage as 30,000, but reasonable water requirements have been found to be 4,844 gad and irrigated acres--as opposed to the total East Maui fields of 30,000 acres--are assumed to be the 28,941 acres identified by HC&S in its 2008 to 2013 data.)

388. For 1986 to 2009, all water needs were lumped together in a single number of 9,019 gad, not only including irrigation requirements but also system losses, irrigation inefficiencies, and industry (factory) needs, *supra*, FOF 322, so system losses cannot be estimated.

389. For 2008 to 2013, HC&D characterized all water that could not be accounted as "seepage, evaporation and miscellaneous system losses." Total surface and ground water deliveries were 183.61 mgd and unaccounted water was 41.67 mgd, or 22.7 percent of surface water delivered and ground water pumped, *supra*, FOF 312-313, 315. (Exh. C-137.)

390. Estimating seepage and evaporation losses by way of direct measurement would require closing sections of the ditches and reservoirs, allowing the water to remain in those structures for a period of time, and taking before and after readings. This is impractical to do on a large scale

because it would interrupt plantation operations. (Garret Hew, WDT, ¶ 10; Garret Hew, Tr., March 17, 215, pp. 184, 186.) [HC&S FOF 636.]

391. As an alternative to direct measurement, HC&S calculated the amount of water that cannot be accounted for, *supra*, FOF 389.

392. To obtain a benchmark against which the estimated 22.7 percent loss rate could be compared, HC&S consulted the National Engineering Handbook published by the Soil Conservation Service of the U.S. Department of Agriculture ("USDA"), which provides seepage rate factors that can be applied to various sections of HC&S's system. HC&S calculated the average surface area under water for each type of material that holds or conveys the water (i.e., lined or unlined ditches or reservoirs). For each type of material, HC&S selected a relatively low seepage factor along with a relatively high seepage factor from the USDA Handbook and applied each factor to the estimated surface area under water to calculate what would represent low seepage loss and high seepage loss in the HC&S system per USDA's standards. Based on the foregoing calculations, a low seepage loss per day was estimated to be 30.75 mgd, or 16.76 percent of average daily water deliveries of surface and ground water of 183.61 mgd; a high seepage loss per day was estimated to be 65.06 mgd, or 35.46 percent of average daily water deliveries. (Garret Hew, WDT, ¶¶ 11-12; Exh. C-138, Figure 2-50; Exh. C-139.) [HC&S FOF 638.]

393. To account for loss due to evaporation, HC&S estimated the average daily amount of evaporation from the surface of the water contained in the same ditches and reservoirs as those considered in estimating the seepage losses. The average daily evaporation rate of 0.40 acre-inches was multiplied by the average daily surface area of the water in the system (243.48 acres), which yielded an average daily evaporation loss rate of 2.64 mgd. Added to the high and low seepage calculations, an estimated range of losses from both seepage and evaporation was 33.40 mgd, or 18.20 percent of average daily water deliveries, to 67.70 percent, or 36.90 percent of average daily water deliveries. (Garret Hew, WDT, ¶ 13; Exh. C-139.) [HC&S FOF 639.]

394. The average of the high and low estimated losses from seepage and evaporation is 27.55 percent, and HC&S's losses of 22.7 percent falls below this average. (Exh. C-139.) [HC&S FOF 640.]

395. HC&S's losses of 22.7 percent include not only seepage and evaporation losses, but also miscellaneous losses such as back-flushing of filters, drip tube ruptures or breaks, animal damage, pipeline breaks, misreported irrigation (if they are not applying the correct hours to the

amount that they ran), testing of systems prior to planting, or where water is taken out of the system but not accounted for in daily irrigation, *supra*, FOF 315.

396. In the Nā Wai `Ehā contested case hearing, the Commission identified a number of other factors that could contribute to miscellaneous losses, describing such losses in HC&S's field operations as "plausible and reasonable factors that would significantly increase their actual irrigation requirements" and ascribing such losses as the equivalent of 5 percent of irrigation requirements. (Exh. C-120, COL 79, 90-91.)

397. Five percent of irrigation requirements would be 7.01 mgd (4,844 gad x 28,941 acres x 0.05 = 7.01) mgd, losses that are plausible and reasonable."

398. Of HC&S's unaccounted water of 41.67 mgd, or 22.7 percent of surface water delivered and ground water pumped, *supra*, FOF 389, 34.66 mgd (41.67 mgd minus 7.01 mgd), or 18.9 percent, would be ascribed to seepage and evaporation losses. This percentage is nearly equal to the low seepage rate of 18.20 percent as calculated under USDA's standards, *supra*, FOF 393.

399. Thus, HC&S's system losses of 22.7 percent (41.67 mgd of 183.61 mgd of surface water delivered and ground water pumped) are reasonable losses.

c. Alternate Sources

1. Ground Water

400. HC&S's irrigation structure includes 15 brackish water wells and associated pumps with a total pumping capacity of 228 mgd, which may be used to supplement surface water to irrigate 17,200 acres of the approximately 30,000 acres serviced by waters from the EMI Ditch system. (Exh. C-33; Exh. C-35; Exh. E-76 at 3 (PDF); Garret Hew WDT, ¶ 25.) [HC&S FOF 606; Nā Moku/MTF FOF 997.]

401. The remaining 12,800 acres cannot be serviced by pumped ground water on a consistent basis. Ground water can be delivered to 7,000 acres via a shared pipeline that serves as a penstock line for a hydroelectric unit for the majority of the year. This pump system was designed and built to be an emergency water source for high-elevation fields in the event of extreme drought, rather than a primary source of water. The system consists of a booster pump system that diverts primary ground water at the Lowrie Ditch level to a higher elevation. (Rick Volner, WDT, ¶ 19.) [HC&S FOF 645.]

402. The maximum instantaneous pumping capacity of wells that can service the East Maui fields is 215 mgd. However, the true instantaneous pumping capacity of the wells--i.e., the most

HC&S can pump over 3 to 5 days--is 115 mgd to 120 mgd. Sump levels in the wells start to drop when pumping reaches 115 mgd to 120 mgd, especially in the summer months where there is little recharge. Further lowering of the sump levels could cause severe mechanical damage to the pumps. (Rick Volner, Tr., March 23, 2015, pp. 16-19.) [HC&S FOF 611.]

403. In contrast, by 1931, HC&S had been able to pump 144 mgd, and in dry times, pumps supplied up to 45 percent of the irrigation water. And as late as a 1996 Memorandum of Understanding between EMI, MDWS, and others, ground water was described as supplying 45 percent of HC&S's irrigation needs. (Exh. E-92, p. 121; Exh. E-110, p. 1.) [Nā Moku/MTF FOF 1126, 1129.]

403. From 2008 to 2013, HC&S pumped an annual average of 25,512 million gallons, or 69.90 mgd, for use on the East Maui fields, including mill use. (Exh. C-137, Column C.) [HC&S FOF 619.]

404. From 1986 to 2009, HC&S pumped an average of 72 mgd; and from 1986 to 2013, an average of 71 mgd. Compared to service water deliveries during these times, the amounts and percentage of totals were as follows:

	Total	Surface water/percent	Ground water/percent
1986-2013:	224 mgd	153 mgd (68%)	71 mgd (32%)
1986-2009:	239 mgd	167 mgd (70%)	72 mgd (30%)
2008-2013:	184 mgd	114 mgd (62%)	70 mgd (38%)

(Exhs. C-74, C-103, pp. 14-15, C-137.)

405. Ground water contributions to total irrigation uses have remained constant at or near 70 mgd, or about half of the 1931 capacity, and about 60 percent of what HC&S claims is the present capacity, *supra*, FOF 402-403. The percent of total rose from 30 percent in 1986 to 2009 to 38 percent in 2008 to 2013, because surface water contributions decreased from 167 mgd to 114 mgd, while ground water contributions remained the same, even though ground water contributions could have been increased by another 45 mgd to 50 mgd *supra*, FOF 402, 404.

406. In its 2013 annual report, A&B, HC&S's parent company, made the following statement:

> (A) change in A&B's power sales contracts may adversely affect power revenue and provide less protection against internal power generation costs in a rising oil price market. As a result, A&B may consider decreasing or eliminating power sales on Maui in future years, and, instead, use its power for field irrigation purposes, which would be expected to increase sugar yields. (Exh. E-112, p. 29.) [Nā Moku/MTF FOF 1134.]

407. Thus, it can be inferred that HC&S has not increased ground water for irrigation, because revenues from selling electricity from its hydropower operations have outweighed revenues from

increased sugar production, which would require using electricity to operate its ground water pumps, *supra*, FOF 406.

408. Furthermore, by using about 70 mgd of a ground-water usable capacity of 115 mgd to 120 mgd, HC&S has an alternative ground water source of 45 to 50 mgd, *supra*, FOF 405.

409. This potential capacity may be less, because a reduction in surface water importation coupled with an increase in ground water pumping will likely increase aquifer salinity levels, especially in the summer months when pumping is highest. (Exh. C-71, Appendix A, p. E-2 and exhibit E-3.) [HC&S FOF 646.]

2. Additional Reservoirs

410. Reservoirs would be most valuable as a water source in the summer months, when it's dry and HC&S's daily irrigation needs are at their maximum. (Rick Volner, Tr., March 23, 2015, p. 33.)

411. Storing water in the existing reservoirs or lining them to reduce or eliminate seepage would not provide large amounts of new water, because in the summer months the water is not being put in the reservoirs, and if it is, it's put in and taken out relatively quickly. (Rick Volner, Tr., March 23, 2015, p. 35.)

412. The 36 reservoirs located throughout the plantation range in size from 4 million gallons to 80 million gallons, which are a total of 862 million gallons at full capacity, only a five- to ten-day supply for the approximately 12,800 acres that are serviced by these reservoirs. The reservoirs are primarily holding ponds where water is collected and distributed for irrigation or other uses on a daily basis. Only when ditch flows are high do they have the ability to store additional water. (Exh. C-68, pp. 5-6.)

413. A reservoir would need to have an extremely large storage capacity to meet demands for a prolonged period of time during the summer months when water would be the most valuable. To be of most value, a large reservoir would need to be located at the highest elevation at the head of the Wailoa Ditch, above Paia or Haliimaile, which supplies the greatest amount of water to HC&S, so as to maximize the ability of the reservoir to supply water to various parts of the plantation during dry periods. (Rick Volner, Tr., March 23, 2015, pp. 32-33.) [HC&S FOF 659.

414. In the 1960s, HC&S internally considered building such a large reservoir, but decided not to pursue it after a study indicated that a billion-gallon reservoir would provide only a 10-day supply of water. HC&S's daily water needs were in the range of 200 mgd to 300 mgd, and even a

billion-gallon reservoir would provide 200 mgd for only five days. (Garret Hew, Tr., March 18, 2015, p. 236; Rick Volner, Tr., March 23, 2015, P. 33.) [HC&S FOF 658.]

415. Assuming that there is a reduction of stream water, not a total cessation, smaller deficits would mean that a billion-gallon reservoir could provide, for example, 40 mgd for 25 days.

416. However, there are some complexities with how you would fill such a large reservoir,. Even if the Wailoa Ditch were flowing at capacity in the summertime, it would make more sense to apply that water as quickly as possible to the fields to avoid having system losses or to reduce system losses instead of trying to store it and meter it out. (Rick Volner, Tr., March 23, 2105, pp. 34-35.)

417. Ever since the Kaloko Dam incident on Kauai, all dam structures are highly scrutinized by the state. Constructing a large dam today will require much more scrutiny, much more oversight, than previously constructed reservoirs, and community opposition would also be expected. Any dam that would be sited would be at the highest elevation possible, and that would be above either Paia or Haliimaile. (Rick Volner, Tr., March 23, 2015, p. 34.)

418. A billion-gallon reservoir is approximately 3,800 acre-feet. If the reservoir is 10 feet deep, it would occupy approximately 30 acres. It would be very difficult to site a reservoir that large at the highest elevation on the plantation. (Garret Hew, Tr. March 18, 2015, p. 98; Rick Volner, Tr., March 23, 2015, p. 33.) [HC&S FOF 660.]

419. The cost of building a billion-gallon reservoir would depend on a number of factors, including terrain, acquisition of land, and permitting. In 2009, HC&S estimated that building a billion-gallon reservoir on Maui would cost well in excess of $150 million. (Exh. C-68, p. 6.) [HC&S FOF 663.]

420. HC&S has not considered building a large number of small reservoirs at the top of the plantation, because they wouldn't have the benefit that a large reservoir at the highest elevation, the most eastward end of the plantation, would have. This would be where the largest supply comes in, the Wailoa ditch. (Rick Volner, Tr., March 23, 2015, pp. 142-143.)

3. Recycled Wastewater

421. Nā Moku/MTF proposed a number of FOF on the use of wastewater for sugarcane irrigation, based on the December 20, 2010, Central Maui Recycled Water Verification Study. (Nā Moku/MTF Proposed FOF 973-985.)

422. Nā Moku/MTF contends that "(f)unds in the County budget have been set aside for an R-1 upgrade and transmission lines at the Kahului plant. What remains to be decided is where these lines would be placed." (Nā Moku/MTF Proposed FOF 974.) No reference accompanies this proposed FOF. What is in the record is the response of Irene Bowie, Executive Director of MTF:

> A. There has been ongoing conversation, and I've talked with staff in the Department of Environmental Management about funding for that, and the county has looked to put money into the budget. I believe in the 2015 budget there is money set aside.
>
> And also Department of Transportation Airports Division was willing to put money into a line that would go to the airport.
>
> (Irene Bowie, Tr., March 23, 2015, p. 167.)

"Funding for the distribution system could come jointly from Hawaii Department of Transportation, Airports Division, HC&S and others." (Irene Bowie, WDT, ¶ 14.) [Nā Moku/MTF FOF 976.]

423. Irene Bowie, Executive Director of MTF, makes a number of statements that do not distinguish the use of wastewater from the Kahului Wastewater Reclamation Facility ("WWRF") on HC&S's West Maui versus East Maui fields, *infra*, FOF 423-427.

424. Nā Moku/MTF contends that "Option 2 on page 8 of the Central Maui Recycled Water Verification Study proposes a distribution system from the Kahului WWRF to Kanaha Beach Park and Kahului Airport that could be extended to HC&S fields north of the airport." (Exhs. E-88, E-88-A, E-126.) (Na Moku/MTF FOF 975.]

425. However, the study proposal was for a distribution system to Kanaha Beach Park and Kahului Airport, and it was Irene Bowie's suggestion "that it could conceivably go on out to the fields in the north side of HC&S's plantation." (Irene Bowie, Tr., March 23, 2015, p. 166.)

426. The HC&S fields immediately north of the airport are irrigated by either EMI ditch water or HC&S wells. (Exh. C-35.)

427. The other options identified by Irene Bowie pertain to HC&S's West Maui fields: 1) a proposed pipeline along Kaahumanu Avenue to reach existing Maui Land and Pine ("ML&P") pipe lines that used to carry wastewater from its cannery operations to HC&S's seed cane fields; and 2) pumping R-1 water from the WWRF directly to HC&S's reservoir, are all in the West Maui fields. (Exh. C-120, FOF 506, p. 86; Exh. C-119, p. 36.)

428. In order to realize the use of WWRF R-1 water on HC&S's East Maui fields immediately north of Kahului Airport: 1) upgrade of the Kahului WWRF to R-1 water capability , with an estimated cost in December 2010 of $4,965,000 (Exh. E-88, p.6); 2) the pipeline to Kahului

Airport must be completed, and 3) a dedicated HC&S pipeline from that point to its East Maui fields above the airport must be completed.

429. Furthermore, there is presently only 2.95 mgd to 4.2 mgd of R-2 available on a consistent basis, and the current dry-weather flow capacity of the WWRF is 7.9 mgd. (Exh. C-119, p. 36; Exh. E-88, pp. 2, 6.)

4. Maui Land and Pine

430. Nā Moku/MTF contends that Maui Land and Pine (MLP) relied on EMI for irrigation water for 2,800 acres of its 6,000 acres, or approximately 4.5 mgd, and that 4.5 mg can be deducted from any determination of actual need for HC&S because MLP has gone out of business. (Exh. C-85, p. 32.) [Nā Moku/MTF FOF 1108-1113.]

431. However, MLP and HC&S had a transportation agreement, and not a water-use agreement, for use of the EMI transmission system to transport water MLP pumped into the EMI ditch at Nahiku for use on its pineapple fields. Furthermore, EMI/HC&S does not intend to use water from the well in the future, because the pump is small, and the cost of electricity outweighs the use of that water. (Exh. E-107; Garret Hew, Tr., March 18, 2015, pp. 165-166.) [Nā Moku/MTF FOF 1109-1110, 113.]

5. Green Harvesting

432. Irene Bowie does not consider herself an expert in cultivation of sugarcane but considers her position as Executive Director of MTF as capable of researching issues and reaching out to different entities and organizations that have the expertise. (Irene Bowie, Tr., March 23, 2015, p. 193.) As such, she is no more qualified as an expert than a layperson who has formed an opinion after becoming interested in a particular subject.

433. Bowie states that the replacement of pre-harvest burning by the adoption of green cane harvesting and trash blanketing has worked well on a large scale in Australia and does not reduce productivity or efficiency. Trash blanketing is the spreading of leaves and other plant residue in a thick layer of mulch over the ground. Because trash blankets help to prevent evaporation of water from the soil surface and allows better water infiltration, Bowie contends that the practice reduces irrigation requirements and produces higher cane yields in drier areas. However, one of her references, Exh. E-127, a study in South Africa, concludes that a trash blanket could also inhibit crop growth. Bowie also claims that HC&S currently green harvests between 4 percent

and 6 percent of their fields, and have publicly stated that they could increase that amount to possibly 20 percent. (Exhs. E-91, E-127; Irene Bowie, WDT, ¶¶ 28-29.) [Nā Moku/MTF FOF 1116-1123.]

434. The water savings that could theoretically be realized from green harvesting are due to the green trash blanket on the ground reducing evaporation from the soil surface. However, HC&S installs drip irrigation tubing below the ground. As a result, soil surface evaporation is very low, and the fields generally are not irrigated to the to the point that the surface becomes wet. (Rick Volner, WDT, ¶ 7; Rick Volner, Tr., March 23, 2015, pp. 38-39.) [HC&S FOF 665.]

435. In regions where green harvesting reportedly is practice, sugar is not a two-year crop as is uniquely the case in Hawaii. Sugarcane that is green harvested in a one-year crop cycle is ratooned (i.e., cut and allowed to regrow) multiple times over a four- to five-year period. Every time the crop is ratooned, it must be irrigated the next day to prevent damage to the stock core. Green harvesting sugarcane also has a shorter ripening and drying off stage (which uses little or not water), and thus it is very likely that green harvesting would increase annual water usage as compared to the current two-year crop cycle. Rick Volner, WDT, ¶ 7; Rick Volner, Tr., March 23, 2015, pp. 37, 39-40; Irene Bowie, Tr., March 23,2015, pp. 193-196.) [HC&S FOF 666.]

436. HC&S previously considered adopting a green harvesting approach and determined that it would not achieve economies of scale. Mechanical harvesting requires that the fields be free of rocks. Based on that limitation, approximately 12,000 acres could effectively be green harvested if HC&S were to purchase the equipment. There are probably an additional 4,000 acres to 5,000 acres that would require extensive rock-clearing in order to be green harvested. The remaining 13,000 acres to 14,000 acres cannot be green harvested. (Rick Volner, Tr., March 23, 2015, p. 39.) [HC&S FOF 667.]

437. The desert-like climate where most of the plantation is situated does not promote good trash breakdown over a four to five-year period. Consequently, after a crop is ratooned, the trash must be disposed of either by burning or plowing. (Rick Volner, Tr., March 23, 2015, pp. 40-41.) [HC&S FOF 668.]

d. Economic Impacts

438. HC&S provided two analyses on the economic impact of reduced water for its sugarcane operations: 1) the incremental impacts to HC&S of reductions in East Maui surface water

diversions; and 2) the impact on Maui County and the State of Hawaii of the termination of HC&S's sugar operations. (HC&S's Proposed FOF 695-715.)

439. On the impact of terminating HC&S's sugar operations, HC&S provided no information on when and how reduced surface water availability would reach the point that HC&S would cease operations. HC&S only stated in broad terms that it was in the public interest to continue HC&S's operation, because cessation of its sugar operations would affect the County of Maui and the State, MDWS and its customers, renewable energy benefits, and agricultural benefits. (HC&S Proposed FOF 698-715.)

440. On the incremental impacts to HC&S of reductions in deliveries from the EMI ditch system, HC&S created a model for assessing the economic impact of reducing the amount of EMI ditch water, separately assessing reductions of deliveries to the two upper ditches (the Wailoa Ditch and the Kauhikoa Ditch) and reduction of deliveries to the two lower ditches (the Lowrie Ditch and the Haiku Ditch). (Exhs. C-76, C-77, C-78.)[HC&S FOF 695.]

441. Reduced deliveries to the Wailoa Ditch and Kauhikoa Ditch result in reduced water availability to irrigate the 12,800 acres of sugarcane that cannot be irrigated with ground water. The financial impact is therefore calculated in terms of HC&S's anticipated loss in sugar yields due to the average decrease in available water. According to the model, the estimated value to HC&S of the average yield per million gallons per day of available water is $1,390. Therefore, the estimated average annual financial impact to HC&S per million gallons of reduced deliveries to either the Wailoa Ditch or the Kauhikoa Ditch would be $507,858. (Rick Volner, WDT, ¶ 69; Rick Volner, Tr., March 23, 2015, pp. 20-22; Exhs. C-76, C-78.) [HC&S FOF 696.]

442. Reduced deliveries to the Lowrie Ditch and Haiku Ditch are assumed to be compensated for by increased pumping of brackish ground water. The financial impact is therefore calculated in terms of the average cost of this pumping; $439 per million gallons per day for the Lowrie Ditch and $205 per million gallons per day for the Haiku Ditch. Therefore, the estimated average annual financial impact to HC&S per million gallons per day of reduced deliveries to either the Lowrie Ditch or the Haiku Ditch would be $160,250 and $74,825, respectively. (Rick Volner WDT, ¶ 69; Rick Volner, Tr., March 23, 2015, p. 22; Exhs. C-76, C-78.) [HC&S FOF 697.]

443. For the Wailoa Ditch and Kauhikoa Ditch, total water delivered and tons of sugar produced for the years 2003 to 2013 were used to arrive at "tons sugar/million gallons of water," with the yearly average at 2.19 tons sugar/million gallons of water. Dollars per ton of sugar is calculated at $520 (at $0.26 per pound,), dollars per ton of molasses at $85, dollars per ton of

bagasse at $50, and various factory costs at $60 per ton of sugar. A ton of molasses is calculated at 0.32 per ton of sugar, and a ton of bagasse is calculated at 2.97 per ton of sugar. Adding the dollars per ton of sugar, the tons of molasses and bagasse adjusted to a ton of sugar, and subtracting the factory costs, the average value of water would be $1,390/mgd, which, when multipled by 365 days, equals the annual financial impact of $587, 858 per million gallons per day of reduced deliveries to either the Wailoa Ditch or the Kauhikoa Ditch, *supra*, FOF 441.

444. The $520 per ton of sugar is based on a price of $0.26 per pound, while the prevailing price per pound was $0.2382 in 2014. (Rick Volner, Tr., March 23, 2015, pp. 52-53.)

445. While the yearly average for 2003 to 2013 is 2.19 tons sugar/million gallons of water, the yearly averages ranged from 1.55 for 2009, when total water deliveries were 82,003 million gallons (224.67 mgd) and tons of sugar were 126,800, to 2.51 for 2003, when total water deliveries were 81,913 million gallons (224.42 mgd) and tons of sugar were 205,700. (Exh. C-77.)

446. For the year 2003, 82,003 million gallons (224.67 mgd) produced 205,700 tons of sugar, while for 2009, a nearly identical supply of water, 81,913 million gallons (224.42 mgd), produced only 126,800 tons of sugar. (Exh. C-77.)

447. Given this large difference between tons of sugar produced by nearly identical amounts of water (a ratio of 1.55 for 2009 versus 2.51 for 2003), a consistent relationship between tons of sugar produced and amount of irrigation water is questionable.

448. For the increased pumping costs for the Lowrie and Haiku ditches, a direct relationship between pumping costs and increased pumping is logical.

449. In Exh. C-76, HC&S estimates a total economic impact of $1,250,775, but this is the sum of costs for each of the four ditches; i.e., $507,858 for both the Wailoa Ditch and Kauhikoa Ditch, $160,250 for the Lowrie Ditch, and $74,825 for the Haiku Ditch. Therefore, the sum is actually HC&S's estimated costs of reducing EMI ditch system water by 1 mgd at each of the four ditches, or the cost of reducing EMI ditch system water by 4 mgd, spread equally across the four ditches.

450. According to HC&S's own model and calculations, the economic impact of a 1 mgd reduction in EMI ditch system water would range from $74,825 at the Haiku Ditch, to $160,250 at the Lowrie Ditch, to $507,858 at either the Wailoa Ditch or Kauhikoa Ditch.

451. Given these large differences in impact, if faced with shortages of EMI ditch system water, to minimize costs and to the extent possible, HC&S should serve those fields irrigated

from the Wailoa and Kauhikoa ditches first, then the fields irrigated from the Lowrie Ditch, and lastly, the fields irrigated from the Haiku Ditch.

452. However, the estimated costs for the Wailoa and Kauhikoa ditches, which are based on tons of sugar per million gallons of water per day, are based on a questionable assumption that there is a consistent relationship between amounts of irrigation water and tons of sugar produced, *supra*, FOF 447.

453. Finally, HC&S's model is based on a reduction of surface water delivered through the EMI ditch system. Such costs have to be predicated on reductions of water that are necessary for irrigation, not on reductions of water that are currently delivered. As previously analyzed, even after the reductions of the Commission's 2008 and 2010 orders, more water than is required is still being delivered, *supra*, FOF 375-376.

2. MDWS

a. Uses

454. MDWS is the sole municipal water provider for the County of Maui. The MDWS Upcountry Water System serves the communities of Kula, Haiku, Makawao, Pukalani, Haliimaile, Waiakoa, Keokea, Waiohuli, Ulupalakua, Kanaio, Olinda, Omaopio, Kula Kai, and Pulehu. (David Taylor, WDT, David Taylor, Tr., March 11, 2015, p. 41.) [MDWS FOF 13.]

455. The population served by the MDWS upcountry system is projected at 35,251 people and includes several businesses, churches, Kamehameha Schools, Hawaiian Homelands, and government facilities. By 2030, the population is anticipated to grow by about 8,424 to a total of 43,675. (Michele McLean, WDT, ¶5; Exh. B- David Taylor, WDT, ¶ 6; David Taylor, Tr., March 11, 2015, p. 41; Michele McLean, Tr., March 12, 2015, pp. 120-127; Exhs. B-1, B-18, B-58.) [MDWS FOF 15, 34.]

456. Approximately 60 percent of MDWS's system is used domestically, and the remaining 40 percent for agricultural purposes. (David Taylor, WDT, ¶ 17; Exh. B-2, pp. 1-2; David Taylor, Tr., March 11, 2015, pp. 44-47.) [MDWS FOF 21.]

457. Approximately 80 to 90 percent of the water delivered within the upcountry system comes from surface water sources, either directly or by way of various raw water storage facilities. (David Taylor, WDT, ¶¶ 7-8, 18; Exh. B-2, Table 2; David Taylor, Tr., March 11, 2015, p. 44.) [MDWS FOF 20.]

458. MDWS relies on three surface water sources, one of which is delivered by EMI through the Wailoa Ditch, and the other two through two MDWS higher-elevation aqueducts maintained by EMI that transport water to Olinda and Kula, under a contractual agreement originated under the 193 East Maui Water Agreement and subsequent agreements. (Exhs. B-5, B-6, B-7, C-3.) [Na Moku/MTF FOF 844.]

459.

Water Treatment Plant ("WTP")	Elevation	Conveyance System	Production Capacity	Average Production
Olinda	4,200 feet	Upper Kula Flume	2.0 mgd	1.6 mgd
Piiholo	2,900 feet	Lower Kula Flume	5.0 mgd	2.5 mgd
Kamole-Weir	1,120 feet	Wailoa Ditch	6.0 mgd	3.6 mgd

(David Taylor, WDT, ¶ 9-11; David Taylor, Tr., March 11, 2015, p. 47; Exh. B-3, pp. 24-25; Exh. B-16, pp. 6-7.) [MDWS FOF 23-25; Nā Moku/MTF FOF 844.]

460. The Olinda facility diverts water from the Waikamoi, Puohokamoa, and Haipuaena streams. Water is stored in the 30-million gallon Waikamoi Reservoirs (two, at 15 million gallons each) and the 100-million gallon Kahakapao Reservoir. (David Taylor, WDT, ¶ 11; Exh. B-3, p. 25; David Taylor, Tr., March 11, 2015, p. 47.) [MDWS FOF 25.]

461. The Piiholo facility diverts water from the Waikamoi, Puohokamoa, Haipuaena, and Honomanu streams into the 50-million gallon Piiholo Reservoir. (David Taylor, WDT, ¶ 10; David Taylor, Tr., March 11, 2015, p. 47; Exh. B-3, p. 25.) [MDWS FOF 24.]

462. The Kamole-Weir facility, which has no reservoir, relies on water from the Wailoa Ditch, which diverts water from Honopou, Hanehoi, Puolua, Alo, Waikamoi, Puohokamoa, Haipuaena, Kolea, Punalau, Honomanu, Nuaailua, Piinaau, Paluhulu, East and West Wailuanui, West Wailuaiki, East Wailuaiki, Kopiliula, Puakaa, Waiohue, Paakea, Waiaaka, Kapaula, Hanawi, and Makapipi streams. (David Taylor, WDT, ¶ 9; David Taylor, Tr., March 11, 205, p. 47; Exh. B-3, p. 24.) [MDWS FOF 23.]

463. Besides its customers on the Upcountry Water System, *supra*, FOF 454, MDWS also provides non-potable water to the Kula Agricultural Park ("KAP") through diversions from the same streams which serve the Kamole-Weir WTP through the Wailoa Ditch. Water is stored in two reservoirs with a total capacity of 5.4 million gallons. KAP consists of 31 farm lots ranging in size from 7 to 29 acres, and which are owned by the County of Maui. The individual lots are metered and billed by MDWS. (David Taylor, WDT, ¶ 13; Exh. B-4.) [MDWS FOF 27.]

464. MDWS receives its surface water under a series of contracts with EMI. The original contract was entered into in 1961, and the "Master Water Agreement" was replaced by a 1973 "Memorandum of Understanding" as the primary contract, which had a term of 20 years. Since its expiration, there have been a total of 8 extensions, and after the lapse of the most recent extension, water has continued to be provided through a "Memorandum of Understanding Concerning Settlement of Water and Related Issues" dated April 13, 2000 ("MOU"). (David Taylor, WDT, ¶15; Exhs. B-5 to B-15.) [MDWS FOF 29.]

465. The MOU provides that MDWS will receive 12 mgd with an option for an additional 4 mgd. During low-flow periods, the County and HC&S will both receive a minimum allotment of 8.2 mgd. If these minimum amounts cannot be delivered, MDWS and HC&S will receive prorated shares of the water that is available. (David Taylor, WDT, ¶ 15; David Taylor, Tr., March 11, 2015, pp. 53-54; Exh. B-15.) [MDWS FOF 30.]

466. Approximately 80 to 90 percent of the water delivered within the upcountry system comes from surface water sources, *supra*, FOF 457, with the remaining 10 to 20 percent coming from a series of basal aquifer wells. The Haiku Well can produce 0.5 mgd, the Pookela Well, 1.3 mgd, and the two Kaupakalua wells, 1.6 mgd, for a total of 3.4 mgd. (Exh. B-16, p. 8.) [Na Moku/MTF FOF 850.]

467. In times of emergency, MDWS may also draw 1.5 mgd from the Hamakuapoko Wells. This water, however, is only available during times of emergency due to concerns over pesticides from former pineapple production. (David Taylor, Tr., March 11, 2015, pp. 61-62.)

468. The combined surface and ground water sources have a production capacity of 17.9 mgd: 13.0 mgd from surface water, *supra*, FOF 459, and 4.9 mgd from ground water (including 1.5 mgd in emergencies from the Hamakuapoko wells), *supra*, FOF 466-467.

469. However, due to occasional maintenance requirements and limitations on the use of the Hamakuapoko Wells, reliable capacity stands at 9.1 mgd. This is premised on the following sources not being available: 1) the largest surface-water facility, the Kamole-Weir at 6.0 mgd production capacity; 2) the Pookela Well at 1.3 mgd production capacity; and 3) Hamakuapoko Wells at 1.5 mgd, which is only available at times of emergency. These three sources total 8.8 mgd, potentially reducing total production capacity of 17.9 mgd to 9.1 mgd. (David Taylor, Tr., March 12, 2015, pp. 68-69.)

470. Customer usage based on meter readings between 2004 and 2013 average 7.9 mgd, varying between 6 mgd and 10 mgd. (Exhs. B-2; B-16, p. 3, table 3; B-21, p. 14, figure 1.) [MDWS FOF 33.]

471. There are currently 9,865 water connections to the Upcountry System. As of June 30, 2014, there were 1,852 applicants on the County's waiting list for new water connections. MDWS contends that if all were connected to the Upcountry System, water demand would increase by approximately 7.5 mgd, or 95 percent of current usage of 7.9 mgd, *supra*, FOF 470. However, because of the high cost of these connections, approximately half of the applicants who have been offered new meters have declined, and MDWS anticipates that this trend will continue, leaving demand at about 3.75 mgd. (David Taylor, WDT, ¶¶ 20-23.)

472. MDWS explained that its current 9,865 water connections use an average of 7.9 mgd, and it expects that the additional 1,852 applicants, if meters are granted, would increase usage by 7.5 mgd, or 95 percent, because some of those applicants are asking for multiple meters for subdivisions. Therefore, 1,852 applicants represent many, many more actual meters. Staff engineers went through each of the applications, did an estimate for each one, and came up with the increased usage of 7.5 mgd. (David Taylor, Tr., March 11, 2015, p. 67-69.)

473. MDWS also expects that by 2030 the population of the area served by the Upcountry System is anticipated to grow by about 8,424, from 35,251 to 43, 675, with a predicted additional need for water of 1.65 mgd. (Michele McLean, WDT, ¶ 5; Michele McLean, Tr., March 12, 2015, pp. 120-127; David Taylor, WDT, ¶ 24; David Taylor, Tr., March 11, 2015, pp. 76-78; Exhs. B-1; B-2, amended table 5; B-16, table 3;B-18; B-58.) [MDWS FOF 34-35.]

474. MDWS anticipates that it will need to develop between 4.2 mgd and 7.95 mgd to meet demands through 2030, including present use, expected increased demand due to population growth, and a percentage of new connections from the current priority list for meters. (David Taylor, WDT, ¶ 25.)

b. Losses

475. The 1.1-mile Waikamoi Flume transports surface water from the intakes at Waikamoi, Puohokamoa, and Haipuaena streams to the Olinda WTP. Water is stored in the 30-million gallon Waikamoi Reservoirs (two, at 15 million gallons each) and the 100-million gallon Kahakapao Reservoir, *supra*, FOF 460.

476. Over the years, the Waikamoi Flume became so leaky that MDWS estimated it lost as much as 40 percent of total flow through cracks and holes along its whole length. (Exh. B-54, pp. 27-29; Exh. E-114, p. 8.) [Nā Moku/MTF FOF 907-908.]

477. MDWS could not measure actual losses, because it had no mechanism for quantifying water levels at either the intake or discharge sites of the Waikamoi Flume. (David Taylor, First Supplemental Declaration, ¶ 5.) [Nā Moku/MTF FOF 911.]

478. If the reliable capacity of the Olinda WTP is the reported 1.6 mgd, *supra*, FOF 459, then the flume could have wasted as much as 0.64 mgd (1.6 mgd x 0.40) at that level of operation. (Nā Moku/MTF FOF 910.)

479. MDWS has just completed replacing the entire Waikamoi Flume. (David Taylor, Tr., March 11, 2015, pp. 55-59.)

480. Because the new flume isn't going to be leaking, MDWS assumes that everything going in will come out. They measure the reservoir levels every day, and also know how much water is taken out to the water treatment plant. So MDWS will be able to calculate how much water is coming from the flume on days when the main intake from the dam is dry, which is most of the days. All of the water coming in wil be from the flume, so MDWS will be able to quantify how much water comes in from the flume most of the time. (David Taylor, Tr., March 11, 2015, p. 60.)

481. There is no way to accurately compare intake versus outtake of the Waikamoi Flume prior to versus completion of the replacement flume. (David Taylor, Tr., March 11, 2015, p. 60.)

482. Further, the two 15 million-gallon Waikamoi reservoirs as well as the 2 million-gallon on-site basin at the Olinda WTP have just been relined. (David Taylor, Tr., March 11, 2015, p. 54-55.)

c. Alternate Sources

483. MDWS has no plans to drill new production wells to serve the Upcountry areas at the present time. They are very expensive, use a lot of energy, and there are some legal and procedural difficulties:

1. Water is very heavy, so moving it to higher elevations takes a lot of energy. Because a lot of the Upcountry System is at 1,000 to 4,000 feet and the basal aquifer is roughly at sea level, moving water is projected to cost $1.64 per thousand gallons for distribution from the Kamole-Weir WTP, $4.07 per thousand gallons at the Piiholo WTP,

and $5.93 per thousand gallons at the Olinda WTP. On top of pumping costs, increased reliance on ground water sources would require substantial initial capital expenditures and on-going maintenance. Ground water development also involves risks due to the uncertainty of the quantity and quality of water that will be presentt. MDWS's current charges for water only average about $4 per thousand gallons, so just the electrical costs is more than what MDWS charges overall for its entire operation. (David Taylor, Tr., March 11, 2015, pp. 62-65; David Taylor, Tr., March 12, 2015, pp. 17-19, 52; Exh. B-16, pp. 10, 14, 16.) [MDWS FOF 39-43.]

2. MDWS has entered into a Consent Decree in the case of Coalition to Protect East Maui Water Resources v. Board of Water Supply, County of Maui, Civil No. 03-1-0008(3), December 2003, which requires that MDWS conduct vigorous cost/benefit analyses of other water source options before developing ground water in the East Maui region. On several occasions, MDWS has tried but been unsuccessful in working within the framework of the consent decree to develop new ground water sources. (David Taylor, WDT, ¶¶ 29-30; David Taylor, Second Supplemental Declaration, ¶¶ 26-28; David Taylor, Tr., March 11, 2015, pp. 64-65; Exhs. B-19, B-20, B-52.

484. New raw water storage facilities, which would be fed by streams in times of water surplus for use during times of low flows, are an additional means by which MDWS could mitigate the effects of stream flow restoration:

1. Currently, MDWS is considering construction of a 100- to 200-million gallon reservoir at the Kamole-Weir WTP, which has no reservoir, *supra*, FOF 462, and has allocated $1.5 million in its FY2015 budget toward land acquisition for a possible reservoir. The total six-year estimated cost for the project is $25.25 million. No money has been allocated for design or construction. (David Taylor, First Supplemental Declaration, ¶¶ 10-11; David Taylor, Second Supplemental Declaration, ¶ 24; David Taylor, Tr., March 11, 2015, pp. 50-53; Exhs. B-16, p. 13 table 13; E-124.) [MDWS FOF 45-46.]

2. Like new basal groundwater source development, development of new raw water storage would require significant initial capital expenditures and on-going maintenance costs. (David Taylor, Tr., March 12, 2015, pp. 19-24; Exh. B-16, pp. 14, 16 table 4.) [MDWS FOF 47.]

485. Raw water storage at the Kamole WTP is more cost-effective than providing backup capacity by extensive additions of basal groundwater wells, which require high long-term energy expenditures. (Exh. E-147, p. 48.) [Nā Moku/MTF FOF 952-953.]

486. Reservoirs mitigate fluctuations in both stream flow and consumer demand, and mitigations in fluctuations in stream flow allow more of it to be used at the proper time; i.e., during drier times when it is most needed for irrigation, by making more water available without simultaneously taking directly from the water source being protected. (David Taylor, WDT, ¶ 10; Richard Mayer, Supplemental Declaration, ¶¶ 13-14.) [Nā Moku/MTF FOF 949-950.]

d. Economic Impact

487. A study conducted for the Draft "Maui Water Use and Development Plan ("WUDP") Upcountry Final Strategies Report" (July 25, 2009) examined the impacts of amended IIFS on drought period reliable capacity at the Kamole-Weir water treatment plant. (Exh. E-130.)

488. In 2014, MDWS also commissioned an engineering analysis of the impact to MDWS if the County's use of East Maui surface water were reduced or eliminated, based on documents provided by MDWS, including the July 25, 2009 Draft WUDP for MDWS's Upcountry System. (Exh. B-16.)

489. The 2014 review and analysis compared new groundwater sources versus construction of raw water storage reservoirs to mitigate Upcountry drought conditions. New reservoirs carry high capital costs but have lower operation and maintenance costs compared to groundwater wells. New wells carry relatively lower capital costs but also require transmission and storage improvements to be integrated into the existing water delivery systems, have risks associated with the uncertainty of the quantity and quality of water that will be present, and have higher operational costs due to the costs of pumping ground water from basal aquifers at sea level to the Upcountry system. (Exh. B-16, p. 14.)

490. Life-cycle cost comparisons were made, with new ground water sources and construction of storage reservoirs carrying similar life-cycle costs. Life-cycle costs incorporate capital, operating, and maintenance costs over a defined planning period and include inflationary effects. Over a 25-year period, both new ground water wells and reservoirs would cost about $33-$35/thousand gallons, for a total of $250 to $260 million for each strategy. (Exh. B-16, p. 15.)

491. The Kamole-Weir WTP has no storage reservoir, while both the Olinda and Piiholo WTPs have reservoirs, *supra*, FOF 460-462. The Kamole-Weir WTP has a production capacity of 6 mgd and an average production of 3.6 mgd, *supra*, FOF 459.

492. Under the MOU between EMI and MDWS, MDWS can receive 12 mgd with an option for an additional 4 mgd. During low-flow periods when ditch flows are greater than 16.4 mgd, both will receive a minimum allotment of 8.2 mgd. If these minimum amounts cannot be delivered, both will receive prorated shares of the water that is available, *supra*, FOF 464-465. In recent periods of low Wailoa Ditch flow, EMI has not restricted the allotment of water to MDWS according to the terms of the agreement, and MDWS withdrawals have been limited only by the amounts of water available in the ditch and the physical limitations of the existing Kamole-Weir WTP intake structures. During drought conditions, MDWS may withdraw 6 mgd, and what remains is used by HC&S for irrigation. (Exhs. E-130, p. 4; Exh. B-16, p. 10.)

493. For the period 1922 to 1987, flows in the Wailoa Ditch exceeded 40 mgd more than 90 percent of the time and exceeded 20 mgd more than 99 percent of the time. (Exh. E-130, p. 4.)

494. Assuming a drought period exists if water available to MDWS is less than the 6 mgd capacity of the Kamole-Weir WTP, recent existing reliability was 4.5 mgd drought period yield, with raw water requirements assumed to be 5.0 mgd to provide 4.5 mgd of potable water capacity.[27] (Exh. E-130, p.6.)

495. For the 23,680-day period of record from 1922 to 1987, assuming a daily withdrawal of 5.0 mgd from the Wailoa Ditch, there was deficient water on 54 days (0.23 percent of the time) with a maximum of 16 consecutive days of deficiency. (Exh. E-130, p. 7.)

496. For the ten-year period 2001 to 2011, the number of days when the Wailoa Ditch flow was less than 20 mgd was 50 days, and the longest continuous span of no flow was 5 days. (Exh. B-16, p. 11 table 12.)

497. There would be little or no impact if Wailoa Ditch flows were reduced 15 mgd. MDWS would not have full access to the 6 mgd capacity of the Kamole-Weir WTP for 5 days, the same as for the period 2001 to 2011, *supra*, FOF 496, and less than the maximum of 16 days for the period 1922 to 1987, *supra*, FOF495. (David Taylor, Tr., March 11, 2015, pp. 145-146; Exh. B-16, p. 16.)

498. With a 20 mgd reduction in Wailoa Ditch flow and assuming a daily drought period withdrawal of 5.0 mgd, *supra*, FOF 494, there would not be sufficient water to provide reliable

[27] The study uses 4.5 mgd or 4.6 mgd for various reasons. 4.6 mgd will be used to simplify the discussion.

drought period capacity without some mitigating actions. For a 23,680 day period, *supra*, FOF 495, 5.0 mgd would not be able to be withdrawn for 822 days or 3.47 percent, with 54 consecutive days of deficiency. (Exh. E-130, p. 9.)

499. Note, however, that the deficiency only means that 5 mgd could not be withdrawn. Lesser amounts could still be withdrawn from the Wailoa Ditch. Furthermore, while the study defined drought period deficiency as being less than 4.6 mgd of a total capacity of 6 mgd, actual use from the Kamole-Weir WTP has been 3.6 mgd out of the total capacity of 6 mgd, *supra*, FOF 459.

500. With the addition of a 100-million gallon reservoir at the Kamole-Weir WTP, the drought period reliable yield with the 20 mgd reduction in Wailoa Ditch flow would be 4.6 mgd, approximately equal to the existing WTP reliable yield without reductions in ditch flows. (Exh. E-130, p. 10.)

501. With a 200-million gallon reservoir, the drought period reliable yield with the 20 mgd reduction in Wailoa Ditch flow increases to 7.1 mgd, an increase of 2.4 mgd compared to a 100-million gallon reservoir and greater than the total capacity of 6 mgd of the Kamole-Weir WTP. (Exh. E-130, p. 10.)

502. Estimated costs of a 100- to 200-million reservoir at the Kamole-Weir WTP are $25.25 million, *supra*, FOF 484, and life-cycle costs over 25 years are estimated at $33 per thousand gallons or $250 million, *supra*, FOF 490. (Exh. B-16, p. 15.)

II. CONCLUSIONS OF LAW

A. Applicable Laws

1. Interim Instream Flow Standards (IIFS)

1. "'Instream flow standard' means a quantity or flow of water or depth of water which is required to be present at a specific location in a stream system at certain specified times of the year to protect fishery, wildlife, recreational, aesthetic, scenic, and other beneficial instream uses." (HRS § 174C-3.)

2. "A petition to adopt an interim instream flow standard under this section shall set forth data and information concerning the need to protect and conserve beneficial instream uses of water and any other relevant and reasonable information required by the commission." (HRS §174C-71(2)(C).)

3. "In considering a petition to adopt an interim instream flow standard, the commission shall weigh the importance of the present or potential instream values with the importance of the present or potential uses of water for noninstream purposes, including the economic impact of restricting such uses." (HRS § 174C-71(2)(D).)

4. The value of water that is diverted, only to be lost due to avoidable or unreasonable circumstances, is unlikely to outweigh the value of retaining the water for instream uses. Therefore, the Commission should consider whether system losses experienced by diverters are unreasonable, and whether reduction of such losses is reasonably practicable. (*Nā Wai `Ehā*, 128 Haw. at 257-258; 287 P.3d at 158-159.)

5. The availability of alternative water sources is a consideration in the weighing of instream values with noninstream purposes when establishing IIFS, because the availability of alternative sources diminishes the "importance" of diverting stream water for noninstream use. (*Nā Wai `Ehā*, 128 Haw. at 259; 287 P.3d at 160.)

6. "'Instream use' means beneficial uses of stream water for significant purposes which are located in the stream and which are achieved by leaving the water in the stream (*Emphasis added*). Instream use include, but are not limited to:

1. Maintenance of fish and wildlife habitats;
2. Outdoor recreational activities;
3. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation;
4. Aesthetic values such as waterfalls and scenic waterways;
5. Navigation;
6. Instream hydropower generation;
7. Maintenance of water quality;
8. The conveyance of irrigation and domestic water supplies to downstream points of diversion; and
9. The protection of traditional and customary Hawaiian rights." (HRS § 174C-3.)

7. "'Noninstream use' means the use of stream water that is diverted or removed from its stream channel and includes the use of stream water outside the channel for domestic, agricultural, and industrial purposes." (HRS § 174C-3.)

8. "Interim instream flow standards may be adopted on a stream-by-stream basis or may consist of a general instream flow standard applicable to all streams within a specified area." (HRS § 174C-71(2)(F).)

2. The Public Trust Doctrine

9. Under Articles XI, sections 1 and 7 of the Hawaii State Constitution, the public trust doctrine applies to all waters of the State without exception or distinction. (*In re Water Use Permit Applications* ["*Waiāhole I*"], 94 Haw. 97, 133; 9 P.3d 409, 445 [2000].)

10. The state water resources trust embodies a dual mandate of protection and maximum reasonable and beneficial use. The object is not maximum consumptive use but the most equitable, reasonable, and beneficial allocation of state water resources, with full recognition that resource protection also constitutes use. (*Waiāhole I*, 94 Haw. at 139-140; 9 P.3d at 451-452.)

11. The purposes of the water resources trust are: 1) maintenance of waters in their natural state; 2) domestic water uses of the general public, particularly drinking; 3) native Hawaiian and traditional and customary rights, including appurtenant rights; and 4) reservations of water, particularly for Hawaiian home lands. (*Waiāhole I*, 94 Haw. at 136-138; 9 P.3d at 448-450. *In re Wai`ola o Moloka`i, Inc.*("*Wai`ola*"), 103 Haw. 401, 429, 431; 83 P.3d 664, 692, 694 [2004].)

12. There are no absolute priorities among trust purposes, and resource protection is not a "categorical imperative." The Commission must weigh competing public and private water uses on a case-by-case basis, according to any appropriate standards provided by law. (*Waiāhole I*, 94 Haw. at 142; 9 P.3d. at 454.)

13. Any balancing between public and private purposes must begin with a presumption in favor of public use, access, and enjoyment. Use consistent with trust purposes is the norm or "default" condition, which effectively prescribes a higher level of scrutiny for private commercial uses. (*Waiāhole I*, 94 Haw. at 142; 9 P.3d at 454.)

14. Reason and necessity dictate that the public trust may have to accommodate offstream diversions inconsistent with the mandate of protection, to the unavoidable impairment of public instream uses and values. (*Waiāhole I*, 94 Haw. at 141; 9 P.3d at 453.)

15. When scientific evidence is preliminary and not yet conclusive regarding the management of fresh water resources which are part of the public trust, it is prudent to adopt "precautionary principles" in protecting the resource. Lack of full scientific certainty should not be a basis for postponing effective measures to prevent environmental degradation. (*Waiāhole I*, 94 Haw. 154-155, 159; 9 P.3d 466-467, 471.)

16. Uncertainty regarding the exact level of protection necessary justifies neither the least protection feasible nor the absence of protection. Although interim standards are merely stopgap measures, they must still protect instream values to the extent practicable. The Commission may

still act when public benefits and risks are not capable of exact quantification. (*Waiāhole I*, 94 Haw. at 159; 9 P.3d at 471.)

17. "In requiring the Commission to establish instream flow standards at an early planning stage, the Code contemplates the designation of the standards based not only on scientifically proven facts, but also on future predictions, generalized assumptions, and policy judgments." (*Waiāhole I*, 94 Haw. at 155; 9 P.3d at 467.)

18. "(I)n the interest of precaution, the Commission should consider providing reasonable 'margins of safety' for instream trust purposes when establishing instream flow standards." (*Waiāhole I*, 94 Haw. at 156; 9 P.3d at 468.)

3. Appurtenant Rights and Riparian Rights

19. There are no designated surface water management areas under HRS §§ 174C-45 and 174C-46 in the East Maui region from which the EMI Ditch System diverts water.

20. Water rights in non-designated areas are governed by the common law. (*Ko`olau Agr. Co. v. Commission on Water Resource Management* ["*Ko`olau*"], 83 Haw. 484, 491; 927 P.2d 1367, 1374 [1996]).

21. Appurtenant rights and riparian rights are the common law surface water rights.

22. Appurtenant rights are rights to the use of water utilized by parcels of land at the time of their original conversion into fee simple land, when title was confirmed by the Land Commission Award and title conveyed by the issuance of a Royal Patent. (*Reppun v. Board of Water Supply* ["*Reppun*"], 65 Haw. 531, 551; 656 P.2d 57, 71 [1982].)

23. When "the same parcel of land is being utilized to cultivate traditional products by means approximating those utilized at the time of the Mahele, there is sufficient evidence to give rise to a presumption that the amount of water diverted for such cultivation sufficiently approximates the quantity of the appurtenant water rights to which that land is entitled." (*Reppun*, 65 Haw. at 554; 656 P.2d at 72.)

24. Appurtenant rights are superior to riparian rights as they constituted an easement in favor of the property with the appurtenant right as the dominant estate. (*Reppun*, 65 Haw. at 551; 656 P.2d at 71; *Peck v. Bailey*, 8 Haw. 658, 662 [1867].)

25. Under riparian rights, owners of land adjacent to a natural watercourse are entitled to its use, no one owns the water, and the rights of one owner is not superior to another's. (*McBryde v. Robinson* ("*McBryde*"), 54 Haw. 174, at 198; 504 P.2d 1330, at 1344 [1973]; *aff'd on rehearing*,

55 Haw. 260; 517 P.2d [1973]; *appeal dismissed for want of jurisdiction and cert. denied*, 417 U.S. 962 [1974].)

26. Surface water rights are limited to the base flows. "(T)itle to water was reserved to the State for the common good when parcels of land were allotted to the awardee under the mahele. Thus 'storm and freshet' water is the property of the State." (*McBryde*, 54 Haw at 199-200; 504 P.2d at 1345.)

27. The exclusive purpose of the statutory imposition of riparian rights in this jurisdiction was to enable tenants of ahupuaa to make productive use of their lands. (*Reppun*, 65 Haw. at 553; 656 P.2d at 72.)

28. There is no right to divert water by non-riparian landowners, but such diversions are permissible if they are reasonable and beneficial. (*Robinson v. Ariyoshi*, 65 Haw. 641, 648-650; 658 P.2d 287, 294-295 [1982].)

29. The continuing use of the waters of the stream by non-riparian landowners is contingent on a demonstration that such use will not harm the established rights of others. (*Reppun*, 65 Haw. at 554; 656 P.2d at 72.)

30. Such non-riparian diversions will be restrained only if a riparian owner can demonstrate actual harm to his/her own reasonable use of those waters. (*Reppun*, 65 Haw. at 553; 656 P.2d at 72.)

31. Where water has been improperly diverted by a public entity for actual public use, a complainant may not obtain injunctive relief against the diversion to which a public use has attached at the time suit is filed, unless the court finds that another public interest of substantially the same magnitude as that of the public's interest in adequate water will be advanced by injunctive relief. A public use attaches at the time the water is actually used by the public and only to the extent of such actual use. In the case of prior attachment, damages rather than injunctive relief would be the preferred solution. In the case of gradually increasing water diversion, the point at which the public use doctrine becomes operational is when the diversion causes harm to the complainants, and not when the complaint is filed. (*Reppun*, 65 Haw. at 565; 656 P.2d at 79.)

32. Since the 1982 *Reppun* decision, "domestic use of the general public" has been identified as a public trust purpose, *supra*, COL 9, thereby conflicting with the rights of riparian and appurtenant rightsholders to seek injunctive relief or damages under the public use doctrine, *supra*, COL 30.

33. For non-public-entity diverters, riparian and appurtenant rightsholders are entitled to waters sufficient to cultivate their crops in the manner in which they were accustomed prior to the diversions that led to a damaging of their crops. (*Reppun*, 65 Haw. at 553; 656 P.2d at 72.)

B. Burden of Proof in Amendments to the IIFS

34. "In the context of IIFS petitions, the water code does not place a burden of proof on any particular party; instead, the water code and our case law interpreting the code have affirmed the Commission's duty to establish IIFS that 'protect instream values to the extent practicable' and 'protect the public interest.'" (*In re Water Use Permit Applications ["Waiāhole II"]*, 105 Haw. 1, 11, 93 P. 3d 643, 653 [2004].)

35. In the IIFS-setting context, the Commission "need only reasonably estimate instream and offstream demands."(*In re `Īao Ground Water Management Area High-Level Surface Water Use Permit Applications and Petition to Amend Interim Instream Flow Standards of Waihe`e River and Waiehu, `Īao, and Waikapu Streams Contested Case Hearing* ["*Nā Wai `Ehā*"], 128 Haw. 228, 258; 287 P.3d 129, 159 (2012); *Waiāhole I*, 94 Haw. at 155 n. 60; 9 P.3d at 467 n. 60.)

36. "In requiring the Commission to establish instream flow standards at an early planning stage, the Code contemplates the designation of the standards based not only on scientifically proven facts, but also on future predictions, generalized assumptions, and policy judgments," *supra*, COL 17.

37. Legal conclusions made in this proceeding pertaining to a particular party's water rights, traditional and customary rights, water use requirements, alternative water sources, and system losses are made without prejudice to the rights of any party and the Commission to revisit these issues in any proceeding involving the use of water from any of the East Maui streams that are the subject of this contested case hearing. The burden of proof with respect to such issues will be upon the petitioner rather than upon the Commission. (*See* 2014 Mediated Agreement, pp. 3-4 and Exhibit 1, p. 25.)

C. The EMI Ditch System is a "Hydrologically Controllable Area"

38. In *Waiāhole I*, the Court concluded that consolidated regulation of separate water management areas was not precluded when a water delivery system draws water from several different water management areas. "HRS § 174C-50(h) addresses competition arising between existing uses when 'they draw water from the same hydrologically controllable area and the

aggregate quantity of water consumed by the users exceeds the appropriate sustainable yield or instream flow standards established pursuant to law for the area (*emphasis in original*).' The Code defines 'hydrologic unit' as 'a surface drainage area or a ground water basin or a combination of the two,' HRS § 174C-3, but does not define a 'hydrologically controllable area.' The plain reading of the latter term indicates that the area 'controlled' by the ditch system qualifies, irrespective of 'hydrologic units.'" (*Waiāhole I*, 94 Haw. at 174; 9 P.3d at 486.)

39. In the context of amendments to the IIFS, the same logic applies: the East Maui streams "controlled" by the EMI ditch system qualifies as a "hydrologically controllable area," and consolidated amendments to the IIFS of the East Maui streams are not precluded.

D. Instream Uses

40. Of the instream uses identified in COL 6, *supra*, the principal uses in the East Maui streams are the exercise of appurtenant and riparian water rights; gathering of fish, mollusks, and crustaceans; and the exercise of traditional and customary Hawaiian rights. Gathering of stream animals and stream flows to enable the downstream exercise of appurtenant and riparian rights constitute the instream exercise of traditional and customary Hawaiian rights. (FOF 286.)

41. Petitioners' use of water for growing wetland taro, for other agricultural uses, and for domestic household uses are also noninstream uses but are addressed as instream uses because their uses are met by "the conveyance of irrigation and domestic water supplies to downstream points of diversion," supra, COL 6. Furthermore, in the weighing of instream values versus noninstream values, the Commission must consider the economic impact of restricting noninstream uses, *supra*, COL 3, and petitioners' are asking for more water for their agricultural and domestic household uses.

1. Conveyance of Water for Appurtenant and Riparian rights

a. Water Requirements

42. Approximately 94.721 acres have appurtenant rights, 49.805 acres for taro lo`i and 44.916 acres for other types of agricultural uses. (FOF 299-304.)

43. These acres are located in the following areas and watered by the following streams:

	Taro Lo`i	Other Agriculture	Source of Stream Water
Keanae	13.475 acres	7.00 acres	Palauhulu Stream
Wailua	30.160 acres	28.096 acres	Waiokamilo & Wailuanui Streams

Honopou	6.17 acres	9.82 acres	Honopou Stream

(FOF 294-304.)

44. In addition, the following areas and streams have some acreage identified with use of stream waters:

	Taro Lo`i	Other Agriculture	Source of Stream Water
Hanehoi	2.3 acres	?	Hanehoi & Puolua Streams
Makapipi	4.17 acres	3.25 acres	Makapipi Stream

The "other agriculture" category is for riparian rights: 1) a parcel adjacent to Hanehoi Stream for which the owner would like to exercise her riparian rights, and 2) for Jeffrey Paisner's property adjacent to Makapipi Stream.

(FOF 151, 219, 305, 310.)

45. The acres have not been reduced by 10 percent, as Na Moku's expert witness had done in a previous proceeding. (FOF 292, 299.) Instead, when accounting for water for the "other agriculture" category, the water assigned to "taro lo`i" is assumed to be more than enough to meet the irrigation requirements of the "other agriculture" category, *infra*, COL 58-59.

46. In the Nā Wai `Ehā contested case, the Commission had adopted a water budget of 130,000 to 150,000 gad for taro lo`i, which the Commission reaffirms here for East Maui. (FOF 192.)

47. Given the approximately half of the crop cycle that no water is needed to flow into the lo`i, the Commission's water budget means that average flow requirements for the half of the time that flow is needed would be 260,000 to 300,000 gad. On the other hand, Reppun contends that the water budget should be 100,000 to 300,000 gad, even when taking into consideration the 50 percent of time that no water is flowing into the lo`i. Reppun's requirements would translate into an average of 200,000 to 600,000 gad when inflow is needed. (FOF 194.)

48. On the other hand, Reppun also concludes that any general water requirement is questionable, because there is no definitive answer, and that the average is a result of such parameters as percolation rates, weather, season, location on the stream relative to other diversions, initial water temperature, and rate of dilution of used water. Reppun's use of the 100,000 to 300,000 gad figure is predicated on when the taro needs the most water: the summer months, the hottest times, the longest days. (FOF 194-196.)

49. The temperature of 27°C (80.6°F) is the threshold point at which wetland kalo beccomes more susceptible to fungi and rotting diseases. (FOF 197.)

50. Reppun participated in a 2007 USGS study of what farmers were actually using, which looked at quantities of water and correlated that to temperature. To assure consistency of data, only lo`i with crops near harvesting (continuous flooding of the mature crop) was studied in the dry season (June to October), when water requirements for cooling kalo approach upper limits. (FOF 199-201.)

51. Keanae and Wailua (Lakini, Wailua, and Waikani) in East Maui were part of the areas studied. Keanae receives water from Palauhulu Stream, Lakini and Wailua receive water from Waiokamilo Stream, and Waikani receives water from Wailuanui Stream. (FOF 203.)

52. Inflow measurements on July 30, 2006 and September 21, 2006 were as follows:

Keanae: 180,000 gad and 150,000 gad (for 10.53 acres)
Waikani: 190,000 gad and 93,000 gad (for 2.80 acres)
Wailua: 180,000 gad and 140,000 gad (for 3.32 acres)
Lakini: 750,000 gad and 550,000 gad (for 0.74 acres)

(FOF 206.)

53. All taro complexes had inflow temperatures well below 27°C. (FOF 208.)

54. Outflow temperatures were not measured at Wailua, and there was an equipment malfunction at Keanae. (FOF 209.)

55. For Lakini and Waikani, temperatures exceeded 27°C for several hours a day for one-half to two-thirds of the time: 16.9 percent of the time for Lakini and 29.1 percent of the time for Waikani. Reppun is of the opinion that percent of time that outflows exceed 27°C is the most important factor. (FOF 209, 212.)

56. For Lakini, Reppun was of the opinion that the water was not going to heat up very much at all, given the enormous amount of water relative to the size of the area, and that the amount was more than adequate. (FOF 216.)

57. The Commission's water budget of 130,000 to 150,000 gad translates to an <u>average</u> of 260,000 to 300,000 gad for the time when water is needed to flow into the lo`i, *supra*, COL 46-47. The USGS study focused on the times when water requirements were at their maximum, and for which much more water than 260,000 to 300,000 gad would be available without exceeding the limits of the water budget. Thus, there would likely have been sufficient water to significantly reduce the percent of time that temperatures for these taro complexes exceeded 27°C and still stay within the limits of an overall water budget of 130,000 to 150,000 gad for a crop cycle.

58. Applying a water budget of 130,000 to 150,000 gad to the acreage in COL 43-44, *supra*, results in the following water requirements from the identified streams.

Palauhulu:	13.475 acres x (130,000 to 150,000 gad) = 1.75 mgd - 2.02 mgd
Waiokamilo & Wailuanui:	30.160 acres x (130,000 to 150,000 gad) = 3.92 mgd - 4.52 mgd
Honopou:	6.17 acres x (130,000 to 150,000 gad) = 0.80 mgd - 0.93 mgd
Hanehoi/Puoloa:	2.3 acres x (130,000 to 150,000 gad) = 0.30 mgd - 0.35 mgd
Makapipi:	4.17 acres x (130,000 to 150,000 gad) = 0.54 mgd - 0.63 mgd

59. These requirements should also meet the requirements for acres in "other agriculture," because the acreage has not been reduced by 10 percent, which Na Moku's expert did not do for this contested case, *supra*, COL 45, and water requirements for "other agriculture" are far less than for taro lo`i. For example, for Palauhulu Stream, 10 percent of 13.475 acres is 1.348 acres, and multiplying by 130,000 to 150,000 gad, 0.18 mgd to 0.20 mgd would be available for 7.00 acres for "other agriculture," or 25,714 gad to 28,571 gad. For Waiokamilo and Wailuanui Streams, the comparable water available for other agricultural uses would be 13,880 to 16,728 gad; for Honopou Stream, available water would be 8,168 to 9,425 gad; and for Makapipi Stream, available water would be 16,680 to 19,246 gad, all far in excess of any agricultural requirements other than taro lo`i (*see*, COL 43, *supra*, for other agriculture acreage).

60. Furthermore, the taro lo`i water requirements are for flow-through amounts, most of which will exit the lo`i complex and then may either flow into another lo`i complex or back into the stream. Thus, much of the 130,000 to 150,000 taro lo`i water requirements will be available for use by others such as for downstream lo`i complexes and other agricultural uses, or for increased stream flow for improved stream animal habitat.

61. The 2008 Commission order made the following amounts of water available in these streams:

Palauhulu:	3.56 mgd (for taro)
Waiokamilo & Wailuanui:	Waiokamilo: 3.17 mgd for taro and domestic Wailuanui: 1.26 mgd for taro and habitat
Honopou:	1.29 mgd[28]: 0.82 mgd for taro and domestic; 0.47 mgd for habitat
Hanehoi/Puoloa:	1.72 mgd: 0.98 mgd for taro; 0.74 mgd for Huelo community
Makapipi Stream:	not included in 2008 Commission order

[28] In actuality, 1.15 mgd (1.7 cfs) was added just below the Haiku Ditch, then the IIFS was raised to 1.29 mgd (2.00 cfs) because Honopou Stream gains an unknown amount below the Haiku Ditch. (FOF 121.)

(FOF 121-122, 141-147, 154, 162, 175-177.)

62. However, the existing stream flows at these locations were either unknown or estimates from the modeling effort, *supra*, FOF 84-93, 182, and were to be confirmed after initial implementation, but, as described earlier, *supra*, FOF 250-258, no evaluation of whether or not the purposes of the amended IIFS were met have been conducted.

63. As can be seen by comparing COLs 58 and 61, *supra*, had the 2008 Commission order been able to be implemented, the water requirements would have been met with waters from Honopou and Waiokamilo/Wailuanui Streams, and exceeded for irrigation from Palauhulu and Hanehoi/Puolua Streams. However, in the implementation, Commission staff has learned that: 1) the regression estimates used for flows had, in many cases, overstated what those flows would be, so if the sluice gates on the ditches are opened, there still may not be enough flow to meet the amended IIFS; 2) there is a natural variability in stream flow which may dip below the IIFS, generally due to periods of low rainfall, so guaranteeing that a specific flow is always in the stream and still meet the objective of the IIFS is not possible; and 3) in Wailuanui and Keanae, the Ko`olau Ditch has only been taking, for the most part, water generated by rainfall, and spring water below the Ditch is what the taro farmers have access to. (FOF 256-257.)

b. Appurtenant and Riparian Uses

64. Appurtenant and riparian rights are limited to the base flows, and storm and freshet water is the property of the State, *supra*, COL 26, which the State may assign or apportion among users that is in the public interest.

65. Appurtenant rights are superior to riparian rights, *supra*, COL 24.

66. The amount of water accompanying the appurtenant right is determined by its use on the property at the time of the Mahele, while a riparian right is not superior to the rights of other riparian landowners and the amount of water is determined by whether its use is reasonable and beneficial, *supra*, COL 22-23, 25.

67. The continuing use of stream waters by non-riparian landowners is permissible if the use is reasonable and beneficial and will not harm the established rights of appurtenant and riparian landowners, *supra,* COL 28-29.

68. Such non-riparian diversions will be restrained only if a riparian landowner can demonstrate actual harm to his/her own reasonable use of those waters, *supra*, COL 30.

69. Appurtenant and riparian rightsholders have demonstrated actual harm to their reasonable use of the waters of Palauhulu, Waiokamilo, Wailuanui, Honopou, Hanehoi, and Makapipi Streams. (FOF 93, 185-187, 225, 250-257.)

2. Maintenance of Fish and Wildlife habitats

70. Incorporating hydrology, stream morphology, and microhabitat preferences, a model of stream systems was used to simulate habitat/discharge relationships for various species and their life stages, and to provide quantitative habitat comparisions at different streamflows. (FOF 96.)

71. For East Maui streams, 64 percent of natural median base flow ($0.64xBFQ_{50}$) is required to provide 90 percent of the natural habitat (H_{90}), or the minimum viable habitat flow (H_{min}) expected to produce suitable conditions for growth, reproduction, and recruitment of native stream animals. (FOF 99, 105.)

72. Habitat less than H_{90} would not result in viable flow rates for growth, reproduction, and recruitment. There is no linear relationship between the amount of habitat and the number of animals. H_{70}, or twenty percent less habitat than H_{90}, would not result in only 20 percent less animals; nor would H_{50}, which is twenty percent less than H_{70}, result in only an additional 20 percent less animals. (FOF 106.)

73. A geographic approach to stream restoration was taken in the Commission's 2010 order, meaning that flows were restored in selected streams both east and west of Keanae Valley. Benefits of this approach included biological diversity in the East Maui area, and regional diversity in traditional gathering opportunities. (FOF 240a.)

74. A geographic approach to stream restoration is in compliance with the Code:

a. "Interim instream flow standards may be adopted on a stream-by-stream basis or may consist of a general instream flow standard applicable to all streams within a specified area," HRS § 174C-71(2)(F), *supra*, COL 8.

b. Each of the streams in this contested case has been and will be addressed on a stream-by-stream basis, and the Code does not prohibit evaluating each stream's contribution to a geographic approach to stream restoration in amending (or not) its IIFS.

75. A geographic approach is the most feasible method of restoring streams that are collectively diverted by EMI's Ditch System:

a. The EMI Ditch System qualifies as a "hydrologically controllable area," and a geographic approach, or consolidated amendments to the IIFS, of the East Maui streams are not precluded, *supra*, COL 38-39.

76. Streams were selected which would result in the most biological return from additional flow. (FOF 240b.)

77. Final selections were as follows, with the Commission adopting its staff selections:

Division of Aquatic Resources (DAR)	Commission Staff
East Wailuaiki Stream	East Wailuaiki Stream
West Wailuaiki Stream	West Wailuaiki Stream
Puohokamoa Stream	
Waikamoi Stream	Waikamoi Stream
Kopiliula Stream	
Haipuaena Stream	
Waiohue Stream	Waiohue Stream
Hanawi Stream	Hanawi Stream
	Makapipi Stream

(FOF 115, 238.)

78. Puohokamoa, Haipuaena, and Kopiliula Streams were not selected by Commission staff, reasoning that these streams are used for conveyance, more water may exist in the portion of the stream used for conveyance than would naturally occur, and any interim IFS should be based on the surface water available within the given hydrological unit. (FOF 241.)

a. However, during the contested case hearing, Garrett Hew of EMI agreed that there's no identification of particular conveyance streams. If storm waters overflow a ditch, the water goes into the stream and then hits the next ditch downstream. There are no actual conveyance ditches or designated conveyance streams in the system. (FOF 242.)

79. For Hanawi Stream modification of the diversion would serve mainly to create a wetted pathway for stream animal connectivity from the diversion to the ocean. The stream already had adequate flow to sustain a viable biota population, but the biological health of the stream could be further improved simply by providing connectivity through a wetted pathway in the dry reach immediately below the diversion. (FOF 240d.)

80. Makapipi Stream was selected by the Commission staff because the Nahiku community relies heavily on the stream for cultural practices, recreation, and other instream uses. But with the uncertainty of gaining and losing reaches along most of the stream's course to the ocean, it was not known whether restored flow will result in continuous stream flow from the headwaters

to the stream mouth. Thus, a short-term release of water past the one major EMI diversion was made to determine the sustainability of the proposed IIFS of 0.60 mgd (BFQ_{50}), just upstream of Hana Highway. (FOF 240e.)

a. Flows ranging from 0.76 mgd to 0.87 mgd were released from the Ko`olau Ditch in September 2010, but no flow was observed at the Hana Highway Bridge located about two-thirds of a mile downstream of the diversion. A 1,000-foot reach upstream of the Hana Highway Bridge was dry, with the exception of a few isolated pools of water, and there was no indication of recent streamflow. The precise location where the stream went dry farther upstream was not determined, because it could not be safely accessed on foot. Much of the lower sections of the stream below the highway was largely dry, with isolated reaches with pools of water. (FOF 268.)

81. The seasonal approach of the Commission's 2010 order established winter flows at 64 percent of BFQ_{50} (H_{90}) and summer flows at 20 percent of BFQ_{50} for the remaining four streams: East Wailuaiki, West Wailuaiki, Waiohue, and Waikamoi Streams. Although flow rates less than 64 percent of BFQ_{50} would not result in habitat sufficient for growth, reproduction, and recruitment, *supra*, COL 72, the rationale was that it would provide minimum connectivity for native stream animals to survive in shallow pools without long-term growth or reproduction. (FOF 234.)

82. Three of these streams, with the exception of Waikamoi Stream, were studied, with the following results:

a. There was no evidence that the summertime flows were advantageous to the animals. The concept of varying flow over times is well supported in fisheries, but in this case it was not. For example, if the wintertime flows had been returned during the summer and complete flow restoration had been done in the winter, that would have been a seasonal flow approach, and completely different results might have been seen. (FOF 264.)

b. Overall, the seasonal flow hypothesis (higher winter flows and lower summer flows) was conceptually coherent but not supported by the data. The lack of support for the seasonal flow hypothesis may reflect that the prescribed flow amounts were insufficient (i.e. needed higher flows in summer) or that a year round minimum flow is more appropriate for East Maui streams. (FOF 265.)

83. Finally, of the six streams addressed in the Commission's 2008 order, besides increases in the IIFS for taro and/or domestic uses, improvements in stream habitat was among the objectives, but none of the amended IIFS reached the level of 64 percent of BFQ_{50} (H_{90}). (FOF 258.)

a. Waiakamilo Stream was restored to its non-diverted state, but the focus was on taro and domestic uses, and the IIFS at the lowest reach was left at the status quo, diverted state. (Exh. C-85, p. 44-45.)

3. Protection of Traditional and Customary Hawaiian Rights

84. In the context of amendments to the IIFS for the East Maui streams that are the subject of this contested case, instream exercise of traditional and customary Hawaiian rights are at issue, and not all such rights that may be exercised in the East Maui watersheds and nearshore ocean, *supra*, COL 3, 6.

85. One of the public trust purposes is native Hawaiian and traditional and customary rights, including appurtenant rights, supra, COL 11.

a. Appurtenant rights are property rights to the use of water utilized by parcels of land at the time of their original conversion into fee simple land, when title was confirmed by the Land Commission Award and title conveyed by the issuance of a Royal Patent, *supra*, COL 22.

b. Traditional and customary Hawaiian rights are personal rights "customarily and traditionally exercised for subsistence, cultural and religious purposes and possessed by ahupua`a tenants who are descendants of native Hawaiians who inhabited the Hawaiian Islands prior to 1778, subject to the right of the State to regulate such rights." (Haw. State Constitution, Article XII, § 7.)

86. In order to qualify as traditional and customary Hawaiian rights, gathering of stream animals and the exercise of appurtenant rights must meet the following criteria:

a. it is being exercised by descendants of native Hawaiians who inhabited the Hawaiian Islands prior to 1778 (Haw. State Constitution, Article XII, § 7);

b. there are six elements essential to traditional and customary native Hawaiian practices: 1) the purpose is to fulfill a responsibility related to subsistence, cultural, or religious needs of the practitioner's family; 2) the practitioner learned the practice from an elder; 3) the practitioner is connected to

the location of practice, either through a family tradition or because that was the location of the practitioner's education; 4) the practitioner has taken responsibility for the care of the location; 5) the practice is not for a commercial purpose; and 6) the practice is consistent with custom. (*State v Pratt["Pratt"]*, 127 Haw. 206, at 209; 277 P.3d 300, at 303 [2012].)

c. There is an adequate foundation connecting the claimed right to a firmly rooted traditional or customary native Hawaiian practice traceable to at least November 25, 1892, when the State adopted English common law with exceptions that included "established by Hawaiian usage." (HRS Ch. 1, § 1-1; *State v Zimring [I]*, 52 Haw. 472, at 475; 479 P.2d 202, at 204 [1970]; *Public Access Shoreline Hawaii v Hawaii County Planning Commission ["PASH"]*, 79 Haw. 425, at 447; 903 P.2d 1246, at 1268 [1995]; *cert. denied* 517 U.S. 1163; 116 S.Ct. 1559; 134 L.Ed. 660 [1996].)

1. "(I)t is established that the application of a custom has continued in a particular area (*emphasis added*)." (*PASH*, 79 Haw. 525, at 442; P. 2d 1246, at 1263.)

2. Through expert testimony and kama`āina witness testimony, claimants can personally trace their practices in the subject area to a period prior to November 25, 1892. (*State of Hawaii v Hanapi*, 89 Haw. 177, at186-187 n.12; 970 P.2d 485, at 495 n. 12 [1998].)

87. Therefore, not all appurtenant rightsholders have traditional and customary Hawaiian rights, because appurtenant rights are property rights held by any owner of the appurtenant lands, while traditional and customary Hawaiian rights are personal rights.

88. The record is not clear whether any person holds traditional and customary Hawaiian rights in the East Maui area, whether for gathering rights or for farming in traditional and customary ways. There was testimony that at least some Nā Moku members gathered for subsistence and cultural purposes in the East Maui area, and wetland taro was being grown or attempted to be grown with traditional and customary practices, sometimes by members who have lived in the area for generations. (*See*, Edward Wendt, WDT, ¶ 2; Edward Wendt, Tr., March 9, 2015, p. 8; Terrance Akuna, Tr., March 10, 2015, pp. 17-19; Norman Martin, Tr., March 9, 2015, pp. 113-114; Jerome Kekiwi, Tr., March 9, 2015, p. 202; Joseph Young, Tr., March 9, 2015, pp. 222-223.)

89. For the purposes of this contested case to amend the IIFS, it will be assumed that at least some persons have traditional and customary Hawaiian rights to gather stream animals and farm wetland taro in the East Maui area.

90. Therefore, the Commission must make specific findings and conclusions on:

a. the identity and scope of valued cultural, historical, or natural resources in the area, including the extent to which traditional and customary native Hawaiian rights are exercised in the petition area;

b. the extent to which those resources will be affected or impaired by the proposed action; and

c. the feasible[29] action, if any, to be taken to reasonably protect native Hawaiian rights if they are found to exist. (*Ka Pa`akai O Ka`aina v Land Use Commission,* 94 Haw. 31, at 47; 7 P.3d 1068, at 1084 [2000].)

91. The petition area covers four watersheds of approximately 50,000 acres, of which 33,000 acres are owned by the State, and 17,000 acres are owned by EMI. (FOF 47.) Traditional and customary native Hawaiian rights are exercised in the streams in the form of subsistence gathering of native fish, mollusks, and crustaceans, and stream flows are diverted for the cultivation of wetland taro, other agricultural uses, and domestic uses that can be traced back to the Mahele. (FOF 286.)

92. The proposed actions will not impair these resources but instead they will be improved by increasing stream flows. (*See* the September 25, 2008 Commission Order, FOF 117-232, and the May 25, 2010 Commission Order, FOF 233-268, and the Decision and Order, *infra.*)

93. The feasible actions, or a balancing of benefits and costs, that are being undertaken in this contested case are "to weigh the importance of the present or potential instream values with the importance of the present or potential uses of water for noninstream purposes, including the economic impact of restricting such uses." (HRS § 174C-71[2][D].)

4. Estuaries and Wetlands; Recreational Activities; Waterfalls; Water Quality

94. Navigation and instream hydropower generation are not uses in the East Maui streams. (FOF 278.)

95. Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation:

[29] "Feasible" is defined as a "balancing of benefits and costs," and not whether the action is "capable of achievement." *Waiahole I,* 94 Haw. at 141 n. 39; 9 P.3d 409, at 453 n. 39.

a. East Wailuaiki, West Wailuaiki, and Waiohue streams have estuaries; and

b. from east to west, all of the streams except Waiaaka and Ohia Streams have seasonal, non-tidal palustrine wetlands. (FOF 283.)

96. Outdoor recreational activities:

a. from east to west, Makapipi, Hanawi, Waiohue, East Wailuaiki, West Wailuaiki, Wailuanui, Waiokamilo, Ohia, Honomanu, Waikamoi, Hanehoi, and Honopou streams have outdoor recreational activities, and nearly all include scenic views. (FOF 282.)

97. Aesthetic values such as waterfalls and scenic waterways:

a. Waterfalls, some including plunge pools at their base, and to a lesser extent, springs, constitute the principal aesthetic values in the East Maui streams. From east to west, the streams include Makapipi, Hanawi, Kapaula, Waiaaka, Paakea, Waiohue, Kopiliula, West Wailuaiki, East Wailuaiki, Wailuanui, Waiokamilo, Palauhulu, Piinaau, Honomanu, Punalau, Haipuaena, Puohokamoa, Waikamoi, and Honopou. (FOF 284.)

98. Maintenance of water quality:

a. Streams that appear on the 2006 List of Impaired Waters in Hawaii, Clean Water Act § 303(d), include, from east to west, Hanawi, Puakaa, East Wailuaiki, West Wailuaiki, Ohia, Honomanu, Punalau, Haipuaena, Puohokamoa, and Waikamoi streams. (FOF 285.)

99. Streams that have had their IIFS increased to address wetland taro and domestic uses and/or habitat improvement for native stream animals include (FOF 117-181, 233-249):

a. Honopou: also on the list for palustrine wetlands, aesthetic values and outdoor recreation.

b. Hanehoi/Puolua: also on the list for palustrine wetlands and outdoor recreation.

c. Palauhulu: also on the list for palustrine wetlands and aesthetic values.

d. Waiokamilo: also on the list for palustrine wetlands, outdoor recreation, and aesthetic values.

e. Wailuanui: also on the list for palustrine wetlands, outdoor recreation, and aesthetic values.

f. Waikamoi: also on the list for palustrine wetlands, outdoor recreation, aesthetic values, and impaired water quality.

g. East Wailuaiki: also on the list for estuaries, palustrine wetlands, outdoor recreation, aesthetic values, and impaired water quality.

h. West Wailuaiki: also on the list for estuaries, palustrine wetlands, outdoor recreation, aesthetic values, and impaired water quality.

i. Waiohue: also on the list for estuaries, palustrine wetlands, outdoor recreation, and aesthetic values.

j. Hanawi: also on the list for palustrine wetlands, aesthetic values, and impaired water quality.

k. Makapipi: palustrine wetlands, outdoor recreation, and aesthetic values.

100. Therefore, these other instream uses are substantially represented by the streams that have had their IIFS increased by the two previous Commission decisions in 2008 and 2010.

E. Noninstream Uses

1. HC&S

a. Requirements

101. Reasonable and beneficial irrigation requirements are 4,844 gad for its 28,941 acres in sugarcane cultivation, or 140.19 mgd. (FOF 346.)

b. Losses

102. Reasonable and beneficial system losses are 22.7 percent of total water uses, which consist of HC&S irrigation, deliveries to MDWS, and HC&S industrial and other uses. (FOF 312-315, 399.)

c. Alternative Sources

103. Brackish ground-water usable capacity is 115 mgd to 120 mgd, limited by a likely increase in aquifer salinity levels, especially in the summer months when pumping is highest. (FOF 408-409.)

104. The brackish water wells can be used to irrigate 17,200 acres of the approximately 30,000 acres serviced by waters from the EMI Ditch System (FOF 400), or about 83.32 mgd (4,844 gad x 17,200 acres) of the 115 mgd to 120 mgd usable capacity.

105. From 2008 to 2013, HC&S received 113.71mgd from surface water deliveries and 69.90 mgd in pumped groundwater for a combined total of 183.61 mgd, 62 percent from surface water and 38 percent from groundwater. (FOF 312.) Under those conditions, an additional 13.42 mgd (83.32 - 69.90 mgd) of groundwater would be available as an alternative source. 83.32 mgd of

pumped groundwater would be 69 to 72 percent of usable capacity, *supra*, COL 103, which would likely not increase aquifer salinity levels significantly.

106. Additional reservoirs, recycled wastewater, Maui Land and Pine, and green harvesting are not reasonable alternatives based on analyses of costs, technology, and logistics. (FOF 410-437.)

d. Economic Impact

107. On the impact of terminating HC&S's sugar operations, HC&S provided no information on when and how reduced surface water availability would reach the point that HC&S would cease operations. HC&S only stated in broad terms that it was in the public interest to continue HC&S's operation, because cessation of its sugar operations would affect the County of Maui and the State, MDWS and its customers, renewable energy benefits, and agricultural benefits. (FOF 439.)

108. On the incremental impacts to HC&S of reductions in deliveries from the EMI ditch system, HC&S created a model for assessing the economic impact of reducing the amount of EMI ditch water, separately assessing reductions of deliveries to the two upper ditches (the Wailoa Ditch and the Kauhikoa Ditch) and reduction of deliveries to the two lower ditches (the Lowrie Ditch and the Haiku Ditch). (FOF 440.)

109. Reduced deliveries to the Wailoa Ditch and Kauhikoa Ditch result in reduced water availability to irrigate the 12,800 acres of sugarcane that cannot be irrigated with ground water. The financial impact is therefore calculated in terms of HC&S's anticipated loss in sugar yields due to the average decrease in available water. (FOF 441.)

110. Reduced deliveries to the Lowrie Ditch and Haiku Ditch are assumed to be compensated for by increased pumping of brackish ground water. The financial impact is therefore calculated in terms of the average cost of this pumping. (FOF 442.)

111. Given the large difference between tons of sugar produced by nearly identical amounts of water (a ratio of 1.55 for 2009 versus 2.51 for 2003), a consistent relationship between tons of sugar produced and amount of irrigation water is questionable. (FOF 443-447.)

112. For the increased pumping costs for the Lowrie and Haiku ditches, a direct relationship between pumping costs and increased pumping is logical. (FOF 448.)

a. HC&S estimates a total economic impact of $1,250,775, but this is the sum of costs for each of the four ditches; i.e., $507,858 for both the Wailoa Ditch and Kauhikoa Ditch, $160,250 for the Lowrie Ditch, and $74,825 for the Haiku Ditch. Therefore, the

sum is actually HC&S's estimated costs of reducing EMI ditch system water by 1 mgd at each of the four ditches, or the cost of reducing EMI ditch system water by 4 mgd, spread equally across the four ditches. (FOF 449.)

b. According to HC&S's own model and calculations, the economic impact of a 1 mgd reduction in EMI ditch system water would range from $74,825 at the Haiku Ditch, to $160,250 at the Lowrie Ditch, to $507,858 at either the Wailoa Ditch or Kauhikoa Ditch. (FOF 450.)

c. Given these large differences in impact, if faced with shortages of EMI ditch system water, to minimize costs and to the extent possible, HC&S should serve those fields irrigated from the Wailoa and Kauhikoa ditches first, then the fields irrigated from the Lowrie Ditch, and lastly, the fields irrigated from the Haiku Ditch. (FOF 451.)

d. However, the estimated costs for the Wailoa and Kauhikoa ditches, which are based on tons of sugar per million gallons of water per day, are based on a questionable assumption that there is a consistent relationship between amounts of irrigation water and tons of sugar produced. (FOF 447, 452.).

113. Finally, HC&S's model is based on a reduction of surface water delivered through the EMI ditch system. Such costs have to be predicated on reductions of water that are necessary for irrigation, not on reductions of water that are currently delivered. As previously analyzed, even after the reductions of the Commission's 2008 and 2010 orders, more water than is required was still being delivered. (FOF 375-376, 453.)

2. MDWS

a. Uses

114. MDWS provides two types of surface water to its users: 1) potable water from its Olinda, Piiholo, and Kamole WTPs, with a combined capacity of 13 mgd and an average daily production of 7.7 mgd; and 2) non-potable water from HC&S's Hamakua Ditch at Reservoir 40 for the Kula Agricultural Park, with two reservoirs with a total capacity of 5.4 million gallons and average daily use of 3.5 mgd. (FOF 71, 73-74, 77, 79, 83.)

115. Current unmet demand is approximately 3.75 mgd, and by 2030, there is a predicted additional need for 1.65 mgd. MDWS anticipates it will need to develop between 4.2 mgd and 7.95 mgd to meet demands through 2030. (FOF 471, 473-474.)

116. MDWS is a purveyor of domestic water uses of the general public, particularly drinking. In this capacity, MDWS serves one of the purposes of the public trust, *supra*, COL 11.

117. "Domestic use" as defined in the Code is distinct from "domestic uses of the general public." In the Code, "'(d)omestic use' means any use of water for individual personal needs and for household purposes such as drinking, bathing, heating, cooking, noncommercial gardening, and sanitation (*emphasis added*)." (HRS § 174C-3.) The purpose of this definition in the Code is to exempt individual users from the permit provisions of the Code: "(N)o permit shall be required for domestic consumption of water by individual users..." (HRS § 174C-48(a).) On the other hand, "domestic uses of the general public" acknowledges "the general public's need for water," and "the public trust applies with equal impact upon the control of drinking water reserves (*quotation marks in original deleted*) ." (*Waiāhole I*, 94 Haw. at 136-138; 9 P.3d at 448-450.)

118. MDWS is also a non-riparian diverter of East Maui stream waters, and under the common law, its continuing use of stream waters is permissible if the use is reasonable and beneficial and will not actually harm the established rights of appurtenant and riparian landowners. (COL 67-68.)

119. For MDWS's use of East Maui stream waters, there is a potential conflict between the public trust doctrine and the common law. Under the public trust doctrine, there is a presumptive in favor of trust purposes, and competing water uses must be weighed on a case-by-case basis. Under the common law, MDWS's use must not actually harm the established rights of appurtenant and riparian landowners. While some appurtenant rightsholders are also likely to have traditional and customary Hawaiian rights in their exercise of appurtenant rights, *supra*, COL 89, and also have a presumption in their favor, they do not have priority over MDWS as a purveyor of domestic water uses of the general public, and competing uses must still be weighed on a case-by-case basis according to any appropriate standards provided by law.

120. The Public Trust Doctrine applies in all situations, whether or not in a water management area, and whether or not the common law applies.

121. The appropriate standard is a cost-benefit analysis in weighing appurtenant and riparian uses with MDWS as a purveyor of domestic water uses of the general public.

122. Finally, MDWS is a public entity for actual public use. If MDWS's diversions are ruled improper, appurtenant and riparian rightsholders cannot obtain injunctive relief (but may seek damages) against MDWS because of the public use doctrine, *supra*, COL 31.

b. Losses

123. The 1.1-mile Upper Waikamoi Flume, which serves the Olinda WTP, was estimated to lose as much as 40 percent of total flow through cracks and holes along its whole length. Actual losses could not be measured, because MDWS had no mechanism for quantifying water levels at either the intake or discharge sites of the flume. If reliable capacity of the Olinda WTP is the reported 1.6 mgd, then the flume could have lost as much as 0.64mgd (1.6 mgd x 0.40) at that level of operation. (FOF 475-478.)

124. MDWS has just completed replacing the entire flume, as well a completely relining the two 15 million-gallon Waikamoi reservoirs and the 2 million-gallon on-site basin a the Olinda WTP. (FOF 479, 482.)

125. With the new flume, MDWS will be able to calculate how much water is coming from the flume on days when the main intake from the dam is dry, which is most of the days. (FOF480.)

c. Alternative Sources

126. New reservoirs, which would be fed by streams in times of water surplus for use during times of low flows, are not alternatives to using stream waters but a means of mitigating the impacts of reduced availability of stream waters. Reservoirs mitigate fluctuations in both stream flow and consumer demand, and mitigations in fluctuations in stream flow allow more of it to be used at the proper time. (FOF 484, 486.)

127. New production wells are not an alternative to serve the Upcountry areas in the immediate and intermediate future. Water is heavy, so moving it to higher elevations such as where much of the Upcountry System is located, at 1000 to 4000 feet, from basal aquifers at sea level is projected to cost $1.64 per thousand gallons for distribution from the Kamole-Weir WTP, $4.07 per thousand gallons at the Piiholo WTP, and $593 per thousand gallons at the Olinda WTP. MDWS's current charges for water only average about $4 per thousand gallons, so just the electrical costs to pump the water is more than what MDWS charges overall for its entire operation. On top of pumping costs, there would be substantial initial capital expenditures and on-going maintenance. (FOF 483.)

128. MDWS has also entered into a Consent Decree, which requires that MDWS conduct vigorous cost/benefit analyses of other water source options before developing ground water in

the East Maui region, and has tried unsuccessfully on several occasions to work within the framework of the consent decree to develop new ground water sources. (FOF 483.)

d. Economic Impact

129. Under the MOU between EMI and MDWS, MDWS can receive 12 mgd with an option for an additional 4 mgd. During low-flow periods when ditch flows are greater than 16.4 mgd, both will receive a minimum allotment of 8.2 mgd. If these minimum amounts cannot be delivered, both will receive prorated shares of the water that is available. In recent periods of low Wailoa Ditch flow, EMI has not restricted the allotment of water to MDWS according to the terms of the agreement, and MDWS withdrawals have been limited only by the amounts of water available in the ditch and the physical limitations of the existing Kamole-Weir WTP intake structures. During drought conditions, MDWS may withdraw 6 mgd, and what remains is used by HC&S for irrigation. (FOF 492.)

130. There would be little or no impact if Wailoa Ditch flows were reduced 15 mgd. MDWS would not have full access to the 6 mgd capacity of the Kamole-Weir WTP for 5 days, the same as for the period 2001 to 2011, and less than the maximum of 16 days for the period 1922 to 1987. (FOF 497.)

131. With a 20 mgd reduction in Wailoa Ditch flow and assuming a daily drought period withdrawal of 5.0 mgd, there would not be sufficient water to provide reliable drought period capacity without some mitigating actions. For a 23,680 day period, *supra*, FOF 495, 5.0 mgd would not be able to be withdrawn for 822 days or 3.47 percent, with 54 consecutive days of deficiency. (FOF 498.)

132. The deficiency only means that 5 mgd could not be withdrawn. Lesser amounts could still be withdrawn from the Wailoa Ditch. Furthermore, while the study defined drought period deficiency as being less than 4.6 mgd of a total capacity of 6 mgd, actual use from the Kamole-Weir WTP has been 3.6 mgd out of the total capacity of 6 mgd. (FOF 499.)

133. With the addition of a 100-million gallon reservoir at the Kamole-Weir WTP, the drought period reliable yield with the 20 mgd reduction in Wailoa Ditch flow would be 4.6 mgd, approximately equal to the existing WTP reliable yield without reductions in ditch flows. (FOF 500.)

134. With a 200-million gallon reservoir, the drought period reliable yield with the 20 mgd reduction in Wailoa Ditch flow increases to 7.1 mgd, an increase of 2.4 mgd compared to a 100-

million gallon reservoir and greater than the total capacity of 6 mgd of the Kamole-Weir WTP. (FOF 501.)

135. Estimated costs of a 100- to 200-million reservoir at the Kamole-Weir WTP are $25.25 million, and life-cycle costs over 25 years are estimated at $33 per thousand gallons or $250 million. (FOF 502.)

F. Streams That Have Been Amended

136. Stream restoration for appurtenant rights was the focus of the September 25, 2008 Commission Order and done on a stream-by-stream basis for water rights associated with specific streams. (FOF 2, 3, 8-9.)

137. A geographic approach to stream restoration was taken in the Commission's 2010 order, meaning that flows were restored in selected streams both east and west of Keanae Valley. Benefits of this approach included biological diversity in the East Maui area, and regional diversity in traditional gathering opportunities, *supra*, COL 73.

138. The East Maui streams diverted by EMI's Ditch System are in a hydrologically controllable area, and consolidated amendments to their IIFS are not precluded, *supra*, COL 38-39.

139. A geographic approach to stream restoration is in compliance with the Code, *supra*, COL 74.

140. A geographic approach is the most feasible method of restoring streams that are collectively diverted by EMI's Ditch System, *supra*, COL 75; and streams were selected which would result in the most biological return from additional flow. (FOF 240b.)

1. Stream-by-Stream Amendments

141. The streams in the September 25, 2008 Commission Order addressed the taro and domestic water needs of Nā Moku members, and were done on a stream-by-stream basis. There were eight streams addressed: Honopou, Hanehoi and its tributary Puolua (Huelo), Piinau, Palauhulu, Waiokamilo, Kualani, and Wailuanui Streams, *supra*, FOF 3.

142. Six of the eight streams had some diverted water restored, for a net restoration of 4.65 mgd (7.19 cfs), *supra*, FOF 182-183. Because estimates of flows under diverted conditions were available for some streams, after adding the restored amounts to existing flows, available stream

water was 11.71 mgd (18.12 cfs). Water would be available for the following streams, along with estimated requirements, *supra*, COL 58, 61:

	Available water	Requirements
Palauhulu:	3.56 mgd	1.75-2.02 mgd for taro
Waiokamilo & Wailuanui:	3.17 mgd 1.97 mgd	3.92-4.52 mgd for taro
Honopou:	1.29 mgd (0.82 mgd for taro and domestic; 0.47 mgd for habitat)	0.80-0.93 mgd for taro
Hanehoi/Puoloa:	1.72 mgd: (0.98 mgd for taro; 0.74 mgd for Huelo community)	0.30-0.35 mgd for taro

143. For Palauhulu and Hanehoi/Puoloa Streams, taro water requirements are greatly exceeded. Moreover, the taro lo`i water requirements are for flow-through amounts, most of which will exit the lo`i complex and then may either flow into another lo`i complex or back into the stream. Thus, much of the 130,000 to 150,000 taro lo`i water requirements will be available for use by others such as for downstream lo`i complexes and other agricultural uses, or for increased stream flow for improved stream animal habitat, *supra*, COL 60.

a. There are 15,000 to 40,000 gad of net loss between lo`i inflow and outflow from evaporation, transpiration, and percolation through the bottoms and leakage through the banks, with most of the loss through percolation and leakage. (FOF 192.) Of the 130,000 to 150,000 gad of in-flow water, a minimum of 90,000 to 110,000 gad to a maximum of 115,000 to 135,000 gad will out-flow, with much if not most available to downstream lo`i or returned to the stream.

144. However, it is unclear whether or not these amended IIFS were achieved. Commission staff concentrated on making sure that a specific amount of water was always present in the stream, and that the complaints of taro farmers that they were not getting enough water was not material to whether or not staff would have changed their decision to recommend higher releases into the stream. Therefore, most of the amended IIFS were based on low-flow values, *supra*, FOF 182. However, even at the flow values used by Commission staff, the comparision with water requirements has found that such quantities would have been sufficient and even excessive

for Palauhulu and Hanehoi/Puolua Streams, *supra*, COL 142. Therefore, it is most likely that the amended IIFS were never fully implemented: either through Commission staff striving to achieve constant IIFS and therefore setting them lower than intended, or to insufficient water in the ditches to restore the streams to the levels intended.

145. Of the two remaining streams, Kualani Stream was first thought to be the easternmost tributary of Waiokamilo Stream and had its IIFS kept at the status quo, but it was subsequently determined to be a separate stream that is below the EMI Ditch System and has never been diverted. (FOF 58, 165.)

146. Piinaau Stream was kept at its status quo IIFS at its lower reach at 40 feet elevation, upstream from its confluence with Palauhulu Stream. Piinaau Stream is dry immediately downstream of the Koolau Ditch, possibly from infiltration losses and diversions at the Ditch. Actual flow measurements are not available because of geographic inaccessibility and a major landslide in 2001. A flow value could not be determined due to the large uncertainty in the hydrological data. Moreover, even with the current flow, the stream exhibited a rich native species diversity, offered a variety of recreational and aesthetic opportunities, and the two registered diversions had not indicated a lack of water availability. (FOF 152-153.)

2. Amendments through the Geographic Approach

147. Five streams were partially restored to increase habitat availability, and a short-term release of water into Makapipi Stream was conducted to see if a continuous flow from the headwaters to the stream mouth could be achieved. (FOF 240.)

a. The short-term release into Makapipi Stream was unsuccessful in achieving continuous flow. (FOF 268.)

b. For Hanawi Stream, it had adequate flow to sustain native animal populations, but there was a dry reach immediately below the Ko`olau Ditch, so 0.06 mgd (0.1 cfs) was released to create a wetted pathway from the Ditch to the ocean. (FOF 240.)

c. For Waikamoi, East Wailuaiki, West Wailuaiki, and Waiohue Streams, seasonal restorations were implemented, with wet season (winter) flows set at 64 percent of BFQ_{50} to achieve H_{90} and dry season (summer) flows reduced 20 percent of BFQ_{50} to maintain minimum connectivity for native stream animals to survive in shallow pools without suitable long-term growth or reproduction. (FOF 234.)

148. The results of the evaluation of the seasonal approach were as follows:

a. There was no evidence that the summertime flows were advantageous to the animals. The concept of varying flow over times is well supported in fisheries, but in this case it was not. For example, if the wintertime flows had been returned during the summer and complete flow restoration had been done in the winter, that would have been a seasonal flow approach, and the results might have been completely different. (FOF 264.)

b. Overall, the seasonal flow hypothesis (higher winter flows and lower summer flows) was conceptually coherent, yet not supported by the data. The lack of support for the seasonal flow hypothesis may reflect that the prescribed flow amounts were insufficient (i.e. needed higher flows in summer) or that a year round minimum flow is more appropriate for East Maui streams. (FOF 265.)

3. Reliability of the Estimated Stream Flows

149. Prior to the partial restorations of twelve streams in 2008 and 2010 and subsequent installation of gages in these streams, there were only four active gages, one each in Hanawi Stream, West Wailuaiki Stream, Waiokamilo Stream, and Honopou Stream (which is outside the study area to be described, *infra*). (FOF 84.) Gages had been previously installed on a number of streams for various periods of time and for various years. For example, Makapipi Stream had a gage at 920 feet elevation between 1932-1945; Hanawi Stream had gages at 500 feet elevation between 1932-1947 and again between 1992-1995, and at 1,318 feet elevation between 1914-1915 and again between 1921-Present; and West Wailuaiki Stream had a gage at 1343 feet elevation between 1914-1917 and again between 1921-Present. (FOF 85.)

150. USGS's 2005 Stream Flow Study estimated stream flows under natural (undiverted) and diverted conditions for 21 streams, using a combination of continuous-record gaging-station data, low-flow measurements, and values determined from regression equations developed for the study. For the drainage basin for each continuous-record gaged site and selected ungaged sites, morphometric, geologic, soil, and rainfall characteristics were quantified. Regression equations relating the non-diverted streamflow statistics to basin characteristics of the gaged basins were developed. Regression equations were also used to estimate stream flow at selected ungaged diverted and undiverted sites. (FOF 86-87.)

151. Estimates were made for 50 percent and 95 percent duration total flow (TFQ) and base flow (BFQ). Base flow is the groundwater contribution to flow. Total flow includes all sources;

i.e., ground, freshet ("normal" rainfall) and storm waters. A 50 percent duration flow (median streamflow; Q_{50}) means that, for a specific period of time, half of the measured stream flow was greater than the Q_{50} value, and half was less. For example, for measurements of total flows in a particular stream for the specified period of time: 1) if TFQ_{50} = 25 mgd, then total stream flow was above 25 mgd half of the time and below 25 mgd half of the time,; and 2) if TFQ_{95} = 2 mgd, total stream flow was above 2 mgd 95 percent of the time and below 2 mgd 5 percent of the time. (FOF 88-89.)

152. Relative errors between observed and estimated flows ranged from 10 to 20 percent for the 50-percent duration total flow and base flow, and from 29 to 56 percent for the 95-percent duration total flow and base flow. Errors are higher for lower flows because, for the same absolute error in flow, the relative error in percent increases as the actual flow decreases. (FOF 90.)

153. East of Keanae Valley, the 95-percent duration discharge equation generally underestimated total flow (TFQ_{95}), due to gains in flow from groundwater discharge, and within and west of Keanae Valley, the equation generally overestimated total flow, due to loss of water at lower elevations. (FOF 91.)

154. Therefore, when the amended IIFS for both the 2008 and 2010 Commission Orders were approved, it was intended that streamflows be monitored at the proposed IIFS locations, and the IIFS be revised if necessary. (Exh. C-85, p. 63; Exh. C-103, p. 26.)

155. Commission staff has since learned that: 1) the regression estimates used for flows had, in many cases, overstated what those flows would be, so if the sluice gates on the ditches are opened, there still may not be enough flow to meet the amended IIFS; 2) there is a natural variability in stream flow which may dip below the IIFS, generally due to periods of low rainfall, so guaranteeing that a specific flow is always in the stream and still meet the objective of the IIFS is not possible; and 3) in Wailuanui and Keanae, the Ko`olau Ditch has only been taking, for the most part, water generated by rainfall, and spring water below the Ditch is what the taro farmers have access to, *supra*, COL 63.

4. Implementation of the Amended IIFS

In addition to whether or not the amended IIFS were achieved, *supra*, COL 155, there are implementation issues that have to be clarified and resolved:

156. Meeting the amended IIFS:

a. "'Instream flow standard' means a quantity or flow of water or depth of water which is required to be present at a specific location in a stream system at certain specified times of the year to protect fishery, wildlife, recreational, aesthetic, scenic, and other beneficial instream uses," *supra*, COL 1.

b. This definition does not limit "a quantity or flow of water or depth of water" to a specific quantity that must be present at the specific location at all times. In fact, the very definitions of "base flow (BFQ)" and "total flow (TFQ or Q)" recognize that stream flows vary, even base flows. BFQ and TFQ are expressed in terms of the percent of time the referenced quantity was present in the stream, *see* COL 152, *supra*. Thus, when all diversions onWaiokamilo Stream were closed, total undiverted flow was expressed as TFQ_{50} or Q_{50}, meaning that the median flow, or the Q_{50}, was 3.17 mgd. (FOF 162.) It does not mean that 3.17 mgd was present at the IIFS location at all times. It means that half the time, the amount was greater than 3.17 mgd, and the other half of the time, less than 3.17 mgd. As a further example of variations in stream flow, for the Wailoa Ditch, which diverts multiple streams, daily flows between 1922 to 1987 ranged from only 1.16 mgd to as much as 212 mgd. (FOF 61, 70.)

c. Thus, to have a specific quantity in a specific location in a stream cannot be achieved, and an IIFS must be achieved by an average of multiple measurements at the specified location. Furthermore, it would be technically difficult to adjust releases so that the median (half of measurements greater, and half, less)is achieved. Instead, it would probably be easier that the amended IIFS equal the mean or average of all readings. This would be similar to the quantities under water-use permits, in which 12-month moving averages are used to monitor water use, instead of the permitted amount being the maximum amount that could be used under the permit. In the latter instance, over a defined period of time, permit holders would always be limited to using less than what was allowed under their permits.

157. Release of water to meet the amended IIFS.

a. A similar situation would exist to that which was just immediately discussed, *supra*, if the release of water was capped at the quantity needed to meet the IIFS. For example, suppose an IIFS is established at 2.0 mgd immediately

downstream of a diversion, and the stream is dry at that point. If the diversion from the stream into a ditch were modified to allow the first 2.0 mgd to continue downstream, stream flows 2.0 mgd or less would remain in the stream. However, when the stream flow is greater than 2.0 mgd, flows over 2.0 mgd would be diverted into the ditch. Thus, the stream flow at the IIFS location would always be 2.0 mgd or less, and the mean and median would always be less than 2.0 mgd, because there would be no flows higher than 2.0 mgd to balance against the flows less than 2.0 mgd.

b. Thus, amended IIFS cannot be met unless there are continual adjustments to the ditch modifications, or if the amount allowed to continue downstream is higher than the target IIFS. Either approach presents operational difficulties.

158. Almost all of the stream flows on which the amended IIFS are based are estimates and not observed measurements. (FOF 84-93.) Therefore:

a. In some cases, actual flows may be insufficient to meet the amended IIFS.

b. Values assigned to TFQ and BFQ flows have relative errors ranging from 10 to 20 percent for TFQ_{50} and BFQ_{50} and from 29 to 56 percent for TFQ_{95} and BFQ_{95}. (FOF 90.) The use of BFQ_{50} in determining viable stream habitat (64 percent of $BFQ_{50} = H_{90}$) may result in inaccurate habitat values, and in the evaluation of the effect of increased stream flows from the 2010 Commission Order, the monitoring effort did not include an assessment of whether or not the winter flows, based on 64 percent of BFQ_{50}, had in fact achieved the minimum habitat of H_{90} necessary for growth, reproduction, and recruitment of native stream animals. (FOF 260.)

G. Amended IIFS

159. The Commission affirms its choice of the streams which had their IIFS amended in either the 2008 or 2010 Commission order, subject to modifications of the IIFS as described, *infra*. The Commission also modifies its prior decisions for Kopiliula Stream and its tributary, Puakaa Stream, also described, *infra*.

160. Stream-flow restorations for taro lo`i complexes are based on flow-through requirements, which in turn are allocated the full amount of 130,000 to 150,000 gad for each acre, *supra*, COL 58. However, each acre of taro lo`i complexes consumes only 15,000 to 40,000 gad, *supra*, COL 143, leaving a minimum of 90,000 to 110,000 gad and a maximum of 115,000 to 135,000 gad

that exits the lo`i complex and potentially available to downstream lo`i or to be returned to the stream.

161. Neither stream restorations nor the exercise of appurtenant and riparian rights can depend on the unpredictability of storm and freshet ("normal" rainfall) waters. Both are based on base flows, or the ground-water contribution to stream flow. (FOF 98, 105; COL 22, 25-26.) In Wailuanui and Keanae, the Ko`olau Ditch has only been taking, for the most part, water generated by rainfall, *supra*, COL 63, 155.

162. The exercise of appurtenant and riparian rights require diversions of water from the stream and therefore will compete with stream restoration if the sum of their requirements exceeds the amount of available base flow.

163. Hawaii`s stream flows are highly variable in nature, and flows are expressed in the percent of the time that a certain amount of water is flowing in the stream in a given time period. For example, a stream's total flow ("Q" or "TFQ") and base flow ("BFQ") in a given time period are expressed as the median flow (TFQ_{50} and BFQ_{50}), where half of the measured flows was greater and half was less. (FOF 89.)

164. The expectation that an IIFS requires that a specific amount of water must be present in the stream at all times will be at odds with the objective of the amended IIFS. For example, if an IIFS is amended to provide the flow (64 percent of BFQ_{50}) equivalent to H_{90} and that flow were 10 cfs, there will be times when the entire flow in the stream will be less than 10 cfs. If the flow that would be in the stream 100 percent of the time (BFQ_{100}) were less than 10 cfs or even zero, establishing the amended IIFS at BFQ_{100} would obviously not meet the H_{90} objective.

165. On the other hand, monitoring amended IIFS through median flows would require adjusting flows so that the IIFS would be at the median, a monitoring approach that is unlikely to be achieved on an ongoing basis. Monitoring the IIFS through mean (average) flows is likely the most achievable approach and has its counterpart in monitoring water-use permits, where 12-month moving averages are used.

166. When the IIFS were amended to provide water to taro farmers in the 2008 Commission order, the 2009 Habitat Availability Study, with its conclusions that there was a threshold for viable habitat and that H_{90} was equal to a flow of 64 percent of BFQ_{50}, was not yet available. Thus, the 2005 Habitat Study was used when addressing habitat availability for Palauhulu, Wailuanui, Honopou, and Hanehoi/Puolua Streams.

167. Despite the use of low reference flows in order to assure that the IIFS would always be meet, the comparision with water requirements has found that such quantities would have been sufficient and even excessive for Palauhulu and Hanehoi/Puolua Streams, *supra*, COL 142, 144, but Commission staff has since learned that the regression estimates used for flows had, in many cases, overstated what those flows would be, so if the sluice gates on the ditches are opened, there still may not be enough flow to meet the amended IIFS, *supra*, COL 155.

1. Palauhulu and Piinaau Streams

168. The major diversion on Palauhulu and Piinaau Streams is the Ko`olau Ditch (east of and flowing into the Wailoa Ditch). (FOF 152.) In Wailuanui and Keanae, the Ko`olau Ditch has only been taking, for the most part, water generated by rainfall, and spring water below the Ditch is what the taro farmers have access to, *supra*, COL 63, 155.

169. For Piinaau Stream, the Commission kept the status quo IIFS at its lower reach at 40 feet elevation, upstream from its confluence with Palauhulu Stream. A flow value could not be determined due to the large uncertainty in the hydrological data. Moreover, with the current flow, the stream exhibited a rich native species diversity, offered a variety of recreational and aesthetic opportunities, and the two registered diversions had not indicated a lack of water availability. (FOF 153.)

170. The IIFS for Palauhulu Stream was based on BFQ_{50} and established at 3.56 mgd (5.50 cfs) near 80 feet elevation, upstream with its confluence with Piinaau Stream, to ensure that the proposed flow reaches downstream users in Keanae peninsula. Estimated diverted flow at that point was BFQ_{50} = 3.10 mgd (4.80 cfs), so the net addition was estimated at 0.46 mgd (0.71 cfs). (FOF 182.)

171. 3.56 mgd (5.50 cfs) was half of the estimated undiverted base flow at the site, and part of the rationale was that if flow were restored to 50 percent of natural base flow, potentially 80 to 90 percent of native habitat would be available in Palauhulu Stream upstream of its confluence with Piinaau Stream. (FOF 155.)

172. Above the confluence with Piinaau Stream and Store Spring, Palauhulu Stream is dry from infiltration losses, losing the estimated flow of 2.7 mgd from Plunkett Spring below the Ko`olau Ditch. (FOF 152.) So it is questionable whether or not releases from the Ko`olau Ditch would reach the IIFS site.

173. No IIFS was proposed for the stream mouth because the amount of water flowing from both streams into the estuary, Waiahole Pond, was deemed adequate. (FOF 154.)

174. Irrigation requirements from Palauhulu Stream was estimated at 1.75 mgd to 2.02 mgd, *supra*, COL 58. Thus, even without the addition of 0.46 mgd, the 3.10 mgd of diverted flow estimated to already be present in the stream was more than sufficient to meet irrigation requirements.

175. If increasing flow to meet both irrigation and H_{90} requirements were the objectives, then the IIFS should be an estimated 6.30 mgd to 6.57 mgd (9.75 cfs to 10.17 cfs), rather than 3.56 mgd (5.50 cfs). The estimated flow with diversions at the Ko`olau Ditch is BFQ_{50} = 7.11 mgd (11 cfs). 64% of 7.11 mgd (11 cfs) = 4.55 mgd (7.04 cfs). Irrigation requirements are 1.75 mgd to 2.02 mgd, so total requirements would be 4.55 mgd + 1.75 mgd to 2.02 mgd, or 6.30 mgd to 6.57 mgd (9.75 cfs to 10.17 cfs).

176. The estimated flow already present under diverted conditions is 3.10 mgd (4.80 cfs), so 3.20 mgd to 3.47 mgd would have to be added from the Ko`olau Ditch diversion instead of the current 0.46 mgd (0.71 cfs). However, as noted earlier, in Wailuanui and Keanae, the Ko`olau Ditch has only been taking, for the most part, water generated by rainfall, and spring water below the Ditch is what the taro farmers have access to, *supra*, COL 63, 155.

177. It is also questionable whether or not releases from the Ko`olau Ditch would reach the IIFS site because of the dry reach in-between from infiltration losses. Moreover, the gain in habitat would be small, extending only from the IIFS site to the dry reach.

178. The estimated flow under diverted conditions of 3.10 mgd (4.80 cfs) should be more than sufficient to meet estimated irrigation requirements of 1.75 mgd to 2.02 mgd without the additional 0.46 mgd (0.71 cf).

179. Therefore, the current amended IIFS for Palauhulu Stream established at 3.56 mgd (5.50 cfs) near 80 feet elevation, upstream with its confluence with Piinaau Stream, should be amended back to its former diverted flow, estimated at 3.10 mgd (4.80 cfs).

2. Waiokamilo Stream

180. The major diversion on Waiokamilo Stream is the Ko`olau Ditch. (FOF 159.) In Wailuanui and Keanae, the Ko`olau Ditch has only been taking, for the most part, water generated by rainfall, and spring water below the Ditch is what the taro farmers have access to, *supra*, COL 63, 155.

181. With no diversions, the measured IIFS near Dam 3 is TFQ_{50} = 3.17 mgd (4.9 cfs), just above the diversion to the Lakini taro patches. (FOF 162.) Together with Wailuanui Stream, *infra*, irrigation requirements are 3.92 mgd to 4.52 mgd, with amendments to Wailuanui Stream's IIFS contributing 1.26 mgd (FOF 177), *supra*, COL 61.Thus, the amended IIFS of both streams total 4.43 mgd, approximately equal to irrigation requirements. However, the division of irrigation requirements between Waiokamilo and Wailuanui Streams is not clear. (FOF 294-295.)

182. With existing flows needed to meet irrigation requirements, there would not be additional flows that could be applied to meet H_{90} for habitat improvements. Furthermore, there is no data on which to calculate flows needed to meet H_{90}.

3. Wailuanui Stream

183. The major diversion on Wailuanui Stream is the Ko`olau Ditch. (FOF 174.) In Wailuanui and Keanae, the Ko`olau Ditch has only been taking, for the most part, water generated by rainfall, and spring water below the Ditch is what the taro farmers have access to, *supra*, COL 63, 155.

184. The IIFS for Wailuanui Stream was established at 1.97 mgd (3.05 cfs) at 620 feet elevation, downstream of the Ko`olau Ditch and below the confluence of East and West Wailuanui Streams. Estimated diverted flow at this site was 0.65 mgd (1.0 cfs), so there would be a net addition of 1.32 mgd (2.05 cfs). (FOF 175.)

185. The IIFS is half of the BFQ_{50} of 3.94 mgd (6.1 cfs) and was established on the rationale that with half of median base flow, potentially 80 to 90 percent of natural habitat will be available, as well as providing more surface water to the downstream users, the majority of whom are downstream of the IIFS location. (FOF 176.)

186. The IIFS of 0.71 mgd (1.1 cfs), BFQ_{50} of diverted flow, was kept at the status quo further downstream below Waikani Falls. Therefore, 1.26 mgd (1.95 cfs) of the 1.97 mgd up above at 620 feet elevation would be available for irrigation, *supra*, COL 61.

187. At the location below Waikani Falls, BFQ_{50} of undiverted flow is 4.33 mgd (6.7 cfs), and 64 percent of BFQ_{50}, or H_{90}, would be 2.77 mgd (4.29 cfs). Therefore, the status quo IIFS of 0.71 mgd (1.1 cfs) would be less than that needed for growth, reproduction, and recruitment of native stream animals, and an additional 2.06 mgd (3.19 cfs) would be needed to meet both irrigation and habitat requirements. (FOF 177.)

188. Therefore, to meet both irrigation and habitat requirements, the IIFS at 620 feet elevation, downstream of the Ko`olau Ditch, would have to be increased by 3.38 mgd (5.23 cfs) instead of by 1.32 mgd (2.05 cfs), bringing the IIFS from 1.97 mgd (3.05 cfs) to 4.03 mgd (6.23 cfs) when added to the 0.65 mgd (1.0 cfs) of flow already estimated to be present.

189. The estimated undiverted flow at 620 feet elevation is BFQ_{50} = 3.94 mgd (6.1 cfs). If this estimate is accurate, the 3.38 mgd (5.23 cfs) required to be left in Wailuanui Stream should be available from the Ko`olau Ditch. However, as noted earlier, in Wailuanui and Keanae, the Ko`olau Ditch has only been taking, for the most part, water generated by rainfall, and spring water below the Ditch is what the taro farmers have access to, *supra*, COL 63, 155.

4. Honopou Stream

190. The major diversions on Honopou Stream are the Wailoa, New Hamakua, Lowrie, and Haiku Ditches. (FOF 118.)

191. The 2008 Commission decision established the amended IIFS just below the Haiku ditch at 1.29 mgd (2.00 cfs). (FOF 121.)

192. A second IIFS of 0.47 mgd (0.72 cfs) was established downstream of taro and domestic diversions below the Haiku ditch, to prevent drying of the stream and increase the continuity of flow to enhance biological integrity in the stream. This resulted in 0.82 mgd (1.29 - 0.47 mgd) available to the taro and domestic diversions, and 0.47 mgd to increase continuity of flow to the ocean. (FOF 122.)

193. Taro water requirements were estimated at 0.80-0.93 mgd, essentially matching the available water of 0.82 mgd for taro, *supra*, COL 142.

194. Available water for habitat restoration was 0.47 mgd, *supra*, COL 142, but flows for habitat restoration (H_{90}) are not known, because Honopou Stream was not included in the 2009 Habitat Availability Study. (FOF 103.)

195. However, total ground water gain to a point just below the Haiku Ditch is estimated at 2.3 mgd (3.6 cfs). (Exh. C-85, p. 16.) If it is assumed that this is BFQ_{50}, then H_{90} or 64 percent of BFQ_{50} would be 1.49 mgd (2.3 cfs). With the amended IIFS at the lower IIFS location at 0.47 mgd (0.72 cfs), an additional 1.02 mgd (1.58 cfs) would be needed to reach flows equivalent to H_{90}. Thus the lower IIFS would be amended to 1.49 mgd (2.3 cfs), and the upper IIFS would be amended to 2.31 mgd (3.58 cfs) to keep 0.82 mgd available for taro.

5. Hanehoi/Puolua (Huelo) Streams

196. Major diversions on Hanehoi Stream are the Wailoa, New Hamakua, Lowrie, and Haiku Ditches. Its tributary, Puolua Stream, is diverted by the Lowrie and Haiku Ditches. (FOF 137.)

197. One amended IIFS of 0.74 mgd (1.15 cfs) was established on Hanehoi Stream above the Lowrie Ditch to provide water for domestic use in the Huelo community. (FOF 144, 147.)

198. Two other amended IIFS were established on Hanehoi Stream and Puolua Stream below the Haiku Ditch and above the confluence of the two streams to serve users downstream of the Haiku Ditch: 0.57 mgd (0.89 cfs) for Puolua Stream and 0.41 mgd (0.63 cfs) for Hanehoi Stream. (FOF 143, 146.)

199. Part of the purpose of the two amended IIFS below the Haiku Ditch was to improve stream habitat. (FOF 142.) But the IIFS at the stream mouth was not amended because of the small number of registered users below the confluence of the two streams, and because of a terminal waterfall. (FOF 145.)

200. As with Honopou Stream, Hanehoi/Puolua Streams were not included in the 2009 Habitat Availability Study (FOF 103), so flows for habitat restoration (H_{90}) are not known.

201. However, estimates of undiverted flow at the stream mouth are available, with BFQ_{50} estimated at 3.46 mgd (5.35 cfs). (Exh. C-85, p. 26.) Estimated H_{90} flows would therefore be 64 percent of BFQ_{50}, or 2.21 mgd (3.42 cfs).

202. Requirements for taro are estimated at 0.30-0.35 mgd, *supra*, COL 142, while a total of 0.98 mgd have been made available, 0.57 mgd from Puolua Stream and 0.41 mgd from Hanehoi Stream. Therefore, about 0.63 mgd (0.97 cfs) would remain below the confluence of the two streams at the stream mouth.

203. To increase flow at the stream mouth to H_{90} or 2.21 mgd (3.42 cfs), an additional 1.58 mgd (2.45 cfs) would need to reach the mouth from the amended IIFS locations on Puolua and Hanehoi Streams.

204. The current amended IIFS for Puolua Stream of 0.57 mgd (0.89 cfs) is the estimated natural, undiverted BFQ_{95} flow. The BFQ_{50} at that location below the Haiku Ditch is estimated at 0.95 mgd (1.47 cfs), but BFQ_{50} above the Haiku Ditch is estimated at a lower 0.69 mgd (1.07 cfs).

205. Using the BFQ_{50} above the Haiku Ditch for Puolua Stream, the amended IIFS below the Haiku Ditch would be increased by 0.12 mgd (0.18 cfs), from 0.57 mgd (0.89 cfs) to 0.69 mgd

(1.07 cfs), and the remainder of the increase, 1.46 mgd (2.27 cfs), would be added to the amended IIFS on Hanehoi Stream, increasing it from 0.41 mgd (0.63 cfs) to 1.87 mgd (2.90 cfs).

206. The revised IIFS would be as follows:

a. The amended IIFS of 0.74 mgd (1.15 cfs) on Hanehoi Stream above the Lowrie Ditch to provide water for domestic use in the Huelo community would remain unchanged.

b. The IIFS on Puolua Stream below the Haiku Ditch would be amended from 0.57 mgd (0.89 cfs) to 0.69 mgd (1.07 cfs).

c. The IIFS on Hanehoi Stream below the Haiku Ditch would be amended from 0.41 mgd (0.63 cfs) to 1.87 mgd (2.90 cfs).

d. A new IIFS of 2.21 mgd (3.42 cfs) would be established just above the terminal waterfall at the mouth of Hanehoi Stream.

0.74 mgd (1.15 cfs) would continue to be available to the Huelo community, 0.35 mgd would meet the taro requirements of 0.30-0.35 mgd, and the flow at the mouth of Hanehoi Stream of 2.21 mgd (3.42 cfs) would be the H_{90} flow for native stream animals.

207. Assuming no flows at the amended IIFS sites before the 2008 Commission Order, that order restored a total of 1.72 mgd (2.67 cfs) at three sites. The proposed amended IIFS and additional IIFS restores an additional 1.58 mgd (2.45 cfs), for a total restoration of 3.3 mgd (5.12 cfs) to meet domestic uses for the Huelo community, water requirements for taro, and habitat requirements for native stream animals.

6. East Wailuaiki,West Wailuaiki,Waikamoi, and Waiohue Streams

208. The IIFS of these four streams should be amended to annual, year-round flows in the amounts they were previously amended only for wet season (winter) flows. (FOF 245.)

209. East Wailuaiki Stream: The interim IIFS below all EMI diversions and just above Hana Highway, near an altitude of 1,235 feet, shall be an estimated flow of 2.39 mgd (3.70 cfs). (Exh. HO-1; Exh. C-103, p. 22.)

210. West Wailuaiki Stream: The interim IIFS below all EMI diversions and just above Hana Highway, near an altitude of 1,235 feet, shall be an estimated flow of 2.46 mgd (3.80 cfs). (Exh. HO-1; Exh. C-103, p. 22.)

211. Waikamoi Stream: The interim IIFS below the confluence with its tributary, Alo Stream, below all EMI diversions and just above Hana Highway, near an altitude of 550 feet, shall be an estimated flow of 1.81 mgd (2.80 cfs). (Exh. HO-1; Exh. C-103, p. 21.)

212. Waiohue Stream: The interim IIFS below all EMI diversions and just above Hana Highway, near an altitude of 1,195 feet, shall be an estimated flow of 2.07 mgd (3.20 cfs). (Exh. HO-1; Exh. C-103, p. 23.)

7. Hanawi Stream

213. The purpose of the amended IIFS in the 2010 Commission Order was to create a wetted pathway to provide connectivity from the Ko`olau Ditch diversion to the ocean for native stream animals. (FOF 240.)

214. The interim IIFS below all EMI diversions and just above Hana Highway, near an altitude of 1,300 feet, shall remain at an estimated flow of 0.06 mgd (0.10 cfs). (Exh. HO-1; Exh. C-103, p. 23.)

8. Makapipi Stream

215. The major diversion on Makapipi Stream is the Ko`olau Ditch. (FOF 267-268.)

216. Makapipi Stream was preliminarily selected for restoration, because the Nahiku community relies heavily on the stream for cultural practices, recreation, and other instream uses. However, with the uncertainty of gaining and losing reaches along most of the stream's course to the ocean, it was not known whether restored flow will result in continuous stream flow from the headwaters to the stream mouth. Therefore, a short-term release of water from the Ko`olau Ditch was ordered to determine the sustainability of the proposed standard of 0.60 mgd (0.93 cfs), TFQ_{70} or BFQ_{50}, just upstream of Hana Highway. (FOF 240, 267.)

217. When the sluice gates on the Koolau Ditch were partially opened to allow the majority of the water in Makapipi Stream to flow downstream of the diversion, flows ranged from 0.87 mgd (1.35 cfs) on September 14, 2010 to 0.76 mgd (1.18 cfs) on September 17, 2010. Daily site visits during September 13-17, 2010, indicated zero flow at the Hana Highway Bridge, located about two-thirds of a mile downstream of the diversion. A 1,000-foot reach upstream of the Hana Highway Bridge was dry, with the exception of a few isolated pools of water, and there was no indication of recent streamflow. The precise location where the stream went dry farther upstream was not determined, because it could not be safely accessed on foot. Much of the lower sections

of the stream below the highway was largely dry, with isolated reaches with pools of water. (FOF 268.)

218. Five days of releases is not a definitive test of whether infiltration losses would be permanent. There was enough water to be released from the Ko`olau Ditch to meet the proposed amended IIFS of 0.60 mgd (0.93 cfs), because only partially opening the sluice gates resulted in flows ranging from 0.76 mgd (1.18 cfs) to 0.87 mgd (1.35 cfs) over four days in September 2010.

219. Irrigation requirements for Makapipi Stream are 0.54 mgd - 0.63 mgd, *supra*, COL 58, so an amended IIFS of 0.60 mgd (0.93 cfs), if achievable, would be sufficient to meet irrigation needs.

9. Kopiliula Stream and its Tributary, Puakaa Stream

220. The major diversion on Kopiliula Stream and its tributary Puakaa Stream is the Ko`olau Ditch. (Exh. C-103, p. 1-21.)

221. Kopiliula Stream and its tributary, Puakaa Stream, was ranked fourth in DAR's initial top eight streams for restoration in its 2009 Habitat Availability Study (FOF 108), was ranked number fifth in DAR's revised priority ranking (FOF 115), but was one of three streams in DAR's top eight ranking that was not recommended by Commission staff because the streams were used for conveyance. However, in the case of Kopiliula Stream, DAR had also recommended that the area of commingling of the ditch and stream water could be bypassed with a box flume. (FOF 241.)

222. Below the Ko`olau Ditch, natural $BFQ_{50}$ would be 3.23 mgd (5.00 cfs), so $H_{90}$ (64 percent of $BFQ_{50}$) would be 2.07 mgd (3.20 cfs). Diverted $BFQ_{50}$ is 0.32 mgd (0.5 cfs), so 1.75 mgd (2.70 cfs) would have to be added from the Ko`olau Ditch to reach an amended IIFS of 2.07 mgd (3.20 cfs). (Exh. HO-1.)

223. For Puakaa Stream, as in the case of Hanawi Stream, habitat could be restored through minimal flow restoration for connectivity, but Commission staff concluded that there would be only 300 meters of habitat unit gain, compared to over 1300 meters for Hanawi Stream, and that the cost and effort to modify the Ko`olau Ditch diversion was better spent on Hanawi Stream. (FOF 243.)

224. Flow below the Ko`olau Ditch under diverted conditions is an estimated 0.39 mgd (0.50 cfs), which provides minimal connectivity in the wet season. In the dry season, an additional

0.06 mgd (0.1 cfs) would have to be added to the existing 0.39 mgd (0.60 cfs) of flow to achieve minimal connectivity. Thus, the amended IIFS for Puakaa Stream would be 0.45 mgd (0.70 cfs). (Exh. HO-1.)

10. Kualani (Hamau) and Ohia (Waianu) Streams

225. Kualani (Hamau) and Ohia (Waianu) Streams are both below the EMI Ditch System and have never been diverted by EMI. (FOF 58.)

226. Kualani (Hamau) Stream: The interim IIFS shall remain as designated on October 8, 1988. The estimated flow is unknown. (Exh. HO-1.)

227. Ohia (Waianu) Stream: The interim IIFS just above Hana Highway, near an altitude of 195 feet, shall remain as designated on October 8, 1988. This is equivalent to an estimated flow of 2.97 mgd (4.60 cfs). (Exh. HO-1; Exh. C-103, p. 22.)

11. Alo, Kapaula, Waiaaka, Paakea, Puakaa, Nuaailua, Honomanu, Punalau/Kolea, Haipuaena, Puohokamoa, and Wahinepee Streams

228. The IIFS of the remaining streams shall remain at their status quo flows as designated on October 8, 1988.

229. Alo Stream (tributary of Waikamoi Stream): The interim IIFS shall remain as designated on October 8, 1988. (The interim IIFS of Waikamoi Stream has been set below its confluence with Alo Stream.) (Exh. HO-1.)

230. Kapaula Stream: The interim IIFS below all EMI diversions and just above Hana Highway, near an altitude of 1,194 feet, shall remain as designated on October 8, 1988. This is equivalent to an estimated flow of 0.13 mgd (0.2 cfs). (Exh. HO-1; Exh. C-103, p. 23.)

231. Waiaaka Stream: The interim IIFS below all EMI diversions and just above Hana Highway, near an altitude of 1,235 feet, shall remain as designated on October 8, 1988. This is equivalent to an estimated flow of 0. (Exh. HO-1; Exh. C-103, p. 23.)

232. Paakea Stream: The interim IIFS below all EMI diversions and just above Hana Highway, near an altitude of 1,265 feet, shall remain as designated on October 8, 1988. This is equivalent to an estimated flow of 0.97 mgd (1.50 cfs). (Exh. HO-1; Exh. C-103, p. 23.)

233. Nuaailua Stream: The interim IIFS below all EMI diversions and just above Hana Highway, near an altitude of 110 feet, shall remain as designated on October 8, 1988. This is equivalent to an estimated flow of 2.0 mgd (3.1 cfs). (Exh. HO-1; Exh. C-103, p. 22.)

234. Honomanu Stream: The interim IIFS below all EMI diversions and just above Hana Highway, near an altitude of 20 feet, shall remain as designated on October 8, 1988. This is equivalent to an estimated flow of 0. (Exh. HO-1; Exh. C-103, p. 21.)

235. Punalau/Kolea Stream: The interim IIFS below all EMI diversions and just above Hana Highway, near an altitude of 40 feet, shall remain as designated on October 8, 1988. This is equivalent to an estimated flow of 0.13 mgd (0.20 cfs). (Exh. HO-1; Exh. C-103, p. 1-9.)

236. Haipuaena Stream: The interim IIFS below all EMI diversions and just above Hana Highway, near an altitude of 510 feet, shall remain as designated on October 8, 1988. This is equivalent to an estimated flow of 0.06 mgd (0.1 cfs). (Exh. HO-1; Exh. C-103, p. 21.)

237. Puohokamoa Stream: The interim IIFS below all EMI diversions and just above Hana Highway, near an altitude of 565 feet, shall remain as designated on October 8, 1988. This is equivalent to an estimated flow of 0.26 mgd (0.4 cfs). (Exh. HO-1; Exh. C-103, p. 21.)

238. Wahinepee Stream: The interim IIFS below all EMI diversions and just above Hana Highway, near an altitude of 575 feet, shall remain as designated on October 8, 1988. This is equivalent to an estimated flow of 0.32 mgd (0.5 cfs). (Exh. HO-1; Exh. C-103, p. 21.)

H. Balancing of Instream versus Noninstream Uses

239. "In considering a petition to adopt an interim instream flow standard, the commission shall weigh the importance of the present or potential instream values with the importance of the present or potential uses of water for noninstream purposes, including the economic impact of restricting such uses." (HRS § 174C-71(2)(D).)

1. Instream Values

240. The primary instream values are the conveyance of irrigation and domestic water supplies to downstream points of diversion for appurtenant/riparian and domestic uses, and the maintenance of fish and wildlife habitats, which protect the traditional and customary Hawaiian rights of growing wetland taro and gathering of native stream animals. The stream-by-stream IIFS amendments have addressed appurtenant/riparian and domestic uses, and the geographic approach has addressed the maintenance of fish and wildlife habitats.

241. Waiokamilo Stream no longer is diverted, and Kualani (Hamau) Stream and Ohia (Waianu) Streams are below, and therefore have never been diverted by, the EMI Ditch System.

242. The proposed amended IIFS would restore the following amounts of flow:

	Amended IIFS	Amount Restored
Palauhulu Stream	3.10 mgd (4.80 cfs)	0[30]
Waiokamilo Stream	3.17 mgd (4.90 cfs)	0[31]
Wailuanui Stream	4.03 mgd (6.23 cfs) 2.77 mgd (4.29 cfs)	2.06 mgd (3.19 cfs)[32]
Honopou Stream	2.31 mgd (3.58 cfs) 1.49 mgd (2.30 cfs)	2.17 mgd (3.36 cfs)[33]
Hanehoi/Puolua Streams	0.74 mgd (1.15 cfs) 1.87 mgd (2.90 cfs) 0.69 mgd (1.07 cfs)	3.30 mgd (5.12 cfs)[34]
East Wailuaiki Stream	2.39 mgd (3.70 cfs)	2.39 mgd (3.70 cfs)[35]
West Wailuaiki Stream	2.46 mgd (3.80 cfs)	2.46 mgd (3.80 cfs)[36]
Waikamoi Stream	1.81 mgd (2.80 cfs)	1.68 mgd (2.60 cfs)[37]
Waiohue Stream	2.07 mgd (3.20 cfs)	2.07 mgd (3.20 cfs)[38]
Hanawi Stream	0.06 mgd (0.10 cfs)	0.06 mgd (0.10 cfs)[39]
Kopiliula/Puakaa Streams	2.07 mgd (3.20 cfs) 0.45 mgd (0.70 cfs)	1.75 mgd (2.70 cfs)[40] 0.06 mgd (0.1 cfs)[41]
Makapipi Stream	0.60 mgd (0.93 cfs)--**test**	0.60 mgd (0.93 cfs)--**test**[42]

[30] 2008 amendment to 3.56 mgd (5.50 cfs) reduced back to status quo, *supra*, COL 178-179.
[31] No longer diverted due to BLNR ordering 6 mgd to be restored, but without diversions, flow is only 3.17 mgd (4.90 cfs). (FOF 160, 162.)
[32] COL 187-188.
[33] FOF 121, 124, 182; COL 195.
[34] FOF 182; COL 197-198, 206.
[35] Exh. HO-1.
[36] Exh. HO-1.
[37] Exh. HO-1.
[38] Exh. HO-1.
[39] Exh. HO-1.
[40] COL 222.
[41] COL 224.

Total (with Makapipi Stream):	18.60 mgd (28.80 cfs)
Total (without Makapipi Stream)	18.00 mgd (27.87 cfs)

243. The amended IIFS for Palauhulu, Waiokamilo, Wailuanui, Honopou, and Hanehoi/Puolua Streams would provide sufficient flows for irrigation and domestic uses.

244. Whether flows can be increased to serve irrigation requirements from Makapipi Stream are to be determined by a longer test period than initially conducted.

245. Flows sufficient to enable growth, reproduction, and recruitment of native stream animals would be restored for Wailuanui, Honopou, Hanehoi/Puolua, East Wailuaiki, West Wailuaiki, Waikamoi, Waiohue, Hanawi, and Kopiliula/Puakaa Streams.

246. Commission staff estimates that approximately 43.82 mgd (67.83 cfs) of groundwater (base flows, BFQ_{50}) have been diverted by EMI from the streams that are the subject of this contested case, and the total amount diverted by EMI should be calculated from total median flow (TFQ_{50}) to include the contribution of rainfall. (Exh. HO-1, footnotes 3-4.)

247. Based on the foregoing premises, the amended IIFS would restore about (18.00 - 18.60)/43.82, or 41 to 42 percent of base flows that EMI had previously diverted from the 23 of 27 streams that are the subject of this contested case. (FOF 57-59.)

248. The amount of total flows diverted from these streams could be calculated but was not presented in this contested case. Moreover, the EMI Ditch System diverts a total of at least 43 streams (FOF 59.)

249. On average, the total amount of stream flows diverted by EMI's Ditch System has been 114 mgd to 167 mgd. (FOF 14, 312.) Therefore, the proposed amendments' total of 18 mgd would represent 11 to 16 percent of EMI's diversions. Diversions also vary greatly, averaging 134 mgd in the winter months and 268 in the summer months. (FOF 14.) The proposed IIFS amendments would therefore represent a 13 percent reduction in the winter and a 7 percent reduction in the summer of EMI's diversions.

[42] The five days of test releases were not enough to determine if infiltration losses could be overcome with a constant flow. Therefore, it is proposed that a longer test period be conducted before concluding whether or not continuous flow to the ocean from the Ko`olau Ditch can be achieved with a flow of 0.60 mgd (0.93 cfs) to provide 0.54 to 0.63 mgd for irrigation requirements. (COL 217-219.)

250. Finally, the never-diverted flows of Kualani and Ohia Streams continue to provide their natural habitats, and any restoration of habitat for Waiokamilo Stream will depend on how much of the fully restored flows remain, if any, after diversions for irrigation.

2. Noninstream Values

a. HC&S

251. HC&S's reasonable and beneficial irrigation requirements are 4,844 gad for its 28,941 acres in sugarcane cultivation, or 140.19 mgd. (FOF 346.)

252. Reasonable and beneficial system losses are 22.7 percent of total water uses, which consist of HC&S irrigation, deliveries to MDWS, and HC&S industrial and other uses. (FOF 312-315, 399.)

253. Brackish ground-water usable capacity is 115 mgd to 120 mgd, limited by a likely increase in aquifer salinity levels, especially in the summer months when pumping is highest. (FOF 408-409.)

254. The brackish water wells can be used to irrigate 17,200 acres of the approximately 30,000 acres serviced by waters from the EMI Ditch System (FOF 400), or about 83.32 mgd (4,844 gad x 17,200 acres) of the 115 mgd to 120 mgd usable capacity.

255. After adding total water uses and system losses and subtracting about 83 mgd from ground-water wells, the remainder would be the reasonable and beneficial use of EMI ditch system surface waters.

256. Assuming the following:

a. sugarcane irrigation requirements at 4,844 gad for its 28,941 acres in sugarcane cultivation, or 140.19 mgd, *supra*, COL 251;

b. average use by MDWS from the Wailoa Ditch at 7.1 mgd for the Kamole WTP and Kula Agricultural Park (FOF 83); and

c. HC&S industrial and other uses at 6.66 mgd (FOF 313); and

d. reasonable losses at 22.7 percent, *supra*, COL 252, of 153.95 mgd (140.19 + 7.1 + 6.66 = 153.95), or 34.95 mgd.

Total reasonable and beneficial use would be 188.9 mgd.

257. Water from brackish groundwater wells could provide a maximum of 83.32 mgd, *supra* COL 254, leaving a total of 105.58 mgd to be provided from surface water from EMI's Ditch System.

249. On average, the total amount of stream flows diverted by EMI's Ditch System has been 114 mgd to 167 mgd, and the proposed amendments, *supra* COL 249, would reduce that amount to 96 to 149 mgd, compared to a need of 105.58 mgd of stream waters, *supra*, COL 257.

250. HC&S provided estimates of costs related to:

a. reduced deliveries to the Wailoa Ditch and Kauhikoa Ditch, which result in reduced water availability to irrigate the 12,800 acres of sugarcane that cannot be irrigated with ground water. The financial impact was therefore calculated in terms of HC&S's anticipated loss in sugar yields due to the average decrease in available water, with an average annual financial impact to HC&S per million gallons of reduced deliveries to either the Wailoa Ditch or Kauhikoa Ditch estimated at $507,858. (FOF 441.)

b. reduced deliveries to the Lowrie Ditch and Haiku Ditch, assumed to be compensated for by increased pumping of brackish ground water. The financial impact was therefore calculated in terms of the average cost of this pumping. (FOF 442.)

251. However, given the large difference between tons of sugar produced by nearly identical amounts of water (a ratio of 1.55 for 2009 versus 2.51 for 2003), a consistent relationship between tons of sugar produced and amount of irrigation water was questionable. (FOF 443-447.)

252. For the increased pumping costs for the Lowrie and Haiku ditches, a direct relationship between pumping costs and increased pumping was logical (FOF 448), but no more ground water could be pumped than the maximum of 83.32 mgd, *supra* COL 254, assumed to being already pumped before use of surface water was necessary.

253. Compared to a need of 105.58 mgd of stream waters, there would be 96 mgd to 149 mgd available, *supra*, COL 249. Therefore, there would be no more than a 10 mgd or 9 percent shortfall some of the time, and still more surface water than needed most of the time.

b. MDWS

254. MDWS diverts water:

a. at its upper Waikamoi Flume from the Waikamoi, Puohokamoa, and Haipuena Streams (FOF 73);

b. at its lower Waikamoi Flume from the Waikamoi, Puohokamoa, Haipuaena, and Honomanu Streams (FOF 74); and

c. draws water from EMI's Wailoa Ditch, which diverts multiple streams, including all the streams for which amended IIFS are being proposed, except that Waiokamilo Stream is reported as no longer being diverted (FOF 167).

255. The Upper Waikamoi Flume diverts an average of 1.6 mgd from Waikamoi, Puohokamoa, and Haipuaena Streams for treatment into potable water at the Olinda WTP. (FOF 73.)

256. The 1.6 mgd represents 21 percent of the 7.7 mgd average daily potable water production for MDWS's Upcountry System. (FOF 73-74, 77.)

257. From upstream to below the Upper Waikamoi Flume, no habitat has been lost from either flow diversions or barriers on Waikamoi, Puohokamoa, or Haipuaena Streams. (2009 Habitat Availability Study (*see* FOF 102), p. 97, Table 13.)

258. The Lower Waikamoi Flume diverts an average of 2.5 mgd from Waikamoi, Puohokamoa, Haipuaena, and Honomanu Streams. (FOF 74.)

259. The 2.5 mgd represents 32 percent of the 7.7 mgd average daily potable water production for MDWS's Upcountry System. (FOF 73-74, 77.)

260. From below the Upper Waikamoi Flume to below the Lower Waikamoi Flume, Waikamoi Stream has lost 1.8 percent of total habitat units from flow diversion and 3.6 percent from a barrier. (2009 Habitat Availability Study, p. 96-97, Table 13.)

261. For restoration of flows to 64 percent of BFQ_{50}, or H_{90}, DAR had recommended no change at the Upper and Lower Kula Flumes except to address the barriers, recommending instead that flows be restored at the Wailoa Ditch or its counterparts (Ko'olau and Spreckels ditches) and lower for Waikamoi Stream. (C-103, p. 1-1.)

262. Thus, there are no competing costs and benefits between restoring Waikamoi Stream and continued diversions by MDWS at its Upper and Lower Waikamoi Flumes. MDWS could continue to divert 53 percent of potable water supplies for its Upcountry System, and Waikamoi Stream could be restored to H_{90}.

263. EMI's Wailoa ditch, which diverts multiple streams, including all of the streams for which increased IIFS are being proposed, is the source of water for MDWS's Kamole water treatment facility. The Kamole facility's average daily production is 3.6 mgd, with a capacity of 6 mgd. (FOF 77.)

264. HC&S's Hamakua ditch (the western extension of the Wailoa ditch), at reservoir 40, is the source of water for Kula Agricultural Park. (FOF 79.)

265. Average daily use by MDWS from the Wailoa ditch is 7.1 mgd, which includes water for the Kamole facility and Kula Agricultural Park. (FOF 83.)

266. The impact on MDWS's provision of water for upcountry Kula would be a potential loss of up to 47 percent (3.6 mgd/7.7 mgd) of its average daily potable water production, and loss of the only source of water for Kula Agricultural Park.

267. The proposed amended IIFS restoring 18 mgd would come mostly from the Ko`olau Ditch, which becomes the Wailoa Ditch as water flows westerly toward HC&S's fields. (*See* Exh. C-1, attached.)

268. MDWS's agreement with EMI provides that MDWS will receive 12 mgd from the Wailoa ditch with an option for an additional 4 mgd. During periods of low flow, no water will be diverted to lower-elevation ditches, and MDWS will receive a minimum allotment of 8.2 mgd and HC&S will also receive 8.2 mgd. If these minimum amounts cannot be delivered, MDWS and HC&S will receive prorated shares of the water available. (FOF 82.)

269. Therefore, the 18 mgd in proposed restored flows will come from HC&S's share of the water until Wailoa Ditch flows begin to drop below 34.4 mgd (18 mgd + 8.2 mgd + 8.2 mgd = 34.4 mgd). Average Wailoa Ditch flow from 1922 to 1987 has been 108.8 mgd, with flows less than 42.46 mgd for five days out of a year. (FOF 70.)

270. Therefore, MDWS's use of 7.1 mgd of water from the Wailoa Ditch would seldom compete with the amended IIFS's increased needs for 18 mgd, and if such competition occurs, it would be for only a few days a year, *supra*, COL 269.

271. Furthermore, while MDWS's needs would be at least 3.6 million gallons daily for potable water (the Kula Agricultural Park use of 3.5 mgd could be met for a few days by its 5.4 million gallon reservoirs [FOF 79]), the 18 mgd for the amended IIFS would be spread among 9 streams, *supra*, COL 242, and temporary, modest decreases in flow for irrigation and habitat would be better tolerated than decreases in available potable water for Upper Kula residents.

272. Finally, resource protection--i.e., instream uses--is not a categorical imperative; there are no absolute priorities among trust purposes--e.g., between stream restoration and domestic uses of the general public, particularly drinking, *supra*, COL 12.

273. Thus, the weighing of costs and benefits is in favor of MDWS's continued use of its share of Wailoa Ditch diversions.

III. DECISION AND ORDER

The Commission bears the burden of establishing IIFS that protect instream values to the extent practicable and to protect the public interest, need only to reasonably estimate instream and offstream demands, and may base the IIFS not only on scientific proven facts but also on future predictions, generalized assumptions, and policy judgments. (COL 34-36.)

Legal conclusions made in this proceeding pertaining to a particular party's water rights, traditional and customary Hawaiian rights, water-use requirements, alternative water sources, and system losses are made without prejudice to the rights of any party and the Commission to revisit these issues in any proceeding involving the use of water from any of the East Maui streams that are the subject of this contested case hearing. The burden of proof with respect to such issues will be upon the petitioner rather than upon the Commission. (COL 37.)

When scientific evidence is preliminary and not yet conclusive regarding the management of fresh water resources which are part of the public trust, it is prudent to adopt "precautionary principles" in protecting the resource. Lack of full scientific certainty should not be a basis for postponing effective measures to prevent environmental degradation. (COL 15.)

Uncertainty regarding the exact level of protection necessary justifies neither the least protection feasible nor the absence of protection. Although interim standards are merely stopgap measures, they must still protect instream values to the extent practicable. The Commission may still act when public benefits and risks are not capable of exact quantification. (COL 16.)

However, reason and necessity dictate that the public trust may have to accommodate offstream diversions inconsistent with the mandate of protection, to the unavoidable impairment of public instream uses and values. (COL 14.)

A. Amended IIFS

The regression estimates have, in many cases, overstated stream flows, so if the sluice gates on the ditches are opened, there still may not be enough flow to meet the amended IIFS. *See* COL 149-155.

If actual flows are insufficient to meet the amended IIFS which were based on the regression estimates, flows up to actual BFQ_{50} shall be released for irrigation and domestic uses.

a. Surface water rights apply only to groundwater or base flows; rainfall and storm waters are the property of the State. *See* COL 26. 13.

b. The estimates of wetland taro and other agricultural requirements, including those that would also qualify for traditional and customary Hawaiian rights, were based on a subset of acreage that Nā Moku claimed for appurtenant and riparian rights. *See* COL 291-310. These acres were demonstrated as suffering actual harm to their owners' reasonable use. *See* COL 30.

c. The continued use of the waters by diverters HC&S and MDWS is contingent on a demonstration that such use will not harm the established rights of appurtenant and riparian landowners, and that has been demonstrated, either through no harm, or requiring reduced use by the diverter if there is insufficient water for both rightsholders and diverters. *See* COL 249, 253, 262, 270-273.

The IIFS of the following streams are amended from their previous IIFS, at the approximate locations specified, with final locations approved by the Commission, if necessary, after implementation by Commission staff:

Palauhulu Stream:

Amended IIFS:	The lesser of 3.10 mgd (4.80 cfs) or the estimated BFQ_{50} flow at the site as derived from actual flows.
Location:	Near 80 feet elevation, upstream with its confluence with Piinaau Stream (*See* COL 179).

Waiokamilo Stream:

Amended IIFS:	3.17 mgd (4.90 cfs)
Location:	Near Dam 3, just above the diversion to the Lakini taro patches *(See* COL 181).

Wailuanui Stream:

Amended IIFS:	The lesser of 4.03 mgd (6.23 cfs) or the estimated BFQ_{50} flow at the site as derived from actual flows.
Location:	Near 620 feet elevation, downstream of the Koolau Ditch and below the confluence of East and West Wailuanui Streams (*See* COL 184, 188).
Amended IIFS:	The lesser of 2.77 mgd (4.29 cfs) or the estimated 64 percent of BFQ_{50} flow (H_{90}) at the site as derived from actual flows.

Location: Below Waikani Falls (*See* COL 187).

Honopou Stream:

Amended IIFS: The lesser of 2.31 mgd (3.58 cfs) or the estimated BFQ_{50} flow at the site as derived from actual flows.

Location: Just below the Haiku ditch (*See* COL 191).

Amended IIFS: The estimated 64 percent of BFQ_{50} flow (H_{90}) at the site as derived from actual flows, currently estimated as 1.49 mgd (2.30 cfs).

Location: Downstream of taro and domestic diversions below the Haiku ditch, (*See* COL 192).

Hanehoi/Puolua Streams:

Amended IIFS: The lesser of 0.74 mgd (1.15 cfs) or the estimated BFQ_{50} flow at the site as derived from actual flows.

Location: On Hanehoi Stream above the Lowrie Ditch *(See* COL 206).

Amended IIFS: The estimated 64 percent of BFQ_{50} flow (H_{90}) at the site as derived from actual flows, currently estimated as 2.21 mgd (3.42 cfs).

Location: Just above the terminal waterfall at the mouth of Hanehoi Stream (*See* COL 206).

Amended IIFS: 0.69 mgd (1.07 cfs) or the estimated BFQ_{50} flow at the site as derived from actual flows.

Location: On Puolua Stream below the Haiku Ditch (*See* COL 206).

Amended IIFS: 1.87 mgd (2.90 cfs) or as explained below.

Location: On Hanehoi Stream below the Haiku Ditch (*See* COL 206).

The purpose of the two IIFS below the Haiku Ditch, one on Hanehoi Stream and the other on Puolua Stream, is to provide 0.35 mgd to meet the taro irrigation requirements, *supra*, COL 142, 202. The sum of both IIFS, 2.56 mgd (0.69 mgd plus 1.87 mgd), is 0.35 mgd greater than the IIFS of 2.21 mgd for habitat restoration located downstream. Thus, if the estimated IIFS

cannot be achieved, The IIFS on Puoloa Stream would be established as the BFQ_{50} flow at the site as derived from actual flows, and the IIFS on Hanehoi Stream would be established such that flows from both streams contribute to the 0.35 mgd to meet the taro irrigation requirements, and the remaining combined flows equal 64 percent of BFQ_{50} flow (H_{90}) at the lowest site as derived from actual flows.

East Wailuaiki Stream:

Amended IIFS: The estimated 64 percent of BFQ_{50} flow (H_{90}) at the site as derived from actual flows, currently estimated as 2.39 mgd (3.70 cfs).

Location: Below all EMI diversions and just above Hana Highway, near an altitude of 1,235 feet (*See* COL 209).

West Wailuaiki Stream:

Amended IIFS: The estimated 64 percent of BFQ_{50} flow (H_{90}) at the site as derived from actual flows, currently estimated as 2.46 mgd (3.80 cfs).

Location: Below all EMI diversions and just above Hana Highway, near an altitude of 1,235 feet (*See* COL 210).

Waikamoi Stream:

Amended IIFS: The estimated 64 percent of BFQ_{50} flow (H_{90}) at the site as derived from actual flows, currently estimated as 1.81 mgd (2.80 cfs).

Location: below all EMI diversions and just above Hana Highway, near an altitude of 550 feet (*See* COL 211).

Waiohue Stream:

Amended IIFS: The estimated 64 percent of BFQ_{50} flow (H_{90}) at the site as derived from actual flows, currently estimated as 2.07 mgd (3.20 cfs).

Location: Below all EMI diversions and just above Hana Highway, near an altitude of 1,195 feet (*See* COL 212).

Hanawi Stream:

Amended IIFS: 0.06 mgd (0.10 cfs) (to create a wetted pathway)

Location: Below all EMI diversions and just above Hana Highway, near an altitude of 1,300 feet (*See* COL 214).

Kopiliula/Puakaa Streams:

Amended IIFS: The estimated 64 percent of BFQ_{50} flow (H_{90}) at the site as derived from actual flows, currently estimated as 2.07 mgd (3.20 cfs).

Location: On Kopiliula Stream, below the Ko`olau Ditch (*See* COL 222).

Amended IIFS: Flow necessary to create a wetted pathway for an annual IIFS, estimated at 0.45 mgd (0.70 cfs) in the dry season (*See* COL 224).

Location: On Puakaa Stream, below the Ko`olau Ditch (*See* COL 224).

Makapipi Stream[43]:

Amended IIFS: 0.60 mgd (0.93 cfs) (achieved during test release, *supra* FOF 268.)

Location: Below the Ko`olau Ditch (*See* COL 216).

IIFS is subject to a continuous flow being established.

B. Status Quo IIFS

The remaining streams shall continue with their status quo IIFS as of October 8, 1988 (*See* COL 226-238).

C. Method of Monitoring

Monitoring of the IIFS will be through 12-month moving averages. This method recognizes that requiring a specific amount of flow at all times at a specific location is incompatible with the objectives of providing sufficient flow to meet irrigation and domestic requirements and/or providing sufficient habitat for growth, reproduction, and recruitment of native stream animals. *See* COL 155-156.

D. Reporting

Approximately one year from the date of this Order, the following information shall be provided:

a. Commission staff shall report on:

[43] Makapipi Stream's amended IIFS is subject to a continuous flow being established.

1. Whether or not continuous flow could be established in Makapipi Stream.

2. All other aspects of the implementation of the amended IIFS.

b. DAR shall report on:

1. Whether or not the flows implemented for East Wailuaiki, West Wailuaiki, Waikamoi, and Waiohue Streams that were estimated at 64 percent of BFQ_{50} did in fact result in H_{90} habitat.

2. Whether or not the assumptions that there is a treshold and that it is H_{90} are inconclusive or conclusive.

3. A reconnaissance of Kualani (Hamau) and Ohia (Waianu) Streams, which have never been diverted by the EMI Ditch System (FOF 58), for a qualitative assessment of the abundance of native stream animals.

c. Nā Moku shall report on:

1. Adequacy of water deliveries in terms of inflow quantity and outflow water temperatures from Pauluhu Stream, Waiokamilo and Wailuanui Streams, Honopou Stream, and Hanehoi/Puolua Streams.

2. Taro loi from which outflows continue to lower loi or return to the stream; and loi from which outflows are not reused or returned.

3. Actual and potential maintenance, irrigation and farming practices for more efficient use of stream waters.

4. Nā Moku members as "konohiki" for the streams that they use for irrigation and/or domestic uses, including managing their uses so that the downstream IIFS for habitat restoration are met.

d. EMI shall report on:

1. Modifications to diversions to meet the amended IIFS.

2. Water deliveries at Honopou Stream and Maliko Gulch, and any changes EMI ascribes to the amended IIFS.

e. HC&S shall report on:

1. Surface, pumped, and total water usage.

f. MDWS shall report on:

1. Water deliveries at the Upper Waikamoi Flume, including any amounts ascribed to reduced losses from replacing the flume.

2. The status of plans for a 100-million or 200-million gallon reservoir at the Kamole WTP.

COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII

PETITION TO AMEND INTERIM INSTREAM FLOW STANDARDS FOR HONOPOU, HUELO (PUOLUA), HANEHOI, WAIKAMOI, ALO, WAHINEPEE, PUOHOKAMOA, HAIPUAENA, PUNALAU/KOLEA, HONOMANU, NUAAILUA, PIINAAU, PALAUHULU, OHIA (WAIANU), WAIOKAMILO, KUALANI, WAILUANUI, WEST WAILUAIKI, EAST WAILUAIKI, KOPILIULA, PUAKAA, WAIOHUE, PAAKEA, WAIAAKA, KAPAULA, HANAWI, AND MAKIPIPI STREAMS	)	Case No. CCH-MA13-01 CERTIFICATE OF SERVICE

CERTIFICATE OF SERVICE

On January 15, 2016, a copy of the foregoing document was served on:

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Commission on Water Resource Management

IN THE CIRCUIT COURT OF THE FIRST CIRCUIT

STATE OF HAWAII

HEALOHA CARMICHAEL, LEZLEY JACINTHO, and NĀ MOKU AUPUNI O KO`OLAU HUI, Plaintiffs, v. BOARD OF LAND AND NATURAL RESOURCES, SUZANNE CASE, in her official capacity as Chairperson of the Board of Land and Natural Resources, the DEPARTMENT OF LAND AND NATURAL RESOURCES, ALEXANDER & BALDWIN, INC., EAST MAUI IRRIGATION CO., LTD., HAWAIIAN COMMERCIAL AND SUGAR, CO., and COUNTY OF MAUI, DEPARTMENT OF WATER SUPPLY, Defendants.	CIVIL NO. 15-1-0650-04 RAN (Environment; Declaratory Judgment) CERTIFICATE OF SERVICE

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that a copy of the foregoing document was served by hand delivery and/or U.S. Mail as indicated below, on the following parties at their last known address:

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ImanageDB:3362586.1

Civil No. 19-1-0019-01 (JPC)

Defendant A&B/EMI's Exhibit AB-169

FOR IDENTIFICATION _____

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CLERK _____